Lexical Generalizations in the Syntax of German Non-Finite Constructions

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CHAPTER 1

Introduction

The syntactic analysis of German non-finite constructions has received much attention in the linguistic literature, both traditional and generative. While these works are based on a wide range of different background assumptions and grammatical frameworks, also a wealth of empirical phenomena has been explored.

The purpose of the first part of this thesis is to provide an overview of these empirical phenomena in order to situate the theoretical investigations in part three. The overview is not intended to recapitulate the many different theoretical questions under which German non-finite constructions have been examined or the various mechanisms employed in their analyses. Rather, the leading idea of the first part is to provide an empirical overview which assumes something like a "smallest common denominator" of syntactic analyses of German non-finite constructions and recapitulates the observable properties along this basic syntactic skeleton. Despite all the differences between the theoretical proposals, a suitable least common denominator seems to be that (at least on a certain level of syntactic structure) a verbal head selects a non-finite verbal complement in a head-complement construction – a notion we will make more precise at the beginning of part one.

Apart from serving as a theory-neutral starting point, the empirical overview will also highlight the fact that the natural classes into which the observations fall are lexical classes, at least in a first step. While some of these lexical classes and their properties can possibly be derived from more abstract syntactic properties, we believe they should be taken seriously as the empirical desideratum which has to be captured by any more abstract syntactic 'explanation'.

It thus is the empirical desideratum evolving around lexical classes of verbs which constitutes the theme of this overview, and from a more formal and theoretical perspective on lexical generalizations also that of part two and three of this thesis.

Turning to the formal issues involved, in the second part of the thesis we investigate the status of the lexicon and the possibilities for expressing lexical generalizations in the paradigm of Head-Driven Phrase Structure Grammar. We show that the architecture readily supports the use of principles to express generalizations over a particular class of word objects. A second kind of lexical generalizations expressing relations between classes of words, is often expressed in terms of lexical rules, which however lack a precise formalization in the HPSG paradigm. To provide lexical rules in HPSG with a clear formal foundation and interpretation, we show how lexical rules can be integrated into the formal setup for HPSG developed by King (1989, 1994), investigate a lexical rule specification language allowing the linguist to only specify those properties which are supposed to differ between the related classes, and define how this lexical rule specification language is interpreted.

The third part of the thesis builds on the empirical overview of the first and uses the formal mechanisms introduced in the second part to provide theoretical interpretations for central aspects of German non-finite constructions: the partial topicalization phenomenon and the challenge it poses to a theory of constituency, the status and word order phenomena in coherent constructions which are irregular with respect to the regularities expected of general head-complement constructions, and the apparent violations of locality of case assignment and subject-verb agreement involving subjects as part of non-finite verbal projections. The focus of these chapters is on the theoretical consequences which follow from the empirical observations rather than exploring theoretical issues within a particular grammar architecture. The theoretical work in this thesis is based on the HPSG architecture, a paradigm which supports our emphasis on explicit and empirically adequate theorizing. Nonetheless, we generally separate the empirical argumentation and conclusions from the more technical formulation of the actual theories, so that most of part three (and all of part one) of this thesis should also be accessible and hopefully relevant to researchers working in other paradigms.

Part I

The Empirical Domain

CHAPTER 2

Basic Properties of Non-Finite Constructions

Let us start by making concrete what we in the introduction referred to as least common denominator of syntactic treatments of German non-finite complementation: head-complement constructions and the properties one can assume for such constructions. While the following paragraphs might appear to be overly basic, we start exploring the issue at this fundamental level to establish a clear theory-neutral basis on which we will build our empirical overview of non-finite verbal constructions.

Firstly, in a head-complement construction a head can select certain properties of its complement which are not properties of the head itself. This selection has traditionally been referred to as *government*.

Secondly, one can observe *agreement* when a head and its complement both exhibit certain morphological properties. Most instances of agreement require a level of abstraction to be introduced, since it is not the directly observable concrete morphological realizations, but morphological properties abstracted from the observation which are exhibited by head and complement in such a construction.

Thirdly, a certain subclass of properties of the lexical head sometimes referred to as *head properties* are also properties of the head-complement construction projected from this head. That non-lexical constituents exist and bear properties can of course not be directly observed. Rather, it is the result of the theoretical assumption that grammatical regularities should be formulated as referring to locally present properties. Such postulation of properties of non-lexical constituents can (and should) be limited to cases in which non-lexical constituents behave parallel to a lexical element which overtly exhibits the postulated property.

The fourth point is also related to the locality postulate, the percolation of *subcategorization* information. The subcategorization requirements of a non-lexical constituent is taken to be derived from that of the head by canceling off the part of the requirement corresponding to the complement which the head just combined with.

A fifth property often assumed for head-complement constructions is that the relative *word order* of a head with respect to its complement (head-first vs. head-last) is the same for all heads of a specific class, at least in the *basic word order* (*Grundwortstellung*).[1] In the HPSG architecture, in which we will work out our analysis in part three, such a uniformity of linearization is not required by the framework. Rather, so-called linear precedence constraints can order the constituents in a local tree (or a larger linearization domain) according to any property of the construction or the constituents. Nonetheless, the idea to restrict linearization possibilities in head-complement constructions in a uniform way for all heads of the same (sub-)category is implicitly present in much HPSG work and explicitly encoded in the proposal of Kiss (1995b, pp. 200ff).

Finally, the syntactic structure of head-complement constructions is paralleled by a semantic level in which *semantic composition* takes the syntactic head as semantic functor and the complement as its semantic argument.

In the following, we introduce the empirical domain of non-finite constructions in German along this skeleton of fundamental properties. We start with the basic properties of non-finite constructions, where 'basic' partly stands for 'regular' with respect to the expected head-complement properties and partly for 'introductory' in the sense of laying the ground for the theoretical proposals focusing on particular subproblems in part three. Chapter 3 then complements the regular aspects of non-finite constructions with the irregular aspects arising in the syntax of so-called coherent constructions. Apart from completing the empirical landscape, the particular perspective on the lexical distinctions and (ir)regularities introduced in chapter 3 will give rise to a particular theoretical interpretation of coherent constructions in chapter 8.

1. Syntax

Turning to basic syntactic properties of non-finite constructions in German, most of the properties expected of head-complement constructions can be observed and play a role in the classification of different non-finite constructions.

[1]Some authors, such as Zwart (1993), go one step further and claim that heads universally precede their complements in the basic word order.

1.1. Government. A verbal head V' governs the verb form of its complement V''. Adopting the terminology of Bech (1955)[2] we will refer to the verb form as the *status* of a verb; and parallel to the government of case for nominal complement we will refer to the assignment of status as *status government*. The verb *will* in (1a) governs the bare infinitive (*first status*) of *hören*, whereas *scheint* in (2a) and *weigern* in (3a) govern the *zu*-infinitive (*second status*) and *hat* in (4a) the past participle (*third status*). Completing the picture, Bech also refers to the finite verb form as *null status*.

(1) a. daß er das Meer hören^{2}(1) will^{1}(0)
that he the sea hear wants
'that he wants to hear the sea'

b. * daß er das Meer zu hören^{2}(2) / gehört^{2}(3) will^{1}(0)
that he the sea to hear / heard wants

(2) a. daß er das Meer zu hören^{2}(2) scheint^{1}(0)
that he the sea to hear seems

b. * daß er das Meer hören^{2}(1) / gehört^{2}(3) scheint^{1}(0)
that he the sea hear / heard seems

(3) a. daß er versucht^{1}(0), das Meer zu hören^{2}(2)
that he tries the sea to hear

b. * daß er versucht^{1}(0) das Meer hören^{2}(1) / gehört^{2}(3)
that he tries the sea hear / heard

(4) a. daß er das Meer gehört^{2}(3) hat^{1}(0)
that he the sea heard has

b. * daß er das Meer hören^{2}(1) / zu hören^{2}(2) hat^{1}(0)
that he the sea hear / to hear has

In general, each specific verb is lexically specified to govern a single status, just like it is a lexically property of certain verbs to assign a specific lexical case to one of its nominal arguments. When a specific verb form represent several interpretations, understanding each of these variants as separate syntactic verbs makes it possible to extend this regularity to

[2]Much of the following discussion is based on the proposal of Bech (1955), and we will introduce the relevant terminology as we proceed. In building our empirical overview on Bech (1955), we take a similar starting point as Kiss (1995a). A summary of the relationship to our work is included in chapter 11. For a review of Bech's proposal from the theoretical perspective of the principles and parameters paradigm, the reader is referred to Stechow (1984).

verbs like *haben* (*have*) which in its use as tense auxiliary[3] exemplified above assigns a third status whereas its use as modal auxiliary governs the second status. Finally, a small class of verbs can govern either the first or the second status without any change in meaning (Bech, 1955, ch. 15).[4]

Bech (1955) makes use of status government as observable syntactic selection to define the notion of *subordinative* or *hypotactic chain*. We adopt his notation to mark the rank of the ungoverned verb in a hypotactic chain with the (upper) index 1. Every other verb bears the rank of its governor plus one. In case only the relative relationships are relevant, we write V' for the governor and V'' for the verbal complement it selects. Finally, we include the status of a verb in parenthesis after the index, so that we obtain the following notation to be used throughout this thesis: $V^{rank}(status)$.

Having defined the rank of a verb, Bech (1955, §23) also uses it to identify the arguments of a verb. The (logical) subject of a verb V^n is referred to as N^n, and the (logical) accusative and dative objects are specified as A^n and D^n. Related to this, Bech (1955, §36) defines the notion of a *verb-field* (*Verbalfeld*) F^n which includes the verb V^n and all the elements syntactically depending on V^n. In contrast to the other field notions which, following Bech, we will introduce in the following to structure the observable word-order regularities, one should note that the notion of a verb-field is not defined as a topological unit. Instead, the term provides a means to refer to a verbal head and all elements which are syntactically related to this head, be it as adjuncts or arguments. We introduce the term *dependent* to refer to each element in the verb-field F^n except for V^n itself.

1.2. Head properties. Turning to the second aspect of head-complement constructions, the selection and percolation of head properties, in a sentence like the one we saw in (1a) on page 11, the constituent [*er das Meer hören will*] has to bear certain properties of its head *will*. This

[3]Note that we here and in the following use the term auxiliary only as mnemotechnically useful, pre-theoretic name of a traditional class of verbs. Höhle (1978, pp. 88ff) shows that for German the notion auxiliary cannot be precisely delimited on theoretical grounds. Which verbs are included in the class of German auxiliaries therefore is arbitrary to a certain degree.

[4]This class includes *brauchen* (*need to*), *heißen* (*ask someone to do something*), *helfen* (*help*), *lehren* (*teach*), *lernen* (*learn*), and (stato)motoric verbs like *gehen* (*go*), *kommen* (*come*), or *schicken* (*send*).

is empirically motivated, for example, by the fact illustrated in (5) that certain complementizers like *daß* combine with finite verbal projection, whereas others, like *anstatt* select a non-finite projection in second status.

(5) a. daß er das Meer hören^2(1) will^1(0) / *wollen^1(1) / *zu wollen^1(2) / *gewollt^1(3)
that he the sea hear wants / want / to want / wanted
'that he wanted to hear the sea'

b. anstatt das Meer hören^2(1) *will^1(0) / *wollen^1(1) / zu wollen^1(2) / *gewollt^1(3)
instead the sea hear want / want / to wants / wanted
'instead of wanting to hear the sea'

Based on the examples shown in (6) one can argue that for German mood has to be a head property as well,[5] since in certain constructions like indirect speech, embedded questions, or counterfactual sentences the verbal projections generally has to occur in subjunctive mood.[6]

(6) a. Er schwor, er habe^1(0) nichts davon gewußt^2(3).
he swore he have-SM *not there.of known*
'He swore not to have known about it.'

b. Karl fragte ihn, wo er gewesen^2(3) sei^1(0).
Karl asked him where he been is-SM
'Karl asked him where he (claimed to) have been.'

c. Wenn Karl gekommen wäre, hätte^1(0) er Anna getroffen^2(3).
If Karl come was had-SM *he Anna met*
'Had Karl come, he would have met Anna.'

Finally, theories assigning contoured structures to verbal projections, i.e., theories in which a verb does not have to combine with all of its arguments in the same local tree, also need to percolate person and number information along the head projection to permit local checking of subject-verb agreement.

[5]Alternatively, one could consider integrating mood as a semantic property percolating along the projection of the semantic head.

[6]Below and at relevant places throughout the thesis we annotate the English verb glosses with SM for subjunctive mood.

1.3. Agreement. The third criterion, *agreement* of a head with its dependent plays no role in the context of non-finite verbal constructions. If one extends the notion of agreement to include likeness of conjuncts in coordinate constructions, though, it is relevant to note that in German supina[7] agree in status when they are coordinated. The status shown in the examples in (7) thus are the only grammatical possibilities.[8]

(7) a. Er soll^1(0) heute kommen^2(1) und morgen gehen^2(1).
he shall today come and tomorrow go
'He is supposed to come today and leave tomorrow.'

b. Er versprach^1(0) heute zu kommen^2(2) und morgen wieder zu gehen^2(2).
he promised today to come and tomorrow again to go.
'He promised to come today and to leave again tomorrow.'

c. Er ist^1(0) gestern gekommen^2(3) und heute wieder gegangen^2(3).
he is yesterday come and today again left
'He came yesterday and left again today.'

As pointed out by Bech (1955, §§5f), the situation is different in English (8a) and Danish (8b). Either one has to assume that in these languages there is no status agreement with coordinated verbal structures, or *to* and *at* in these languages are to a certain degree independent syntactic entities. In the latter case, the English and Danish examples would be analyzed as a coordination of two bare verb forms which as a whole is marked by *to/at*.

(8) a. to come and go
b. at komme og gå

[7] Bech (1955, §§1, 9) distinguishes *supina* from so-called *participia*. The former are the status governed verbal forms we are interested in in this thesis, whereas the latter are non-finite verbs patterning with adjectives.
[8] An interesting exception to this generalization was brought to my attention by Stefan Müller:

(i) Die Bilder sind^1(0) gestern angekommen^2(3) und heute schon zu besichtigen^2(2).
the pictures are yesterday arrived and today already to be.on.view
'The pictures arrived yesterday and are already on view today.'

The finite verb *sind* at the same time seems to function as perfect tense auxiliary selecting the third status in the first conjunct and as modal passive auxiliary selecting a second status complement in the second conjunct.

Haider (1993, p. 234) supports Bech's assessment and shows that structures with an independent syntactic element *to* can reasonably be assumed for English, whereas for German *zu* has no properties of an independent element and should be analyzed as morphological part of a verb in second status.[9]

1.4. Word order. The fourth observable property, word order, plays a major role in the classification of different non-finite constructions. We first focus on the general topology of non-finite constructions, before turning to the word-order relations resulting from grammatical phenomena like topicalization and extraposition.

1.4.1. *General topology of non-finite constructions.* Almost all verbs selecting non-finite complements in a German verb-last sentence can be linearized according to the rule that the head V' appears to the right of its verbal complement V" (= head-last).[10] This is illustrated in (9).

(9) a. daß er ihr einen Ring schenken^2(1) kann^1(0)
that he her a ring give be.able
'that he is able to give her a ring'

b. daß er den Spargel zu schälen^3(2) versprechen^2(1) mußte^1(0)
that he the asparagus to peal promise had
'that he had to promise to peal the asparagus'

For verb-first and verb-second sentences, apart from the order of the fronted verb, the same word-order regularities hold, as shown in (10).

(10) a. Er wird^1(0) ihr einen Ring schenken^3(1) können^2(1).
he will her a ring give be.able
'He will be able to give her a ring.'

b. Ein richtiger König würde^1(0) einen Walzer tanzen^4(1) können^3(1) müssen^2(1).
a real king would a waltz dance be.able have
'A real king would have to be able to dance a waltz.'

[9] Apart from the two positions mentioned here, the literature also includes hybrid theories, such as the proposal of Stechow (1990, pp. 157f) who argues that *zu* in a coherent construction is a morphological part of the verb whereas in an incoherent construction it is an independent element governing first status.
[10] A small group of verbs require obligatory extraposition of their verbal complement.

In (10) and (9), a (non-fronted) verbal head V' immediately follows the head V" of its verbal complement and all dependents of V" directly precede it. Dependent on the nature of the construction, a number of other word orders are also possible. The relevant notion distinguishing these constructions was introduced by Bech (1955). He discusses two kinds of constructions in which a verb combines with a non-finite complement, *coherent* and *incoherent* ones. Whether a coherent or an incoherent combination (or both) is possible for a verbal head and its non-finite complement is a lexical property of the verbal head. Transferring the classification of the construction a verb can occur in to the verb itself, one can thus classify a verb as obligatorily coherent if it only occurs in coherent constructions, as optionally coherent if it can be realized in both coherent and incoherent constructions, and as obligatorily incoherent if it only ever surfaces in incoherent constructions.

While the various properties distinguishing coherent from incoherent constructions are introduced in detail in the context of the empirical phenomena discussed below, very generally speaking the idea behind this distinction is that the verbal complement in an incoherent construction is an independent syntactic constituent, whereas in a coherent construction the two verb-fields are merged and form a tighter unit. To discuss the topology of such units it is useful to introduce the term *coherence-field* (*Kohärenzfeld*) of Bech (1955, §§55ff). A coherence-field is an inseparable topological unit made up of one or more coherently combined verbal fields. It consists of a sequence of coherently constructing verbs in the *final-field* (*Schlußfeld*) preceded by the *rest-field* (*Restfeld*) which contains the dependents of the final-field verbs. Regarding notation, we write K' for the coherence-field of a verb V', and R' and S' for the rest- and final-fields of this coherence-field. On the basis of this terminology, we can now zoom in on the word-order regularities holding in the two sub-fields, the verbs in the final-field and the dependents in the rest-field.

Order in the final-field. The verbs in the final-field in general follow a strict head-follows-complement order ($V^{i+1} < V^{i}$) as shown in the examples in (11) provided by Bech (1955, pp. 65f).

(11) a. wenn sie eine fallende Bombe zu pfeifen^{3}(2) beginnen^{2}(1) hörte^{1}(0)
when she a falling bomb to whistle begin heard
'when she heard a falling bomb start to whistle'

b. daß dies Papier nicht aus seinem Geschäftszimmer genommen^{4}(3)
that this paper not from his office taken
worden^{3}(3) sein^{2}(1) könne^{1}(0)
been have can
'that this paper cannot have been taken from his office'

The basic ordering of verbal heads with respect to their verbal complement thus follows the uniform linearization we declared as characteristic of head-complement constructions at the beginning of this chapter.

For coherently constructing verbs there is a well-known exception to this uniform ordering of verbs in the final-field which is illustrated in (12).

(12) Es sei aber zu erwarten, daß in geraumer Zeit der Landkreis seinen
it is however to expected that in certain time the district its
Beitrag zur Unterbringung werde^{1}(0) leisten^{3}(1) müssen^{2}(1).
contribution to.the housing will deliver have
'It is however expected, that before long the district will have to help with the housing.'

Instead of occurring as the rightmost verb of the final-field, *werde* in (12) occurs at the left edge of the final-field. As exception to the uniform ordering expected of a head-complement structure, the occurrence of such an *upper-field* (*Oberfeld*) will be discussed in detail in section 2.1 of chapter 3.

Order in the rest-field. A characteristic word-order property of constructions in which a V' coherently selects a verbal complement is that the dependents of V' and V" which form the rest-field can be interleaved. Such *scrambling of rest-field elements* is illustrated in (13).

(13) a. daß es$^{A^2}$ der Junge$^{N^1}$ zu kaufen^{2}(2) versuchte^{1}(0)
that it the boy to buy tried
'that the boy tried to buy it'

b. daß er$^{N^1}$ es$^{A^2}$ den Jungen$^{A^1}$ kaufen^{2}(1) sah^{1}(0)
that he it the boy buy saw
'that he saw the boy buy it'

In (13a) the subject *der Junge* of *versuchte* intervenes between *zu kaufen* and its object *es*. And example (13b) shows that if V' selects an accusative object, this A' can intervene between V" and A".

In an incoherent construction, on the other hand, each verb-field forms a separate coherence-field. The two verbal heads thus surface in two distinct final-fields and the dependents of V' and V" are realized in two independent rest-fields. Since a coherence-field is introduced as a topological unit which cannot be broken up, scrambling of the dependents of V' and V" is predicted not to be possible in an incoherent construction. This is illustrated by the ungrammaticality of example (14) with the obligatorily incoherent verb *fortfahren*.

(14) * daß es$^{A^2}$ die Studenten$^{N^1}$ zu lesen^2(2) fortfuhren^1(0)
that it the students to read continued
'that the students continued reading it'

Linearization of coherence-fields in the rest-field. With incoherently selected verbal complement forming their own coherence-field, this topological unit has additional word-order possibilities unavailable to coherently selected verbal complements. It was pointed out by Haider (1985b) that for incoherently selected verbal complements not only the basic word order repeated in (15), where the coherence-field K" is left-adjacent to the final-field of K', but also a Mittelfeld[11] position further to the left as shown in (16) is possible, which we will refer to as *coherence-field left-dislocation.* In these and the following examples, coherence-field boundaries are marked by square brackets.

(15) a. Wahrscheinlich hat^1(0) niemand$^{N^1}$ je$^{Adv^2}$ [solch fette Ratten$^{A^3}$ zu
probably has no.one ever such fat rats to
fangen^3(2)] versucht^2(3).
catch tried
'Probably no one ever tried to catch such fat rats.'

b. Sicher hat^1(0) niemand$^{N^1}$ je$^{Adv^2}$ [allen Gästen$^{D^3}$ ein Geschenk$^{A^3}$ zu
surely has no.one ever all guests a present to
geben^3(2)] versucht^2(3).
give tried
'Surely no one has ever tried to give a present to every guest.'

[11]The Mittelfeld is the topological field in-between the complementizer in verb-last or the finite verb in verb-first/second sentences and the right-sentence bracket containing the non-finite verbal elements or particles. For a discussion of the topological fields traditionally assumed for German sentences, the reader is referred to Reis (1980), Höhle (1986), and Kathol (1995, ch. 2).

(16) a. Wahrscheinlich hat^1(0) [solch fette Ratten$^{A^3}$ zu fangen^3(2)]
probably has such fat rats to catch
niemand$^{N^1}$ je$^{Adv^2}$ versucht^2(3).
no.one ever tried

b. Sicher hat^1(0) [allen Gästen$^{D^3}$ ein Geschenk$^{A^3}$ zu geben^3(2)]
surely has all guests a present to give
niemand$^{N^1}$ je$^{Adv^2}$ versucht^2(3).
no.one ever tried

In a coherent construction, the verbal head V" is placed in the same final-field as V' so that it is not possible for a rest-field element to intervene between V' and V":

(17) * daß solch fette Ratten$^{A^2}$ zu fangen^2(2) niemand$^{N^1}$ je$^{Adv^2}$ pflegt^1(0)
that such fat rats to catch no.one ever usually.does

Summary. Concerning the possible orders in the Mittelfeld, we thus obtain the following picture. Obligatorily incoherent verbs as V' allow their non-finite complement to occur freely in the rest-field R' as long as it remains a complete unit. Thus immediately left-adjacent to the final-field S' is a possible linearization (18a), as is a position further to the left (18b), but the coherence-field K" cannot be broken up by a constituent belonging to K' like the subject in (18c).[12]

(18) a. Es erstaunt mich, daß ein jeder$^{N^1}$ [diesen Menschen$^{A^2}$ zu
it astonishes me that an everyone this person to
kennen^2(2)] bedauert^1(0).
know regrets
'It astonishes me that every person regrets knowing this person.'

b. daß [diesen Menschen$^{A^2}$ zu kennen^2(2)] ein jeder$^{N^1}$ bedauert^1(0)
that this person to know an everyone regrets

c. * daß diesen Menschen$^{A^2}$ ein jeder$^{N^1}$ zu kennen^2(2) bedauert^1(0)
that this person an everyone to know regrets

Obligatorily coherent verbs like *pflegen* as V', on the other hand, form a single coherence-field K' with its verbal complement so that (in a verb-last sentence) V' and V" have to occur in the same final-field S'. This

[12]The class of obligatorily incoherent verbs appears to be rather fragile in that one often manages to force such verbs into a coherent pattern if one tries long enough. This 'training effect' does not surface with obligatorily coherent verbs, which when forced into an incoherent pattern always cause ungrammaticality.

permits the basic Mittelfeld order in (19a), but in the absence of a separate coherence-field K" as member of the rest-field R', no coherence-field left-dislocation is available, which rules out the word order in (19b). As the dependents of V' and V" occur in the same rest-field R', they can be permuted as shown in (19c).

(19) a. daß ein jeder^{N1} diesen Menschen^{A2} zu kennen^{2}(2) pflegt^{1}(0)
that an everyone this person to know usually.do
'that usually everyone knows this person'

b. * daß [diesen Menschen^{A2} zu kennen^{2}(2)] ein jeder^{N1} pflegt^{1}(0)
that this person to know an everyone usually.do

c. daß diesen Menschen^{A2} ein jeder^{N1} zu kennen^{2}(2) pflegt^{1}(0)
that this person an everyone to know usually.do

1.4.2. *Extraposition.* Turning to word-order possibilities associated with general word-order regularities outside the Mittelfeld, let us start with the extraposability of non-finite complements. As shown in (20) a subclass of verbs selecting a non-finite complement allows the complement to be extraposed. In the normal case, the verbal complement includes the non-finite verb and all its dependents.[13]

(20) a. daß er sich weigert^{1}(0) / *scheint^{1}(0) zu kommen^{2}(2)
that he REFL[14] *refuses / seems to come*
'that he refuses / seems to come'

b. daß er sich weigert^{1}(0), ihr das Buch auszuleihen^{2}(2)
that he REFL *refuses her the book to lend*
'that he refuses to lend her the book'

c. daß er sich weigern^{2}(1) wird^{1}(0), das Buch verkaufen^{4}(1) zu lassen^{3}(2)
that he REFL *refuse will the book sell to let*
'that he will refuse to let (someone) sell the book'

d. obwohl er begann^{1}(0), den Fragebogen auszufüllen^{2}(2)
even.though he began the questionnaire fill.out
'even though he began to fill out the questionnaire'

[13]The other case, in which the extraposed verbal head leaves some of its arguments behind in the Mittelfeld, was first noted by Höhle (1986, fn. 4) and has since become known under the name of *third construction* (den Besten and Rutten, 1989).

[14]Here and in the following we use REFL as glossing for a reflexive pronoun as dependent of an obligatorily reflexive verb.

The class of verbal heads which allows the extraposition of their complement is the same class of verbs which above was to allow for preposing of the complement's coherence-field in the Mittelfeld, i.e., it is the class of incoherently constructing verbs. Following Bech (1955, §68 (2)), extraposability of the verbal complement thus is a sufficient condition for incoherence of a construction.

1.4.3. *Pied piping.* A further word-order possibility available for verbs which can construct incoherently arises in relative clause constructions. If the relative pronoun at the left edge of the relative clause is an argument of V", it can be directly followed by all elements of the coherence-field K", i.e., by V" and its dependents. Bech (1955, §81) illustrates this with the example (21a) and the parallel example (21b) showing the unavailability of this word order for obligatorily coherent verbs like *pflegen* (*be used to*).

(21) a. ein Umstand, den zu berücksichtigen^{2}(2) er immer vergißt^{1}(0)
a circumstance which to consider he always forgets
'a circumstance which he always forgets to consider'

b. * ein Umstand, den zu berücksichtigen^{2}(2) er immer pflegt^{1}(0)
a circumstance which to consider he always is.used
'a circumstance which he is used to always consider'

Since the verbal head and its dependents in this construction seem to follow the dislocation to the left of its pronominalized object, the construction is often referred to as pied piping (Ross, 1967; Riemsdijk, 1985). Note that different from the basic word order we saw in (9) on page 15, in the pied-piping word order the verb V" is separated from its governor V' by the subject N' and an adverbial Adv'. The pied-piping word order thus closely resembles the coherence-field left-dislocation we showed in the examples in (16). Haider (1985b) and others therefore view the pied-piping word order as nothing but an instance of coherence-field left-dislocation.

1.4.4. *Topicalization.* The various options for topicalization in sentences involving non-finite constructions constitute a very interesting word-order phenomenon, not only because they provides a further empirical criterion for distinguishing coherent and incoherent constructions, but also because from a theoretical perspective they pose significant problems for the fundamental syntactic notion of constituency. We here focus on the word-order properties as such and turn to the constituency problem in chapter 7.

Topicalization of the final-field. We saw above that the word-order properties of a hypotactic chain of coherently combined verbs caused Bech (1955) to assume that such a verb sequence is part of the final-field of a single coherence-field. In (22) we see that this topological unit can also appear in the Vorfeld, i.e., preceding the finite verb in a verb-second sentence.[15]

(22) Heiraten^3(1) können^2(1) | wird^1(0) sie ihn aber nicht.
marry be.able will she him but not
'But she will not be able to marry him.'

For incoherently combined verbs, (23) shows that the option of such a verbal sequence in the Vorfeld is not available, which is in-line with the topological analysis of Bech (1955) which assigns these two verbs to final-fields of two separate coherence-fields.

(23) * zu heiraten^3(1) bedauern^2(1) | wird^1(0) sie ihn aber nicht.
to marry regret will she him but not
'But she will not regret marrying him.'

The topicalizability of a verb sequence thus is a sufficient criterion for the coherence of the combination of the fronted verbs.

Topicalization of a verb with its dependents. A second option for topicalization is to front a verb together with its (non-verbal) dependents. As shown in (24), this option is available for incoherently selected complements, which is in line with Bech's proposal to view incoherently selected complements as separate topological units in that they form their own coherence-field.

(24) Einen Engländer zu heiraten^3(1) | würde^1(0) sie sicher nicht
an Englishman to marry would she surely not
bedauern^3(1).
regret
'She would surely not regret marrying an Englishman.'

The verb-field comprising a coherently selected verbal complement, however, in the Mittelfeld is not analyzed as its own topological unit. It therefore comes as a surprise that such coherently selected verbal complements can equally well be fronted as shown in (25).

[15]In this and the following examples, the right edge of the Vorfeld is marked off by '|'.

(25) Einen Engländer heiraten^3(1) | würde^1(0) sie sicher nicht wollen^3(1).
an Englishman marry would she surely not want
'She would surely not want marry an Englishman.'

A conclusion one can draw from this is that even though one has good reasons to assume that a coherently selected verbal complement does not form a topological unit when it occurs in the Mittelfeld (e.g., no coherence-field left-dislocation available), such complements can apparently function as a topological unit for topicalization. In chapter 7 we will show how one can make formal sense out of this conclusion.

1.4.5. *Summary.* Summing up the discussion of basic word-order properties of non-finite constructions, we have seen that the uniform ordering of a head with respect to its complements which we would expect of a head-complement construction can in general be observed with non-finite constructions. More interestingly, this basic word-order regularity can be extended by incorporating the suggestions of Bech (1955) to distinguish different topological units for different classes of verbs selecting non-finite complements. We came across two exceptions to this picture: Firstly, the briefly mentioned occurrence of a so-called higher-field is an exception to the expected uniform order by decreasing rank indices of verbs in the final-field. We therefore turn to an empirical discussion of this phenomenon in section 2.1 of chapter 3 before proposing a theory in chapter 8 which incorporates the idea that this exception sheds doubt on the head status of verbs in the upper-field. The second issue concerns the mismatch between those topological units available in coherent construction in the context of topicalization compared to those apparently present in the Mittelfeld. This issue will be picked up again in chapter 7.

1.5. Subcategorization. Compared to the status government and the word-order phenomena discussed in the previous sections, the representation, realization, and percolation of subcategorization requirements is one step further away from directly observable linguistic properties and rests on certain theoretical assumptions, in particular on the existence of constituent structure and the belief that the realization of subcategorization requirements is a local process, i.e., only involves nodes in a local tree. In other words, only after a notion of constituency has been derived from the observable word-order phenomena and the postulated non-lexical constituents have been validated through substitutability with lexical elements of the same class does it make sense to invent something like the percolation and realization of subcategorization requirements within a local domain such as a head-projection. Compared to the previous sections, the discussion in this section will therefore have to be more theory and architecture dependent in that it essentially is a continuation of the word-order discussion on a more theoretical level.

Let us start with the simple case, namely the one of incoherently selected non-finite complements. In section 1.4 we recapitulated Bech's observation that incoherently selected verbal complements form coherence-fields which include all of the dependents of a verb and behave as independent topological units. Apart from the overtly missing subject, such coherence-fields thus constitute saturated constituents. Selection of such saturated constituents as arguments of a verb thus directly conforms to the realization of subcategorization requirements assumed for head-complement constructions in that each verbal head locally realizes its dependents within its own head-projection.

The situation is much more complex with coherent verbal constructions, in particular since the questions which subcategorization requirements should be assumed for a verbal head and how these are saturated is closely connected to the question of what constituent structure should be assumed for sentences containing coherent constructions. The tests usually applied to determine constituency in German do not provide clear evidence for these cases. For example, under the traditional assumptions that only a single constituent can be fronted in German and that constituents which can be topicalized can also occur in their base positions in the Mittelfeld, one would argue on the base of example (26a) that the main verb forms a constituent with its nominal complement. Example (26b) on the other hand supports the opposite conclusion that the modal verb forms a constituent with the main verb since they can be topicalized together, leaving the arguments of the main verb behind in the Mittelfeld.

(26) a. [Das Meer hören^3(1)] | wird^1(0) er wollen^2(1).
the sea hear will he want
'He'll want to hear the sea.'

b. [Hören^3(1) wollen^2(1)] | wird^1(0) er das Meer.
hear want will he the sea

It therefore is not uncontroversial, which constituent structure or structures should be assumed for sentences containing coherent verbal constructions.

In the principles and parameters paradigm, at one level of representation a structure is assumed, in which the verb V" combines with its arguments and the resulting constituent is selected by V'. In the classical analysis of Evers (1975), a verb raising transformation (followed by S-pruning) then applies to this underlying structure to obtain a surface structure in which the verb V" forms a constituent with V' (for German via left, for Dutch via right adjunction). An alternative, more far-reaching proposal by (Haegeman and van Riemsdijk, 1986) substitutes verb raising by a reanalysis mechanism. Reanalysis is supposed to supply multiple structures for one and the same example, all of which are possible inputs for further grammatical processes, such as an inversion rule.

Common to these two approaches (and a family of variants) is the idea that the structures of coherent verbal constructions should be derived from underlying structures in which the embedded verbal head realizes its argument in a way which makes it possible to assume the percolation of subcategorization information expected for head-complement constructions.[16]

The approaches in the HPSG paradigm naturally have the same problem of having to license multiple constituent structures for sentences such as the ones shown in (26). Since the HPSG architecture does not assume multiple levels of syntactic structure,[17] it is an interesting issue how a structure can be assigned to sentence (26b) and how the subcategorization information can be percolated in this structure. The idea pursued in the HPSG paradigm is the following: When a verb V" combines with its verbal governor V' instead of with its own arguments, the resulting constituent must take over the unrealized subcategorization requirements of V". To formalize this inheritance of subcategorization requirements,

[16]In his chapter 9.4 "Derivationelle Verwirrungen [Derivational Confusions]", Haider (1993) provides a detailed and convincing argumentation showing that the classical idea of deriving coherent from incoherent verbal constructions cannot be sensibly entertained. He instead develops an approach in which the coherent verbal complex is not derived, but directly generated as a complex projection basis. Such an approach is very close to the analyses developed in the HPSG paradigm, including the one we present in part three of this thesis, which provides interesting cross-framework support for an analysis viewing coherent constructions as first class citizens.

[17]The so-called linearization approaches in HPSG (Reape, 1993; Kathol, 1995; St. Müller, 1995, 1999; Richter, 1997; Penn, 1999; and others) can be viewed as assuming multiple levels of constituency. Still, most if not all of these approaches can be understood as positing only one level of syntactic constituency. The additional second level represents something often referred to as phonological constituency, a notion which to our knowledge has not been fully explored.

Johnson (1986) suggested to incorporate the idea of functional composition from categorial grammar (Geach, 1970). Hinrichs and Nakazawa (1989) picked up this idea and showed how the relevant aspect of functional composition can be integrated into the HPSG architecture in form of a specific lexical specification of coherently constructing verbs. This lexical specification often referred to as *argument attraction* or *argument raising* adds the unsaturated subcategorization requirements of the verbal complement to the subcategorization requirements of the verbal head as shown in figure 1.[18]

$$\left[\textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{val}|\textsc{comps}\ \boxed{1} \oplus \left\langle\left[\textsc{loc}|\textsc{cat}|\textsc{val}|\textsc{comps}\ \boxed{1}\right]\right\rangle\right]$$

FIGURE 1. Argument attraction as lexical specification

With respect to the example (26b) we saw on page 24, this lexical specification is part of the lexical entries of *wollen* and *wird*. The verb *wollen* raises the complement *das Meer* from its verbal complement *hören* and the verb-second verb *wird* raises that argument from the COMPS list of *wollen* onto its own subcategorization requirements, from which it is realized together with the subject as part of the Mittelfeld.

It is interesting to note that the formulation of argument attraction as a lexical specification differs from the original functional composition rule of categorial grammar on which it was modeled. In the functional composition, the subcategorization requirements of the complement are transferred to the mother of the construction. In the lexicalized variant of figure 1, it is the head of the construction which inherits the subcategorization requirements of its complement. Different from the original functional composition, the lexical argument attraction specification thus makes it possible to assume completely flat structures, since in a single local tree a verbal head can inherit arguments from any of the verbs lower in the hypotactic chain and realize them together with its own arguments. This option is actually made use of in some of the HPSG proposals like Nerbonne (1994) or Bouma and van Noord (1998) who propose theories licensing entirely flat structures also for sentences traditionally analyzed

[18]As signature with respect to which this description is to be interpreted we here assume the one defined in the appendix of Pollard and Sag (1994), including the changes of the encoding of valence attributes proposed in chapter 9 of that book. As usual in HPSG, the infix operator $\oplus$ represents a relation concatenating two lists.

as including a verbal cluster. The lexical argument attraction specification is, however, also used in more traditional HPSG approaches licensing verbal clusters[19] with left-branching (Hinrichs and Nakazawa, 1989; Kathol, 1995) or right-branching structures (Kiss, 1995a). Common to all of the HPSG proposals we are aware of is that the lexical argument attraction specification is used to be able to apply the ordinary mechanism for percolating subcategorization specification for all head-complement constructions.

Surfacing at this point from this short discussion of theoretical mechanisms used to map the percolation of subcategorization requirements assumed for head-complement construction onto the situation found with coherent constructions, we will return to the issue in detail in chapter 7 when we discuss the flexible nature of constituents required by the phenomenon of partial VP-topicalization before generalizing the issue to partial constituents of different categories in chapter 9.

2. Semantics

Turning from the observable morphologic and syntactic properties to issues of interpretation, for ordinary non-finite constructions, the semantic functor-argument structure conforms to what would be expected of head-complement constructions. A sentence like (1a), for example, repeated here as (27) can be assigned the simple functor-argument structure in (27a).

(27) daß er das Meer hören^2(1) will^1(0)
that he the sea hear wants
a. want(x,hear(x,sea))

Leaving aside a very limited number of exceptions we discuss in section 4 of chapter 3, the interpretation of the syntactic head V' is always the semantic functor and the verbal argument its direct argument. This simple observation has some practical value in that it makes the functor-argument relation a reliable indication of the selection relation among a sequence of coherently combined verbs in the cases where status government as defining relation behind the notion of a hypotactic chain is not

[19]In this thesis we will use the term verbal cluster in the broad sense as referring to any structure in which a verbal head combines with a verbal complement that has not itself selected any complements (except for a possibly occurring embedded verbal cluster).

reliable, which is the case when unexpected infinitival forms surface as discussed in section 1 of chapter 3.

Apart from the functor-argument structure, there are three semantic properties of non-finite constructions which we want to include in this empirical discussion even though they might appear to be digressions from the main line of argumentation following the basic properties expected of head-complement constructions. In section 3 we will remind ourselves, however, that these semantic properties, in addition to representing important empirical criteria for a classification of verbal heads selecting non-finite complements, closely relate to the properties discussed above and thus to our main line of argumentation.

2.1. Interpretation of the unexpressed subject of V". In general, the subject of a non-finite verb V" cannot overtly be realized as part of its own head projection – exceptions to this rule and their consequences are the topic of chapter 10. When no overt subject is present, the question arises which referent can fill the semantic subject role of an infinitival construction. The question is addressed under the title of *orientation* (*Orientierung*) by Bech (1955, ch. 3) and has played an important theoretical role under the heading of a theory of control in the principles and parameters paradigm, HPSG, LFG and most other frameworks.

In sentences containing only one NP, the subject of the finite V', it is this subject which is interpreted as the subject of V". Note that the overt subject NP is known to be the subject of V' (and not of V") since the subject agrees with V' in person and number.[20] The case is illustrated in (28).

(28) N' = N"

a. Karl will^{1}(0) gehen^{2}(1).
Karl wants go

b. Karl scheint^{1}(0) zu lachen^{2}(2).
Karl seems to laugh

In subjectless and in passive constructions, N" is interpreted as picking out an arbitrary referent from discourse, similar to the interpretation of *man* (*one*), which is shown in (29).[21]

[20] In subjectless constructions the verb exhibits an invariant third person singular morphology.

[21] As discussed by Grewendorf (1991, sec. 8.2.6), arbitrary reference of N" is sometimes claimed to only be available with subject infinitives (cf., Manzini, 1983; Sternefeld, 1985). An example for such an orientation of a subject infinitive is shown in (i).

(29) *man* = N"

a. Jetzt heißt^{1}(0) es sich beeilen^{2}(1).
now means it REFL *hurry*
'Now one has to hurry.'

b. Dort wird^{1}(0) getanzt^{2}(3).
there is danced
'One dances there.'

c. Karl wird^{1}(0) geküßt^{2}(3).
Karl is kissed
'Someone kisses Karl.'

When V' selects an object NP (A' or D') in addition to the verbal complement (V"), it is usually the object and not the subject of V' which is interpreted as the subject of V" (Bech, 1955, §84). This, however, is only a general tendency and not a rule. In general, the orientation of the non-finite complement therefore depends on a lexical classification of the verb V' which cannot simply be derived from the subcategorization requirements of that verb. In the following, we thus turn to the different classes which have to be accounted for.

A verb selecting a dative complement in general has two options for its coefficient: D':N" and N':N". In accordance with the above mentioned tendency, the largest class of such verbs has the coefficient D':N". An example with the verb *befehlen* is shown in (30). A small class of verbs semantically related to 'promising' or 'threatening' require the subject to fill the role of the unexpressed subject as illustrated in (31). Finally, as shown in (32) the verb *vorschlagen* (*suggest*) allows both options and additionally permits N'+D' to act as a plural referent (Bech, 1955, §114).

(30) D' present, D' = N"

Karl befahl^{1}(0) dem Burschen$^{D^1}$ zu kommen^{2}(2).
Karl commanded the boy to come

(i) Ein Haustier zu schlachten ist grausam.
a domestic.animal to slaughter is cruel
'It is cruel to slaughter a domestic animal.'

For a more general discussion of the issue of arbitrary control, the reader is referred to Siebert-Ott (1983), Wyngaerd (1994), and Wurmbrand (1998).

(31) D' present, N' = N"

Karl verspricht^1(0) dem Burschen$^{D^1}$ zu kommen^2(2).
Karl promises the boy to come

(32) D' present, D'/N'/D'+N' = N"

Ich schlage^1(0) ihm$^{D^1}$ vor, ihr ein Buch zu schicken^2(2).
I suggest him PART *her a book to send*
'I suggest to him that he/I/we send her a book.'

Since the orientation of a non-finite complement is a lexical property of the verb V', we follow Bech in classifying verbs according to their *coefficient* (*Koeffizient*), where a verb with the coefficient N':N" will only occur in constructions with the orientation N'=N", etc. In addition, we will call the argument of V' appearing in the coefficient, the NP controlling the infinitive or simply the controller.

The conclusion that a lexical classification of verbs is necessary to predict the orientation of an infinitival complement receives additional support from the fact that in a construction in which no dative object is overtly expressed, like the one shown in (33), since this V' has the coefficient D':N', the subject role of V' is interpreted to be an arbitrary referent from discourse, and not the only remaining overtly expressed referent N'.

(33) D' unexpressed, *man* = N"

Ich riet^1(0), es ihm zu holen^2(2).
I advised it him to get
'I advised someone to get him the thing.'

Turning to verbs selecting an accusative object in addition to the verbal complement, all such verbs can have the coefficient A':N" exemplified by (34). But verbs semantically related to *bitten* selecting a V" *dürfen* or a passive auxiliary can have the coefficient N':N", which is shown in (35) (Bech, 1955, §113).[22]

[22]Verbs selecting an obligatory reflexive could be put in either of the two classes, since independent of whether they are analyzed as having the coefficient D'/A':N" or N':N", the semantic referent will be identical as illustrated in (i). (Bech, 1955, ch. 14)

(i) N' = N" or D'/A' = N"

a. daß ich mir$^{D^1}$ einbildete^1(0) pünktlich zu sein^2(2).
that I REFL *believed on.time to be*
'that I believed to be on time'

b. Karl beeilt^1(0) sich$^{A^1}$ fortzukommen^2(2).
Karl hurries REFL *get.away*
'Karl hurries to get away.'

(34) A' present, A' = N"

a. Sarah sieht^1(0) den Burschen$^{A^1}$ gehen^2(1).
Sarah sees the boy leave

b. Sarah bittet^1(0) den Burschen$^{A^1}$ zu gehen^2(1).
Sarah asks the boy to leave

(35) A' present, N' = N"

a. Sarah bittet^1(0) den Burschen$^{A^1}$ gehen^3(1) zu dürfen^2(2).
Sarah asks the boy go to be.allowed
'Sarah asks the boy to allow her to leave.'

b. Ich flehte^1(0) sie$^{A^1}$ an, ihr beim Geschirrabtrocknen helfen^3(1) zu dürfen^2(2).
I implored her PART *her at drying.dishes help to be.allowed*
'I implored her to be allowed to help her dry the dishes.'

c. Er bittet^1(0) ihn$^{A^1}$, nicht schon wieder bestraft^3(3) zu werden^2(2).[23]
he asks him not already again punished to be
'He asks him not to be punished again.'

Just like with verbs selecting dative objects, the coefficient is independent of whether the object is actually realized (Bech, 1955, §168):

(36) A' unexpressed, *man* = N"

a. Ich lasse^1(0) es holen^2(1).
I let it get
'I let someone get it.'

b. Ich bitte^1(0), auch mein Zimmer zu durchsuchen^2(2).
I ask also my room to search
'I ask someone to also search my room.'

(37) A' unexpressed, N' = N"

a. Sarah bittet^1(0) gehen^3(1) zu dürfen^2(2).
Sarah asks go to be.allowed
'Sarah asks someone to allow her to leave.'

[23]Apart from the N':N" orientation, this sentence also supports an A':N" interpretation, e.g., in a context where a father asks his son not to get into trouble again.

b. Er bittet^1(0), nicht schon wieder bestraft^3(3) zu werden^2(2)
he asks not already again punished to be
'He asks someone/everyone not to be punished again.'

An interesting special case are the verbs *vorschlagen* and *anbieten*. Their coefficient is underspecified since, as shown in (38), N" can be interpreted to be N', D' or N'+D', dependent on the context (Bech, 1955, §§185, 198).[24]

(38) a. N' = N"
Karl bot^1(0) ihr$^{D^1}$ an, sie zu küssen^2(2).
Karl offered her PART *her to kiss*
'Karl offered her to kiss her.'

b. D' = N"
Ich bot^1(0) ihm$^{D^1}$ an, mit seiner Familie bei uns den Urlaub zu verbringen^2(2).
I offered him PART *with his family at us the vacation to spend*
'I offered him that he and his family could spend his vacation at our place.'

c. N'+D' = N"
Karl bot^1(0) ihr$^{D^1}$ an, gemeinsam in den Urlaub zu fahren^2(2).
Karl offered her PART *together on the vacation to go*
'Karl offered her to go on vacation together.'

Finally, apart from N', A', and D' as direct NP arguments of V', the controller can also be an argument of a preposition in a PP which is a dependent of V' (Bech, 1955, §§85, 155). For example, in (39) the controller is an accusative NP as complement of the preposition *in* which is the head of a PP-complement of V'.

(39) *in* A':N"
Er würde^1(0) nicht weiter in sie$^{inA^2}$ dringen^2(1), mitzukommen^3(2).
he would not further into her urge come.along
'He would not urge her further to come along.'

[24]Note that the coefficient of these verbs is not contextually underspecified and then syntactically resolved, as is the case for optionally coherent verbs, which in an actual construction are either coherent or incoherent (cf., sec. 3.1.6 of ch. 9). The sentences in (38) have a preferred reading, but the other orientations remain possible as well (except for the adverbial *gemeinsam* forcing a plural antecedent in (38c)).

2.2. Nature of the relation of V' to the controller. A related semantic property of non-finite constructions, which was not distinguished by Bech but has received much attention in the later literature, is the relation between the verb V' and the element in its verb-field controlling the infinitive. On the one hand, the lexical class of *raising*[25] verbs only establish a syntactic relation to this controller; or viewed the other way, the controller does not fill a semantic role of V'. This can be empirically established as follows. Firstly a syntactic relation like subject-verb agreement is ensured (40).

(40) a. Karl scheint zu kommen.
Karl seems to come

b. Die Kinder scheinen zu kommen.
the children seem to come

Secondly, V' can select *subjectless non-finite complements* like the impersonal passive (41a) or a complement headed by a lexically idiosyncratic verb (41b).

(41) a. Dort scheint getanzt zu werden.
There seems danced to be.
'Someone seems to dance there.'

b. Ihn scheint zu frieren.
him seems to freeze
'He seems to be cold.'

Thirdly, V' can select a verbal complement requiring a *non-referential subject*, i.e., one that does not contribute a semantic index (42).

(42) Es scheint zu regnen.
it seems to rain

And finally, passivization of the non-finite complement does not change the interpretation of the entire construction (43).[26]

[25]The term *raising* introduced here as well as the term *equi* introduced below have a long tradition in generative grammar (Postal, 1974; Perlmutter and Soames, 1979) and were originally associated with a particular kind of analysis. They have since become traditional names for two classes of verbal complement taking verbs distinguishable by the tests mentioned above. It is in this empirically-descriptive sense that we make use of these terms. Note that we employ the term *control* or *orientation* to refer to any relationship determining the interpretation of N" as introduced in the last section. It therefore covers both equi and raising relationships.
[26]See, e.g., discussion in Pollard and Sag (1994, p. 136) and Kiss (1995a, p. 10).

(43) a. Karl scheint das Buch auszuleihen.
Karl seems the book to borrow
'Karl seems to borrow the book.'

b. Das Buch scheint von Karl ausgeliehen zu werden.
the book seems by Karl borrowed to be
'The book seems to be borrowed by Karl.'

An *equi* verb V', on the other hand, establishes both a semantic and a syntactic relation to the controller in its verb-field, i.e., the controller is a syntactic and semantic argument of V'. The verb *versuchen* in (44) can be classified as an equi verb with the help of the above mentioned tests showing the unavailability of subjectless complements (45) or non-referential subjects (46), and the failure of the passivization of the complement (47) to result in a paraphrase.

(44) Karl versucht zu lachen.
Karl tries to laugh

(45) a. * Hier versucht getanzt zu werden.
hier tires danced to be

b. * Ihn versucht zu frieren.
him tries to freeze

(46) * Es versucht zu regnen.
it tires to rain

(47) a. Karl versucht das Buch auszuleihen.
Karl tries the book to borrow
'Karl tries to borrow the book.'

b. % Das Buch versucht von Karl ausgeliehen zu werden.
the book tries by Karl borrowed to be
'The book tries to be borrowed by Karl.'

Verbs not having the coefficient N':N" are not as easily classified as raising verbs since one cannot use subject-verb agreement to illustrate that an A or D actually belongs to V' and not V". One can, however, observe that the class of AcI verbs differ from object-oriented equi verbs in that they permit subjectless verbal complements or complements requiring non-referential subjects, and we will therefore classify them as subject-to-object raising verbs. The relevant contrast is illustrated by (48) compared to (49).

(48) a. Karl sieht es regnen.
Karl sees it rain

b. Er sah ihr schlecht werden.[27]
Karl sees her sick become.

(49) a. Karl bittet Maria zu lachen.
Karl asks Maria to laugh

b. * Karl bittet es zu regnen.
Karl asks it to rain

Ending the short overview of the nature of the relation of a verb V' to its controller, i.e., the raising/equi distinction, let us introduce the term *control-level* so that we can speak of the control-level of a verb V' to refer to the raising/equi distinction in the same way we speak of other lexical classifications such as the coefficient (N':N", A':N", ...) or the (in)coherence (obl. coherent, opt. coherent, obl. incoherent) of a verb.[28]

We will return to the raising/equi distinction when we discuss how it relates to the coherence/incoherence classification in section 3.2. Turning to the theoretical interpretation in part three of this thesis, we will show that the control-level of a verb plays a major role for a local account of apparently long-distance case and agreement relations in partial fronting constructions.

2.3. Interpretation of scope bearing elements. After discussing the functor-argument structure, the interpretation of the unexpressed subject and the nature of the relation of V' to the controller, we now take a brief look at the interpretation of scope bearing elements as a further observable semantic criterion for the classification of verbs.

The sentence (50) is ambiguous with respect to what the adverbial *laut* semantically modifies. Either it was the talking which was loud (narrow scope) or it was the promise to talk which was loudly voiced (wide scope). Depending on the semantic plausibility and context, one or the other

[27] Example due to Höhle (1978, p. 70).
[28] Kiss (1995a, pp. 4ff) and other German linguistics texts use the term *Subjektfähigkeit* to refer to the equi and raising distinction. Since this term does not include the occurrence of accusative controllers in equi and raising (= AcI) constructions, we decided to instead introduce the new term control-level. The intuition behind this term is that what distinguishes raising from equi verbs is the level (syntactic vs. semantic) at which a verb V' relates to the controller figuring in its coefficient.

reading can be prominent; in (51a) the narrow scope reading is preferred, whereas in (51b) it is the wide-scope reading.

(50) daß Karl laut zu reden versprach
that Karl loud to talk promised

a. promise(k,loud(talk(k)))

b. loud(promise(k,talk(k)))

(51) a. daß Karl laut zu hupen versprach.
that Karl loud to honk promised
'that Karl promised that he would honk loudly'

b. daß Karl laut zu verlieren versprach.
that Karl loud to lose promised
'that he loud-voicedly promised that he would lose'

The same effect is illustrated with negation as another kind of scope bearing adjunct in (52).

(52) a. Gott schrieb auf die Gebotstafeln, daß der Mensch nicht töten soll.
god wrote onto the commandments that the man not kill shall
'God wrote onto the commandment-boards that man shall not kill.'
shall(not(kill(x,y)))

b. Gott bedauerte, daß der Mensch nicht lesen kann.
god regretted that the man not read be.able
'God regretted that man is unable to read.'
not(be.able(read(x,y)))

As illustrated by the following examples, this scope ambiguity only arises in coherent constructions and not in incoherent ones:

(53) a. daß Karl versprach, laut zu hupen.
that Karl promised loud to honk
'that Karl promised to honk loudly'

b. daß vor der Kirche laut zu hupen ein jeder hier versprechen muss.
that bef. the church loud to honk an everyone here promise has
'that everyone here has to promise to honk loudly in front of the church'

(54) a. daß Karl laut versprach, zu hupen.
that Karl loud promised to honk
'that Karl promised loudly to honk.'

b. daß vor der Kirche zu hupen ein jeder hier laut versprechen muss.
that bef. the church to honk an everyone here loud promise has
'that everyone here has to promise loudly that to honk in front of the church.'

Interestingly, Bech (1955, §§57, 69) seems to have a 'lexicalist dependency' perspective on the issue of such scope bearing elements. While, as far as we see, he is not explicit about this issue, one can interpret him to intend that an adverbial is always interpreted with scope over the verbal head of the *verb-field* the adverbial belongs to. As we discussed in section 1.1, a verb-field F' consists of the verbal head V' and all its dependents (except for V"). The ambiguity in coherent examples such as (50) and (52) then arises from the fact that when two verb-fields form a single coherence field, the rest-field elements of V' and V" can scramble so that an adverbial as one of the rest-field elements occurring in the coherence field can be identified either as belonging to the verb-field of V' or to the one of V". In the first case, one obtains the 'wide scope' reading, in the second, the 'narrow scope' one. In incoherent constructions such as (53) and (54), the adverbial can always be identified as part of the verb-field of a specific verb since each verb forms its own coherence field and each coherence field constitutes a separate topological unit. We come back to this perspective on scope bearing elements at the end of section 5.2 in chapter 8.

3. Relating the observed properties

The overview of the fundamental status government, word order, and semantic phenomena has reminded us of four lexical properties which make it possible to structure the observable phenomena. A verb V' selecting a non-finite verbal complement can be classified according to

- the *status* of V" it governs:
  first, second, or third status
- the *(in)coherence* of its combination with F":
  obligatorily coherent, optionally coherent, obligatorily incoherent
- the *coefficient* of V':
  N':N", A':N", D':N", ...
- the *control-level* at which the controller relates to V':
  only syntactic (raising), also semantic (equi)

In light of such a rich lexical classification, the question arises whether and in which way these four properties correlate. On the empirical side, observing such correlations provides generalizations further structuring the empirical domain. On a more theoretical level, it has often been attempted to derive one of the dimensions from one or several of the others. Finally, from the viewpoint of generative linguistics one can try to interpret the correlations as pointing the way to fewer "deeper" classifications from which the above classes can be derived.

In the following, we discuss some of the correlations which can be observed or have been claimed to be observable in the literature.

3.1. Relating status government to coherence.

3.1.1. *First/third status → obligatory coherence?* The most prominent correlation between the status governed by a verb and the coherence of its construction was formulated by Bech (1955, §65) in the so-called *rule of coherence* (*Kohärenzregel*). It states that whenever a verb V' selects a verbal complement V" in first or third status, the construction is coherent. This rule surfaces in different forms in most of the later literature, e.g., when Stechow and Sternefeld (1988, p. 443, our translation[29]) state that "every incoherent infinitive is a *zu*-infinitive.".

While this is an important and useful generalization, Bech (1955, §238) remarks that this rule is not without exception. As we mentioned in section 1.1, a small class of verbs can govern either the first or the second status without any change in meaning. Those verbs of this class which can construct incoherently, in particular *helfen* (*help*), *lehren* (*teach*), *lernen* (*learn*), and (stato)motoric verbs like *gehen* (*go*), *kommen* (*come*), or *schicken* (*send*), apparently can head an incoherent constructions even when they govern a complement in first status. This is illustrated by the following examples from the literature provided by Bech (1955, §§215, 231ff).

[29]Original: "Jeder satzwertige Infinitiv ist ein *zu*-Infinitiv". Note that we used the term 'incoherent' to translate 'satzwertig' (sentential) as Stechow and Sternefeld (1988, p. 407) explicitly equate the two terms. Kiss (1995a, pp. 14ff) discusses that the notion of 'Satzwertigkeit', which refers to an intuitive parallelism between incoherent infinitives and finite sentential complements, at closer inspection fails to capture an independent theoretical notion. In agreement with his argumentation, the term will not be used in this thesis.

(55) a. ? Wer mich geheißen hätte, die Türe öffnen.
who me told had the door open
'Who would have told me to open the door.'

b. ? Daß wir doch lernten, vor allem aushalten und nicht urteilen.
that we still learned before all wait and not judge
'But we nonetheless learned mainly to wait and not to judge.'

(56) Wir wollen helfen, die Unterdrückung enden.
We want help the suppression end
'we want to help end the suppression.'

(57) a. Wollen wir zu den Förstern gehen, ihnen Lebewohl sagen?
Want we to the forest.rangers go them good-bye tell
'Do we want to go to he forest rangers to tell them good-bye?'

b. Hingegen wollte Agnes nach Tirol reisen, dort vorfühlen.
On.the.other.hand wanted Agnes to Tirol travel there get.in.touch
'Agnes, on the other hand, wanted to travel to Tirol to get in touch.'

c. Ich mußte hinauf, die Kinder begrüßen.
i had.to up, the children say.hello
'I had to go upstairs, say hello to the children.'

d. Ich wollte zur Garderobe, meinen Mantel holen.
I wanted to.the wardrobe my coat get
'I wanted to go to the wardrobe to get my coat.'

The status of these counterexamples is, however, not entirely clear, and they do not appear to constitute a homogenous group. Examples like the ones in (55) have an archaic tone to them and could be paratactic constructions, with the phrase after the comma having an imperative interpretation. And for the example (56), Bech (1955, §§215, 231) points out himself that the verb *wollen* occurring in verb-second governs a first status, so that one could attempt to analyze these constructions as involving a coordination of two verbal complements in first status. Such an analysis would not explain Bech's observation, though, that these constructions only arise when the verbal complement in the first conjunct is one of the verbs optionally governing a first or a second status. In this empirical overview, we cannot pursue this issue further. Let us therefore conclude that if one follows the assessment of Bech (1955) that at least some of these examples involve incoherently constructing verbs selecting a complement in first status, one needs to localize the exception to the rule of coherence in the lexical specification of certain verbs, in particular in the specification of the lexical class of verbs which can govern both first or second status. The rule of coherence then has to be defined in terms allowing reference to such lexical classes (cf., Bech, 1955, §§238).

3.1.2. *Second status → optional incoherence?* Bech's rule of coherence makes it a necessary condition for incoherence that the verbal head selects a complement in second status. Kathol (1995, pp. 237–238) claims that one can strengthen the relationship by adding that all verbs governing a second status can construct incoherently.

A closer look at the data shows that such a generalization permitting incoherent combination for all verbs governing a second status is incorrect. Take, for example the sentence (58) which shows that *wissen* (*know*) is an instance of a verb selecting a non-finite complement in second status. The non-finite complement fails the classical test of incoherence in that it cannot be extraposed (59).

(58) a. Karl weiß sich eine gute Suppe zu kochen.
Karl knows REFL *a good soup to cook*
'Karl knows how to cook himself a good soup.'

b. Karl weiß sich zu benehmen.
Karl knows REFL *to behave*
'Karl knows how to behave himself.'

(59) a. * daß Karl weiß, sich eine gute Suppe zu kochen
that Karl knows REFL *a good soup to cook*

b. * daß Karl weiß, sich zu benehmen.
that Karl knows REFL *to behave*

In general, there are a number of verbs which select a verbal complement in second status and can only construct coherently, which we illustrate with an example each, mostly following Askedal (1982, p. 293): *brauchen* (*need to*)[30] (60) (cf., also Bech, 1955, §§87, 225), *scheinen* (*seem*) (61), *haben* (*have*) (62), *sein* (*be*) (63), *bleiben* (*stay*) (64), *bekommen* (*get*) (65), *pflegen* (*usually do*) (66)(cf., Bech, 1955, §§81, 87, 127), the light verb constructions *zu erkennen geben* (*disclose identity*) (67) and *zu schaffen machen* (*work on something*) (68), and *geben* (*give*) (69) (cf., Tappe, 1984).

[30]Note that *brauchen* is one of the verbs which can also govern a first status.

(60) a. daß er nicht mehr nach Hause zu fahren brauchte
that he no more to home to drive need
'that he did not have to drive home any more'

b. * daß er nicht mehr brauchte, nach Hause zu fahren
that he no more needed to home to drive

(61) a. daß er (uns allen) krank zu sein schien
that he (us all) sick to be appeared
'that (to all of us) he appeared to be be sick'

b. * daß er (uns allen) schien, krank zu sein
that he (us all) appeared sick to be

(62) a. daß alle Angestellten die Vorschriften zu befolgen haben
that all employees the rules to follow have
'that all employees have to follow the rules'

b. * daß alle Angestellten haben, die Vorschriften zu befolgen
that all employees have the rules to follow

c. obwohl er als Kunsthänder einen Namen zu verlieren hatte
even.though he as art.seller a name to lose had
'even though he as art.seller had a name to lose'

d. * obwohl er als Kunsthänder hatte einen Namen zu verlieren
even.tough he as art.seller had a name to lose

(63) a. daß die Vorschriften von allen Angestellten zu befolgen sind
that the rules by all employees to follow are
'that the rules are to be followed by all employees'

b. * daß die Vorschriften sind, von allen Angestellten zu befolgen
that the rules are by all employees to follow

(64) a. daß vieles noch zu erledigen blieb
that much still to do remained
'that much remained to be done'

b. * daß vieles noch blieb zu erledigen
that much still remained to do

(65) a. als er die Nachricht zu hören bekam
when he the news to hear got
'when he got to hear the news'

b. * als er bekam, die Nachricht zu hören
when he got the news to hear

(66) a. daß er mir zu helfen pflegt
that he me to help is.used
'that he is used to helping me'

b. * daß er pflegt, mir zu helfen
that he is.used me to help

(67) a. daß er sich sofort zu erkennen gab
that he REFL *immediately to be.recognized gave*
'that he immediately disclosed his identity'

b. * daß er sofort gab, sich zu erkennen
that he immediately gave REFL *to be.recognized*

(68) a. daß er sich sofort an dem Auto zu schaffen machte
that he REFL *immediately at the car to work made*
'that he immediately turned to working on the car'

b. * daß er sich sofort machte, an dem Auto zu schaffen
that he REFL *immediately made at the car to work*

(69) a. Er gab ihr die Medizin zu trinken.
he gave her the medicine to drink

b. * obwohl er ihr gab, die Medizin zu trinken
even.though he her gave the medicine to drink

The examples in (69) taken from Tappe (1984) are particularly interesting since *geben* is an object-oriented equi verb which, as we discuss in section 3.2.2 and 3.3.1 below, are usually considered prime examples of incoherently constructing verbs.

3.2. Relating the control-level to coherence.

3.2.1. *Raising → obligatory coherence?* An assumption underlying many of the proposals in the principles and parameters paradigm is that raising verbs cannot construct incoherently, or viewed the other way around, verbs heading incoherent constructions have to be equi verbs. Haider (1990a, p. 128, our translation[31]), for example, states that there "is general agreement about the fact that the so-called raising verbs are obligatorily coherent".

While this is true for most raising verbs, there are verbs which appear to falsify the generalization, the so-called *phase verbs*, the verb *drohen* in

[31] Original: "Einigkeit besteht auch darüber, daß die sog. Anhebungsverben obligat kohärent sind."

the variant meaning 'danger of an unwelcome event happening' (Haider, 1993, p. 242f), and finally we could add the impersonal use of *versprechen* (*promise*).[32] As illustrated by the examples (70), (71), and (72), each of these verbs can occur in structures combining two properties: First, the verbal complement is extraposed, which identifies the construction as incoherent. And second, the verb fails to require the presence of a thematic subject, which makes them plausible candidates for raising verbs.[33]

(70) a. Als mir erneut anfing, schlecht zu werden, ...
when me again began sick to become
'When I started to become sick again, ... '

b. Es hatte aufgehört zu regnen.
it had stopped to rain
'It had stopped raining.'

(71) a. Im Herbst schließlich stoppte Apple die Auslieferung einiger Power
in autumn finally stopped apple the delivery of.some Power
Books, weil sie drohten sich zu überhitzen und in Flammen
Books because they threatened REFL *to overheat and in flames*
aufzugehen.[34]
go.up
'In autumn, finally, Apple stopped the delivery of some Power Books since there was a danger that they would overheat and go up in flames.'

[32] Incoherent examples with the phase verbs are also mentioned by Bech (1955, §117). He also reports the particular variants of *drohen* and *versprechen*, but only with coherent examples (Bech, 1955, §126).

[33] The other test identifying raising verbs we discussed above, passivization of the verbal complement in order to check whether one obtains a paraphrase of the active sentence, does not provide clear results. Passivization in a coherent construction (ib) seems to be possible with roughly the same interpretation as the active form. Extraposing the passivized complement to ensure incoherence as in (ic), however, seems to result in a sentence which is of questionable grammaticality.

(i) a. obwohl der Lehrer nicht sofort begann, den Schüler zu bestrafen
even.though the teacher not directly began the student to punish
'even though the teacher did not directly begin to punish the student'

b. obwohl der Schüler vom Lehrer nicht sofort bestraft zu werden begann
even.though the student by.the teacher not directly punished to be began

c. ?? obwohl der Schüler nicht sofort begann, vom Lehrer bestraft zu werden
even.though the student not directly began by.the teacher punished to be

[34] Thanks to Stefan Müller for this example from taz (20./21.01.96, p. 7).

b. Das elektronische Stabilitätsprogramm ESP überwacht die
the electronic stability.program ESP monitors the
Fahrzeugbewegungen und greift in kritischen Situationen ein,
vehicle.movements and intervenes in critical situations PART
wenn der Wagen droht, außer Kontrolle zu geraten.[35]
when the car threatens out.of control to get
'The electronic stability program ESP monitors the movements of the car and intervenes in critical situations when the car is in danger of getting out of control.'

c. obwohl ihm nun droht der Führerschein entzogen zu werden
even.though him now threatens the driving.license taken.away to be
'even though he is now in danger of losing his drivers license'

(72) obwohl heute verspricht ein wunderschöner Tag zu werden
even.though today promises a wonderful day to become
'even though today looks like it will develop into a wonderful day'

The lexical class of phase-verbs as well as *drohen* and *versprechen* thus seem to be exceptions to the generalization that raising verbs always construct coherently.

Interestingly, this collection of exceptional verbs could be argued to have a common property, namely that each of these verbs exists in two forms: a raising and an equi variant. For *drohen* and *versprechen* the semantics of the two variants is different enough to make it easy to distinguish them. For the phase verbs, the existence of the two variants is less obvious. Perlmutter (1970), however, argues for distinguishing a raising from an equi variety of *begin* in English – a proposal one could carry over to the German phase-verbs.[36]

Note that establishing the existence of an equi variety for each of the verbs in the above examples does not make these examples less exceptional since the absence of a thematic subject role shows that it is the raising and not the equi variety which constructs incoherently there. But if the same verb also exists as an equi variety, for which an incoherent construction would be expected, the nature of the exception caused by these verbs bears an interesting similarity to the exceptions to the rule of coherence discussed in section 3.1.1. The exception there also arose from the fact that a verb with two variants, one governing first, the other second status, permitted an incoherent construction not only in the expected case when

[35]Thanks to Stefan Müller for this example from Spiegel (41/99, p. 103).
[36]Thanks to Stefan Müller for bringing this paper to my attention.

a second status is governed, but also in the exceptional case when the complement bears first status. A conclusion one could draw from this is that what actually plays a role in licensing a particular construction are the properties of the lexical class an item belongs to. More abstract generalizations, such as the one that only verbs selecting second status complements or equi verbs can construct incoherently, are either derived epiphenomena or they represent earlier language stages which have since been reinterpreted in terms of lexical classes.

Semantic properties → obligatory coherence? Related to the idea that verbs syntactically but not semantically selecting a controller can only construct coherently, it has sometimes been suggested that the class of verbs constructing coherently can be derived from semantic properties of the predicate. While such a regularity could be based on a wide variety of lexical semantic distinctions, it is instructive to realize that verbs with essentially the same interpretation, such as *wollen* and *wünschen* (*want*) differ significantly with respect to their syntactic properties.[37] The verb *wollen* selects a complement in first status and obligatorily constructs coherently, whereas *wünschen* governs a second status and optionally constructs incoherently. It is unclear how these syntactic differences could be derived purely from the semantic properties of these two predicates.

3.2.2. *Equi → optional incoherence?* Equi verbs have also been claimed to relate to a certain mode of construction. One of the fundamental generalizations underlying the proposal of Stechow and Sternefeld (1988, p. 443) is that "if an equi verb can coherently embed a *zu*-infinitive it can also embed this infinitive incoherently." (our translation[38]). In other words, all equi verbs selecting a complement in second status are predicted to have the option of constructing incoherently.

We already came across an example at the end of section 3.1.2 which sheds some doubt on this generalization. Tappe (1984) pointed out that the object-oriented equi verb *geben* governing a complement in second status can construct coherently, as shown by the rest-field scrambling example in (73). Interestingly, this verb cannot head an incoherent constructions, as shown by the ungrammaticality of the extraposition in (74a) and the equally ungrammatical pied-piping word order in (74b).

[37]Thanks to Arnim von Stechow for pointing this out to me.
[38]Original: "Falls ein Kontrollverb einen *zu*-Infinitiv kohärent einbetten kann, kann es diesen Infinitiv auch inkohärent einbetten."

(73) a. obwohl es ihr der Mann zu trinken gab
even.though it her the man to drink gave

(74) a. * obwohl er ihr gab, die Medizin zu trinken
even.though he her gave the medicine to drink

b. * die Medizin, die zu trinken er ihr gab
the medicine which to drink he her gave

The verb *geben* thus appears to represent an instance of an equi verb selecting a *zu*-infinitive which in contradiction to the generalization envisaged by Stechow and Sternefeld (1988) can construct coherently but not incoherently.[39]

3.3. Relating the coefficient to coherence.

3.3.1. *Object-oriented equi → obligatory incoherence?* Bech (1955, §§88, 191ff) pointed out that the coefficient of a verb is an important indicator for the (in)coherence of the constructions it can occur in. More specifically, he states that there is a strong tendency for object-oriented verbs to construct incoherently.[40]

Reshaping the tendency observed by Bech (1955) to a generalization over equi verbs, Stechow and Sternefeld (1988, pp. 445f, attributing the idea to Tappe 1982) claim that only subject-oriented equi verbs can construct coherently, i.e., object-oriented equi verbs have to construct incoherently. They mention as a possible counter-example sentences like the one shown in (75), in which the dative complement of *helfen* controls a coherently selected complement, which can be deduced by the rule of coherence since the complement bears first status.

(75) Wir helfen ihnen sparen.
we help them save
'We help them save money.'

To explain this counter-example away, they suggest to analyze *sparen* not as a verbal but as a nominal complement derived from *beim Sparen*. Independent on whether this explanation can be fruitfully entertained,

[39] An alternative would be to follow Marga Reis (p.c.) in viewing Tappe's *geben* construction as a syntactic idiom which is a relict of what Ebert (1976) calls the *shared construction*, where the NP is at the same time selected by both verbs.

[40] Bech (1955, §125) reports the same tendency for verbs subcategorizing for an object NP having the coefficient N':N".

there appear to be other examples for coherently constructing object-oriented equi verbs which do not fall into this class.

Bech (1955, §191) reports some supposedly coherently constructed examples such as the one with the object-oriented equi verb *verbieten* in (76).

(76) so daß er nun böse und wild geworden sei, weil sein eigener Vater
so that he now angry and wild become is because his own father
ihm zu leben verbiete
him to live forbid
'so that he now became angry and wild, since his own father forbid him to live'

Since the sentence neither exhibits scrambling of rest-field elements nor a dependent of V" with scope over V', the example could, however, equally well be analyzed as an incoherent construction.[41] Bech himself claims that such example do not occur with a transitive V" and if one replaces V" in (76) with a transitive verb to enforce coherence with rest-field scrambling one does obtain a sentence of questionable grammaticality (77).

(77) ?? daß er sie ihm zu heiraten verbietet
that he her him to marry forbids
'that he forbids him to marry her'

A reasonably well-formed instance of such a construction is provided by Haider (1990a, p. 128) though. The sentence (78) shows the dative-object-oriented equi verb *versprechen* in a coherent construction.

(78) ? weil es ihr jemand zu lesen versprochen hat
because it her someone to read promise has
'because someone promised her to read it'

As a further type of example illustrating the possibility of coherent constructions with such verbs, he presents the 'remote passive' sentence in

[41] As already pointed out by Grewendorf (1991, pp. 275f), Bech (1955) appears to have rashly classified sentences in which an infinitival complement appears in the Mittelfeld as coherent whenever the verbs occur in a sequence which could form the final-field of a single coherence-field. In the absence of further evidence for the existence of such a single coherence-field, such as rest-field scrambling or dependents of V" with scope over V', such sentences, however, are in fact ambiguous between coherence and incoherence as nothing prohibits an independent coherence-field K" from occurring as rightmost element in the rest-field of K'.

(79a), which he attributes to Tilman Höhle.[42] Askedal (1988, p. 13) points out the parallel example (79b) from Stefan Zweig as presented by Bech (1955, §350).

(79) a. der Erfolg wurde uns nicht auszukosten erlaubt
the success was us not enjoy permitted
'we were not permitted to enjoy our success'

b. Keine Zeitung wird ihr zu lesen erlaubt.
no newspaper is her to read permitted
'She was not permitted to read the newspaper.'

Finally, as we already mentioned in sections 3.1.2 and 3.2.2, Tappe (1984) shows that the object-oriented equi verb *geben* governing a complement in second status occurs in coherent constructions and can actually only construct coherently.

There thus appear to be a variety of counter-arguments which would have to be addressed if one wants to keep entertaining the claim that object-oriented equi verbs cannot construct coherently.[43]

3.3.2. *Subject-orientation ↔ optional coherence?* While we above discussed the tendencies observed by Bech in terms of object-orientation as a sufficient condition for incoherence, Haider (1993, p. 250) interprets Bech (1955, §88,125) under the perspective of what verbs are candidates for coherence. The regularity under this perspective would then be that coherence is an option exactly for subject-oriented verbs without nominal objects.

As we already saw above, restricting coherence to subject-oriented verbs is too strict, as there are object-oriented verbs which can construct coherently, and Haider comes to the same conclusion.

The new aspect of the generalization Haider investigates is that if coherence cannot be reduced to subject-orientation, subject-orientation might at least be a sufficient condition for coherence. He points out, however,

[42]The fact that such 'remote passivization' is only possible in coherent constructions is discussed in section 3.4.2 of chapter 10.

[43]Haider (1993, p. 251) comes to a similar conclusion and therefore does not entertain the general claim that object-oriented equi verbs can only construct incoherently. Instead he narrows it down to the claim that verbs which select an accusative object in addition to the non-finite complement, i.e., generally accusative-object-oriented equi verbs, cannot construct coherently. We are not aware of counter-examples to this generalization.

that there are subject-oriented verbs without nominal objects which do not allow a coherent construction, and he illustrates this with the verbs *Abstand nehmen* (*abstain*), *fortfahren* (*continue*), *verzichten* (*renounce*), and *vorgeben* (*pretend*) in (80).

(80) a. * daß sich Max dieser Anrede nicht zu bedienen Abstand nahm
that REFL *Max this address not to use distance take*

b. * daß sich Max nicht darum zu kümmern fortfuhr
that REFL *Max not about.that to care continued*

c. * daß sie Max nicht wiederzusehen verzichtete
that her Max not see.again renounced

d. * daß sich Max nicht dafür zu interessieren vorgab
that REFL *Max not for.that to be.interested pretended*

One can thus conclude that even though subject-orientation and coherence are often closely related, there appears to be no direct generalization correlating the two in general. It is neither possible to reduce coherence to subject-orientation nor is subject-orientation a necessary condition for coherence.

3.4. Summary. In the last sections we investigated a number of generalizations from the literature which were claimed to relate coherence to other phenomena such as status government, the control level or the coefficient of a verb.[44] Many of these generalizations have played a central role as basis for higher-level 'explanations' in generative linguistics. We showed that even though these generalizations nicely characterize the majority of examples, each one comes with a number of exceptions which, unless properly taken into account, invalidate any higher-level 'explanation' built on these generalizations.

[44]Note that we usually only picked one exemplary reference from the literature to introduce each claim. Most of the generalizations discussed are explicitly or implicitly made in many other publications. To add one more example, Haider et al. (1995b, p. 9) state that "Control constructions (with the exception of dative control verbs which are obligatorily incoherent) have the option of entering into either a coherent or an incoherent construction". We saw above that as it stands this sentence is doubly incorrect: certain dative-object-oriented equi verbs can construct coherently (cf., sec. 3.3.1), and there are equi verbs which only construct incoherently (or only coherently) (cf., sec. 3.3.2 and 3.3.1).

CHAPTER 3

Irregular Properties of Coherent Constructions

After reviewing the basic properties of non-finite constructions, this chapter introduces a number of systematic deviations from the regularities expected for head-complement structures which arise in coherent constructions.

1. Status government

In section 1.1 of chapter 2, status government was introduced as defining criterion for hypotactic chains: in a hypotactic chain, a verb V' governs the status of a verb V". Which of the three status is governed is a lexical property of the verb V', and a specific verb will always govern the same status. There are two systematic deviations from this syntactic regularity. Firstly, the much discussed *substitute infinitive* also referred to as *infinitive pro participio* (*IPP*). These are cases in which a verb V" selected by a verb governing the third status surfaces in the first status instead of the third. Secondly, a much less discussed phenomenon which we will refer to as *substitute zu-infinitive* in which a verb surfaces in the second instead of the governed third status.

In the generative literature, the substitute infinitive is usually discussed in connection with an irregular word order of the final-field arising in coherent constructions, the so-called upper-field phenomenon we briefly mentioned in the discussion of the final-field in section 1.4.1 of chapter 2. In the following discussion, we depart from this tradition of viewing the irregular status and word-order phenomena as two sides of the same coin since even though in verb-last sentences the substitute infinitive usually arises in conjunction with the verb *haben* in the upper-field, the two phenomena are to a certain degree independent. The substitute infinitive also surfaces in sentences in which no verb occurs in the upper-field, namely when *haben* is the matrix predicate in a verb-first or verb-second sentence. And even in verb-last sentences, the ordinary upper-field linearization of verbs at the left edge of the final-field is not the only irregular word order correlating with irregular status government but positions further to the left as well as to the right of the most deeply embedded verb seem to have the same effect. In the following, we therefore first turn to a discussion of the status phenomena in sections 1.1 and 1.2 before dealing with the word-order phenomena in section 2. In section 3 we then turn to the relation between the status and word-order phenomena.

1.1. Substitute infinitive. In (81) we see a typical example for the occurrence of a substitute infinitive. While the status government relations in (81a) are as expected – the finite verb *hat* assigns the third status to its complement *gehört*, and *gehört* governs the first status of its complement *singen* – in sentence (81b), which is interpreted in exactly the same way, we find the infinitive of *hören* instead of the past participle. In the example, we add a lower index to the status to mark the status which would regularly be assigned.

(81) a. Er hat^1(0) sie singen^3(1) gehört^2(3).
he has she sing heard
'He heard her sing.'

b. Er hat^1(0) sie singen^3(1) hören^2(1_3).
he has her sing hear

As mentioned above, the generative literature on coherent constructions has usually discussed this status phenomenon as a side-effect of certain word-order regularities. The focus of these works is on the constituent structure involved and the formal mechanisms which have to be assumed to obtain the relevant word orders. Extensive empirical discussions of the status irregularities as such can mostly be found in the non-generative literature, such as Merkes (1895, 1896) or Aldenhoff (1962).[1] Apart from diachronic considerations concerning the origins of the past participle and substitute infinitive verb forms, which are only indirectly relevant to our synchronic investigations, Merkes and Aldenhoff present a detailed lexical

[1] Interesting discussions of the topic can also be found in Kehrein (1856, pp. 38–41, §48–50), Grimm (1898, pp. 168–169), Erdmann (1886, §153), Blatz (1896, pp. 612–616), Curme (1922, pp. 257–259), and in particular Wilmanns (1906, pp. 161–163, §87), who discusses the substitute infinitive, its relation to word order, and in a footnote on p. 163 also the often ignored substitute *zu*-infinitive cases we turn to in section 1.2.

classification distinguishing verbs which can or have to occur as substitute infinitives from those which always surface as ordinary participles, which we turn to next.

1.1.1. *Which verbs occur as substitute infinitives?* As pointed out by most authors, there is a fair amount of dialectal and inter-speaker variation concerning the classification of verbs which can or have to occur as substitute infinitives. The situation seems to be clearest with the six modal verbs *dürfen* (*be allowed to*), *können* (*be able to / be possible*), *mögen* (*may*), *müssen* (*have to*), *sollen* (*shall*) und *wollen* (*want to*). These modal verbs selecting a non-finite complement in first status do not have a regular past participle form. They form the perfect tense with *haben* and then always surface as substitute infinitive, which is illustrated by (82).

(82) Er hat^1(0) heute Schokolade essen^3(1) dürfen^2(1_3) / *gedurft^2(3).
he has today chocolate eat be.allowed / be.allowed
'He was allowed to eat chocolate today.'

Aldenhoff (1962) and Merkes (1895, 1896) discuss few exceptions to this regularity, such as the sentences shown in (83a) and (83b), and Bech (1955, p. 66) mentions the sentence (83c) without a discussion. At least in current high German, however, these cases no longer appear to be grammatical, so that we have starred them below.

(83) a. * die Mutter hätte^1(0) den Namen nicht tragen^3(1) gedurft^2(3)
*the mother had-*SM *the name not carry be allowed*
'the mother would not have been allowed to carry the name'

b. * ich wünschte, daß ich es früher tun^3(1) gedurft^2(3) hätte^1(0)
*I wished that I it earlier do be allowed had-*SM
'I wished I would have been allowed to do it earlier.'

c. * Christian machte eine heftige Bewegung danach, obgleich sie es
Christian made a harsh move for it even though she it
ihm ohnedies hatte^1(0) reichen^3(1) gewollt^2(3)
him anyway had give wanted
'Christian made a harsh move for it, even though she had wanted to give it to him anyway.'

Note that the above said only concerns the use of these verbs as modal verbs selecting a non-finite complement. Some of these verbs also have a use in which they do not select a non-finite complement. Since these uses of verbs will surface throughout this chapter, let us introduce the term *full verb use* for them here. The modal verb *mögen*, for example, exists as a transitive verb meaning *like*, and *wollen* as synonym of *desire/want* selects an NP or a sentential complement. Furthermore *können* is used in collocations like *nicht umhin können* (*be obliged to do something*), and *sollen* can select an NP and a PP complement where the PP describes the intended location of the NP. The examples in (84)–(87) show that in perfect tense constructions these verbs can occur in a regular past participle form.[2]

(84) Er hat^1(0) seine Schwester sehr gemocht^2(3).
he has his sister much liked
'He really liked his sister.'

(85) a. Er hat^1(0) es nicht anders gewollt^2(3).
he has it not differently wanted
'He did not want it differently.'

b. Oma hätte^1(0) sicher gewollt^2(3), daß Du zu Weihnachten in die Kirche gehst.
grandma had surely wanted that you at Christmas into the church go
'Grandma would have surely wanted you to visit church at Christmas.'

(86) Er hatte^1(0) damals nicht umhin gekonnt^3(,) ihr das Erbe auszuzahlen.
he had back.then not around be.able her the inheritance pay.out
'Back then, he had been obliged to give pay her off the inheritance.'

(87) a. Es hätten^1(0) darauf [auf die vier Schnecken des Turmes] noch vier leichte Turmspitzen gesollt^2(3).[3]
it had on.this onto the four spirals of.the tower still for light spires at.shall
'On top of the four spirals of the tower there should have been four light spires added.'

b. Die Bierkiste hätte^1(0) doch in den Keller gesollt^2(3)!
the beer-case had well into the cellar should
'The beer case should have been put into the cellar.'

[2]Some of these full verb uses also have a substitute infinitive form. They are discussed on pages 69ff of section 1.1.3.

Apart from the modal verbs, the literature does not provide a clear picture regarding which verbs can or have to occur as substitute infinitives. Merkes (1896, pp. 145–169) critically discusses the different views presented in the older linguistics literature and provides an overview of the different claims made in a table which is replicated in figure 1 on the following page. He comes to the conclusion that a substitute infinitive form is usually used for the following verbs: *brauchen* (*need to*), *heißen* (*ask someone to do something*), *helfen* (*help*), *hören* (*hear*) and *sehen* (*see*). Different from modal verbs, these verbs also have a past participle form, which is however rarely used for perfect tense constructions.

Analyzing current German texts, Aldenhoff (1962) presents the same list of verbs except for additionally mentioning certain variants of *lassen*. In addition, he discusses a second class of verbs which can surface as substitute infinitive but usually occur as regular past participles: *fühlen* (*feel*), *machen* (*make*), and *lernen* (*learn*).

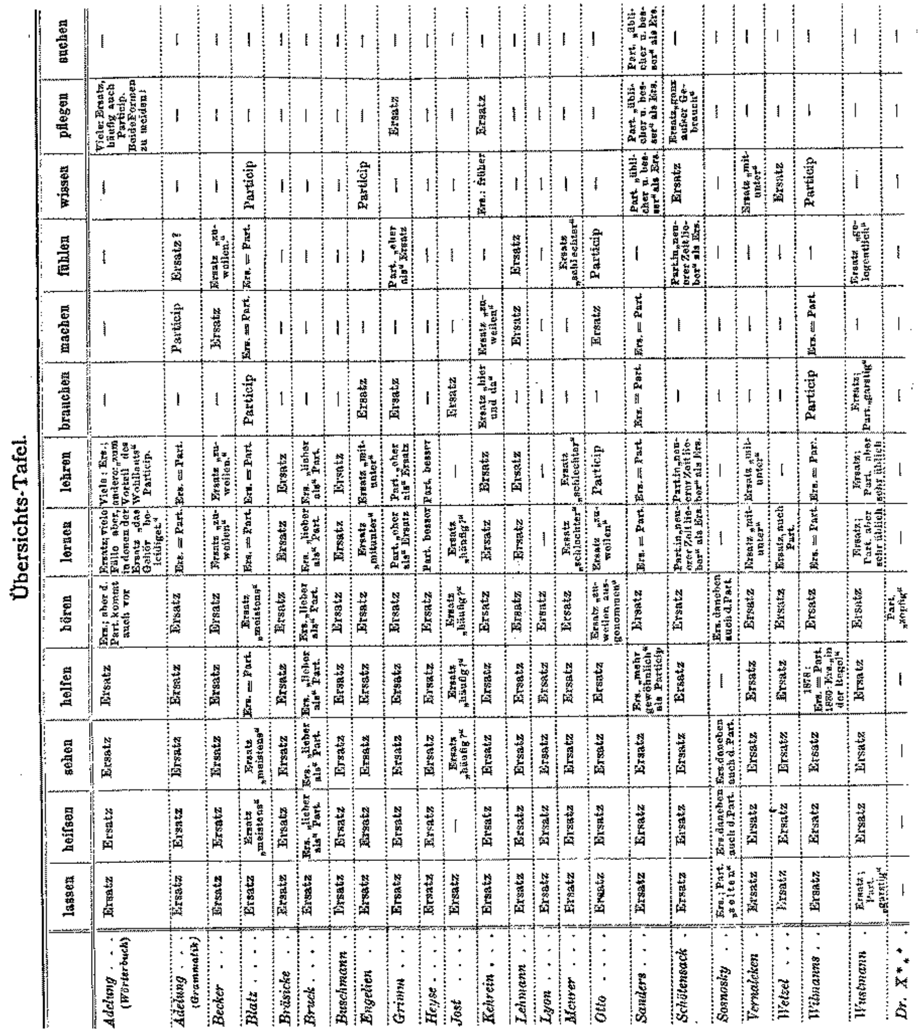
AcI verbs. Suchsland (1994, p. 22) claims that AcI verbs embedded under *haben* in a perfect tense construction have to be realized as substitute infinitive as illustrated by the example (88) he provides.

(88) Er hat^1(0) ihn über die Straße gehen^3(1) sehen^2(1_3).
he has him over the street walk see
'He saw him walk over the street.'

The following examples from a Donaukurier corpus[4] showing perfect tense constructions in which the AcI verbs *hören* (*hear*) and *sehen* (*see*) surface as ordinary past participles show that this generalization cannot be correct.[5]

[3]Johann Wolfgang von Goethe: *Aus meinem Leben: Dichtung und Wahrheit.* Weimar, Germany: Hermann Böhlaus Nachfolger, p. 82, on the topic of the cathedral in Straßburg.
[4]The text of this newspaper corpus (8.469.700 words/523.353 sentences) is taken from the ECI/DCI Multilingual Corpus I CD-ROM, directory data/eci2/ger04.
[5]Apart from the AcI verb *sehen* selecting a verbal complement in first status as discussion above, the verb *sehen* (and other AcI verbs like *fühlen*) can also embed stative passives. When such a construction is selected by the perfect tense auxiliary *haben* as illustrated in (i), the AcI verb obligatorily appears as a regular past-participle.

(i) a. Die freien Großhändler östlich der Elbe hatten^1(0) sich bislang deutlich benachteiligt gesehen^2(3) und über Verluste geklagt.
the free wholesalers east of.the Elbe had REFL *until.now clearly disadvantaged seen and about losses complained*
'Until now, the free wholesalers east of the Elbe had seen themselves at a clear disadvantage and complained about the losses.'



Übersichts-Tafel.

	lassen	heißen	sehen	helfen	hören	lernen	lehren	brauchen	machen	fühlen	wissen	pflegen	suchen
Adelung (Wörterbuch)	Ersatz	Ersatz	Ersatz	Ersatz	Ers.; aber d. Part. kommt auch vor	Ersatz; viele Fälle aber, in denen der Ersatz „das Gehör beleidigt"	Viele: Ers.; andere: zum Vorteil des Wohllauts Particip.	—	—	—	—	Viele: Ersatz, häufig auch Particip. Beide Formen zu meiden!	—
Adelung (Grammatik)	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ers. = Part.	Ers. = Part.	—	Particip	Ersatz?	—	—	—
Becker	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz „zuwollen"	Ersatz „zuwollen"	—	Ersatz	Ersatz „zuwollen"	—	—	—
Blatz	Ersatz	Ersatz „meistens"	Ersatz „meistens"	Ers. = Part.	Ersatz „meistens"	Ers. = Part.	Ers. = Part.	Particip	Ers. = Part.	Ers. = Part.	Particip	—	—
Brüsicke	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	—	—	—	—	—	—
Bruck	Ersatz	Ers. „lieber als" Part.	Ers. „lieber als" Part.	Ers. „lieber als" Part.	Ers. „lieber als" Part.	Ers. „lieber als" Part.	Ers. „lieber als" Part.	—	—	—	—	—	—
Buschmann	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	—	—	—	—	—	—
Engelien	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz „mitunter"	Ersatz „mitunter"	Ersatz	—	—	Particip	—	—
Grimm	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Part. „eher als" Ersatz	Part. „eher als" Ersatz	Ersatz	—	Part. „eher als" Ersatz	—	Ersatz	—
Heyse	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Part. besser	Part. besser	—	—	—	—	—	—
Jost	Ersatz	—	Ersatz „häufig"	Ersatz „häufig"	Ersatz „häufig"	Ersatz „häufig"	—	Ersatz	—	—	—	—	—
Kehrein	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz „hier und da"	Ersatz „zuweilen"	—	Ers.: früher	Ersatz	—
Lehmann	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	—	Ersatz	Ersatz	—	—	—
Lyon	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	—	—	—	—	—	—	—	—
Meurer	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz „schlechter"	Ersatz „schlechter"	—	—	Ersatz „schlechter"	—	—	—
Otto	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz „zuweilen ausgenommen"	Ersatz „zuweilen"	Particip	—	Ersatz	Particip	—	—	—
Sanders	Ersatz	Ersatz	Ersatz	Ers. „mehr gewöhnlich" als Particip	Ersatz	Ers. = Part.	Ers. = Part.	Ers. = Part.	Ers. = Part.	—	Part. „üblicher u. besser" als Ers.	Part. „üblicher u. besser" als Ers.	Part. „üblicher u. besser" als Ers.
Schötensack	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Part. in „neuerer Zeit beliebter" als Ers.	Part. in „neuerer Zeit beliebter" als Ers.	—	—	Part. in „neuerer Zeit beliebter" als Ers.	Ersatz	Ersatz „ganz außer Gebrauch"	—
Sosnosky	Ers.; Part. „selten"	Ers. daneben auch d. Part.	Ers. daneben auch d. Part.	—	Ers. daneben auch d. Part.	—	—	—	—	—	—	—	—
Vernaleken	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz „mitunter"	Ersatz „mitunter"	—	—	—	Ersatz „mitunter"	—	—
Wetzel	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz, auch Part.	—	—	—	—	Ersatz	—	—
Wilmanns	Ersatz	Ersatz	Ersatz	1878: Ers. = Part. 1889: Ers. „in der Regel"	Ersatz	Ers. = Part.	Ers. = Part.	Particip	Ers. = Part.	—	Particip	—	—
Wustmann	Ersatz; Part. „geläufig"	Ersatz	Ersatz	Ersatz	Ersatz	Ersatz; Part. aber sehr üblich	Ersatz; Part. aber sehr üblich	Ersatz; Part. „geläufig"	—	Ersatz „gelegentlich"	—	—	—
Dr. X**	—	—	—	—	Part. „richtig"	—	—	—	—	—	—	—	—

FIGURE 1. Literature overview from Merkes (1896): Lexical classification of verbs according to their occurrence as substitute infinitive or past participle.

(89) a. Ich hab's in meiner Schulter krachen gehört – es hat höllisch weh
I have.it in my shoulder crack heard – it has hell.like hurt
getan, sagte der 24jährige Kölner.
done said the 24-year-old person.from.Cologne

'I heard it crack in my shoulders – it hurt like hell, said the 24 year old man from Cologne.'

b. Die Frau hatte einen dumpfen Schlag sowie Münzgeld
the woman had a muted hit as.well.as coins
klimpern gehört und sofort die Polizei verständigt.
thrumming heard and immediately the police contacted

'The woman had heard a muted hit as well as thrumming coins and immediately contacted the police.'

c. Nicht wenige der Anwesenden hatten das Wesen mit der Flasche
not few of.the people.present had the being with the bottle
schon zu vergangenen Anlässen singen gehört, so daß sich die
already at past events sing heard so that REFL *the*
Frage, ob es dies nun kann oder nicht, schon vorher
question whether it this now can or not already before
erübrigt hatte.
become.unnecessary had

'Not few of the people present had already heard the being with the bottle sing at previous occasions, so that the question, whether it can sing or not had already been dealt with.'

d. so wollen Ohrenzeugen den Eintracht-Trainer schließlich in
so want ear-witnesses the Eintracht-coach at.the.end in
astreinem Serbo-Hessisch vor sich hinmurmeln gehört haben
perfect Serbo-Hessian before REFL *murmur heard have*

'ear-witnesses claim to have heard the coach of Eintracht murmur this in perfect Serbo-Hessian'

---

b. Durch die schlechte Auftragslage speziell im Plutoniumzweig
because.of the bad situation.of.orders in.particular in.the plutonium.business
haben^1(0) sich aber einige gezwungen gesehen^2(3), Siemens den Rücken zu kehren.
have REFL *but some forced seen Siemens the back to turn*

'Because of the lack of orders in the plutonium business, some companies felt forced to turn their back on Siemens.'

e. 100 angehende Pädagogen wollen Deutschlehrer oder Dolmetscher
100 beginning pedagogs want German.teacher or translator
werden, aber sie haben noch nie jemanden Deutsch sprechen
become but they have still not someone German speak
gehört.
heard

'100 pedagogs in training want to become German teachers or translators, but they never heard anyone speak German.'

(90) a. Ko Murobushi hat Tatsumi Hijikata tanzen gesehen.
Ko Murobushi has Tatsumi Hijikata dance seen

'Ko Murobushi has seen Tatsumi Hijikata dance.'

b. Der Präsident des Nationalen Olympischen Komitees (NOK), der
the president of.the National Olympic Committee (NOK) who
mit seinen 79 Jahren viele Funktionäre kommen und wenige gehen
with his 79 years many officials come and few go
gesehen hat, sprach von Herrenmenschen, neuem Kolonialismus und
seen has spoke of master.race new colonialism and
Siegermentalität.
winner.mentality

'The president of the National Olympic Committee (NOK), who at his 79 years has seen many officials come and few leave, spoke of master race, new colonialism and winner mentality.'

c. Ich hatte seit meiner Kindheit nie solch eine Stille erlebt,
I had since my childhood never such a quietness witnessed
ich lebe in der Stadt und habe noch nie den Schnee so fallen
I live in the city and have still never the snow so fall
gesehen, ich hatte keine Ahnung, wie magisch diese kalte
seen I had no idea how magic this cool
Atmosphäre sein kann.
atmosphere be can

'Since my childhood I had never witnessed such a quietness. I live in the city and I have never seen the snow fall in this way. I had no idea of the magic of this cool atmosphere.'

d. Es soll Leute geben, verlautet aus gut unterrichteten Kreisen, die
It shall people give sounded from well informed circles who
wollen ihn schon einmal lachen gesehen haben.
want him already once laugh seen have

'According to well informed circles, there supposedly are people, who claim to have seen him laugh once.'

e. Während er sich den Vorfall nicht erklären kann, wollen Zeugen
While he REFL *the incident not explain can want witnesses*
einen älteren Mann davonfahren gesehen haben.
an oldish man drive.away seen have

'While he cannot explain the incident, witnesses claim to have seen an oldish man drive away.'

f. Niemand verbietet einer Nonne das Rauchen, aber haben Sie schon
Nobody forbids a nun the smoking but have you already
eine rauchen gesehen?
one smoke seen

'Nobody forbids a nun to smoke, but have you ever seen one smoke?'

g. Als alter Hase im Ballettgeschäft hat Roland Petit viele Epochen
As old hare in.the ballet.business has Roland Petit many epochs
erlebt, die Moden kommen und gehen gesehen, Klassik
lived.through the fashions come and go seen classic
sowie triviale Revuen inszeniert.
as.well.as trivial shows put.on.stage

'Having been around in the ballet business for a long time, Roland Petit has seen fashions come and go and has put on stage classic as well as trivial shows.'

h. "Wenn wir auch gegen Osnabrück verlieren, na dann Gute Nacht",
if we also against Osnabrück lose well then good night
hätte der Stürmer nach sechs Spielen ohne Sieg noch
had the center.forward after six games without victory even
kräftigeres Ungemach im Frankfurter Umfeld aufkommen
stronger problems in Frankfurt environment come.up
gesehen.
seen

'"If we also lose against Osnabrück, that's it." has the center forward seen serious problems arise for Frankfurt after six games without a victory.'

While the general claim that AcI verbs in perfect tense constructions can only surface as substitute infinitives is incorrect, at the same time it is clear that past participle and substitute infinitive are not always interchangeable. The complexity of the issue can be nicely illustrated by taking a closer look at the AcI verb *lassen*.

The verb *lassen* (*let*) exists in a large number of semantic varieties which differ with respect to their realizability as participles or substitute infinitives. Merkes (1895, pp. 100ff), Aldenhoff (1962, pp. 202ff), Höhle (1978, sec. 2.9.1) and others proposed classifications of the varieties of *lassen*.

Focusing solely on the possibility of *lassen* to surface as substitute infinitive or past participle, we obtains two large classes: in a small class of cases, *lassen* can occur both as past participle and as substitute infinitive, whereas most uses of the verb (seven of eight in the classification of Höhle 1978) always surface as substitute infinitive.

The uses of *lassen* which can occur as past participles all appear to express a 'leaving unchanged of a spatial relation', including metaphorically derived uses. The clearest case seems to be when *lassen* embeds a predicate relating to a static location such as *stehen* (*stand*), *liegen* (*lie*), *hängen* (*hang*), *stecken* (*stick*), and *sitzen* (*sit*) or a change in location as expressed by *fallen* (*fall*). As illustrated by the following examples, such uses of the verb *lassen* can occur both as a substitute infinitive or as ordinary participle.[6]

(91) a. Er hat die Koffer stehen gelassen!
he has the suitcases stand let-PART2
'He left the suitcases where they were.'

b. Auch sie hatten vor zwei Tagen die Spaten fortgeworfen, die Gewehre liegen gelassen und waren davongelaufen.
also they had before two days the spade thrown.away the guns lie let-PART2 *and were run.away*
'Two days ago they too had thrown away the spades, left the guns where they were and ran away.'

c. Den Rock hat sie wieder fallen gelassen.
the skirt has she again fall let-PART2
'She let the skirt fall down again.'

(92) a. Unsere Tür hat der Krieg stehen lassen, zufällig, aus Versehen.
our door has the war stand let-IPP *accidentally by chance*
'The war has left our door standing, accidentally, by chance.'

b. ich hatte meine Zeche bezahlt, mein Gepäck neben dem des Kumpels liegen lassen und war in der Dämmerung in dieses Städtchen hineingetaumelt
I had my bill payed my luggage next to.that of.the buddy lie let-IPP *and was in the dusk into this little.city stumble*
'I had payed my bill, put my luggage next to that of my buddy, and then had stumbled at dusk into this little city.'

[6]These and the following examples are taken from Aldenhoff (1962, pp. 202ff).

c. Der Seconde-Lieutenant von Salomon hatte seine Handschuhe achtlos zu Boden fallen lassen.
the lieutenant of Salomon had his gloves carelessly to ground fall let-IPP.
'The lieutenant of Salomon had carelessly let his gloves fall to the ground.'

Some of the metaphorical uses derived from the above cases, such as *liegen lassen* in the meaning of *leave unfinished*, or *fallen lassen* as synonym for *abandon* also permit both past participle and substitute infinitive forms of *lassen*.

(93) a. 1786 hatte Goethe den 1910 aufgefundenen sogenannten Urmeister liegen gelassen
1786 had Goethe the 1910 discovered so-called Urmeister lie let-PART2
'In 1786, Goethe had put away the so-called Urmeister manuscript which was discovered in 1910.'

b. Nein, ich habe den Plan fallen gelassen.
no I have the plan fall let
'No, I have abandoned the plan.'

(94) a. Ich habe diese Aufzeichnungen nun wieder wochenlang liegenlassen, weil ich mich scheute ...
I have these notes now again for.weeks lie.let-IPP *because I* REFL *shied.away.from*
'I had already abandoned these notes for weeks, since I shied away from'

b. Darum hat die AEG das auf diese Funkenstrecken angemeldete Patent fallen lassen.
therefore has the AEG the on these spark.spans registered patent fall let
'This is why AEG dropped the patent which it had secured on these spark spans.'

In other metaphorical uses derived from the same underlying spatial meaning, such as *liegen/sitzen lassen* for *abandon*, or *ein Wort / eine Bemerkung fallen lassen* with the meaning of *saying something*, as far as we can see only the substitute infinitive of *lassen* is available.

(95) Du hast uns ja schwer sitzen lassen!
you have us well badly sit let-IPP
'You abandoned us in a bad way!'

(96) ein Wort, das die Mutter zu dem Mädchen hatte fallen lassen.
a word which the mother to the girl have fall-IPP *let*
'a word, which the mother had said to the girl'

For all other uses of *lassen*, including 'granting of permission', 'causation', or combinations with complements expressing spatial relations other than the ones mentioned above, only the substitute infinitive form is available.

(97) a. Die Mutter hatte sie das Eis essen lassen.
the mother had her the ice eat let
'The mother had allowed her to eat the ice-cream.'

b. Ich habe in Valls Arbeitszimmer ein Mikrophon anbringen lassen.
I have in Vall's office a microphone install let
'I asked for a microphone to be installed in Vall's office.'

c. und Heuß hat es dabei bewenden lassen
and Heuß had it there rest let
'and Heuß had left it at that'

d. Vielleicht hat er die Nachtlampe brennen lassen.
perhaps has he the night-light burn let
'Perhaps he left the night-light on.'

e. Teta hatte den ganzen dicken Stoß in ihren Schoß gleiten lassen.
Teta had the whole thick pile into her lap glide let
'Teta had let the while pile glide into her lap.'

This preliminary overview of the distinctions relevant for determining the form of *lassen* in perfect tense constructions should be sufficient to illustrate that a high-level generalization like the one entertained by Suchsland (1994) has to be substantially revised to properly account for the rich lexical variation involved. In the absence of a property from which the relevant lexical classes could be deduced, class membership has to be lexically stipulated to obtain empirically adequate theories.

1.1.2. *Past participle vs. passive participle.* So far, we have not been explicit about the environments in which a substitute infinitive can surface in place of an ordinary past participle. In principle, a past participle form

of a supinum can surface in perfect tense as well as in passive constructions.[7] This raises the question whether a substitute infinitive can occur in both environments as well.

The relevant test cases are those verbs which we above listed as occurring as substitute infinitives in perfect tense construction. As illustrated by the following examples partly adopted from Aldenhoff (1962) and Blatz (1896, pp. 612–616), it is always the regular past participle which has to surface when such verbs are passivized.

(98) a. Ich habe ihn fallen sehen.
I have him fall see-IPP
'I saw him fall.'

b. Er wurde fallen gesehen / *sehen.
he was fall seen-PART2 / *see*-IPP
'He was seen falling.'

(99) a. Er hat alle Bedenken fallen lassen.
he has all worries fall let-IPP
'He stopped worrying.'

b. Alle Bedenken wurden fallen gelassen / *lassen.
all worries were fallen let-PART2 / *let*-IPP
'All worrying was stopped.'

However, only a subset of the verbs which can occur as substitute infinitives can be passivized. There is an interesting correlation between the class of verbs which have no proper participle form in perfect tense constructions and those verbs which cannot be passivized. The modal verbs selecting non-finite complements, for example, have no proper participle forms and cannot be passivized. The different variants of *lassen* discussed above pattern accordingly. According to Aldenhoff (1962), passivization is possible with *heißen* (*ask someone to do something*), *machen* (*make*), *lehren* (*teach*), *lernen* (*learn*), and the relevant variants of *lassen*.

What we said about the inexistence of substitute infinitive forms in passive constructions above only concerns the form of the complement in stative and agentive passive constructions, where the passive auxiliaries *sein* and *werden* select a complement in third status. As we discussed in section 2.1,

[7]The term past participle generally used thus is an unfortunate choice which would better be replaced with a neutral term like 'second participle'. We still use the traditional term in this thesis to avoid unnecessary confusion.

in sentences where no accusative object A' is realized the subject of the verbal complement of verbs with the coefficient A':N" is interpreted to be some referent from discourse parallel to the interpretation of *man*. For AcI verbs like *hören* (*hear*), *sehen* (*see*), or *lassen* (*let*), one thus obtains a passive-like interpretation when the accusative object is left unexpressed – which naturally is independent of a syntactic passive construction with an auxiliary governing a third status. The construction is exemplified in (100).

(100) a. Ich hörte sagen, daß ...
I heard say that ...
'I heard someone say that ... '

b. Die Mutter läßt ihr Kind taufen.
the mother lets her child baptize
'The mother has her child baptized.'

These uses of AcI verbs can also occur as complement of the perfect tense auxiliary *haben* and then obligatorily surface as substitute infinitive form (Kehrein, 1856, §16, and works cited there).[8]

(101) a. Ich habe sagen hören, daß ...
I have say heard that ...
'I have heard someone say that ... '

b. Die Mutter hat das Kind taufen lassen (vom Pfarrer).
the mother has the child baptize let by.a priest
'The mother had the child baptized (by a priest).'

A potentially confusing example is shown in (102). Here, the auxiliary *werde* is not the passive but the future tense auxiliary which governs the expected first status, and the passive interpretation arises from *sehen* itself.

(102) der Gedanke, daß man in wenig Stunden werde seinen Sarg in die
the idea that one in few hours will his coffin into the
Erde senken sehen[9]
earth lower see
'the idea that soon one will see his coffin be lowered into the earth'

[8]Kehrein (1856) also includes archaic examples with a proper participle which however do not seem to be well formed in current German.
[9]Example from the literature provided by Kefer and Lejeune (1974, p. 331) in a thematically unrelated discussion.

1.1.3. *A sequence of two infinitives as necessary condition?* The occurrence of the substitute infinitive, together with the upper-field linearization phenomenon we turn to in section 2.1, is often discussed under the name of *double infinitive construction* (*DIC*). The idea underlying this choice of terminology is that the substitute infinitive is dependent on being the second infinitival form in the verb sequence of the final-field. Such a syntactic condition is very attractive and underlies many proposals since it appears to generalize over the collection of lexical material which can surface as substitute infinitive. In the following, we take a closer look at the range of data to show that this generalization, despite its elegance, is empirically incorrect.

The presence of two first status verbs in the final-field is neither a sufficient nor a necessary condition for the occurrence of a substitute infinitive. We already established in the last sections that only a small subclass of verbs governing a complement in first status can be realized as substitute infinitive. Thus the class of verbs which can or have to occur as substitute infinitive is smaller than the class of verbs which can follow a verb in first status. Furthermore the exact membership in this class depends on dialectal and idiolectal variation, which clearly contradicts the idea of a uniform syntactic generalization as sufficient criterion.

The double infinitive condition also turns out not to be a necessary condition since the class of verbs which occur as substitute infinitive is larger than the class of verbs governing a verbal complement in first status. In the following, we take a look at two sub-cases for which this is true: first, a class of verbs governing a verbal complement in second status and second, verbs constructing without a verbal complement.

Substitute infinitives selecting a zu-infinitive. The verbs *brauchen* (*have to*) and *heißen* (*ask someone to do something*) in section 1.1.1 were classified as verbs which can occur as substitute infinitives or as past participles, with the substitute infinitive being the more common option. This becomes relevant when we recapitulate that in section 1.1 of chapter 2 the verbs *brauchen* and *heißen* were introduced as selecting a verbal complement in first or second status.[10] Focusing on these two properties, Aldenhoff (1962, pp. 201f) observes that the possibility of being realized as substitute infinitive is independent of whether *brauchen/heißen* selects

[10]Note that the two verbs differ with respect to other properties though. For *brauchen* we saw in section 3.1.2 of chapter 2 that it obligatorily constructs coherently, whereas *heißen* surfaced in section 3.1.1 of the same chapter as a verb allowing incoherent constructions even with verbal complements in the first status.

a first or a second status complement. In (103) one sees examples in which a substitute infinitive form of *brauchen* selects a *zu*-infinitival complement. According to Aldenhoff (1962) this is actually the more common option, even though, as shown in (104), a substitute infinitive of *brauchen* can also select a complement in first status.

(103) a. Wir haben^1(0) uns nicht zu schämen^3(2) brauchen^2(1_3).
we have us not to be.ashamed have
'We didn't have to be ashamed of ourselves.'

b. Die staatliche Zersplitterung war sehr weit gediehen, so daß Rom
the national dissipation was very far developed so that Rome
hier (in Spanien) kaum mit allzu großen Schwierigkeiten hätte^1(0)
here (in Spain) hardly with all.too big problems had-SM
zu kämpfen^3(2) brauchen^2(1_3), wenn nur die römische Verwaltung
to fight have.to if only the Roman administration
nicht versagt hätte.
not failed had-SM
'The national dissipation had already developed quite far so that Rome here in Spain would not have had big problems if only the Roman administration had not failed.'

c. Dies verstand sich von selbst, dies hatten die Hunde, dies hatte
this understood REFL *by itself this had the dogs this had*
der Schieler begriffen, ohne daß Nespoli es hätte^1(0)
the squinter grasped without that Nespoli it had-SM
auszusprechen^3(2) brauchen^2(1).
express have.to
'That was clear. The dogs and the squinter had grasped it without Nespoli having to express it.'

(104) und sie hatte^1(0) es nur einmal erleben^3(1) brauchen^2(1_3).
and she had it only one.time live.through have
'and she only had to live through it once'

It is interesting to note that these exceptions to the rule that a substitute infinitive always follows a verbal complement in first status bear a certain similarity to two exceptions to generalizations we discussed in chapter 2. In section 3.1.1, we saw that verbs which can govern a first or a second status, in violation of the rule of coherence also permit an incoherent construction when governing a first status. And in section 3.2.1 we observed that verbs with a raising and an equi variety allowed for an incoherent construction even in the raising variety, even though for ordinary raising

verbs this option is not available. All three cases thus seem to suggest that it is not a specific property of a verb which licenses a particular construction but only the lexical class a verb is assigned to which ultimately underlies the grammatical options. For the concrete verb at hand, this means that independent of the actual realization in a sentence, the *brauchen* always patterns as would be expected of an obligatorily coherent verb selecting a first status complement.

Substitute infinitives without a verbal complement. The second case in which a substitute infinitive occurs which is not the second infinitive of a verb sequence in the final-field arises when a verb which does not select a verbal complement surfaces as substitute infinitive. According to Aldenhoff (1962, pp. 197ff) and Helbig and Buscha (1991, pp. 123f), the uses of substitute infinitivals occurring without a verbal complement fall into two main classes. Firstly, elliptical uses of verbs ordinarily selecting a verbal complement and complement anaphora. And secondly, full verb uses of verbs which also exist as verbs taking a verbal complement. In the following, we take a look at these two classes and some of the examples provided by Aldenhoff (1962) to illustrate them.[11]

Ellipsis. Starting with the elliptical case, in the simplest form illustrated in (105) the missing infinitival complement can be reconstructed from the preceding sentence, either as a direct syntactic copy (105a), or on a semantic level to ensure proper referents for pronominal elements (105b).

(105) a. Damals hätten wir abtreten sollen. Das ist bald gesagt: Man
back.then have we step.down should this is soon said one
hätte sollen, man hätte sollen!
have should-IPP *one have should*-IPP
'Back then we should have stepped down. Now it's easy to say that one should have done so.'

b. Du hast dich einschreiben lassen? Ich hab' doch müssen.
you have yourself enlist let I have still must-IPP
'You let them enlist you? I had to.'

Such reconstruction from the previous sentence can involve additional transformations, such as in (106), where supposedly a passivized form of the predicate occurring in the previous sentence would have to be inserted.

[11] The following examples are all attested examples from the literature, mostly from Southern German authors.

(106) Alsdann haben wir ihn mit uns hinausgezogen, er hat wollen oder nicht.
then have we him with us pull.out he has wanted-IPP *or not*
'Then we pulled him out with us, whether he wanted it or not.'

In other cases, only an indirect relation to the preceding discourse is available to reconstruct what could have been expressed as a verbal complement, such as in the example in (107).

(107) Ich möchte fragen: Wie komm ich denn dazu? Hab ich denn dürfen?
I want ask how come I well to.that have I well be.allowed-IPP
'I want to ask: How come me? Was I even allowed to?'

Given the illustrated range of possibilities for reconstruction of what could have been a verbal complement and the clear inadequacy of a proposal based on copying the syntactic elements, it is unclear how the occurrence of substitute infinitives in the above examples could be reconciled with a syntactic condition demanding that a substitute infinitive can only arise as the second infinitive in a verb sequence.

Anaphora. Related to the elliptical cases, one often finds anaphoric elements as complements of a substitute infinitive, which can refer to a verbal complement in the preceding sentence as illustrated in (108).

(108) Warum haben Sie mich nicht vorher gefragt? Hätte ich das denn müssen?
why have you me not before asked had-SM *I that well must*-IPP
'Why didn't you ask me beforehand? Would I have had to do so?'

As with the elliptical cases in the previous paragraph, the need to preserve the referent of the pronominal *mich* rules out the possibility of a mechanism syntactically providing a second infinitive in place of the anaphoric element *das* in order to satisfy the double infinitive condition.

Full verb uses. We already mentioned in section 1.1.1 that a subset of the modal verbs also exist as verbs without a verbal complement, such as *mögen* as synonym for *like*, *wollen* as that of *desire*. Furthermore, *können* occurs in the collocations *nicht umhin können* (*be obliged to do something*) and *miteinander können* (*get along with*). The examples in (109) show that at least in Southern German some of these uses can also occur as substitute infinitives.

(109) a. und eben wegen der Leute hast du wollen, daß ...
and just because the people have you want-IPP *that*
'and exactly because of the people you wanted that ... '

b. Wir haben es nie recht gut miteinander können.
we have it never so well with.each.other can-IPP
'We never got along so well.'

In standard German, at least the expression *nicht umhin können* can be realized as substitute infinitive. This is illustrated by the example (110) taken from Engel (1988, p. 481).

(110) Sie hatte nicht umhin können, den Besucher anzustarren.
she had not around be.able-IPP *the visitor stare.at*
'She had been unable to keep from staring at the visitor.'

This use of *können* is closely related to a common construction with modal verbs discussed by Aldenhoff (1962) in which a modal verb selects a directional preposition or PP argument instead of the ordinary verbal complement. One can either view this as a full verb use of a modal verb or group it with the elliptic uses discussed above if one assumes that a verb expressing a not further determined form of movement has been elided. As shown in (111), despite the absence of a dependent infinitive, such uses of the modal verbs can also be realized as substitute infinitives.

(111) a. Er hatte mit Tagesanbruch weiterwollen.
he had with daybreak further.want-IPP
'At daybreak he had wanted to go on.'

b. Er hatte die Hüfte gebrochen und hätte sofort in den chirurgischen Saal müssen.
he had the hip broken and should.have directly in the surgical room must-IPP
'He had broken the hip and should have been moved to the operating room immediately.'

c. Du bist dran schuld, daß mein Vater hat fortmüssen.
you are thereon blame that my father has away.must-IPP
'You are to blame for the fact that my father had to go away.'

d. Seine Töchter hatten ihn ins Bette gepackt, während er nicht
his daughters had him into bed put while he not
aus dem alten Ohrensessel hatte fortwollen.
out.of his old armchair had away.want-IPP
'His daughters had put him into his bed even though he had not wanted to leave his old armchair.'

Summing up, there seem to be significant empirical obstacles for any theory restricting the occurrence of substitute infinitives to sentences with a 'double infinitive': substitute infinitives exist for verbs governing a second status, and they arise in sentences without a verbal complement due to elliptical effects, anaphora and full verb uses of modal verb. One should keep in mind though that as we pointed out at the end of the paragraph 'Substitute infinitives selecting a *zu*-infinitive' the exceptions to the double infinitive generalization reported above are not arbitrary. The verbs selecting a second status complement and the ones constructing in sentences without a verbal complement are always verbs which in other uses or realizations would satisfy the double infinitive condition. Thus even though it is incorrect to make substitute infinitives dependent on the occurrence of a double infinitive in a particular construction, the possibility of realizing a substitute infinitive is dependent on the occurrence of a verb from a specific lexical class.

1.2. Substitute *zu*-infinitive. A second kind of substitute status realization is discussed much less frequently than the substitute infinitive: the occurrence of a *zu*-infinitive in place of a past participle which is illustrated by example (112).

(112) Er verstarb, ohne sich haben^1(1_2) entschuldigen^3(1) zu können^2(2_3)
he died without REFL *have excuse to be.able*
'He died without having been able to excuse himself.'

In the generative literature, the construction is mentioned by den Besten and Edmondson (1983), Stechow and Sternefeld (1988, pp. 444f), Sternefeld (1990), Geilfuß (1990), and Haider (1993), with the latter disputing the status of the construction as a well-formed grammatical phenomenon. A look at the discussion in earlier works like Merkes (1895, p. 65–72), Wilmanns (1906, p. 163, §86 fn.), Curme (1922, §178), Aldenhoff (1962, p. 214) and Bech (1963), however, provides significant empirical evidence for considering the substitute *zu*-infinitive a systematic grammatical phenomenon. For example, even though Merkes (1895) remarks in the schoolmasterly attitude of early scholars that the construction is illogical and should be avoided, he does not draw the existence into question and illustrates the construction with the examples in (113) from the literature. And Wilmanns (1906) provides the examples in (114).

(113) a. Ich glaube^1(0) es haben^2(1_2) tun^4(1) zu können^3(2)3.
I believe it have do to can
'I believe having been able to do it.'

b. Er braucht^1(0) es nicht haben^2($1_{1/2}$) tun^4(1) zu wollen^3(2_3).
he needed it not have do to want
'I didn't have to want to do it.'

c. Warum sollte Seneca notwendig ein Christ sein, um so
why should Seneca necessarily a Christian be for such
manches wahre, schöne Wort haben^1(1_2) schreiben^3(1) zu
some true beautiful word have write to
können^2(2_3).
be.able
'Why should Seneca have to be a Christian, for him to have been able to write such true and beautiful words.'

d. Ich erinnere^1(0) mich, einen Reisenden das eigentümliche Entsetzen
I remember me a traveler the peculiar shock
haben^2(1_2) schildern^4(1) zu hören^3(2_3), welches er beim Anblick
have describe to hear which he at.the sight
eines gewaltigen Eichbaumes empfand.
of.a huge oak.tree sensed
'I remember having heard a traveler describe the peculiar shock which he sensed at the sight of a huge oak tree.'

e. Wir rechnen^1(0) es dem Verfasser zum Verdienst an, nicht mehr
we value it the author to merit PART *not more*
haben^2(1_2) bestimmen^4(1) zu wollen^3(2_3).
have ordained to want
'We are grateful to the author for not having wanted to ordain more.'

f. Jedes Verbum Comp. scheint^1(0) die Reduplikation haben^2(1_2)
each verbum compositum seems the reduplication have
wegwerfen^4(1) zu können^3(2_3).
throw.away to be.able
'Each verbum compositum seems to have been able to do away with the reduplication.'

(114) a. Er scheint^1(0) ihn nicht haben^2(1_2) sehen^4(1) zu können^3(2_3).
he seems him not have see to be.able
'He seems not to have been able to see him.'

b. Ich freue^1(0) mich ihn haben^2(1_2) begrüßen^4(1) zu dürfen^3(2_3).
I be.glad me him have welcome to be.allowed
'I am glad to have been allowed to welcome him.'

While the above examples illustrate the productivity of this construction, it is also clear that this construction is much less common than the widespread use of the substitute infinitive. More concretely, the occurrence of the substitute *zu*-infinitive is restricted to a rather specific lexical and syntactic setup. The non-finite verb *haben* must occur as the least embedded verb in the final-field and be realized in the upper-field of that final-field (or one of the other irregular linearizations we turn to in section 2). Furthermore, this *haben* in the final-field must be assigned a second status, either by a finite coherently constructing verb in verb-first or verb-second position, or by an incoherently constructing verb, or by one of the conjunctions selecting non-finite constructions in second status such as *um* (*for*), *ohne* (*without*), or *anstatt* (*instead of*).

Under these conditions, two status irregularities arise. Firstly, the *haben* in the final-field is realized in the first status instead of the second status which it is assigned. And second, the verb selected by *haben* is realized in second status instead of the third status governed by *haben*, i.e., as substitute *zu*-infinitive. The class of verbs which can be realized in such a substitute *zu*-infinitive form seems to be identical to the class of verbs we identified in section 1.1.1 as being able to occur as substitute infinitive.

1.3. Summary. We discussed two systematic exceptions to the regular status government relations in non-finite constructions we introduced in section 1.1 of chapter 1: the frequent occurrence of a substitute infinitive, and the less common case of a substitute *zu*-infinitive.

We established that the substitute status only arise when a perfect tense construction is formed with a verb from a specific lexical class, which, as far as we can see, fails to be definable purely on the basis of properties a verb of this class has in a construction. In particular, we showed that the often assumed occurrence of two adjacent infinitives is neither a necessary nor a sufficient condition for the realization of a substitute infinitive. Verbs thus have to be lexically specified as to whether they can be realized as substitute infinitive. A subset of those verbs lack a regular

past participle form, so that the substitute infinitive is the only available option in perfect tense constructions.

2. Word order

After focusing on the status (ir)regularities in the previous section, we now turn to a discussion of certain word-order phenomena which are outside of the regular linearization possibilities of non-finite constructions discussed in chapter 2.

2.1. Upper-field formation. A much discussed deviation from the word order expected of coherent verbal complexes is the *upper-field formation* (*Oberfeldumstellung*), in the HPSG literature also referred to as *aux-flip phenomenon* (Hinrichs and Nakazawa, 1989). In addition to the regular word order shown in (115a), in which every verbal head follows its complement, the exceptional word order illustrated in (115b) is equally grammatical and receives the same interpretation.

(115) a. ob er lachen^3(1) können^2(1) wird^1(0)
whether he laugh be.able will
'whether he will be able to laugh'

b. ob er wird^1(0) lachen^3(1) können^2(1)
whether he will laugh be.able

To talk about these examples in a precise way, let us introduce some additional terminology from Bech (1955). We already made use of the term *final-field* (*Schlußfeld*) in our discussion of the basic word-order phenomena in chapter 2 to refer to the topological unit of verbal elements at the right edge of a sentence with a coherent verb sequence. Every (non-empty) final-field at least consists of a *lower-field* (*Unterfeld*), in which the verbs are always linearized in the regular head-follows-complement order discussed in chapter 2. In contrast to this word order, the highest verbs in a hypotactic chain, i.e., the ones with the lowest rank index, can also be realized preceding lower-field and form the so-called upper-field (*Oberfeld*) as was illustrated in (115b).

If several verbs occur in the upper-field as shown in (116a), the upper-field verbs are linearized so that the head precedes the complement, i.e., the inverse order of what one finds in the lower-field. Finally, (116b) shows that all verbs of the final-field which select an upper-field verb also have to be linearized in the upper-field.

(116) a. ob er wird^1(0) haben^2(0) lachen^4(1) können^3(1)
whether he will have laugh be.able
'whether he will have been able to laugh'

b. * ob er haben^2(1) lachen^4(1) können^2(1) wird^1(0)
whether he have laugh be.able will

The two examples in (117) taken from the Donaukurier Corpus are more natural instances of the upper-field phenomenon.

(117) a. eine wertvolle Uhr, in die man eine Widmung hat^1(0)
a valuable watch into which one a dedication has
eingravieren^3(1) lassen^2(1).
engrave let
'a valuable watch, into which one has let someone engrave a dedication'

b. Weil er ein solches Vorhaben nie würde^1(0) haben^2(1)
because he such a plan never would have
durchsetzen^4(1) können^3(1), versagte sich der Kanzler.
fight.through be.able denied REFL *the chancellor*
'Because he would have never got the plan through, the chancellor did not want to be involved.'

Generalizing over the word-order possibilities in the final-field, figure 2 represents the schematic word-order possibilities of verbs in the final-field as envisaged by Bech (1955).

$$\overbrace{\underbrace{V^i \ldots V^{j-1}}_{\text{upper-field}} \mid \underbrace{V^n \ldots V^j}_{\text{lower-field}}}^{\text{final-field}} \text{ where } 1 \leq i \leq j \leq n \text{ and } i < j \rightarrow n - j \geq 2$$

FIGURE 2. The topology of the final-field according to Bech (1955, §61)

In addition to the general properties of hypotactic chains and particularly of coherent verb sequences in the final-field, the occurrence of an upper-field is subject to further conditions. Firstly, the class of verbs which can occur in the upper-field is quite restricted. And secondly, only a lower-field with specific properties is compatible with the presence of an upper-field. Let us first turn to the class of verbs which can occur in the upper-field.

2.1.1. *Which verbs occur in the upper-field?* The class of verbs which can occur in the upper-field is very small. In current German, almost all examples involves occurrences of the auxiliaries *werden* (*will*) or *haben* (*have*).

The verb *werden* selecting a verbal complement in first status can function as future tense auxiliary or have a modal meaning. As illustrated below, both these uses of *werden*, which apparently only exist as finite forms, optionally occur in the upper-field.

(118) a. daß er morgen kommen^3(1) wollen^2(1) wird^1(0)
that he tomorrow come want will
'that he will want to come tomorrow.'

b. daß er morgen wird^1(0) kommen^3(1) wollen^2(1)
that he tomorrow will come want

(119) a. daß er gestern zuspätgekommen^1(3) sein^2(1) wird^1(0)
that he yesterday late.come be will
'that he will have been late yesterday.'

b. daß er gestern wird^1(0) zuspätgekommen^3(3) sein^2(1)
that he yesterday will late be

The use of *werden* as passive auxiliary selecting a third status complement, however, can apparently not occur in the upper-field, as is suggested by (120b).

(120) a. Unter der Leiter sollte man nicht stehen, da dort manchmal
under the ladder should one not stand as there sometimes
etwas fallen^3(1) gelassen^2(3) wird^1(0).
something fall let is
'One should not stand under the ladder, as things are sometimes dropped there.'

b. * da dort manchmal etwas wird^1(0) fallen^3(1) gelassen^2(3)
since there sometimes something is fall let

The perfect tense auxiliary *haben* is the most common verb in the upper-field. In such sentences, the complement of *haben* does not surface in the governed third, but in the substitute first (or second) status we discussed in section 1.1. Since the status government in such cases is not a reliable indicator for rank in the hypotactic chain, the syntactic functor-argument relation has to be deduced from the semantic one.

(121) a. daß er sie dort hat^1(0) tanzen^3(1) sehen^2(1_3)
that he her there has dance seen
'that he has seen her dance there'

b. daß er dort hat^1(0) tanzen^3(1) dürfen^2(1_3)
that he there has dance be.allowed

c. daß er sie wird^1(0) haben^2(1) tanzen^4(1) sehen^3(1_3)
that he her will have dance seen
'that he will have seen here dance'

Older variants. According to Fritz (1992), examples with modal verb in the upper-field were quite common in the 17th century. In current German, the construction illustrated by the following literature examples from Bech (1955, p. 66), Kefer and Lejeune (1974, p. 322), and Merkes (1895, p. 89, 93) no longer appears to be accepted by all, but still by many speakers.

(122) a. daß er noch einmal den Strom des Lebens [. . .] durch sein Blut
that he still once the stream of life through his blood
könnte^1(0) strömen^3(1) hören^2(1)
be.able flow hear
'that he once again would be able to hear the stream of life flow through his blood'

b. daß man die Leute in ihrem Schlamme soll^1(0) sitzen^3(1) lassen^2(1)
that one the people in their mud shall sit let
'that one shall let the people worry about their problems'

c. Ich werde dich am Ende müssen^1(0) hängen^3(1) sehen^2(1).
I will you at.the end have hang see
'In the end, I will have to see you hang.'

d. Man hätte^1(0) eine Mücke können^2(1) trappen^4(1) hören^3(1).
one could.have a gnat be.able walk hear
'One could have been able to hear a gnat walk.'

e. daß sie der Sohn für keinen Preis dem Alten hätte^1(0) wollen^2(1)
that she the son for no price the old had-SM wanted
bekannt werden^4(1) lassen^3(1)
known become let
'that the son for nothing in the world would have wanted to let the old guy get to know her'

The examples show that both epistemic and deontic readings of modal verbs in the upper-field appear to be possible. Furthermore, the differences in control-level – some of the modal verbs are raising, other are equi verbs – appear to have no effect on the upper-field realizability of the verb.

Bech (1955, p. 64) provides the example (123) with the verb *lassen* in the upper-field.

(123) daß man ihn hier läßt^1(0) liegen^3(1) bleiben^2(1)
that one him here lets lie stay
'that one lets him stay lying around here'

Judgments on the grammaticality of such occurrences of *lassen* in the upper-field vary. They seem to correlate with the grammaticality assigned to modal verb occurrences in the upper-field.

Finally, the auxiliary *sein* governing a third status occurs in perfect tense constructions with some verbs selecting a verbal complement, namely *bleiben* (*stay*) and *sein* itself.

(124) a. daß der Brief abgeschickt^3(3) worden^2(3) ist^1(0)
that the letter sent been is
'that the letter has been sent'

b. daß der Mann stehen^3(1) geblieben^2(3) ist^1(0)
that the man stand remain is
'that the man stopped'

According to Fritz (1992), in the 17th century it was possible for such occurrences of *sein* to be linearized in the upper-field. The number of documented examples is small, however, since in subordinate clauses the finite tense or passive auxiliary was often dropped. In current German, such upper-field occurrences of *sein* are no longer grammatical (125) and the only attested example for an irregular linearization of *sein*, (125c) by Peter Handke as listed by Kefer and Lejeune (1974), appears to be equally ill-formed.[12]

(125) a. * daß der Brief ist^1(0) abgeschickt^3(3) worden^3(2)
that the letter is sent been

[12] The other uses of *sein*, as stative passive auxiliary selecting a third status and as a modal auxiliary selecting a second status, are equally impossible in the upper-field.

b. * daß der Mann ist^1(0) stehen^3(1) geblieben^2(3)
that the man is stand remain

c. * Da in allen bewohnten Räumen laut über den Tod des anderen,
since in all inhabited rooms loud over the death of the.other
des ertrunkenen Bruders geklagt^3(3) ist^1(0) worden^2(1).
the drowned brother wailing is been
'Since in all inhabited rooms there was wailing about the death of the drowned brother.'

Erroneous classifications. Askedal (1991, p. 7) discusses the example (126) of Bech (1955, p. 66) , in which *glauben* (*believe*) could be interpreted as occurring in the upper-field.

(126) daß sie eine Absicht glaubten^1(0) verbergen^3(1) zu können^2(2), die
that they an intention believed hide to be.able which
so zutage lag
so open lay
'that they believed to be able to hide an intention, which was so clearly visible.'

If one, however, uses the *rank test* (*Rangprobe*) of Bech (1955, §71) as indicator for the coherence of a construction by adding *hatten* as highest verb of the hypotactic chain, *hatten* has to occur to the right of its verbal complement as shown in (127), i.e., in the word order typical for verbs in the lower-field.

(127) daß sie eine Absicht geglaubt^2(3) hatten^1(0) verbergen^4(1) zu
that they an intention believed had hide to
können^3(2)
can

It is therefore plausible to assume that *glauben* in (126) and (127) is part of the lower-field. On the other hand, it was already pointed out by Höhle (1986, p. 331, fn. 4) that sentences like (126) do not properly fit into the system of Bech. In this system, the occurrence of the object *eine Absicht* of *verbergen* in between the verb *glauben* and its subject *sie* is only possible if *verbergen* is part of the same coherence-field. This is so, since a is defined as a topological unit that cannot be split or include intervening material (Bech, 1955, §57). At the same time, the extraposition of an infinitive is a sufficient criterion for the incoherence of a combination. The construction thus shows properties of coherence and of incoherence and has since been discussed under the term *third*

construction (den Besten and Rutten, 1989), or, less commonly, as a form of *left nesting* (*Linksverschachtelung*) (Kvam, 1979).[13]

Parallel to the case above, Grewendorf (1991, p. 279) claims that in the sentence (128) the verbs *versuchen* or *beschließen* are part of the upper-field.

(128) Peter hat^1(0) das Examen versucht^3(3) / beschlossen^3(3) zu
Peter has the exam tried / decided to
wiederholen^2(2).
repeat
'Peter has decided / tried to repeat the exam.'

Again, using the rank test, this time by transforming the verb-second into a verb-last sentence, shows that the verb-second verb has to surface after *versucht/beschlossen* so that the verbs are identified as being in the lower-field and not the upper-field where the order would be the other way around.

(129) a. weil Peter das Examen versucht^3(3) / beschlossen^3(3) hat^2(1) zu
because Peter the exam tried / decided has to
wiederholen^4(2)
repeat

b. * weil Peter das Examen hat^2(1) versucht^3(3) / beschlossen^3(3) zu
because Peter the exam has tried / decided to
wiederholen^4(2)
repeat

The example (128) therefore is not an example for a coherent construction with *versuchen* in the upper-field, but another instance of the third construction in which *zu wiederholen* has been extraposed without its complement *das Examen.*

2.1.2. *Conditions on the lower-field to support an upper-field.* The occurrence of two infinitives in the lower-field is usually considered to be a necessary condition for upper-field formation and the realization of a substitute infinitive often associated with this word-order phenomenon. Regarding the substitute infinitive, we saw in section 1.1.3 that a sequence of two verbs in first status is not a necessary (and also no sufficient) condition for the occurrence of a substitute infinitive. In the following, we illustrate that a sequence of two verbs in first status also fails to be a

[13] See St. Müller (1999, sec. 17.5) for further references relating to this construction.

necessary condition for upper-field formation. There are two classes of counter examples for such a condition. Firstly, certain coherently constructing verbs allow for a filled upper-field when they are the highest verb in the final-field even though they select a verbal complement in second or third status. And secondly, there is a class of verbs which supports an upper-field even though the verbs in this class occur in the final-field without a verbal complement.

Upper-field with a past-participle in the lower-field. The question, whether *haben* as V" in the lower-field permits a V' in the upper-field, as far as we know, has not been explicitly discussed in the literature, but one can find some pointers to the issue. For example, Stechow and Sternefeld (1988, p. 412) mention the example (130) and mark it as ungrammatical.

(130) * weil er sie nicht wird^1(0) verstanden^3(3) haben^2(2)
because he her not will understand have
'because he will not have understood her'

Hinrichs and Nakazawa (1994a) do not discuss such examples, but their theory excludes such sentences for the following reason. Hinrichs and Nakazawa (1994a) want to capture Bech's topology of the final-field we displayed in figure 2 on page 74, in particular the restriction that all final-field verbs which govern an upper-field verb also have to be part of the upper-field. They thus want to allow examples like (131b) but exclude sentences like (131c). The generalization they express to do so is that *haben* as V" always has to occur in the same field, i.e., upper-field or lower-field, as a V' in the final-field. This part of their theory of upper-field formation is also incorporated by Kathol (1995, pp. 222ff) and St. Müller (1999, sec. 14.2.1).

(131) a. daß er sie die Lieder singen^4(1) gehört^3(3) haben^2(1) wird^1(0)
that he her the songs sing hear have will
'that he will have heard her sing the songs'

b. daß er sie die Lieder wird^1(0) haben^2(1) singen^4(1) hören^3(1)
that he her the songs will have sing hear

c. * daß er sie die Lieder haben^2(1) singen^4(1) hören^3(1) wird^1(0)
that he her the songs have sing hear will

The generalization proposed by Hinrichs and Nakazawa (1994a) covers the data in (131), but it also has the consequence of excluding sentences like (132) or the example (130) we started with.

(132) ? daß er sie die Lieder wird^1(0) singen^4(1) gehört^3(3) haben^2(1)
that he her the songs will sing heard have

At closer inspection, constructions in which a *haben* as V" in the lower-field is selected by an upper-field V' do seem to exist, however. This is illustrated by the following examples from Walser[14] and Goethe[15], whose second example shown in (134b) shows that the other perfect auxiliary *sein* supports an upper-field equally well.

(133) a. das ihr wahrscheinlich aus dem Munde eines anderen
which her probably out.of the mouth of another.one
würde^1(0) lächerlich und blöde geklungen^3(3) haben^2(1)
would ridiculous and stupid sounded have
'which for her probably would have sounded ridiculous and stupid if said by someone else'

b. nachdem Du sattsam genug mußtest^1(0) die Erfahrung
after you sufficient enough had the experience
gemacht^3(3) haben^2(1), daß ohne Geduld ...
made have that without patience
'after you often enough had to have made the experience that without patience ... '

c. Ich interessierte mich bloß, welches Gefühl sie dazu könnte^1(0)
I interested me only which feeling you to.that could
veranlaßt^3(3) haben^2(1)
motivated have
'I was just interested, which feeling could have motivated you to do it.'

d. wie Johannes der Täufer, der außerdem Heuschrecken soll^1(0)
like John the baptist who furthermore grasshoppers shall
gegessen^3(3) haben^2(1)
eaten have
'like John the baptist who furthermore is supposed to have eaten grasshoppers'

(134) a. Wie lange wir mögen^1(0) gesessen^3(3) haben^2(1), weiß ich nicht.
how long we might sit have know I not
'I do not know how long we might have sat there.'

[14] Robert Walser: *Geschwister Tanner.* Zürich: Suhrkamp Taschenbuch Verlag. pp. 73, 13, 66, 101.
[15] Johann Wolfgang von Goethe: *Aus meinem Leben: Dichtung und Wahrheit.* Weimar, Germany: Hermann Böhlaus Nachfolger, pp. 417, 443.

b. Mancherlei Lustwäldchen [...] zeigten, wie angenehm die kleine
various pleasure.forests showed how agreeable the little
Residenz ehemals müsse^1(0) gewesen^3(3) sein^2(1).
residence once must been be
'Various pleasure forests showed how agreeable the little residence once must have been.'

Generally disallowing a V' in the upper-field whenever the perfect auxiliaries *haben* or *sein* occur as V" in the lower-field thus seems to be incorrect. This conclusion is also supported by the empirical survey of Härt (1981, p. 148), who reports that the construction is quite rare but does occur.

Upper-field with a zu-infinitive in the lower-field. In section 1.1 of chapter 2 we mentioned *brauchen* as a verb which can govern a verbal complement in first or second status, and the verb re-appeared in our discussion of substitute infinitives which can select a *zu*-infinitive in section 1.1.3.

Turning to the possibility of an upper-field verb selecting *brauchen*, we see in (135) that *brauchen* as highest verb of the lower-field can co-occur with an upper-field even when it selects a complement in second status.

(135) daß wir uns nicht hätten^1(0) zu schämen^3(2) brauchen^2(1)
that we us not had-SM *to be.ashamed have*
'that we would not have had to be ashamed'

Interestingly, this construction is not limited to *brauchen* but also occurs with *haben*, which in its modal use selects a verbal complement in second status. The example in (136) from Bech (1955, p. 66) illustrates this.

(136) den wichtigsten Dienst, den der Berufene ihr selbst einst
the most.important duty which the selected her himself once
würde^1(0) zu leisten^3(2) haben^2(1)
would to do have
'the most important duty, which the selected person himself at one point would have to do for her'

One can thus conclude that the occurrence of an upper-field with a *zu*-infinitive in the lower-field should not generally be ruled out.

Upper-field without two verbs in the lower-field. When we presented the topology of the final-field according to Bech (1955, §61) in figure 2 on page 74, we kept silent about one of the restrictions Bech makes, namely

that two verbs need to be present in the lower-field in order for the upper-field to be filled, which in our figure is expressed by '$i < j \rightarrow n - j \geq 2$'. Even though Bech (1955, §61) includes this condition in his representation of the word order possibilities, he apparently was aware that such a condition on upper-field formation is too strong. This can be inferred from his reference to the 'ordinary use' in §60 where he writes: "The lower-field always contains the maximally subordinated verb of the final-field and *in ordinary use* the two maximally subordinated verbs of the final-field." (our font emphasis and translation[16]).

The assessment that a filled upper-field usually co-occurs with two verbs in the lower-field is correct in that it allows for two classes of examples in which an upper-field occurs with only a single verb in the lower-field. Firstly, there are cases in which the verbal complement can be taken to be elided, which is illustrated by the example in (137a). And secondly, there are cases like (137b) as verb-last version of the (110) we saw on page 69, in which a full verb use of a modal verb is involved. The example in (137c) discussed by den Besten and Edmondson (1983, p. 171) further illustrates the possibility of an upper-field in the presence of a single lower-field verb.

(137) a. Er behandelte die Leute auf der Bounty besser als er hätte^1(0)
he treated the people on the Bounty better than he had-SM
müssen^2(1_3).
have
'He treated the people on the Bounty better than he would have had to.'

b. daß sie nicht hatte^1(0) umhin können^2(1_3), den Besucher
that she not had around be.able the visitor
anzustarren^3(2)
stare.at
'that she had been unable to keep from staring at the visitor.'

c. weil er nicht anders hat^1(0) können^2(1_3)
because he not different had been.able
'because he had not been able to act differently'

The situation thus is parallel to the cases we discussed in section 1.1.3 where we focused on the occurrence of a substitute infinitive without a double infinitive. In fact, the above examples can also be seen as further illustrations of such a substitute status.

[16] Original: "Das unterfeld enthält immer das maximal untergeordnete verbum des schlußfeldes, und im normalen usus die zwei maximal untergeordneten verben des schlußfeldes."

2.1.3. *Alternative linearizations of the upper-field.*

Lower-field split. Apart from the standard topology of the final-field in which the upper-field precedes the lower-field, the word order exemplified in (138) can sometimes be observed.

(138) daß er das Examen bestehen^{3}(1) wird^{1}(0) können^{2}(1)
that he the exam succeed will be.able
'that he will be able to succeed in the exam'

Bech (1955) does not mention this word order possibility, in which the upper-field seems to split the lower-field in the middle, explicitly. But he writes in his description of the topology of the verbal complex that "the upper-field *usually* occurs before the lower-field." (p. 63, our font emphasis and translation[17]), which makes it likely that Bech was aware of the word order we will refer to as *lower-field split* (*Zwischenstellung*) as an alternative linearization for the upper-field.

The lower-field split occurs much less frequently than the upper-field preceding the lower-field and the few linguistic publications which mention this construction assign it to specific (sub-)dialects. Den Besten and Edmondson (1983, p. 182), for example, present (139a) and (139b) as utterances of speakers of Middle Bavarian (Munich, Salzburg, Vienna) which "attempt to sound non-dialectal, since the local dialects show no sign of inversion whatsoever" (our translation[18]) and the sentence in (139c) as Southern Bavarian (Carinthia, Tirol).

(139) a. weil er sich untersuchen^{4}(1) lassen^{3}(1) hat^{1}(0) wollen^{2}(1_3)
because he himself examine let has wanted
'because he had wanted to let someone examine him'

b. weil er sie sprechen^{4}(1) hören^{3}(2) hat^{1}(0) können^{2}(1_3)
because he her speak hear has be.able
'because he has been able to hear her speak'

c. damit unser Lager von einer Lawine nicht getroffen^{4}(3) hätte^{1}(0) werden^{3}(1) können^{2}(1_3)
*so.that our camp of an avalanche not hit had-*SM *been be.possible*
'so that our camp had not been possible to be hit by an avalanche'

[17] Original: "Das oberfeld steht *gewöhnlich* vor dem unterfeld."
[18] Original: "versuchen nicht-dialektal zu klingen, da die lokalen Dialekte keinerlei Inversion aufweisen"

Lötscher (1978, pp. 18ff) discusses six different systems of verb orders in German dialects. For the Franconian system VIa, he also includes lower-field split examples. Based on his work, Kroch and Santorini (1991, p. 304) present the example (140) for Franconian and, in contrast to den Besten and Edmondson (1983), include an analysis of such data (Kroch and Santorini, 1991, pp. 314ff and 320ff).

(140) daß er singen^{3}(1) hat^{1}(0) müssen^{2}(1_3)
that he sing has must
'that he has had to sing'

Louden (1990) points out that the lower-field split is also possible in Palatinate and in Pennsylvania German. The latter is of particular interest since according to Louden in this dialect the lower-field split word order shown in (141) is the only possible word order, i.e., the finite verb cannot occur in an ordinary upper-field.

(141) Ich wees, as er lese^{3}(1) hot^{1}(0) kenne^{2}(1).
I know that he read has be.able

Kefer and Lejeune (1974) provide a number of examples for lower-field split from the literature, which even though they mostly stem from southern German authors, can hardly be taken to represent dialectal speech. This is confirmed by the fact that such sentences with lower-field split are judged as grammatical by many non-southern German speakers.

(142) a. Da erkennt er, daß er das Versteck seines Bruders verraten^{3}(1) wird^{1}(0) müssen^{2}(1).
there recognized he that he the hiding.place of.his brother betray will have
'At that point he recognizes that he will have to betray the hiding place of his brother.'

b. der erste, mit dem ich sprechen^{3}(1) hatte^{1}(0) können^{2}(1_3)
the first with whom I speak had be.able
'the first person, with whom I had been able to speak'

c. etwas, was immer so sein^{3}(1) hätte^{1}(0) sollen^{2}(1_3)
something which always so be had should
'something, which always should have been that way'

d. das letzte Mal, wie ich entlassen^{4}(3) werden^{3}(1) hätte^{1}(0) sollen^{2}(1_3)
the last time when I dismiss will have should
'the last time, when I should have been dismissed'

e. weil die Auseinandersetzung, welche Frage am letzten
because the argument which question at.the last
Sonntag entschieden^4(3) hatte^1(0) werden^3(1) sollen^2(1_3), keine Zeit
Sunday decided have been should no time
für die eigentliche Entscheidung ließ
for the proper decision let
'because the argument, which question should have been decided last Sunday, left no time for the decisions itself.'

It therefore does not come as a surprise that closer inspection also provides examples for the construction outside of the dialectal areas claimed by den Besten and Edmondson (1983) and Lötscher (1978). In (143a) we have included an example stemming from an interview with a Northern German sports manager, and the other examples in (143) were found in the Frankfurter Rundschau, a national German newspaper.[19]

(143) a. Zu dem Zeitpunkt, an dem ich mich entscheiden^3(1) hätte^1(0)
at the time at which I me decide had-SM
müssen^2(1_3), war das Gesangsbuch wichtiger.
have was the hymn.book more.important
'At the time at which I would have had to decide, the hymn book was more important to me.'

b. der Glaube, daß jener Clan, der als nächster Mogadischu
the belief that the clan that as next Mogadischu
kontrolliert, sich nach dem Vorbild der Marehan von Siad
controls REFL *after the model of Siad Barre equally*
Barre genauso bereichern^3(2) wird^1(0) können^2(1)
enrich will be.able
'the belief that the clan which controls Mogadischu next will be able to enrich following the model of Siad Barre'

c. Der Steinauer ging zuversichtlich in den dritten
the person.from.Steinau went confidently into the third
Quali-Lauf, in dem er gut abschneiden^3(1) hätte^1(0) müssen^2(1_3),
qualifying.run in which he well finish had-SM have
um sich für das Finale zu qualifizieren.
to REFL *for the finals to qualify*
'The runner from Steinau confidently went into the third qualifying round, in which he would have had to run well to qualify for the finals'

[19] The text of this newspaper corpus (39.569.709 words/2.621.622 sentences) is taken from the ECI/DCI Multilingual Corpus I CD-ROM.

d. und sie hatten auch keinen Ort, wohin sie fliehen^3(1) hätten^1(0)
and they had also no place where they flea had-SM
können^2(1_3)
be.able
'and they also had no place to which they would have been able to flea'

e. Nicht daß ich das ernsthaft bezweifeln^3(1) hätte^1(0) wollen^2(1_3).
not that I that seriously doubt had-SM want
'Not that I would have seriously wanted to doubt that.'

f. ?? Ja, wir wollen ja nur, daß nicht alles von der öffentlichen
yes we wanted yes only that not everything of the public
Hand verlangt^3(3) kann^1(0) werden^2(1).
hand demanded can be
'Yes, we only wanted that not everything can be asked of the government.'

The conjecture that the lower-field split could be a relatively new word order stemming from Austria and slowly spreading north (Tilman Höhle, p.c.) is plausible but probably incorrect. According to Takada (1994) the lower-field split can already be found in the 17th century in the work of West-Middle German, West- and West-Upper German, and (more rarely) in that of Low-German authors. And Merkes (1895) provides several examples for a lower-field split from the older literature.

The lower-field split examples we saw above all involve three verbs so that one cannot determine whether the upper-field can only be inserted immediately to the right of the leftmost lower-field verb. The examples with four verbs in (144) show that positions further to the right are also possible, as long as one lower-field verb remains to the right.

(144) a. laut der der Landeszuschuß nicht bei den Betriebskosten
according to.which the subsidy not for the operating.costs
berücksichtigt^4(3) hätte^1(0) werden^3(1) sollen^2(1)
considered have be should
'according to which the subsidy should not have been considered for the operating costs'

b. die laut Erschließungsbeitragssatzung zu 90 Prozent auf
which according.to statutes to 90 percent on
die Anwohner umgelegt^4(3) werden^3(1) hätten^1(0) müssen^3(0)
the neighbors apportioned be have have
'90 percent of which should have been apportioned on the neighbors according to the statutes'

c. die Ortskernsanierung in Steinkirchen, die sicher 1993
the sanitation of Steinkirchen which surely 1993
abgeschlossen^{4}(3) werden^{3}(1) hätte^{1}(0) können^{2}(1)
completed be have could

'the sanitation of Steinkirchen, which surely could have been completed by 1993'

In Meurers (1994a) we therefore concluded that the lower-field split should be considered a possible construction of German syntax which one should be able to deal with in a theory of German non-finite constructions. Apart from the linearization as such, the lower-field split phenomenon appears to share the properties of the ordinary upper-field cases, so that it makes sense to view the lower-field split as nothing but a special linearization of the upper-field.

Upper-field left dislocation. A second alternative linearization which can be observed with upper-field verbs is similar to the standard upper-field position in that the verb surfaces to the left of the lower-field. But different from the standard linearization it allows non-verbal elements to intervene between the upper-field and the lower-field. This linearization, which we will refer to under the name of *upper-field left dislocation* (*Linksstellung*), has sometimes been discussed under the theoretical perspective of verb-projection raising (Haegeman and van Riemsdijk, 1986), but discussions exploring the empirical dimensions of this word-order possibility are rare. A noteworthy exception is the paper by Kefer and Lejeune (1974). They show that as intervening elements between the left-dislocated verb and the lower-field one can find ordinary objects (145a), predicative complements (145b), objects taking part in light-verb constructions (145c), as well as adverbials (145d).

(145) a. ohne daß der Staatsanwalt hätte^{1}(0) darum bitten^{3}(1)
*without that the public.prosecutor had-*SM *about.it ask*
müssen^{2}(1_3)
have

'without that the public prosecutor would have had to ask for it'

b. wenn ich nur ein einziges Mal habe^{1}(0) glücklich sein^{3}(1)
if I only one single time have happy be
dürfen^{2}(1_3)
be.allowed

'if I have been allowed to be happy for one single time'

c. Es war ein Wackelkontakt, den er mit ein paar Handgriffen
it was a lose.contact which he with a few hand.moves
hätte^{1}(0) in Ordnung bringen^{3}(1) können^{2}(1_3).
*had-*SM *in order bring be.able*

'It was a lose contact which he would have been able to fix up without requiring much work.'

d. daß er es habe^{1}(0) genau erkennen^{3}(1) lassen^{2}(1_3)
that he it has exactly recognized let

'that he had made sure that it was recognized well'

While the data discussion of Kefer and Lejeune (1974) provides many interesting examples, the empirical generalizations drawn by the authors are rather vague and in one case problematic. More concretely, they remark "that only those elements can be bracketed which are relatively closely related to the immediately following verb" (p. 325, our translation[20]). But neither the kind of relationship nor how relative closeness is to be quantified is made more specific. The problematic generalization concerns the occurrence of subjects. Kefer and Lejeune (1974, p. 324) claim that subjects are excluded from surfacing to the right of an upper field verb (146a). As pointed out by Marga Reis (p.c.), this restriction seems to be too strict in light of grammatical examples such as (146b).

(146) a. * Sie wußte, daß vielleicht hätte^{1}(0) Paul kommen^{3}(1) sollen^{2}(1_3).
she knew that perhaps had Paul come shall

'She knew that perhaps Paul should have come.'

b. Daß ihn gestern hätte^{1}(0) jemand besiegen^{3}(1) können^{2}(1_3), ist
that him yesterday had someone defeat be.able is
unwahrscheinlich.
improbable

'It is improbable that someone wold have been able to defeat him yesterday.'

Related to this issue, let us mention that an upper-field can occur with subjectless constructions as in (147), so that upper-field verbs in principle must be permitted to combine with verbal projections which do not (or no longer) subcategorize for a subject.[21]

[20]Original: "daß die Einklammerungsstelle nur Satzgliedern zugänglich ist, die zum unmittelbar folgenden Verb in relativ enger Beziehung stehen"
[21]Note that example (147) becomes ungrammatical when the adverbial *gestern* is removed. More generally, Marga Reis (p.c.) points out that an upper-field verb can

(147) daß heute hätte^1(0) getanzt^4(3) werden^3(1) sollen^2(1)
that today have danced be should
'that today people should have been dancing'

As general setting for these two specific issues, the questions how the notion of relative closeness can be made more precise and what role the subject plays, the central theoretical question is whether in constructions where the upper-field verb occurs to the left of non-verbal material, the upper-field verb still is part of the verbal complex or whether it is part of the Mittelfeld. In the first case, the material to the right of the upper-field verb forms a constituent, potentially including non-verbs. In the second case, the material to the right of the upper-field does not necessarily have constituent status.

The latter possibility is mentioned by Höhle (1986, p. 331, fn. 3). On the other hand, Haider (1993, pp. 283f), Hinrichs and Nakazawa (1994a, p. 34), and others point out the parallels between the partial VP constituents which can be topicalized and those elements which can occur to the right of an upper-field verb. We focus on the theoretical issues involved in the partial topicalization cases in the chapters 7, 9, and 10. A comparison of the results of these investigations with the situation found in upper-field left dislocation has to be left to future work.

2.2. Summary. Investigating certain word order possibilities not respecting the uniform head-follows-complement word order of the final-field, we followed Bech (1955) in dividing the final-field into an upper and a lower-field, where the latter represents the ordinary head-follows-complement order and the upper-field usually precedes the lower-field and shows the inverse order.

We saw that two lexical classes of verbs are relevant for an upper-field to surface. On the one hand, only a very restricted class of verbs can

never immediately follow the complementizer (ia) even though a finite verb-last verb can immediately follow a complementizer in extraposition contexts (ib).

(i) a. ?? dass hätte^1(0) getanzt^4(3) werden^3(1) sollen^2(1)
that have danced be should
'that people should have been dancing'

b. wenn ansteht^1(0), diese Dinge zu erledigen^2(2)
when be.at.issue these things to take.care
'when it is at issue to take care of these things'

occur in the upper-field, namely finite and first status forms of *werden*, *haben*, and, less regularly, the modal verbs.[22] On the other hand, a class of verbs usually selecting a first-status complement permit their selecting head to surface in the upper-field. We showed that attempts to establish a syntactic regularity which relies on the occurrence of a lower-field sequence of two verbs in first status instead of making reference to the second lexical class are problematic as there are regular occurrences of upper-fields with only a single verb in the lower-field.

Finally, we discussed two less common linearizations of the upper-field. In the first alternative, the upper-field is inserted into the lower-field instead of preceding it (upper-field split) and in the second, the upper-field does not occur adjacent to the lower-field but further to the left (upper-field left dislocation).

3. Relation between status government and word order

Having introduced the irregular word order and status phenomena which can be observed in coherent constructions, we can now turn to the way in which the word order and status phenomena are related.

Starting with the most important correlation, in a sentence in which a form of the perfect-auxiliary *haben* occurs as V' in an irregular final-field word order, the verb V' always shows a substitute status (substitute infinitive or substitute *zu*-infinitive). The three irregular word orders we discussed (ordinary upper-field, lower-field split, upper-field left dislocation) behave identical in this respect, so that it is plausible to view all three as realizations of the same upper-field phenomenon. The following examples illustrate this with the AcI verb *sehen* having a regular past participle in its paradigm and for the modal verb *dürfen*, for which no regular past participle exists.

(148) a. daß er den Bären tanzen^3(1) gesehen^2(3) hat^1(0)
that he her dance seen has

b. daß er den Bären hat^1(0) tanzen^3(1) sehen^2(1_3)
that he her dance seen has

c. daß er den Bären tanzen^3(1) hat^1(0) sehen^2(1_3)
that he her dance seen has

[22] Additional verbs which one could interpret as occurring in the upper-field are discussed in section 6 of chapter 8.

d. daß er hat^1(0) den Bären tanzen^3(1) sehen^2(1_3)
that he her dance seen has

(149) a. * daß er das Buch kopieren^3(1) gedurft^2(3) hat^1(0)
that he the book copy be.allowed has-PART2

b. daß er das Buch hat^1(0) kopieren^3(1) dürfen^2(1_3)
that he the book has copy be.allowed-IPP

c. daß er das Buch kopieren^3(1) hat^1(0) dürfen^2(1_3)
that he the book copy has be.allowed-IPP

d. daß er hat^1(0) das Buch kopieren^3(1) dürfen^2(1_3)
that he has the book copy be.allowed-IPP

When *haben* occurs as verb-second V' the status of V" can be either a substitute infinitive (150a) or, for verbs having such a form in the paradigm, a past participle (150b). The situation thus is parallel to a verb-last *haben* occurring either in the upper or in the lower field.

(150) a. Er hat^1(0) den Bären tanzen^3(1) gesehen^2(3).
he has the bear dance seen-PART2

b. Er hat^1(0) den Bären tanzen^3(1) sehen^2(1_3).
he has the bear dance see-IPP

Haider (1993, p. 283, fn. 1) claims that non-finite forms of *haben* cannot occur in the upper-field and provides the examples in (151).

(151) a. daß er sie nicht hat^1(0) kommen^3(1) hören^2(1_3)
that he her not has come hear
'that he has not heard her come'

b. * ohne sie zu haben^1(2) kommen^3(1) hören^2(1_3)
without her to have come hear
'without having heard her come'

While Haider's example (151b) correctly illustrates that *haben* in second status cannot occur in the upper-field, we already saw in section 1.2 that this is a far more general phenomenon in that verbs in second status can never occur in the upper-field. It is this construction which gives rise to the substitute *zu*-infinitive.

Turning to the other non-finite form, the first status of *haben*, which Haider also claims to be excluded from the upper-field, the examples in

(152) taken from the Frankfurter Rundschau corpus and the constructed examples in (153) suggest that this claim is false.[23]

(152) a. Nur wenige der Premieren-Zuschauer dürften^1(0) sich
only few of.the first-nighters will themselves
daher von diesem kritischen Anspruch in ihrer
therefore of this critical demand in their
sommerabendlichen Erbauung haben^2(1) stören^4(1) lassen^3(1_3).
summer.eveningly pleasure have disturb let
'Only few of the first-nighters will have let themselves be disturbed in their summer-eveningly pleasure by this critical demand.'

b. Das muß man gesehen haben. Da muß man hineingetreten sein.
this must one seen have there must one step into
Diese Schmach muß^1(0) man an sich haben^2(1) vorüberziehen^4(1)
this disgrace must one at oneself have pass
lassen^3(1_3): Dieses Land. Diese Mörder. Diese Justiz.
let this country this murderers this legal.system
'That is something one must have seen. This is something one must have experienced. This disgrace is something one must have been exposed to: This country. These murderers. This legal system.'

c. Der Generalarzt Kron soll^1(0) sich Presseberichten zufolge
the doctor Kron shall himself press.report according.to
mit einem Hubschrauber der Bundeswehr zu einer
with a helicopter of.the army to a
Familienfeier haben^2(1) fliegen^4(1) lassen^3(1_3).
family.celebration have fly let

[23] Haider (1993, p. 283, fn. 1) relates the (incorrect) claim that non-finite *haben* cannot occur in the upper-field to another observation he reports based on the examples in (i), namely that the complement of *haben* according to Haider cannot be topicalized.

(i) a. * Im Radio gehört^3(3) glaubt^1(0) er die Nachricht zu haben^2(2).
in.the radio heard believes he the news to have
'He believes to have heard the news in the radio.'

b. Im Radio gehört^3(3) hat^1(0) er die Nachricht
in.the radio heard has he the news

c. Gehört^3(3) zu haben^2(2) glaubt^1(0) er die Nachricht im Radio.
heard to have believes he the news in the radio

As far as we see, the status of this observation is questionable since a sentence like (ii) appears to be grammatical even though the complement of a non-finite form of *haben* has been topicalized.

(ii) Im Radio gehört^3(3) wird^1(0) er die Nachricht sicher nicht haben^2(1).
in.the radio heard will he the news surely not have

(153) a. Er wird das Buch haben$^{1}(0)$ stehlen$^{3}(1)$ wollen$^{2}(1_3)$.
he will the book have steal want
'He will have wanted to steal the book.'

b. Er war krank, so daß er es wird$^{1}(0)$ haben$^{2}(1)$ kopieren$^{5}(1)$ lassen$^{4}(1)$ müssen$^{3}(1_3)$.
he was sick so that he it will have copy let must
'He was sick so that he will have had to let someone copy it (for him).'

In contradiction to Haider's claim we thus conclude that in a verb-first or verb-second sentence in which *haben* in first status occurs in the upper-field, the situation appears to be identical to that of verb-last sentences with finite *haben* in the upper-field described above.

Summing up, one can observe the following three regularities correlating status government and word order:

1. substitute status V" ↔ V' *haben* in upper-field or verb-first/second
2. past-participle V" ↔ third status governing V' in lower-field or verb-first/second
3. second status assigned to upper-field V' → V' bears irregular first status and V" bears irregular second status

In general, there appears to be no status government into nor out of the upper-field.[24]

3.1. Finite vs. non-finite status and irregular word order. After focusing on the relationship between irregular final-field orders and irregular non-finite status in the last section, we now turn to the interaction of irregular word orders with finite verbs. The examples in (154) and (155) show the distribution of finiteness in verb-first/second and verb-last sentences with an upper-field.

(154) a. Er hat$^{1}(0)$ das Attentat verhindern$^{3}(1)$ wollen$^{2}(1_3)$.
he has the assassination prevent want
'He wanted to prevent the assassination.'

b. daß er das Attentat hat$^{1}(0)$ verhindern$^{3}(1)$ wollen$^{2}(1_3)$
that he the assassination has prevent want

(155) a. Er wird$^{1}(0)$ das Attentat haben$^{2}(1)$ verhindern$^{4}(1)$ wollen$^{3}(1_3)$.
he will the assassination have prevent want

[24] But see section 6 of chapter 8 for a possible exception to this rule.

b. daß er das Attentat wird$^{1}(0)$ haben$^{2}(1)$ verhindern$^{4}(1)$ wollen$^{3}(1_3)$
that he the assassination will have prevent want

In (154a) the finite verb *haben* as verb-second selects a substitute infinitive as last verb in the lower-field. The parallel case (154b) shows *haben* in the upper-field. Extending the hypotactic chain with the auxiliary *wird* makes it the finite verb, which can be placed in verb-second (155a) or in the upper-field (155b).

Turning to the less common upper-field linearizations, we see an example for a lower-field split in (156) and some for upper-field left-dislocation in (157) taken from Kefer and Lejeune (1974).

(156) a. Zu dem Zeitpunkt an dem ich mich entscheiden$^{3}(1)$ hätte$^{1}(0)$ müssen$^{2}(1_3)$, war das Gesangsbuch wichtiger.
at the time at which I me decide had-SM *have was the hymn.book more.important*
'At the time at which I would have had to decide, the hymn book was more important to me.'

b. das letzte Mal, wie ich entlassen$^{4}(3)$ werden$^{3}(1)$ hätte$^{1}(0)$ sollen$^{2}(1_3)$
the last time when I dismiss will have should
'the last time, when I should have been dismissed'

c. daß er das Buch kopieren$^{5}(1)$ wird$^{1}(0)$ haben$^{2}(1)$ lassen$^{4}(1)$ müssen$^{3}(1_3)$
that he the book copy will have let have
'that he will have had to make someone copy the book'

(157) a. Er wird$^{1}(0)$ die Landkarte haben$^{2}(1)$ zu Rate ziehen$^{4}(1)$ können$^{3}(1_3)$.
he will the map have to counseled pull be.able
'He will have been able to consult the map.'

b. gerade ehe Schwester Bauer sich Käse ohne Brot hatte heimlich in den Mund schieben können
just before sister Bauer REFL *cheese without bread had secretly into the mouth shove be.able*
'just before sister Bauer had been able to shove cheese without bread into her mouth'

All of these examples illustrate that independent of the word order in the final-field finiteness is always regularly assigned to the highest verb in a hypotactic chain. Finiteness thus differs from the non-finite status, where an irregular word order resulted in a failure of the irregularly linearized verb to receive or govern regular status.

4. Semantics

We mentioned in the introduction to the general properties of non-finite verbal constructions in section 2 of chapter 2 that the semantic functor-argument structure in all but a few exceptional examples is parallel to the observable syntactic selection. Let us now take a closer look at these exceptions.

Reis (1979, p. 15) observed that the example (158) from a German news magazine shows a mismatch between the syntactic and the semantic functor-argument structure.

(158) Eine Pariserin namens Dimanche soll^1(0) sich ein gewaltiges
a Parisian called Dimanche shall REFL *a huge*
Stirnhorn operativ entfernt^4(3) haben^3(1) lassen^2(1).
bump.on.the.forehead surgically removed have let
'A woman from Paris called Dimanche is said to have had a huge bump on her forehead removed.'

Looking at the syntactic relations in this sentence, *entfernt* is the most deeply embedded predicate and since it is in third status it has to be governed by *haben*. From the word order and finiteness marking one can then determine that *haben* is selected by *lassen* as last word in the lower-field, which in turn is selected by finite form *soll* as highest verb of the hypotactic chain.

Semantically, however, the functor-argument structure of the sentence is as sketched in (159). The mismatch is in the reversed relations of the perfect tense operator 'perf' as interpretation of *haben* and the causative 'let' as interpretation of *lassen*.

(159) supposedly(perf(let(x,remove(y))))

The exceptional syntactic character of (158) also becomes apparent when one decomposes the hypotactic chain. Eliminating the highest verb *soll* from the chain, one obtains the sentence (160a) in which *hat* is the highest verb so that the syntactic and semantic structure are again in parallel. If one instead tries to keep the syntactic relations of (158) one obtains the ungrammatical sentence (160b).

(160) a. Sie hat es sich entfernen lassen.
she has it REFL *remove let*
perf(let(x,remove(y)))

b. * Sie läßt es sich entfernt haben.
she lets it REFL *remove have*

Interestingly, the example discussed by Reis (1979) is not a solitary instance of such a syntax-semantics mismatch. Merkes (1895, p. 72) remarks on the example in (161) which shows a similar mismatch.

(161) Es war ein Schüler, der das Zeitliche gesegnet hatte, ohne seine
he was a student which the time blessed have without his
Studien vollendet^3(3) haben^2(1) zu können^1(2_3).
studies finish have to be.able
'He was a student who departed this life without having been able to finish his studies.'

In this sentence, the morphological status marking shows that syntactically the preposition *ohne* introducing the adverbial infinitival clause selects the second status of *können* as highest verb in the hypotactic chain. The modal *können* governs the first status of *haben* which in turn selects the third status of *vollenden*.

The semantic relations are again different from the observable syntactic selection since the example is not interpreted parallel to (162a) but to (162b), i.e., the perfect tense operator stemming from *haben* out-scopes the semantic contribution of *können*.

(162) a. Er kann^1(0) sie (morgen) vollendet^3(3) haben^2(1).
he be.able it tomorrow finished have
'He is able to have it finished (by tomorrow).'
able(perf(finish(x,y)))

b. Er hat^1(0) sie vollenden^3(1) können^2(1_3).
he has it finish be.able
'He was able to finish it.'
perf(able(finish(x,y)))

A promising idea for explaining the existence of such syntax-semantic mismatches is already mentioned by Merkes (1895, p. 33). He reports that in the 14th/15th century, sentences like (163a) were used in the way that sentences like (163b) are employed in current German.

(163) a. Er soll^1(0) das getan^3(3) haben^2(1).
he shall it done have
'He is supposed to have done it.'

b. Er hat^1(0) das tun^3(1) sollen^2(1_3).
he had it do shall
'He was supposed to do it.'

Both sentences are still grammatical, but the sentence (163a) can no longer be interpreted in the way that (163b) is, which is indicated by the translations. Merkes remarks, however, that in some dialects the option still exists and points out that the older construction is still used in modern English so that as translation of (164a) one has to use (164b).

(164) a. Er hätte^1(0) das tun^3(1) sollen^2(1_3).
he had that do ought

b. He ought to^1(0) have^2(1) done^3(3) it.

Summing up, except for a very limited set of exceptions of which we have seen two examples the syntactic and semantic selection are always in parallel. The regular nature of the semantic functor-argument structure is particularly useful in light of the defective status phenomena we discussed in section 1, which can make it impossible to determine the syntactic relations on the basis of status government alone.

5. Summary

After reviewing the basic syntactic and semantic properties of non-finite constructions in chapter 2, in this chapter we focused on certain word order and status phenomena which are irregular with respect to the relations expected for instances of head-complement constructions in which a verbal head combines with a non-finite complement.

As irregular status phenomena we discussed the substitute infinitive and the substitute *zu*-infinitive which both occur in place of a past-participle when a form of the verb *haben* occurs in the upper-field or in verb-first/second. Which of the two substitute status surfaces in this situation is dependent on whether the coherence-field includes a finite verb, in which case the substitute infinitive arises, or whether the highest verb in the coherence-field is assigned a second status, which results in a substitute *zu*-infinitive.

Lower-field uses of verbs always properly govern their lexically specified status (and verb-first/second verbs can do so). As certain verbs such as the modals do not have a regular past participle form, in a perfect construction *haben* obligatorily has to occur in the upper-field or in verb-first/second.

Regarding the upper-field phenomenon as irregular word order possibility in the final-field, we showed that there are three variants. In the most common form, the upper-field is realized left adjacent to the lower-field. Alternatively, the upper-field can be inserted into the lower-field as long as a lower-field verb remains to the right of the upper-field. As second alternative, the lower-field can occur to the left of the upper-field in a way permitting non-verbal elements to intervene between the two. The three linearization possibilities seem to reflect the same syntactic phenomenon since they correlate with the same status properties: only verbs in null and first status can occur in them and such verbs can neither receive nor govern a status. As an upper-field verb can be either finite or in first status, finiteness differs from the non-finite status in that it is assigned to the highest verb in a hypotactic chain, regardless of whether the verb is realized in verb-first/second, the upper-field, or the lower-field.

Investigating the often cited occurrence of a double infinitive as necessary criterion for the realization of an irregular status or word order, we showed that there are several classes of exceptions to such a double infinitive condition. In general one thus cannot determine on the syntactic properties of a construction alone whether a substitute infinitive or upper-field word order can arise. Instead, reference to certain lexical classes of verbs is required, be it to determine which verbs can occur in the upper-field, which verbs in the lower-field support an upper-field, or which verbs can surface as substitute infinitives. Even though the double infinitive condition is empirically incorrect as a syntactic condition on a specific structure, it appears to be useful in determining membership in some of these lexical classes in that only those verbs can support an upper-field or surface as substitute infinitive which exist in a realization in which they could govern a verbal complement in first status.

Part II

Lexical Generalizations in HPSG

This part of the thesis builds on the following publications: Meurers (1994b), Meurers (1995), Calcagno and Meurers (1996), Meurers (1997b) and Meurers and Minnen (1997).

CHAPTER 4

Introduction

After introducing the empirical linguistic domain of German non-finite verbal constructions in the previous chapters, we now turn to the formal architecture in which we will develop the linguistic proposal in part three: the HPSG paradigm as laid out in Pollard and Sag (1994). After a brief overview of a formal setup for this paradigm, we concentrate on those aspects which are central to our linguistic proposal: the nature of the lexicon in HPSG and the different methods for expressing lexical generalizations in that architecture. In the second chapter of this part we then provide a detailed investigation of one of the methods, lexical rules, in order to supply the formal foundations required to make exact use of this mechanisms in HPSG.

1. A formal setup for HPSG

An HPSG grammar formally consists of two parts: The *signature* defines the ontology of linguistic objects, and the *theory*, i.e., the generally implicational constraints encoding the grammatical principles, describe the subset of those linguistic objects which are grammatical. The constraints constituting the theory are expressions of a formal language which define the set of grammatical objects in the sense that every grammatical object is described by every principle in the theory.

The signature consists of the *type hierarchy* defining which *types* of objects exist and the *appropriateness conditions* specifying which objects have which *features* defined on them to represent their properties.[1] A signature is interpreted as follows: Every object is assigned exactly one most specific

[1]The terminology used in the literature varies. Types are also referred to as *sorts*, appropriateness conditions as *feature declarations*, and features as *attributes*.

type, and in case a feature is appropriate for some object of a certain type, then it is appropriate for all objects of this type.[2]

A logic which provides the formal architecture required by Pollard and Sag (1994) was defined by King (1989, 1994). The formal language of his *Speciate Re-entrant Logic* (*SRL*) allows the expression of grammatical principles using type assignments to refer to the type of an object and path equalities to require the (token) identity of objects. These atomic expressions can be combined using conjunction, disjunction, and negation. The expressions are interpreted by a set-theoretical semantics. In section 4.1.1, we introduce the description language of SRL and its interpretation in formal detail in order to incorporate lexical rules into this setup.

2. Two kinds of lexical generalizations

The need to organize the lexicon in a non-redundant fashion has long been recognized. The proposals range from the use of templates, macros or frames in implementation-oriented proposals over work on special lexical representation formalisms such as DATR (Evans and Gazdar, 1996) to extensions of feature-based grammars using defaults. Briscoe et al. (1993) provide a good collection of papers reflecting the breadth of work on this topic. Since the purpose of our investigation in this part of the thesis is to establish a clear background for our linguistic proposal, we focus on the way different kinds of lexical generalizations can be expressed in HPSG as formalized in King (1989, 1994) and show how that formal setup can be extended where necessary.

Following Flickinger (1987) one can distinguish between two kinds of regularities within the lexicon: one is sometimes referred to as *horizontal*, the other as *vertical*. Horizontal generalizations express a "systematic relationship holding between two word classes, or more precisely, between the members of one class and the members of another class" (Flickinger, 1987, p. 105). A common example for such a horizontal regularity is the relationship between active verbs and their passive counterparts. Vertical generalizations, on the other hand, express that certain properties are common to all words of a single class or subclass. For example, in Pollard and Sag (1994) all finite verbs assign nominative case to their subject valence.

[2]This interpretation of the signature is sometimes referred to as "closed world" (Gerdemann and King, 1994; Gerdemann, 1995).

2.1. Horizontal generalizations. Horizontal generalizations can be captured in the linguistic theory with the help of *lexical rules*, which have been used for this purpose at least since Jackendoff (1975). Two ways to formalize lexical rules in the HPSG architecture of Pollard and Sag (1994) were proposed in Calcagno (1995) and Meurers (1995). We here focus on the latter formalization and return to the differences between the two formalizations in chapter 5. A lexical rule "$D \mapsto E$" in HPSG under the formalization of Meurers (1995) expresses an implicational statement of the form "If there is a grammatical word described by D, then the corresponding words described by E' are also grammatical", where the description E' is derived from E to reflect the fact that only the properties in which the output is intended to differ from the input is explicitly provided in the lexical rule specification. Employing a lexical rule in a linguistic theory thus makes clear theoretical predictions, which can be seen from the fact that such predictions can be falsified if one observes that in a language a word described by a D is grammatical but not its corresponding counterpart.

To illustrate the nature of lexical rules and how they make predictions with something more concrete than "$D \mapsto E$", consider the verb-initial lexical rule for German proposed by Kiss and Wesche (1991) in the formulation of Kiss (1995b, p. 229) which is shown in figure 1.

$$\left[\text{SYNSEM}\ \left[\begin{array}{l}\text{LOCAL}\ \boxed{3}\left[\text{CAT}|\text{HEAD}\ \boxed{1}\left[\begin{array}{ll}\text{VFORM} & \textit{fin}\\ \text{DIR} & \textit{left}\end{array}\right]\right]\\ \text{NON-LOCAL}|\text{TO-BIND}|\text{DSL}\ \{\}\end{array}\right]\right] \mapsto$$

$$\left[\text{SYNSEM}\ \left[\begin{array}{ll}\text{LOCAL} & \left[\begin{array}{ll}\text{CAT} & \left[\begin{array}{ll}\text{HEAD} & \left[\begin{array}{ll}\text{VFORM} & \textit{fin}\\ \text{DIR} & \textit{right}\end{array}\right]\\ \text{SUBCAT} & \left\langle\left[\begin{array}{l}\text{LOC}\ \left[\begin{array}{ll}\text{CAT} & \left[\begin{array}{ll}\text{HEAD} & \boxed{1}\\ \text{SUBCAT} & \langle\rangle\end{array}\right]\\ \text{CONT} & \boxed{4}\end{array}\right]\\ \text{NON-LOCAL}|\text{INH}|\text{DSL}\ \left\{\boxed{3}\right\}\end{array}\right]\right\rangle\end{array}\right]\\ \text{CONTENT}|\text{NUCLEUS} & \left[\begin{array}{ll}\text{RELN} & \textit{mood}\\ \text{SOA-ARG} & \boxed{4}\end{array}\right]\end{array}\right]\\ \multicolumn{2}{l}{\text{NON-LOCAL}|\text{TO-BIND}|\text{DSL}\ \left\{\boxed{3}\right\}}\end{array}\right]\right]$$

FIGURE 1. A verb-initial lexical rule for German

Generally speaking, this lexical rule is intended to capture the following situation: There are two kinds of occurrences of finite verbs in German, sentence-initial and sentence-final ones. Sentence-initial verbs differ from sentence-final occurrences, for example in that they share some properties with complementizers. Despite the differences, however, one needs to capture that sentence-initial and sentence-final verbs share many properties. The idea behind the verb-initial lexical rule in figure 1 thus is to establish a relation between the two possible occurrences of a finite verb.[3]

The left-hand side of the rule describes finite verbs which take their dependents to the left ([DIR *left*]), i.e., sentence-final verbs. The right-hand side of the rule describes finite verbs taking their dependents to the right ([DIR *right*])and specifies a number of aspects in which those sentence-initial occurrences differ from the sentence-final ones. While this is not the place to discuss the actual analysis, it should become clear that this lexical rule predicts that for every verb which is described by the left-hand side of the lexical rule, i.e., for every finite verb which can occur sentence-finally, there is a verb-initial occurrence of this verb which differs from the sentence-final occurrence as specified in the lexical rule. The lexical rule thus makes a clear theoretical prediction which can be empirically tested and possibly falsified. As it stands, this verb-initial lexical rule could, for example, be falsified by the existence of certain verbs in German which only exist sentence-finally (or by particle verbs). To avoid these counter-examples, one needs to specify the lexical entries of these verbs or the verb-initial lexical rule so that the problematic verbs are not described by the left-hand side of the rule. Alternatively, one needs to rule out the resulting verbs on independent grounds, i.e., as the result of a lexical principle expressing generalizations over grammatical words in the way discussed in the following section.

We will come back to the topic of sentence-initial verbs and a particular variant of the verb-initial lexical rule in our discussion of the German sentence structure in chapter 8.

2.2. Vertical generalizations.

2.2.1. *Abbreviations and their theoretical irrelevance.* Vertical generalizations are often expressed by some mechanism which allows the abbreviation of a lexical specification (macros, templates, etc.). Once an abbreviation is defined, it can be used in the specification of each lexical entry

[3]In addition to the aspect of deriving sentence-initial verbs from sentence-final ones we focus on here, the central linguistic insight behind the verb-initial rule is that the sentence-initial verb derived includes a partial description of a sentence-final verb (under the DSL attribute) to ensure that this information gets realized as part of an empty sentence-final element.

in a class. By defining an abbreviation in such a way that it refers to an already defined one, it is possible to organize abbreviations for lexical specification in a hierarchical fashion. A lexicon which is specified using such a hierarchy of macros has sometimes been referred to as "hierarchical lexicon". Since the method allows for a compact specification of the lexicon, it is widely used for grammar implementation. Also, the use of abbreviations in the presentation of a theory or the discussion of example analyses can serve the expository purpose of focusing the reader's attention on those aspects of the theory which are central to the discussion.

From a theoretical perspective, though, macros are far less useful. Starting with the formalism as such, macros are not part of the formal setup provided by King (1989, 1994) for the HPSG architecture of Pollard and Sag (1994). However, in Richter (1997, 1999) and Richter et al. (1999) the setup of SRL is extended with relations, which makes it possible to make reference to a relation instead of having to repeat the bundle of specifications used in defining it.[4]

But what impact can abbreviations have on the adequacy of a theory? Let us first consider the question of observational adequacy of a theory, i.e., whether a particular theory licenses the grammatical signs of a particular language and rules out the ungrammatical ones. An abbreviation and the set of descriptions which are abbreviated describe the same objects. A theory written down using abbreviations and the same theory written down without them thus make exactly the same predictions. In other words, the use of abbreviations makes no difference regarding observational adequacy. While it could be argued that observational adequacy has been neglected in the generative tradition, it remains the central empirical criterion distinguishing linguistic theories for a particular language. In fact, observational adequacy has played a central role for the work in the HPSG paradigm, which has largely focused on the explicit empirical characterization of particular languages. In conclusion, for most of the work in the HPSG paradigm, abbreviations play no theoretical role.

Regarding more abstract levels of adequacy, the potential role of abbreviations is less transparent. Descriptive adequacy can be understood as empirical adequacy of a parameterized core theory across languages. While Pollard and Sag (1994, p. 14) are explicit in stating that they "take it to be the central goal of linguistic theory to characterize what it is that

[4]While in this thesis we are not concerned with computational issues, let us mention that the idea to express 'macros' just like other kinds of relations is also incorporated in the ConTroll system (Götz and Meurers, 1995, 1997a,b).

every linguistically mature human being knows by virtue of being a linguistic creature, namely, universal grammar", an investigation of what constitutes the universal core of an HPSG grammar and how this can be parameterized for a specific language as far as we see has largely been postponed until more elaborate observationally adequate theories of particular languages have been established – and we believe this to be a very reasonable choice. But with the mid-term goal of developing a descriptively adequate theory in mind, one could use macros in the formulation of current theories as a placeholder abstracting over language specific realizations. For example, when formulating some principle restricting finite sentences, one could use a macro *S-fin* as the antecedent of a principle to abstract away from the possible realizations of finite clauses in different languages. Taking descriptive adequacy seriously would, however, require replacing such a use of macro placeholders with proper parameters as part of a meta-theory[5] of universals and parameters in an HPSG architecture of grammar.

Returning to the notion of a lexical class that was at the basis of the original idea of vertical generalizations, macros can also be shown to fail to express vertical generalizations in another way. The problem is that no criterion determining which elements belong to a specific lexical class over which some generalization is to be expressed is part of the grammar. Whether an abbreviation is used in the specification of lexical entries and where this is done is decided by the grammar writer on the basis of personal preference or some kind of meta regime which (s)he follows in writing the grammar, but it does not follow from anything in the grammar itself. That no generalization in a theoretical meaningful sense is expressed can be seen from the fact that no predictions which can be proven incorrect follow from such an encoding. If some word does not obey the restrictions encoded in the abbreviation which is intended to capture the properties of that class, nothing in the grammar stops us from not using the abbreviation in the specification of the problematic lexical entry in order to license it anyhow. Finally, due to the theory-external role of abbreviations, a possibly present hierarchical structure of the abbreviations ("hierarchical lexicon") is not reflected in the theory either. In particular, the hierarchical structure of abbreviations stands in no formal relationship to the hierarchical organization of types defined in the type hierarchy of an HPSG grammar.

[5]That a meta-level is involved here is clearly expressed in the discussion of *descriptive adequacy*, where Chomsky (1965, p. 24) states that "a linguistic theory must contain a definition of 'grammar,' that is, a specification of the class of potential grammars."

2.2.2. *Lexical principles.* Vertical lexical generalizations should be expressed such that they have a predictive power just like the lexical rule mechanism mentioned above. A mechanism expressing vertical lexical generalization should capture statements of the form "If a word is described by D, then it is also described by E." A mechanism for formulating such lexical generalizations is readily available in the HPSG architecture. The implicational constraints used to express the grammatical principles make statements of the form that all objects described by the antecedent must satisfy the consequent in order to be grammatical. This expresses a generalization over all objects described by the antecedent that can be falsified if one finds grammatical linguistic objects which satisfy the antecedent but violate the consequent.

The remaining question is which kind of antecedents are to be used as antecedents of the principles encoding the vertical generalizations. If the lexical class to which a generalization is to be attached cannot directly be picked out on the basis of a property common to all and only the elements of that class, we need to make the lexical class explicit in the theory in some other way. Pollard and Sag (1987, ch. 8.1) introduced a 'hierarchy of lexical types' for a similar purpose. However, while there are clear intuitions behind these 'lexical types', their exact meaning and how they fit into the HPSG architecture has never been clarified. A straightforward solution is to introduce the relevant class distinctions as ordinary types – a possibility which is already mentioned but not pursued by Riehemann (1993, p. 56) as alternative to her 'lexical types'. Where to introduce a new type distinction in case the ontology does not yet make it possible to pick out the relevant class of objects naturally depends on the particular kind of class which is to be singled out. For example, for lexical classes which are subclasses of categorial distinctions, the most appropriate location would be to introduce them as subtypes in the hierarchy below *head*, where certain categorial distinctions are already encoded.

Note that in contrast to the macros discussed above, the newly introduced or already present properties which are referred to in a specification singling out a class of elements in any case are an explicit part of the model. Where in the macro case avoiding falsification of a supposed generalization by not using the macro in the problematic case had no effect on the denotation of the grammar, such an attempt to avoid falsification of a lexical principle would have an observable effect on grammar denotation, since it requires changing one of the properties of an object which cause it to be picked out as part of the specific class.

Let us illustrate the idea of lexical principles with an example. For English, Pollard and Sag (1994, p. 30) propose to assign nominative case to the subject of finite verbs as part of their lexical entries. Instead of specifying in the lexical entry of each finite verb with a nominal subject that the subject bears nominative case, one could formulate a lexical principle to ensure nominative case assignment as a generalization over all such verbs. To do so, we first need to check whether the ontology assumed by Pollard and Sag (1994, pp. 396ff) is rich enough to single out the set of words which are verbs that have a finite verb-form and subcategorize for a nominal subject. The type *word* is introduced as a subtype of *sign*, and the different categories of signs are represented by subtypes of *head*. The *head*-subtype *verb* has the additional attribute VFORM with *finite* as one of its appropriate values. Finally, their signature also includes a SUBCAT attribute, the first element of which is taken to be the subject requirement, so that together with the *head*-subtype *noun* we can describe nominal subject requirements. The independently motivated ontology defined by Pollard and Sag (1994, pp. 396ff) thus is rich enough to single out the relevant subclass of words we want to generalize over. We can therefore preceed to formulate the simple lexical principle in figure 2 to express the generalization that nominative case is assigned to the subject requirement of each finite verbal word which has a nominal subject.

$$\begin{bmatrix} \textit{word} \\ \textsc{synsem}|\textsc{loc}|\textsc{cat} \begin{bmatrix} \textsc{head} \begin{bmatrix} \textit{verb} \\ \textsc{vform} \ \textit{finite} \end{bmatrix} \\ \textsc{subcat}|\textsc{first}|\textsc{loc}|\textsc{cat}|\textsc{head} \ \textit{noun} \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{subcat}|\textsc{first}|\textsc{loc}|\textsc{cat}|\textsc{head}|\textsc{case} \ \textit{nominative} \end{bmatrix}$$

FIGURE 2. A lexical principle assigning nominative case

Complex vs. type antecedents. The sketched approach of expressing lexical generalizations with lexical principles bears a lot of similarities to the principles in the work of Sag (1997), who sub-classifies phrasal types and uses principles to express generalizations about nonlocal specification. It also is very similar to the lexical generalizations expressed in Bouma et al. (1998). One formal difference between their and our approach is that they only makes use of type antecedents, whereas we employ complex descriptions as antecedents of the lexical principles.

From a formal perspective, implicational constraints with complex antecedents and those with type antecedents are both well-formed expressions of the HPSG description language defined in King (1989, 1994) and they are interpreted in the same way as any other formula of that language: as the set of objects described by that formula. In particular, using implicational statements with complex antecedents does not require something like a conversion into a disjunctive normal form in order to be interpreted.

From a linguistic perspective, we believe that complex antecedents of implicational constraints are advantageous since they make it possible to use the articulate data structure of HPSG to refer to the relevant subset of objects for which some generalization is intended to be expressed. Restricting oneself to type antecedents, one needs to introduce types for every set of objects to which a generalization applies, which duplicates specifications in case the information was already encoded under one of the feature paths for independent linguistic reasons.

Take, for example, the simple lexical principle we defined in figure 2 on the facing page to express the generalization that nominative case is assigned to the subject of finite verbs which select a nominal subject. We discussed above that each of the specifications we needed to express the antecedent singling out the relevant subclass of words was an independently motivated part of the already defined ontology. The category distinctions, for example, are represented as subtypes of *head* in order to ensure their percolation along the head projection. The attributes VFORM and CASE are defined for the *head* subtypes *verb* and *noun*, respectively, which ensures that these attributes only occur on words of the appropriate category and equally ensures the proper percolation of this information along the head projection. The subcategorization requirements are encoded as value of the SUBCAT attribute appropriate for *category*, which among other things ensures that they are mediated as part of an unbounded dependency construction. And so on. This should be sufficient to illustrate that the complex internal structure of signs generally assumed in HPSG has ample motivation.

Returning to our example, the only possibility to obtain a type antecedent describing the same subset of words as the complex antecedent in figure 2 on the preceding page thus is to introduce new subtypes of *word* which duplicate part of the ontological distinctions which, for well-motivated reasons, are already encoded elsewhere in the ontology. One needs to introduce a type *verbal-word* as one of the subtypes of *word* and this new type must have a type like *finite-verbal-word* as one of its subtypes.

Furthermore, one has to separate those finite verbal words which have a nominal subject from those which do not, so that *finite-verbal-word* has to have *finite-verbal-word-with-nominal-subject* as one of its subtypes. Additionally one has to introduce (at least) three further subtypes to represent each of the other possibilities, i.e., *non-verbal-word*, *non-finite-verbal-word*, and *finite-verbal-word-without-nominal-subject*. Apart from having to introduce these six types lacking independent motivation, one also has to specify a principle for each type as shown in figure 3 to ensure that the well-motivated ontological distinctions encoded elsewhere in a sign, which the new subtypes are supposed to duplicate, are actually associated with the respective new subtype.

$$\textit{verbal-word} \rightarrow \begin{bmatrix} \textit{word} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{HEAD} \;\; \textit{verb} \end{bmatrix}$$

$$\textit{finite-verbal-word} \rightarrow \begin{bmatrix} \textit{verbal-word} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{HEAD}|\text{VFORM} \;\; \textit{fin} \end{bmatrix}$$

$$\textit{finite-verbal-word-with-nominal-subject} \rightarrow \begin{bmatrix} \textit{finite-verbal-word} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{SUBCAT}|\text{FIRST}|\text{LOC}|\text{CAT}|\text{HEAD} \;\; \textit{noun} \end{bmatrix}$$

FIGURE 3. Principles needed to ensure the new subtypes are properly associated with the duplicated ontological distinctions made elsewhere

The problem which arises at this point is that even though the principles in figure 3 ensure that, for example, each object of type *verbal-word* bears the relevant specification of its head type, nothing enforces that every object described by $\begin{bmatrix} \textit{word} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{HEAD} \;\; \textit{verb} \end{bmatrix}$ also is described by the type *verbal-word*. To enforce this, two things are required: Firstly, one has to share the (standard SRL) assumption that the most specific subtypes partition the entire domain. And second, one has to define principles associating the sister types of the newly introduced types with properties which are incompatible with those associated with the newly introduced types themselves. For our example, this means one additionally has to define the three principles in figure 4 on the facing page.[6]

[6]Note that their formulation makes use of negation ($\neg$) to single out the complement of objects described with each sister-type. For our example, this negation could be eliminated by disjunctively enumerating all possibilities. In dealing with a principle including a path equality in the consequent, eliminating negation in this way would result in path inequalities.

$$\textit{non-verbal-word} \rightarrow \begin{bmatrix} \textit{word} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{HEAD} \;\; \neg\, \textit{verb} \end{bmatrix}$$

$$\textit{non-finite-verbal-word} \rightarrow \begin{bmatrix} \textit{verbal-word} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{HEAD}|\text{VFORM} \;\; \neg\, \textit{fin} \end{bmatrix}$$

$$\textit{finite-verbal-word-without-nominal-subject} \rightarrow \begin{bmatrix} \textit{finite-verbal-word} \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{SUBCAT} \;\; \neg \begin{bmatrix} \text{FIRST}|\text{LOC}|\text{CAT}|\text{HEAD} \;\; \textit{noun} \end{bmatrix} \end{bmatrix}$$

FIGURE 4. Additional principles needed to ensure the new subtypes are properly implied by the duplicated ontological distinctions made elsewhere

At this point one finally has the type *finite-verbal-word-with-nominal-subject* available to describe the same set of objects as the antecedent of the principle we saw in figure 2 on page 110. The same principle can now be expressed with a type antecedent as shown in figure 5.

$$\textit{finite-verbal-word-with-nominal-subject} \rightarrow \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{SUBCAT}|\text{FIRST}|\text{LOC}|\text{CAT}|\text{HEAD}|\text{CASE} \;\; \textit{nominative} \end{bmatrix}$$

FIGURE 5. The principle assigning nominative case with a type antecedent

Concluding the discussion of the example, we believe it clearly demonstrates that a setup including principles with complex antecedents has significant advantages over one employing only type antecedents. A restriction to type antecedents entails a substantial duplication of ontological distinctions which for well-motivated reasons are encoded elsewhere in the ontology, and it makes it necessary to define special principles correlating the new types with the duplicated properties.

Surfacing from the discussion of particular encodings of vertical generalizations at this point, we showed that the HPSG architecture readily supplies the formal ingredients necessary to express vertical generalizations as implicational constraints, be it with complex or type antecedents. In the following chapter we concentrate on the formally less developed field of horizontal generalizations. We show how lexical rules can be integrated into the formal for HPSG as defined by King (1989, 1994), investigate a specification language for lexical rules and define how this language is formally interpreted.

CHAPTER 5

Horizontal Generalizations

1. Preliminaries

Lexical rules are a powerful tool for capturing horizontal generalization in the lexicon (Carpenter, 1991) and they are widely used in linguistic proposals expressed in the HPSG architecture. However, while a formal foundation for basic HPSG theories is provided by the *Speciate Re-entrant Logic* (*SRL*) of King (1989, 1994), until recently no such formal basis had been given to lexical rules. In order to be able to make precise and explicit use of lexical rules in the linguistic theory developed in part three, in this chapter we want to investigate the fundamental question: What are lexical rules as they are commonly written down in HPSG supposed to mean? Based on our previous work (Meurers, 1995; Calcagno and Meurers, 1996; Meurers and Minnen, 1997), this chapter provides an answer to this question.

A second question, which also deserves to be answered if lexical rules are to play a theoretically interesting role in linguistics concerns the powerful nature of lexical rules mentioned above: What are linguistically motivated restrictions on the range of possible lexical rules? Or more concretely: What generalizations holding across lexical rules are there and how can they be expressed? While the answers to these two questions are beyond the scope of this chapter, which primarily aims at establishing and formalizing a lexical rule mechanism for use in the theory developed in later chapters, the question of generalizations across lexical rules and methods for expressing these is closely tied to the way in which lexical rules are formalized. At the end of introducing the formal basis of our lexical rule proposal in section 2.2.2, we therefore show how this formalization of lexical rules makes it possible to express generalizations over lexical rules in a straightforward way.

Lexical rules in the HPSG literature usually look like the one shown in figure 1, which is modeled after the rule proposed by Pollard and Sag (1987) to relate passive and active verbs.

$$
\begin{bmatrix}
\text{CATEGORY} & \begin{bmatrix}
\text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{psp} \end{bmatrix} \\
\text{VALENCE} & \begin{bmatrix} \text{SUBJ} & \left\langle \text{NP}_{\boxed{1}} \right\rangle \\ \text{COMPS} & \left\langle \text{NP}_{\boxed{2}} \mid \boxed{3} \right\rangle \end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\mapsto
\begin{bmatrix}
\text{CATEGORY} & \begin{bmatrix}
\text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{pas} \end{bmatrix} \\
\text{VALENCE} & \begin{bmatrix} \text{SUBJ} & \left\langle \text{NP}_{\boxed{2}} \right\rangle \\ \text{COMPS} & \boxed{3} \oplus \left\langle \left(\text{PP}\big[\text{by}\big]_{\boxed{1}} \right) \right\rangle \end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$

FIGURE 1. A passive lexical rule

On an intuitive level, the effect that this rule is supposed to have is clear: anything in the grammar that corresponds to the AVM on the left-hand side of the rule should get related to something that corresponds to the AVM on the right-hand side. So why is this intuitive understanding not sufficient?

To begin with, the rule in figure 1 just consists of two AVMs separated by an arrow, but a lexical rule is supposed to be some kind of *relation*. Is there any systematic way to specify what relation the notation in figure 1 denotes? An answer to this question presupposes a discussion of the following subquestions: First, what does it mean to "correspond" to the left-hand side of the rule? Is the input required to be as specific as the AVM on the left-hand side or is it sufficient for the input not to contain incompatible specifications?

Second, given some input to the rule, what should the corresponding output be? Intuitively, of course, it is supposed to look something like the right-hand side of the rule. But most linguists agree that it should not look exactly like the right-hand side; it is also supposed to retain some of the properties of the input. Sometimes what is intended is explained informally in the following way: change the input only in ways that the right-hand side of the rule tells us to change it, and leave everything else the same. But the right-hand side of the rule is not an algorithm; it's only a description. How are we supposed to know what this piece of syntax is telling us to do to the inputs? And, are ordinary AVMs enough to express intended changes to the input in a compact and unambiguous way?

Third, what kinds of things are the inputs and outputs to lexical rules? That is, most linguists agree that a lexical rule is some kind of relation, but what exactly does it relate? Pollard and Sag (1994) state that lexical rules are relations between lexical entries, which in turn are descriptions, and this is the line pursued in Calcagno (1995). Meurers (1995), however, argues that lexical rules are better treated as relations between the structures that lexical entries denote, i.e., as relations between word objects. And indeed some passages in Pollard and Sag (1994) seem only to be consistent with this latter approach. So which approach captures the intentions, if any?

Finally, assuming that we arrive at satisfactory answers to all of the above, how can lexical rules be integrated into a grammar in such a way as to license the desired relationships among lexical elements. That is, if lexical rules relate lexical entries, then what is the proper place in the grammar for meta-rules of this type? And if lexical rules relate word objects, how can a lexicon including lexical rules be expressed as part of the theory?

In the following, we propose one set of answers to the above questions in the hope that the lexical rule specification language and its interpretation which we define provides a sensible formalization for lexical rules as they are commonly used in HPSG.

2. THE LEXICON IN THE HPSG ARCHITECTURE

Generally speaking, a grammar in the frameworks of GB, LFG, GPSG, and early versions of HPSG includes a way to license constituent structure and a lexicon licensing the words grounding the recursion. The lexicon often is highly specified and information-rich, so that the question naturally arises as to whether the information within the lexicon can be structured in such a way as to capture generalizations about classes of words with common behavior or to eliminate redundant specification across entries. Lexical rules have been used to express such generalizations.

In the last decade, however, as the logical foundations of HPSG have been explicated in more detail (King, 1989, 1994), the notion of a grammar has been simplified to a point where, from a formal point of view, no distinction is made between lexical entries, syntactic rules or any other grammatical statement. An HPSG theory is simply a set of descriptions;

some of those descriptions constrain phrases, while others describe words. In this framework, the lexicon can be thought of as a disjunctive constraint on objects of a certain sort, usually the sort *word*. Other theory statements can also be used to state generalizations about word objects, and as a result the lexical entries comprising the lexicon are less specific and have lost their unique position in specifying lexical information. This suggests that the concept of a lexicon and lexical rules as outside of the theory in the formal sense of King (1989, 1994) are redundant in that one should be able to provide an interpretation of lexical rules on a par with other generalizations in the theory, i.e., as a relation on word objects.

Of course, this does not mean that lexical rules as they existed before, cannot play any role in current HPSG. Rather, it shows that lexical rules as specified by the linguist can be interpreted in two ways – as meta-descriptions relating *lexical entries* (Calcagno, 1995), or as descriptions relating *word objects* (Meurers, 1995). To distinguish the two approaches in the discussion, a lexical rule under the former approach is called a *Meta-level Lexical Rule* (MLR), while a lexical rule in the latter setup is referred to as a *Description-Level Lexical Rule* (DLR).

2.1. Defining the basic lexicon.

2.1.1. *The lexicon as a set external to the theory.* Corresponding to the two conceptions of a grammar introduced above, there are two options for integrating the lexicon into the HPSG architecture. In a traditional perspective distinguishing a lexicon from other grammatical constraints, the natural move is to extend the notion of an HPSG grammar by introducing the *lexicon* as an extra set of descriptions of word objects. A *lexical entry* then is an element of this set.[1] More formally, under this view, a grammar is a triple $G = <\Sigma, \Theta, L>$, with Σ a signature, Θ a theory, and L a lexicon. The denotation of a grammar, then, is the denotation of Θ with the additional restriction that those elements that are of type *word* also have to satisfy (at least) one lexical entry. The denotation of a grammar thus is a subset of the denotation of its theory.

2.1.2. *The lexicon as part of the theory.* The second possibility for expressing a *lexicon* in the HPSG architecture is to include it in the theory

[1]Please note the terminology used here and throughout the thesis: The *lexicon* is a collection of lexical entries and each *lexical entry* is a description of a set of word objects. Sometimes we will simply speak of *words* when we mean word objects (but never for lexical entries).

as an ordinary implicational constraint on word objects (Meurers, 1994b, p. 25; Höhle, 1996a) like the one shown in figure 2.

$$word \rightarrow D_1 \vee D_2 \vee \ldots \vee D_n$$

FIGURE 2. The lexicon defined as part of the theory

A constraint of this form is sometimes called the *Word Principle*, with each D_i ($1 \leq i \leq n$, n finite) a *lexical entry*, i.e., a description of word objects. Unlike in the first setup, in the Word Principle approach no extension of the notion of an HPSG theory and its interpretation is required. The lexicon is a constraint like all other constraints in the theory and is interpreted in the standard way.

An interesting formal point to note about the Word Principle is that since the length of a description in SRL, just as in standard first-order logic, is required to be finite, the word principle formalization restricts us to a finite set of lexical entries. It is possible to license an infinite number of *word* objects, though, since in principle any description can have an infinite denotation.

Höhle (1996b) remarks that Pollard and Sag (1994, p. 395, fn. 1) conceive the basic lexicon to be an "*exclusive* disjunction of descriptions". This implies a complication of the word principle of figure 2 in order to make all disjuncts exclusive, for example as shown in figure 3.

$$\begin{array}{lll} word \rightarrow & & (D_1 \wedge \neg D_2 \wedge \neg D_3 \wedge \ldots \wedge \neg D_n) \\ & \vee & (D_2 \wedge \neg D_1 \wedge \neg D_3 \wedge \ldots \wedge \neg D_n) \\ & \vdots & \\ & \vee & (D_n \wedge \neg D_1 \wedge \neg D_2 \wedge \ldots \wedge \neg D_{n-1}) \end{array}$$

FIGURE 3. Complicating the lexicon to obtain exclusive disjunctions

It has, however, never been argued why every word should only be described by exactly one disjunct. Furthermore, checking whether a specific word is licensed by a lexicon in such a setup would require considering all descriptions D or the negation thereof – a highly complex task which is virtually impossible for any larger lexicon. We therefore follow Höhle (1996b) in considering such a complication of the word principle to be unjustified.

2.2. Extending the lexicon with lexical rules. Now that we have a formal characterization of a basic lexicon, we can turn to the issue of extending this lexicon with lexical rules. We start with lexical rules under the MLR approach before showing how lexical rules as DLRs can be integrated into the theory.

2.2.1. *Extending the lexicon with* MLR*s.* An MLR is a binary relation between descriptions, which for any description in the domain of the relation (the input entry) will produce a set of descriptions (the output entries). MLRs expand a finite base lexicon by licensing additional lexical entries much in the same way that meta-rules in GPSG (Gazdar et al., 1985) were thought of as expanding a basic set of phrase structure rules by licensing additional phrase structure rules.

Calcagno and Pollard (1995) provide the following definition which uses a least fixed point construction to define a full lexicon on the basis of a base lexicon and a set of lexical rules:

DEFINITION 1 (Full Lexicon under MLR approach). *We assume a finite set $R = \{r_1, \ldots, r_k\}$ of binary relations between formulas, called lexical rules, and a finite set of base lexical entries $B = \{\beta_1, \ldots, \beta_l\}$. Then the full set of lexical entries is the least set L such that:*

- *$B \subset L$; and*
- *for all $\lambda \in L$ and $r \in R$ such that $r(\lambda, \phi)$, $\phi \in L$.*

The full lexicon is defined as the relational closure of the base lexicon under the set of lexical rules. The base lexical entries in the set B are specified by the linguist; the full set of lexical entries is obtained by adding each description to the lexicon set which is related to a base or an already derived lexical entry via one of the lexical rule relations r.

Some consequences of an MLR *formalization.* As long as the closure under lexical rule application, the full lexicon set L in definition 1 is finite, it is possible to formally express the lexicon either as a distinguished set of descriptions of word objects or as disjuncts on the right-hand side of a Word Principle. The mentioned meta-rules of GPSG were in fact restricted so that only a finite number of phrase structure rules were produced. However, restricting lexical rule application in this way appears to be empirically inadequate or at least in contradiction to the development of HPSG: most current HPSG analyses of Dutch, German, Italian, and French make use of infinite lexica. This is, for example, the case for all

proposals working with verbal lexical entries which raise the arguments of a verbal complement in the style of Hinrichs and Nakazawa (1989) that also use lexical rules such as the Complement Extraction Lexical Rule (Pollard and Sag, 1994) or the Complement Cliticization Lexical Rule (Miller and Sag, 1993) to operate on those raised elements. Also an analysis treating adjunct extraction via lexical rules (Van Noord and Bouma, 1994; Bouma et al., 1998) results in an infinite lexicon. Finally, Carpenter (1991) provides examples from the English verbal system for which recursive rule application and hence a potentially infinite lexicon seems necessary.

Let us illustrate one of these examples in which an infinite number of lexical entries (not the words described) arises in an MLR setup: the interaction of argument raising with the Complement Extraction Lexical Rule. In figure 4 we see the essential aspect of the lexical entry for the German auxiliary *haben*, namely the argument raising specification introduced by Hinrichs and Nakazawa (1989) and used in most current HPSG analyses of Germanic and Romance languages.

$$\begin{bmatrix} \text{PHON} & <\textit{haben}> \\ \text{COMPS} & \left\langle \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{psp} \end{bmatrix} \\ \text{COMPS} & \boxed{1} \end{bmatrix} \middle| \boxed{1} \right\rangle \end{bmatrix}$$

FIGURE 4. Argument raising in the lexical entry of a German auxiliary

One of the complements which this perfect auxiliary *haben* subcategorizes for is its past participle verbal complement. The rest of the COMPS list (after the | operator in the figure) is specified to be identical to the list of complements which are subcategorized for by the verbal complement. The exact number of complements thus is not fixed in the lexical entry.[2]

The Complement Extraction Lexical Rule (CELR) as provided by Pollard and Sag (1994, ch. 9, p. 378) is shown in figure 5 on the following page. The essential effect of the rule is that it removes the element tagged $\boxed{3}$ from the COMPS list of the input. The resulting output thus has one less

[2]Attempting to reformulate the lexical entry to obtain one lexical entry for each possible subcategorization frame of the verbal complement is no real option. This is so since there are argument raising verbs which subcategorize for a nominal object and a verbal complement, such as the so-called AcI verbs. Regarding the generative potential of the language there thus is no upper limit on the number of complements on the subcat frame of a verb.

$$\begin{bmatrix} \text{SUBCAT} & \left\langle \dots, \boxed{3}, \dots \right\rangle \\ \text{COMPS} & \left\langle \dots, \boxed{3}\left[\text{LOC } \boxed{1}\right], \dots \right\rangle \\ \text{INHER|SLASH} & \boxed{2} \end{bmatrix} \mapsto$$
$$\begin{bmatrix} \text{SUBCAT} & \left\langle \dots, \boxed{4}\left[\text{LOC } \boxed{1}, \text{INHER|SLASH } \left\{\boxed{1}\right\}\right], \dots \right\rangle \\ \text{COMPS} & \left\langle \dots \dots \right\rangle \\ \text{INHER|SLASH} & \left\{\boxed{1}\right\} \cup \boxed{2} \end{bmatrix}$$

FIGURE 5. The Complement Extraction Lexical Rule (Pollard and Sag, 1994)

element on the COMPS list and can again serve as input to the CELR. The question we are interested in is: How many lexical entries result from the application of the CELR to the entry of the auxiliary we saw in figure 4 on the page before? Given that the length of the COMPS list of the entry is not fixed, the answer has to be that the CELR under the MLR perspective produces an infinite number of lexical entries when applied to a verb specified using the argument raising specification.

A consequence of such theories licensing infinite lexica is that it commits the MLR approach to a view of the lexicon as a set outside of the theory. This is the case since in SRL it is not possible to specify an infinite disjunction as a description.[3]

Another important consequence of the MLR approach arises from the fact that it is undecidable whether a description is grammatical with respect to an HPSG theory. In the MLR setup it therefore is not possible to restrict the input of lexical rules to those lexical entries describing only grammatical word objects, i.e., words which satisfy the principles expressed in the theory. Adding a test for grammaticality to definition 1 would amount to adding an undecidable precondition to grammar denotation. Expressed differently, the consequence of this is that in an MLR setup the lexical entries in the basic lexicon set are the only part of the grammar that constrains the possible inputs of a lexical rule – it is not possible to require other principles to hold of the inputs to lexical rules, be it to restrict what can constitute a possible base lexical entry or a possible "intermediate" entry, i.e., an entry which is the output of one lexical rule and the input of another one.

[3]One could attempt to extend SRL to allow infinite disjunctions, where each of the disjuncts can be recursively enumerated, but such an extension is beyond the scope of this thesis.

A related consequence develops from the fact that not only the lexical entries but also the lexical rules in an MLR approach are introduced as entities separate from the rest of the linguistic theory. It therefore is not possible to use the existing architecture, i.e., principles in the theory, to express generalizations over possible lexical rules. Similarly, there are no mechanisms for encoding a hierarchical organization of lexical rules to organize them in classes with common properties.

2.2.2. *Introducing* DLR*s into the theory.* A DLR is a binary relation between word objects. While this departs from the more traditional view, in which lexical rules are formalized as meta-relations, it makes it possible to integrate lexical rules at the level at which the other grammatical constraints in the HPSG architecture are expressed. An SRL description denotes a set of objects; so that a formula describing both an object and the value of one of its appropriate attributes can be thought of as relating two objects. In the grammar defined in Pollard and Sag (1994), for example, a description of a *functional* head object and its SPEC value expresses such a binary relation holding between a head object and its SPEC value.

Perhaps the simplest way to formalize lexical rules as part of the description language would be to introduce two subtypes of *word*, say *simple-word* and *derived-word* and give *derived-word* an additional appropriate attribute IN with *word* as appropriate value. Figure 6 shows the relevant portion of the signature.

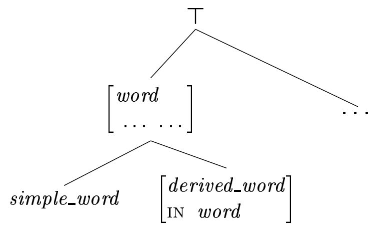


FIGURE 6. The signature for the word-in-word encoding

The implicational constraints in figure 7 on the next page then define the lexicon including lexical rules. In this encoding, the in-description D_j of a DLR j ($1 \leq j \leq m$) is specified on the IN-attribute, while the out-description E_j is specified directly on the *derived-word*.

The disadvantage of this encoding, however, is that if a specific linguistic theory introduces subtypes of *word*, "parallel" subtypes will have to be

$$\begin{array}{lcl} \textit{simple-word} & \rightarrow & L_1 \vee \ldots \vee L_n \\ \textit{derived-word} & \rightarrow & \left(\begin{bmatrix}\text{IN} & D_1\end{bmatrix} \wedge E_1\right) \vee \ldots \vee \left(\begin{bmatrix}\text{IN} & D_m\end{bmatrix} \wedge E_m\right) \end{array}$$

FIGURE 7. The theory for the word-in-word encoding

introduced for *derived-word*. Furthermore, to refer to the output of a lexical rule when we discuss and define the interpretation of lexical rule specifications below, one always has to distinguish between the special attribute IN of words and all its other attributes. To avoid these problems we propose a more modular encoding which clearly separates the lexical rules from the words. Figure 8 shows an implicational constraint on *word* defining an extended lexicon including lexical rules.

$$\textit{word} \rightarrow \left(L_1 \wedge \begin{bmatrix}\text{STORE} & \langle\rangle\end{bmatrix}\right) \vee \ldots \vee \left(L_n \wedge \begin{bmatrix}\text{STORE} & \langle\rangle\end{bmatrix}\right) \vee \boxed{1}\begin{bmatrix}\text{STORE} & \left\langle \begin{bmatrix}\textit{lex\_rule} \\ \text{OUT} & \boxed{1}\end{bmatrix} \right\rangle\end{bmatrix}$$

FIGURE 8. A Word Principle for an extended lexicon

The type *word* is assumed to have an additional appropriate feature STORE, which is *list*-valued. Furthermore, a new species *lex_rule* is introduced, having IN and OUT as appropriate features with *word* values. The relevant part of the signature is shown in figure 9.

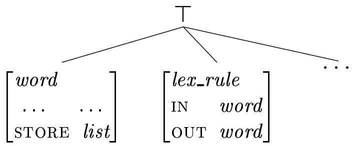


FIGURE 9. A signature for the modular lexical rule encoding

The different lexical rules are specified in a constraint on *lex_rule* like the one shown in figure 10. Each disjunct on the right-hand side of the

$$\textit{lex\_rule} \quad \rightarrow \quad \begin{bmatrix}\textit{lex\_rule} \\ \text{IN} & D_1 \\ \text{OUT} & E_1\end{bmatrix} \vee \ldots \vee \begin{bmatrix}\textit{lex\_rule} \\ \text{IN} & D_m \\ \text{OUT} & E_m\end{bmatrix}$$

FIGURE 10. Defining lexical rule objects in the modular encoding

implication encodes a lexical rule. We will refer to each such disjunct as a description language lexical rule (DLR) and to the in- and out-descriptions D_j and E_j $(1 \leq j \leq m)$ as DLR-In and DLR-Out.

So how does this encoding work? The constraint in figure 8 on the preceding page says that every object of type *word* is either described by a base lexical entry L_i $(1 \leq i \leq n)$ or it is the value of the OUT attribute of a *lex_rule* object. The implicational constraint on *lex_rule* ensures that only a certain set of words are possible values of its OUT attribute, namely those which satisfy one of the out-descriptions E_j in the consequent. The corresponding D_j also has to be consistent and, since the appropriateness conditions for *lex_rule* ensure that the value of an IN feature is of type *word*, it also has to satisfy the constraint on *word*, i.e., one of the lexical entries of figure 8 on the facing page. Naturally the lexical entry satisfied can again be the last disjunct, i.e., the output of a lexical rule. Even though the disjunction is finite, we therefore still can license an infinite number of non-isomorphic grammatical word objects via the last disjunct in the Word Principle of figure 8 on the preceding page.

Finally, we turn to a somewhat different alternative for expressing lexical rules as a binary relation on word objects. This alternative consist of expressing relations by constructs which are part of the relational extension of the description language. This would formalize lexical rules parallel to relations like *append*, or more accurately a binary relation like *member*. If we chose a formal language for HPSG which allows us to use definite relations within the description language, such as the system defined in Götz (1995) which extends King (1989) with ideas from Höhfeld and Smolka (1988) and Dörre (1994), it is possible to represent a lexicon including lexical rules in the formal language without extending the signature. The figures 11 and 12 illustrate this possibility. Note that

$$\textit{word} \quad \rightarrow \quad L_1 \vee \ldots \vee L_n \vee \text{lex\_rule}(\textit{word})$$

FIGURE 11. A lexicon with added lexical rule relations

$$\begin{array}{lcl} \text{lex\_rule}(D_1) & := & E_1. \\ & \vdots & \\ \text{lex\_rule}(D_m) & := & E_m. \end{array}$$

FIGURE 12. Defining the lexical rule relation

a functional notation for relations is used. Just as before, D_j is the in-description of lexical rule j and E_j its out-description. What is different in this encoding is that now the lexical rules are defined on a different level than the *word* objects. As a result, the linguistic ontology does not have to be complicated by book-keeping features like STORE or special types like *lex_rule*. Which *word* objects satisfy our theory is defined using the description language, while the *lex_rule* relation is defined using the relational extension of that description language.

Some consequences of a DLR *formalization.* Before turning to the consequences of the DLR formalization, we need to pick one of the possibilities discussed above for introducing DLRs into the theory. Since a discussion of how a formal language for HPSG can be extended with relations and which extension is the most appropriate one is a highly complex topic on its own (Götz, 1995; Richter, 1997, 1999; Richter et al., 1999, see, for example), we avoid this largely orthogonal issue by basing the formalization of DLRs in section 4 on the modular encoding with the *lex_rule* type. Note that the use of STORE and the *lex_rule* type in the modular encoding is quite traditional in that it is an instance of the so-called junk-slot encoding of relations as introduced by Aït-Kaci (1984) and employed by King (1992) and Carpenter (1992).

The key motivation for formalizing lexical rules in HPSG as DLRs develops from the already mentioned fact that in the formal language for HPSG of King (1989, 1994) the notion of an HPSG grammar has been simplified to a point where, from a formal point of view, no distinction is made between lexical entries, syntactic rules or any other grammatical statement. This simple, uniform notion of an HPSG grammar can be maintained if one introduces lexical rules on a par with the other grammatical constraints, i.e., as a description language mechanism like the DLR encoding described above. However, since such an encoding differs from a more traditional view of the lexicon where lexical entries are defined in a separate lexicon set and lexical rules as relationships between lexical entries (and not the words described by the entries), an issue we need to investigate is whether it makes sense to consider DLRs as a formalization of lexical rules in the HPSG framework. That is, apart from being able to express the same generalizations, the relevant question is whether properties which were claimed to distinguish lexical rules from other mechanisms, in particular syntactic transformations, still hold for lexical rules in their reincarnation as DLRs.

Lexical vs. structural information and mechanisms. Höhle (1978, pp. 9ff) discusses the differences between lexical rules and syntactic transformations based on the setup of a grammar along the lines of Chomsky (1965) (henceforth: ATS). Syntactic transformations operate on (representations of) sentences, which are lexically fully specified. All words in the sentence which the transformation does not explicitly change thus have to occur in the same form in the output. Lexical rules on the other hand, operate on single lexical entries. Words occurring in the syntactic environment of a word licensed by a lexical entry which is the input of a lexical rule thus do not stand in a direct relationship to the words which occur in the syntactic environment of a word licensed by the output of a lexical rule.

In the HPSG architecture of Pollard and Sag (1994), the lexical and the syntactic level of explanation are more difficult to separate. Syntactic structure transformation have never been proposed in this architecture, so that a direct comparison between a syntactic and a lexical mechanism within HPSG is not possible. But one can investigate how a DLR incarnation of lexical rules in HPSG is situated with respect to the classification into lexical and syntactic mechanisms of Höhle (1978).

One relevant difference between ATS and HPSG concerns the status of lexical specification. Contrary to ATS, a word in HPSG has an explicit internal structure which among other things includes the word's valence requirements. Each valence requirement is a description of the elements that the word licensed by the entry can combine with. When a word constructs as the head of a phrase in an actual utterance, each valence requirement represented in the word itself is identified with the actually realized argument. Following Pollard and Sag (1994) most HPSG proposals assume that not the entire information about the argument (the *sign*) but only the *synsem* part of the information of an argument is represented in the valence requirements of a word and identified with the arguments realized in an actual utterance.

Alternatively, Hinrichs and Nakazawa (1994b) propose to represent and identify the entire *sign* value of each argument. In the latter setup, looking at a single word at the leaf of a tree reveals all information about the word and all its arguments. To a large degree this eliminates the distinction between a lexical and a syntactic level of explanation. Depending on the rest of the grammatical setup, some traces of the distinction remain, however. In a word, only the arguments of that word are represented, whereas adjuncts are not. On the other hand, following Miller (1992) and Van Noord and Bouma (1994), a significant line of research in HPSG has argued for a lexicalization of adjunct selection parallel to the selection of arguments. Combining such an approach with a Hinrichs and Nakazawa (1994b) style representation of entire signs on the valence lists would seem to eliminate the remaining rest of a distinction between lexical and syntactic information loci. The information encoded in a word then corresponds directly to that encoded in its head projection in a syntactic tree. An interesting complication in this picture arises in a setup in which valence requirements do not have to be realized by the local head but instead can be raised, be it for subjects in raising constructions or different kinds of arguments in argument raising verbal complex constructions. In such a setup arguments of one head can be realized outside of that head's projection, interleaved with adjuncts and arguments of other heads, which eliminates the direct correspondence between lexical entry and its syntactic head-domain.

Let us return to the more traditional HPSG setup, where only the *synsem* part of each argument is represented in a word. A word in such a setup on its valence list still contains a partial representation of each of the elements it is required to combine with in order to project to a saturated syntactic construction. But these requirements are only *synsem* objects, so that the particular phonological or morphological realization is not included. Furthermore, the word contains no information on whether the argument *synsem* is realized as a *word* or a *phrase* and, in case of the latter, what the daughters structure of the phrase is. In fact, nothing ensures that the *synsem* object on the valence structure of a word is part of some grammatical sign at all. And if it is part of a grammatical sign, possibly constraints on signs allow only a subset of the originally described argument *synsems* objects to occur. Summing up, this means that in this kind of an HPSG setup we have a clear separation of lexical and syntactic information loci in the sense that a word does not contain information on whether and how its arguments are syntactically realized. Formalizing lexical rules in such an architecture to operate on words will therefore provide us with a mechanism which, parallel to the characterization of lexical rules by Höhle (1978) mentioned above, make sure that words occurring in the syntactic environment of a word which is the input of a lexical rule thus do not stand in a direct relationship to the words which occur in the syntactic environment of a word licensed by the output of a lexical rule.

The problematic status of the input to lexical rules. After establishing that a formalization of lexical rules as DLRs in a traditional HPSG architecture remains a truly lexical mechanism, we can turn to another issue which in Calcagno and Pollard (1995) is claimed to be problematic for a DLR formalization of lexical rules, the status of the input to lexical rules.

Calcagno and Pollard (1995, p. 6) base their discussion on a word-in-word encoding like the one we introduced in figure 7 on page 124, using SOURCE as attribute name instead of IN, and they point out that this encoding can be equated to that of a unary phrasal schema. The argumentation then runs as follows:

> But this [lexical rule encoding] is problematic. To see why, let's suppose we have a token of a grammatical agentless-passive English sentence such as (165).
>
> (165) Carthage was destroyed.
>
> If the passive lexical rule is indeed a unary schema as we are supposing, then the passive verb *destroyed* must have as its SOURCE some token of the active verb *destroy*. Now consider the SUBJ value of that active verb. It must be a grammatical *synsem* object. But which one? For example, the category of this *synsem* object might be some form of NP, or it might be a *that*-S. If it is an NP, then what kind of NP is it? A pronoun? An anaphor? A nonpronoun? And if it is a *that*-S, what species of state-of-affairs occurs in its CONTENT: *run*? *sneeze*? *vibrate*? Of course there is no reasonable answer to these questions; or to put it another way, all answers are equally reasonable. The conclusion that is forced upon us is that the sentence in (165) is infinitely structurally ambiguous, depending on the detailed instantiation of the subject of the active verb. This *reductio ad absurdum* forces us to reject the view of lexical rules as unary schemata.

The basis of this argumentation is of course correct: The passive verbal word is related by the lexical rule to an active verbal word. For the passive verbal word to be grammatical, every substructure of the word, such as the active verbal word which is housed under its SOURCE attribute, also has to be grammatical.

The misconception in the argumentation creeps in from the focus on a particular *token* of a grammatical agentless-passive sentence. To see what is involved here, let us take a step back and consider an ordinary lexical entry like that for the base form verb *laugh* shown in figure 13.

$$\begin{bmatrix} \text{PHON} & \langle \textit{laugh} \rangle \\ \text{SYNSEM} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{bse} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle \text{NP}_{\boxed{1}} \rangle \\ \text{SPR} & \langle\rangle \\ \text{COMPS} & \langle\rangle \end{bmatrix} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \textit{walk} & \\ \text{ARG1} & \boxed{1} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

FIGURE 13. A lexical entry for *laugh*

This description will license an untold number of word objects. These tokens will all have the phonology <*laugh*>, the head value *verb*, and bear all other specifications required by the entry. But since objects are total representations, they will also include values for all of the other appropriate attributes and paths. Assuming a traditional HPSG signature, for our example this means that some of the objects described by the lexical entry of figure 13 will have a SUBJ value with nominative case, others with accusative case, etc. For some this subject will be a pronominal, for others a non-pronoun. Some of the word objects will have an empty set as CONTEXT|BACKGROUND value while others have a set with, for example, four elements. And some of the word objects will have an empty NONLOCAL|TO-BIND|SLASH value while others have one elements in that set. Note that this is not just a question of a lexical entry describing words that can be used in different syntactic configurations. The same syntactic configuration can be used in different utterance situations which regarding their grammaticality are not distinguished by the grammar. For example, when the sentence *I laugh* is uttered by me, the CONTEXT|BACKGROUND|SPEAKER index of that sentence will refer to a different person than when the same words are uttered by someone else.

This situation appears to be exactly the situation described as a problem of the DLR approach by Calcagno and Pollard (1995). But is it really? Regarding the example of the TO-BIND values, even though in most lexical entries listed in the literature such a value is not specified, this omission is in effect an error which, if taken at face value, would cause the nonlocal

feature percolation mechanism to malfunction. The simple remedy for this problem is to include a $\begin{bmatrix}\text{TO-BIND} & \langle\rangle\end{bmatrix}$ specification in the entry.

This remedy will not carry over to the other cases, though. Take the issue of the case of the subject. It cannot be fixed in the lexical entry of *laugh*, since in the utterance *I see him laugh.* the subject bears accusative, whereas in the occurrence of *laugh* in *I laugh.* it bears nominative. At this point, one could argue that the problem only arises if one looks at single words instead of complete sentences. In a complete phrase there will be a subject, so that the case value of the subject valence is fixed. This will, however, not work as a general solution: On the one hand, one would presumably want a linguistic theory to function properly for grammatical signs in general and not only for fully saturated, sentential phrases. On the other hand, even in a fully saturated, sentential phrase not all of the paths are required to have a specific value by the grammar. Returning to the case of the subject valence of the word *laugh*, consider the utterance *I try to laugh.*. Even though it is a fully saturated sentential phrase, the subject of laugh is not (overtly) realized. The control relation between the subject *I* of *try* in the standard HPSG analysis is established by coindexing, i.e., by specifying in the lexical entry of *try* that the semantic index of the subject valence of *try* is token identical with that of the subject valence of *laugh.* As a result, the other attributes of the subject of *laugh* are not fixed by a particular overt syntactic realization and therefore to a large degree arbitrary. As before, one could remedy part of the situation by being more explicit in the specification of the lexical entry of *try.* For example, following observations by Höhle (1983, ch. 6), one should fix the case value of controlled subjects in German to nominative. It is unclear, though, whether one can find similarly well-founded reasons for fixing every attribute value of unrealized controlled subjects. Rather than fixing grammatical attribute values which happen to be unobservable with stipulated values, it seems to be preferable to permit these values to vary freely, i.e., to not use the grammar to distinguish between them if we do not have grammatical evidence for doing so. That a grammar has to permit the values of certain attributes to vary freely becomes particularly clear for features like the CONTEXT value already mentioned above, the value of which is dependent on the particular utterance context and thus cannot be fixed by the grammar alone.

In sum, the formal setup of HPSG is such that for every grammatical token there can be an untold number of other grammatical tokens which differ only with respect to attribute values not distinguished by the theory. Not only is this a consequence of the setup, this state of affairs is actually intended, since it uses the grammar only for its task of singling out the classes of grammatical objects. If certain values of attributes are irrelevant of the grammaticality of a sentence, different uses of this sentence in actual utterances should be allowed to differ with respect to these attribute values. Moreover, there will also be an untold number of exactly identical tokens, which is needed in order to distinguish between accidental identity of objects and identity of objects required by path equalities.

Let us now return to the discussion of the lexical rule example provided by Calcagno and Pollard (1995). By expressing a lexical rule relating a passive verb to an active one, one relates the occurrence of *destroy* in (165) not to a particular instance of the active *destroy*, but to all the instances which allow the lexical rule application. These active instances of the word *destroy* will include some which cannot construct as a daughter in any phrase, it will include some which specify their subject valence to match a *that*-S argument, and any other possible occurrence of the active verb in any possible utterance.[4]

The interesting status of the input to lexical rules. So far, we have only discussed the potential problems which were argued to arise from the fact that under a DLR formalization of lexical rules, the word which is the input of the lexical rule also has to be grammatical, i.e., be licensed by a lexical entry and satisfy the other grammatical principles. Turning the coin around, the positive side is that under a DLR formalization we can be sure that only those words which satisfy the theory can be the input of a lexical rule. We believe that this property is of central importance since this property makes it possible to express generalizations over the entities which are lexical rule inputs. If this were not possible, the lexical entry would be the only locus of information which is input to a lexical rule. As a result, all information would have to be repeated in each and every lexical entry, even though – as a whole industry on this topic shows – a significant amount of lexical information is identical for the members

[4]Note that nothing we have stated here changes the distinction between syntactic transformations and lexical rules discussed above. In a syntactic transformation a word has to exist as part of a grammatical syntactic tree, whereas this is not the case for lexical rules. This is still true here, since we only require that the word that is the input to the lexical rule is grammatical and not that it constructs in a grammatical syntactic tree.

of different lexical classes. Not checking the input of a lexical rule for grammaticality would either render lexical rules useless or ban all work on vertical lexical generalizations to outside the currently available formal setup for HPSG.

Let us illustrate the interaction of vertical lexical generalizations and lexical rules with an example taken from the approach to partial fronting phenomena we will present in chapter 9. At the heart of the proposal is a lexical principle which introduces argument raising as a general option for non-finite verbal words. The basic version of this argument raising principle is shown in figure 14. This principle applies to base form verbal

$$\begin{bmatrix} \textit{word} & \\ \text{S|L|C|HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{bse} \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \text{S|L|C|V} & \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1} \right\rangle \\ \text{COMPS} & \textit{raised}\left(\boxed{3}\right) \oplus \boxed{2} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1} \mid \boxed{2} \right\rangle \ \wedge\ \left(\boxed{3} \bigcirc \textit{indep}\right) \end{bmatrix}$$

FIGURE 14. The basic lexical argument-raising principle

words and defines how the elements on the argument structure ARG-ST are mapped onto the valence attributes SUBJ and COMPS. The details are not relevant here, but one can note that as part of this mapping, complement requirements of one of the arguments can be raised and added to the COMPS list (via the relation *raised*).

As example for a lexical entry in this setup, consider that of the transitive verb *ausleihen* (*borrow/lend*) in figure 15. The base form entry

$$\begin{bmatrix} \text{PHON} & \langle \textit{ausleihen} \rangle \\ \text{S|L|C|HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{bse} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \begin{bmatrix} \text{L|C|HEAD} & \textit{noun} \end{bmatrix}, \begin{bmatrix} \text{L|C|HEAD} & \textit{noun} \end{bmatrix} \right\rangle \end{bmatrix}$$

FIGURE 15. Lexical entry of a transitive verb

specifies the ARG-ST list, but not the valence attributes SUBJ and COMPS. The principle of figure 14 applies to the words described by the entry in figure 15 and only those words which also satisfy the consequent of the principle, i.e., identify the valence attribute values with the relevant parts of the argument structure, are grammatical.

$$
\begin{bmatrix}
\textit{word} & \\
\text{PHON} & \boxed{1} \\
\text{S}|\text{L}|\text{C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{bse} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \boxed{2} \\ \text{COMPS} & \boxed{3} \end{bmatrix} \end{bmatrix}
\end{bmatrix}
\mapsto
\begin{bmatrix}
\text{PHON} & \textit{bse2fin}\left(\boxed{1},\boxed{2}\right) \\
\text{S}|\text{L}|\text{C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{VFORM} & \textit{fin} \end{bmatrix} \\ \text{VAL} & \begin{bmatrix} \text{SUBJ} & \langle\rangle \\ \text{COMPS} & \boxed{2} \oplus \boxed{3} \end{bmatrix} \end{bmatrix}
\end{bmatrix}
$$

FIGURE 16. A simple finitivization lexical rule

Coming to the crucial point of this example, finite verbs are assumed to be derived from their base forms by the lexical rule shown in figure 16. If the inputs to lexical rules were not checked for grammaticality, this would mean that a base form verb feeding this finitivization lexical rule would not have to be grammatical. The principle of figure 14 on the preceding page would therefore not ensure that the valence attributes of the input are identified with the relevant parts of the argument structure so that the valence attributes of the inputs to the lexical rule would be entirely unspecified. As a result the COMPS list of the finite verbs derived by the lexical rule would be equally unconstrained – which naturally is not the intended result.

Concluding the discussion of this example, we believe it clearly illustrates that a theory including principles generalizing over words only interacts in a reasonable way with lexical rules if the inputs of lexical rules are required to be grammatical.

We already saw in section 2.2.1, though, that under the MLR formalization of lexical rules it is not possible to restrict the input of lexical rules to those entries which describe grammatical words. A meta-level lexical rule therefore can derive grammatical entries from ungrammatical lexical entries as well as from grammatical ones.[5] An MLR formalization of lexical rules therefore cannot be sensibly used for linguistic proposals which include principles generalizing over words, at least when these words are described by lexical entries that can feed a lexical rule.

[5] Note that there is a small exception to this statement, since it naturally is possible to specify specific meta-level lexical rules which include the complete input as part of the output, e.g., by introducing an extra attribute for words which in the output of the lexical rule is specified to be identical to the complete input. However, since one of the motivations for a meta-level formalization of lexical rules is to avoid representing the source of the derivation as part of the model, this possibility is not very attractive and would only amount to specifying DLRs in an indirect way.

Carl Pollard and Gosse Bouma (p.c.) mention that one might want to exploit the fact that ungrammatical lexical rule input is possible in an MLR setup to encode that such entries obligatorily feed a lexical rule and thereby (possibly) become grammatical. However even under a description language formalization, where the input of a lexical rule has to be grammatical, it is possible to express that some lexical entry cannot be used unless it has undergone some lexical rule. Such 'phantom' lexical entries only have to bear a specification which makes them unusable in any syntactic construction. Ideally, this would be a specification of independently motivated attributes; if this is not possible, a new attribute would have to be introduced for this purpose. In any case, this specification would not keep them from being lexical entries which satisfy the grammatical constraints. In a DLR setup, we can thus exclude these entries from surfacing in phrasal structures without making them ungrammatical.

Expressing constraints on lexical rules. Parallel to the issue of the relationship between the input to a lexical rule and the rest of the linguistic theory, the relationship between the lexical rule itself and the rest of the linguistic theory deserves some attention. The central question here is whether principles in the theory can be used to express generalizations over lexical rules. In the DLR setup, lexical rules are encoded by ordinary linguistic objects. One can therefore restrict the range of possible lexical rules and express generalizations over subclasses of them with the help of ordinary principles. In the MLR setup, lexical rules do not interact with the theory at all; they only serve to extend the lexicon set located outside of the theory. Without extending the setup of HPSG it therefore is not possible to express generalizations over MLRs.

As an example, take the case of an adjuncts-as-complements approach. Ivan Sag (p.c.) suggests that instead of formulating a lexical rule adding the adjuncts onto the complement-list directly (Van Noord and Bouma, 1994), or introducing an additional attribute DEPENDENTS to eliminate the lexical rule with a principle adding adjuncts onto this new attribute (Bouma et al., 1998), one could express the addition of adverbials by a constraint on all lexical rules mapping lexeme to words. A sketch of such a constraint in a DLR formalization of lexical rules is shown in figure 17 on the next page. Note that the DLR formalization of lexical rules in principle makes it possible to express lexical rule relations not only between words. By changing the appropriate value for the attribute IN of type *lex-rule* in the signature shown in figure 9 on page 124 to a common supertype of

$$\begin{bmatrix} \textit{lex-rule} & \\ \text{IN} & \textit{lexeme} \\ \text{OUT} & \textit{word} \end{bmatrix} \rightarrow \begin{bmatrix} \text{IN}|\text{ARG-ST} & \boxed{1} \\ \text{OUT}|\text{ARG-ST} & \boxed{1} \oplus \textit{list}\Big(\textit{adverbial}\Big) \end{bmatrix}$$

FIGURE 17. A constraint on lexical rules

word and *lexeme*, lexical rules can also be specified to express relationships between lexemes and words. The advantage of using lexical rules for this purpose is that, as long as the feature geometry of lexemes corresponds to that of words, only those properties which change have to be explicitly included in the lexical rule specification. The interpretation of the lexical rule specification language introduced in section 3 will make sure that all unchanged properties are carried over.

Principles restricting lexical rules could also be used to express that a more restricted set of lexical rules shares some properties. Since different principles can restrict and interact on different sets and subsets of lexical rule mappings, this allows for a hierarchical organization of constraints on lexical rules. Here hierarchical is intended to mean that when one principle restricts the properties of a set of lexical rules, another principle can restrict further properties of a subset of these lexical rules.

3. A Lexical Rule Specification Language

Having discussed the different possibilities to integrate relations between words or lexical entries into the formal setup of an HPSG grammar, we can now turn to the question how such lexical rule relations can be *specified*. We believe the answer to this question is independent of a particular formal basis for lexical rules. That is, regardless of whether lexical rules relate word objects as in the DLR approach, or lexical entries as in the MLR approach, they are intended to capture the same class of generalizations and a precise language to specify these generalization can be defined independently. To emphasize this point, and to facilitate discussion, we introduce the term *lexical element* as an intentionally neutral term meaning the entities related by a lexical rule.

3.1. What needs to be expressed? So what kind of relation needs to be expressed by a lexical rule? Consider two lexical elements related by a lexical rule. We can distinguish three parts: a) Certain specifications of the input are related to *different* properties of the output. b) Certain specifications of the input are related to *identical* properties of the output. And finally, c), certain specifications of the input have *no relation* to specifications of the output, either because i. the linguist intends those specifications to be unrelated, or ii. because those specifications are appropriate for one lexical element but not the other.

For example, a lexical rule relating German base form verbs to their finite forms, among other things needs to a) relate the base verb form specification and the base morphology to a finite verb form and the corresponding finite morphology, b) ensure that the semantic predicate expressed is the same for both objects, and c-i.) ensure that the finite verb can appear in inverted or non-inverted position regardless of the inversion property of the base verb (which in fact can only occur in non-inverted position). An example for the case c-ii.), where certain properties cannot be transferred, could occur in a nominalization lexical rule which relates verbs to nouns. Since a verb form specification is inappropriate for nouns, that specification cannot be transferred from the verb.

In standard practice, lexical rules in HPSG are written down as two AVMs separated by an arrow, as exemplified by the lexical rule in figure 1 on page 116. At first sight, the AVMs, or more precisely the description language expressions which they stand for, clearly and explicitly express the intended relationship between lexical elements: the AVM to the left of the arrow specifies the domain, while the AVM to the right specifies the range. However, as we will motivate in the following, closer inspection reveals a fundamental unclarity: lexical rules as traditionally specified rely on implicit specifications and the ordinary description language does not allow unambiguous specification of certain relationships. We therefore distinguish the language used by the linguist to write down a lexical rule, the *lexical rule specification language*, from the actual relation intended to be captured. Lexical rules specifications (LRS) are written as "LRS-In ↦ LRS-Out". The input- and the output-specification LRS-In and LRS-Out will be specified in an extended version of the description language introduced below, which is designed to provide an unambiguous notation for specifying lexical rule relations.

So in what way is implicit specification used in an LRS? Traditionally, an input to a lexical rules is understood to be minimally altered to obtain an output compatible with LRS-Out: the lexical rule in figure 1 on page 116 "(like all lexical rules in HPSG) preserves all properties of the input not mentioned in the rule." (Pollard and Sag, 1994, p. 314; following Flickinger, 1987). Therefore, no specifications expressing identities (i.e., case b discussed above) are included in an LRS. Interpreting the two AVMs as ordinary descriptions would therefore miss part of the intended effect. This idea to preserve properties can be considered an instance of the well-known *frame problem* in Artificial Intelligence (McCarthy and Hayes, 1969). We will refer to the additional restrictions on the elements in the range of the rule which are left implicit by the linguist and thus have to be inferred on the basis of the lexical rule specification and the signature as *frame specification* or simply the frame of a lexical rule.

The second claim made above was that the standard description language does not allow unambiguous specification of the relationships intended to be expressed. The reason is that no notation is available to distinguish between intended unrelatedness (case c) and mere change of specifications (case a).

3.1.1. *Type specifications and type flattening in* LRS-O*ut.* Take, for example, the signature in figure 18, which will serve as the basis for the non-linguistic examples in the following (unless indicated otherwise).

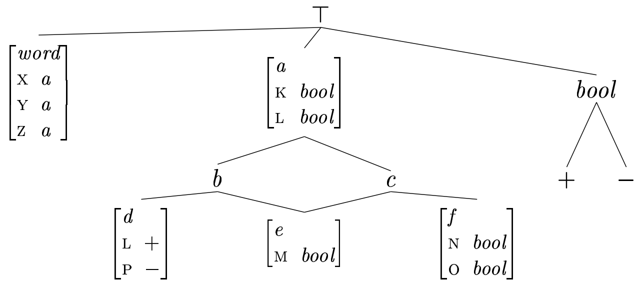


FIGURE 18. The signature for the non-linguistic examples

What kind of X value do we want for the output of the relation specified by the lexical rule specifications in figure 19? One possible interpretation

$$\textit{word} \;\mapsto\; \begin{bmatrix}\text{X} & c\end{bmatrix}$$

FIGURE 19. An example for ambiguous type assignment

is to understand the rule as requiring the output value of X to be *c* if the input's value was incompatible with this assignment, but to keep the value of the input in the output in case it is compatible and more specific.

The other possibility is to say that every output of this rule is intended to have *c* as value of X. In other words, the value of X of the output is intended to be unrelated to the value of X in the input. We will refer to this second interpretation as *flattening* of a type assignment.

Since the first, non-flattening interpretation is closer to the intuition of minimally altering the lexical element to obtain an output, we will adopt this as the standard interpretation of type assignment. To still be able to specify a flattening type assignment, we introduce the new symbol $\flat$ (flat) and figure 20 shows the LRS of figure 19 on the facing page with a flattening type assignment.

$$\textit{word} \;\mapsto\; \begin{bmatrix}\text{X} & \flat c\end{bmatrix}$$

FIGURE 20. A lexical rule using flat

To get a better feel for the interpretation of the two notations, we take a detailed look at the precise mappings expressed. Figure 21 illustrates the relation expressed with the LRS of figure 19 on the facing page, i.e., without flat.[6]

$$\left\{\left\langle\begin{bmatrix}\text{X} & d\end{bmatrix},\begin{bmatrix}\text{X} & e\end{bmatrix}\right\rangle,\left\langle\begin{bmatrix}\text{X} & d\end{bmatrix},\begin{bmatrix}\text{X} & f\end{bmatrix}\right\rangle,\left\langle\begin{bmatrix}\text{X} & e\end{bmatrix},\begin{bmatrix}\text{X} & e\end{bmatrix}\right\rangle,\left\langle\begin{bmatrix}\text{X} & f\end{bmatrix},\begin{bmatrix}\text{X} & f\end{bmatrix}\right\rangle\right\}$$

FIGURE 21. The mapping for (non-flattening) type assignment

Note that it only shows the mapping for the species. One obtains the result for a supertype by taking the mapping for each of its minimal subtypes and interpreting the result disjunctively. Figure 22 on the next page shows the resulting derivations.[7]

In the first three cases the value of X of the input is compatible but less specific than the value specified for X in LRS-Out. For these inputs the

[6]In this and the following figures only the X type values are shown.

[7]Formally, the derivations show slightly different things for the two approaches: For the MLR approach, the derivations show which lexical entry an input entry is related to by the lexical rule. For the DLR approach, the derivations should be interpreted as: given the set of word objects described by the left-hand side description is licensed by the theory, e.g., by satisfying the word principle, adding the lexical rule to the theory will then also license the word objects described by the right-hand side description.

$$\begin{array}{llll}
1. \begin{bmatrix}\text{X} & a\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} & 2. \begin{bmatrix}\text{X} & b\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} & 3. \begin{bmatrix}\text{X} & c\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} \\
4. \begin{bmatrix}\text{X} & d\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} & 5. \begin{bmatrix}\text{X} & e\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & e\end{bmatrix} & 6. \begin{bmatrix}\text{X} & f\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & f\end{bmatrix}
\end{array}$$

FIGURE 22. Lexical entries and what they license via the LRS of figure 19

lexical rule therefore requires the output to have c as value for X. The same requirement is made for the output of case four, this time because d as value of X of the input is incompatible with the LRS-Out specification. Finally, in cases five and six, the specification of the input is compatible and more specific than the assignment in LRS-Out so that the input's value for X can be carried over to the output.

Taking another look at the second derivation in figure 22, one might wonder whether the value of X in the output should not be restricted to e, i.e., the common subtype of b and c, instead of the more general c which seems to violate the intuition of minimal alteration. To obtain this interpretation though, we would also have to map d into e (and not into $f \vee e$), since b denotationally is equivalent to $d \vee e$ and we would like to maintain that two denotationally equivalent lexical entries result in equivalent lexical rule outputs. Since restricting the mapping of d to e in this way is not a sensible interpretation, the mapping of b to e is undesirable.

Turning to the second lexical rule specification, the LRS with the flattening type assignment shown in figure 20 on the page before, the derivations resulting for some lexical entries are shown in figure 23.

$$\begin{array}{llll}
1. \begin{bmatrix}\text{X} & f\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} & 2. \begin{bmatrix}\text{X} & b\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} & 3. \begin{bmatrix}\text{X} & c\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} \\
4. \begin{bmatrix}\text{X} & d\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} & 5. \begin{bmatrix}\text{X} & e\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix} & 6. \begin{bmatrix}\text{X} & f\end{bmatrix} \Rightarrow \begin{bmatrix}\text{X} & c\end{bmatrix}
\end{array}$$

FIGURE 23. Applying the flattening type assignment LRS

Using the flat symbol, the value of X was specified as unrelated to the input and c is assigned as value. Therefore every X value is mapped to both species of c.

The way in which type specifications in a LRS-Out are interpreted is summed up below.

DECISION 1 (Interpretation of type specification in LRS-Out). *A type specification t on path τ in* LRS-Out *is interpreted as expressing the following relation:*

- *The value of path τ in the output is t' if*
  - *type t' assigned to path τ in the input is a subtype of t, and*
  - *path τ is not specified as flat in* LRS-Out
- *Else, the value of path τ in the output is t.*

Indirect type specifications and normalization. So far, so good; but what about the cases in figure 24? The problem is that in those examples even

$$\begin{array}{lll}
1. & \textit{word} \mapsto & \begin{bmatrix}\text{X}|\text{N} & +\end{bmatrix} \\
2. & \textit{word} \mapsto & \begin{bmatrix}\text{X}|\text{L} & -\end{bmatrix} \\
3. & \textit{word} \mapsto & \begin{bmatrix}\text{X} & \begin{bmatrix}\text{K} & \boxed{1} - \\ \text{L} & \boxed{1}\end{bmatrix}\end{bmatrix}
\end{array}$$

FIGURE 24. Lexical rule specifications with implicit type assignments

though no type is specified directly in LRS-Out for X, still only certain types as values for X in LRS-Out will yield a consistent description. In the first LRS in figure 24, the attribute N is only appropriate for objects of type f, in the second LRS the attribute L with value "$-$" is not appropriate for elements of type d, and in the third LRS the attribute L is structure shared with K and, since K has "$-$" as value, again d is not a possible value for X.

The solution to this class of problems is to first infer the type values of the nodes in LRS-Out which are compatible with the descriptions in LRS-Out and the signature. Then, the ordinary interpretation for LRS-Out type specifications defined in decision 1 can be used. Luckily, the task of inferring the compatible species as value of each attribute in a description has already been dealt with: The normalization algorithm of Götz (1993) and Kepser (1994) can be used to transform a description into a normal form representation in which (among other things) every attribute is assigned every species consistent with the rest of the description. The formal definition of the normal form and the normalization algorithm is provided in section 4.

A related complication can be illustrated with a linguistic example based on the signature of Pollard and Sag (1994). The lexical rule shown in figure 25 on the next page, which we proposed for expository purposes only, derives predicative versions for all words.

While the PRD value is to be set to $+$, the usual intention is that the different HEAD types of the input are to be preserved, e.g., if the input of

$$\textit{word} \;\mapsto\; \left[\textsc{synsem}|\textsc{local}|\textsc{cat}|\textsc{head}|\textsc{prd} \;\; +\right]$$

FIGURE 25. PRD–Lexical Rule Specification (for exposition only)

the lexical rule has a HEAD of type *verb*, the output is intended to have a *verb* HEAD as well. As before, normalizing first and then applying the ordinary interpretation for LRS-Out type specifications produces the right result: Normalizing the LRS-Out infers the type *substantive* as HEAD value and by decision 1 a subtype of *substantive*, such as *verb* will be mapped to itself.

Summing up this last part, normalizing LRS-In and LRS-Out allows us to capture rather complex type assignments with the simple interpretation for LRS-Out type specifications defined in decision 1.

Negated type specifications in LRS-O*ut.* Having discussed the effect of positive type specifications in LRS-Out, we can now turn to the interpretation of negated type specifications. It turns out that the SRL setup with its closed world interpretation and a finite set of species allows us to replace all negated type assignments by positive ones. In fact, in section 4 we show that one can eliminate all occurrences of negation. Eliminating negation for negated path equalities does introduce path inequalities, which are dealt with in section 3.1.5 below. But no special treatment of negated type assignments in LRS-Out needs to be defined – the discussion of the positive type assignments above carries over.

Interaction with framing of path equalities. Until now, we have only discussed the effect of type specifications in LRS-Out on typing of the input. So we still need to discuss what effect LRS-Out type specifications are intended to have on the framing of the input's path equalities. There are two possible interpretations here. The first possibility is to argue that a type specification of a path in LRS-Out is a specification of that path and therefore no framing of path equalities takes place. The second possibility is to still ensure framing of those paths even though in some cases this will result in inconsistent outputs.

Consider the LRS and the two possible derivations in figure 26 on the facing page. For the first derivation, the specification of a type for K in LRS-Out is understood as assigning a new value for K and therefore no framing of path equalities takes place. The second case shows the

$$\textit{word} \;\mapsto\; \left[\textsc{x}|\textsc{k}\;\; -\right] \qquad \left[\textsc{x}\;\begin{bmatrix}\textsc{k} & \boxed{1}\\ \textsc{l} & \boxed{1}\end{bmatrix}\right] \;\Rightarrow\; 1.\;\left[\textsc{x}\;\begin{bmatrix}\textsc{k} & -\\ \textsc{l} & \textit{bool}\end{bmatrix}\right] \quad 2.\;\left[\textsc{x}\;\begin{bmatrix}\textsc{k} & \boxed{1}-\\ \textsc{l} & \boxed{1}\end{bmatrix}\right]$$

FIGURE 26. Type assignment in LRS-Out and path equality in the input

derivation under the second interpretation, where a type specification in LRS does not exclude framing of path equality.

While the second interpretation in this example succeeds in preserving more specifications, this second strategy becomes increasingly complex when looking at more cases. Consider figure 27 showing a slightly different derivation with the same LRS but this time with an input with a type specification.

$$\textit{word} \;\mapsto\; \left[\textsc{x}|\textsc{k}\;\; -\right] \qquad \left[\textsc{x}\;\begin{bmatrix}\textsc{k} & \boxed{1}+\\ \textsc{l} & \boxed{1}\end{bmatrix}\right] \;\Rightarrow\; 1.\;\left[\textsc{x}\;\begin{bmatrix}\textsc{k} & -\\ \textsc{l} & +\end{bmatrix}\right] \quad 2.\;\left[\textsc{x}\;\begin{bmatrix}\textit{c} & \\ \textsc{k} & \boxed{1}-\\ \textsc{l} & \boxed{1}\end{bmatrix}\right]$$

FIGURE 27. Type assignment in LRS-Out conflicting with path equality plus type assignment in the input

In this example, the type assignment in LRS-Out conflicts with the path equality and type assignment of the input. Applying the first strategy is straightforward, since the specification of K means that the path equality between K and L holding in the input will not be transferred. To obtain a result for the second strategy, an additional decision needs to be taken which decides how to resolve the conflict between the assignment of L to + and the path equality between K and L. One possibility would be to decide that the specification in LRS-Out always has priority, and that path equalities in the input have priority over type assignments in the input. Such a strategy would then result in the second derivation result shown as part of figure 27 above.

However, a very similar conflict can arise where it is not possible to eliminate the input's type specification since it is the appropriate value of the attribute as in the example in figure 28 on the next page. The first strategy works as in the previous example: since K is specified in LRS-Out the path equality with K is not transferred to the output. The second strategy assumed for the last example fails this time, since objects of type *d* allow only + as appropriate value of L. Therefore the conflict between the path equality and the type specification in the input cannot be resolved by eliminating the type specification.

$$\textit{word} \mapsto \left[\textsc{x}|\textsc{k}\ -\right] \qquad \left[\textsc{x}\ \begin{bmatrix} d \\ \textsc{k}\ \boxed{1} \\ \textsc{l}\ \boxed{1}+ \end{bmatrix}\right] \Rightarrow 1.\ \left[\textsc{x}\ \begin{bmatrix} d \\ \textsc{k}\ - \\ \textsc{l}\ + \end{bmatrix}\right] \quad 2.\ \bot$$

FIGURE 28. Type assignment in LRS-Out, path equality and conflicting appropriate types in the input

Summing up, we believe the above discussion shows that the idea to preserve some input path equalities for attributes specified in LRS-Out opens up a very hard problem, basically that of belief revision involved in the task to eliminate a minimal number of facts from a database that has become inconsistent in order to obtain a consistent one. The strategies which are needed to successfully solve these problems are highly complex. We believe that basing the interpretation of lexical rules on such complex strategies conflicts with the idea of providing a clear mechanism for expressing linguistic generalizations and therefore settle for the less expressive but clear interpretation which is summed up in decision 2.

DECISION 2 (framing of path equalities). *Only path equalities holding between paths in the input which are not mentioned in* LRS-O*ut are transferred to the output.*

3.1.2. *Path independence specifications in* LRS-O*ut.* We decided in the previous section that a type or type-flattening specification of a path in LRS-Out prevents framing of a path equality with that path. This brings up the question of how one can make a specification which prevents framing of a path equality for an attribute, without having to specify or flatten its type. For this purpose one could introduce a binary operator $\sharp$ (sharp) to be used to express that no framing of a path equality between the two paths is intended. The notation with different subscripts, i.e., $\sharp_i$, could then be used if multiple pairs of path equalities are to be eliminated. There is a problem with such a notation though, which is illustrated by the LRS in figure 29.

$$\textit{word} \mapsto \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \sharp_2 \\ \textsc{l}\ \sharp_2 \end{bmatrix}\right]$$

FIGURE 29. A LRS with the binary $\sharp$ notation

The sharps in LRS-Out specify that in the output we don't want to force attributes K and L to be token identical. For certain inputs there are

several possibilities for eliminating the path equality restriction on K and L, though, which is shown in figure 30.

$$\left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \boxed{1} \\ \textsc{l}\ \boxed{1} \\ \textsc{n}\ \boxed{1} \\ \textsc{o}\ \boxed{1} \end{bmatrix}\right] \Rightarrow 1.\ \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \boxed{1} \\ \textsc{l}\ \boxed{2} \\ \textsc{n}\ \boxed{1} \\ \textsc{o}\ \boxed{2} \end{bmatrix}\right],\ 2.\ \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \boxed{2} \\ \textsc{l}\ \boxed{1} \\ \textsc{n}\ \boxed{1} \\ \textsc{o}\ \boxed{2} \end{bmatrix}\right],\ 3.\ \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \boxed{1} \\ \textsc{l}\ \boxed{2} \\ \textsc{n}\ \boxed{1} \\ \textsc{o}\ \boxed{1} \end{bmatrix}\right],$$

$$4.\ \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \boxed{2} \\ \textsc{l}\ \boxed{1} \\ \textsc{n}\ \boxed{1} \\ \textsc{o}\ \boxed{1} \end{bmatrix}\right],\ 5.\ \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \boxed{2} \\ \textsc{l}\ \boxed{3} \\ \textsc{n}\ \boxed{1} \\ \textsc{o}\ \boxed{1} \end{bmatrix}\right]$$

FIGURE 30. Five possible derivations

The problem is that because of the transitivity of path equality, eliminating the path equality between K and L also entails altering the relationships of K and L to N and Z.

To obtain a unique interpretation of the binary $\sharp$ notation one would need to complicate the $\sharp$ notation further. Instead of complicating matters in this way, we introduce path equality elimination $\sharp$ as a unary operator eliminating all path equalities with one path.

To specify a LRS resulting in the five possibilities of figure 30, the path equalities which are intended to be kept for an attribute for which $\sharp$ was used to eliminate some path equalities need to be restated. As shown in figure 31 it is necessary to repeat certain path equalities because it is only possible to eliminate all path equalities with an attribute and not only those holding between two attributes leaving the others as in the binary notation.

$$1.\ \textit{word} \mapsto \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \sharp\boxed{2} \\ \textsc{n}\ \sharp\boxed{2} \end{bmatrix}\right] \quad 2.\ \textit{word} \mapsto \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \sharp\boxed{2} \\ \textsc{o}\ \sharp\boxed{2} \end{bmatrix}\right] \quad 3.\ \textit{word} \mapsto \left[\textsc{x}\ \left[\textsc{l}\ \sharp\right]\right]$$

$$4.\ \textit{word} \mapsto \left[\textsc{x}\ \left[\textsc{k}\ \sharp\right]\right] \quad 5.\ \textit{word} \mapsto \left[\textsc{x}\ \begin{bmatrix} \textsc{k}\ \sharp \\ \textsc{l}\ \sharp \end{bmatrix}\right]$$

FIGURE 31. LRSs using unary $\sharp$ to specify the derivations in figure 30

Proceeding to a slightly more complex case, consider the LRS and the example derivation in figure 32 on the following page.

$$word \mapsto \begin{bmatrix} \text{X} & \sharp \end{bmatrix} \quad 1.\ \begin{bmatrix} \text{X} & \boxed{1}d \\ \text{Y} & \boxed{1} \\ \text{Z} & \boxed{1} \end{bmatrix} \Rightarrow \begin{bmatrix} \text{X} & d \\ \text{Y} & \boxed{1}d \\ \text{Z} & \boxed{1} \end{bmatrix} \quad 2.\ \begin{bmatrix} \text{X} & \boxed{1}\begin{bmatrix} \text{K} & \boxed{2} \\ \text{L} & \boxed{2} \end{bmatrix} \\ \text{Y} & \boxed{1} \\ \text{Z} & \boxed{1} \end{bmatrix} \Rightarrow \begin{bmatrix} \text{X} & \begin{bmatrix} \text{K} & \boxed{2} \\ \text{L} & \boxed{2} \end{bmatrix} \\ \text{Y} & \boxed{1}\begin{bmatrix} \text{K} & \boxed{2} \\ \text{L} & \boxed{2} \end{bmatrix} \\ \text{Z} & \boxed{1} \end{bmatrix}$$

FIGURE 32. A more complex example using ♯

The LRS specifies that the attribute X is independent of the path equalities which held on X in the input. The interesting question is what value is supposed to be assigned to X in the output. Following the intuition that the output should be the minimal alteration of the input required by the specifications in LRS-Out, we interpret the LRS in figure 32 to require only that the structure sharing with X is not present in the output. As shown in the first derivations, the type assigned to X is preserved, and the second derivation illustrates that path equalities in a substructure and between substructures is preserved as well. If no framing is intended for the type assignment of X, an additional flat specification has the desired effect. If the attributes of the value of X are intended to also be independent of the input's path equalities, they also have to be specified as sharp.

3.1.3. *Path equality specifications in* LRS-O*ut.* Turning to the second kind of basic specification in LRS-Out, path equalities, we need to decide on whether any framing is intended for paths specified with a path equality in LRS. This question was already partly answered in section 3.1.1, where we decided to not assume framing of the input's path equalities for attributes which are specified in LRS-Out. The remaining question is whether type values of the input should be transferred to paths in the output, for which a path equality is defined in LRS-Out.

Recall that the motivation for restricting framing of path equalities to unspecified LRS-Out paths came from the insight that highly complex strategies are needed to decide how to resolve a conflict resulting from framing of a path equality in the input and an incompatible type specification to one of the paths in LRS-Out. The situation we are faced with now is a mirror image of this problem: how should one resolve a conflict resulting from framing of a type specification in the input and a path equality in LRS-Out. While it might be possible to develop a strategy to answer this question, it will in all likelihood be equally complex as the answers to the mirror-image problem discussed in section 3.1.1. Rather than engage in this traditional problem, we therefore follow the same strategy

as in the earlier section and propose to avoid these conflicts all together by not framing type specifications of the input for paths which occur in a path equality in LRS-Out.

DECISION 3 (Interpretation of path equalities in LRS-Out). *A path equality between two paths τ_1 and τ_2 in* LRS-O*ut is interpreted as preventing framing of the input's type values of τ_1 or τ_2.*

3.1.4. *Specifying identities between* LRS-I*n and* LRS-O*ut.* In a useful lexical rule specification language it must be possible to express that an attribute in the output is supposed to be assigned the value which another attribute has in the input. Traditionally, the notation for specifying structure sharing between two paths of an object has been carried over for this use, as illustrated for example by the use of the tags $\boxed{1}$, $\boxed{2}$, and $\boxed{3}$ in LRS-In and LRS-Out of the passive LRS shown in figure 1 on page 116. Formally, however, such a use of tags can only be interpreted as structure sharing if the rule specified is interpreted as a description of two word objects (DLR) and not as a meta-level rule relating lexical entries (MLR). To allow for a theory neutral specification of lexical rules, it therefore is necessary to distinguish tags specifying ordinary structure sharing from those tags specifying relationships between input and output of a lexical rule.

DECISION 4 (Meta-variables). Meta-variables *are used to specify identity between paths in* LRS-I*n and* LRS-O*ut. They are notated as double boxed numbers (e.g.,* $\boxed{\boxed{1}}$*).*

Figure 33 shows a simple example for an LRS exchanging the values of its X and Y attribute.

$$\begin{bmatrix} \text{X} & \boxed{\boxed{1}} \\ \text{Y} & \boxed{\boxed{2}} \end{bmatrix} \mapsto \begin{bmatrix} \text{X} & \boxed{\boxed{2}} \\ \text{Y} & \boxed{\boxed{1}}\boxed{3} \\ \text{Z} & \boxed{3} \end{bmatrix} \qquad \begin{bmatrix} \text{X} & \begin{bmatrix} \text{K} & \boxed{1}+ \\ \text{L} & \boxed{1} \end{bmatrix} \\ \text{Y} & e \end{bmatrix} \Rightarrow \begin{bmatrix} \text{X} & e \\ \text{Y} & \boxed{2}\begin{bmatrix} \text{K} & \boxed{1}+ \\ \text{L} & \boxed{1} \end{bmatrix} \\ \text{Z} & \boxed{2} \end{bmatrix}$$

FIGURE 33. A simple use of meta-variables

Note that the single attributes Y in LRS-Out of figure 33 is specified with two numbered boxes, a double line one for the 'structure sharing between LRS-In and LRS-Out and a traditional one specifying an ordinary path equality between Y and Z.

Type specifications on or path equality specifications with a node bearing a meta-variable in the input or LRS-In have the same effect as such specifications on the occurrences of the meta-variable in LRS-Out. The first two LRSin figure 34 therefore are interpreted in the same way, and so is the second pair of LRS.

$$1.\quad \begin{bmatrix}\textsc{x} & \boxed{\boxed{1}}\end{bmatrix} \mapsto \begin{bmatrix}\textsc{y} & \boxed{\boxed{1}}f\end{bmatrix} \qquad \begin{bmatrix}\textsc{x} & \boxed{\boxed{1}}f\end{bmatrix} \mapsto \begin{bmatrix}\textsc{y} & \boxed{\boxed{1}}\end{bmatrix}$$

$$2.\quad \begin{bmatrix}\textsc{x} & \boxed{\boxed{1}}\\ \textsc{y} & \boxed{\boxed{2}}\end{bmatrix} \mapsto \begin{bmatrix}\textsc{x} & \boxed{\boxed{2}}\boxed{3}\\ \textsc{y} & \boxed{\boxed{1}}\boxed{3}\end{bmatrix} \qquad \begin{bmatrix}\textsc{x} & \boxed{\boxed{2}}\boxed{3}\\ \textsc{y} & \boxed{\boxed{1}}\boxed{3}\end{bmatrix} \mapsto \begin{bmatrix}\textsc{x} & \boxed{\boxed{1}}\\ \textsc{y} & \boxed{\boxed{2}}\end{bmatrix}$$

FIGURE 34. Meta-variables and other specifications

Finally, figure 35 illustrates that a meta-variable specification in LRS-Out just like any other kind of specification prevents framing of a) type specifications and b) path equalities.

$$\begin{bmatrix}\textsc{x} & \boxed{\boxed{1}}\end{bmatrix} \mapsto \begin{bmatrix}\textsc{y} & \boxed{\boxed{1}}\end{bmatrix} \qquad a) \begin{bmatrix}\textsc{x} & c\\ \textsc{y} & f\end{bmatrix} \Rightarrow \begin{bmatrix}\textsc{x} & c\\ \textsc{y} & c\end{bmatrix} \quad b) \begin{bmatrix}\textsc{x} & f\\ \textsc{y} & \boxed{1}\\ \textsc{z} & \boxed{1}\end{bmatrix} \Rightarrow \begin{bmatrix}\textsc{x} & a\\ \textsc{y} & f\\ \textsc{z} & a\end{bmatrix}$$

FIGURE 35. Meta-variables and the framing of path equalities

3.1.5. *Path inequality specifications in* LRS-O*ut.* As the final kind of specification that can occur in LRS-Out we now discuss path inequalities. Consider the example in figure 36.

$$\mathit{word} \;\mapsto\; \begin{bmatrix}\textsc{x}|\textsc{k} \not\approx \textsc{x}|\textsc{l}\end{bmatrix} \qquad \begin{bmatrix}\textsc{x} & \begin{bmatrix}\textsc{k} & \boxed{1}\\ \textsc{l} & \boxed{1}\\ \textsc{n} & \boxed{1}\\ \textsc{o} & \boxed{1}\end{bmatrix}\end{bmatrix} \Rightarrow \begin{bmatrix}\textsc{x} & \begin{bmatrix}\textsc{k} & \mathit{bool}\\ \textsc{l} & \mathit{bool}\\ \textsc{n} & \boxed{1}\\ \textsc{o} & \boxed{1}\end{bmatrix}\end{bmatrix}$$

FIGURE 36. Path inequalities in LRS-Out

The case of path inequality specifications in LRS-Out is very similar to the case of the binary sharp notation discussed above. The problem is that because of the transitivity of path equality, requiring a path inequality to hold of two paths in the output of a lexical rule cannot be accomplished by adding the path inequality and removing a possibly occurring path equality between those paths. One additionally has to decide what happens with other path equalities in which those two paths occur.

The decision 2 restricting framing of path equalities to paths not mentioned in LRS-Out therefore also appears to make sense for path inequalities specified in LRS-Out. An example derivation for this interpretation is shown in figure 36 on the facing page. Note that in case one does want to keep the path equalities in the output which hold with one of the inequated paths, one can include a meta variable between that attribute in LRS-In and LRS-Out to obtain the desired effect.

3.2. Is automatic framing reasonable? After this long discussion of the specification language, one might wonder whether it is not an artifact of assuming automatic framing that a special specification language is needed. After all, when writing down a lexical rule, the linguist only needs to express two of of the three cases (relating differing properties, relating identical properties, unrelated properties). When the linguist specifies those properties which are intended to differ (a) and one more case (b or c), the third kind can be deduced; i.e., it does not have to be expressed explicitly and could be called the "default" specification of lexical rules (in a non-technical sense).

So there really are two possibilities here, of which we have only pursued one above: We discussed a LRS notation in which we explicitly have to mention those properties which are intended to be unrelated in the elements described by LRS-In and LRS-Out (case c-i.). For this we had to introduce additional notation, but the positive side of this was that no explicit specifications are needed for the case in which specifications are intended to remain unchanged, i.e., automatic framing takes place. The other possibility, however, would be to not have automatic framing and instead have a LRS notation in which those properties which are intended to be identical in the elements described by LRS-In and LRS-Out (case b) are explicitly mentioned. The non-related properties can then remain unexpressed – which eliminates the need for the extra notation introduced above.

At first sight, it does indeed seem natural to ask the linguist to express in a LRS those specifications which relate properties, i.e., cases a) and b), and keep unexpressed which parts of the objects are unrelated (case c). However, in highly lexicalized theories like HPSG a lexical entry contains many specifications of which only few are relevant in a specific lexical rule. Asking the linguist to explicitly specify that all those specifications without relevance to the lexical rule are identical in the elements related (in case they are appropriate) would thus amount to asking for a lexical rule with many specifications which are of no direct importance to what the lexical rule is intended to do.

Furthermore, as discussed in Meurers (1994b, sec. 4.1.3), specifying all identities by hand in many cases can only be achieved by splitting up a lexical rule into several instances. This is the case whenever one needs to specify the type of an element an attribute of which gets specified in the lexical rule output.[8] A second case which requires splitting up the LRS is when one has to specify framing of the value of those attributes which are only appropriate for some of the elements in the domain. Finally, a significant problem can arise from having to explicitly specify framing of the different path equalities which can occur in inputs to a lexical rule.

So, while for simple lexical rules one could specify framing of identical specifications by hand and the ordinary specification language would not have to be extended, for most cases it seems well motivated to assume automatic framing and specify the lexical rules with the extended specification language introduced above.

Summing up, we have argued that additional notation needs to be introduced to obtain a precise specification language. Additional notation is introduced for the case in which non-relatedness is intended, i.e., to mark those linguistic specifications which should not be altered by framing. Two new symbols $\flat$ and $\sharp$ are introduced and $\flat$ is used to mark a type specification as independent of framing, while $\sharp$ marks an attribute as independent of path equality framing.

4. Formalizing the lexical rule specification language

4.1. A mathematical foundation for HPSG: SRL. As the formal basis of our approach we assume the logical setup of King (1989). As shown in King (1994), this setup provides the foundation desired for HPSG in Pollard and Sag (1994). The formal language defined in the following is a version of the one proposed by King (1994).

[8]One could avoid splitting up the LRS by adding type equality as syntactic sugar to SRL. But as this is only one of several problematic aspects discussed here, we will not pursue this possibility.

4.1.1. *Syntax.*

Definition 1 (Signature). *A* **signature** Σ *is a triple* $\langle \mathcal{S}, \mathcal{A}, approp \rangle$ *s.t.*

- $\mathcal{A}$ *is a finite set of* **attribute** *names*
- $\mathcal{S}$ *is a finite set of* **varieties** *(also called species or minimal types)*[9]
- $approp : \mathcal{S} \times \mathcal{A} \rightarrow Pow(\mathcal{S})$ *is a total function from pairs of varieties and attribute names to sets of varieties*

Everything which follows is done with respect to a signature. For notational convenience we will work with an implicit signature $\langle \mathcal{S}, \mathcal{A}, \mathrm{approp} \rangle$. This is possible since at no point in our proposal do we have to alter the signature.

Definition 2 (Term). *Let : be a reserved symbol, the root symbol of a path. A* **term** *is a member of the smallest set* $\mathcal{T}$ *s.t.*

- $: \in \mathcal{T}$ *and*
- $\tau\alpha \in \mathcal{T}$ *if* $\tau \in \mathcal{T}$ *and* $\alpha \in \mathcal{A}$

Definition 3 (Description). *Let* $(,), \sim, \approx, \neg, \wedge, \vee$ *and* $\rightarrow$ *be reserved symbols. A* **description** *is a member of the smallest set* $\mathcal{K}$ *s.t.*

- $\tau \sim \phi \in \mathcal{K}$ *if* $\tau \in \mathcal{T}$ *and* $\phi \in \mathcal{S}$
- $\tau_1 \approx \tau_2 \in \mathcal{K}$ *if* $\tau_1, \tau_2 \in \mathcal{T}$
- $\neg\delta \in \mathcal{K}$ *if* $\delta \in \mathcal{K}$
- $(\delta_1 \wedge \delta_2), (\delta_1 \vee \delta_2), (\delta_1 \rightarrow \delta_2) \in \mathcal{K}$ *if* $\delta_1, \delta_2 \in \mathcal{K}$

Definition 4 (Theory). *A* **theory** Θ *is a subset of* $\mathcal{K}$ $(\Theta \subseteq \mathcal{K})$.

Definition 5 (Set of Literals). *A* **set of literals** Σ *is a proper subset of the set of descriptions* $\mathcal{K}$*, i.e.,* $\Sigma \subset \mathcal{K}$*, s.t. each* $\delta \in \Sigma$ *has one of the four forms* $(\tau, \tau_1, \tau_2 \in \mathcal{T}; \phi \in \mathcal{S})$*:*

- $\tau \sim \phi$
- $\tau_1 \approx \tau_2$
- $\neg\, \tau \sim \phi$
- $\neg\, \tau_1 \approx \tau_2$

[9]For easier comparison with standard HPSG notation, one can introduce a finite join semi-lattice $\langle \mathcal{Z}, \preceq \rangle$ as type hierarchy with $\mathcal{Z} \supset \mathcal{S}$. A type assignment is then simply an abbreviation for a set of variety assignments: $\tau \sim t = \bigvee\{\tau \sim \phi \mid \phi \preceq t\}$ with $\tau \in \mathcal{T}$, $t \in \mathcal{Z}$, and $\phi \in \mathcal{S}$. In this thesis, we assume every type assignment to be expanded in that way. Nothing of theoretical importance hinges on this.

4.1.2. *Semantics.*

DEFINITION 6 (Interpretation of a Signature). *An* **interpretation** I *is a triple* $\langle \mathrm{U}, \mathrm{S}, \mathrm{A}\rangle$ *s.t.*

- U *is a* **set of objects**, *the domain of* I,
- $\mathrm{S} : \mathrm{U} \rightarrow \mathcal{S}$ *is a total function from the set of objects to the set of varieties, the* **variety assignment** *function,*
- $\mathrm{A} : \mathcal{A} \rightarrow \{\mathrm{U} \rightharpoonup \mathrm{U}\}$[10] *is an* **attribute interpretation** *function s.t. for each* $u \in \mathrm{U}$ *and* $\alpha \in \mathcal{A}$*:*
  - *if* $\mathrm{A}(\alpha)(u)$ *is defined then* $\mathrm{S}(\mathrm{A}(\alpha)(u)) \in \mathit{approp}(\mathrm{S}(u), \alpha)$, *and*
  - *if* $\mathit{approp}(\mathrm{S}(u), \alpha) \neq \emptyset$ *then* $\mathrm{A}(\alpha)(u)$ *is defined.*

DEFINITION 7 (Interpretation of Terms). $[]^I : \mathcal{T} \rightarrow \{\mathrm{U} \rightharpoonup \mathrm{U}\}$ *is a* **term interpretation** *function over interpretation* $\mathrm{I} = \langle \mathrm{U}, \mathrm{S}, \mathrm{A}\rangle$ *s.t.*

- $[:]^I$ *is the identity function on* U, *and*
- $[\tau\alpha]^I$ *is the functional composition of* $[\tau]^I$ *and* $\mathrm{A}(\alpha)$.

DEFINITION 8 (Interpretation of Descriptions). $D_I() : \mathcal{K} \rightarrow \mathit{Pow}(\mathrm{U})$ *is a* **description interpretation** *function over interpretation* $\mathrm{I} = \langle \mathrm{U}, \mathrm{S}, \mathrm{A}\rangle$ *s.t.* $(\tau, \tau_1, \tau_2 \in \mathcal{T}; \phi \in \mathcal{S}; \delta, \delta_1, \delta_2 \in \mathcal{K})$*:*

- $D_I(\tau \sim \phi) = \{u \in \mathrm{U} \mid [\tau]^I(u) \text{ is defined and } \mathrm{S}([\tau]^I(u)) = \phi\}$,
- $D_I(\tau_1 \approx \tau_2) = \left\{ u \in \mathrm{U} \;\middle|\; \begin{array}{l} [\tau_1]^I(u) \text{ is defined,} \\ [\tau_2]^I(u) \text{ is defined, and} \\ [\tau_1]^I(u) = [\tau_2]^I(u) \end{array} \right\}$,
- $D_I(\neg\delta) = \mathrm{U} \setminus D_I(\delta)$
- $D_I((\delta_1 \wedge \delta_2)) = D_I(\delta_1) \cap D_I(\delta_2)$
- $D_I((\delta_1 \vee \delta_2)) = D_I(\delta_1) \cup D_I(\delta_2)$
- $D_I((\delta_1 \rightarrow \delta_2)) = (\mathrm{U} \setminus D_I(\delta_1)) \cup D_I(\delta_2)$

DEFINITION 9 (Interpretation of a Theory). *A theory is interpreted conjunctively.*
$[\![]\!]^I : \mathit{Pow}(\mathcal{K}) \rightarrow \mathit{Pow}(\mathrm{U})$ *is a* **theory interpretation** *function over interpretation* $\mathrm{I} = \langle \mathrm{U}, \mathrm{S}, \mathrm{A}\rangle$ *s.t.*

$$[\![\Theta]\!]^I = \bigcap\{D_I(\delta) \mid \delta \in \mathcal{K}\}$$

DEFINITION 10 (Satisfiability). *A theory* Θ *is* **satisfiable** *iff there is an interpretation* I *s.t.*

- $[\![\Theta]\!]^I \neq \emptyset$

[10]We write $\{X \rightharpoonup Y\}$ for the set of partial functions from set X to set Y.

DEFINITION 11 (Model). *An interpretation* $\mathrm{I} = \langle \mathrm{U}, \mathrm{S}, \mathrm{A}\rangle$ *is a* **model** *of a theory* Θ *if* $[\![\Theta]\!]^I = \mathrm{U}$

The definitions above define a class of formal languages which can be used to express HPSG grammars. We only list these definitions here to make it possible to follow the formal definition and interpretation of the lexical rules specification language in the next sections. The reader interested in a discussion of the formal language of SRL is referred to King (1994).

4.2. The lexical rule specification language.

4.2.1. *Syntax.*

DEFINITION 12 (Lexical Rule Signature). *Every signature* Σ *for which the following condition holds is a lexical rule signature* Σ_{lr}.

- $\mathit{lex\_rule} \in \mathcal{S}$ *and*
- $\textsc{in}, \textsc{out} \in \mathcal{A}$ *and*
- $\mathit{approp}(\mathit{lex\_rule}, \textsc{in}) = \{\mathit{word}\}$ *and*
- $\mathit{approp}(\mathit{lex\_rule}, \textsc{out}) = \{\mathit{word}\}$.

DEFINITION 13 (L-Description). *Let* $\flat$ *and* $\sharp$ *be reserved symbols. With respect to a lexical rule signature* Σ_{lr} *let* $\mathcal{T}$ *be a set of terms,* $\mathcal{K}$ *a set of descriptions. A L-description is a member of the smallest set* $\mathcal{K}_{\mathcal{I}}$ *s.t.*

- $d \in \mathcal{K}_{\mathcal{I}}$ *if* $d \in \mathcal{K}$ *and*
- $:\textsc{out}\mu \sim \flat \in \mathcal{K}_{\mathcal{I}}$ *if* $\mu \in \mathcal{A}^+$ *and*
- $:\textsc{out}\mu\sharp \in \mathcal{K}_{\mathcal{I}}$ *if* $\mu \in \mathcal{A}^+$.

DEFINITION 14 (Lexical Rule Specification). *With respect to a given lexical rule signature* Σ_{lr} *a lexical rule specification* LRS *is a subset of the set of L-descriptions* $\mathcal{K}_{\mathcal{I}}$ *containing at least the following literals* $(\phi \in \mathcal{S}; \mu, \mu_1, \mu_2 \in \mathcal{A}^+)$*:*

- $: \sim \mathit{lex\_rule}$ *and*
- $:\textsc{out}\mu \sim \phi$ *or* $:\textsc{out}\mu_1 \approx :\textsc{out}\mu_2$ *or* $:\textsc{out}\mu \sim \flat$ *or* $:\textsc{out}\mu\sharp$.

There's nothing complicated going on here. We just add the additional LRS notation by defining L-formulas with respect to a lexical rule signature. A lexical rule specification then consists of L-formulas, and for convenience sake we ask for an LRS-Out containing at least one specification.

In most HPSG theories proposed in the literature, AVMs are used as descriptions instead of the term notation introduced above. AVMs can be seen as a kind of normal form representation for descriptions. Now that we've introduced the formal lexical rule specification language, let us illustrate the different ways in which one can write down LRSs with an example (which is not intended to say much but just show the way things are written down). We will use the notation shown in figure 37 on the left as shorthand for the AVM shown on the right, which in the formal notation defined above is expressed as shown below that.[11]

$$\begin{bmatrix} \text{B} & \boxed{1} \\ \text{X} & \boxed{1} \\ \text{Y} & \begin{bmatrix} u \\ \text{Z} & \boxed{1} \end{bmatrix} \end{bmatrix} \mapsto \begin{bmatrix} \text{A} & \flat \\ \text{B} & \sharp \\ \text{U}|\text{V} & \flat\ \boxed{2} \\ \text{X} & \sharp\ \boxed{2} \end{bmatrix} \qquad \begin{bmatrix} \textit{lex\_rule} \\ \text{IN} & \begin{bmatrix} \text{B} & \boxed{1} \\ \text{X} & \boxed{1} \\ \text{Y} & \begin{bmatrix} u \\ \text{Z} & \boxed{1} \end{bmatrix} \end{bmatrix} \\ \text{OUT} & \begin{bmatrix} \text{A} & \flat \\ \text{B} & \sharp \\ \text{U}|\text{V} & \flat\ \boxed{2} \\ \text{X} & \sharp\ \boxed{2} \end{bmatrix} \end{bmatrix}$$

$$:\sim \textit{lex\_rule} \wedge \text{:IN B} \approx \text{:IN X} \wedge \text{:IN X} \approx \text{:IN Y Z} \wedge \text{:IN Y} \sim u \wedge$$
$$\text{:OUT A} \sim \flat \wedge \text{:OUT B}\sharp \wedge \text{:OUT U V} \sim \flat \wedge \text{:OUT U V} \approx \text{:OUT X} \wedge \text{:OUT X}\sharp$$

FIGURE 37. Three ways to write down LRSs

A normal form for L-descriptions. In section 3.1.1 we saw that the L-formulas making up the LRS need to be normalized to have a consistent variety assigned to each defined attribute, which is needed for the mapping from LRSs to LRs. This section serves to introduce a normal form for descriptions. It reports work carried out in Götz (1993) and Kepser (1994). Originally, the normalization algorithm is used to determine if a given description is satisfiable.

The linguist writes down LRSs. So we want to normalize L-formulas, not simple descriptions. Since L-formulas are a simple extension of descriptions with two additional statements for type and path equality elimination, we only need to add two trivial clauses to the description normalization algorithm of Götz (1993) to obtain an algorithm which transforms an

[11] Since the path equality relation is transitive, there are several possibilities to encode the example in the formal notation. Normalization (cf., section 4.2.1) introduces all path equalities which can be inferred due to transitivity.

L-formula into normal form. First, we need to introduce some additional terminology.

DEFINITION 15 (Terms and subterms in Σ). *The set* TERM(Σ) *contains all paths occurring in a set of literals* Σ *and their subpaths* $(\tau \in \mathcal{T}; \pi \in \mathcal{A}^*; \phi \in \mathcal{S})$*:*

$$\begin{aligned} \text{TERM}(\Sigma) \; = \; & \{\tau \in \mathcal{T} \mid (\neg)\, \tau\pi \approx \tau' \in \Sigma\} \\ & \cup \{\tau \in \mathcal{T} \mid (\neg)\, \tau' \approx \tau\pi \in \Sigma\} \\ & \cup \{\tau \in \mathcal{T} \mid (\neg)\, \tau\pi \sim \phi \in \Sigma\} \end{aligned}$$

DEFINITION 16 (Clause and Matrix).

- *A* **clause** Σ *is a finite (possibly empty) set of literals.*
- *A* **matrix** Γ *is a finite (possibly empty) set of clauses.*

DEFINITION 17 (Interpretation of a Clause and a Matrix).

- *A* **clause** *is interpreted conjunctively.*
  If Σ *is a clause, then* $D_I(\Sigma) = \bigcap_{\delta \in \Sigma} D_I(\delta)$.
- *A* **matrix** *is interpreted disjunctively.*
  If Γ *is a matrix, then* $D_I(\Gamma) = \bigcup_{\Sigma \in \Gamma} D_I(\Gamma)$.

The conversion from L-formulas to its normal form proceeds in two steps. First, the L-formula is transformed into disjunctive normal form, i.e., where all negations are pulled in and the disjuncts are on the top level. The resulting matrix Γ is a finite set, each element of which represents one disjunct. Each disjunct is a clause which consists of a finite set of literals. Since the transformation into disjunctive normal form is a rather standard procedure, we simply assume its existence here. Second, the resulting matrix is normalized. We start with a declarative characterization of what it means for an L-formula to be in normal form.

DEFINITION 18 (Normal Clause). *A set Σ of literals is* **normal** *iff the following conditions hold* ($\tau, \tau_1, \tau_2 \in \text{TERM}(\Sigma); \phi, \phi_1, \phi_2 \in \mathcal{S}; \alpha \in \mathcal{A}; \pi \in \mathcal{A}^*$)

Original:

1. ${:}\approx{:} \in \Sigma$ *(root is defined)*
2. *if* $\tau_1 \approx \tau_2 \in \Sigma$ *then* $\tau_2 \approx \tau_1 \in \Sigma$; *(symmetry of* $\approx$*)*
3. *if* $\tau_1 \approx \tau_2, \tau_2 \approx \tau_3 \in \Sigma$ *then* $\tau_1 \approx \tau_3 \in \Sigma$; *(transitivity)*
4. *if* $\tau\pi \approx \tau\pi \in \Sigma$ *then* $\tau \approx \tau \in \Sigma$; *(prefix closure)*
5. *if* $\tau_1 \approx \tau_2, \tau_1\pi \approx \tau_1\pi, \tau_2\pi \approx \tau_2\pi \in \Sigma$ *then* $\tau_1\pi \approx \tau_2\pi \in \Sigma$; *(*$\approx$ *and path extensions)*
6. *if* $\tau \approx \tau \in \Sigma$ *then for some* $\phi \in \mathcal{S}, \tau \sim \phi \in \Sigma$; *(exhaustive typing)*
7. *if for some* $\phi \in \mathcal{S}, \tau \sim \phi \in \Sigma$ *then* $\tau \approx \tau \in \Sigma$; *(*$\sim$ *path is defined)*
8. *if* $\tau_1 \approx \tau_2 \in \Sigma, \tau_1 \sim \phi_1 \in \Sigma, \tau_2 \sim \phi_2 \in \Sigma$ *then* $\phi_1 = \phi_2$; *(*$\approx$ *and* $\sim$*)*
9. *if* $\tau \sim \phi_1 \in \Sigma, \tau\alpha \sim \phi_2 \in \Sigma$ *then* $\phi_2 \in \mathit{approp}(\phi_1, \alpha)$; *(appropriateness 1)*
10. *if* $\tau \sim \phi \in \Sigma, \tau\alpha \in \text{TERM}(\Sigma), \mathit{approp}(\phi, \alpha) \neq \emptyset$ *then* $\tau\alpha \approx \tau\alpha \in \Sigma$; *(appropriateness 2)*
11. *if* $\neg\delta \in \Sigma$ *then* $\delta \notin \Sigma$. *(no contradictions)*

Additional:

12. *if* $\tau \sim \flat \in \Sigma$ *then* $\tau \approx \tau \in \Sigma$; *(*$\sim \flat$ *path is defined)*
13. *if* $\tau\sharp \in \Sigma$ *then* $\tau \approx \tau \in \Sigma$; *(*$\sharp$ *path is defined)*
14. *if* ${:}\text{OUT}\pi\alpha \approx {:}\text{OUT}\pi\alpha, {:}\text{IN}\pi \sim \phi \in \Sigma, \mathit{approp}(\phi, \alpha) \neq \emptyset$ *then* ${:}\text{IN}\pi\alpha \approx {:}\text{IN}\pi\alpha \in \Sigma$; *(corresponding in-paths are defined)*

The algorithm which takes an L-descriptions as a DNF matrix and returns its normal form is given below as a set of rewrite rules on sets of clauses. Γ is used as variable over sets of clauses and Σ as variable over clauses. Readers interested in the formal properties of the algorithm and a discussion of the normal form are referred to Kepser (1994, section II).

ALGORITHM 1 (Clause Normalization). *The algorithm consists of a sequence rewrite rule applications. One step of the algorithm is the application of exactly one rewrite rule. The algorithm terminates, if no rule can be applied (any more). A rule applies to a set of clauses* Γ' *only if the left hand side of the rule matches* Γ'*, and if the right hand side is a valid set description under the same variable assignment. The rewrite rules are* ($\phi_1, \phi_2 \in \mathcal{S}; \alpha \in \mathcal{A}; \pi \in \mathcal{A}^*$) :

$$(1)\quad \Gamma \uplus \{\Sigma\} \longrightarrow \Gamma \cup \{\Sigma \uplus \{{:}\approx{:}\}\}$$

$$(2)\quad \Gamma \uplus \{\Sigma \uplus \{\tau_1 \approx \tau_2\}\} \longrightarrow \Gamma \cup \left\{\begin{array}{l}\Sigma \uplus \{\tau_1 \approx \tau_2\}\\ \quad \uplus \{\tau_2 \approx \tau_1\}\end{array}\right\}$$

$$(3)\quad \Gamma \uplus \left\{\Sigma \uplus \left\{\begin{array}{l}\tau_1 \approx \tau_2,\\ \tau_2 \approx \tau_3\end{array}\right\}\right\} \longrightarrow \Gamma \cup \left\{\begin{array}{l}\Sigma \uplus \left\{\begin{array}{l}\tau_1 \approx \tau_2,\\ \tau_2 \approx \tau_3\end{array}\right\}\\ \quad \uplus \{\tau_1 \approx \tau_3\}\end{array}\right\}$$

$$(4)\quad \Gamma \uplus \{\Sigma \uplus \{\tau\sigma \approx \tau\sigma\}\} \longrightarrow \Gamma \cup \{\Sigma \uplus \{\tau\sigma \approx \tau\sigma, \tau \approx \tau\}\}$$

$$(5)\quad \Gamma \uplus \left\{\Sigma \uplus \left\{\begin{array}{l}\tau_1 \approx \tau_2,\\ \tau_1\sigma \approx \tau_1\sigma,\\ \tau_2\sigma \approx \tau_2\sigma\end{array}\right\}\right\} \longrightarrow \Gamma \cup \left\{\begin{array}{l}\Sigma \uplus \left\{\begin{array}{l}\tau_1 \approx \tau_2,\\ \tau_1\sigma \approx \tau_1\sigma,\\ \tau_2\sigma \approx \tau_2\sigma\end{array}\right\}\\ \quad \uplus \{\tau_1\sigma \approx \tau_2\sigma\}\end{array}\right\}$$

$$(6)\quad \Gamma \uplus \{\Sigma \uplus \{\tau \approx \tau\}\} \longrightarrow \Gamma \cup \left\{\Sigma \uplus \left\{\begin{array}{l}\tau \approx \tau,\\ \tau \sim \phi\end{array}\right\} \mid \phi \in \mathcal{S}\right\}, \quad \textit{if } \forall\phi'.\ \tau \sim \phi' \notin \Sigma$$

$$(7)\quad \Gamma \uplus \{\Sigma \uplus \{\tau \sim \phi\}\} \longrightarrow \Gamma \cup \{\Sigma \uplus \{\tau \sim \phi, \tau \approx \tau\}\}$$

$$(8)\quad \Gamma \uplus \left\{\Sigma \uplus \left\{\begin{array}{l}\tau_1 \approx \tau_2,\\ \tau_1 \sim \phi_1,\\ \tau_2 \sim \phi_2\end{array}\right\}\right\} \longrightarrow \Gamma, \ \textit{if } \phi_1 \neq \phi_2$$

$$(9)\quad \Gamma \uplus \left\{\Sigma \uplus \left\{\begin{array}{l}\tau \sim \phi_1,\\ \tau\alpha \sim \phi_2\end{array}\right\}\right\} \longrightarrow \Gamma, \ \textit{if } \phi_2 \notin \mathit{approp}(\phi_1, \alpha)$$

$$(10)\quad \Gamma \uplus \{\Sigma \uplus \{\tau \sim \phi\}\} \longrightarrow \Gamma \cup \{\Sigma \uplus \{\tau \sim \phi, \tau\alpha \approx \tau\alpha\}\}, \quad \textit{if } \tau\alpha \in \text{TERM}(\Sigma) \textit{ and } \mathit{approp}(\phi, \alpha) \neq \emptyset$$

$$(11)\quad \Gamma \uplus \{\Sigma \uplus \{\delta, \neg\delta\}\} \longrightarrow \Gamma, \ \textit{for any positive literal } \delta$$

$$(12)\quad \Gamma \uplus \{\Sigma \uplus \{\tau \sim \flat\}\} \longrightarrow \Gamma \cup \{\Sigma \uplus \{\tau \sim \flat, \tau \approx \tau\}\}$$

$$(13)\quad \Gamma \uplus \{\Sigma \uplus \{\tau\sharp\}\} \longrightarrow \Gamma \cup \{\Sigma \uplus \{\tau\sharp, \tau \approx \tau\}\}$$

$$(14)\quad \Gamma \uplus \left\{\begin{array}{l}\Sigma \uplus\\ \left\{\begin{array}{l}{:}\text{OUT}\pi\alpha \approx {:}\text{OUT}\pi\alpha,\\ {:}\text{IN}\pi \sim \phi\end{array}\right\}\end{array}\right\} \longrightarrow \Gamma \cup \left\{\begin{array}{l}\Sigma \uplus\\ \left\{\begin{array}{l}{:}\text{OUT}\pi\alpha \approx {:}\text{OUT}\pi\alpha,\\ {:}\text{IN}\pi \sim \phi,\\ {:}\text{IN}\pi\alpha \approx {:}\text{IN}\pi\alpha\end{array}\right\}\end{array}\right\}, \quad \textit{if } \mathit{approp}(\phi, \alpha) \neq \emptyset$$

Each rewrite rule corresponds to a line in the definition of a normal clause. Line 3 of definition 18, for example, demands transitivity of path equality. The corresponding rewrite rule (3) in algorithm 1 picks out a clause with two literals expressing path equalities and adds a literal expressing the path equality resulting from transitivity, if it is not already part of the clause. Note the use of ordinary ($\cup$) and disjoint union ($\uplus$). The last occurrence of disjoint union in the rewrite rule (3) ensures that this rule will only apply, if the literal to be added was not part of the original clause, i.e., if transitivity for the two literals did not already hold in Σ.

The original normalization algorithm of Götz (1993) consists of rules 1–11. Since we are dealing with L-descriptions, in addition we have to take care of the new symbols $\flat$, and $\sharp$. For each such literal, rule (12) adds a literal defining the corresponding path. The rest of the algorithm will then ensure that each subpath is also defined and that each (sub)path is assigned the possible varieties. Finally, rule (13) ensures that for each path in the out-description the corresponding path in the in-description is introduced, if it is appropriate.

4.2.2. *Semantics.* We define an algorithm which realizes a function from lexical rules as specified by the linguist (LRS) to enriched descriptions of lexical rule objects which can be given the standard set theoretical interpretation defined in section 4.1.[12] The conversion from LRS to ordinary descriptions proceeds in two steps. First, the LRS is converted into normal form, then the normal form LRS is enriched with additional path equalities and variety assignments to encode the framing which is only implicit in the LRS. As a result of enriching the LRS we obtain an ordinary description, i.e., a LR, which is interpreted in the normal way.

Enriching an LRS *matrix.* We saw in section 4.2.1 what it means for a L-formula to be in normal form. Now we turn to the enriching algorithm. The input to the enriching algorithm is a LRS in normal form. A normalized LRS is a matrix Γ^{lrs}, a finite set, each element of which represents one disjunct. Each disjunct is a clause which consists of a finite set of literals.

Take a normalized LRS and apply the following steps:

1. For every clause Σ in the LRS matrix, define a new matrix $\Gamma = \{\Sigma\}$.
2. With each such Γ obtain an enriched matrix Γ^e by applying a sequence of rewrite rules with respect to Σ until no rules can be applied.

[12]The formal setup used in this section is modeled after the description normalization algorithm of Götz (1993) which is reported in Kepser (1994).

The frame enriched LRS matrix Γ^{lr} is the union of all frame enriched matrices Γ^e obtained, from which all inconsistent clauses and all literals of the form $\tau\sharp$ and $\tau \sim \flat$ have been eliminated. ($\tau \in \mathcal{T}$)

More concretely, the algorithm is defined as follows:

ALGORITHM 2 (Enriching a normalized lex_rule description). *The input to the enriching algorithm is a normalized lex_rule description is a matrix Γ^{lrs}, a finite set, each element of which represents one disjunct. Each disjunct is a clause which consists of a finite set of literals. The enriching algorithm then consists of the following three steps:*

1. *For every clause Σ in the matrix Γ^{lrs}, define a new matrix $\Gamma = \{\Sigma\}$.*
2. *With each such Γ obtain an enriched matrix Γ^e by applying a sequence of rewrite rules with respect to Σ until no rules can be applied.*
3. *The frame enriched* LRS *matrix Γ^{lr} is the union of all frame enriched matrices Γ^e obtained, from which all inconsistent clauses and instruction literals of the form $\tau\sharp$ and $\tau \sim \flat$ ($\tau \in \mathcal{T}$) have been eliminated.*

Zooming in on the second step, we see the rules doing the actual enriching with frame information.

ALGORITHM 3 (Frame enriching a LRS matrix). *A rule applies to a matrix Γ with respect to Σ iff the matrix matches the left hand side of the rule and the right hand side is a valid set description under the same variable assignment.* ($\phi_1, \phi_2 \in \mathcal{S}; \nu \in \mathcal{V}; \tau_1, \tau_2 \in \mathcal{T}; \alpha \in \mathcal{A}; \pi \in \mathcal{A}^*$)

The rewrite rules are:

$$(1)\quad \Gamma' \uplus \left\{\Sigma' \uplus \left\{\begin{matrix}\tau_1 \sim \nu\\ \tau_2 \sim \nu\end{matrix}\right\}\right\} \underset{\Sigma}{\longrightarrow} \Gamma' \cup \left\{\Sigma' \cup \left\{\begin{matrix}\tau_1 \approx \tau_2\\ \tau_2 \approx \tau_1\end{matrix}\right\}\right\}$$

$$(2)\quad \begin{matrix}\Gamma' \uplus \left\{\Sigma' \cup \left\{\begin{matrix}:\mathrm{IN}\pi \sim \phi_1,\\ :\mathrm{OUT}\pi \sim \phi_2\end{matrix}\right\}\right\}\\ \uplus \left\{\Sigma'' \cup \left\{\begin{matrix}:\mathrm{IN}\pi \sim \phi_1,\\ :\mathrm{OUT}\pi \sim \phi_1\end{matrix}\right\}\right\}\end{matrix} \underset{\Sigma}{\longrightarrow} \Gamma' \cup \left\{\Sigma'' \cup \left\{\begin{matrix}:\mathrm{IN}\pi \sim \phi_1,\\ :\mathrm{OUT}\pi \sim \phi_1\end{matrix}\right\}\right\}$$

$$\textit{if } \phi_1 \neq \phi_2 \quad \textit{and } :\mathrm{OUT}\pi \sim \flat \notin \Sigma$$

$$(3)\quad \Gamma' \uplus \left\{\Sigma' \uplus \left\{\begin{matrix}:\mathrm{OUT}\pi \sim \phi_1,\\ :\mathrm{IN}\pi \sim \phi_2\end{matrix}\right\}\right\} \underset{\Sigma}{\longrightarrow} \Gamma' \cup$$

$$\left\{\Sigma' \uplus \left\{\begin{matrix}:\mathrm{OUT}\pi \sim \phi_1,\\ :\mathrm{IN}\pi \sim \phi_2,\\ :\mathrm{IN}\pi\alpha \approx :\mathrm{OUT}\pi\alpha\end{matrix} \;\middle|\; \begin{matrix}\mathit{approp}(\phi_1,\alpha)\cap\\ \mathit{approp}(\phi_2,\alpha) \neq \emptyset\end{matrix}\right\}\right\}$$

$$\textit{if } :\mathrm{OUT}\pi\alpha \approx :\mathrm{OUT}\pi\alpha \notin \Sigma$$

The first rule rewrites the parameter-instructions occurring in the in- and out-specification as ordinary path equality between DLR-In and DLR-Out. The second rule is responsible for framing the species of paths the corresponding out-paths of which are mentioned in the out-specification. It checks if the type on a certain in-path is compatible with that on the corresponding out-path, i.e., it checks if the species of the in-path is assigned to both the in and the out-path in some disjunct. If that's the case, eliminate the disjunct in which the in-path and the out-path are not assigned the same species. In case the out-path is specified to be flattened, this step relating the typing in the out-specification to the in-specifications is not applied. Finally, the third rule performs framing of all parts not mentioned in the out-specification. It introduces structure sharing between DLR-In and DLR-Out for all attributes α extending a path which is defined in LRS-Out in case α is appropriate for both the path in LRS-In and the corresponding one in DLR-Out and the path extended by α is not itself defined in DLR-Out. Note that the path extended by α will be defined in DLR-Out in case that path was specified with a flat or sharp instruction, thus keeping the rule from framing a path equality without requiring a special treatment for these instructions.

4.3. An example. To illustrate the formalization with a complex case of a lexical rule, let us take a look at a linguistic example taken from Pollard and Sag (1994), the Complement Extraction Lexical Rule (CELR). There are two reasons for looking at this example. On the one hand the signature is explicitly given by Pollard and Sag. This is necessary to understand what goes on with a lexical rule specification. On the other hand, the CELR is rather difficult to express without a formalized lexical rule mechanism and can cause unwanted results under some interpretations as discussed by Höhle (1995). So this makes it a good test case to see whether we've made things any clearer, even though a lot of the possibilities which we envisaged in the design of the lexical rule specification language will naturally play no role in this particular case.

The CELR as provided by Pollard and Sag (1994, ch. 9, p. 378) which we already briefly mentioned in the discussion around figure 5 on page 122 is repeated in figure 38 on the next page below. This original specification is written down using a number of shorthands, such as abbreviated feature paths and the use of " ... ". As a first step towards providing an interpretation to this lexical rule specification, we thus need to eliminate these shorthands. As explicit representation, we obtain the probably intended lexical rule specification shown in figure 39 on the facing page.

$$\begin{bmatrix} \textsc{subcat} & \left\langle \ldots, \boxed{3}, \ldots \right\rangle \\ \textsc{comps} & \left\langle \ldots, \boxed{3}\begin{bmatrix}\textsc{loc} & \boxed{1}\end{bmatrix}, \ldots \right\rangle \\ \textsc{inher}|\textsc{slash} & \boxed{2} \end{bmatrix} \mapsto \begin{bmatrix} \textsc{subcat} & \left\langle \ldots, \boxed{4}\begin{bmatrix}\textsc{loc}\ \boxed{1},\ \textsc{inher}|\textsc{slash}\ \left\{\boxed{1}\right\}\end{bmatrix}, \ldots \right\rangle \\ \textsc{comps} & \left\langle \ldots\ \ldots \right\rangle \\ \textsc{inher}|\textsc{slash} & \left\{\boxed{1}\right\} \cup \boxed{2} \end{bmatrix}$$

FIGURE 38. The CELR as specified by Pollard and Sag (1994)

$$\begin{bmatrix} \textsc{subcat} & \boxed{7} \oplus \left\langle \boxed{3} \mid \boxed{8} \right\rangle \\ \textsc{synsem} & \begin{bmatrix} \textsc{loc}|\textsc{cat}|\textsc{val}|\textsc{comps} & \boxed{6} \oplus \left\langle \boxed{3}\begin{bmatrix}\textsc{loc} & \boxed{1}\end{bmatrix} \mid \boxed{5} \right\rangle \\ \textsc{nloc}|\textsc{inher}|\textsc{slash} & \boxed{2} \end{bmatrix} \end{bmatrix} \mapsto \begin{bmatrix} \textsc{subcat} & \boxed{7} \oplus \left\langle \begin{bmatrix} \textsc{loc} & \boxed{1} \\ \textsc{nloc}|\textsc{inher}|\textsc{slash} & \left\{\boxed{2}\right\} \end{bmatrix} \mid \boxed{8} \right\rangle \\ \textsc{synsem} & \begin{bmatrix} \textsc{loc}|\textsc{cat}|\textsc{val}|\textsc{comps} & \boxed{6} \oplus \boxed{5} \\ \textsc{nloc}|\textsc{inher}|\textsc{slash} & \left\{\boxed{1}\right\} \cup \boxed{2} \end{bmatrix} \end{bmatrix}$$

FIGURE 39. An explicit version of the CELR

In eliminating the " ... " notation we, however, had to introduce the operator $\oplus$ for the append relation and we left the $\cup$ operator for the set union relation from the original specification. Since we based our lexical rule specification language on SRL, which does not provide such relations as first class citizens, we would need to introduce these relations into our ontology and refer to them using a so-called junk-slot encoding of relations (Aït-Kaci, 1984; King, 1992; Carpenter, 1992). Alternatively, one could redefine the lexical rule specification language and its interpretation to be based on the relatively new extension of SRL with relations as provided by the Relational Speciate Re-entrant Language (RSRL) (Richter et al., 1999; Richter, 1999, in preparation). Since the different ways to encode relations in HPSG are a separate issue and we do not want to complicate the example further with a junk slot encoding of append and union, we will base our illustration on a simplified version of the CELR. The particular instance of the CELR we discuss treats the second element on COMPS and SUBCAT for entries with an empty SLASH set instead of treating any element on COMPS and any on SUBCAT with any SLASH set. The rest of the rule we use is like in the original CELR. Figure 40 shows how in our setup the CELR can be specified by the linguist. Note that only those parts which are intended to be changed need to be mentioned at all. No type or path equality elimination is needed for this example.

$$\begin{bmatrix} \text{SUBCAT}|\text{REST}|\text{FIRST } \boxed{3} \\ \text{SYNSEM} \begin{bmatrix} \text{LOC}|\text{CAT}|\text{VAL}|\text{COMPS}|\text{REST } \left\langle \boxed{3}\begin{bmatrix}\text{LOC } \boxed{1}\end{bmatrix} \middle| \boxed{5} \right\rangle \\ \text{NLOC}|\text{INHER}|\text{SLASH } \{\} \end{bmatrix}\end{bmatrix} \mapsto$$

$$\begin{bmatrix} \text{SUBCAT}|\text{REST}|\text{FIRST}|\text{NLOC}|\text{INHER}|\text{SLASH } \left\{\boxed{2}\right\} \\ \text{SYNSEM} \begin{bmatrix} \text{LOC}|\text{CAT}|\text{VAL}|\text{COMPS}|\text{REST } \boxed{5} \\ \text{NLOC}|\text{INHER}|\text{SLASH } \left\{\boxed{1}\boxed{2}\right\} \end{bmatrix}\end{bmatrix}$$

FIGURE 40. A simplified version of the CELR

Since no typing information is specified in LRS-Out and those attributes which have types as values that have subtypes (HEAD, NUCLEUS, REST-IND, DTRS, etc.) are not mentioned in LRS-Out, all the work to map the CELR into a description is done by the rewrite rule that adds path equalities between the in- and the out-description. The DLR resulting from enriching the CELR is shown in figure 41 on the facing page. To graphically distinguish the tags present in the lexical rule specification from the tags representing path equalities which were added by the enriching algorithm, the latter are marked in grey. Also, the attributes that were part of the original specification are underlined. For each of these defined paths normalization introduced a specification $:\tau \approx :\tau$ to mark which paths are defined and species specifications $:\tau \sim \phi$. So, the species along the underlined paths in figure 41 on the next page are introduced by normalization. The path equalities represented by the grey tags are introduced by enriching: Along the defined paths the appropriate attributes are introduced and path equalities between paths in the in-specification and the out-specification are added for those attributes which directly extend a defined path but are not themselves defined, i.e., underlined.

Note that the element on the SUBCAT list of the output which corresponds to the one that is extracted from the COMPS list turns out to be identical to the element on the input's SUBCAT list except for the NLOC|INHER|SLASH specification. This is just what was intended but what in the absence

[12] The feature names F and R are used as abbreviated notation for the *ne_list* attributes FIRST and REST.

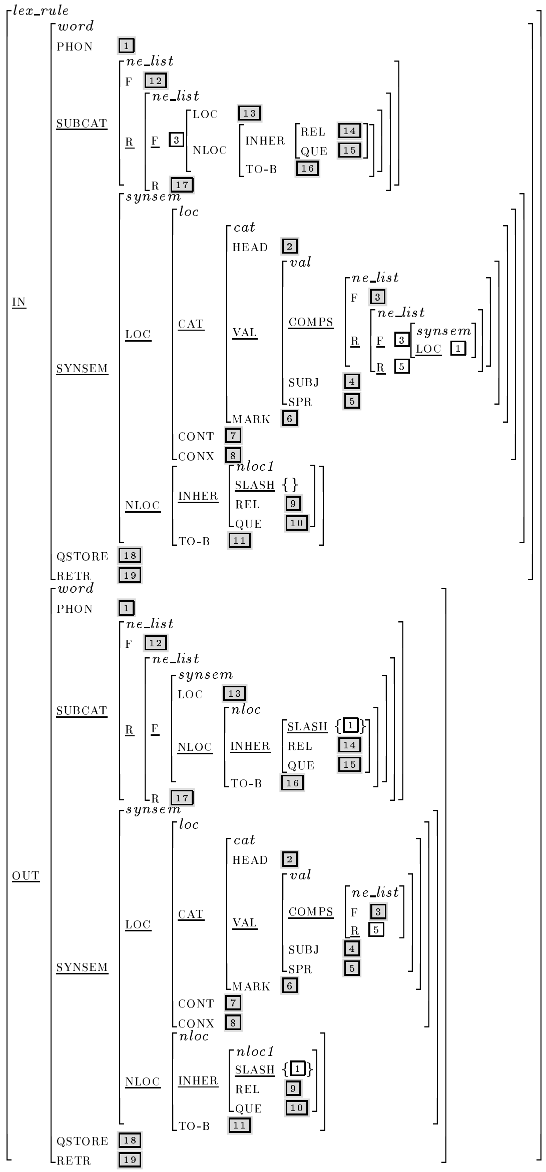


FIGURE 41. The explicit DLR resulting from enriching the CELR of figure 40

of a formalized lexical rule mechanism was not formally expressed in the original formulation of the CELR as discussed by Pollard and Sag (1994, p. 378, fn. 37).

Regarding the problem of Höhle (1995), this problem is caused by having to modify certain path equalities before 'copying them over' from the in-specification to the out-specification. Since we do no such copying, but rather specify path equalities between the in- and the out-specification this problem does not arise in our approach.

Finally, to take a place in the theory, the description in figure 41 on the preceding page is included as one of the disjuncts on the right-hand side of the constraint on *lex_rule* which we saw in figure 10 on page 124.

5. Summary

In this chapter, we tried to shed some light on a possibility to formalize lexical rules using a standard logical basis of HPSG. First, we defined lexical rules so that they can be constrained by ordinary descriptions. Then we explored and defined a lexical rule specification notation which allowed us to leave certain things implicit. Finally, we showed how we can get from the lexical rule specification to the explicit lexical rule constraints.

Even though the two approaches to interpreting a LRS, the MLR and the DLR approach, share many aspects, it is important to understand that the way in which these approaches do the actual interpretation is very different. In the MLR approach, an algorithm is supplied which, independent of the rest of the theory, takes a set of lexical entries, and constructs a (possibly infinite) set of derived lexical entries resulting from lexical rule application. In the DLR approach, the interpretation of a LRS is divided into two steps: First, the LRS is transformed into an ordinary constraint which is integrated into the theory. The real interpretation of the LRS as a relation extending the set of grammatical word objects is left to the second step, where the whole theory is interpreted in the ordinary way.

We believe there are some nice properties of such an approach: First of all, apart from the mapping from the specification to explicit constraints, we did not add any additional machinery to the logic. The semantics of the lexical rule specification after the mapping is provided by the ordinary definition of the interpretation of an HPSG theory in SRL. The advantage this has for the linguist is that when it comes down to seeing exactly what a certain lexical rule specification means, (s)he can always take a look at

the resulting enriched, fully explicit descriptions of lexical rules in the language used to write the rest of the HPSG theory, instead of having to interpret the lexical rule specification directly in some kind of additional formal system.

Second, the mapping from lexical rule specifications to explicit constraints is done independent of the lexical entries. It suffices to look at a lexical rule specification and the signature to determine what remained implicit in the lexical rule specification and how it can be made explicit. This is possible because HPSG is built on a type feature logic and a closed word interpretation of a type hierarchy.

Third, the approach presented is highly modular and adaptable to the linguist's needs: One can decide on the data structure for lexical rules one likes best (relations or ordinary descriptions), alter/extend the lexical rule specification language in a way one likes, and alter/extend the rewrite rules which enrich lexical rule specifications to ordinary descriptions in a way one likes. This is important until a real discussion of possibilities and linguistic consequences of various setups has shown what HPSG linguist's really want to write down and what it's supposed to mean.

And fourth, if one takes descriptions of lexical rule objects as basic encoding as we have done in the main part of this part of the thesis (and not 'proper' relations as part of the relational extension as considered in the beginning), this makes it possible to hierarchically group lexical rules and express constraints on (groups of) lexical rules. This allows us to express general principles every lexical rule has to obey, and it makes it possible to express that a group of lexical rules shares certain properties.

Finally, as mentioned in the introduction, this part of the thesis builds on ideas developed in Meurers and Minnen (1997) and can be seen as providing a formal foundation for that computational proposal. The computational treatment proposed in Meurers and Minnen (1997) can be used for lexical rules producing an infinite lexicon since it avoids expanding out the lexicon under lexical rule application. The compiler at the heart of the computational treatment transforms a set of lexical rules into a set of relational constraints on lexical entries by considering the possible interaction of the set of lexical rules and the lexicon in an abstract way. The encoding is then advanced by program transformation techniques to allow on the fly application of the relations encoding the lexical rules.

Part III

Aspects of a Theoretical Interpretation

CHAPTER 6

Introduction

The empirical introduction to the domain of non-finite verbal constructions in the first part of this thesis was organized along the general idea that non-finite constructions are instances of structures in which a head combines with a complement. Organizing the empirical overview in this way, on the one hand provided many of the dimensions under which non-finite constructions can be empirically classified, such as government and word order phenomena. On the other hand, viewing non-finite structures as instances of general head-complement structures allowed us to separate those properties of non-finite constructions which are regular in the sense that they fall out of the properties generally assumed for any kind of head-complement structure from those properties which are exceptional under this perspective.

The regular properties were introduced in chapter 2 and we saw that a core of the observable status government and word order phenomena, as well as the percolation of head and subcategorization information which one can infer from these observations, pattern in accordance with a general head-complement setup. First exceptions became apparent even in this basic setup when we introduced the topicalization possibilities observable with coherently constructing verbs. In the first chapter of this third part of the thesis (ch. 7), we focus on the theoretical consequences of these observations, in particular the mechanisms needed in an HPSG architecture to formally capture the variable constituency displayed by such coherent constructions.

We continued the empirical overview in chapter 3 with a discussion of the particular word order and status phenomena of coherent constructions which are exceptional under the head-complement perspective. Showing the empirical inadequacy of syntactic generalizations such as the double infinitive condition, we had come to the conclusion that the construction should be understood as a result of the lexical specification of specific classes of verbs. In chapter 8 we now turn to a theoretical interpretation of these lexical classes and their syntactic consequences. As most important syntactic consequence we will claim that the constructions not conforming to the head-complement regularities fail to do so because the verbs occurring in these structures belong to a lexical classes which fails to construct as ordinary heads.

After this particular theoretical interpretation of the empirical overview we presented in the first part of the thesis, in chapter 9 we take a second look at the issues involved in the topicalization of partial VPs in coherent constructions. We show that the approach to partial VPs presented in chapter 7 can fruitfully be generalized to account for partial constituents of three different categories: partial NPs, APs, and VPs. In a second step, the empirical domain covered by the theory is further enlarged to include partiality of constituents resulting from dislocated adjuncts in addition to partiality due to missing arguments we primarily dealt with.

In the final chapter (ch. 10) we then turn to partial non-finite constituents including subjects, which pose special problems for a theory of case assignment and agreement. We show that the traditionally local case and agreement relations do not need to be redefined in non-local terms. Instead, the apparent non-local nature of these relations in certain examples stems from an interaction of the well-established relations introduced by raising verbs with the ordinary local case and agreement relations. These theoretical rendition of this idea interacts in a non-trivial way with the formalization of coherence we start this part with (ch. 7) and thus sheds new insights on phenomena such as remote passivization.

CHAPTER 7

On the Flexible Nature of Constituency

In section 1.5 of chapter 2 we took a first look at word order phenomena under the perspective of the constituency and the percolation of subcategorization information they require. We pointed out that the multiple possibilities which are available in coherent constructions for topicalizing (partial) verb phrases are an important theoretical issue in that the variable constituency displayed is a challenge to the traditionally central role of constituent structure. In the HPSG framework, Pollard (1996, orig. ms. 1990), and more recently Hinrichs and Nakazawa (1994b) and Nerbonne (1994) met this challenge with a variety of mechanisms and drew conclusions for the general architecture: Pollard showed how the extended notion of valence introduced by argument raising (Hinrichs and Nakazawa, 1989) can be used to license the required multiple structures. Nerbonne introduced a non-monotonic device to relax certain requirements for fronted constituents and claimed that only a traceless analysis can provide a satisfactory account. Hinrichs and Nakazawa based their analysis on a special lexical rule constructing new constituents for topicalization only and strengthened the unbounded dependency mechanism to be able to license topicalized constituents containing a gap.

The purpose of this chapter is to reexamine whether the phenomenon of partial verb phrase topicalization (henceforth: PVP topicalization) supports these conclusions, and which consequences need to be drawn for the general architecture of HPSG to capture the flexible nature of constituents displayed by this phenomenon.

1. PVP topicalization and HPSG theory

It has become standard to analyze German verb-second sentences as verb-first structures from which an element has been topicalized. Leaving aside

This chapter is a revised and extended version of Meurers (1999a).

few classes of exceptions, the topicalized element is a) a single constituent which b) could also occur in non-topicalized position.

Under these two assumption (henceforth: topicalization assumptions), the phenomenon of PVP topicalization is problematic. To see why this is the case, consider the sentences in (166).[1] Example (166a) is an ordinary verb-first question. In (166b) the main verb and one object has been fronted, with the other object remaining in its "base position" in the Mittelfeld. In (166c) the main verb and the auxiliary is topicalized, leaving both objects behind. The problem is that under the two topicalization assumptions, no single structure can be found for (166a) that allows both topicalizations.

(166) a. Wird er ihr einen Ring schenken können?
will he her a ring give be.able
'Will he be able to give her a ring?'

b. [Einen Ring schenken] wird er ihr können.
a ring give will he her be.able

c. [Schenken können] wird er ihr einen Ring.
give be.able will he her a ring

Pollard (1996) proposes an HPSG theory using optional argument raising for auxiliaries in the style of Hinrichs and Nakazawa (1989) and a standard UDC mechanism employing traces. He shows that such an analysis can account for the data he discusses, but also points out that this is done at the cost of licensing multiple structures for sentences like (166a) – such as structures in which the accusative object *einen Ring* forms a constituent with the verb *schenken*, corresponding to the constituent topicalized in (166b), and others in which *schenken* and *können* form a constituent, as motivated by examples like (166c). Since these multiple structures are not independently motivated, they are spurious ambiguities which under most concepts of linguistic theory should be eliminated.

This is where Nerbonne (1994) and Hinrichs and Nakazawa (1994b) pick up. Common to both proposals is that they keep the first topicalization assumption, i.e., that only a single constituent can be topicalized, but relax the second, the assumption that a topicalized constituent can also occur in non-fronted position. The basic idea thus is to license partial constituents only in fronted position. Reducing the two proposals to the essentials, we believe there are two key ingredients needed to exclude the spurious structures of the Pollard (1996) analysis:

[1]The example basically follows those discussed by Nerbonne (1994, example (1)) and Hinrichs and Nakazawa (1994b, example (17)).

1. Instead of *optional* argument raising, which introduces the many subcategorization possibilities at the basis of the spurious structures, some version of *obligatory* argument raising must be employed.
2. The topicalized verb phrase must be exempt from this requirement.

Before turning to the different possibilities for enforcing obligatory argument raising in section 1.2, let us discuss an interesting empirical aspect of the idea to license constituents for topicalization only.

1.1. Constituents for topicalization only. As discussed above, Nerbonne (1994) and Hinrichs and Nakazawa (1994b) propose to abandon the assumption that a sequence of words which can be topicalized as a constituent also corresponds to a constituent when it shows up in its base position. They motivate this move on theoretical grounds as necessary for eliminating the spurious structures in the Mittelfeld which otherwise could not be avoided in light of the empirical necessity to license since various partial verb phrases for topicalization.

Even though the two studies do not point this out, one can also find empirical arguments motivating such a proposal. In the following, we first show that the unavailability of certain word orders in the Mittelfeld supports the idea that coherently constructing verbs cannot select a saturated verbal complement in the Mittelfeld. Further support for this idea is then provided in section 1.1.2, where the availability of extraposition sites in the Mittelfeld is discussed.

1.1.1. *Word order possibilities in the Mittelfeld.* When we introduced the different word order possibilities for coherently and incoherently selected non-finite complements in section 1.4.1 of chapter 2, we observed that an incoherently selected verbal complement forms a topological unit which can, for example, undergo coherence-field left dislocation. This is illustrated by the example (167a), in which the verb *empfehlen* incoherently selects the verbal complement [*das Pferd zu verkaufen*].

(167) a. Er wird [das Pferd zu verkaufen] ihr noch heute empfehlen.
he will the horse to sell her still today recommend
'He will advise her to sell the horse today.'

b. [Das Pferd zu verkaufen] wird er ihr noch heute empfehlen.
the horse to sell will he her still today recommend

For such incoherently constructing verbs we thus have independent empirical evidence for assuming that the verbal complement which can be topicalized (167b) also forms a constituent in its base position in the Mittelfeld (167a).

Turning to coherently constructing verbs such as *wollen*, one finds that the verbal complement cannot occur in the left-dislocated Mittelfeld position (168a), but it can be topicalized (168b)

(168) a. * Er wird [das Pferd verkaufen] noch heute wollen.
he will the horse sell still today want.to
'He will want to sell the horse today.'

b. [Das Pferd verkaufen] wird er noch heute wollen.
the horse sell will he still today want.to

In light of the fact that we saw in (167a) that verbal complements can in principle occur in this Mittelfeld linearization, the most plausible conclusion from the ungrammaticality of (168a) is that the constituent consisting of the head of the verbal complement and its arguments which we observed in the topicalization example (168b) is not present in the Mittelfeld example (168a) and therefore cannot undergo coherence-field left dislocation.

In section 2.2 of chapter 9 we return to these examples and show that, apart from the aspect discussed here, they also provide important evidence for an evaluation of two analysis ideas which have been proposed in the literature on partial constituents, remnant movement and reanalysis.

1.1.2. *Extraposition.* Topicalized constituents also fail to correspond to Mittelfeld occurrences in other ways, in particular with respect to extraposition phenomena. Reis (1980, p. 83) shows that *ob*-complement clauses can occur at the right edge of the Vorfeld but not at the edge of the corresponding elements in the Mittelfeld (169). And Haider (1993, p. 282) makes the parallel point with respect to the extraposition of relative clauses (170).

(169) a. [Fragen, ob einer links oder rechts wählt,] wird man ja wohl
ask if someone left or right votes will one yes well
noch dürfen.
still be.allowed
'It must be acceptable to ask if someone votes left or right.'

b. * Man wird ja wohl noch fragen, ob einer links oder rechts
one will yes well still ask if someone left or right
wählt, dürfen.
votes be.allowed

(170) a. [Ein Buch empfehlen, das sie nicht auch selbst gelesen hat,]
a book recommend which she not also herself read has
würde dir Maria nie.
would Maria never
'Maria would never recommend you a book which she has not read herself.'

b. * daß Maria dir kein Buch empfehlen, das sie nicht auch selbst
that Maria you no Book recommend that she not also herself
gelesen hat, würde
read has would

In both of these example pairs, the verbal complement is selected by an obligatorily coherent verb, *dürfen* in (169) and *werden* in (170). If one replaces the obligatorily coherent verb with a verb which can construct incoherently, such as *versäumen*, extraposition of the relative clause to the right edge of the verbal complement also becomes possible in the Mittelfeld (171b).

(171) a. [Eine Dissertation zu lesen, die derart spannend ist,] würde er
a dissertation to read which so exciting is would he
bestimmt nicht versäumen wollen.
certainly not miss want
'He certainly would not want to miss reading a dissertation which is so exciting.'

b. deshalb würde er [eine Dissertation zu lesen, die derart
therefore would he a dissertation to read which so
spannend ist,] bestimmt nicht versäumen wollen.[2]
exciting is certainly not miss want

The observation thus is that extraposition of a relative clause to the right edge of a topicalized verbal complement is generally possible, whereas such extraposition in the Mittelfeld is only possible to the right of incoherently selected verbal complements. This is exactly the state of affairs to be expected if obligatorily coherent verbs can only select a non-lexical verbal complement when the complement is topicalized.

1.2. Enforcing obligatory argument raising. Returning to the theoretical side, two versions of obligatory argument raising are proposed. Nerbonne (1994) proposes to raise *all complements* of the embedded verb and assumes flat structures with no verbal complex.[3] Hinrichs and

[2]Example due to Tilman Höhle (p.c.).
[3]Nerbonne (1994, p. 141) suggests that one might consider extending his proposal to accommodate a contoured verbal complex.

Nakazawa (1994b) raise only *all non-verbal complements* and assume a contoured, left-branching verbal complex.

The way to achieve obligatory argument raising is basically the same in both approaches. A new attribute LEX[4] is introduced with the idea of marking a verbal constituent as [LEX −] if it has realized either one or more complements (in the flat Nerbonne approach) or one or more non-verbal complements (in the contoured Hinrichs/Nakazawa approach). To enforce obligatory argument raising, it then suffices to specify the lexical entries of auxiliaries to require their verbal complement to be [LEX +].

In the Nerbonne approach, the idea of marking all verbal constituents in which complements are realized as [LEX −] is easily formalized by requiring every *phrase* to be [LEX −]. To obtain a theory enforcing a contoured verbal complex, Hinrichs and Nakazawa (1994b) propose a slightly more complicated encoding. The head-complement schema is split up into a binary branching "Verbal Complex Schema" (their figure (6), p. 4) licensing [LEX +] constituents as the combination of a *word* head with a single verbal complement and a "Head-NP-Complement ID Schema" (their figure (21), p. 11) licensing [LEX −] constituents consisting of a head combining with any number of non-verbal constituents plus an optional verbal complement. Furthermore, the verbal complements are excluded from argument raising by specifying the elements raised to be non-verbal signs.

1.3. Relaxing obligatory argument raising for topicalization. With two methods for enforcing obligatory argument raising on our hands, the remaining issue is to find a way to relax the obligatory argument raising between an auxiliary and its topicalized verbal complement. Regarding this issue, Nerbonne says of his theory:

> Phrasal PVPs are licensed in the Vorfeld first because they are licensed by a SLASH specification generated via the complement extraction rule (Pollard and Sag, 1994, p. 446), with an important modification – the feature LEX is nonmonotonically relaxed on SLASH specifications. It is this nonmonotonic relaxing of LEX which ultimately explains the lack of perfect correspondence between Vorfeld "fillers" and Mittelfeld "sources". (Nerbonne, 1994, p. 127)

[4]Hinrichs and Nakazawa (1994b) name the attribute NPCOMP and interpret its value as the polar opposite of the value of LEX. To have a uniform setup, we will call the attribute LEX throughout the chapter; but note that different connotations were associated with the attribute name of the original proposal.

Hinrichs and Nakazawa (1994b, p. 10, figure (19)) introduce a new lexical rule, the *PVP-Topicalization Lexical Rule.* This rule does not extract a constituent to be topicalized, but rather it creates a new verbal element for topicalization only. This hand assembled constituent is specified to share some selected properties with a verbal element subcategorized for by the input of the lexical rule. Furthermore, the lexical rule uses a modified UDC mechanism to require complements missing from the topicalized verb phrase to be realized in the Mittelfeld. For this purpose, the SLASH feature is changed to take a set of *signs* as value instead of the more restrictive *local* objects usually assumed.

Looking back at the task to be achieved – to relax the obligatory argument raising requirement – a rather simple alternative solution comes to mind.[5] Even though the LEX attribute has traditionally been assumed to be appropriate for *category* objects, to our knowledge no real arguments why this needs to be the case have been given. Thus, it is unproblematic to make LEX appropriate for *synsem* objects instead. The standard UDC mechanism only identifies the *local* properties of a filler and a trace so that having LEX as attribute of *synsem* objects will have the effect that the LEX property is no longer shared between a filler and its trace.[6] As a result, the topicalized constituent does not have to obey the obligatory argument raising enforced by [LEX +] on its trace. Note that this makes argument raising optional only for the topicalized constituent itself; argument raising remains obligatory for the subconstituents of the topicalized element.

Before we can show how this idea is spelled out by describing how the original Pollard (1996) proposal can be modified to exclude the spurious structures, there are two relevant issues left to discuss: the use of traces and the directionality of branching in contoured verbal complexes.

1.4. Related issues.

1.4.1. *Traces.* The theory proposed by Nerbonne (1994) employs a complement extraction lexical rule to obtain a traceless theory of unbounded

[5]The solution we propose here stands in the tradition of so-called *reanalysis* approaches, which assume special mechanisms to license 'small' constituents for topicalization, in our case argument raising. The approach of Hinrichs and Nakazawa (1994b), on the other hand, assumes that the topicalized element is a complete constituent containing a trace which is bound off by an element in the Mittelfeld. A discussion of the two kinds of approaches including an empirical evaluation of the different predictions they make is one of the topics of chapter 9.

[6]Independently, Höhle (1994) and St. Müller (1997) also came up with the idea to relocate the LEX attribute to *synsem* (or *sign*) in order to relax the LEX restriction on topicalized PVPs.

dependencies. In connection with this choice, he makes the following claim:

> The key to eliminating the spurious ambiguity problem [...] is the elimination of traces in favor of an analysis in which long distance dependence is grounded not in a missing constituent, but rather in an unrealized functor-argument relation. (Nerbonne, 1994, p. 117)

This claim, which is shared by Netter (1996, pp. 219, 228), on closer inspection turns out to be false. A PVP topicalization account works equally well with traces. The trace can stand for a topicalized constituent which happens to be a partial-VP. Due to argument raising, the verbal head selecting the trace then attracts the complements not yet realized in the topicalized constituent. To illustrate this, the theories discussed in section 2.2 all make use of a standard UDC mechanism employing traces.

On pp. 147f Nerbonne (1994) notes independent motivation for abandoning traces. He claims that in an analysis employing traces, another kind of spurious ambiguity can arise, e.g., in complex VPs, because "there is no nonarbitrary single location at which a "trace" might be posited." However, if only the phonologies are ordered, as assumed in standard HPSG (cf., Pollard and Sag, 1987, pp. 169ff), this is not the case since the phonology of a trace is the empty list and therefore *a trace is not linearized* at all.[7] The phonology of each sign is a list of phonological symbols. It is these symbols that are linearized, not the lists themselves. Traces have an empty list as phonology.

1.4.2. *Left- and right-branching verbal complexes.* Two different styles of verbal complexes have been proposed for German. Hinrichs and Nakazawa (1994b) employ a traditional left-branching structure for the verbal complex. Kiss (1995a) proposes a right-branching one, in which the auxiliaries combine one by one and the main verb is added at the end.[8] Kiss (1995a, p. 281ff) himself states that the analysis he proposes cannot account for VP topicalization if the two topicalization assumptions are made, because the constituent structure needed for topicalization is not contained in the structure he assigns to a verb-first sentence. However, if we take a closer look at the problem his analysis has with VP topicalization, it turns out to be the same problem which we discussed for the PVP topicalization

[7]Cf., also Pollard and Moshier (1990, pp. 291f) and Höhle (1994) for a discussion to the end that empty constituents have no word order properties. Kathol (1995, pp. 152f) comes to the same conclusion for a linearization-based variant of HPSG.

[8]Additional motivation for such a right-branching structure is discussed in chapter 8.

analyses avoiding spurious ambiguities above, namely that one has to allow elements which do not form a constituent in the structure assumed for verb-first sentences to be topicalized as a constituent. Our analysis idea for PVP topicalization thus is equally applicable to a setup using right-branching structures, which is spelt out in section 2.2.3.

2. Modifying Pollard (1996) to exclude spurious structures

This section provides a more formal proposal of how Pollard's original theory can be modified to exclude the spurious structures. First, we review the basic ingredients of Pollard's theory. Then, we discuss the modifications which are necessary to obtain a theory licensing only flat structures in the style of Nerbonne. Finally, we introduce the modifications of Pollard's theory needed to obtain theories licensing contoured structures à la Hinrichs/Nakazawa and à la Kiss. While the three theories we define differ with respect to the structures they license, all three successfully exclude the spurious structures using the LEX feature defined on *synsem* to enforce obligatory argument raising for all local selection.

2.1. Pollard's original theory. We briefly review the lexical entries of auxiliaries and the ID schemata proposed by Pollard (1996). The principles (Head-Feature Principle, Subcat Principle, etc.) Pollard uses are rather standard and carried over without discussion.

Figure 1 shows the lexical entry of the non-finite form of the perfect auxiliary *haben*.[9] While the verbal complement is encoded on SUBCAT,

$$\begin{bmatrix} \text{PHON} & \langle \textit{haben} \rangle \\ \text{S|L|C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{bse}\end{bmatrix} \\ \text{SUBJECT} & \{\boxed{1}\} \\ \text{SUBCAT} & \left\{ (P)VP\textit{psp} \begin{bmatrix} \text{L|C} & \begin{bmatrix}\text{SUBJECT} & \{\boxed{1}\} \\ \text{SUBCAT} & \boxed{2}\end{bmatrix}\end{bmatrix}\right\} \cup \boxed{2} \end{bmatrix}\end{bmatrix}$$

FIGURE 1. Pollard (1996, 300): Lexical entry for the base-form auxiliary *haben*

the subject valence of non-finite verbs is encoded on a separate SUBJECT attribute. The structure sharing of $\boxed{1}$ between the SUBJECT attribute and

[9]Here and throughout the thesis, for space reasons we sometimes abbreviate attribute names by their first letter. Additionally, SBC sometimes abbreviates SUBCAT.

that of the selected verbal complement indicates that *haben* is analyzed as a subject-raising verb. Finally, the valence requirements encoded on the SUBCAT attribute of the selected verbal complement are raised by unioning them to subcategorization requirements of *haben*.[10]

Figure 2 shows the lexical entry of the finite future auxiliary *wird*. The

$$\begin{bmatrix} \text{PHON} & \langle \textit{wird} \rangle \\ \text{S|L|C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{fin} \end{bmatrix} \\ \text{SUBCAT} & \left\{ \boxed{1} NP_{nom},\ (\text{P}) VP_{bse} \begin{bmatrix} \text{L|C} & \begin{bmatrix} \text{SUBJECT} & \{\boxed{1}\} \\ \text{SUBCAT} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\} \cup \boxed{2} \end{bmatrix} \end{bmatrix}$$

FIGURE 2. Pollard (1996, 299): Lexical entry for the finite auxiliary *wird*

SUBCAT set of finite auxiliaries consists of two elements, the subject NP and the non-finite verbal complement from which, just like in the non-finite case, the complements are raised.

The two relevant ID Schemata are shown in figure 3.[11] Schema B' licenses

$$\begin{bmatrix} \textit{phrase} & \\ \text{DTRS} & \textit{headed-struc} \end{bmatrix} \rightarrow \begin{bmatrix} \text{S|L|C|SUBJ} & \{\boxed{1}\} \\ \text{DTRS|HEAD-DTR} & \begin{bmatrix} \textit{word} & \\ \text{S|L|C|SUBJ} & \{\boxed{1}\} \end{bmatrix} \end{bmatrix} \quad \text{(Schema B')}$$

$$\vee \begin{bmatrix} \text{S|L|C} & \begin{bmatrix} \text{SUBJ} & \{\} \\ \text{SUBCAT} & \{\} \end{bmatrix} \end{bmatrix} \quad \text{(Schema C)}$$

$$\vee \quad \ldots \quad \text{(Schemata D, E, F)}$$

FIGURE 3. Pollard (1996): ID Schemata B' and C

non-finite verbal projections where the head is a *word* and combines with any number of its complements. Schema C licenses finite verbal projections in which all of the complements are realized.

[10]Traditionally argument raising is explicitly specified in the lexical entries of an intuitively understood lexical class, like in the lexical entry shown in figure 1 on the page before. Meurers (1997b) shows how argument raising can be introduced by lexical principles as a theoretical generalization over a class of words. The issue is discussed in detail in chapter 9.

[11]The schemata A and B (without prime) "missing" here are introduced by Pollard (1996) for English only.

To illustrate this, the two structures for example sentence (166a) discussed in section 1 are shown in figure 4 and figure 5.

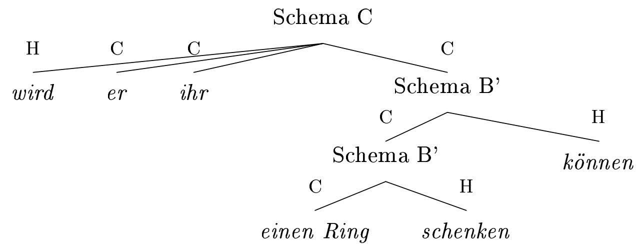


FIGURE 4. A structures for (166a) with [*einen Ring schenken*] as constituent

In the tree in figure 4, *schenken* combines with its accusative complement, while its dative complement is raised to become a complement of *können* and further raised to become a complement of *wird*, as which it is finally realized. In figure 5, on the other hand, *schenken* combines directly with

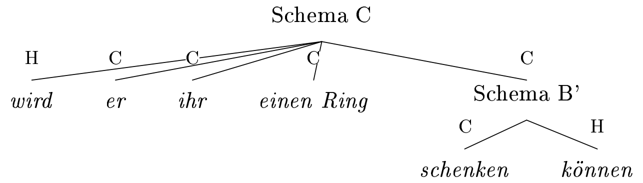


FIGURE 5. One of the structures of (166a) with constituent [*schenken können*]

können, which raises both of the NP arguments. Those are then raised further to *wird*, in order to be realized as complements of that auxiliary.

2.2. Three theories for PVP topicalization. We base the three theories introduced below on the proposal of Pollard (1996) and change only those aspects of direct relevance to the issues under discussion. In the feature geometry, the *boolean*-valued attribute LEX is introduced for *synsem* objects as discussed in section 1.3. For ease of notation, we make one further modification: Following a suggestion in Kiss (1995a), Pollard's attribute SUBJ is introduced for *head* instead of for *category*. As a result, the Head-Feature Principle takes care of the correct percolation of SUBJ in non-finite verb projections and no separate mention of SUBJ in the schemata is needed.

2.2.1. *Theory 1: Flat structures.* In a theory licensing completely flat structures, as proposed by Nerbonne, we need to ensure that all phrases are [LEX −]. Rather than adding this specification to the mother in Pollard's head-complement schemata B' and C (and the other schemata), we can express this in the simple principle shown in figure 6.

$$\textit{phrase} \rightarrow \left[\text{SYNSEM}|\text{LEX} \ -\right]$$

FIGURE 6. Theory 1: A principle requiring phrases to be [LEX −]

The lexical entries of the auxiliaries are modified to require their verbal complement to be [LEX +].[12] We thus obtain the lexical entry for the finite future auxiliary *wird* shown in figure 7.

$$\begin{bmatrix} \text{PHON} & \left\langle \textit{wird} \right\rangle \\ \text{S}|\text{L}|\text{C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} \\ \text{VFORM} \ \textit{fin} \end{bmatrix} \\ \text{SUBCAT} & \left\{ \boxed{1} NP_{nom},\ VP_{bse} \begin{bmatrix} \text{LEX} & + \\ \text{LOC}|\text{CAT} & \begin{bmatrix} \text{HEAD}|\text{SUBJECT} & \left\{\boxed{1}\right\} \\ \text{SUBCAT} & \boxed{2} \end{bmatrix} \end{bmatrix} \right\} \cup \boxed{2} \end{bmatrix} \end{bmatrix}$$

FIGURE 7. Theory 1: Lexical entry for the finite auxiliary *wird*

This minimally modified Pollard theory succeeds in eliminating the spurious ambiguity problem. But a completely flat analysis can also be achieved with a single head-complement schema replacing Pollard's schemata B' and C, which is shown in figure 8.[13] This schema licenses all head-complement constructions whose head daughter is a *word*.

$$\begin{bmatrix} \textit{phrase} \\ \text{DTRS} \ \textit{headed-struc} \end{bmatrix} \rightarrow \begin{bmatrix} \text{DTRS}|\text{HEAD-DTR} \ \textit{word} \end{bmatrix} \qquad \text{(HC Schema)}$$

$$\vee \ \ldots \qquad \text{(Schemata D, E, F)}$$

FIGURE 8. Theory 1: One head-complement ID schema

To illustrate this first theory using the single head-complement schema, the structure licensed for the PVP topicalization example (166b) is shown in figure 9 on the facing page. Note that just as in the original theory of Pollard, the analysis uses a standard UDC mechanism employing traces.

[12] Note that here it is not possible to eliminate the LEX attribute by requiring the verbal complements to be of type *word* since the SUBCAT set only contains *synsem* objects.

[13] The original theory of Nerbonne (1994) also contains two head-complement schemata since he uses a special schema to license topicalized constituents.

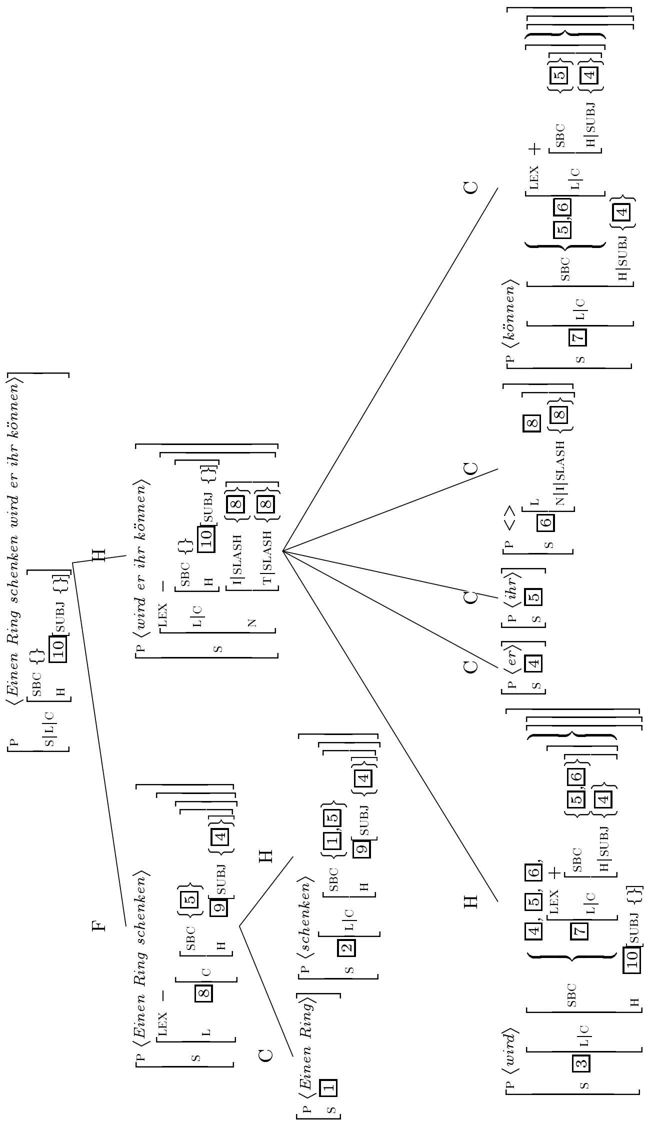


FIGURE 9. Theory 1: Flat structure for sentence (166b)

2.2.2. *Theory 2: Left-branching verbal complexes.* To obtain a theory licensing left-branching verbal complexes in the style of Hinrichs and Nakazawa (1994b), in addition to the schema for [LEX −] constituents we need a second head-complement schema to license binary branching verbal complexes. So we define a variant of Hinrichs/Nakazawa's Verbal Complex ID Schema. Both schemata are shown in figure 10.

$$\begin{bmatrix} \textit{phrase} \\ \text{DTRS} \ \ \textit{headed-struc} \end{bmatrix} \rightarrow \begin{bmatrix} \text{S|LEX} & - \\ \text{DTRS|HEAD-DTR} & \textit{word} \end{bmatrix} \qquad \text{(HC)}$$

$$\vee \begin{bmatrix} \text{S|LEX} \ + & \\ \text{DTRS} & \begin{bmatrix} \text{HEAD-DTR} & \textit{word} \\ \text{COMP-DTRS} & \left\langle \begin{bmatrix} \text{S|L|C|HEAD} \ \ \textit{verb} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \qquad \text{(VC)}$$

$$\vee \quad \ldots \qquad \text{(Schemata D, E, F)}$$

FIGURE 10. Theory 2: Two head-complement ID schemata

Since we cannot force all phrases to be [LEX −] as done in the first theory, we need to explicitly require this in the HC Schema. Our second schema licenses binary branching head-complement constructions marked [LEX +] whose head daughter is a *word* and whose complement daughter's head value is *verb*.

As discussed in section 1.2, we also need to change the specification of the lexical entries of auxiliaries to exclude verbal complements from argument raising. We require this indirectly by adding a specification to the lexical entries of auxiliaries which requires each argument raised to be [LEX −].

To illustrate the resulting proposal, the structure of the PVP topicalization example (166b) as assigned by this second theory is shown in figure 11 on the facing page. In this figure, the tree in which the auxiliary *können* combines with the trace is licensed by the binary head-complement schema.

2.2.3. *Theory 3: Right-branching verbal complexes.* Finally, to get a theory licensing a structure with a right-branching verbal complex in the style of Kiss (1995a), we need to specify two different head-complement schemata. The first head-complement schema licenses [LEX −] constructions with a head daughter of type *word* and complement daughters marked [LEX −]. The verbal-complex schema licenses binary branching

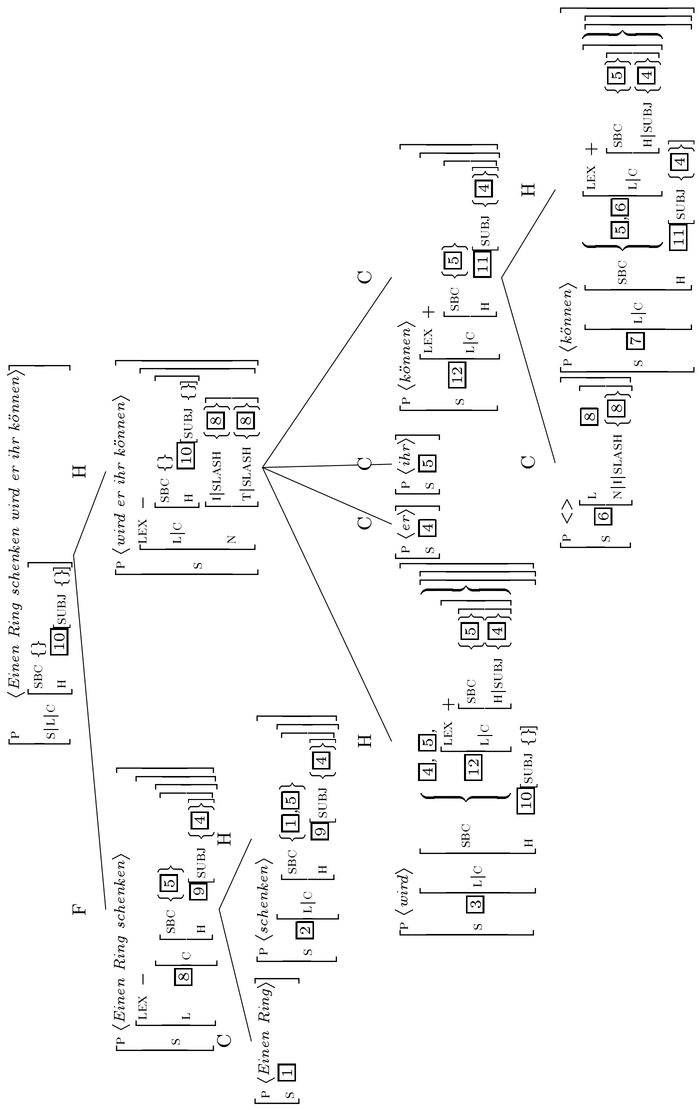


FIGURE 11. Theory 2: Left-branching verbal complex for sentence (166b)

head-complement constructions marked [LEX −] whose complement daughter is marked [LEX +] and has the HEAD value *verb*. The two schemata are shown in figure 12.

$$\begin{array}{ll}
\begin{bmatrix} \textit{phrase} \\ \text{DTRS}\ \ \textit{headed-struc} \end{bmatrix} \rightarrow & \begin{bmatrix} \text{S|LEX} & - \\ \text{DTRS} & \begin{bmatrix} \text{HEAD-DTR} & \textit{word} \\ \text{COMP-DTRS} & \textit{list}\left(\begin{bmatrix} \text{S|LEX} & - \end{bmatrix}\right) \end{bmatrix} \end{bmatrix} \qquad \text{(HC)} \\
\lor & \begin{bmatrix} \text{S|LEX} & - \\ \text{DTRS} & \begin{bmatrix} \text{COMP-DTRS} & \left\langle \begin{bmatrix} \text{S} & \begin{bmatrix} \text{L|C|HEAD} & \textit{verb} \\ \text{LEX} & + \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \qquad \text{(VC)} \\
\lor & \ldots \qquad \text{(Schemata D, E, F)}
\end{array}$$

FIGURE 12. Theory 3: Two head-complement ID schemata

As lexical entries for the auxiliaries, this third theory uses those of the original Pollard theory we showed in figures 1 and 2 on page 180, which do not make reference to the LEX attribute. Obligatory argument raising in this theory follows from the interaction of the LEX specification in the two head-complement schemata alone.

Since the example (166b) we used to illustrate the different proposals is not complex enough to actually show the difference in structure between the left- and the right-branching theory, let us visualize the two verbal complex structures in figure 13 which are licensed by the two theories once

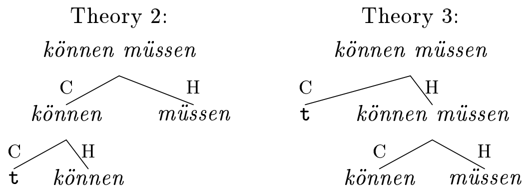


FIGURE 13. Left-branching and right-branching verbal complex structures

we extend our running example with one more modal auxiliary: *Einen Ring schenken wird er ihr können müssen* (It must be the case that he will be able to give her a ring). To follow the relevant distribution of specifications, the detailed analysis for the simpler PVP topicalization example (166b) can be found in figure 14 on the facing page.

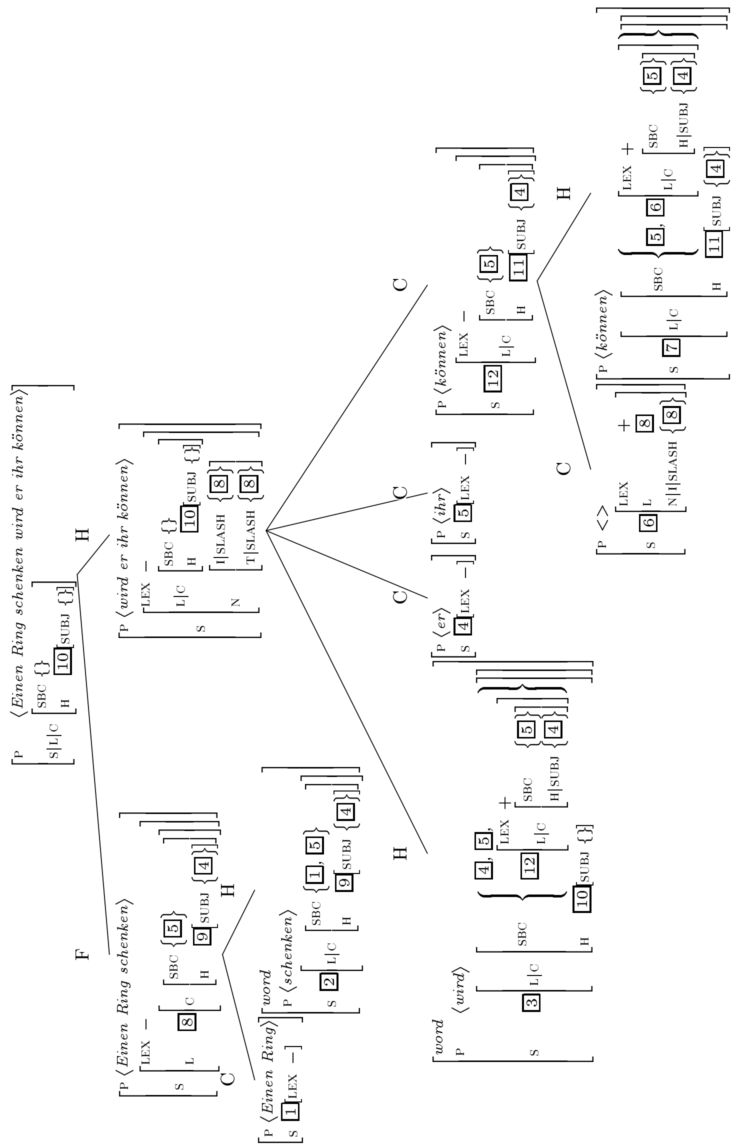


FIGURE 14. Theory 3: Right-branching verbal complex for sentence (166b)

3. Summary

The variable constituency displayed by the phenomenon of PVP topicalization arising in coherent constructions is a challenge for any theory of constituency and subcategorization. In this chapter, we showed that it is possible to meet this challenge in the HPSG framework in a transparent way since its elaborate linguistic data structure makes it possible to represent the complex interaction of subcategorization requirements in coherent constructions and to distinguish those properties of a sign which are related between a filler and a gap from those which are not.

On the basis of two recent proposals for PVP topicalization, Hinrichs and Nakazawa (1994b) and Nerbonne (1994), we identified two essential ingredients that are required to license the full range of different constituents for topicalization without introducing spurious structures in the Mittelfeld as was the case in the original HPSG proposal of Pollard (1996): obligatory argument raising to obligatorily merge the subcategorization requirements of a verb and its non-finite complement as encoding of coherence, and a method to exclude the relation which holds between the topicalized constituent and the verb of which it is a complement from this requirement. While both Hinrichs and Nakazawa (1994b) and Nerbonne (1994) successfully introduce a version of obligatory argument raising, the conclusions drawn in connection with the second issue were shown to be less convincing. In particular, we showed that there is no need for a non-monotonic device to relax specifications or "hand-assembled" constituents since it is sufficient to make LEX appropriate for *synsem* instead of for *category* in order to make non-local dependencies exempt from obligatory argument raising.

We backed up our claim that the identified ingredients are the essential ones by illustrating that it is sufficient to introduce them into the original theory of Pollard (1996) to eliminate the spurious ambiguities. To falsify Nerbonne's claim that traces are the source of the problem we formalized our proposal as a trace-based theory. In general, both a traceless analysis and an analysis employing traces are equally possible.

Finally, in formalizing three different theories, we showed that a flat structure without a verbal complex, a structure with a left-branching verbal complex, and a structure with a right-branching verbal complex are equally suitable for PVP topicalization. This shows that in an approach employing argument raising, the selectional properties encoded in the valence attributes and the constituent structure are related much more indirectly than traditionally assumed.

CHAPTER 8

Heads and Non-heads in the Coherent Construction

1. Introduction

In the second part of the empirical overview in chapter 3, we suggested that three lexical classes of verbs are relevant for an understanding of the irregular word order and status phenomena discussed in that chapter. Firstly, a small class of verbs which can occur in one of the irregular linearizations, be it the ordinary upper-field or the lower-field split and the upper-field left dislocation phenomena as alternative linearizations of the upper-field. Secondly, a class of verbs which permits an upper-field to surface when it occurs as highest verb of the lower-field. And thirdly, a subclass of these verbs supporting an upper-field which do not have a regular past participle form in their paradigm.

In the following we want to illustrate how these lexical classes can be put to work in a linguistic theory which relates the lexical classes to the syntactic properties which can be observed.

2. Upper-field verbs as non-heads

We saw in chapter 3 that the constructions which regarding their status and word order properties do not pattern according to the regularities expected for head-complement constructions all contain a verb in the upper-field (or in verb-second). But if constructions with verbs in the upper-field do not pattern like head-complement constructions then why not assume that the lexical class of upper-field verbs do not construct as ordinary heads? This conclusion seems natural in light of the fact that the structures in which the upper-field verbs are usually taken to be heads are not just unusual but they fail to show any of the properties one would

This chapter builds on ideas presented in Meurers (1994a, 1997b).

expect if the upper-field verb were constructing as ordinary head in that structure. Let us back this up by reconsidering the relevant word order and status government properties of upper-field verbs.

The word order properties of upper-field verbs were shown in section 2 (ch. 3) to differ in two respects from ordinary verbs in the lower-field. Firstly, upper-field verbs occur to the left of their argument instead of the right as ordinary verbal heads, which violates the uniform ordering of heads relative to their complement one would like to assume for head-complement structures in general. And secondly, while ordinary lower-field verbs follow a strictly uniform word order in their separate topological field, upper-field verbs have substantially more word order freedom in that three upper-field linearizations are available (ordinary, lower-verb split, upper-field left dislocation).

Regarding status assignment there are two relations to consider: the one between a V' and the upper-field verb V", and that between the upper-field verb V" and its verbal complement V"'. Regarding the first relation, there is no empirical evidence showing that the status of an upper-field verb V" can be governed, be it by a verbal head V' or a complementizer like *um* or *ohne*. Instead, upper-field verbs always show first status in a non-finite construction or verb-second sentence. But if all attempts to govern the status of an upper-field verb fail, it is unclear whether a government relationship between the higher verb and the verb in the upper-field is established at all. Note that finiteness was shown in section 3.1 of chapter 3 to differ from the non-finite status in that the highest upper-field verb shows finite morphology in a finite verb-last sentence. Finiteness thus needs to be dealt with separate from the non-finite status.

Turning to the second relation, the one between the upper-field verb and its verbal complement, the situation appears to be parallel in that there is no evidence that an upper-field verb can govern the status of its verbal complement.[1] In particular, when a form of the perfect auxiliary *haben* occurs in the upper-field, its verbal complement can show up in first (substitute infinitive) or in the less commonly observed second status (substitute *zu*-infinitive, cf., (172) below) instead of the third status which would be expected.

Summing up, it is difficult or impossible to empirically establish that upper-field verbs govern status or are governed status which makes it interesting to explore how far we can get if we eliminate the government relationships with upper-field verbs altogether by taking the upper-field out of the hypotactic status government chain.

[1]But see section 6 for a possible exception.

This idea immediately raises the question what the syntactic status of upper-field verbs is supposed to be if they are not to be understood as ordinary heads in a head-complement structure. The answer we want to suggest is that they are functional elements similar to complementizers. In the HPSG architecture of Pollard and Sag (1994) these are formalized as *markers* which do not function as heads but only 'mark' few properties of a head projection. All such functional elements share the property that they are linearized to the left of the head-projection they combine with, and they only combine with a single constituent.[2]

2.1. Exploring the idea of upper-field verbs as non-heads.

2.1.1. *Substitute zu-infinitive as regular second status.* Let us illustrate the intuitive idea of removing upper-field verbs from the hypotactic chain with two examples, before we turn to a formalization of the notion of a marker and how upper-field verbs can be subsumed under this notion in chapter 4. The example in (172) is a simple instance of a sentence with an upper-field and a substitute *zu*-infinitive patterned after the example (113c) we saw on page 71.

(172) um es haben^1(1_2) schreiben^3(1) zu können^2(2_3)
for it have write to be.able
'for to have been able to write it'

A sketch of a syntactic analysis tree for this sentence is shown in figure 1 on the next page. Here and throughout the chapter we mark the head of a local tree with H, the complements (and the subject) with C, and upper-field verbs and complementizers with M.

[2]While we focus on arguing for the non-head status of upper-field verbs, a positive characterization of upper-field verbs as functional elements also seems to be within reach. Abney (1987, pp. 64f) lists five properties characterizing functional elements, all of which can be argued to apply to upper-field verbs: Firstly, we saw that only a restricted lexical class of elements can occur as upper-field verbs. Secondly, one of the characteristics of upper-field verbs is that they are never stressed (Bech, 1955, pp. 64, 67). Thirdly, upper-field verbs only select a single complement, a verbal projection. And fourthly, the complement of upper-field verbs cannot be topicalized. The fifth criterion is that functional elements lack what Abney (1987, p. 65) calls a "descriptive content"; instead they are "regulating or contributing to the interpretation of their complement". This criterion requires a detailed discussion of the semantic contribution of upper-field verbs in order to be evaluated, which is beyond the scope of this thesis. A related discussion is, however, provided by Van Eynde (1994), who argues on semantic grounds for treating a similar class of verbs as functional elements.

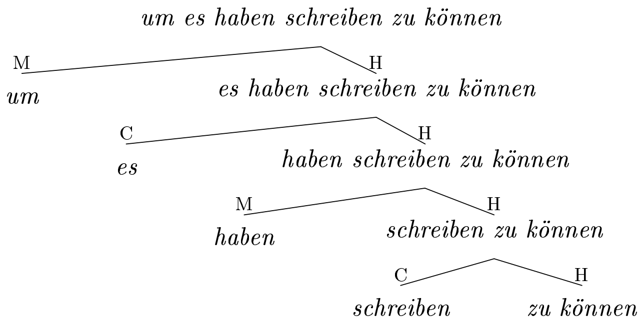


FIGURE 1. Upper-field with a substitute *zu*-infinitive

The complementizer *um* occurring in the example generally selects a non-finite projection in second status. Under the traditional view, the highest verb in the non-finite projection of the example is the upper-field verb *haben*. Instead of the second status selected by *um*, the verb *haben*, however, shows a first status. And *haben* under the traditional view selects *können*, which, however, is realized in second status (= substitute *zu*-infinitive) instead of the third status usually governed by *haben*.

Under the alternative view we want to propose, upper-field verbs do not construct as regular heads so that *haben* is not present in the hypotactic chain. As a result the highest verb in the hypotactic chain is the verb *können* in the lower-field, which bears the second status assigned by *um*. Under this alternative view, status government thus is completely regular. The first status of *haben* in the upper-field is expected if one assumes that upper-field verbs only have a single non-finite form.

The word order in (172), which under the traditional view is irregular since *haben* occurs to the left instead of the right of the other verbs, under the alternative assumption with *haben* as a non-head is regular as well since the head in each tree always follows the non-head.

Both the substitute status and the word order, which are exceptional under the traditional perspective, thus turn out to be regular once one assumes that the upper-field verb *haben* is not part of the hypotactic chain.

2.1.2. *Substitute infinitive.* The second example we want to discuss on this intuitive level is a verb-last sentence with a substitute infinitive such as the one shown in (173).

(173) daß er sie hat^1(0) treffen^3(1) können^2(1_3)
that he her has meet be.able
'that he was able to meet her'

A sketch of its syntactic structure is shown in figure 2. Under the tra-

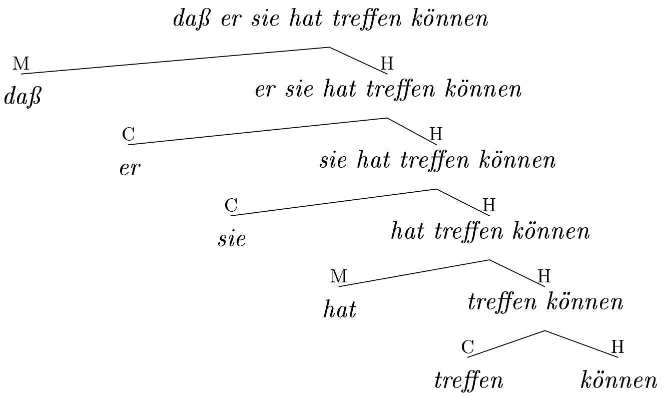


FIGURE 2. Upper-field with a substitute infinitive

ditional view, the finite verb *hat* occurs in an irregular upper-field linearization and fails to properly govern the status of its verbal complement *können* which is realized in first (= substitute infinitive) instead of the regular third status.

Under the alternative view, the verb *hat* as upper-field verb does not construct as a head and therefore is not present in the hypotactic status government chain. As a result, *hat* cannot govern a third status of *können*. But where does *können* get its first status from? One possible answer would be to assume that the first status is the basic form of a verb which surfaces whenever no status is assigned.[3] A closer look at the specific case at hand reveals, however, that the 'default' occurrence of a first status on the highest lower-field verb correlates with another property. The relevant empirical correlation is that this first status arises only in finite coherence-fields (in contrast to the substitute *zu*-infinitive which arises in non-finite coherence-fields).[4] One can thus use the occurrence

[3]The related issue of nominative case as an unmarked case arising when no case is assigned is discussed in section 3.5.1 of chapter 10.
[4]A finite coherence field is a coherence field which contains a finite verb, be it as part of the final field or as verb-first/second.

of finiteness as a trigger for the first status occurring when no status is explicitly governed. This idea will be spelt out in section 4.

Another option for assigning the first status of the highest lower-field verb *können* in example (173) would be to assume that the complementizer *daß* is responsible. But since the same problem arises in verb-second sentences like (174) this option is not very promising.

(174) Er hat^{1}(0) sie treffen^{3}(1) können^{2}(1_3).
he has her meet be.able
'He was able to meet her.'

3. Sentence structure considerations

In order for the intuitive idea to take a more concrete shape, we need to clarify the syntactic environment into which we want to embed this idea. In the previous chapter (ch. 7) we discussed two ingredients for capturing the effects of coherence in an HPSG theory: obligatory argument raising and a way to relax the obligatoriness for non-local dependencies. At the same time, we showed that the phenomenon of PVP topicalization puts no constraints on the possible sentence structure and the directionality of branching in the verbal complex: a flat sentence structure, and one with a left-branching or right-branching verbal complex were equally possible. In the following we therefore take a look at these options to decide on the syntactic setup we want to use as basis of our HPSG formalization of the upper-field verbs as non-heads idea.

While approaches to German verbal complexes using an entirely flat sentence structure have been proposed in HPSG (Bouma and van Noord, 1998), assuming such structures in essence degrades constituent structure to an uninformative level and recodes the relevant distinctions in other parts of the data structure, e.g., as feature values. Showing that this can be done is important in that it de-mystifies constituent structure as just one particular data structure; but apart from this effect we believe such an encoding is similarly one-sided as the idea of encoding everything in the tree structure by introducing a large number of functional projections. Given that several equally powerful ways of encoding linguistic information are available, it is important to clarify which data structure plays which role. As we showed in the first part of the thesis, the word order facts clearly establish the lower-field as a topological unit and we take such topological units to be prime evidence for constituency. In our

exploration of sentence structures we therefore only consider structures including a verbal complex.

3.1. Left- and right-branching verbal complexes. As empirical motivation for choosing between a left- and a right-branching verbal complex structure, let us take a look at examples of the lower-field split phenomenon such as the sentence in (175).

(175) daß er das Buch kopieren^{5}(1) wird^{1}(0) haben^{2}(1) lassen^{4}(1) müssen^{3}(1_3)
that he the book copy will have let must
'that he will have had to let someone copy the book'

Assuming a left-branching verbal complex structure in this sentence, one obtains the tree shown in figure 3. This structure is problematic in that it

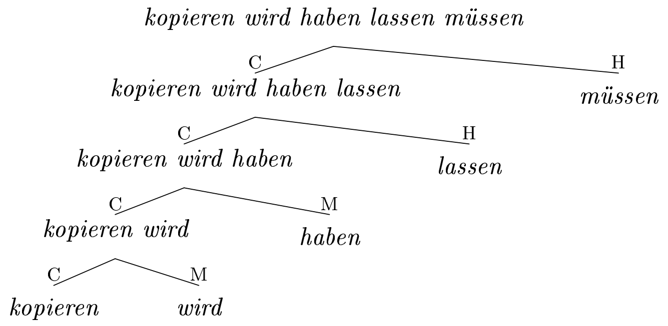


Figure 3. Lower-field split with a left-branching verbal complex

does not provide simple access to the entities which are central for syntactic regularities such as finiteness assignment and subject-verb agreement on the one hand, and the conditions on upper-field formation on the other.

First, we had shown in section 3 of chapter 3 that finiteness is always assigned to what under the traditional perspective is the highest verb in a hypotactic chain, independent of whether it is realized in the upper-field, the lower-field, or in verb-first/second. Under the alternative view, an upper-field verb is taken out of this status government chain, but it remains the verb which is the highest semantic functor. In a structure like that shown in figure 3 the 'highest' verb is deeply embedded inside a complement so that a rather complex procedure is required to determine the correct verb. In essence, it is necessary to search through the entire verbal complex to determine whether an upper-field verb exists. If there is such a verb, then the most deeply embedded upper-field verb is the relevant 'highest' verb; otherwise, one takes the highest lower-field verb. It seems implausible that detecting the 'highest' verb of a sentence to assign finiteness and ensure subject-verb agreement is based on such a complex search procedure.

A second problem with this structure arises from the conditions we observed in section 2.1 of chapter 3 which a sentence has to meet in order for an upper-field linearization to be possible. It turned out to be a central precondition for the existence of upper-field that the highest verb in the lower-field belongs to a certain lexical class of verbs. For the example (175) this means that the occurrence of *müssen* as highest lower-field verb is crucial for the possibility of *haben* to occur as upper-field verb. Strictly speaking, *müssen* even requires an upper-field linearization of *haben* since *müssen* as modal verb lacks a past participle form and therefore could not be selected by *haben* in the lower-field. But if *haben* occurs in the upper-field, another condition on upper-field formation requires *wird* to be part of the upper-field as well. Just like for the assignment of finiteness to the highest verb, the structure in figure 3 on the page before is not well-suited for expressing these relations between *müssen*, *haben* and *wird* in a general way.

An alternative right-branching verbal complex structure for the example (175) is shown in figure 4. Based on this structure, the percolation of

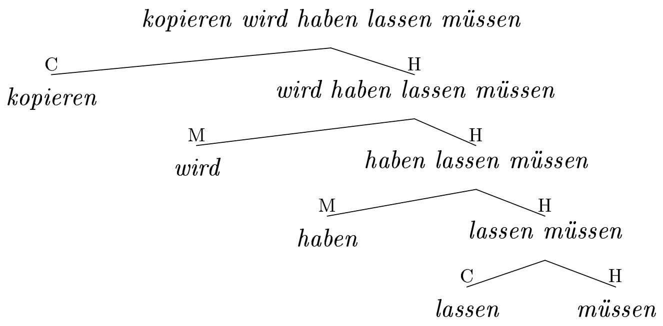


FIGURE 4. Lower-field split with a right-branching verbal complex

finiteness marking and subject-verb agreement information can be determined in a straightforward fashion. Finiteness is percolated along the verbal head-projection and realized by the highest upper-field verb if there is

one and the lexical head of the head-projection itself if there is no upper-field verb. If upper-field verbs are formalized as marker daughters this corresponds exactly to the distribution of marking values envisaged by Pollard and Sag (1994).

Turning to the relation between the highest lower-field verb and the upper-field verbs in lower-verb split linearization, this relationship can also straightforwardly be defined based on the structure in figure 4 on the preceding page. Since all upper-field verbs are direct sisters of the head-projection of the highest lower-field verb one only needs make the verbal subclass a head property to be able to determine locally whether an upper-field verb can combine with this verbal projection.

With respect to the two extremes, uniformly right-branching and uniformly left-branching, we thus conclude that the tree relations in a right-branching verbal complex permit a formulation of finiteness assignment and the conditions on upper-field formation based on independently motivated notions such as percolation of properties along a head projection. Of course, there are numerous possibilities one can explore in-between these two extremes. One could, for example, assume that the lower-field is left-branching except for when an upper-field verb occurs, in which case the lower-field is structured in a way providing access for the upper-field verb to the head projection of the highest lower-field verb. In section 4 we will formalize the uniformly right-branching structure since as the less traditional structuring it requires explicit illustration and we consider it to be a good starting point from which more elaborate hybrid structures could be explored.

3.2. Verb-first and verb-second structures. It is well-known that the finite verb in verb-first or verb-second structures shares some of the properties with complementizers and some with verb-last verbs. The issue is discussed in detail in a number of publications[5] and we will not repeat the argumentation here. Instead, the question we want to address under the perspective of this chapter is how upper-field verbs relate to the verb-first/second phenomenon.

We saw in section 3 of chapter 3 that a substitute infinitive arises if and only if a form of *haben* occurs in the upper-field or as verb-first/second. A regular past-participle, on the other hand, surfaces when a verb governing third status occurs in the lower-field or in verb-first/second. With respect

[5]An overview on an HPSG background can, for example, be found in Netter (1996, ch. 5.2) or Kathol (1995, ch. 5).

to status government, a verb in verb-first/second position thus has the option of behaving like a verb in the lower-field or in the upper-field. One can view this as additional support for an approach in which the verb-first/second verb is systematically related to the verb-last position. As long as the verb-last position which a verb in verb-first/second position is related to can be in the lower or in the upper-field, the status assignment facts in verb-first/second structures follow without further assumptions from the situation in verb-last sentences.

Let us illustrate the head-movement analysis we will formalize in section 4 below with some sketches of analysis trees. A simple verb-second sentence like the one shown in (176) is intended to receive the structure shown in figure 5.

(176) Wir mögen Eis.
we like ice-cream

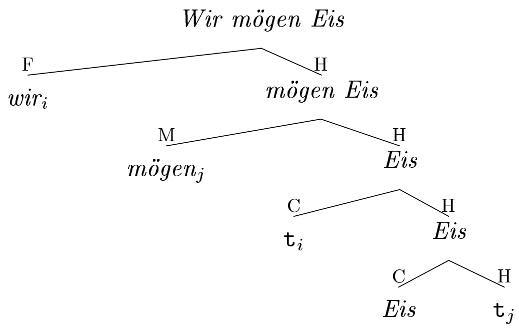


FIGURE 5. Basic structure of a verb-second sentence

The verb-second verb *mögen* is displayed as functional element in a branch marked with an M representing its marking function. It is related to the empty element $\mathtt{t}_j$ in verb-last position. The tree also shows that verb-second sentences are analyzed as verb-initial structures from which an element has been topicalized. In declarative terms, the topicalized element *wir* is a filler daughter (marked by an F) which is related to a trace $\mathtt{t}_i$ in its base position. This idea can be formalized in terms of an HPSG theory using traces or trace-equivalents like *gap-synsem* elements (Bouma et al., 1998). The choice, as far as we see, makes no empirical difference regarding the topic covered in this thesis. For reasons of presentation

we generally make use of ordinary traces throughout the thesis, but our proposals could equally well be formalized in terms of trace-equivalents.[6]

Turning to a more interesting case with the auxiliary *haben* in a verb-second sentence including a verbal complex, we take a look at the structures of the two sentences in (177).

(177) a. Er hat^1(0) ihn lachen^3(1) gehört^2(3).
he has him laugh heard

b. Er hat^1(0) ihn lachen^3(1) hören^2(1_3).
he has him laugh hear

The regular past participle form *gehört* in (177a) according to our analysis idea correlates with an occurrence of the trace of *hat* in the lower-field. This is illustrated by figure 6.

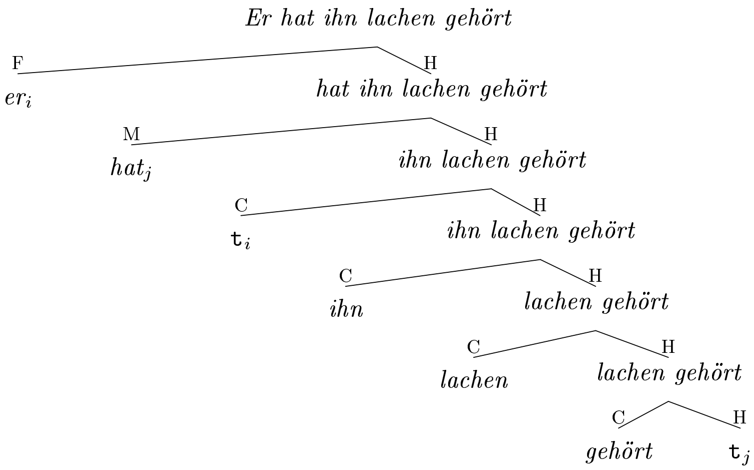


FIGURE 6. Regular past participle in a verb-second sentence

The substitute infinitive form *hören* exhibited by example (177b), on the other hand, requires the trace of *hat* to occur in the upper-field in order to break the status government chain between the two verbs. Figure 7 on the following page illustrates this structure.

Having couched the analysis idea for upper-field verbs as non-heads in a basic analysis of the German sentence structure, we can turn to formalizing this proposal in an HPSG architecture.

[6]See section 6.4 of chapter 9 for some substantiation of this claim.

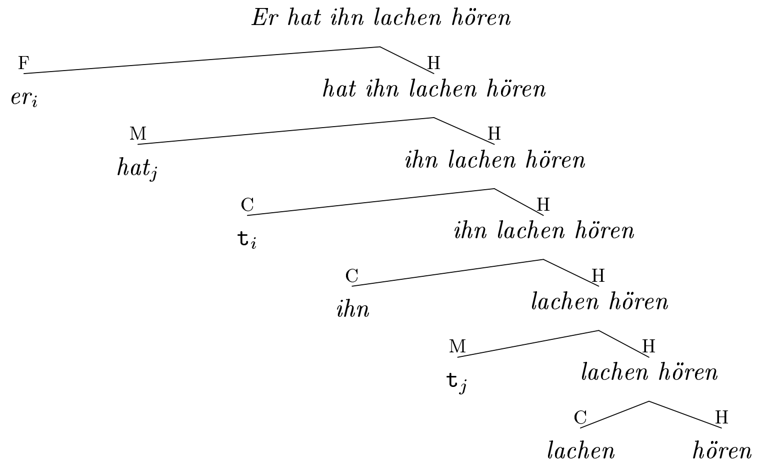


FIGURE 7. Substitute infinitive in a verb-second sentence

4. An HPSG formalization

4.1. Lexical specification. Throughout the first part of this thesis and in this chapter, we have emphasized the importance of different lexical classes of verbs and we showed that they cannot in general be deduced from independently motivated syntactic or lexical properties. Of course, future research might and hopefully will show that some of these classes can be related to other distinctions or even derived from them. Until then, one needs to introduce the relevant lexical class distinctions in the linguistic ontology and take them as basis on which the observable properties of larger units, in particular sentences, can be explained.

4.1.1. *Ontology.* In the HPSG architecture, the linguistic ontology is declared in the signature, so that we start by introducing the relevant lexical classes of verbs as new subtypes below the *head* subtype *verb* in the way shown in figure 8 on the next page. Based on the division into substantive and functional elements from Pollard and Sag (1994), we introduce *initial-verb* to occur as HEAD value of verbs in verb-first and verb-second position. Note that *initial-verb* as a *functional-verb* is a subtype of *verb* and *func*, in order to reflect the fact that it shares some properties with both classes of elements. How verbs in initial position are derived from verbs with the other subtype of *verb*, namely *final-field-verb*, as head value is discussed at the end of section 4.1.2 below.

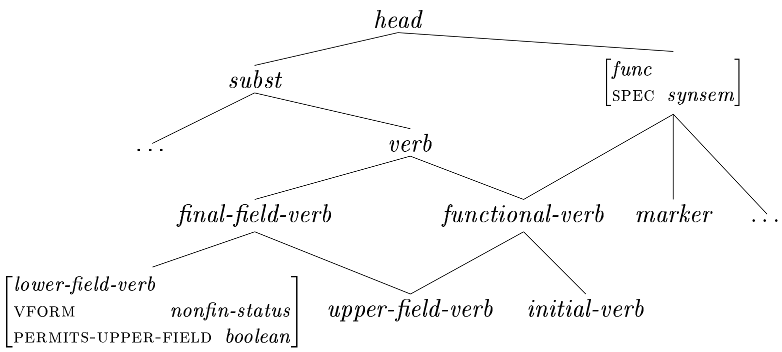


FIGURE 8. Signature below *head*

The head type *final-field-verb* is further sub-classified by subtypes for the upper-field and lower-field verbs. As we want upper-field verbs to construct as functional elements marking a projection and not as heads, the type *upper-field-verb* is a subtype of *functional-verb* and bears the feature SPEC which in traditional HPSG is appropriate for functional heads like complementizers and encodes the restrictions a marker can put on the head projection it combines with. Different from the list-valued valence attributes, the value of SPEC describes the single element which functional elements can combine with.

Turning to lower-field verbs, their head type has two additional attributes PERMITS-UPPER-FIELD (PUF) and VFORM. The attribute PUF encodes whether a verb can occur below an upper-field as highest verb in the lower-field. In essence this follows the idea of den Besten and Edmondson (1983) that the lexical class of the highest verb in the lower-field is responsible for whether an upper-field is possible.[7] Note that this idea is also encoded in the so-called flip-triggers of Hinrichs and Nakazawa (1994a), but in quite a different way. While in our setup a verb is lexically classified according to whether it in principle permits its governor to be realized as part of the upper-field, in the approach of Hinrichs and Nakazawa (1994a) a verb is a flip trigger ([FLIP +]) in a particular construction in which the governor actually is in the upper-field. A related difference is that Hinrichs and Nakazawa (1994a) use the FLIP feature to lexically mark the substitute infinitive form of modal verbs as 'obligatory flip triggers'. In our setup,

[7]In chapter 3 we saw that it is not possible to predict the possibility of an upper-field from the occurrence of two bare infinitives in a sentence.

the obligatoriness of the upper-field in sentences in which a modal verb is selected by a form of the perfect auxiliary *haben* falls out from the fact that the modal verbs lack a past participle form,[8] and we do not assume special substitute infinitive entries, i.e., verbs marked as past participles but with the appearance of an infinitive. When a modal is governed by a verb selecting a past participle such as *haben*, the only grammatical option therefore is to eliminate *haben* from the status government chain by realizing it in the upper-field.

Lower-field verbs are the only verbs which can occur in different non-finite status. They thus have an appropriate attribute VFORM with value *nonfin-status*. As subtypes of *nonfin-status* we introduce the three status *bse*, *zu-inf*, and *psp*.

Finiteness was shown in section 3.1 of chapter 3 to percolate differently from the non-finite status. We therefore do not include it with the non-finite status under the VFORM attribute but group it with the marking information of complementizers under *marking* as shown in the partial signature in figure 9.

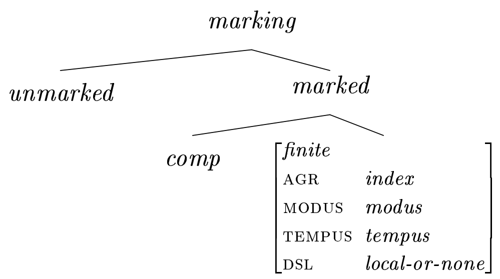


FIGURE 9. Partial signature below *marking*

By introducing four attributes for the type *finite*, we express that finiteness marking comes with four further properties: AGREEMENT, MODUS, TEMPUS, and the possibility of head-movement (DSL). The type *index* as value of AGREEMENT is the collection of *person*, *number* (and *gender*) information traditionally used in HPSG. To encode the modus information, three subtypes of *modus* are introduced: *imperative*, *indicative*, and *subjunctive*. The tense morphology (not its interpretation) is encoded in the type *tempus* with the two subtypes *present* and *past*. Finally, the DSL attribute can have *none* or *local* as values. In the latter case, it houses the

[8] See chapter 3, in particular section 1.1.1, for a discussion.

information of a missing head as part of an encoding of head movement. We turn to this issue at the end of section 4.1.2 below.

While the fact that finiteness and non-finite status properties percolate differently through a tree caused us to separate the two, some link between the two properties is required in order to express that finiteness can only be assigned to a projection which is not required to bear a specific non-finite status. We take the basic, unmarked verb form to be identical to the first status form. The principle in figure 10 expresses that finiteness assignment is restricted to such base forms.

$$\left[\text{SYNSEM|LOC|CAT|MARKING } \textit{fin}\right] \rightarrow \left[\text{SYNSEM|LOC|CAT|HEAD|VFORM } \textit{bse}\right]$$

FIGURE 10. Restricting finiteness assignment to base forms

4.1.2. *Theory.* With the relevant ontological distinctions in place, we can turn to the theory (in the formal sense) defining which of these ontologically possible entities are grammatical. To single out the grammatical words, we define lexical entries as disjuncts in the Word Principle (cf., figure 2 on page 119).[9] In the following, we focus on the lexical entries for the different classes of verbs. Figure 11 shows the lexical entry for

$$\begin{bmatrix} \text{PHON} & \langle \textit{wird} \rangle \\ \text{S|L} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{upper-field-verb} & \\ \text{SPEC|L} & \begin{bmatrix}\text{CAT} & \begin{bmatrix}\text{HEAD|PUF} & + \\ \text{MARK} & \textit{unmarked}\end{bmatrix} \\ \text{CONT} & \boxed{1}\end{bmatrix}\end{bmatrix} \\ \text{MARK} & \begin{bmatrix} \textit{fin} & \\ \text{AGR} & \begin{bmatrix}\textit{index} & \\ \text{NUM} & \textit{sing}\\ \text{PER} & \textit{third}\end{bmatrix} \\ \text{MODUS} & \textit{indicative} \\ \text{TEMPUS} & \textit{present}\end{bmatrix} \\ \text{SBC} & \langle\rangle \end{bmatrix} \\ \text{CONT|NUCL} & \begin{bmatrix}\textit{wird'} & \\ \text{SOA-ARG} & \boxed{1}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

FIGURE 11. Preliminary lexical entry of the upper-field verb *wird*

[9] A detailed discussion of the nature of the lexicon in an HPSG architecture can be found in section 2 of chapter 5.

the upper-field verb *wird*. Via the SPEC attribute, the upper-field verb *wird* requires the head projection it marks to permit upper-field formation ([PUF +]) and to be non-finite. Furthermore, note that for upper-field verbs VFORM is not appropriate. Apart from the finite form, they only have a single non-finite form which differs from the finite form in that it bears *unmarked* as MARKING value.

Many of the specifications in the lexical entry in figure 11 on the preceding page represent properties of the class of upper-field verbs rather than idiosyncratic properties specific to this entry. We discussed in part two of this thesis that such lexical regularities can straightforwardly be captured by lexical principles. This is exemplified by the principle generalizing over the class of upper-field verbs in figure 12.

$$\begin{bmatrix} \textit{word} \\ \textsc{s}|\textsc{l}|\textsc{c}|\textsc{head}\ \ \textit{upper-field-verb} \end{bmatrix} \rightarrow \begin{bmatrix} \textsc{s}|\textsc{l}|\textsc{cat} & \begin{bmatrix} \textsc{h}|\textsc{spec}|\textsc{l} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head}|\textsc{puf}\ + \\ \textsc{mark}\ \ \textit{unmarked} \end{bmatrix} \\ \textsc{cont} & \boxed{1} \end{bmatrix} \\ \textsc{sbc} & \langle\rangle \end{bmatrix} \\ \textsc{cont} & \begin{bmatrix} \textsc{nucl}|\textsc{soa-arg}\ \ \boxed{1} \end{bmatrix} \end{bmatrix}$$

FIGURE 12. Generalizing over the class of upper-field verbs

In the presence of this lexical principle, the lexical entry of the upper-field verb *wird* can be reduced to the specifications shown in figure 13.

$$\begin{bmatrix} \textsc{phon} & \langle \textit{wird} \rangle \\ \textsc{s}|\textsc{l} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \textit{upper-field-verb} \\ \textsc{mark} & \begin{bmatrix} \textit{fin} & \\ \textsc{agr} & \begin{bmatrix} \textit{index} \\ \textsc{num}\ \ \textit{sing} \\ \textsc{per}\ \ \textit{third} \end{bmatrix} \\ \textsc{modus} & \textit{indicative} \\ \textsc{tempus} & \textit{present} \end{bmatrix} \end{bmatrix} \\ \textsc{cont} & \begin{bmatrix} \textsc{nucl}\ \ \textit{wird'} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

FIGURE 13. Lexical entry of the upper-field verb *wird*

Turning to lower-field verbs, we see the lexical entry for the obligatorily coherent subject-oriented raising verb *müssen* in figure 14 on the next page. The obligatory coherence of this verb is reflected by the [LEX +] spec-

$$\begin{bmatrix} \textsc{phon} & <\textit{müssen}> \\ \textsc{s}|\textsc{l} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{lower-field-verb} & \\ \textsc{puf} & + \\ \textsc{vform} & \textit{bse} \end{bmatrix} \\ \textsc{mark} & \textit{unmarked} \\ \textsc{sbc} & \boxed{1} \oplus \left\langle \begin{bmatrix} \textsc{loc} & \begin{bmatrix} \textsc{cat} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{verb}\ \ \textit{vform}\ \ \textit{bse} \end{bmatrix} \\ \textsc{mark} & \textit{unmarked} \\ \textsc{sbc} & \boxed{1} \end{bmatrix} \\ \textsc{cont} & \boxed{3} \end{bmatrix} \\ \textsc{lex} & + \end{bmatrix} \right\rangle \end{bmatrix} \\ \textsc{cont} & \begin{bmatrix} \textsc{nucl} & \begin{bmatrix} \textit{müssen'} & \\ \textsc{soa-arg} & \boxed{3} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

FIGURE 14. Lexical entry of the lower-field verb *müssen*

ification on the verbal complement and the argument raising specification raising the arguments of the verbal complement onto its own SUBCAT list. If the verbal complement requires a subject, it is the least oblique argument on the subcat list $\boxed{1}$ of the verbal complement and as a result of argument raising also that of the subject-to-subject raising verb *müssen*. Since the verb permits an upper-field, it bears a positive PUF value. Apart from the first status form shown in the entry in figure 14, lower-field verbs also have a form in second status which differs only with respect to the values of PHON and VFORM. While modal verbs like *müssen* do not have a past-participle form, those lower-field verbs which do have such a form have a further entry which again only differs with respect to the PHON and VFORM values.

As with the upper-field verbs above, certain specifications in the entry of the lower-field verb *müssen* of figure 14 represent general properties of the class of lower-field verbs or a subclass thereof. One should therefore attach these properties to the class instead of including them in the entry. The most interesting specification of this kind in figure 14 is the argument raising specification encoding coherence. In chapter 9 we show how one can define a general principle introducing this argument raising specification as part of a mapping from the argument structure to the syntactic valence attributes.

Finally, the largest class of verbs are lower-field verbs which do not permit upper-field formation. A lexical entry for the first status form of the optionally coherent subject-oriented equi verb *versuchen* is shown in figure 15 on the next page.

$$\begin{bmatrix} \text{PHON} & \langle \textit{versuchen} \rangle \\ \text{S|L} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{lower-field-verb} & \\ \text{PUF} & - \\ \text{VFORM} & \textit{bse}\end{bmatrix} \\ \text{MARK} & \textit{unmarked} \\ \text{SBC} & \left\langle \text{NP}_{\boxed{2}} \right\rangle \oplus \boxed{1} \oplus \left\langle \begin{bmatrix} \text{L} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{bse} \end{bmatrix} \\ \text{MARK} & \textit{unmarked} \\ \text{SBC} & \left\langle \text{NP}_{\boxed{2}}\right\rangle \oplus \boxed{1} \end{bmatrix} \\ \text{CONT} & \boxed{3} \end{bmatrix}\end{bmatrix} \right\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{NUCL} & \begin{bmatrix} \textit{versuchen'} & \\ \text{ARG0} & \boxed{2} \\ \text{SOA-ARG} & \boxed{3} \end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

FIGURE 15. Lexical entry of the lower-field verb *versuchen*

Deriving verb-initial words. To license verbs in verb-initial position, i.e., in verb-first and second sentences, we follow Kiss and Wesche (1991) in employing a lexical rule relating verb-initial verbs to the verb-last verbs licensed by entries such as the ones described above. While we rely on the idea of their proposal, we formalize the idea in a different way. Kiss and Wesche (1991) follow Borsley (1989) in introducing a non-local attribute DSL to mediate between the sentence-initial verb and the head-movement trace in verb-last position. Introducing this feature as part of the unbounded dependency mechanism has the disadvantage of having to ensure separately that DSL differs from other non-local features like SLASH in that it can never relate a head-movement trace to a binder outside its head domain. This problem is discussed by Kiss (1995b, pp. 231ff), who concludes that one has two options. One can either hand-encode the locality restriction in a special principle percolating the DSL value along head projections and modify the non-local feature percolation to not apply to the DSL attribute. Or one assumes that a finite verb-last verb always occurs in a structure that is introduced by a complementizer so that the lexical entries of complementizers can be specified to require the projection they combine with to have an empty DSL value, i.e, to include no unbound head-movement traces. Both options thus require some stipulation: either a special mechanism has to be introduced to percolate the DSL attribute or one needs to include special requirements in complementizers and assume empty complementizers in those verb-last structures in

which no complementizer is visible. A further disadvantage is that introducing DSL in this way does not capture the fact that head-movement is restricted to finite sentences.

To eliminate these two shortcomings, in figure 9 on page 202 we introduced DSL as an attribute of the *finite* subtype of *marking*. This way head movement is automatically restricted to finite projections and the standard Marking Principle of Pollard and Sag (1994) ensures percolation of the entire marking value, which includes the DSL specification, along the head projection (except when a functional element intervenes).

The empty verb-last element introducing the DSL dependency is licensed by the lexical entry shown in figure 16.[10] The head-movement trace iden-

$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \langle\rangle \\ \text{SYNSEM|LOC} & \boxed{1}\begin{bmatrix}\text{CAT|HEAD|MARKING|DSL} & \boxed{1}\end{bmatrix} \end{bmatrix}$$

FIGURE 16. Lexical entry of the verbal head-movement trace

tifies the value of its DSL attribute with its own LOCAL value. Cyclic structure like these are not very common in HPSG linguistics, but cyclic structures have, for example, been assumed for head-specifier constructions by Pollard and Sag (1994) and we would like to emphasize that they pose no problem from a formal point of view.[11]

The lexical rule relating verb-initial occurrences of verbs to verb-last ones can be formulated as shown in figure 17 on the following page. It is parallel to the rule of Kiss and Wesche (1991) in the version of Kiss (1995b, p. 229) which we discussed as an example for lexical rules in figure 1 on page 105 of chapter 4, but it incorporates our idea to analyze initial verbs as functional elements selecting via SPEC and the use of DSL as a marking attribute. Related to this change, our lexical rule is simpler than the Kiss/Wesche original since no TO-BIND specifications need to be stipulated to ensure proper binding off of the INHERITED|DSL value. Since in our

[10]To ensure that finite verbal heads with a non-empty phonology always introduce *none* as DSL value, one can use a principle such as the following:

$$\begin{bmatrix}\text{HEAD-DTR} & \begin{bmatrix}\text{PHON} & \textit{ne-list} \\ \text{SYNSEM|LOC|CAT|MARKING} & \textit{finite}\end{bmatrix}\end{bmatrix} \rightarrow \begin{bmatrix}\text{HEAD-DTR|SYNSEM|LOC|CAT|MARKING|DSL} & \textit{none}\end{bmatrix}$$

Alternatively, one could imagine a theory in which particle verbs introduce the particle as phonological contribution of the head-movement trace.

[11]While we do not deal with implementation issues in this thesis, let us point out that such cyclic structures are equally unproblematic from an implementation point of view.

$$\begin{bmatrix}\text{SYNSEM|LOC} \; \boxed{1}\begin{bmatrix}\text{CAT}\begin{bmatrix}\text{HEAD} & \textit{final\_field\_verb}\\ \text{MARK} & \textit{finite}\end{bmatrix}\end{bmatrix}\end{bmatrix} \mapsto$$

$$\begin{bmatrix}\text{SYNSEM|LOC} & \begin{bmatrix}\text{CAT} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\textit{initial\_verb} & \\ \text{SPEC} & \left\langle\begin{bmatrix}\text{LOC} & \begin{bmatrix}\text{CAT} & \begin{bmatrix}\text{MARK|DSL} & \boxed{1}\\ \text{SBC} & \langle\rangle\end{bmatrix}\\ \text{CONT} & \boxed{2}\end{bmatrix}\end{bmatrix}\right\rangle\end{bmatrix}\end{bmatrix}\\ \text{CONT|NUCL} & \begin{bmatrix}\textit{mood} & \\ \text{SOA-ARG} & \boxed{2}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

FIGURE 17. Verb-Initial Lexical Rule

setup DSL is a *marking* feature, it percolates along the head projection except when a functional element intervenes. The percolation of the DSL value introduced by an empty verb-last element is thus automatically limited to the head projection of this verb-last element. No special binding off is needed to keep a *marking* feature DSL from penetrating into the projection of the verb-second verb.

4.2. Constituent structure.

4.2. Constituent structure. Before we can turn to some example analyses, we need to introduce constituent structure and the linguistic principles defined on it.

4.2.1. *Ontology.* The relevant part of our linguistic ontology is introduced in figure 18. Following Pollard and Sag (1994), we introduce two subtypes

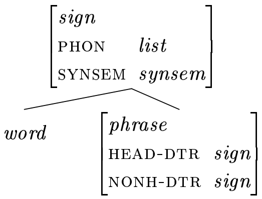


FIGURE 18. The signature below *sign*

of *sign*, *phrase* and *word*. In line with many current HPSG proposals, we, however, eliminate the DTRS attribute with the *const-struc* value of Pollard and Sag (1994). Instead, we introduce two attributes for phrases, HEAD-DTR and NONH(EAD)-DTR with *sign* as appropriate value. Our ontology thus only includes binary-branching trees.

4.2.2. *Theory.* We restrict ourselves to two kinds of phrases, ordinary phrases and lexical clusters. This restriction is imposed by the Immediate Dominance Principle in figure 19. In an ordinary phrase the non-head

$$\textit{phrase} \rightarrow \begin{bmatrix}\text{NONH-DTR|S|LEX} & -\end{bmatrix} \vee \begin{bmatrix}\text{HEAD-DTR|S|LEX} & +\\ \text{NONH-DTR} & \textit{word}\end{bmatrix}$$

FIGURE 19. ID Principle

daughter is required to be [LEX −], whereas a lexical cluster consist of a [LEX +] head daughter which combines with a non-head daughter of type *word*.

To encode the selection options between the two daughters, we collapse the Subcategorization Principle, the Spec Principle and part of the Head-Adjunct Schema and the Head-Filler Schema of Pollard and Sag (1994, pp. 399f) into the Selection Principle shown in figure 20. It defines that

$$\textit{phrase} \rightarrow \begin{bmatrix}\text{S|L|C|SUBC} & \boxed{1}\end{bmatrix} \wedge \left(\begin{bmatrix}\text{HEAD-DTR|S|L|SUBC} & \boxed{1} \oplus \langle\boxed{2}\rangle\\ \text{NONH-DTR|SYNSEM} & \boxed{2}\end{bmatrix} \vee \begin{bmatrix}\text{HEAD-DTR|S|LOC|CAT} & \begin{bmatrix}\text{HEAD|SPEC}\vee\text{MOD} & \boxed{2}\\ \text{SBC} & \boxed{1}\end{bmatrix}\\ \text{NONH-DTR|SYNSEM} & \boxed{2}\end{bmatrix} \vee \begin{bmatrix}\text{HEAD-DTR|S} & \begin{bmatrix}\text{NONLOC} & \begin{bmatrix}\text{IN|SLASH} & \boxed{2}\\ \text{TO|SLASH} & \boxed{2}\end{bmatrix}\\ \text{LOC|CAT|SBC} & \boxed{1}\langle\rangle\end{bmatrix}\\ \text{NONH-DTR|S|LOC} & \boxed{2}\end{bmatrix}\right)$$

FIGURE 20. Selection Principle

in every phrase, one of three kinds of selection occurs: Firstly, the head daughter in a phrase can select an argument; the remaining subcategorization requirements are then passed up to the mother. Secondly, in case the non-head is a functional element or a modifier, the non-head can specify/modify properties of the head and the subcategorization requirements of the mother are identical to those of the head daughter. And thirdly, a saturated head daughter can realize a non-local requirement, i.e., select the filler in a filler-gap dependency.

To restrict the percolation of MARKING values in the tree, we define the Marking Principle in figure 21 on the next page. It is similar to the Marking Principle of Pollard and Sag (1994, p. 400), but instead of making

$$\textit{phrase} \rightarrow \left[\textsc{s}|\textsc{l}|\textsc{c}|\textsc{marking}\ \boxed{1}\right] \wedge \left(\left[\textsc{nonh-dtr}|\textsc{s}|\textsc{l}|\textsc{cat}\ \begin{bmatrix}\textsc{h}|\textsc{spec} & \textit{synsem}\\ \textsc{marking} & \boxed{1}\end{bmatrix}\right] \vee \begin{bmatrix}\textsc{nonh-dtr}|\textsc{s}|\textsc{l}|\textsc{c}|\textsc{head} & \neg\left[\textsc{spec}\ \textit{synsem}\right]\\ \textsc{head-dtr}|\textsc{s}|\textsc{l}|\textsc{c}|\textsc{marking} & \boxed{1}\end{bmatrix} \right)$$

FIGURE 21. Marking Principle

reference to a MARKER-DAUGHTER attribute of a specific kind of structure, our version of the principle passes up the MARKING value of the non-head daughter if it is a functional element, i.e., bears a non-*none* SPEC value, and else that of the head daughter.

In the Semantics Principle of Pollard and Sag (1994, pp. 401/2) the semantic head is the syntactic head unless one of the daughters is an adjunct, in which case the adjunct daughter is the semantic head. We adopt this principle, but modify it so as to also make functional elements semantic heads as well.[12] The resulting Semantics Principle is shown in figure 22.[13]

$$\textit{phrase} \rightarrow \left[\textsc{s}|\textsc{l}|\textsc{cont}\ \boxed{1}\right] \wedge \left(\left[\textsc{nonh-dtr}|\textsc{s}|\textsc{l}\ \begin{bmatrix}\textsc{cat}|\textsc{h} & \left[\textsc{spec}\vee\textsc{mod}\ \textit{synsem}\right]\\ \textsc{cont} & \boxed{1}\end{bmatrix}\right] \vee \begin{bmatrix}\textsc{nonh-dtr}|\textsc{s}|\textsc{l}|\textsc{c}|\textsc{head} & \neg\left[\textsc{spec}\vee\textsc{mod}\ \textit{synsem}\right]\\ \textsc{head-dtr}|\textsc{s}|\textsc{l}|\textsc{cont} & \boxed{1}\end{bmatrix} \right)$$

FIGURE 22. Semantics Principle defining the semantic head

Finally, in figure 23 we specify the relevant part of the Constituent Order Principle. For verbal projections it defines a uniform head-last linearization of the phonology.

$$\begin{bmatrix}\textit{phrase} & \\ \textsc{s}|\textsc{l}|\textsc{c}|\textsc{head} & \textit{verb}\end{bmatrix} \rightarrow \begin{bmatrix}\textsc{phon} & \boxed{1} \oplus \boxed{2}\\ \textsc{nonh-dtr}|\textsc{phon} & \boxed{1}\\ \textsc{head-dtr}|\textsc{phon} & \boxed{2}\end{bmatrix}$$

FIGURE 23. Constituent Order Principle for verbal projections

[12]Since the MOD attribute of modifiers also has the function of specifying properties of the head-projection which the non-head combines with, one should consider eliminating the MOD attribute and doing all such selection via SPEC. We here focus on our main issue though and leave an exploration of this idea to future work.

[13]The Semantics Principle of Pollard and Sag (1994) also encodes the Cooper storage mechanism for quantifiers, which we ignore here.

5. Example analyses

With the theory in place, we can take a closer look at the analyses which we had sketched in section 3. We start with two analyses illustrating the basic sentence structure, before turning to the more interesting cases in involving coherent constructions.

5.1. Basic sentence structure. In figure 24 we see the analysis tree

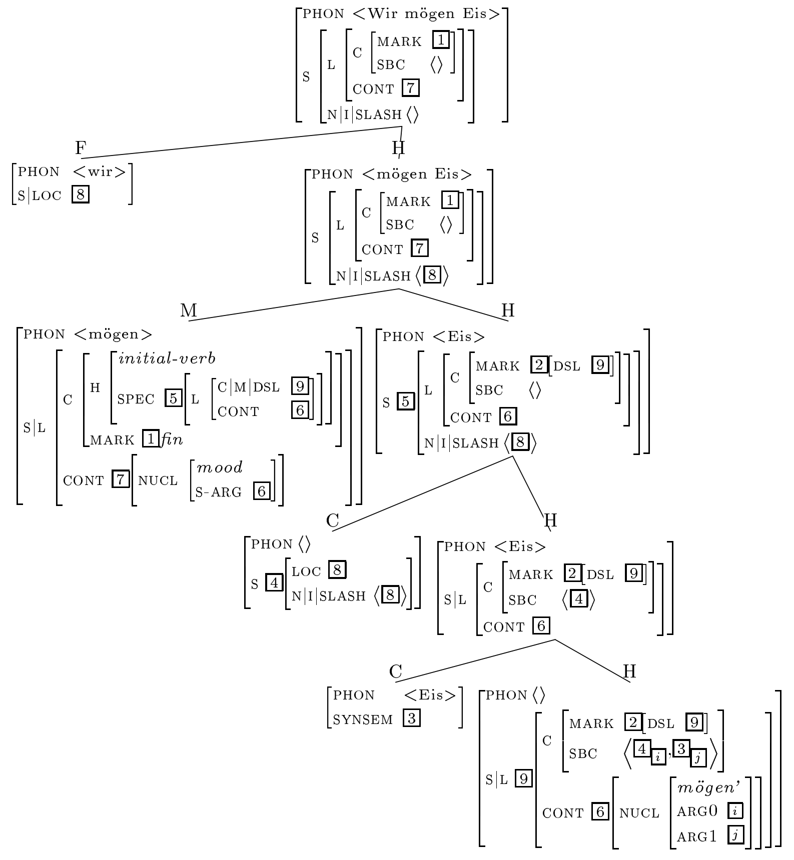


FIGURE 24. Analysis of a basic verb-second sentence

for the basic verb-second sentence we had sketched in figure 5 on page 198, adorned with the specifications from the theory wherever relevant for the analysis. Starting with the highest local tree, we see that the topicalized subject bearing the LOCAL value $\boxed{8}$ realizes the SLASH specification of the head daughter *mögen Eis*. One local tree further down, the verb-second verb *mögen* as *initial-verb* is a functional element specifying the SYNSEM value $\boxed{5}$ of the head daughter it combines with. As result of the Verb-Initial Lexical Rule, the DSL value of verb-initial *mögen* is specified to be the LOCAL value of a verb-last *mögen*. In our example tree, the DSL value $\boxed{9}$ of *mögen* is identified via the Selection Principle with the DSL value of the head daughter *Eis*. By virtue of the Marking Principle, the marking values of the head projection down to the empty verbal head are identical. The empty verbal head then identifies this DSL value with its own LOCAL properties. The *local* properties of the verb-last *mögen* serving as input to the verb-initial lexical rule thus turn up as LOCAL value of the head-movement trace. These properties include the subcategorization requirements of a transitive verb and the linking of the INDEX values of the subcategorized for arguments (marked by the subscripts $\boxed{i}$ and $\boxed{j}$) with the semantic roles ARG0 and ARG1 of the semantic relation *mögen'*. Finally, the subcategorization requirements of the transitive verb are realized in two steps. In the lowest tree, the head movement trace combines with the direct complement of *mögen* and one local tree higher with the (trace of the) subject.

Turning to basic verb-last sentences introduced by the complementizer *daß*, the lexical entry of the complementizer is shown in figure 25. Parallel

$$\begin{bmatrix} \text{PHON} & \langle \textit{daß} \rangle \\ \text{SYNSEM|LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{marker} & \\ \text{SPEC} & \left\langle \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{MARKING|DSL} & \textit{none} \\ \text{SBC} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{MARKING} & \textit{comp} \\ \text{SBC} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{NUCL} & \begin{bmatrix} \textit{assertion} & \\ \text{SOA-ARG} & \boxed{1} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

FIGURE 25. Lexical entry for the complementizer *daß*

to verb-first/second verbs it is a functional element selecting a single element via SPEC. Following an idea of Jacobs (1984) introduced to HPSG by

Kiss (1995b, p. 205), we assume that the complementizer *daß* semantically introduces an assertion operator which we notate with the type *assertion*. The parallelity of verb-first/second verbs and complementizers thus also carries over to the semantic structure of these functional elements, since following Kiss (1995b, p. 229) the semantics of verb-initial verbs as introduced by the Verb-Initial Lexical Rule in figure 17 on page 208 also embeds the semantic contribution of the sentence under a *mood* operator, of which following *assertion* and *interrogative* are two subtypes (which are only partially determined by syntactic factors).

An analysis of a simple verb-last sentence introduced by the complementizer *daß* is exemplified in figure 26. The functional element *daß*

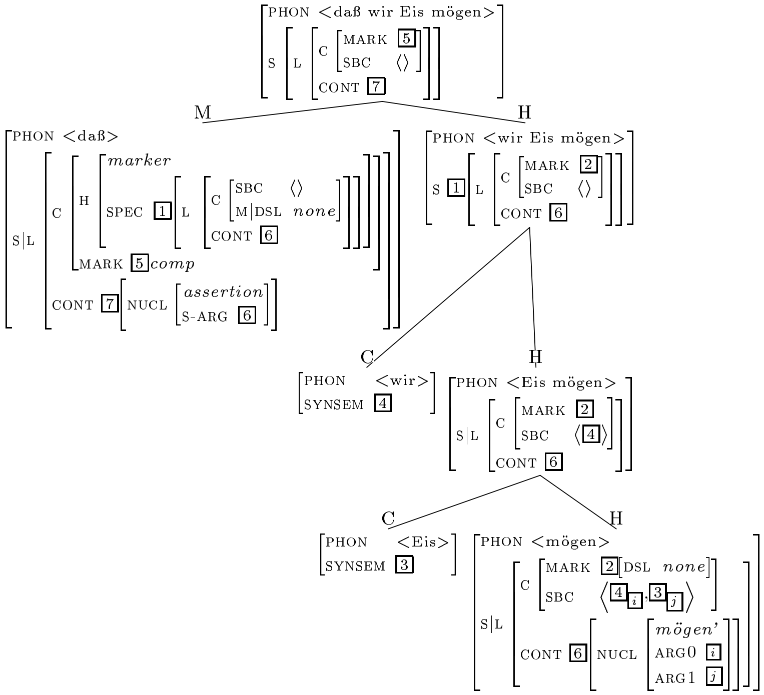


FIGURE 26. Analysis of a basic verb-last sentence

in the topmost local tree marks the saturated head-daughter so that the

SPEC value $\boxed{1}$ of *daß* is identified with the SYNSEM value of the the head-daughter. On the semantic side, the complementizer embeds the semantics of the sentence $\boxed{6}$ under an assertion operator. The lower part of the tree is identical to the verb-second sentence shown in figure 24 on page 211 except for the fact that the verbal head *mögen* and the subject *wir* this time appear in-situ.

5.2. Coherent Constructions. In figure 1 on page 192 we had envisaged an analysis of the example (172) repeated here as (178).

(178) um es haben^1(1_2) schreiben^3(1) zu können^2(2_3)
for it have write to be.able

The figure 27 on the next page shows the relevant parts of the analysis tree as it is licensed by the theory defined in section 4 above. The complementizer *um* in the highest local tree is a functional element specifying that the head-projection it combines with is an *unmarked* verbal projection in second status (*zu-inf*). This VFORM requirement is part of the HEAD value and therefore percolates along the head projection all the way down to the *können* which thus appears in second status. As obligatorily coherent subject-oriented equi verb *können* selects a [LEX +] complement and identifies the subject index $\boxed{i}$ of its own subject requirement ($\boxed{10}$) with that of its verbal complement ($\boxed{11}$). It forms a verbal cluster with *schreiben* and attracts its unrealized valence requirement $\boxed{6}$. Before this complement is realized, *haben* as functional element selects the verbal cluster. This is possible since the head-projection is rooted in *können* as the highest verb of the lower-field, which is one of the verbs permitting an upper-field and thus bears a positive PUF value as part of its lexical entry.

The second coherent construction we want to look at in some more detail is the substitute infinitive example (173) repeated here as (179).

(179) daß er sie hat^1(0) treffen^3(1) können^2(1_3)
that he her has meet be.able

The structure we had argued for in figure 2 on page 193 is now completed in figure 28 on page 216 with the relevant details as licensed by the theory. Parallel to the basic verb-last sentence in figure 26 on the preceding page, the complementizer *daß* selects a finite saturated complement $\boxed{4}$. The finiteness marking $\boxed{2}$ percolates down the head projection until the functional element *hat* is encountered which according to the Marking Principle receives the finiteness marking. The verb *hat* can be realized

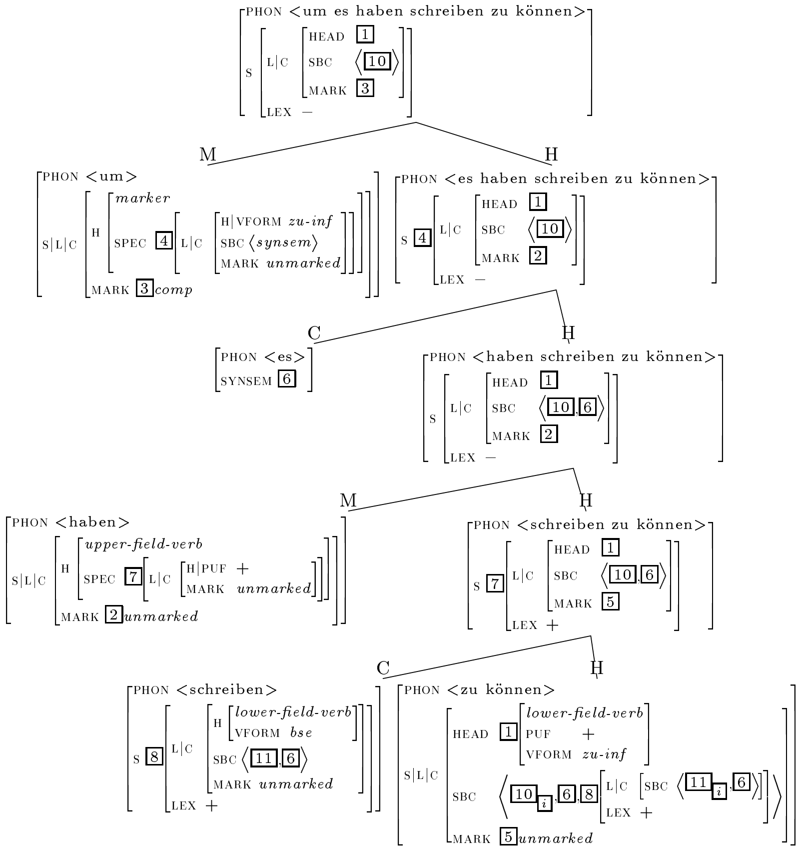


FIGURE 27. A sentence with an upper-field and a substitute *zu*-infinitive

in the upper-field since the highest lower-field verb *können* has a positive PUF value marking it as a verb which permits an upper-field construction. The obligatorily coherent verb *können* requires its verbal complement *treffen* to be [LEX +] and inherits the object requirement $\boxed{6}$. Parallel to the previous example, the subject-oriented equi verb *können* identifies the semantic index $\boxed{i}$ of the subject $\boxed{11}$ of its verbal complement with the semantic index of its own subject $\boxed{10}$. The subject $\boxed{10}$ and the inherited

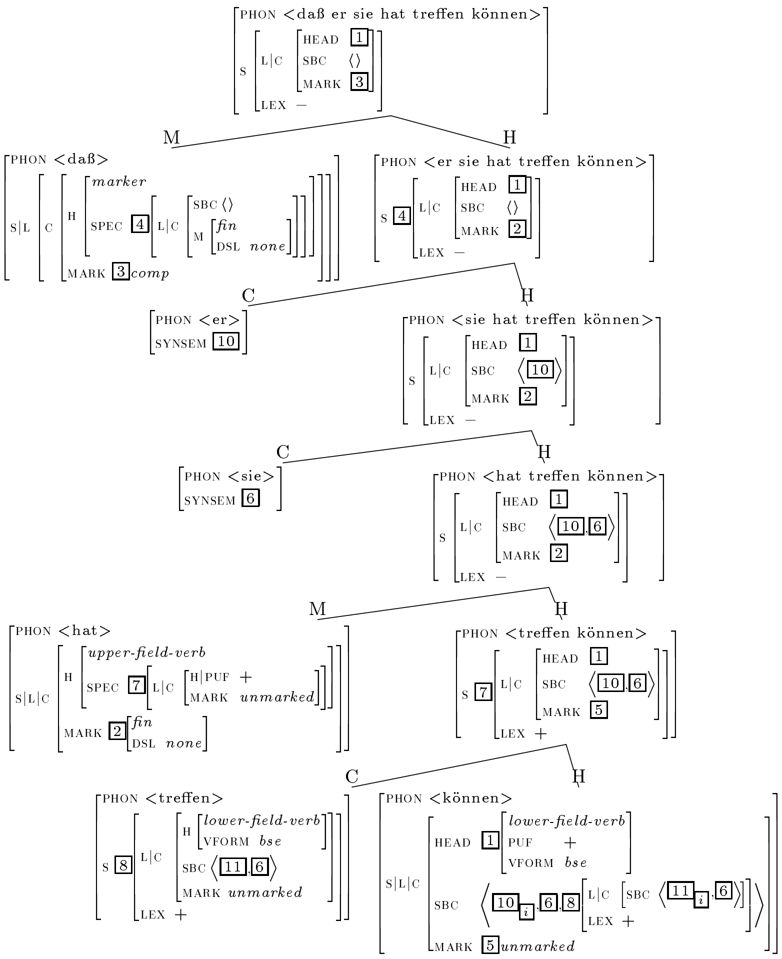


FIGURE 28. Upper-field with a substitute infinitive

object $\boxed{6}$ are realized once the two lower-field verbs have combined in a lexical cluster which is marked by the upper-field verb *hat*.

As last example we want to illustrate the right-branching verbal complex structure we had argued for in section 3.1. In figure 4 on page 196 we had

sketched a right-branching verbal complex structure for the example (175) repeated here as (180).

(180) daß er das Buch kopieren^{5}(1) wird^{1}(0) haben^{2}(1) lassen^{4}(1) müssen^{3}(1_3)
that he the book copy will have let must

The relevant part of the analysis tree as licensed by our theory is shown in figure 29 on the following page. As transitive verb, *kopieren* subcategorizes for two arguments, the subject $\boxed{4}$ and the object $\boxed{3}$. As part of the lexical entry of *kopieren*, the indices *i* and *j* of the two arguments are assigned to fill the two semantic roles of the predicate. The causative verb *lassen* at the bottom of the tree coherently ([LEX +]) selects the verbal complement *kopieren* ($\boxed{2}$) and attracts its unrealized complement $\boxed{3}$. Semantically, the index $\boxed{k}$ of the subject of *lassen* fills the subject role, the index $\boxed{i}$ of the unrealized subject of *kopieren* is identified with the object role of *lassen*, and the semantics of the verbal complement is identified with the state-of-affairs argument of *lassen*.

The subject-oriented equi verb *müssen* identifies the index *i* of its subject requirement $\boxed{11}$ with the index of the subject requirement $\boxed{10}$ of its verbal complement. As obligatorily coherent verb, it selects *lassen* ($\boxed{9}$) as a [LEX +] complement and attracts its non-subject subcategorization requirements $\boxed{2}$ and $\boxed{3}$, i.e., the verbal complement of *lassen* (*kopieren*) and the object of *kopieren* which had been attracted by *lassen*. As *müssen* is one of the verbs permitting upper-field formation, it has a positive PUF value. So once *müssen* combines with its verbal complement *lassen* in the lowest tree, this verbal cluster can combine with the upper-field verb *haben*. The content of *haben*, $\boxed{15}$, embeds the semantics of the lower-field projection $\boxed{14}$. Since *haben* as functional element is the semantic head of the construction, its content value ($\boxed{15}$) is identified with that of the mother. One local tree higher up, we have a parallel construction. This time the head projection of *müssen* combines with *wird* as upper-field verb. Finally, the verbal complement $\boxed{3}$ which *müssen* had attracted from *lassen*, is realized as a complement of the head projection of *müssen*.

Finally, let us take a look at the percolation of finiteness and the status selection going on in this example. The sentence is finite, which as part of the MARKING value $\boxed{2}$ percolates along the head projection down to *wird haben lassen müssen*. Since we restricted finiteness marking to otherwise unmarked, i.e., [VFORM *bse*] verbal projections (cf., figure 10 on page 203), the VFORM specification as part of the HEAD value $\boxed{1}$ has to be *bse*.

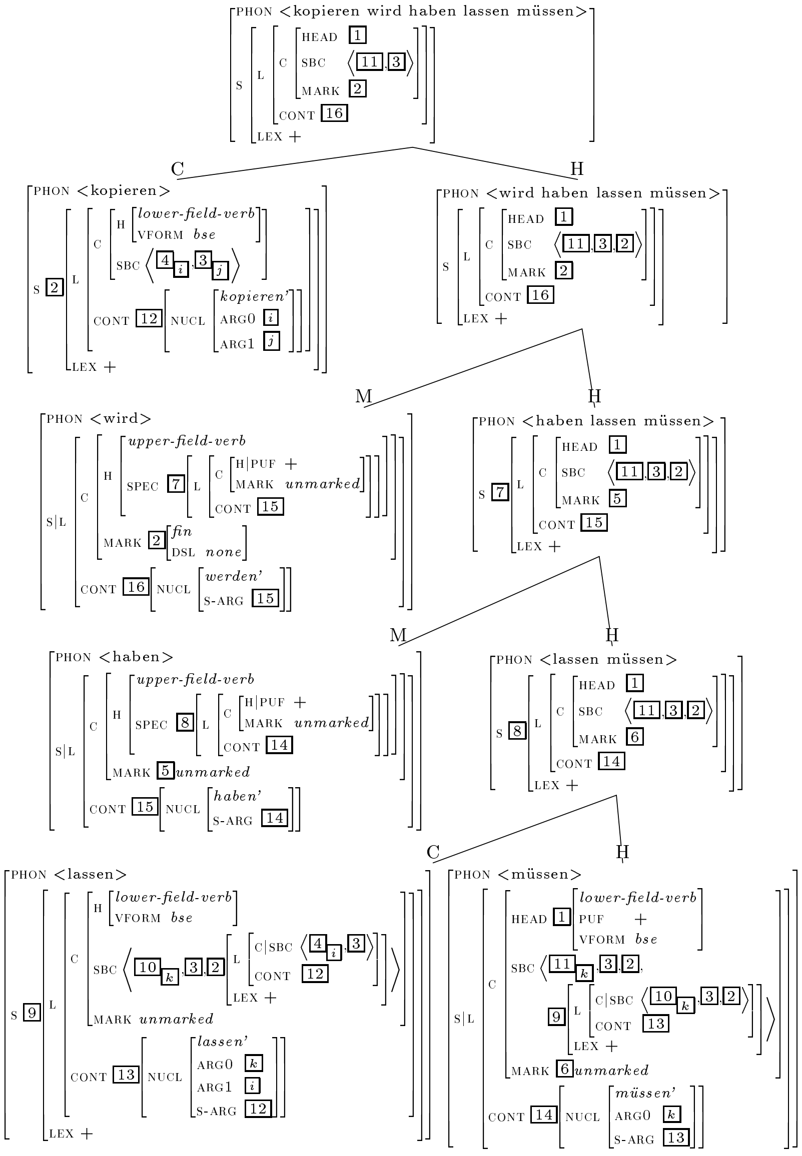


FIGURE 29. Licensing the final-field in a lower-field split example

The node *wird haben lassen müssen* dominates a tree in which the functional upper-field verb *wird* selects the head daughter *haben lassen müssen* ($\boxed{7}$) and requires it to be *unmarked*. The finite marking value $\boxed{2}$ of the mother correctly percolates down to the verb *wird* since it is the functional daughter selecting via SPEC. As mentioned above, the head daughter *haben lassen müssen* is *unmarked* and as part of the HEAD value $\boxed{1}$ has a VFORM value *bse*. This VFORM specification percolates along the head projection all the way down to *müssen*, which is correctly realized in first status.

The status of the other three verbs are straightforward. The second upper-field verb *haben* by virtue of being an upper-field verb only exists as a finite or base form verb. It cannot be finite since then the projection marked by the finite upper-field verb *wird* would be finite, in contradiction to what is required by *wird* via SPEC. The verbal complement of *müssen*, the verb *lassen*, is required to be a base form verb due to the lexical specification of the subcategorization frame of *müssen*. And finally, the full verb *kopieren* has to be realized in first status since this is what the lexical entry of *lassen* requires of its verbal complement.

5.2.1. *Semantic structure and scope bearing elements.* Since it is not self-evident that a right-branching verbal complex structure like the one shown in figure 29 on the facing page supplies the correct semantic functor-argument structure, let us briefly comment on why this is the case. Syntactically, the lexical specification of subcategorization requirements together with argument attraction as encoding of coherence supports a right-branching structure in which upper-field verbs can attach as functional elements along the head-projection of the highest lower-field verb (in the above case *müssen*). The semantic functor-argument structure, on the other hand, follows the lexically specified subcategorization, with the upper-field verbs functioning as operators embedding the highest functor of the lower-field (which they syntactically attach to). Figure 30 on the next page highlights the functor-argument structure resulting as semantics of the above example.

While this provides an exemplary answer to the question of how the right semantic functor-argument structures are obtained despite of the non-traditional right-branching syntactic structures we assume, we should also briefly address the question of the interpretation of negation and other scope bearing adverbials. The interesting question here is how we obtain the two readings in a coherent example like (181) which we discussed as (50) on p. 36.

$$\boxed{16}\begin{bmatrix}\text{NUCL}\begin{bmatrix}\textit{werden'}\\ \text{S-ARG}\ \boxed{15}\begin{bmatrix}\text{NUCL}\begin{bmatrix}\textit{haben'}\\ \text{S-ARG}\ \boxed{14}\begin{bmatrix}\text{NUCL}\begin{bmatrix}\textit{müssen'}\\ \text{ARG0}\ \boxed{k}\\ \text{S-ARG}\ \boxed{13}\begin{bmatrix}\text{NUCL}\begin{bmatrix}\textit{lassen'}\\ \text{ARG0}\ \boxed{k}\\ \text{ARG1}\ \boxed{i}\\ \text{S-ARG}\ \boxed{12}\begin{bmatrix}\text{NUCL}\begin{bmatrix}\textit{kopieren'}\\ \text{ARG0}\ \boxed{i}\\ \text{ARG1}\ \boxed{j}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

FIGURE 30. Semantic structure of the lower-field split example

(181) daß Karl laut zu reden versprach
that Karl loud to talk promised
a. promise(k,loud(talk(k)))
b. loud(promise(k,talk(k)))

In the discussion of the issue at the end of section 2.3 in chapter 2 we mentioned that one can interpret this ambiguity in terms of the multiple possibilities of assigning the adverbial to a verb-field. In (181) the adverbial *laut* can either be a dependent of *versprach* or of *zu reden* since both verbs form a single coherence-field in which the dependents of both verbs can scramble. We want to propose to take this notion of an adverbial as a dependent of a verb seriously, in the sense that adverbials should be lexically introduced as dependents of the verb they semantically modify. As basis for the formalization of this idea in HPSG, one can build on the work of Bouma et al. (1998) who suggest to extend the representation of words with a DEPENDENTS list which represents adjuncts on a par with arguments. To capture that in a coherent construction the dependents of the two verb-fields are joined in a single coherence-field, one then needs to generalize argument raising as encoding of coherence in HPSG to a notion of dependent raising. In section 6 of chapter 9 we show how this can be done.

6. Open issues

In the previous section we worked out and exemplified the idea that upper-field verbs do not construct as heads but as functional elements specifying a head projection. This idea was built on the empirical observation made in chapter 3 that upper-field verbs regarding their status and word order

properties do not pattern as would be expected of verbal heads in a head-complement construction. Regarding the status properties, we interpreted the two substitute cases in which an upper-field verb fails to govern the usual status of its verbal complement as an indication of the fact that upper-field verbs are taken out of the status government chain. While it does indeed seem to be the case that no verb ever governs the status of an upper-field verb, the example in (182) mentioned by Askedal (1991, p. 7) sheds some doubt on whether an upper-field verb never governs the status of its complement.

(182) die der faschistischen Woge noch einen Damm schienen^1(0)
which the fascist wave still a dam seemed
entgegensetzen^3(1) zu können^2(2)
put up to be-able
'which seemed to be able to resist the fascist wave'

There are two possible analyses for this example. Under the first analysis, the sentences is an instance of a coherent construction in which *scheinen* occurs in the upper-field. In that case one has to extend the class of verbs which have been considered to be possible upper-field verbs in the literature. And since *schienen* in (182) governs the second status of *zu können*, this analysis would constitute an exception to our generalization that upper-field verbs are excluded from the status government chain.[14]

The second possible analysis would group this example with the example (183) mentioned by Askedal (1991) in the same context.

(183) daß sie eine Absicht glaubten^1(0) verbergen^3(1) zu können^2(2), die
that they an intention believed hide to be.able which
so zutage lag
so open lay
'that they believed to be able to hide an intention, which was so clearly visible.'

We discussed this example as (126) in section 2.1 of chapter 3 and showed it to be an instance of the so-called *third construction*, in which instead

[14] Of course, this would not force us to abandon the underlying idea that the syntactic mode of construction of upper-field verbs is responsible for the observable word order and status irregularities. But even though we had good reasons to argue that finiteness assignment differs from non-finite status government, assuming a similar distinction between third status assignment (which is impossible from the upper-field) and second status assignment (which this example suggests to be possible from the upper-field) would clearly water down the generalization that upper-field verbs are exempt from status government.

of an upper-field preceding a lower-field, we have a single lower-field verb followed by a second 'extraposed' lower-field. Unfortunately, the embedding test we used for determining that the verb *glaubten* in (183) is not part of the upper-field is problematic with respect to (182) since *scheinen* generally resists being embedded. In any case, analyzing the example (182) as an instance of the third construction would require an analysis of the third construction in which the second lower-field does not follow the first as the result of ordinary extraposition, since the verbal complement of an obligatorily coherent verb like *scheinen* cannot be extraposed. As the question which analysis should be assumed for the third construction is far from having been conclusively answered, we for now have to leave the proper analysis of examples like (182) as an open issue.

Going over other obligatorily coherent subject-to-subject raising verbs governing a second status, the use of *haben* as a modal auxiliary governing second status seems to be another candidate parallel to *scheinen*. In (184a) we see a verb-second sentence using *haben* governing a second status. Note that the second status on the highest lower-field verb *können* is obligatory, a substitute first status is not available. For some speakers, this modal use of *haben* can marginally also occur in the upper-field (184b) and, in contradiction to our original assumption, regularly governs the second status of the highest upper-field verb. The marginality of such examples might be independent of the upper-field occurrence as such, since a lower-field occurrence of this modal use of *haben* as in (184c) appear to be similarly degraded.

(184) a. Als Clown hat^1(0) er lachen^3(1) zu können^2(2) / *können^2(1).
as clown must he laugh to be.able
'As a clown, he must be able to laugh.'

b. ?? daß er als Clown hat^1(0) lachen^3(1) zu können^2(2)
because he as clown must laugh to be.able

c. ?? daß er als Clown lachen^3(1) zu können^2(2) hat^1(0)
that he as clown laugh to be.able must

Related to these apparent exceptions to the regularity that a upper-field verbs do not properly govern status, Bech (1955, p. 67) and Jørgensen (1966, p. 160) mention another interesting example with the perfect auxiliary *haben*. In (185) the perfect auxiliary appears to be in the upper-field and yet the highest lower-field verb *geglaubt* is a regular past-participle form and not the substitute infinitive which normally has to occur in such a construction.

(185) daß der Mann sich sogar die höfliche Phrase einer Einladung
that the man REFL *even the courteous phrase of.an invitation*
hatte^1(0) ersparen^4(1) zu können^3(2) geglaubt^2(3)
had spare to be.able believed
'that the man had even believed to be able to spare himself the trouble of a courteously phrased invitation'

Normally, the verb *glauben* is not a verb which as highest verb in the lower-field permits an upper-field and it thus does not occur as a substitute infinitive. As illustrated by (186) a substitute infinitive is not an option in the problematic sentence.

(186) * daß der Mann sich sogar die höfliche Phrase einer Einladung
that the man REFL *even the courteous phrase of.an invitation*
hatte^1(0) ersparen^4(1) zu können^3(2) glauben^2(1_3)
had spare to be.able believe

The example (185), of course, is not only a problem for our idea of excluding upper-field verbs from status government but also for all more traditional analyses of the substitute infinitive we are aware of.

Finally, one could try to find further empirical arguments bearing on the issue of substitute status assignments. We have tried to deduce the substitute infinitive and the substitute *zu*-infinitive from the upper-field occurrence of the status assigner, which we claim to be exempt from the hypotactic status government chain. Traditionally, it has been argued that it is a property of the perfect auxiliary *haben* that some of the complements it governs show up in a special past-participle form, the substitute infinitive (which in that view is not an infinitive but a special form of a past participle). Our view that it is the upper-field occurrence which is causing the apparent failure of status government would receive significant support if one could find cases with substitute *zu*-infinitives where not *haben* but another verb occurs in the upper-field. Unfortunately, the very limited number of possible upper-field verbs in current German makes finding such constructions unlikely. The future auxiliary *werden*, for example, cannot occur in such constructions since it seems to be limited to finite occurrences and the substitute *zu*-infinitive can only arise in non-finite constructions (as the *zu*-infinitive has to be assigned from outside the coherence-field). And since modal verb occurrences in the upper-field are already marginal or archaic, one does not easily find examples in corpora in which such upper-field verbs co-occur with in the rare substitute *zu*-infinitive construction. Constructed examples such as the ones below appear to be ungrammatical, but perhaps a sentence like (188b) is not impossible.

(187) a. ohne es bekannt werden^3(1) lassen^2(1) zu wollen^1(2)
without it known become let to want
'without wanting to let it become known'

b. ?* ohne es wollen^1(1_2) bekannt werden^3(1) zu lassen^2(2_1)
without it want known become to let

(188) a. Er scheint^1(0) es veröffentlichen^4(1) lassen^3(1) zu müssen^2(2).
he seems it publish let to must
'It seems that he must ask someone to publish it.'

b. ?* Er scheint^1(0) es müssen^2(1_2) veröffentlichen^4(1) zu lassen^3(2_1).
he seems it must publish to let

a. ?? Er scheint dies nachweisen können zu müssen.
he seems this prove be.able to must
'It seems that he must be able to prove this.'

b. ? Er scheint dies müssen nachweisen zu können.
he seems this must prove to be.able

7. Situating the proposal and summing up

Let us conclude this chapter by situating our proposal with respect to the previous work in the HPSG paradigm on coherent constructions. In chapter 7 we had introduced three approaches to coherent constructions within the HPSG paradigm. They differ in assuming a left-branching verbal complex (Hinrichs and Nakazawa, 1994a), a right-branching verbal complex (Kiss, 1995a), or a flat sentence structure without a verbal complex (Nerbonne, 1994). To license the percolation and realization of valence requirements in these structures, all three approaches rely on the argument raising specification of Hinrichs and Nakazawa (1989) though.

Empirically we established in chapter 7 that, based on the argument raising technique, all three types of theories can account for the phenomenon of PVP topicalization, which one might not have expected for approaches licensing right-branching structures. Regarding another empirical criterion for distinguishing the three constituent structure options, Hinrichs and Nakazawa (1989, 1994a) claim that the upper-field linearization phenomenon supports an analysis licensing left-branching structures since such a structure makes it possible to license the upper-field as nothing

but an alternative linearization in the highest local tree of the verbal complex. The lower-field split phenomenon, however, which we discussed as an alternative linearization of the upper-field in section 2.1.3 of chapter 3, makes such a linearization analysis of the upper-field implausible. This is the case since in the lower-field split cases the head appears in-between the sequence of verbs it selects as complement so that the relevant linearization cannot be obtained by reordering in a local tree. The lower-field split phenomenon is equally problematic for all proposals in the principles and parameters paradigm we are aware of. Kathol (1995, sec. 7.1.1) therefore discusses the alternative upper-field linearization phenomena presented in Meurers (1994a) under the heading of problems for a phrase structure-based account of the verb cluster and interprets them as motivation for a dissociation of constituent and linearization structure. In the tradition of Reape (1996), he proposes linearization domains which are larger than a local tree and shows that such an architecture can license the lower-field split and upper-field left dislocation phenomena. Bouma and van Noord (1998) agree with the conclusion of Kathol (1995) that larger linearization domains are needed to handle the alternative upper-field linearization examples, but instead of dissociating the linearization from the constituent structure they follow the tradition of Nerbonne (1994) in obtaining the larger linearization domains by entirely flattening the constituent structure.

In essence, both the approach of Kathol (1995) and that of Bouma and van Noord (1998) keep the idea of Hinrichs and Nakazawa (1994a) to use special linearization rules to account for the irregular word orders. But they extend the coverage of this idea to the alternative upper-field phenomena by allowing a wider range of linearizations – be it by extending the linearization mechanism beyond local trees or by flattening the sentence into a single local tree. The discrepancy between the properties expected of head-complement constructions as discussed in chapter 2 and the properties which can be observed with coherent constructions is thus met by providing more possibilities for specifying irregular properties and not by reconsidering the analysis of coherent constructions in order to narrow down the gap between the observed properties and those generally expected of head-complement constructions. For example, none of these approaches support a uniform daughter linearization for heads of the same category. And the occurrence of the two kinds of substitute infinitives has to be stipulated and explicitly related to the various irregular linearizations they occur in.

The analysis we presented in this chapter is an attempt to question the traditional perspective on the irregular status and word order phenomena in the verbal complex. We showed that eliminating upper-field verbs from the hypotactic status government chain makes it possible to provide a completely regular analysis of the problematic status government phenomena.[15] Combining this reinterpretation of upper-field verbs with an analysis relating verb-second occurrences of verbs to a base position in the upper or in the lower-field, our proposal also predicts the optionality of the substitute infinitive of AcI verbs in verb-first and second sentences. Regarding the irregular word orders, an analysis of upper-field verbs as functional elements outside of the hypotactic chain of ordinary verbal heads allows upper-field verbs to attach anywhere along the head projection of the highest lower-field verb, which correctly characterizes the possible upper-field linearizations and predicts that only subject-oriented verbs can occur in the upper-field. With respect to the idea of mapping non-finite constructions onto the properties expected of general head-complement constructions, the revised perspective on upper-field verbs makes it possible to close at least part of the gap between the expected properties and those observable with coherent constructions, which is also illustrated by the possibility of assuming a uniform head-final linearization in the binary-branching structures licensed by our theory.

While the reinterpretation of upper-field verbs is successful in deriving the well-known status and word order irregularities from a single source, it also directs the view to interesting new data which could be problematic for such an approach, such as occurrences of *scheinen* which possibly should be analyzed as part of the upper-field. Even though we have to leave this issue unresolved, we believe to have shown that deriving the idiosyncratic linearization and status properties of certain coherent constructions from a special syntactic status of upper-field verbs instead of assuming special morphological forms and special linearizations for the cases when status government overtly breaks down is an alternative worth considering.

[15] A related idea for breaking the status government chain of upper-field verbs is also sketched by Haider et al. (1995a, p. 12) who write: "The IPP, on the other hand, results when two infinitives (the IPP being a lexically underspecified version of the participial in this case) form a base-generated complex V containing two minimal Vs. This complex V projects to VP, but due to its unmarked character isn't status governed and consequently isn't bound to the matrix verb's governing direction."

CHAPTER 9

Partial Constituents

1. Introduction

The issue of partial constituent topicalization has already surfaced several times in this thesis, both as empirical phenomenon relevant for the sub-classification of verbs with non-finite complements in part one and as challenge to the theory of constituency in chapter 7. As we saw in that chapter, the attention in the HPSG paradigm has focused on the topicalization of partial verb phrases. But G. Müller (1993, 1996a) and others noted that partial constituent fronting in German also occurs with nominal and adjectival phrases. A simple example for each of the categories is shown in (189).

(189) a. [Verkaufen] wird er *das Pferd*.
sell will he the horse
'He will sell the horse.'

b. [Ein Buch] hat Hans *über Syntax* ausgeliehen.
a book has Hans on syntax borrowed
'Hans borrowed a book on syntax.'

c. [Stolz] ist er *auf seine Kinder* gewesen.
proud is he of his children been
'He was proud of his children.'

In (189a), the transitive verb *verkaufen* has been fronted, leaving its complement, the NP *das Pferd*, behind. In (189b), the NP *ein Buch* is topicalized without its PP complement *über Syntax*. And in (189c), the AP *stolz* has been fronted, leaving its PP argument *auf seine Kinder* behind.

This chapter integrates work presented in De Kuthy and Meurers (1998a,b) and is partly identical to De Kuthy and Meurers (1999a,b).

As for the theoretical consequences drawn from such data, two ideas pursued in the principles and parameters paradigm are that (i) the constructions involve movement of a constituent containing a trace, so-called *remnant movement* (Thiersch, 1985; Webelhuth and Besten, 1987; G. Müller, 1996a) or that (ii) "small" constituents can be topicalized which are licensed with the help of special processes like *reanalysis* (Fanselow 1987, for partial NPs). Parallel to these two ideas, HPSG approaches to partial VP topicalization have proposed a remnant movement-like analysis (Hinrichs and Nakazawa, 1994b) or employed *argument raising*, a lexicalized variant of functional composition which supports partial structures like those resulting from reanalysis (Pollard, 1996; Hinrichs and Nakazawa, 1994b; Nerbonne, 1994; Kathol, 1995, sec. 7.7; Meurers, 1999a; St. Müller, 1997; Bouma and van Noord, 1998, sec. 3.4). One of the arguments against reanalysis fielded by G. Müller (1991, 175) is that a reanalysis rule cannot properly be expressed in the GB framework. Therefore, an interesting aspect of the parallel development in the two frameworks is that the argument-raising approaches in HPSG give a formally precise rendering to a notion of reanalysis. Independent of the mechanisms used, we will use the term *reanalysis-like* to refer to any analysis licensing partial constituents as "small" constituents.

Given this state of affairs, the purpose of this chapter, which integrates and extends our work presented in De Kuthy and Meurers (1998a,b), is twofold: Firstly, we reevaluate the empirical basis of the choice between the two analysis ideas proposed in the literature, remnant movement and reanalysis. More specifically, we show that the empirical arguments that are presented by G. Müller (1996a) in favor of an extraction analysis are not convincing, and we provide empirical evidence supporting a reanalysis-like approach. The second purpose of this chapter is to provide an explicit theory licensing reanalysis-like structures for partial constituents of three different categories. In order to extend the empirical coverage of previous reanalysis-like theories in such a way, we first discuss and compare the partial constituents of the three different categories illustrated in (189) in order to highlight the similarities and the differences in the three sets of data. Finally, we provide a theory licensing reanalysis-like structures in an HPSG architecture.

2. Remnant movement vs. reanalysis

It is traditionally assumed that verb-second clauses in German are derived from verb-first structures by extracting an element and fronting it. A second assumption which is made in the principles and parameters paradigm is that the fronted element has to be a maximal projection, an assumption which follows from Chomsky's 1986 restrictions on movement and X-bar theory: movement is restricted to XPs and X^0-categories, every non-head is an XP, and the landing site of fronted elements is a non-head position.

Under these assumptions, the partial fronting phenomenon in German exemplified in (189) is a serious problem. One of the solutions to this problem is the *remnant-movement* approach, which assumes that the apparently partial, fronted constituents are in fact full XPs containing a trace of the argument left behind in the Mittelfeld, so-called *remnant categories*. While such an approach faces certain theoretical problems concerning the question of how a trace can be bound by a filler occurring configurationally lower in the tree, in the following we focus on the empirical arguments which G. Müller (1996a) provided to justify the existence of remnant categories. We start our empirical reevaluation with nominal complements, a domain on which much of the remnant movement vs. reanalysis debate has focused.

2.1. Nominal complements. Example (190) shows a sentence in which the PP argument of a noun has been topicalized.

(190) *Über Syntax* hat Hans sich [ein Buch] ausgeliehen.
on syntax has Hans himself a book borrowed
'Hans borrowed a book on syntax.'

Webelhuth (1992), G. Müller (1996a), and others argued that in such sentences the PP has been extracted from the NP. But as pointed out by Fanselow (1987), sentences like (191) are problematic for this assumption, since the extraction source *ein Buch* and not the extracted element *über Syntax* has been fronted.

(191) [Ein Buch] hat Hans sich *über Syntax* ausgeliehen.
a book has Hans himself on syntax borrowed

For such examples, G. Müller (1996a) proposes a remnant movement account in which the fronted NP contains a trace of the PP argument. The alternative reanalysis approach of Fanselow (1987) for the two kinds of examples in (190) and (191) is to employ a reanalysis rule that splits up the complex NP into a partial NP and a PP which are sisters in the VP.

2.1.1. *Aspects of a remnant-movement analysis.* G. Müller (1996a) argues for a remnant-movement analysis by showing that the NP remaining in the Mittelfeld in (190) and the fronted NP in (191) obey the following restrictions to be expected from a constituent containing a trace.

Subject-object asymmetries. Firstly, he claims that fronting a PP argument of a subject NP and the reverse case of fronting an incomplete subject NP result in ungrammaticality, as is shown in (192). Since it is usually assumed that subjects in German may not contain a gap, this behavior would be predicted under a remnant-movement account.

(192) a. * *Worüber* hat [ein Buch] Karl beeindruckt?
about what has a book$_{NOM}$ *Karl*$_{ACC}$ *impressed*
'A book about what impressed Karl?'

b. * [Ein Buch] hat Karl *über Syntax* beeindruckt.
a book has Karl on syntax impressed

Haider (1993), however, presents examples like the ones shown in (193) which show that subject NPs can occur separate from their PP arguments.

(193) a. *Über Strauß* hat [ein Witz] die Runde gemacht.
about Strauß has a joke the round made
'A joke about Strauß went round.'

b. [Ein Witz] hat *über Strauß* die Runde gemacht.
a joke has about Strauß the round made

Specificity effect. Secondly, G. Müller (1996a) uses examples like (194) to show that both fronting out of an NP and the reverse case exhibit the "Specificity Effect", a classical restriction on extraction.

(194) a. * *Über Syntax* hat Karl [**das** Buch] gelesen.
on syntax has Karl the book read
'Karl read the book on syntax.'

b. ?? [**Das** Buch] hat Karl *über Syntax* gelesen.
the book has Karl on syntax read

Again, it was already shown by Pafel (1993) that the specificity of an NP in German does not disallow fronting of its argument PP in general

(195). As shown in (196), this is not even the case for the prime example of specificity, prenominal genitives.

(195) a. *Über Syntax* hat Karl nur **dieses**, aber nicht **jenes** Buch gelesen.
on syntax has Karl only this but not that book read
'Karl only read this book on syntax and not that one.'

b. [Nur dieses Buch] hat Karl *über Syntax* gelesen.
Only this book has Karl on syntax read
'Karl only read this book on syntax.'

(196) a. *Über Syntax* hat Karl [nur **Margas** Buch] gelesen.
on syntax has Karl only Marga's book read
'Karl only read Marga's book on syntax.'

b. [Nur Margas Buch] hat Karl *über Syntax* gelesen.
only Marga's book has Karl on syntax read

Freezing effect. Finally, G. Müller (1996a) argues that a freezing effect can be observed: constituents appearing at the beginning of the Mittelfeld become opaque for extraction. He provides example (197) to show that this generalization carries over to the fronting of PP arguments of NPs – a claim which is falsified by examples like the one in (198) taken from Fanselow (1991).

(197) * *Worüber* hat [ein Buch] keiner gelesen?
about what has a book nobody read
'On what topic has nobody read a book?'

(198) *Worüber* kann [einen Südkurier-Artikel] selbst Peter nicht am
about what can a Südkurier article even Peter not at the
Strand verfassen?
beach write
'For which topic is it the case that even Peter cannot write an article about it for the Südkurier when he is at the beach.'

Summing up, none of the above arguments convincingly motivate the remnant-movement assumption that argument PPs are extracted out of NP. Next, we turn to the empirical claims made by the alternative hypothesis, the assumption that the complex NP is "reanalyzed" as two sister categories, a partial NP and a PP.

2.1.2. *Aspects of a reanalysis-like approach.* A reanalysis-like theory for the partial-NP phenomenon predicts that the partial NP and the PP can appear separate from each other as other sister constituents do. Regarding the word order possibilities in the Mittelfeld, example (199) illustrates that this prediction is correct. Both the partial NP and the PP can appear independently at the beginning of the Mittelfeld and (200) other material can appear in between the two constituents.

(199) a. Hans hat *über Syntax* während seines Studiums [nur drei
Hans has on syntax during his studies only three
Bücher] ausgeliehen.
books borrowed
'During his studies, Hans borrowed only three books on syntax.'

b. Hans hat [nur drei Bücher] während seines Studiums *über*
Hans has only three books during his studies on
Syntax ausgeliehen.
syntax borrowed

(200) a. Hans hat schließlich [drei Bücher] bei Osiander *über Syntax*
Hans has finally three books at Osiander on syntax
gekauft.
bought
'Hans finally bought three books on syntax at Osiander.'

b. Hans hat schließlich *über Syntax* bei Osiander [drei Bücher]
Hans has finally on syntax at Osiander three books
gekauft.
bought

Further support comes from an observation made by Grewendorf (1989, 46), who notes that independently of the PP, the NP can occur to the right of an upper-field verb in the upper-field left dislocation phenomenon which we had introduced in section 2.1.3 chapter 3:

(201) Niemand hätte gedacht,
nobody had-SM *thought*

a. daß Hans *über Becker* würde [einen Sieg] erringen können.
that Hans against Becker would a victory win be able
'Nobody would have thought that Hans could win against Becker.'

b. daß er über Syntax würde [ein Buch] ausleihen müssen.
that he on syntax would a book borrow have to
'Nobody would have thought that he would borrow a book on syntax.'

Under a reanalysis approach one would also expect that the reverse case, where the PP argument instead of the partial NP is included in the upper-field, should be grammatical. But the examples in (202) appear to be of questionable grammaticality.

(202) Niemand hätte gedacht,
nobody had-SM *thought*

a. ? daß Hans [einen Sieg] würde *über Becker* erringen können.
that Hans a victory win would against Becker be able

b. ? daß er [ein Buch] würde über Syntax ausleihen müssen.
that he a book would on syntax borrow have to

However, Tilman Höhle (p.c.) points out that there appear to be more acceptable instances of such a construction, such as example (203).[1]

(203) Wenn ich derart informative Arbeiten hätte über Semantik finden
if I such informative works had-SM *on semantics find*
können, hätte ich dir die auch noch mitgebracht.
be.able had-SM *I you these also still bring.with*
'Had I been able to find such informative works on semantics, I would have brought you those as well.'

We therefore conclude that the prediction of the reanalysis approach that the PP and the partial NP behave like independent sister constituents appears to be on the right track.

2.2. Verbal complements.

2.2.1. *Aspects of a remnant-movement analysis.* As introduced in chapter 2, Bech (1955) established that for a certain class of verbs requiring an infinitival complement, the arguments of the head of an infinitival complement can be permuted with other elements in the Mittelfeld. The *coherently* constructing verbs allow this permutation, the *incoherently* constructing ones do not.

(204) a. daß *das Pferd* keiner [zu verkaufen] versucht hat.
that the $horse_{A''}$ $nobody_{N'}$ *to* $sell_{V''}$ $tried_{V'}$ *has*
'that nobody tried to sell the horse.'

[1] In the discussion of the partial NPs embedded in fronted VPs in section 3.4, a different construction in which the partial NP actually does not behave parallel to the PP is discussed. As we will see, the ungrammaticality of that construction can, however, be independently explained.

b. * daß *das Pferd* keiner [zu verkaufen] abgelehnt hat.
that the horse$_{A''}$ *nobody*$_{N'}$ *to sell*$_{V''}$ *disapproved*$_{V'}$ *has*
'that nobody disapproved of selling the horse.'

Following an idea of Thiersch (1985), G. Müller (1996a, 18) argues that this contrast can be derived if one assumes that coherently constructing verbs like *versuchen* allow scrambling out of their verbal complement, while obligatorily incoherent verbs like *ablehnen* do not. It is assumed that scrambling is an instance of movement so that the constituent *zu verkaufen* in (204a) is a remnant category containing a trace of the scrambled NP *das Pferd*.

A similar contrast arises with partial VP topicalization: Obligatorily coherent verbs like *werden* in (189a), repeated here as (205a), and optionally coherent verbs like *versuchen* in (205b) allow PVP topicalization, while obligatorily incoherent ones like *empfehlen* in (205c) do not.

(205) a. [Verkaufen] wird er *das Pferd*.
sell will he the horse
'He will sell the horse.'

b. [Zu verkaufen] versuchte er *das Pferd*.
to sell tried he the horse
'He tried to sell the horse.'

c. * [Zu verkaufen] empfahl er ihr *das Pferd*.
to sell advise he her the horse
'He advised her to sell the horse.'

Under the remnant movement idea sketched above, the explanation for these data is straightforward: A coherently constructing verb like *versuchen* in (205a) allows scrambling out of its verbal complement and the resulting remnant VP can then be topicalized. The verbal complement of an incoherently constructing verb like *empfehlen* in (205c) is not transparent for scrambling and thus the occurrence of a remnant VP is ungrammatical.

However, while the remnant movement analysis makes the correct predictions for the data presented above, certain word order phenomena involving coherent and incoherent infinitives are problematic for such an explanation. We mentioned at the beginning of this section that in the remnant movement approach the fronted element is always analyzed as a complete XP category. These categories can undergo topicalization (206), and they can also be scrambled to the beginning of the Mittelfeld (207).

(206) a. [Das Pferd zu verkaufen] wird er noch heute versuchen.
the horse to sell will he still today try
'He will try to sell the horse today.'

b. [Das Pferd zu verkaufen] wird er ihr noch heute empfehlen.
the horse to sell will he her still today advise
'He will advise her to sell the horse today.'

(207) a. Er wird [das Pferd zu verkaufen] noch heute versuchen.
he will the horse to sell still today try

b. Er wird [das Pferd zu verkaufen] ihr noch heute empfehlen.
he will the horse to sell her still today advise

It therefore comes as a surprise that scrambling of complete infinitival complements of obligatorily coherent verbs is not possible (208a) even though the infinitival complements of such heads can be topicalized (208b).

(208) a. * Er wird [das Pferd verkaufen] noch heute wollen.
he will the horse sell still today want to
'He will want to sell the horse today.'

b. [Das Pferd verkaufen] wird er noch heute wollen.
the horse sell will he still today want to

A second problem for the remnant movement explanation comes from the assumptions that a coherent infinitive is transparent for scrambling and that PVP fronting is the result of topicalizing a remnant category emptied in this way. Why is it then that another instance of movement, namely scrambling of this remnant infinitival complement, is ungrammatical? As shown in (209), partial verbal constituent can never occur at the beginning of the Mittelfeld.

(209) a. * Er wird [verkaufen] *das Pferd* noch heute.
he will sell the horse still today

b. * Er versuchte [zu verkaufen] *das Pferd* noch heute.
he tried to sell the horse still today

c. * Er empfahl [zu verkaufen] ihr *das Pferd* noch heute.
he advised to sell her the horse still today

Finally, Haider (1993, 281f) notes a related empirical problem of remnant movement. Since partial VPs are analyzed as complete VPs emptied by scrambling, it is predicted that elements which cannot undergo scrambling obligatorily have to surface as part of the fronted VP. The fact that German wh-indefinites cannot undergo scrambling in the Mittelfeld (210b) but do not have to be included in the fronted VP (210c) contradicts this claim.

(210) a. daß hier selten wem was auf Anhieb gelungen ist
that here rarely somebody something at once succeed is
'that it was rarely the case here that someone succeeded with something right away'

b. * daß hier selten was wem auf Anhieb gelungen ist
that here rarely something someone at once succeed is

c. Gelungen ist hier selten wem was auf Anhieb.
succeed is here rarely someone something at once

2.2.2. *Aspects of a reanalysis-like approach.* Reanalysis-like argument-raising approaches like the ones developed in the HPSG framework can account for the above data. The distinction between coherent and incoherent verbs is captured by specifying coherent verbs as obligatorily raising all complements of their verbal argument so that they become the arguments of a head cluster, whereas the complement of an incoherently selecting verb is required to be a complete VP. As a result, in the case of a coherent verb there is no full VP that could be scrambled to obtain examples like (208a). In a sentence with an incoherently selected infinitive such a VP exists and it can thus occur at different positions in the Mittelfeld (207). Finally, we already saw in chapter 7 that for non-local dependencies the requirement that coherently selected verbal complements combine in a verbal cluster is relaxed, as required for licensing (208b) but excluding (208a), (209a), and (209b).

3. Three categories of partial constituents: A comparison

3.1. Verbal complements. We start the comparison of the three categories of partial constituents with a recapitulation of the properties of verbal complements, many of which were introduced in the theoretically oriented section 2.2.

3.1.1. *Topicalized partial VPs.* The possibility of partial VP topicalization depends on the class of the governing verb. Obligatorily coherent verbs like *brauchen* and optionally coherent verbs like *versuchen* in (211) allow PVP topicalization, while obligatorily incoherent ones like *glauben* do not.

(211) [Zu verkaufen] braucht / versucht / * glaubt er *das Pferd* nicht.
to sell needs tries believes he the horse not
'He does not need to / try to / blieve to sell the horse.'

3.1.2. *Topicalized complete VPs.* Complete verbal complements can be topicalized independent of the embedding verb.

(212) a. [Das Pferd verkaufen] wird er noch heute wollen.
the horse sell will he still today want to
'He will want to sell the horse today.'

b. [Das Pferd zu verkaufen] wird er noch heute versuchen.
the horse to sell will he still today try
'He will try to sell the horse today.'

c. [Das Pferd zu verkaufen] wird er ihr noch heute empfehlen.
the horse to sell will he her still today advise
'He will advise her to sell the horse today.'

3.1.3. *Scrambled complete VPs.* Complete verbal complements can occur at the beginning of the Mittelfeld, but only when embedded under an incoherent verb as shown in example (213). The VP *das Pferd verkaufen* cannot occur at the beginning of the Mittelfeld when embedded under the obligatorily coherent verb *wollen*, but it can occur there when embedded under the optionally coherent verb *versuchen* or the obligatorily incoherent verb *empfehlen*.

(213) a. * Er wird [das Pferd verkaufen] noch heute wollen.
he will the horse sell still today want to

b. Er wird [das Pferd zu verkaufen] noch heute versuchen.
he will the horse to sell still today try

c. Er wird [das Pferd zu verkaufen] ihr noch heute empfehlen.
he will the horse to sell her still today advise

3.1.4. *Scrambled partial VPs.* Partial verbal complements can never occur at the beginning of the Mittelfeld. Thus, the occurrence of the partial infinitive *zu verkaufen* at the beginning of the Mittelfeld in example

(214) is ungrammatical with all three verbs, the obligatorily coherent verb *scheinen*, the optionally coherent verb *versuchen* and the obligatorily incoherent verb *glauben*.

(214) * Er scheint / versucht / glaubt [zu verkaufen] *das Pferd*.
he seems tries believes to sell the horse
'He seems to / tries to / believes to sell the horse.'

Askedal (1983, 187) discusses the following set of examples with scrambled partial VP complements in the Mittelfeld, which seem to be significantly better than the ones presented above.[2]

(215) a. Den alten Wagen hat er [zu fahren] noch nicht gelernt.
this old car has he to drive still not learned
'He still has not learned to drive this old car.'

b. Nach dem Vornamen des Fremden hat er [sie zu fragen] niemals gewagt.
after the first name of the foreigner has he her to ask never dared
'He never dared to ask her for the first name of the foreigner.'

c. Zahlreiche Bedeutungen ist er [auszudrücken] nicht imstande.
many meanings he is to express not capable
'He is not able to express many meanings.'

In contrast to the ungrammatical examples in (214), the partiality of the VP in the Mittelfeld in the examples in (215) results from topicalization of the complement from the VP. If one analyzes such examples of partial VPs as full VPs containing a trace for the topicalized element, the grammaticality of the examples in (215) patterns nicely with that of examples showing scrambled complete VP complements of incoherently constructing verbs, which we showed in (213).

3.1.5. *Scrambled complements of an infinitival complement.* Finally, in sentences with a coherent verb, an argument of the verbal complement can occur at the beginning of the Mittelfeld.

(216) a. Noch heute wird *es* der Mann [verkaufen] wollen.
still today will it the man sell want to
'The man will want to sell it today.'

[2] Askedal (1983, 187) himself marks these examples with a '?'.

b. Noch heute wird *es* der Mann [zu verkaufen] versuchen.
still today will it the man to sell try
'The man will try to sell it today.'

c. * Noch heute wird *es* der Mann [zu verkaufen] empfehlen.
still today will it the man to sell advise
'The man will advise selling it today.'

Thus, the occurrence of the complement of the embedded infinitive *zu verkaufen*, the pronoun *es*, at the beginning of the Mittelfeld is only grammatical with the coherently constructing verbs *wollen* and *versuchen* in (216a) and (216b), whereas it is ungrammatical with the incoherent verb *empfehlen* in (216c).

3.1.6. *Optionally and obligatorily coherent verbs.* In our discussion, we classified optionally coherent verbs as verbs which are lexically underspecified with respect to the way they select their verbal complement so that they have two options: they can occur in coherent or in incoherent constructions. A coherent construction with an optionally coherent verb thus does not differ from a coherent construction headed by an obligatorily coherent verb.

This view contrasts with that of Haider (1993, p. 282), who claims that there are differences between coherent constructions headed by an obligatorily coherent verb compared to those headed by an optionally coherent verb. He claims that optionally coherent infinitives only allow the topicalization of the entire non-finite complement or that of the head of the non-finite complement, but not the topicalization of a partial non-finite complement in which the head has combined with one of its arguments. He illustrates this with the following examples, of which the ones he marks as ungrammatical include a partially fronted constituent consisting of a head and some but not all of its arguments.

(217) a. daß er mir sein Argument (nicht) zu erläutern zu versuchen vergessen hat
that he me his argument (not) to explain to try forgotten has
'that he has (not) forgotten to try to explain his argument to me'

b. [Mir sein Argument zu erläutern] hat er nicht vergessen zu versuchen.
me his argument to explain has he not forgotten to try

c. * [Sein Argument zu erläutern] hat er mir (nicht) zu versuchen vergessen.
his argument to explain has he me (not) to try forgotten

d. [Zu erläutern zu versuchen vergesssen] hat er mir sein Argument nicht.
to explain to try forget has he me his argument not

(218) a. daß sie uns dies nie zu verheimlichen zu bewerkstelligen verstanden hätte
that she us this never to hide to manage understand had-SM
'that she would have never been capable to manage to hide this from us'

b. [Uns dies zu verheimlichen] hätte sie nie verstanden zu bewerkstelligen.
us this to hide had-SM she never understood to manage

c. * [Dies zu verheimlichen] hätte sie uns nie zu bewerkstelligen verstanden.
this to hide had-SM she us never to manage understood

d. * [Dies zu verheimlichen zu bewerkstelligen] hätte sie uns nie verstanden.
this to hide to manage had-SM she us never understood

e. [Zu verheimlichen zu bewerkstelligen verstanden] hätte sie uns dies nie.
to hide to manage understood had-SM she us this never

It is unclear why Haider provides such highly complex examples to illustrate his point, since his claim is very hard to evaluate on that empirical basis. Since the relevant situation only requires two verbs, let us examine his claim on the basis of simpler, more readily available sentences such as the ones in (219).

(219) a. Einen Ring zu schenken versuchte er ihr noch nie.
a ring to present tried he her still never
'He so far never tried to present her a ring.'

b. Einen Ring zu schenken hat er ihr noch nie versucht.
a ring to present has he her still never tried

The verb *versuchen* constructing in these example is an optionally coherent verb and in both examples in (219) the fronted verbal complement of this optionally coherent verb in violation of Haider's claim only includes one of the two arguments of the fronted non-finite head. We conclude that optionally coherent verbs in coherent constructions behave parallel to obligatorily coherent verbs.

3.2. Adjectival complements. After this sketch of the main properties of partial VPs on the basis of Bech's distinction between three classes of verbal complement taking verbs, partial APs can now straightforwardly be characterized as behaving like the partial verbal complements of obligatorily coherent verbs (cf., G. Müller, 1993, St. Müller, 1999). Firstly, a partial AP can be topicalized as shown in (220).

(220) a. [Stolz] ist er *auf seine Kinder* gewesen.
proud is he of his children been
'He was proud of his children.'

b. [Treu] will er *seiner Frau* für immer bleiben.
faithful wants he his wife for ever remain
'He will forever remain faithful to his wife.'

Secondly, neither a partial (221a) nor a complete AP (221b) can occur at the beginning of the Mittelfeld. This is parallel to the behavior of the verbal complements of obligatorily coherent verbs shown in example (214) and (213).

(221) a. * Er ist [stolz] im letzten Jahr *auf seine Kinder* gewesen.
he is proud in the last year of his children been
'Last year he was proud of his children.'

b. * Er ist [stolz auf seine Kinder] im letzten Jahr gewesen.
he is proud of his children in the last year been

Finally, the complement of the AP can occur at the beginning of the Mittelfeld (222), just like the argument of the verbal complement of a coherently constructing verb which was shown in (216a).

(222) Er ist *auf seine Kinder* im letzten Jahr [stolz] gewesen.
he is of his children in the last year proud been
'Last year, he was proud of his children.'

Note that the PP complement *auf seine Kinder* is known to appear independently of its adjectival head *stolz* at the beginning of the Mittelfeld since the adverbial phrase *im letzten Jahr*, which intervenes between the adjective *stolz* and its complement *auf seine Kinder*, modifies the predicate *gewesen*. The alternative analysis of combining the adverbial phrase *im letzten Jahr* with the adjective *stolz* is not available, as is suggested by the fact that the combination of the adverbial with the adjective in attributive use is ruled out (223), whereas such a construction is possible for other adverbials like *immer* (224).

(223) * ein auf seine Kinder im letzten Jahr stolzer Vater
an of his children in last year proud father
'a father who was proud of his children last year'

(224) ein auf seine Kinder immer stolzer Vater
an of his children always proud father
'a father always proud of his children'

The facts presented in this section make it plausible to analyze APs analogously to the verbal complements of coherently constructing verbs in that the arguments of the adjectival head are obligatorily raised to become the arguments of a head cluster.

3.3. Nominal complements. The third kind of partially occurring constituents we are interested in, nominal complements selecting a PP argument, in some respects behave like verbal complements of optionally coherent verbs. Firstly, the nominal complements can be partially topicalized as we saw in (189b) repeated here as (225), which is parallel to the verbal complements of coherently constructing verbs in (211).

(225) [Ein Buch] hat Hans *über Syntax* ausgeliehen.
a book has Hans on syntax borrowed
'Hans borrowed a book on syntax.'

And just like the verbal complements of incoherently constructing verbs (213b), the complete NP can occur at the beginning of the Mittelfeld as exemplified in (226).

(226) Er hat [ein Buch über Syntax] heute ausgeliehen.
he has a book on syntax today borrowed
'Hans borrowed a book on syntax today.'

However, unlike the other partial constituents discussed so far, even a partial NP can occur at the beginning of the Mittelfeld (227).

(227) Er hat [kein einziges Buch] während seines Studiums *über Syntax* ausgeliehen.
he has not a single book during his studies on syntax borrowed
'During his studies, he did not borrow a single book on syntax.'

Finally, parallel to the behavior of arguments of verbal complements selected by a coherently constructing verb as in (216a), the complement of the NP can occur at the beginning of the Mittelfeld (228).

(228) Er hat *über Syntax* während seines Studiums [kein einziges Buch] ausgeliehen.
he has on syntax during his studies not a single book borrowed

The conclusion we want to draw from these facts is that a partial NP and its PP argument should be analyzed as two independent sister constituents. Thus, when a PP argument is raised from an NP, the remaining partial NP complement needs to be treated by its verbal head like any other saturated complement.

Before we now turn to partial constituents embedded in VPs, it remains to be mentioned that the occurrence of partial NPs discussed above is subject to certain lexical restrictions. A discussion of these restrictions and how they can be integrated into our account is provided in De Kuthy (1998). That paper also situates the empirical phenomenon discussed here in the context of other phenomena involving "partial NPs", such as the so-called Split NPs and *Was-für*-Split.

3.4. Partial constituents embedded in (partial) VPs. An interesting aspect of partial constituents is that they can occur embedded inside of fronted verbal constituents.

(229) a. [Verkaufen müssen] wird er *das Pferd*.
sell have to will he the horse
'He will have to sell the horse.'

b. [Stolz gewesen] ist er *auf seine Kinder*.
proud been is he of his children
'He was proud of his children.'

c. [Ein dickes Buch ausleihen] will niemand *darüber*.
a thick book borrow wants nobody on-this
'Nobody wants to borrow a thick book on this topic.'

In example (229a), the partial VP *verkaufen*, leaving behind its complement *das Pferd*, is fronted together with its governor *müssen*. In (229b), the partial AP *stolz* is fronted within a VP and in (229c) the NP *ein dickes Buch* is fronted as part of a VP without its complement *darüber*.

The example in (230) illustrates that such interaction is also possible with a partially fronted VP, in this case including a partial NP complement.

(230) [Ein Buch ausleihen] will er *ihr darüber* aber nicht.
a book lend wants he her on.this but not
'But he does not want to lend her a book on this topic.'

Finally, one can observe that the reverse case, namely a topicalization including an argument of the complement instead of the partial complement, is always ungrammatical (231).

(231) a. * [Das Pferd müssen] wird er *verkaufen*.
the horse have to will he sell

b. * [Auf seine Kinder gewesen] ist er *stolz*.
of his children been he is proud

c. * [Über Syntax ausleihen] will er *ihr ein Buch*.
on syntax lend wants he her a book

The ungrammaticality of the examples is independent of the category of the complement, i.e., verbal (*verkaufen*) in (231a), adjectival (*stolz*) in (231b), and nominal (*ein Buch*) in (231c). Instead, we believe that an explanation of the ungrammaticality must result from a general restrictions on how embedded complements reanalyzed as co-arguments of their head can be realized. If as the result of a reanalysis process (argument raising) a head selects both a complement and a complement of this complement then it can only combine with the 'indirect' complement if the 'direct' complement is realized in the projection of this head as well. Or expressed another way, a verb can only argument-raise an unsaturated head if it also raises the argument(s) of this head. This generalization correctly rules out the ungrammatical examples above: in (231a), *wird* would have to raise the unsaturated head *verkaufen* without also raising its complement *das Pferd*; for (231b), *ist* would have to raise *stolz* without its argument *auf seine Kinder*; and in (231c) it is the verb *will* which would have to raise *ein Buch* from *ausleihen* without also raising the argument of *Buch*, *über Syntax*. This generalization is independent of whether a flat or binary branching Mittelfeld structure is assumed and it does not overgeneralize in a way which would rule out the grammatical examples with partial NPs at the beginning of the Mittelfeld, which were shown in (199b) on page 232.

A superficially similar set of examples is shown in (232). However, while in the examples in (231) each topicalized constituent contains the argument of its complement, in (232) only a verbal head has been fronted, leaving behind its entire verbal (232a), adjectival (232b), or a nominal complement in the grammatical example (232c).

(232) a. * [Müssen] wird er *das Pferd verkaufen*.
have to will he the horse sell

b. * [Gewesen] ist er *auf seine Kinder stolz*.
been is he of his children proud

c. [Ausleihen] will niemand *ein dickes Buch darüber*.
borrow wants nobody a thick book on.this

The pattern of grammaticality in (232) becomes transparent as soon as one realizes that it is the class of the verb that has been fronted and not the category of complement which determines grammaticality in such examples. The verb *müssen* in (232a) obligatorily constructs coherently and, as we showed in section 3.2, constructions with an adjectival complement as in (232b) behave parallel to obligatorily coherent ones. Verbs with nominal complements as in (232c), on the other hand, do not pattern with verbs in coherent constructions.

That coherence is the relevant factor is supported by the existence of grammatical examples which are parallel to the ungrammatical (232a) except for the class of the fronted verb. In (233a), the optionally coherent verb *versuchen* and in (233b) the obligatorily incoherent verb *empfehlen* has been topicalized.

(233) a. [Versuchen] wird er *das Pferd zu verkaufen*.
try will he the horse to sell
'He will try to sell the horse.'

b. [Empfehlen] wird er ihr *das Pferd zu verkaufen*.
advise will he her the horse to sell
'He will advise her to sell the horse.'

4. An HPSG proposal

In chapter 7 we took the proposal of Pollard (1996) as a starting point and showed how this basic setup has to be extended to properly account for the flexible nature of constituency required by the phenomenon of partial-VP topicalization. The setup of Pollard (1996) provides a straightforward basis for focusing on the topicalization discussion by essentially abstracting away from the problem of verb-second by assuming that finite verb can occur in verb-second linearization by virtue of linearization in a local tree for which he assumes a flat sentence structure.

On the basis of the empirical discussion in the last two sections, we propose to generalize the argument-raising approach to partial VP fronting of Pollard (1996) to partial constituent fronting in general. The idea is to introduce argument raising as a general option for verbal heads with different kinds of complements. Building on the discussion of lexical generalizations in section 2.2.2 of chapter 4), we define a lexical principle in the style of Meurers (1997a,b) which introduces argument raising as a generalization in the mapping between the argument structure and the valence specifications of verbs.

4.1. The lexicon. In the lexicon, the argument structure is specified under the ARG-ST attribute, as shown in the lexical entries for the three different kinds of verbs selecting non-finite complements in figure 1 on the facing page.[3] The three kinds of entries differ with respect to the LEX property required of the verbal complement. Following Kiss (1995a) and Hinrichs and Nakazawa (1994a) we want to enforce a verbal cluster for coherently constructing verbs. Obligatorily coherent verbs like *wollen* mark their verbal complement as [LEX +], whereas obligatorily incoherent verbs like *empfehlen* require it to be [LEX −]. The lexical entry of an optionally coherent verb like *hoffen* is underspecified and enforces no LEX restrictions on its complement.

A different kind of encoding for the three classes of verbs is proposed by Kathol (1995) and St. Müller (1999). They employ a special valence attribute (GOV or VCOMP) for complements of coherently constructing

[3]The ARG-ST attribute is specified explicitly or derived by some kind of a linking theory. We assume argument raising to take place only with respect to the valence attributes, not on ARG-ST. The idea behind this is that ARG-ST, which is appropriate for *word* only, serves as a strictly lexical interface between the semantic roles of a predicate and their syntactic realization. The valence features SUBJ, SPR, and COMPS, on the other hand, play the traditional role of encoding syntactic selection requirements.

obligatorily coherent verbal complement:

$$\begin{bmatrix}\text{PHON} & \langle \textit{wollen} \rangle \\ \text{ARG-ST} & \left\langle \begin{bmatrix}\text{L|C|HEAD} & \textit{noun}\end{bmatrix}, \begin{bmatrix}\text{L|C|HEAD} & \begin{bmatrix}\textit{verb} \\ \text{VFORM} & \textit{bse}\end{bmatrix} \\ \text{LEX} & + \end{bmatrix} \right\rangle \end{bmatrix}$$

obligatorily incoherent verbal complement:

$$\begin{bmatrix}\text{PHON} & \langle \textit{empfehlen} \rangle \\ \text{ARG-ST} & \left\langle \begin{bmatrix}\text{L|C|HEAD} & \textit{noun}\end{bmatrix}, \begin{bmatrix}\text{L|C|HEAD} & \begin{bmatrix}\textit{verb} \\ \text{VFORM} & \textit{zu-inf}\end{bmatrix} \\ \text{LEX} & - \end{bmatrix} \right\rangle \end{bmatrix}$$

optionally coherent verbal complement:

$$\begin{bmatrix}\text{PHON} & \langle \textit{hoffen} \rangle \\ \text{ARG-ST} & \left\langle \begin{bmatrix}\text{L|C|HEAD} & \textit{noun}\end{bmatrix}, \begin{bmatrix}\text{L|C|HEAD} & \begin{bmatrix}\textit{verb} \\ \text{VFORM} & \textit{zu-inf}\end{bmatrix}\end{bmatrix} \right\rangle \end{bmatrix}$$

Figure 1. Lexical entries for verbs with infinitival complements

verbs. This, however, results in two lexical entries for each optionally coherent verb instead of the underspecified single entry in the LEX encoding we propose here.

Intuitively, requiring a complement to be [LEX −] in our setup corresponds to the X-bar theory condition that non-heads have to be completed projections.[4] But while the X-bar theory is a condition on structures, the LEX attribute lexicalizes the "trigger" for this restriction, which makes it possible to relax the requirement for the class of verbal heads which construct coherently with their non-finite complement. Introducing the requirement on the complement via such a lexical specification appears to be the proper way to capture the data, since the coherence of a construction depends solely on the lexical class of the verbal head.

[4]Note that we do not assume that words in the lexicon have to be [LEX +]. This makes it possible to license simple words as specifiers, subjects or complements without requiring an otherwise unmotivated unary tree to project these elements. Regarding our particular topic, it allows us to license words as incoherent complements in sentences like (i).

(i) Sie empfiehlt zu gehen.
she recommends to go

In a coherent construction, the verbal head directly combines with the head of its complement in order to form a verbal cluster. This is achieved by requiring the complement of verbs constructing coherently to be [LEX +]; in case of obligatorily coherent verbs this is specified in the lexical entry, for the optionally coherent ones in a coherent construction it follows from the argument-raising principle discussed below.

Finally, as a result of the feature geometry explained at the end of section 4.2, LEX requirements are relaxed for long distance relations like topicalization, so that different projections of (partial) VP complements of obligatorily coherent verbs can be topicalized.

In section 3.2 we discussed the fact that adjectival complements of verbs behave parallel to verbal complements of obligatorily coherent verbs. We therefore make use of the same LEX mechanism as in the coherent case and require the adjectival complement in the lexical entry shown in figure 2 to be [LEX +].

$$\begin{bmatrix} \text{PHON} & \langle \textit{sein} \rangle \\ \text{S|L|C|HEAD} & \textit{verb} \\ \text{ARG-ST} & \left\langle \begin{bmatrix}\text{L|C|HEAD} & \textit{noun}\end{bmatrix}, \begin{bmatrix}\text{L|C|HEAD} & \textit{adjective}\\ \text{LEX} & + \end{bmatrix} \right\rangle \end{bmatrix}$$

FIGURE 2. Lexical entry for a verb selecting an adjectival complement

Finally, we need to provide an entry for verbs with nominal complements. We saw in section 3.3 that the occurrence of complete or partially saturated nominal complements is not subject to the restrictions holding for verbal or adjectival complements. The lexical entry shown in figure 3 therefore does not impose a restriction regarding the LEX value of its nominal complement.

$$\begin{bmatrix} \text{PHON} & \langle \textit{ausleihen} \rangle \\ \text{S|L|C|HEAD} & \textit{verb} \\ \text{ARG-ST} & \left\langle \begin{bmatrix}\text{L|C|HEAD} & \textit{noun}\end{bmatrix}, \begin{bmatrix}\text{L|C|HEAD} & \textit{noun}\end{bmatrix} \right\rangle \end{bmatrix}$$

FIGURE 3. A lexical entry for a verb selecting a nominal complement

4.1.1. *The lexical argument-raising principle.* The lexical principle shown in figure 4 on the next page expresses how the argument structure specified in the ARG-ST list of the lexical entries of base form verbs determines the

$$\begin{bmatrix} \textit{word} & \\ \text{S|L|C|HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{bse} \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \text{S|L|C|V} & \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1} \right\rangle \\ \text{COMPS} & \textit{raised}\left(\boxed{3}\right) \oplus \boxed{2} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1} \mid \boxed{2} \right\rangle \ \wedge \ \left(\boxed{3} \bigcirc \textit{indep}\right) \end{bmatrix}$$

FIGURE 4. The basic lexical argument-raising principle

values of the valence attributes (SUBJ and COMPS). The first element ($\boxed{1}$) of the argument structure is assigned to be the subject and the rest of the arguments ($\boxed{2}$) are specified to surface on the COMPS list. To concentrate on the relevant issues, we here ignore subjectless and subject-raising verbs and return to the issue when we introduce a more complete principle in figure 7 on page 252.

Appended ($\oplus$) to the beginning of the COMPS list are the arguments possibly raised from an element on list $\boxed{3}$. The list $\boxed{3}$ can only contain an element, the so-called *argument-raising source*, if it satisfies the requirements specified in the relation *raised* discussed below.[5] For many of the verbs, $\boxed{3}$ will thus simply be the empty list from which no arguments can be raised.

To the right of the conjunction ($\wedge$) in the specification of ARG-ST, a second restriction on the argument structure is formulated. The arguments on ARG-ST are required to be *indep(endent)*, a notion encoding that these arguments have realized their own complements, which formally is expressed by a unary relation in functional notation introduced below. The only exception is a possibly occurring argument-raising source on list $\boxed{3}$. This list is shuffled ($\bigcirc$) into the list of independent arguments. The list $\boxed{3}$ is either an empty list or a singleton list containing an argument-raising source. In the latter case, shuffling corresponds to inserting the argument-raising source at any place in the list. Note that any argument can be an argument-raising source, including the subject. This correctly licenses the occurrence of partial subjects in examples like the ones we showed in (193) on page 230.

The *indep(endent)* relation is defined in figure 5 on the next page. An argument is independent if it includes all of its complements and is [LEX −]. The argument thus cannot contribute its complements to an argument-raising process and it cannot construct as part of a lexical head cluster.

[5] Here and throughout the thesis relations are written in the functional notation traditionally used in HPSG.

$$\mathit{indep} := \langle\rangle.$$
$$\mathit{indep} := \left\langle \begin{bmatrix} \textsc{l}|\textsc{c}|\textsc{v}|\textsc{comps} & \langle\rangle \\ \textsc{lex} & - \end{bmatrix} \middle| \; \mathit{indep} \right\rangle.$$

FIGURE 5. Definition of independence

The intuition behind calling such arguments independent thus is that they independently take care of realizing their own complements.

The relation *raised* defined in figure 6 parameterizes the argument-raising

$$\mathit{raised}\big(\langle\rangle\big) := \langle\rangle.$$
$$\mathit{raised}\left(\left\langle \begin{bmatrix} \textsc{lex} & + \\ \textsc{l}|\textsc{c} & \begin{bmatrix} \textsc{head} & \mathit{verb} \vee \mathit{adj} \\ \textsc{v}|\textsc{comps} & \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle\right) := \boxed{1}\ \mathit{lex\text{-}minus\text{-}list}.$$
$$\mathit{raised}\left(\left\langle \begin{bmatrix} \textsc{l}|\textsc{c} & \begin{bmatrix} \textsc{head} & \mathit{noun} \\ \textsc{v}|\textsc{comps} & \boxed{1} \end{bmatrix} \end{bmatrix} \right\rangle\right) := \boxed{1}\ \mathit{prep\text{-}list}.$$

FIGURE 6. Definition of possible argument-raising sources

principle with respect to the different kinds of argument-raising sources. The first clause specifies that if there is no argument-raising source, no arguments can be raised.

The second clause of the definition of *raised* deals with adjectival and verbal argument-raising sources, which are restricted to be [LEX +]. The relation *raised* returns the complements which were not realized by the argument-raising source itself (and thus still occur on its COMPS list) in order for them to become complements of the embedding verb to which the argument-raising principle applied. The raised complements are required to be [LEX −] by the relation *lex-minus-list*.[6] Taken together, the two LEX specifications – adjectival and verbal argument-raising sources are [LEX +]

[6] Note that we here use the relation *lex-minus-list* and not the relation *indep* of figure 5 since we do not want to exclude raising of NPs which are unsaturated since a PP argument was raised from them. The relations *lex-minus-list* and *prep-list* are defined as:

$$\mathit{lex\text{-}minus\text{-}list} := \langle\rangle. \qquad \mathit{prep\text{-}list} := \langle\rangle.$$
$$\mathit{lex\text{-}minus\text{-}list} := \Big\langle \big[\textsc{lex}\ -\big] \,\Big|\, \mathit{lex\text{-}minus\text{-}list} \Big\rangle. \qquad \mathit{prep\text{-}list} := \Big\langle \big[\textsc{l}|\textsc{c}|\textsc{head}\ \mathit{prep}\big] \,\Big|\, \mathit{prep\text{-}list} \Big\rangle.$$

It might appear nicer to use a generic, two place list relation to impose such requirements on every list element, e.g., to use $\mathit{list}\big([\textsc{lex}\ -]\big)$ and $\mathit{list}\big([\textsc{l}|\textsc{c}|\textsc{head}\ \mathit{prep}]\big)$ instead of *lex-minus-list* and *prep-list*. However, defining such a relation in the following way would incorrectly require all elements to be structure shared:

$$\mathit{list}\big(\boxed{1}\big) := \langle\rangle.$$
$$\mathit{list}\big(\boxed{1}\big) := \Big\langle \boxed{1} \,\Big|\, \mathit{list}\big(\boxed{1}\big) \Big\rangle.$$

and raised complements [LEX −] – ensure that verbal or adjectival heads from which arguments have been raised cannot be raised themselves. As a result, in a sentence like (234) with several coherently constructing verbs functioning as argument-raising sources, no spurious structural ambiguities arise since only the indicated binary verbal-complex structure can be licensed and not a flat one.

(234) daß er sie [ansehen$_3$ können$_2$] muß$_1$
that he her see can must
'That he must be able to take a look at her.'

The obligatorily coherent verbs *können* and *muß* have a lexical entry like *wollen* in figure 1 on page 247. The verb *muß* cannot raise the verbal complement *ansehen* of its verbal complement *können* because *ansehen* would then have to be [LEX −] but the lexical entry of an obligatorily coherent verb like *können* requires its verbal complement to be [LEX +]. Instead, in our analysis of example (234), *können* raises the object *sie* of *ansehen*. The finite verb *muß* then raises *sie* from the verbal cluster [*ansehen können*] and realizes the subject *er*, the object *sie*, and the verbal cluster *ansehen können* in a flat structure.

Finally, the third clause of the definition of the *raised* relation in figure 6 on the preceding page deals with nominal argument-raising sources. In this case, we restrict the elements which can be raised to prepositional arguments (*prep-list*).[7] No restriction on the argument-raising source is imposed since a partial NP and its PP complement are supposed to occur as two ordinary sister constituents in the Mittelfeld. To license them as independent sister constituents in sentences with a verbal complement, we need to allow nominal heads from which a PP argument has been raised to be raised as well – a case which is excluded for the verbal and adjectival complements via the LEX specifications in the second clause.

The use of the LEX attribute and its interaction with argument raising introduced above for different kinds of complement selecting verbs in German bears an interesting similarity to the approach of Abeillé and Godard (1997) dealing with French word order phenomena. They distinguish between phrasal complements occurring freely to the right of the head and

[7] We only consider prepositional arguments of nominal heads here. Other kinds of complements of nouns, like verbal or genitive-NP complements, cannot be separated from their head in the way described for PP complements. Further research is needed to investigate whether this difference can be deduced from independent properties in order to eliminate the *prep-list* stipulation in the definition of the argument-raising sources in figure 6 on the facing page.

bare complements immediately following the head. Examples for such bare complements, which are referred to as *lite*, are bare nominal complements in light-verb constructions, past participles after tense auxiliaries, and infinitives in causative constructions. A verb lexically specifies whether it selects a lite or a non-lite complement via a WEIGHT attribute similar to the LEX attribute we employ. Verbs selecting a lite complement are lexically specified to inherit the arguments of its complement. The similarity of the techniques used in the approach of Abeillé and Godard (1997) to French and our approach to German provides interesting cross-linguistic support for the elaborate use of an argument-raising technique. As far as we see, our theoretical setup, which minimizes idiosyncratic lexical specification by introducing argument raising as a generalization over all verbs and enforces an obligatory form of argument raising that avoids spurious ambiguities, could be fruitfully applied to the approach to French of Abeillé and Godard (1997).

Extensions for subjectless constructions. Returning to the issue of distributing the argument structure to the different valence attributes in a general way including the case of subjectless and subject-raising predicates, we provide an extended version of the argument-raising principle in figure 7. This principle is identical to the basic principle we showed in

$$\begin{bmatrix} \textit{word} \\ \text{S}|\text{L}|\text{C}|\text{HEAD } \boxed{4}\begin{bmatrix}\textit{verb}\\ \text{VFORM } \; \textit{bse}\end{bmatrix}\end{bmatrix} \rightarrow \begin{bmatrix} \text{S}|\text{L}|\text{C}|\text{V} \begin{bmatrix}\text{SUBJ } \; \boxed{1} \\ \text{COMPS } \; \textit{raised}\big(\boxed{3}\big) \oplus \boxed{2}\end{bmatrix} \\ \text{ARG-ST } \; \textit{distrib-args}\big(\boxed{4},\boxed{1},\boxed{2}\big) \wedge \big(\boxed{3} \bigcirc \textit{indep}\big)\end{bmatrix}$$

FIGURE 7. An extended lexical argument-raising principle

figure 4 on page 249 except for the way in which the ARG-ST is related to the COMPS and SUBJ values. Instead of the simple first/rest division used in the basic principle, the more complicated task is now taken over by a separate relation *distrib(ute)-arg(ument)s* which parameterizes the argument-raising principle depending on the lexical subclass of verb. Every linguistic theory will have to provide a way of distinguishing those verbs which require a subject from those which do not. Either this can be derived from other lexical properties or it has to be explicitly encoded in the verbal lexical entry itself. For our purpose here, it is sufficient to assume the existence of such a distinguishing property. As a simple way of making this property explicit, we encode this subclassification of verbs in the form of subtypes of the head type *verb*. The definition of

the *distrib-args* relation based on such a subclassification of verbal head types is shown in figure 8.

$$\begin{aligned} &\textit{distrib-args}\big(\textit{subj-less-verb}, \langle\rangle, \boxed{2}\big) &&:= \boxed{2} \\ &\textit{distrib-args}\big(\textit{subj-raising-verb}, \boxed{1}, \boxed{2}\big) &&:= \boxed{2}\Big\langle\big[\text{L}|\text{C}|\text{V}|\text{SUBJ } \boxed{1}\big]\Big\rangle \\ &\textit{distrib-args}\big(\textit{subj-verb}, \langle\boxed{1}\rangle, \boxed{2}\big) &&:= \big\langle\boxed{1}|\boxed{2}\big\rangle \end{aligned}$$

FIGURE 8. Mapping argument structure to valence

The first clause deals with subjectless predicates such as psych verbs like *frieren* (*freeze*). It maps the entire argument structure to the third argument, which the argument-raising principle identifies with the COMPS value. The second argument is set to be the empty list, so that no subject can be selected via SUBJ.

The second clause deals with subject-raising verbs like *scheinen* (*seem*). First, it identifies the single element on ARG-ST with the third argument of the relation, which in the argument-raising principle is appended to COMPS. Second, it identifies the SUBJ value of that single ARG-ST element with the second argument of the relation, which in the argument-raising principle is identified with SUBJ. Note that this includes the possibility of returning an empty list in cases where a subject-raising verb selects a subjectless predicate.

Finally, for all other verbs the third clause performs the first/rest division which was used in the basic argument-raising principle in figure 4 on page 249. A list with the first element of the argument structure is returned as the subject valence, and the other elements are returned to be identified with the COMPS list.

Deriving finite verbs. Before turning to the principles licensing constituent structure, we should focus on a detail that has not yet been discussed, namely how the lexical argument-raising principle in figure 4 on page 249, which applies to base form verbs, becomes effective for finite ones. Finite verbs are assumed to be derived from their base forms by a lexical rule which among other things removes the subject from SUBJ and encodes it together with the complements on COMPS in the tradition of Pollard (1996). In order to be explicit, a simple instance of such a finitivization lexical rule is provided in figure 9 on the following page. Relevant in our context is that the subject of finite verbs is encoded as the first argument

$$\begin{bmatrix} \textit{word} & \\ \textsc{phon} & \boxed{1} \\ \textsc{s}|\textsc{l}|\textsc{c} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{verb} & \\ \textsc{vform} & \textit{bse} \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{subj} & \boxed{2} \\ \textsc{comps} & \boxed{3} \end{bmatrix} \end{bmatrix} \end{bmatrix} \mapsto \begin{bmatrix} \textsc{phon} & \textit{bse2fin}\left(\boxed{1},\boxed{2}\right) \\ \textsc{s}|\textsc{l}|\textsc{c} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textsc{vform} & \textit{fin} \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{subj} & \langle\rangle \\ \textsc{comps} & \boxed{2} \oplus \boxed{3} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

FIGURE 9. A simple finitivization lexical rule

of the COMPS valence. If no such subject exists, $\boxed{2}$ is the empty list, and thus the COMPS list contains only the complements. Finally, the relation *bse2fin* transforms the base form into a finite form agreeing with the person and number of the subject, if there is one, and with the third person, singular in subjectless constructions.

4.2. Constituent structure. Constituent structure is licensed by the ID Principle in figure 10 on the next page. The Cluster-Formation Schema (CF) licenses head-complement structures marked [LEX +] which consist of a *word* and a single [LEX +] complement. The Head-Complement Schema (HC), on the other hand, allows head-complement structures in which a *word* combines with any number of complements to form a [LEX −] constituent. To abstract over the nature of verb-second and the structure of the Mittelfeld we thus follow Pollard (1996) in assuming a flat Mittelfeld and obtain verb-second by simple linearization in this local tree.

To license nominal structures, we adopt the Head-Specifier Schema (HSP) and the Head-Adjunct Schema (HA) of Pollard and Sag (1994). In the style of chapter 9 of that book, determiners are selected by the valence feature SPR. As was shown in figure 6 on page 250, argument raising only affects elements on COMPS, i.e., complements, so that determiners cannot undergo argument raising. In addition to the original formulation of the two schemata, our versions bear appropriate LEX specifications: head-specifier structures are always [LEX −], and in a head-adjunct structure, the LEX value of the mother is identified with that of the head daughter.[8] While these two schemata are sufficient for our purpose of analyzing partial constituent fronting including the interaction of partial NPs with VP

[8] Viewing adjunction as an identity operator applicable to categories of different complexity in this way has its roots in the GB literature of the early 90s (see, e.g., Kolb and Thiersch, 1991, p. 273), where it is introduced as an extension of the classical X-bar theoretic view of adjunction as modification of X'.

$$\begin{bmatrix} \textit{phrase} \\ \textsc{dtrs}\ \textit{headed-struc} \end{bmatrix} \rightarrow$$

$$\begin{bmatrix} \textsc{s}|\textsc{lex} & + \\ \textsc{dtrs} & \begin{bmatrix} \textit{head-comps-struc} & \\ \textsc{head-dtr} & \textit{word} \\ \textsc{comp-dtrs} & \left\langle \begin{bmatrix} \textsc{s}|\textsc{lex} & + \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \quad \text{(CF)}$$

$$\vee \begin{bmatrix} \textsc{s}|\textsc{lex} & - \\ \textsc{dtrs} & \begin{bmatrix} \textit{head-comps-struc} & \\ \textsc{head-dtr} & \textit{word} \end{bmatrix} \end{bmatrix} \quad \text{(HC)}$$

$$\vee \begin{bmatrix} \textsc{s}|\textsc{lex} & - \\ \textsc{dtrs} & \textit{head-spr-struc} \end{bmatrix} \quad \text{(HSP)}$$

$$\vee \begin{bmatrix} \textsc{s}|\textsc{lex} & \boxed{1} \\ \textsc{dtrs} & \begin{bmatrix} \textit{head-adj-struc} & \\ \textsc{adj-dtr}|\textsc{s} & \begin{bmatrix} \textsc{l}|\textsc{c}|\textsc{h}|\textsc{mod} & \boxed{2} \end{bmatrix} \\ \textsc{head-dtr}|\textsc{s} & \boxed{2}\begin{bmatrix} \textsc{lex} & \boxed{1} \end{bmatrix} \end{bmatrix} \end{bmatrix} \quad \text{(HA)}$$

$$\vee \begin{bmatrix} \textsc{s}|\textsc{lex} & - \\ \textsc{dtrs} & \begin{bmatrix} \textit{head-filler-struc} & \\ \textsc{filler-dtr}|\textsc{s} & \begin{bmatrix} \textsc{lex} & - \\ \textsc{loc} & \boxed{1} \end{bmatrix} \\ \textsc{head-dtr}|\textsc{s} & \begin{bmatrix} \textsc{loc}|\textsc{c} & \begin{bmatrix} \textsc{head} & \begin{bmatrix} \textit{verb} & \\ \textsc{vform} & \textit{fin} \end{bmatrix} \\ \textsc{val} & \begin{bmatrix} \textsc{subj} & \langle\rangle \\ \textsc{comps} & \langle\rangle \end{bmatrix} \end{bmatrix} \\ \textsc{nloc} & \begin{bmatrix} \textsc{i}|\textsc{slash} & \left\{\boxed{1}\right\} \cup \textit{set} \\ \textsc{t}|\textsc{slash} & \left\{\boxed{1}\right\} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \quad \text{(HF)}$$

FIGURE 10. The ID Principle

topicalization, naturally a full theory of German nominal constituents is more complicated. The reader interested in more details at this point is referred to Netter (1996, sec. 4.9.2), who discusses how the Pollard and Sag (1994) theory we rely on here can be modified to account for the full range of German NP data.

Finally, unbounded dependencies are bound off in a head-filler structure (HF). For this purpose, we use the standard schema of Pollard and Sag (1994) and add the appropriate LEX specifications. The resulting construction is [LEX −] since it does not constitute a lexical cluster. The filler daughter is required to be [LEX −] as well, which eliminates otherwise possible spurious ambiguities. Some empirical support for assuming that the fronted constituent is [LEX −] could be derived from the fact that, as mentioned by Haider (1993, 282), a partial fronted constituent qualifies as a site for extraposition (235).

(235) [Ein Buch empfehlen, das sie nicht auch selbst gelesen hat,] würde
a book recommend that she not also herself read has would
dir Maria nie.
you Maria never
'Maria would never recommend a book to you which she has not read herself.'

As we mentioned in section 1.1.2 of chapter 7, though, not all incoherent verbal complements ([LEX −] constituents) are possible extraposition sites. The [LEX −] marking thus is a necessary but not a sufficient criterion.

Returning to the theoretical setup, we follow Pollard and Sag (1994) in identifying only the *local* information of a filler and its trace in an unbounded dependency construction. Incorporating our proposal from chapter 7 we define LEX as an attribute of *synsem* objects. The fronted constituent and the trace therefore do not have to agree on the LEX specification so that fronted constituents are exempt from a LEX requirement lexically imposed by a head in base position. More concretely, any projection of a (partial) VP complement can be fronted even when selected by obligatorily coherent verbs which require the complement trace to be [LEX +].

4.2.1. *Other principles restricting phrases.* Regarding the other principles, we assume the traditional HPSG setup of Pollard and Sag (1994, ch. 9). In particular, the SPEC-Principle applies to head-specifier structures to ensure identity of the SPEC value of the non-head with the head. And in headed structures, the different valences are realized according to the Valence Principle shown in figure 11. Note that this principle requires

> In a headed phrase, for each valence feature $\mathcal{F}$, the $\mathcal{F}$ value of the head daughter is the concatenation of the phrase's $\mathcal{F}$ value with the list of SYNSEM values of the $\mathcal{F}$-DTRS value.

FIGURE 11. The Valence Principle of Pollard and Sag (1994)

the elements occurring last on a valence list to be realized first. This requirement makes it impossible to combine an argument with a head in a tree that does not also include all of the more oblique arguments.[9] In particular, since the argument-raising principle adds raised arguments in front of the argument-raising source, these raised arguments cannot be realized before the argument-raising source is removed from the COMPS list, i.e., realized as well.[10]

5. Examples

Now that the relevant machinery has been introduced, let us look at some analyses of the examples we discussed in section 3.

5.1. Partial topicalization.

5.1.1. *Partial APs.* We start the discussion with a very simple case of a topicalized partial AP, the example shown in (236).

(236) Stolz ist er *auf seine Kinder*.
proud is he of his children
'He is proud of his children.'

The structure licensed for this sentence is shown in figure 12 on the following page. A lexical entry for the copula *sein* with an adjectival complement was shown in figure 2 on page 248. As motivated in the section 3.2 on partial APs, the entry for such a verb is like that of an obligatorily coherent verbal complement taking verb in that it requires its complement to be [LEX +]. As a result of the interaction of this specification with the mapping to the valence attributes enforced by the argument-raising principle, the occurrence of *ist* in the tree in figure 12 on the following page raises the PP-complement *auf seine Kinder* ($\boxed{2}$) from (the trace of) its adjectival complement *stolz* ($\boxed{4}$). Therefore, the partial AP *stolz* can be fronted independently of its PP-complement. The finite verb *ist* then

[9] While the data are not very clear, partial VP topicalization with ditransitive verbs in German seems to be possible with either of the two complements. Kathol (1995, p. 269) suggests to lexically under-determine the order of such complements in order to allow for either realization.

[10] Note that what we have encoded here is a more restrictive variant of the empirical generalization we reached at the end of section 3.4. It is more restrictive in that it requires a complement to be realized before its complements are, instead of only requiring both to be realized as part of the same head projection. While for our flat analysis of the Mittelfeld this makes no difference, it excludes some possibly more appealing binary branching analyses of the Mittelfeld of examples like the ones with partial NPs at the beginning of the Mittelfeld we showed in (199b) on page 232.

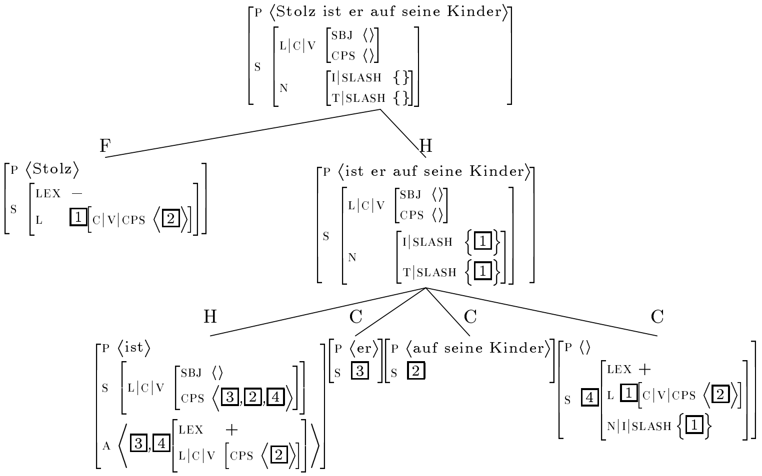


FIGURE 12. Simple topicalization of a partial AP

realizes the raised PP, the subject *er*, and the trace of the fronted AP in a flat head-complement structure. Note that since LEX requirements are not mediated in a non-local dependency, it is unproblematic that the trace of the fronted AP is required to be [LEX +] by the lexical entry of *sein* whereas the fronted AP is [LEX −] as specified in the Head-Filler ID Schema.

5.1.2. *Partial VPs.* A slightly more complex case of a topicalized partial constituent is illustrated by the partial-VP example in (237).

(237) [Eine Vase schenken] will er *ihr*.
a vase donate wants he her
'He wants to give her a vase for a present.'

The verbal head *schenken* is fronted with one of its objects *eine Vase*, while its second object *ihr* remains behind in the Mittelfeld. Figure 13 on the next page shows the analysis tree assigned to this example. In figure 1 on page 247, we showed a lexical entry for *wollen*. It is similar to that of the copula discussed in the previous section in that it requires a [LEX +] complement. In addition, following Pollard and Sag (1994) the control relation between the subject of the equi predicate *will* ($\boxed{5}$) and

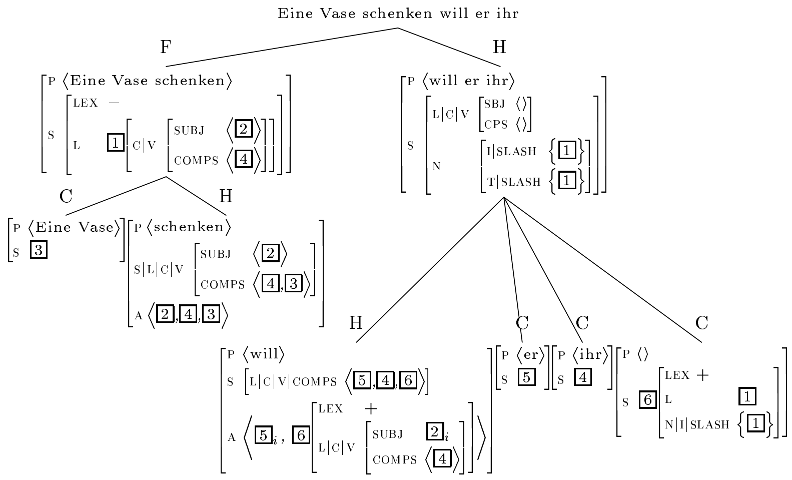


FIGURE 13. Topicalization of a partially saturated VP

the subject of *schenken* ($\boxed{2}$) is included in the lexical entry by semantic coindexation (index *i*).

The occurrence of *will* in the tree in figure 13 raises all complements of the trace of its verbal argument. This is only one NP, *ihr*, because the fronted verbal head *schenken* already combined with its other NP complement, *eine Vase*. Although the combination of a verbal head and its NP complement results in a [LEX −] constituent, just like in the last example this does not conflict with the [LEX +] specification imposed by the complement of *will* since the unbounded dependency relaxes the LEX requirement. In its base position in the Mittelfeld, however, the constituent [*eine Vase schenken*] would not be licensed.

5.1.3. *Partial NPs.* Next, we turn to the analysis of a sentence with a topicalized partial NP, the example shown in (238), which in addition to the simple case (189b) discussed in the introduction includes a verbal complex.

(238) [Ein Buch] hofft jeder *darüber* ausleihen zu dürfen.
a book hopes everyone on.this borrow to be.allowed
'Everyone hopes to be allowed to borrow a book on this topic.'

The analysis tree for this example is shown in figure 14. The interesting

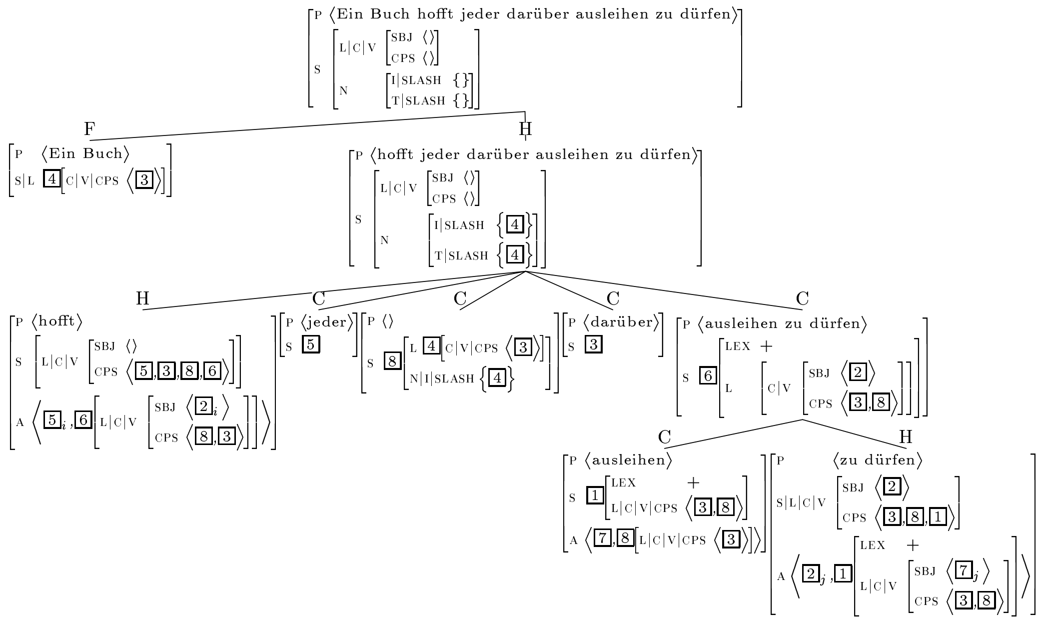


FIGURE 14. Topicalization of a partial NP

details are how the fronted partial NP *ein Buch* and the verbal complex [*ausleihen zu dürfen*] are licensed. The argument-raising principle applies to *ausleihen*, the lexical entry of which we saw in figure 3 on page 248, so that the NPs on ARG-ST can be argument-raising sources as defined in figure 6 on page 250. The occurrence of *ausleihen* ($\boxed{1}$) in the tree in figure 14 can therefore raise the PP argument *darüber* ($\boxed{3}$) from its nominal complement.

The verb *dürfen* belongs to the obligatorily coherent verbs; so it has a lexical entry like *wollen* in figure 1 on page 247 and requires its verbal complement to be [LEX +]. The argument-raising principle therefore has to raise the (trace of the) NP *ein Buch* ($\boxed{8}$) and the PP *darüber* ($\boxed{3}$) from the verbal complement *ausleihen* ($\boxed{1}$) onto the COMPS requirements of *zu dürfen*.

The verb *hoffen* belongs to the optionally coherent verbs, for which a lexical entry was shown in figure 1 on page 247. The argument-raising

principle ensures that the occurrence of *hofft* in the tree in figure 14 on the facing page raises all independent complements from its verbal complement: the PP *darüber* ($\boxed{3}$) and the (trace of the) NP *ein Buch* ($\boxed{8}$). But it cannot raise the verbal complement *ausleihen*, since *ausleihen* is [LEX +]. Instead, *ausleihen* and *zu dürfen* form a verbal complex licensed by the VC schema. The verbal complex, the trace of the fronted NP *ein Buch*, the PP *darüber*, and the subject NP *er* are then all realized in a flat head-complement structure.

5.1.4. *Some ungrammatical cases.* In section 3.4, we observed that a verb coherently selecting a verbal complement cannot be topicalized without this verbal complement, as shown in example (239):

(239) a. * [Das Pferd müssen] wird er *verkaufen*.
the horse have to$_{V2}$ will$_{V1}$ he sell$_{V3}$

b. * [Müssen] wird er *das Pferd verkaufen*.
have to$_{V2}$ will$_{V1}$ he the horse sell$_{V3}$

In the following we want to show how examples of the form of (239a) and (239b) are ruled out by our theory. The example (239a), of which the most promising structure is shown in figure 15 on the next page, is not licensed by our theory for two reasons. Firstly, a conflict arises in the topicalized constituent. The obligatorily coherent verb *müssen* raises the NP argument *das Pferd* ($\boxed{3}$) from its verbal complement *verkaufen* ($\boxed{1}$). The realization of this raised NP ($\boxed{3}$) as a complement of *müssen* in the fronted position is, however, ruled out by the Valence Principle since $\boxed{3}$ precedes the complement ($\boxed{1}$) on COMPS and that complement is not realized in this tree.

The second conflict in this example arises in the Mittelfeld: Similar to the verb *will*, the verb *wird* in figure 15 on the following page obligatorily raises all complements from its verbal argument ($\boxed{6}$). Thus it has to raise the remaining verbal valence requirement ($\boxed{1'}$) from this verbal argument. The occurrence of the verb *verkaufen* ($\boxed{1}$) in the tree is unsaturated because it has not realized its nominal complement *das Pferd*. Furthermore, the obligatorily coherent verb *müssen* requires *verkaufen* to be [LEX +]. But according to the argument-raising principle, the raised complement ($\boxed{1'}$) has to be [LEX −]. This conflicts via the Valence Principle with the different specifications of *verkaufen* ($\boxed{1}$).

For example (239b) three potential structures are shown in figures 16–18 on page 264. All three structures are correctly ruled out by our theory.

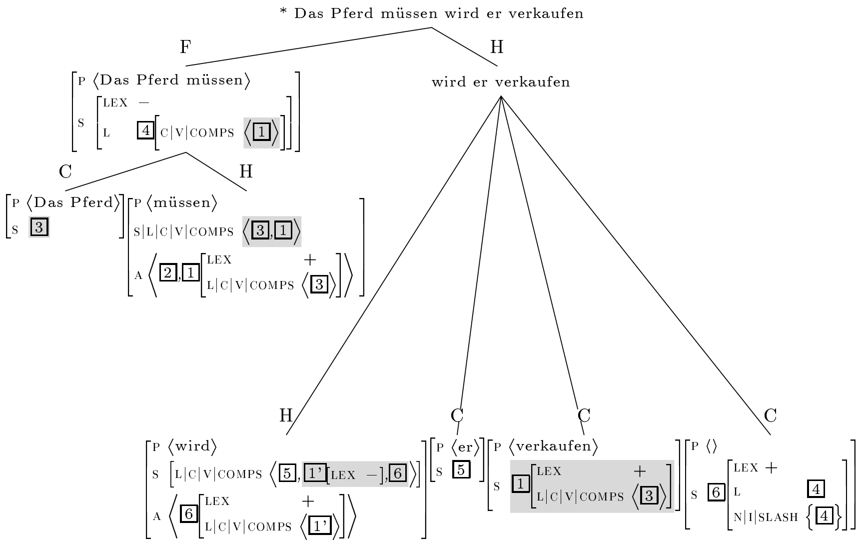


FIGURE 15. Topicalizing a verb and an argument of its complement

In the first structure in figure 16 on the facing page, the verb *verkaufen*, selected by the topicalized *müssen*, realizes its own complement *das Pferd* ($\boxed{3}$) in a head-complement structure and the finite verb *wird* raises the resulting VP from its verbal complement ($\boxed{6}$). The conflict here arises because the VP *das Pferd verkaufen* ($\boxed{1}$) is [LEX $-$], as required by the head-complement schema, but the obligatorily coherent verb *müssen* requires its verbal complement ($\boxed{1'}$) to be [LEX $+$].

In the second tree in figure 17 on the next page, a similar conflict arises as in the tree in figure 15: To obtain the totally flat Mittelfeld the verb *wird* has to raise all complements ($\boxed{3}$, $\boxed{1'}$) from its verbal argument ($\boxed{6}$). These complements have to be [LEX $-$] due to the argument-raising principle. But the verb *verkaufen* ($\boxed{1}$) is [LEX $+$] as required by its governor *müssen*.

The third possibility, the tree in figure 18 on page 264, is that the embedded verb *verkaufen* and its governor, the trace of *müssen* form a verbal cluster. The conflict here arises because the trace of *müssen* is the head

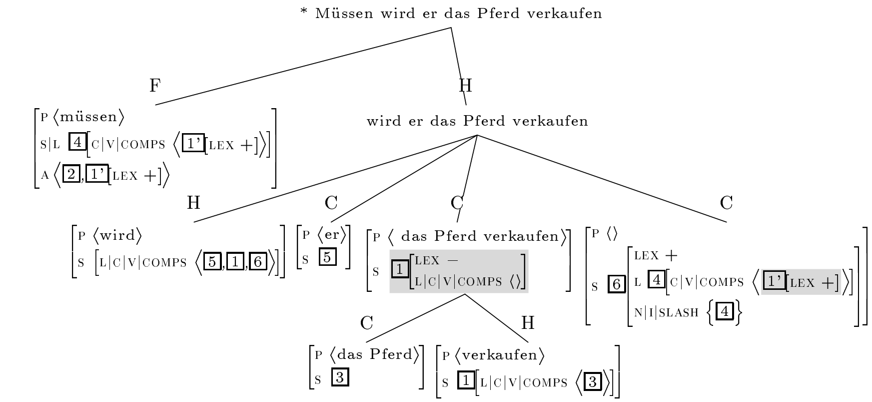


FIGURE 16. Topicalizing a verb without its verbal complement (I)

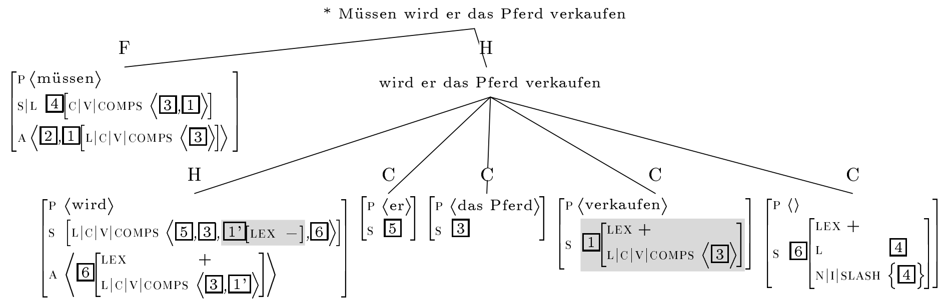


FIGURE 17. Topicalizing a verb without its verbal complement (II)

of this verbal cluster. This conflicts with a standard restriction on unbounded dependencies, the Trace Principle of Pollard and Sag (1994), which states that traces have to be subcategorized for.

As an alternative to the LEX encoding of coherence requirements one might be tempted to rule out examples like (239) by making reference to valence specifications alone, e.g., by stating that only saturated arguments can be raised. However, examples like (239) are also ungrammatical if the

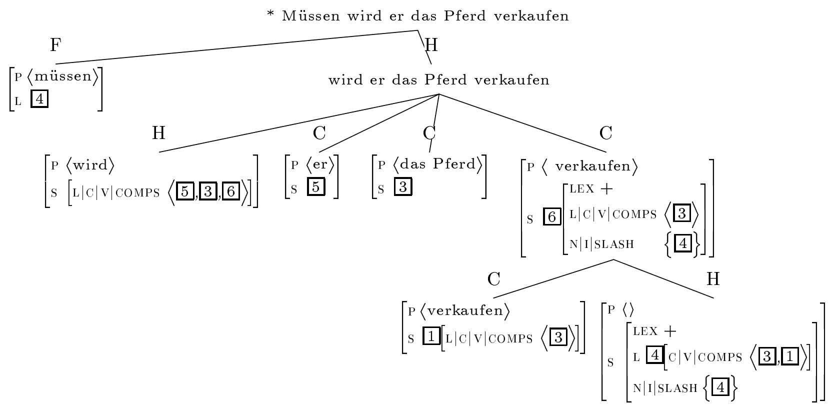


FIGURE 18. Topicalizing a verb without its verbal complement (III)

embedded verb which is left in the Mittelfeld is an intransitive verb, as the examples in (240) show.

(240) a. * Müssen wird er lachen.
have to will he laugh
'He will have to laugh.'

b. * Müssen wird getanzt werden.
have to will danced be
'There will have to be dancing.'

Under our theory with the LEX encoding, the most promising structure for example (240a) is the one shown figure 19 on the facing page. Just like in the transitive verb case discussed above, the explanation building on the LEX requirement as coherence encoding is sufficient to explain the ungrammaticality of this structure: the coherently construction verb *müssen* requires its verbal complement *lachen* ($\boxed{1}$) to be [LEX +]. To obtain the flat Mittelfeld, the verb *wird*, on the other hand, has to raise the verbal complement ($\boxed{1'}$) from its verbal argument ($\boxed{6}$). The argument-raising principle requires this complement ($\boxed{1'}$) to be [LEX −] which conflicts with the LEX value of the occurrence of *lachen* ($\boxed{1}$) in the tree.

Sentence (240b) is an example for a subjectless construction. Because the embedded verb *getanzt* is intransitive, there are no NP complements at all in the whole clause. But since our explanation of the ungrammaticality is independent of the valence specifications, this sentences is ruled out by the theory just like the previous one.

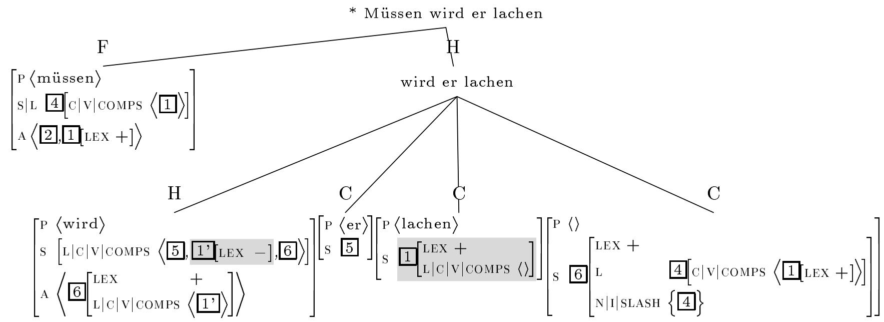


FIGURE 19. Topicalizing a verb without its intransitive verbal complement

5.2. Interaction of partial constituents with VP topicalization.

5.2.1. *Partial APs and VP topicalization.* The next analysis we want to show in detail is an example for a VP topicalization including a partial AP, namely the example (229b) discussed in section 3.4, repeated as (241) below.

(241) [Stolz gewesen] ist er *auf seine Kinder*.
proud been is he of his children
'He was proud of his children.'

In this example, argument raising from an adjectival complement has to interact with argument raising from a topicalized verbal complement in which it is embedded. The structure for this example as licensed by our theory is shown in figure 20 on the next page.

The important detail is how the topicalized constituent with its partial AP *stolz gewesen* is licensed. Just like in the example shown in figure 12 on page 258, the lexical entry of the copula *sein* shown in figure 2 on page 248 comes into play. The occurrence of *gewesen* in the tree in figure 20 on the following page raises the argument *auf seine Kinder* ($\boxed{3}$) from its adjectival complement *stolz* ($\boxed{1}$). The remaining partial complement is then realized in a head-complement structure. The resulting VP *stolz*

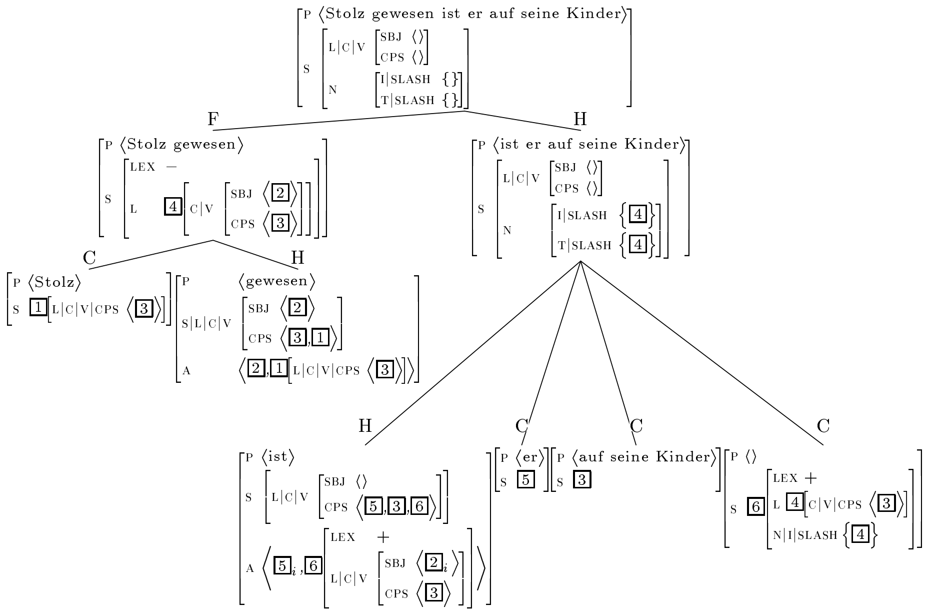


FIGURE 20. Topicalization of a VP including a partial AP

gewesen is [LEX −] and has one element left on its COMPS list, the raised PP *auf seine Kinder* (3).

The tense auxiliary *ist* occurring in verb-second position belongs to the obligatorily coherent verbs and requires its complement to be [LEX +], as was shown in the lexical entry in figure 1 on page 247. The argument-raising principle ensures that the occurrence of *ist* in the tree in figure 20 raises the PP *auf seine Kinder* (3) from (the trace of) its verbal complement *stolz gewesen* (6). Having raised the PP *auf seine Kinder* (3) to the COMPS requirements of *ist*, one can license a flat head-complement structure with *ist* as head daughter and the NP *er*, the trace of the fronted VP, and the raised PP as complement daughters. The PP *auf seine Kinder* has thus been raised twice and is realized independent from its original head *stolz*, as a complement of the verb *ist*.

5.2.2. *Partial NPs and VP topicalization.* We now take a closer look at the two examples for an interaction of partial NPs with VP topicalization which we discussed in section 3.4. The observation was that topicalization including a partial NP is possible (242a), whereas topicalization of the VP including only the PP argument of an NP is ungrammatical (242b).

(242) a. [Ein dickes Buch ausleihen] will niemand *darüber*.
a thick book borrow wants nobody on.this
'Nobody wants to borrow a thick book on this topic.'

b. * [Darüber ausleihen] will niemand *ein dickes Buch*.
on.this borrow wants nobody a thick book

The structure for the grammatical example (229c), is shown in figure 21 on the next page. We first focus on how the partial topicalized constituent *ein dickes Buch ausleihen* is licensed. The structure of the NP *ein dickes Buch* is licensed by the Head-Specifier and the Head-Adjunct Schema. Relevant for the following is that the PP complement (3) of the noun *Buch* is never saturated and thus appears on the COMPS list of the NP (1). As the lexical entry of the verb *ausleihen* shown in figure 3 on page 248 interacts with the argument-raising principle of figure 4 on page 249, the occurrence of *ausleihen* in the tree in figure 21 on the following page raises the PP argument *darüber* (3) from its nominal complement (1). The remaining partial-NP complement *ein dickes Buch* (1) is then realized in a head-complement structure. The resulting VP *ein dickes Buch ausleihen* is [LEX −] and has one element left on its COMPS list, the raised PP *darüber* (3).

The verb *will* belongs to the obligatorily coherent verbs and requires its verbal complement to be [LEX +], as was shown in its lexical entry in figure 1 on page 247. The argument-raising principle ensures that the occurrence of *will* in the tree in figure 21 on the following page raises the PP *darüber* (3) from (the trace of) its verbal complement *ein dickes Buch ausleihen* (6). Again, as in the tree of figure 20 on the preceding page, for this to be possible, the trace must be [LEX +], which does not conflict with the [LEX −] specification on the topicalized VP. The subject NP *niemand*, the raised PP *darüber*, and the trace of the partial-VP complement are then all realized in a flat head-complement structure. Parallel to the first interaction example discussed above, the PP (3) has thus been raised twice and is realized separate from its original head *Buch*, as a complement of the verb *will*.

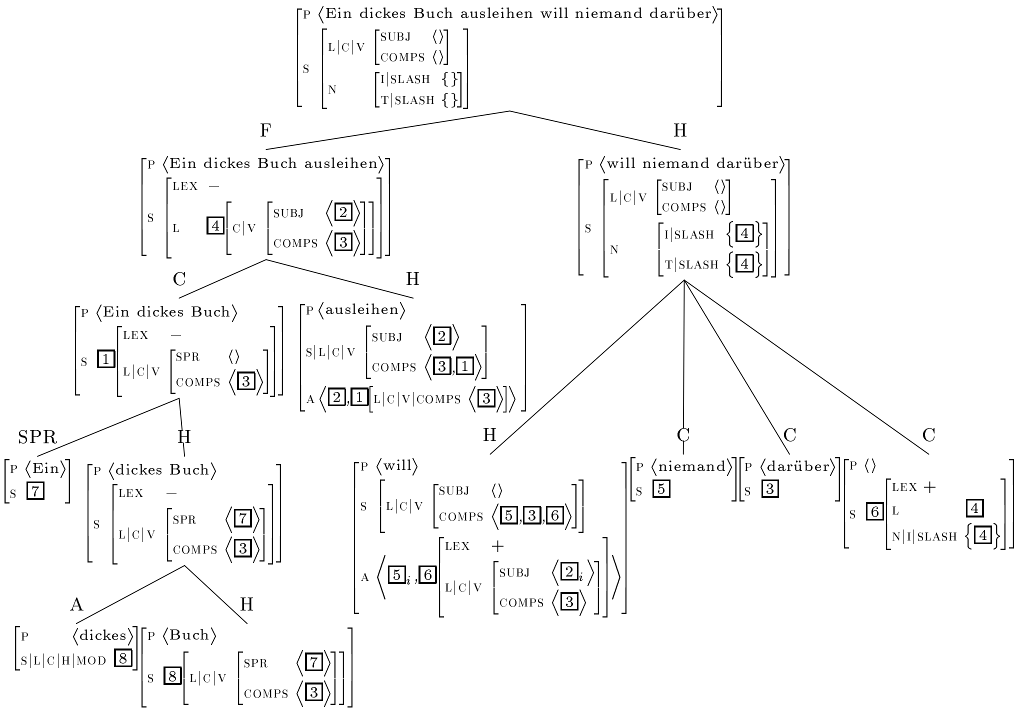


FIGURE 21. Topicalization of a VP including a partial NP

The ungrammatical example (242b) involves a PP argument that has been topicalized with the VP, leaving the NP behind. The most promising structure for this example is shown in figure 22 on the facing page. The example is interesting since in the Mittelfeld both the NP and the PP can appear separately. This is reflected in our theory by allowing the PP to raise and become a sister of the NP. So why is the example (242b) ungrammatical?

The conflict in this example arises in the topicalized constituent: The verb *ausleihen* in the example in figure 22 on the next page can raise the PP argument *darüber* ($\boxed{3}$) of the NP *ein dickes Buch* ($\boxed{1}$). To build the topicalized constituent *darüber ausleihen*, the raised PP has to be realized in a head-complement structure before its governor *Buch* is realized. But

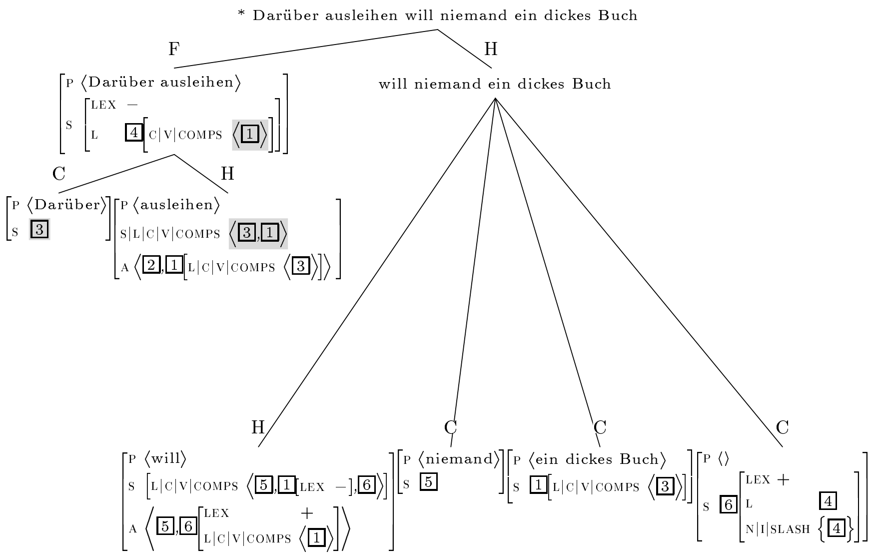


FIGURE 22. Topicalization of a VP including a raised PP

according to the Valence Principle shown in figure 11 on page 256, more oblique complements have to be realized first. The argument-raising principle defined in figure 4 on page 249 adds the raised complements to the beginning of the COMPS list, i.e., as less oblique than the other complements. One of these complements is the raising source, which therefore has to be realized before (or together with) any of the arguments raised from it. As a result, the head-complement structure *darüber ausleihen* cannot be licensed by our theory.

5.3. Scrambling. While our discussions of analyses so far focused on topicalization examples, our theory also provides an explanation for the patterns of grammaticality arising with (partial) VP and AP complements in the Mittelfeld which we discussed in sections 3.1 and 3.2.

5.3.1. *Complete complements.* Scrambling of full VP complements is possible when selected by incoherently constructing verbs, as illustrated again in (243).

(243) a. Er wird [das Pferd zu verkaufen] noch heute versuchen.
he will the horse to sell still today try

b. Er wird [das Pferd zu verkaufen] ihr noch heute empfehlen.
he will the horse to sell her still today advise

Our theory correctly predicts this since incoherently constructing verbs select a [LEX −] constituent. Since the argument-raising principle can only raise complements from [LEX +] constituents, complements of incoherently constructing verbs always have to be full VPs, which like other fully saturated complements can occur in different positions of the Mittelfeld.[11]

Scrambling of full VP complements of coherently constructing verbs, as displayed again in example (244), is correctly predicted not to be possible, since our theory does not license full VP complements of coherently constructing verbs in the Mittelfeld at all.

(244) * Er wird [das Pferd verkaufen] noch heute wollen.
he will the horse sell still today want to

This follows from the interaction of the argument-raising principle and the [LEX +] requirement which coherently constructing verbs impose on their complement. This explanation also covers the AP complements in (245), which are selected coherently as well.

(245) * Er ist [stolz auf seine Kinder] im letzten Jahr gewesen.
he is proud of his children in the last year been

5.3.2. *Partial complements.* The examples (246) and (247) remind us that partial verbal and adjectival complements can never occur at the beginning of the Mittelfeld.

(246) * Er scheint / versucht / glaubt [zu verkaufen] *das Pferd*.
he seems tries believes to sell the horse
'He seems to / tries to / believes to sell the horse.'

(247) * Er ist [stolz] im letzten Jahr *auf seine Kinder* gewesen.
he is proud in the last year of his children been
'Last year he was proud of his children.'

For incoherently selected verbal complements this follows from the fact that, as explained above, our theory never licenses partial verbal complements for incoherently constructing verbal heads.

[11] A theory further restricting German Mittelfeld word order naturally is needed but is a topic of its own.

Coherently selected verbal and adjectival complements combine with their verbal head as part of a head cluster. Different from ordinary complements, these [LEX +] complements are licensed by the binary Head-Cluster Schema, from which we assume no linearization into the Mittelfeld to be possible. To ensure the proper order of the head-cluster (or single [LEX +] element) to the right of all other elements in the flat head-complement structure, it suffices to specify the simple LP statement shown in figure 23.

$$\left[\text{SYNSEM}|\text{LEX}\ -\right] < \left[\text{SYNSEM}|\text{LEX}\ +\right]$$

FIGURE 23. Linearization according to lexical status

6. From argument to dependent raising

In the previous sections, we presented an account of general partial constituent fronting in German. The core of the proposal is a lexical principle which introduces argument raising as a general possibility in the mapping from the argument structure to the valence attributes of verbal words. The principle thereby makes it possible to license partial complements of three different categories: partial APs, NPs, and VPs. Apart from providing a uniform approach to different kinds of partial constituents, the proposal is attractive since it also explains the seemingly non-local interaction in cases where a fronted (partial) VP topicalization contains a partial NP or AP on the basis of local lexical argument raising specifications.

A shortcoming of the proposal, however, is that it only deals with complements which are partial as a result of the complement lacking one or more *arguments*. As we will motivate below, there is a second possibility which deserves more attention, namely that a constituent is partial because it lacks one (or several) of its *adjuncts*. In the traditional HPSG framework of Pollard and Sag (1994) we assumed above, this second possibility is problematic since adjunction is a syntactic process not reflected in the lexical argument or valence structure. Their generalized argument raising approach therefore cannot easily be extended to the cases in which partiality results from displaced adjuncts. On the other hand, following Miller (1992) and Van Noord and Bouma (1994), a significant line of research in HPSG has argued for a lexicalization of adjunct selection parallel to the selection of arguments. While the early approaches employed lexical rules to add adjuncts onto the subcategorization list of the head, in the recent proposal of Bouma et al. (1998) a lexical principle mapping the argument structure to a dependents list is employed which in addition to the mapping of arguments adds a list of adjuncts to the dependents.

The purpose of this section is to investigate how the generalized argument raising approach to partial constituents we developed above can be combined with the lexicalized treatment of adjuncts proposed by Bouma et al. (1998) (henceforth: BMS) to yield a more general theory of dependent realization including arguments, adjuncts and raised dependents of both kinds. Apart from extending the empirical coverage of argument raising approaches to partial constituents, such an integration of the two proposals is also interesting from a theoretical perspective: On the one hand, the core mechanisms of the two proposals, i.e., the lexical principles ensuring the relevant mappings, are very similar and a unified approach therefore promising. On the other hand, BMS include a traceless extraction as part of their lexical argument mapping while we above assumed a trace-based unbounded dependency theory – which we will show to be crucial to obtain the intended structures. Attempting to integrate the two proposals on the theoretical side thus provides important feedback on the interdependence of some of the most widely employed mechanisms in HPSG: argument-raising, adjuncts as dependents, and traceless extraction.

In the following, we first deal with the integration of argument raising with adjuncts as dependents, before turning to the interaction of generalized argument raising and a traceless extraction theory.

6.1. The data: Constituents missing adjuncts. In our empirical discussion of the partial fronting phenomenon in section 6.1, we presented examples where partial VPs, APs or NPs have been fronted, always leaving behind one or more *arguments*. A further class of sentences bearing exhibiting a kind of partiality are examples where *adjuncts* modifying the fronted constituent are left behind in the Mittelfeld. The following sentences illustrate this possibility with adjuncts of fronted verbal, adjectival, and nominal constituents.

(248) [Frieren] müssen sie deshalb aber *in der nächsten Woche* nicht.
freeze have to they therefore but in the next week not
'But they will not have to freeze next week because of this.'

(249) [Interessiert] ist er *vor allem* an den Umständen des Diebstahls.
interested is he before everything in the circumstances of the theft
'He is especially interested in the circumstances of the theft.'

(250) [Nur zwei Gemälde] werden *aus seinem Spätwerk* gezeigt.
only two paintings are from his late works shown
'Only two paintings were shown from the end of his career.'

In (248) the partially fronted VP *frieren* leaves behind the adjunct PP *in der nächsten Woche*. In (249) the fronted AP *interessiert* leaves behind the modifying adverbial particle *vor allem*. Finally, in (250) the adjunct PP *aus seinem Spätwerk* modifies the fronted partial NP *nur zwei Gemälde*. Note that in all three cases the adjunct in the Mittelfeld is interpreted as modifying the fronted constituent and not the finite verbs *müssen*, *ist*, or *werden*.

For the cases discussed we discussed in the first part of this chapter, in which a complement of a fronted partial constituent remains behind in the Mittelfeld, we argue that these complements are raised and realized as the complements of the embedding verb. So the raising of arguments explains how it is possible to license the fronted partial element as a constituent. Since the above examples involving adjuncts appear to be parallel to the complement case, a partial constituent apparently cannot only result from raising of arguments but also from raising of adjuncts.

An alternative analysis for examples like (248) with a fronted partial VP and an adjunct in the Mittelfeld is proposed by St. Müller (1997). He analyzes this construction as an extraction of the head of a head-adjunct structure. While for German there are good arguments for allowing some kind of displacement of a finite verbal head to account for verb-second, it is much less clear whether movement of heads should be allowed in any other case. For example, the verb-second phenomenon is clause-bound, while the topicalization of partial VPs is not. And it is clear that generally allowing head extraction vastly overgenerates. In light of this problematic character of the only available analysis of the phenomenon in HPSG, it appears to be well motivated to in the following pursue our idea of generalizing argument raising to adjuncts as dependents.

6.2. Towards an integrated theory. At the heart of the adjuncts-as-dependents proposal of BMS are two lexical principles. The Argument

Realization Principle shown in figure 24 specifies that the dependents

$$
\mathit{verb}(\mathit{al\text{-}word}) \rightarrow \begin{bmatrix} \text{S|LOC} & \begin{bmatrix} \text{CAT|HEAD} & \boxed{3} \\ \text{CONT|KEY} & \boxed{2} \end{bmatrix} \\ \text{DEPS} & \boxed{1} \oplus \mathit{list}\left(\begin{bmatrix} \text{L|C|H|MOD|L} & \begin{bmatrix} \text{CAT|HEAD} & \boxed{3} \\ \text{CONT|KEY|ARG} & \boxed{2} \end{bmatrix} \end{bmatrix}\right) \\ \text{ARG-ST} & \boxed{1} \end{bmatrix}
$$

FIGURE 24. Argument Realization (BMS)

of a verbal word, which are housed under a newly introduced feature DEPENDENTS, consist of the elements of the argument structure (ARG-ST) plus a (potentially empty) list of adjuncts. The Dependent Realization Principle shown in figure 25 then defines how the arguments and adjuncts

$$
\mathit{word} \rightarrow \begin{bmatrix} \text{S|L|C|VAL} & \begin{bmatrix} \text{SUBJ} & \boxed{1} \\ \text{COMPS} & \boxed{2} \end{bmatrix} \\ \text{DEPS} & \boxed{1} \oplus \boxed{2} \end{bmatrix}
$$

FIGURE 25. Dependent Realization (BMS, preliminary)

collected on DEPS are mapped to the valence attributes SUBJ and COMPS. The combined effect of these two principles is that adjuncts are realized as complements of a verb in a head-complement structure.

To ensure that not only adjuncts of verbs but adjuncts in general can occur as dependents, as a first step towards adopting the BMS proposal to the data presented in section 6.1 we generalize the antecedent of the Argument Realization Principle to *word*.[12]

Returning to the heart of the second proposal to be integrated, our partial constituent approach, we repeat the Basic Lexical Argument Raising Principle of figure 4 on page 249 in figure 26 on the facing page. The relevant part of the principle is that the COMPS list consists of elements

[11] We show the principles of BMS including full feature paths reconstructed from their abbreviations. Since the type *verb* used by BMS as antecedent of their argument realization principle in their notation represents a subtype of *word* and not the usual subtype of *head*, in our figure 24 we have clarified this by writing *verb*(*al-word*) instead.

[12] While the data presented in section 6.1 show that at least some adjuncts of non-verbal heads should be treated as dependents, this clearly is not the case for all kinds of adjuncts. A more elaborate theory of adjunct realization will have to restrict the subclass of adjuncts which are intended to construct as dependents and which are not.

$$
\begin{bmatrix} \mathit{word} & \\ \text{S|L|C|HEAD} & \begin{bmatrix} \mathit{verb} & \\ \text{VFORM} & \mathit{bse} \end{bmatrix} \end{bmatrix} \rightarrow \begin{bmatrix} \text{S|L|C|V} & \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1} \right\rangle \\ \text{COMPS} & \mathit{raised}\left(\boxed{3}\right) \oplus \boxed{2} \end{bmatrix} \\ \text{ARG-ST} & \left\langle \boxed{1} \mid \boxed{2} \right\rangle \;\wedge\; \left(\boxed{3} \bigcirc \mathit{indep}\right) \end{bmatrix}
$$

FIGURE 26. Basic Lexical Argument-Raising Principle

of the argument structure plus possibly some elements raised from $\boxed{3}$. Whether something can be raised from a specific argument follows from the definition of the relation *raised* which we will come back to later on.

To combine this principle with the setup of BMS, one first needs to determine where argument raising should take place. Either it is integrated into the Argument Realization Principle mapping from ARG-ST to DEPS. Or it could be part of the mapping between DEPS and the valence features in the Dependent Realization Principle. Since the DEPS list contains adjuncts and arguments, integrating argument raising into the Dependent Realization Principle would allow argument raising from adjuncts in addition to the traditional argument raising from complements. We are not aware of empirical or theoretical evidence for such partiality of adjuncts. It therefore seems more appropriate to integrate argument raising into the mapping from ARG-ST to DEPS.

The argument realization principle extended to include argument raising is shown in figure 27.

$$
\mathit{word} \rightarrow \begin{bmatrix} \text{S|LOC} & \begin{bmatrix} \text{CAT|HEAD} & \boxed{3} \\ \text{CONT|KEY} & \boxed{2} \end{bmatrix} \\ \text{DEPS} & \left(\mathit{raised}(\boxed{3},\boxed{4}) \oplus \boxed{1}\right) \;\bigcirc\; \mathit{list}\left(\begin{bmatrix} \text{L|C|H|MOD|L} & \begin{bmatrix} \text{CAT|HEAD} & \boxed{3} \\ \text{CONT|KEY|ARG} & \boxed{2} \end{bmatrix} \end{bmatrix}\right) \\ \text{ARG-ST} & \boxed{1} \;\wedge\; \left(\boxed{4} \bigcirc \mathit{indep}\right) \end{bmatrix}
$$

FIGURE 27. Extended Argument Realization

To see how this new principle manages to provide us with constituents that are partial due to missing adjuncts, we need to define the relation *raised* which parameterizes the principle by specifying from which arguments it is possible to raise elements. Since the antecedent of the principle in figure 27 covers all words, and not just the base form verbs for which argument raising is specified in the argument raising principle in figure 26, a new argument has to be added to the original definition of *raised* to take the head value of the word into account. The otherwise unchanged definition of raised from figure 6 on page 250 is shown in figure 28. In

$$
\begin{array}{l}
\textit{raised}\Big(\textit{head}, \langle\rangle\Big) := \langle\rangle. \\[1ex]
\textit{raised}\left(\begin{bmatrix}\text{VFORM} & \textit{bse}\end{bmatrix}, \left\langle \begin{bmatrix}\text{LEX} & + \\ \text{L}|\text{C} & \begin{bmatrix}\text{HEAD} & \textit{verb} \vee \textit{adj} \\ \text{V}|\text{COMPS} & \boxed{1}\end{bmatrix}\end{bmatrix} \right\rangle\right) := \boxed{1}\ \textit{lex-minus-list}. \\[1ex]
\textit{raised}\left(\begin{bmatrix}\text{VFORM} & \textit{bse}\end{bmatrix}, \left\langle \begin{bmatrix}\text{L}|\text{C} & \begin{bmatrix}\text{HEAD} & \textit{noun} \\ \text{V}|\text{COMPS} & \boxed{1}\end{bmatrix}\end{bmatrix} \right\rangle\right) := \boxed{1}\ \textit{prep-list}.
\end{array}
$$

FIGURE 28. Revised definition of possible argument-raising sources

essence, it specifies that verbal, adjectival or nominal arguments of base form verbs can be partial constituents if they contribute their remaining COMPS elements. The important new aspect is that as a result of the Extended Argument Realization Principle and its interaction with the Dependents Realization Principle, the COMPS list also includes adjuncts. They can thus be raised just like ordinary complements and thereby leave a partial constituent behind.

To complete the picture, we have to show how the arguments and adjuncts collected on the DEPS structure are mapped to the valence features. The Dependent Realization Principle of BMS (figure 25 on page 274) is not sufficient here for two reasons: Firstly, the principle does not specify what happens with the valence features of words that do not have a subject, as for example nouns, adjectives, or German subjectless verbs. In these cases all dependents should be mapped onto the COMPS list. Secondly, in case a dependent is raised from the first element on ARG-ST, i.e., the subject, the raised constituent will wind up as the first element on DEPS.[13] The Dependent Realization Principle of figure 25 on page 274 would then map this raised dependent onto SUBJ instead of the real subject.

Regarding the first problem, every linguistic theory will have to provide a way of distinguishing those words which "assign a subject theta role" from those which do not – be it by lexical stipulation or derivable from other notions. For the purpose of this abstract it therefore is safe to assume that in the lexicon all words which require a subject are marked $\begin{bmatrix}\text{SUBJ} & \textit{ne-list}\end{bmatrix}$ while all other words bear a $\begin{bmatrix}\text{SUBJ} & \langle\rangle\end{bmatrix}$ specification. To solve

[13]Remember that raised arguments are specified to precede the argument raising source on the COMPS list is intentional. This formulation of argument raising is used to disallow the ungrammatical constructions in which an argument is realized lower in the tree than the argument raising source it was raised from.

the two problems, it then is sufficient to relax the original Dependent Realization Principle of figure 25 on page 274 to use shuffle ($\bigcirc$) instead of append ($\oplus$) and ensure identification of the subject with the help of the principle in figure 29.

$$
\begin{bmatrix}\text{S}|\text{L}|\text{C}|\text{VAL}|\text{SUBJ} & \left\langle\boxed{1}\right\rangle\end{bmatrix} \rightarrow \begin{bmatrix}\text{ARG-ST}|\text{HD} & \boxed{1}\end{bmatrix}
$$

FIGURE 29. Subject Identification Principle

6.3. A short example. Now that the theory is complete, let us return to the example (248). The partially fronted constituent is licensed in the following way. The verb *frieren* in (248) has one argument (and accordingly one element on its ARG-ST list): the subject NP. According to the Extended Argument Realization Principle in figure 27 on page 275 the occurrence of *frieren* in the example sentence has two elements on its DEPS list: its own argument and the PP adjunct *in der nächsten Woche*. The Dependent Realization Principle then ensures that the dependents are mapped onto the valence features as shown in the description of *frieren* in figure 30.

$$
\begin{bmatrix}
\text{PHON} & \langle \textit{frieren} \rangle \\
\text{S}|\text{L}|\text{CAT} & \begin{bmatrix}\text{HEAD} & \boxed{3} \\ \text{VAL} & \begin{bmatrix}\text{SUBJ} & \left\langle\boxed{1}\right\rangle \\ \text{COMPS} & \left\langle\boxed{2}\right\rangle\end{bmatrix}\end{bmatrix} \\
\text{DEPS} & \left\langle \boxed{1}, \boxed{2}\begin{bmatrix}\text{L}|\text{C}|\text{H}|\text{M}|\text{L}|\text{C}|\text{HEAD} & \boxed{3}\end{bmatrix}\right\rangle \\
\text{ARG-ST} & \left\langle \boxed{1}\text{NP} \right\rangle
\end{bmatrix}
$$

FIGURE 30. A description of *frieren* in sentence (248)

The finite verb *müssen* in (248) has two elements on its ARG-ST list: the subject NP and a verbal complement. According to the Extended Argument Realization Principle in figure 27 on page 275 it raises all complements of this verbal argument onto its own DEPS list. The occurrence of *müssen* in (248) thus has three elements on its DEPS list, as shown in figure 31 on the next page: its own two arguments, and the complement raised from the verbal argument *frieren*. By virtue of the Dependent

$$\left[\begin{array}{ll}\textsc{phon} & \langle \textit{müssen} \rangle \\ \textsc{s}|\textsc{l}|\textsc{c}|\textsc{v}|\textsc{comps} & \left\langle \boxed{4}, \boxed{2}, \boxed{5} \right\rangle \\ \textsc{deps} & \left\langle \boxed{4}, \boxed{2}, \boxed{5} \right\rangle \\ \textsc{arg-st} & \left\langle \boxed{4}\mathrm{NP}, \boxed{5}\mathrm{VP}\left[\textsc{l}|\textsc{c}|\textsc{v}|\textsc{comps}\ \left\langle \boxed{2} \right\rangle\right] \right\rangle \end{array}\right]$$

FIGURE 31. A description of *müssen* in sentence (248)

Realization Principle all the dependents are mapped onto the valence features.[14] The subject NP *sie*, the PP adjunct *in der nächsten Woche* and the trace of the topicalized verbal complement *frieren* can then all be realized in a head-complement structure.

6.4. A related issue: Traceless extraction. BMS provide a lexical account of extraction to replace the configurational nonlocal-feature theory included in Pollard and Sag (1994). A lexical principle, the SLASH Amalgamation Constraint, serves to collect the SLASH values of a word's dependents. A constraint on phrases, the SLASH Inheritance Principle, defines the SLASH inheritance on head-valence phrases (those phrases involving head, complement and/or subject daughters). Third, a constraint is introduced which ensures the correct binding of the SLASH values in head-filler phrases. Finally, BMS replace traces or lexical rules as mechanisms for introducing slashed dependents by an underspecification approach. Dependents in the lexicon are specified as *synsem* objects. Two subtypes of *synsem* are introduced: *canon-synsem* and *gap-synsem*, the latter of which cannot be realized as part of a word but introduces a slash as shown in figure 32. The Dependent Realization Principle of BMS ensures that

$$\textit{gap-ss} \rightarrow \left[\begin{array}{ll}\textsc{loc} & \boxed{1} \\ \textsc{nonloc}|\textsc{slash} & \boxed{1}\end{array}\right]$$

FIGURE 32. Constraint of *gap-synsems*

only objects of type *canon-synsem* occur on the COMPS list, as shown in figure 33 on the facing page.

[14]Note that the finitivization lexical rule we defined in figure 9 on page 254 ensures that the subject of finite verbs occurs as the first element on the COMPS list and not on the SUBJ list.

$$\textit{word} \rightarrow \left[\begin{array}{ll}\textsc{subj} & \boxed{1} \\ \textsc{comps} & \boxed{2} \ominus \textit{list}\left(\textit{gap-ss}\right) \\ \textsc{deps} & \boxed{1} \oplus \boxed{2}\end{array}\right]$$

FIGURE 33. Dependent Realization (BMS, complete version)

At first sight it looks as though we can simply integrate this traceless extraction theory into the account of dependent realization including argument raising which we developed in the last section. One would adopt the lexical nonlocal-feature percolation, assume the division of *synsem* objects into *canon-synsem* and *gap-synsem*, and extend our version of the Dependent Realization Principle such that it allows only *canon-synsem* objects to occur on the COMPS list of word.

Interestingly, such a combination of traceless extraction with argument raising in some cases results in different analyses than under a trace-based approach. Take for example the sentences shown in (251), where the complement of an element selected by an argument raising verb, has been topicalized.

(251) a. *Das Pferd* will er [verkaufen].
the horse wants he sell
'He wants to sell the horse.'

b. *Auf seine Kinder* ist er [stolz] gewesen.
of his children is he proud been
'He has been proud of his children.'

c. *Über Syntax* will er [ein Buch] ausleihen.
on syntax wants he a book borrow
'He wants to borrow a book on syntax.'

Under the trace-based analysis we pursued in the first part of this chapter, the fronted constituent (in italics) in all three examples is raised from the constituent in brackets before it is extracted. Figure 34 on the next page shows the analysis of example (251a) under the trace-based theory. The argument raising verb *will* raises the unrealized complement ($\boxed{3}$) from its verbal argument *verkaufen* $\boxed{6}$ and realizes it as a trace, together with the subject NP ($\boxed{5}$) and the verbal argument ($\boxed{6}$).

Under the traceless approach of BMS the examples in (251) are analyzed differently. Figure 35 on page 281 shows the sketch of an analysis tree for (251a) under the revised theory combining our argument raising approach

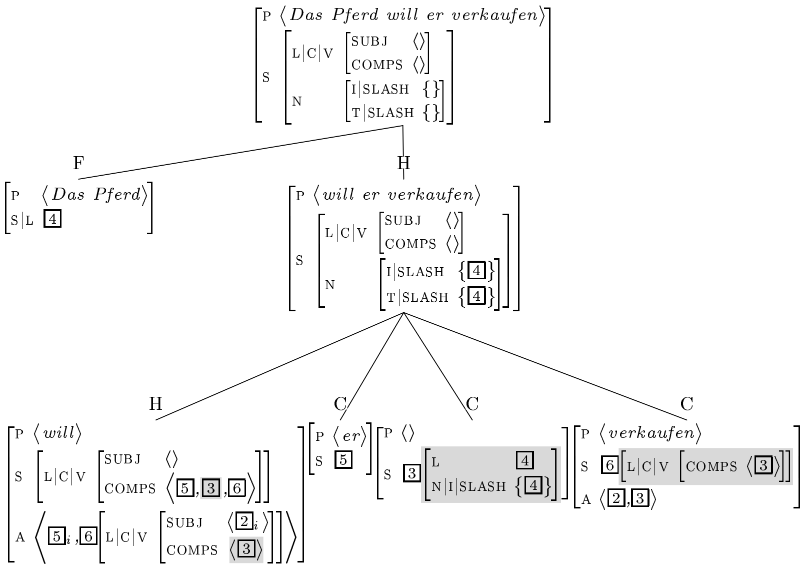


FIGURE 34. Trace-based analysis for (251a)

and the traceless account of BMS. The complement ($\boxed{3}$) of *verkaufen* in the tree in figure 35 on the next page is of type *gap-ss* and, according to the Dependent Realization Principle in figure 33 on the preceding page it does not occur on the COMPS list. Instead, the SLASH value introduced by this *gap-ss* object is amalgamated by *verkaufen*. The argument raising verb *will* cannot raise any arguments from its verbal argument *verkaufen* since the COMPS list of *verkaufen* is empty. Instead, *will* amalgamates the SLASH value from *verkaufen*. The verb *will*, its subject NP *er*, and its verbal argument *verkaufen* are then realized in a head-complement structure.

The crucial difference between the two analyses thus is that under the traceless analysis the fronted constituent *das Pferd* is extracted from the verbal head *verkaufen* of which it is a semantic argument, whereas under the trace-based analysis the fronted constituent is extracted as a complement of the higher verb *will* to which the valence requirement had been raised. This rather subtle difference has a clear effect: Under the trace-based analysis one obtains the same analysis independent of whether the complement (*das Pferd*) of an element (*verkaufen*) selected by an

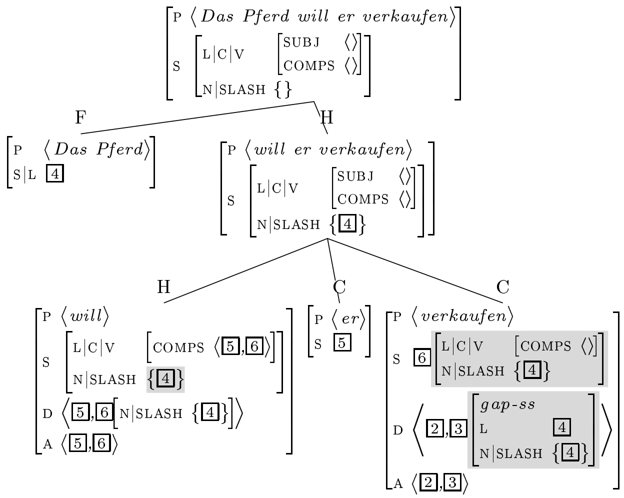


FIGURE 35. Traceless analysis for (251a)

argument-raising verb (*will*) is realized in the Mittelfeld or whether it is extracted and realized in a fronted position. In both cases the argument raising verb raises this NP onto its own COMPS list and either realizes the raised NP or the trace of the raised NP in a head-complement structure. On the other hand, the traceless approach licenses two different structures. For the Mittelfeld realization one obtains the same structure as under the trace based analysis: *das Pferd* is obligatorily raised. For the realization in fronted position the element is not raised since extraction always takes place from the lowest lexical head, i.e., the lexical head of which it is a semantic argument. This contradicts the standard HPSG analyses of obligatory coherence as obligatory argument raising. Future research has to show whether the two different structures licensed by the traceless approach can be independently motivated.

6.5. Conclusion. Based on a set of examples involving fronted constituents which are partial due to missing adjuncts, in this section we sketched how the generalized argument raising approach we presented in the first part of this chapter and the adjuncts-as-dependents, traceless proposal of Bouma et al. (1998) can be integrated into a single theory.

Empirically the combination of an argument raising with an adjuncts-as-dependents approach provides a uniform analysis of the full range of partial constituent phenomena since in the combined analysis adjuncts can undergo argument raising to empty a constituent just like complements can. Formally, the integration of the theories highlights the interdependence of argument raising and the methods for licensing unbounded dependencies: In the traceless analysis of BMS, no empty elements are available to undergo argument raising. As a result, depending on whether a partial constituent has been fronted or is realized in its base position, different structures are licensed.

7. Outlook

Even though we tried to include a wide range of data in the discussion of this chapter, there are a number of topics which are relevant to an investigation of partial constituent fronting that were not included. In the following we want to mention some of these open issues.

7.1. Subjects in fronted non-finite constituents. In our discussion of partiallly fronted verbal constituents, we considered the topicalized verbal projection to be complete in case the verbal head was fronted including all of its *complements*. It was, however, noted by Haider (1982, 1990b) that under certain conditions it is possible to realize a *subject* as part of a fronted, non-finite constituent, i.e., in the notation of Bech (1955), that it is possible to front the constituent [N'(= N") V"]. While this option is generally available for ergative subjects (252), the occurrence of unergative subjects is significantly more restricted, but nonetheless possible as shown by Haider's example (253).

(252) Ein Fehler unterlaufen ist ihr noch nie.
an error crept.in is her still never.
'So far she has never made a mistake.'

(253) Ein Außenseiter gewonnen hat hier noch nie.
an outsider won has here still never
'An outsider has never won here yet.'

The existence of such data naturally raises the question how a theory like the one covering partial VP fronting presented in this chapter can be extended to account for such occurrences of subjects. Apart from general

considerations, a specific problem arising with such occurrences of subjects is how a subject included in a fronted non-finite verbal constituent can receive nominative case and ensure agreement with the finite verb – two traditionally local grammatical relations which seem to have turned non-local in such examples. In chapter 10, we turn to an investigation of these issues.

7.2. Coherently selecting adjectives. Askedal (1989, 103) argues on the basis of examples like (254) that adjectival heads can select coherently.

(254) da man Eiweiß auf Gift nicht mehr zu reimen gewohnt war.[15]
because one$_{N'}$ white of egg$_{A''}$ on poison$_{P''}$ not$_{Neg'}$ anymore to rhyme$_{V''}$ used to was$_{V'}$
'Because one was no longer used to rhyme white of egg with poison.'

The negation *nicht* is interpreted as belonging to the outer predicate *gewohnt sein*. But it intervenes between the inner predicate *zu reimen* and its complements *Eiweiß* and *auf Gift*. The possibility to perform such permutations of elements belonging to different heads is one of the tests of Bech (1955) for coherence.

On the other hand, the examples in (255) show that the full VP complement of the adjective can be fronted in the Mittelfeld (255a) and it can also be pied-piped (255b), which are two tests for an incoherent construction.

(255) a. da Eiweiß auf Gift zu reimen man nicht$_{Neg'}$ mehr gewohnt war.
because white of egg$_{A''}$ on poison$_{P''}$ to rhyme$_{V''}$ one$_{N'}$ not anymore used to was$_{V'}$

b. das ist die Substanz, die auf Gift zu reimen man nicht mehr gewohnt war.
this is the substance which$_{A''}$ on poison$_{P''}$ to rhyme$_{V''}$ one$_{N'}$ not$_{Neg'}$ anymore used to was$_{V'}$

The adjective *gewohnt* thus seem to pattern with optionally coherent verbs. More research is needed to determine which adjectives fall into this category. On the basis of such a classification, the argument-raising principle we presented in figure 4 on page 249 could then be extended to also apply to the appropriate class of adjectives.

[15] Thomas Mann: *Der Zauberberg*, S. Fischer Verlag: Frankfurt a. M., p. 801.

7.3. Lexical restrictions and context effects. In this chapter, we focused on the occurrence of partial constituents and how they are restricted by syntactic factors. In section 3.3 we already mentioned, however, that the occurrence of partial NPs is also subject to additional lexical restrictions. It has, for example, often been observed that grammatical examples containing a partial NP like the ones presented in (256a) become ungrammatical when the embedding verb is replaced by a verb which has the same syntactic properties but a different semantics.

(256) a. *Über Syntax* hat er [ein Buch] **ausgeliehen**.
on syntax has he a book borrowed
'He borrowed a book on syntax.'

b. * *Über Syntax* hat er [ein Buch] **geklaut**.
on syntax has he a book stolen
'He stole a book on syntax.'

The only difference between the two sentences in (256) is that the verb *ausleihen* is replaced by the verb *klauen*. De Kuthy (1998) takes a closer look at the lexical semantic properties of this contrast and shows, how such lexical restrictions can be integrated into an argument-raising approach.

De Kuthy (1998) also shows that the acceptability of ungrammatical examples like the one in (256b) can be significantly improved by adding an appropriate context. Thus, (256b) is much improved if it occurs in the context of a discussion about different books that were stolen at the library. How a theory of these context effects can be formulated and integrated into the presented syntactic theory is another open issue.

7.4. Topicalization of adjuncts. In our discussion of partial NPs in this chapter, we were solely concerned with PP *arguments*. But, similar to verbs, nouns can be modified by a PP, as example (257) shows, where the noun *Freundin* is modified by the PP *mit roten Haaren*.

(257) Peter hat eine neue Freundin mit roten Haaren.
Peter has a new girlfriend with red hair
'Peter has a new, red-haired girlfriend.'

It is generally stated in the literature that such adjunct PPs cannot occur separate from the noun they modify. The following ungrammatical example, where an adjunct PP has been topicalized without the NP it modifies, illustrates this.

(258) * *Mit roten Haaren* hat Peter [eine neue Freundin].
with red hair has Peter a new girlfriend

However, as discussed in De Kuthy (1998), it had gone unnoticed that there are grammatical examples in which an adjunct PP occurs separate from the NP it modifies. To support this claim, she provides the following two grammatical sentences from the "Frankfurter Rundschau".

(259) a. *Aus dem 17. Jahrhundert* erklangen in dynamisch differenziertem Spiel [Tanzsätze von Johann Sebastian Bach].
from the 17th century sounded in dynamically differentiated manner dances by Johann Sebastian Bach
'Some dances from the 17th century by Johann Sebastian Bach were played in a dynamically differentiated manner.'

b. *Aus dem "English Theater"* stehen [zwei Modelle] in den Vitrinen.
of the English Theater are two models in the display
'There are two models from the English Theater on display.'

Furthermore, De Kuthy (1998) observes that the context again plays an important role. The example (260) shows that a sentence like the one that was judged ungrammatical in (258) is in fact grammatical when accompanied by the right kind of context.

(260) Auf einer Show in Düsseldorf wurden die neuesten Frisurmodelle vorgestellt.
a. *Mit kurzen Haaren* wurden dabei nur [drei Modelle] gezeigt.
with short hair were there only three models presented
'The newest haircuts were presented during a show in Düsseldorf. Only three of the models shown had short hair.'

De Kuthy (1998) shows that a combination of the adjuncts-as-dependents approach along the lines of Bouma et al. (1998) and a generalized argument raising architecture like the one we provided in section 6 can be used to account for such data involving adjuncts to NPs.

8. Conclusion

Investigating the nature of partial fronting phenomena in German, we contrasted two approaches: the remnant-movement analysis and a reanalysis-like approach. We showed that the empirical arguments discussed in the literature for preferring remnant movement are not convincing and that certain word order phenomena support a reanalysis-like approach to partial constituents.

We then compared three different kinds of partially occurring complements: verbal, adjectival, and nominal ones. We discussed the different behavior of coherently and incoherently selected verbal complements and showed that adjectival complements behave parallel to the coherently selected verbal complements. Nominal complements, on the other hand, were shown not to be subject to the restrictions holding for the verbal or adjectival complements.

We captured the empirical insights in a reanalysis-like theory formalized in the HPSG paradigm. The account extends the empirical coverage of previous HPSG proposals in a way which accounts for the similarities and the differences between three different kinds of partial constituents. The similarities derive from a generalization of the argument-raising approach to partial VPs: a lexical principle which introduces argument raising as a general possibility for verbal heads. The differences result from the different requirements with respect to the lexicality (LEX) of the complements as specified in the lexical entries and a relation (*raised*) parameterizing the lexical principle. As additional support for the analysis, we showed that the approach predicts the observable interaction between (partial) VP topicalization and partial NPs or APs.

Finally, we discussed examples showing that partial constituents cannot only result from missing arguments but also from dislocated adjuncts. Extending argument raising to dependent raising, we showed that the reanalysis-like approach we proposed for the missing argument cases carries over straightforwardly to the examples involving missing adjuncts.

CHAPTER 10

Subjects in Fronted Non-Finite Constituents

1. Introduction

Haider (1990b) pointed out that under certain conditions it is possible to realize a subject[1] as part of a fronted non-finite verbal constituent, i.e., in the notation of Bech (1955), that it is possible to front the constituent [N'(= N") V"]. While this option is generally available for ergative subjects (261), the occurrence of unergative subjects is significantly more restricted, but nonetheless possible as shown by Haider's example (262).

(261) Ein Fehler unterlaufen ist ihr noch nie.
an error crept.in is her still never.
'So far she has never made a mistake.'

(262) Ein Außenseiter gewonnen hat hier noch nie.
An outsider won has here still never
'An outsider has never won here yet.'

There are at least two questions arising from this observation. First, what are the restrictions on the occurrence of subjects in that position? And second, how does the subject included in the fronted non-finite verbal constituent receive nominative case? The first question has played a significant role in the Germanic syntax literature since the restrictions on such occurrences of subjects are an important empirical criterion for the base position of the subject in German, i.e., whether the subject is VP internal or external. In this chapter, we focus on the second, more neglected question. On the one hand, the question how a subject fronted as part of

This chapter is a slightly extended version of Meurers (1999b).

[1] Reis (1982) showed that establishing a well-defined notion of subject in German is problematic. Here and in the following we essentially use subject in the sense of nominative case marked NP. In German, only such nominative NPs can be eliminated (i.e., turn into PRO) when the sentence is converted to an infinitival complement in an equi construction.

a non-finite construction can receive nominative case is an interesting test case for the locality of grammatical relations like case assignment. On the other hand, clarifying when nominative case can be assigned also explains which constructions are ungrammatical because nominative case assignment was not possible. By answering the second question we thus also contribute to an answer of the more complex first question on the different conditions restricting the occurrence of subjects as part of non-finite fronted projections.

2. The theoretical starting point

The issue of nominative case assignment to subjects as part of non-finite constituents has not received much attention in the literature. In his investigation of ergative verbs, however, Grewendorf (1989, pp. 134ff) discusses a related problem: Nominative case assignment in the principles and parameters architecture traditionally assigns case to an NP co-indexed with and governed by INFL. But since INFL is generally not taken to govern into the VP, it is unclear how an ergative subject, which is taken to be located within the VP, can be assigned nominative case. Note that this problem is different from the one we are concerned with in this chapter in that it does not involve non-locality of case assignment arising from having to assign case to a subject embedded within a non-finite verbal complement within the VP. But it is similar enough to take it as a starting point in exploring possible analyses.

Grewendorf (1989) distinguishes two classes of approaches which have been pursued in the literature. On the one hand, theories of *direct* nominative case assignment (Fanselow, 1985; den Besten, 1985; Reuland, 1985) keep the idea that INFL assigns nominative case to the NP at the cost of relaxing the conditions under which such case assignment is possible. Fanselow (1985, sec. 4.2), for example, proposes to abandon the restriction that INFL must govern the NP to assign nominative case. Theories of *indirect* nominative case assignment, on the other hand, chose to abandon the idea that INFL assigns case to the NP directly (Hoekstra, 1984; Safir, 1985). Instead, case is assigned to some element co-indexed with and governed by INFL in the traditional way and this element then inherits the case down to the nominative bearing NP.

Returning to the apparently non-local case assignment issue we are concerned with, even though to our knowledge no theory has actually been worked out, one can find examples for the ideas of direct and indirect case assignment in the literature. Haider (1990b), for example, does not

address the issue of case assignment to subjects fronted as part of a non-finite verbal constituent directly. But in a different context (p. 96) he contemplates whether a trace of the finite verb could be part of the topicalized constituent. Such a finite verbal trace supposedly could then assign nominative case, e.g., in a construction like (263).

(263) [Ein Außenseiter gewonnen e_i] hat_i hier noch nie.
an outsider won has here still never

However, Haider points out that the existence of such structures would predict that verbal particles could occur in fronted position. As illustrated by example (264), this is clearly not the case.

(264) * [Ein Buch auf e_i] $schlug_i$ Hans.
a book PART *open Hans*
'He opened a book.'

Kratzer (1984, p. 46), on the other hand, follows the indirect case assignment idea in suggesting that nominative case "can be inherited from some other NP by means of co-indexation" for which she assumes "some empty NP outside of their VP". This idea, however, is not worked out any further.

Picking up at this point, we need to clarify the notions mentioned and explain how they fit into the general grammatical architecture. As a first step, we thus need to answer the following three questions:

1. What is the nature of the "*empty NP*" and how can it be assigned case locally?
2. What kind of relationship is the "*co-indexation*" which has to hold between the empty NP and the overt embedded NP?
3. In what way is the "*inheritance*" of case from the empty NP to the overt embedded NP realized?

3. The data

3.1. Nominative case assignment. A relevant property of the construction which points the way to an answer of the questions we raised above seems to have gone unnoticed: the topicalization of [N' V"] is restricted to sentences in which V' is a raising verb.[2] So while a *zu*-infinitive

[2]As so often, this turns out to be a rediscovery: Netter (1991, p. 28) mentions this restriction in passing.

can be fronted with the subject when embedded under the raising predicate *scheinen* (265), the same construction with an equi predicate like *versuchen* is ungrammatical (266).[3]

(265) [Ein Außenseiter zu gewinnen] scheint hier eigentlich nie.
an outsider to win seems here actually never
'An outsider never actually seems to win here.'

(266) * [Ein Außenseiter zu gewinnen] versuchte hier noch nie.
an outsider to win tried here actually never
'An outsider never actually tried to win here.'

Supporting this claim, verbs which are ambiguous between a equi and a raising alternative like *versprechen*, *drohen*, or *können* only have the raising reading when occurring in such a construction:

(267) [Ein Außenseiter zu gewinnen] versprach hier noch nie.
an outsider to win promised here still never
a. * 'An outsider never promised to win here.'
b. 'It was never probable that an outsider wins here.'

(268) [Ein Außenseiter zu gewinnen] drohte hier noch nie.
an outsider to win threatened here still never
a. * 'An outsider never threatened to win here.'
b. 'There was never the danger of an outsider winning here.'

(269) [Ein Kollege aus Köln teilnehmen] kann diesmal leider nicht.[4]
a colleague from Cologne participate be.able this.time unfortun. not
a. * 'Unfortunately, a colleague from Cologne is unable to participate this time.'
b. 'Unfortunately, it is not possible that a colleague from Cologne participates this time.'

So the subject can be realized with the embedded verb V" only in structures in which it would ordinarily be raised to become the subject of the governing verb V' (whereas co-indexing as in the equi case is not enough).

[3]Note that we analyze tense and passive auxiliaries as ordinary raising verbs. See Höhle (1978, pp. 88ff) for an argumentation that the notion of auxiliary in German plays no theoretical role.

[4]Example due to Tilman Höhle (p.c.).

The conclusion we draw from this is that even though the subject is realized as an argument of the embedded verb, raising of a 'spirit' of the subject still takes place as far as case assignment is concerned.[5]

This conclusion is confirmed by the fact that subject-to-subject raising verbs which allow extraposition of their verbal complement also allow a nominative NP to be part of the extraposed verbal projection, as illustrated by example (270).

(270) Obwohl damals anfing, der / *den Mond zu scheinen
*even-though back-then begun the-*N / *the-*A *moon to shine*
'Even though the moon had begun to shine back then'

With respect to the discussion of direct and indirect case assignment we started with, our conclusion provides natural answers to the three questions a theory of indirect case assignment has to answer. First, the nature of the "empty NP" which can locally be assigned case in the ordinary way is unveiled to be whatever representation is taken to undergo raising. In the HPSG paradigm, for example, where raising is formally captured as identification of subcategorization requirements, the "empty NP" is not actually an empty constituent but an element on the list of subcategorization requirements – and it is those subcategorization requirements which (different from HPSG tradition) represent already realized elements that we want to refer to as 'spirits' in a narrower sense.[6]

[5]As Gisbert Fanselow and Gereon Müller pointed out to me, the notion of a spirit we introduce here bears a certain similarity to the idea of abstract feature movement in the minimalist program (Chomsky, 1995). Note, however, that in our proposal the occurrence of spirits is triggered lexically and is of an entirely different nature than ordinary unbounded dependencies like topicalization. Spirits can only arise in the context of a raising verb since they represent (at least the case and agreement information of) an NP that could be but has not been raised in a particular case. As our data discussion shows, there is significant evidence for linking spirits to the lexical occurrence of raising verbs. Without further assumptions this also makes the right locality predictions in that non-locality can only arise through a hypotactic chain of raising predicates, which is discussed in section 3.4. It remains to be shown how the data could instead be explained on the basis of abstract feature movement and the locality restrictions assumed for such movement.

[6]The use of the term subcategorization requirement is slightly misleading in the context of the HPSG paradigm since the subcategorization 'requirement' of a sign in HPSG is actually identified with (a subpart of) the sign realizing this requirement. With respect to a simple finite sentence, for example, the subject requirement of the finite verb is identical to the (*synsem* part of) the actual subject. When we, for lack of a better term, speak of the subcategorization requirement of a sign, one should thus always keep this identity in mind.

Second, the kind of "co-indexation" relationship holding between the "empty NP" (= spirit) and the overt embedded NP is empirically established to be identical to the independently motivated raising relation introduced by verbs of a certain class.

Finally, the "inheritance" of properties like case from the "empty NP" to which it is assigned to the overt NP exhibiting these properties is the immediate effect of the raising relation. In the HPSG paradigm, it is the already mentioned identification of subcategorization requirements which requires part of the realized NP to be identical to the raised spirit.

In sum, the idea to let representations of already realized subjects take part in raising without further stipulations introduces the additional representation required to 'indirectly' assign case without having to relax the conditions under which case assignment takes place.[7]

3.1.1. *Subject-verb agreement.* Additional evidence for such raising of the spirit of the subject comes from subject-verb agreement. Example (271) indicates that the subject realized as complement of the fronted non-finite verb establishes the usual agreement relationship with the embedding finite verb.

(271) [Ein Außenseiter gewonnen] hat / *hast / *haben hier noch nie.
an outsider won has / have-2.SG / *have*-PL *here still never*
'An outsider has never won here yet.'

One might claim that this example does not show agreement but the third person singular marking which surfaces whenever a finite verb has no overt subject:

(272) Hier wurde / *wurden getanzt.
here was / were-PL *danced*
'Here people danced.'

But the example (273) from Höhle (1997, p. 114) shows that proper number agreement has to be accounted for.

[7]As will be shown in section 4.1.3, raising in the HPSG paradigm establishes an identity between the raised spirit and (a part of) the overt NP. The formalizations of the raising spirits idea we present in section 4 can thus also be understood as encoding the idea of 'direct' case assignment. But note that the identification of the raised spirit with (a part of) the overt NP eliminates the need typical of direct case assignment proposals to relax the conditions under which case assignment takes place.

(273) [Die Hände gezittert] haben / *hat ihm diesmal nicht
the hands-PL *tremble have*-PL / *has him this.time not*
'This time his hands didn't tremble.'

And as far as a first person subject can be topicalized as an argument of a non-finite verb at all, the example with agreement appears to be better than the case with a non-agreeing third person singular verb (274).

(274) [Ich Trottel gewonnen] ?habe / *hat hier noch nie.
I fool won have-1.SG / *has here still never*
'I fool have never won here yet.'

In addition to the nominative case assignment data, the subject-verb agreement facts thus show that the subject fronted as part of a non-finite verbal projection selected by a finite subject-to-subject verb behaves just like it does when it constructs as the ordinary subject of the finite verb.

We conclude that in a subject-to-subject raising construction raising of the (spirit of the) subject always takes place as far as grammatical relations like case assignment and subject-verb agreement are concerned – and that this even is the case if the subject is realized as a dependent of the embedded verb. In other words, the raising relation identifying the subject of V' with that required by V" seems to be independent of where the subject is realized. If this *raising spirits hypothesis* is on the right track, one expects to observe the same kind of effect with other kind of raising phenomena. To test this prediction, in the following sections we take a closer look at case assignment in various constructions which have been analyzed as involving raising.

3.2. Accusative case assignment in AcI constructions. One relevant raising phenomenon is the AcI construction under an analysis which raises the subject of the embedded verb to become the object of the AcI verb. Grewendorf (1994, p. 32), St. Müller (1997) and others observed that in examples like those shown in (275)–(277), where an AcI verb selects a fronted verbal complement including the subject, the subject has to bear accusative case.

(275) [*Der / Den Kanzler tanzen] sah der Oskar.
the-N / *the*-A *chancellor dance saw the Oskar*
'Oskar saw the chancellor dance.'

(276) [Den Sänger jodeln] läßt der König.[8]
the singer jodel lets the King
'The King allows/forces the singer to jodel.'

(277) [Den Mechaniker das Auto reparieren] ließ der Lehrer schon oft.[9]
the mechanic the car repair let the teacher already often
'The teacher already often asked the mechanic to repair the car.'

As in the nominative case discussed above, the subject of the embedded verb realized in the fronted verbal projection thus receives case as if it were realized directly in the projection of the AcI verb as in (278).

(278) Der Oskar sah den Kanzler tanzen.
The Oskar saw the chancellor dance
'Oskar saw the chancellor dance.'

To round off the picture, a direct comparison of the subject-to-subject raising case (279) with the subject-to-object raising AcI case (280) illustrates that the fronted verbal constituent itself is not responsible for the case assignment.

(279) [Ein Außenseiter gewinnen] wird hier nie.
*an-*N *outsider win will here never*
'An outsider will never win here'

(280) [Einen Außenseiter gewinnen] läßt Gott hier nie.
*an-*A *outsider win lets god here never*
'God never lets an outsider win here.'

The only obvious exception to this is when the fronted predicate assigns *lexical* case as in (281).

(281) [Ihm schlecht werden] sah ich noch nie.
*him-*D *sick become saw I still never*
'So far I never saw him become sick.'

The raising spirits hypothesis claiming that raising establishes the local case assignment and agreement relations even if the raised element is realized as part of an embedded projection thus correctly predicts the accusative case assignment observed with AcI constructions. The spirits

[8]Example due to Oppenrieder (1991, p. 57, judged ?, cited after St. Müller 1997, p. 23).
[9]Example due to Grewendorf (1994, p. 32).

of the subjects of non-finite projections can be raised by a subject-to-subject raising verb to receive nominative case and establish subject-verb agreement, or it can be raised by a subject-to-object raising (= AcI) verb to receive accusative case.

3.3. Case assignment in passive constructions. An interesting test case for the raising spirits hypothesis are passives. With respect to subjects fronted as part of a verbal projection there are two cases to be considered: the subject 'after' passivization surfacing as nominative NP and the subject 'before' passivization which surfaces as *von*-PP.

3.3.1. *Fronted nominative NP + past participle.* The examples in (282)–(283) illustrate that the nominative NP in a passive construction can be fronted as an argument of the embedded verb.

(282) [Zwei Männer erschossen] wurden während des Wochenendes.[10]
two men shot were during the weekend
'Two men were shot during the weekend.'

(283) [Der Führerschein abgenommen] wurde einem Autofahrer am Samstag
the driving.license taken.away was a driver on Saturday
abend bei Friedrichsdorf.
evening near Friedrichsdorf
'On Saturday evening, the driving-license of a driver was taken away near F.'

Generally speaking, two analyses of such passive constructions are possible. Either the passive auxiliary *werden* is an *object-to-subject* raising verb selecting a *past participle*. Or, the auxiliary is analyzed as a *subject-to-subject* raising verb selecting a *passive participle*. In the former analysis, the generalization over the active–passive relation is encoded in the auxiliary.[11] In the latter it can be expressed in a lexical rule deriving the passive participle[12] or as an effect of the passive morpheme[13].

[10]Example due to Webelhuth (1985, p. 210, cited after St. Müller 1997, p. 23).
[11]Bech (1955, § 28), for example, states: "Das verbum *werden* hat den koeffizienten N':A", wenn es den 3. status regiert. [The verb *werden* has the coefficient N':A" when it governs a participle.]", which suggests an object-to-subject raising analysis of *werden*. This point of view is worked out in some of the HPSG proposals, like Kathol (1994, pp. 245ff) or Pollard (1994, p. 291).
[12]See, for example, Bresnan (1982b), Nerbonne (1982), or Pollard and Sag (1987).
[13]See, for example, the discussion in Abraham (1995, pp. 103ff), who also points out that since German passive and perfect participles cannot be morphologically distinguished, the passivizing effect of the morpheme has to be reversed when the participle combines with the perfect auxiliary *haben*.

Independent of which passive analysis one chooses, the subject of the auxiliary in a passive sentence stands in a raising relationship with an argument of the selected participle. In case the passive auxiliary is finite, it assigns nominative case to its subject. The raising spirits hypothesis thus correctly predicts the grammaticality of examples like (282) and (283). The argument which is fronted as part of the non-finite complement is raised as spirit to become the subject of the finite auxiliary and is thus assigned nominative case.

An important difference between the two passive analyses combined with the raising spirits idea is, however, that under the subject-to-subject analysis of passive one only has to assume that the information on *subjects* of non-finite constituents is available even if the subject is already realized. Or expressed under the raising spirits view, one only has to assume raising of subject spirits – which is all that was needed in the ordinary subject-to-subject raising and the AcI subject-to-object raising cases our discussion started with.[14] Under the object-to-subject raising analysis of passive, on the other hand, one has to provide a link to the *object* realized as part of the non-finite constituent to permit nominative case assignment. Under the raising spirits view of establishing local grammatical relations, this is the only case we are aware of that would require raising of object spirits.

3.3.2. *Fronted von-PP + past participle.* Turning to the other relevant argument of the embedded verb, the ex-subject which is realized as a *von*-PP, the example (284) observed by St. Müller (1999, p. 376) illustrates that it is possible to front the *von*-PP together with the past participle.

(284) [Von Grammatikern angeführt] werden auch Fälle mit dem Partizip
of grammarians mentioned are also cases with the participle
intransitiver Verben.[15]
intransitive verbs
'Grammarians also mention cases with the participle of intransitive verbs'

Under an analysis of the passive auxiliary as an object-to-subject raising verb selecting a past participle, it is totally unexpected that the subject of the past participle can surface as a *von*-PP when forming a constituent with the past participle. A look into a Donaukurier corpus[16] confirms,

[14]Independent evidence for the accessibility of the properties of a subject contained in a verbal projection is provided by Höhle (1997).
[15]Example due to Askedal (1984, p. 28, as part of text, not example).
[16]The text of this corpus (8.469.700 words/523.353 sentences) is taken from the ECI/DCI Multilingual Corpus I CD-ROM, directory data/eci2/ger04.

however, that the construction exemplified in (284) actually occurs on a regular basis and with different kinds of passives. Some examples for *agentive passive* (*Vorgangspassiv*) are shown in (285)–(286), for *stative passive* (*Zustandspassiv*) in (287)–(288), and a further kind of passive with *fühlen* in (289).

(285) [Von ihrer 21 Monate alten Enkelin ausgesperrt] wurde Montag
by her 21 months old granddaughter lock.out was Monday
mittag eine 58jährige Hausfrau aus der Mercystraße.
noon a 58-year-old housewife from the Mercystreet
'On Monday at noon, a 58 year old house wife living on Mercystreet was locked out by her 21 month old granddaughter.'

(286) [Von den Bürgern angeregt] wurde, an der Straße in Richtung
by the townsmen suggested was at the road in direction
Friedhof eine weitere Straßenlampe anzubringen.
cemetery a further street-lamp attach.
'It was suggested by the townsfolk to add another street lamp at the road towards the cemetery.'

(287) [Von Baggern umklammert] ist derzeit Riedenburg.
by excavators embraced is currently Riedenburg
'Riedenburg is currently embraced by excavators.'

(288) [Von den Entwicklungen auf dem Arbeitsmarkt besonders betroffen]
by the developments at the job-market particularly affected
sind laut Arbeitsamt Ingolstadt Männer und ausländische
are according-to labor-exchange Ingolstadt men and foreign
Arbeitnehmer.
employees
'Labor exchange at Ingolstadt reports that the current development of the work market particularly affected men and foreign workers.'

(289) [Von einem Unbekannten verfolgt] fühlt sich ein Imker aus
by a person.unknown followed feels himself a bee-keeper from
Bad Abbach.
Bad Abbach
'A bee-keeper from Bad Abbach feels followed by a person unknown.'

A passive analysis based on a subject-to-subject raising auxiliary selecting a passive participle easily lends itself to an analysis of such data. In the derivation of the passive participle, for example by a passivization lexical rule, the subject of the active form is demoted to become an optional *von*-PP argument of the passive participle. To license a fronted constituent consisting of the *von*-PP and the passive participle, the head thus only needs to combine with its PP-argument.

Under an object-to-subject raising analysis of passive, on the other hand, the participle is the ordinary past participle. Such a passive analysis is prima facia not compatible with the data presented above. The past participles of our examples are verbs subcategorizing for an NP subject, but they instead combine with a *von*-PP. The only way out of this conflict appears to be an analysis that sees the preposition *von* as a special kind of case marking of an NP, i.e., the agentive phrase is analyzed as a *von*-marked NP and not as a PP.[17] Under such an analysis, the passive auxiliaries would assign "*von*-case" to the raised ex-subject. In line with the raising spirits hypothesis, raising of the ex-subject spirit would then ensure "*von*-case" assignment to ex-subjects fronted as part of the non-finite complement.

3.4. Interaction of multiple raising constructions. In the last sections, we investigated different kinds of raising constructions and showed that each of these constructions behaves as expected under the raising spirits hypothesis. Since multiple raising constructions can be combined in a single sentence, we now turn to an investigation of the interaction between different kinds of raising constructions to clarify whether the possibility to consecutively raise an element also applies to spirits.

3.4.1. *Extending the raising relation.*

Nominative case assignment. Examples in which the construction we are interested in is embedded under a further raising verb are already mentioned by Haider (1990b). He lists the sentences in (290), which extend the example (262) presented in the introduction with the subject-to-subject raising verb *scheinen*.

(290) a. [Ein Außenseiter gewonnen] scheint hier noch nie zu haben.
an outsider won seems here still never to have
'An outsider seems never to have won here yet.'

b. [Ein Außenseiter gewonnen zu haben] scheint hier noch nie.
an outsider won to have seems here still never

[17] We are not aware of a proposal for German which analyses *von*-PPs in passives as NPs marked by a preposition in this way. But see Heinz and Matiasek (1994, sec. 6.4.5) for a suggestion to analyze other prepositions without semantic contribution as markers instead of as heads.

Examples with an ergative verb, like the sentence (261) mentioned in the introduction, also permit such embedding under a raising predicate, as shown in (291).

(291) a. [Ein Fehler unterlaufen] scheint ihr dabei aber noch nie zu sein.
an error crept.in seems her there but still never to be
'So far she never seems to have made a mistake there.'

b. [Ein Fehler unterlaufen zu sein] scheint ihr dabei aber noch nie.
an error crept.in to be seems her there but still never

Adding a subject-to-subject raising verb in the way exemplified in the above examples adds one additional level of embedding in between the subject fronted as part of the non-finite constituent and the finite verb assigning nominative case. By adding further raising predicates, further levels of embedding are possible – even though the increasing complexity makes such examples hard to process. In (292) the nominative case of the subject of *scheint* is assigned through three levels of embedding raising predicates to the NP argument of *unterzeichnet*.

(292) ? Der endgültige Vertrag unterzeichnet worden zu sein scheint aber erst nach langen Verhandlungen.
the-N final contract signed be to be seems but only after long negotiations
'The final contract was only signed after long negotiations.'

In light of the fact that the apparently non-local case assignment relationship can be reduced to ordinary local case assignment to the spirit of the subject which was raised by a sequence of raising predicates, under the raising-spirits hypothesis such case assignment is correctly predicted to be possible.

Accusative case assignment. In section 3.2 we showed that AcI verbs can assign accusative case to NPs embedded in the verbal complement of the AcI verb. To support that raising is the relation establishing the link for case assignment, in (293) we have inserted a subject-to-subject raising verb *aufhören* in between the AcI verb and its verbal complement containing the accusative NP.

(293) ? [Den Herbert freiwillig zu streiten aufhören] sah ich wohl noch nie.
the-A Herbert voluntar. to fight stop saw I prob. still never
'I probably never saw Herbert voluntarily stop fighting.'

(294) ? Ich sah wohl noch nie den Herbert freiwillig zu streiten aufhören.
I saw prob. still never the-A *Herbert voluntar. to fight stop*

While such sentences do not appear to be fully grammatical, for our purpose it is relevant that the grammaticality of the example (293), in which the fronted constituent includes an embedded subject receiving accusative case from the AcI verb in verb-second position, appears to be comparable to the grammaticality of the same sentences without such a special fronted constituent (294).

We conclude that grammatical relations with an NP embedded in the verbal complement of a raising predicate can be extended by inserting a further raising verb between the case assigner and the NP. This is in line with our raising-spirits analysis which relies on the raising relation for case assignment even in cases when no overt raising has taken place.

3.4.2. *Multiple case assignment possibilities.* In the cases discussed above, subject-to-subject raising verbs were used to extend the raising relation since they do not alter the function and thereby the case of the raised element. While these cases confirm the basic raising spirits hypothesis, the other possibility of extending a sentence with a raising predicate that changes the function of the raised element can disclose further properties. In the following, we discuss two instances of passivization for this purpose.

Passivization of AcI constructions. Höhle (1978, pp. 169–172) points out that a small subset of AcI constructions in German can be passivized. This is illustrated by example (295).

(295) als das Werkzeug fallen gelassen wurde
when the tool drop let was
'when the tool was dropped'

Due to the presence of two cases which can potentially be assigned to the NP *das Werkzeug*, accusative by the AcI verb and nominative by the finite passive auxiliary, this construction is an interesting test case for determining the exact circumstances under which structural case assignment is possible. Example (296) shows that if a case-disambiguated NP is fronted by itself, it has to occur in nominative case.

(296) [Ein / *Einen Hammer] wird hier nie fallen gelassen.
a-N / *a*-A *hammer is here never fallen let*
'No one ever drops a hammer here.'

In (296) it thus is the finite verb which assigns case to the NP realized as its subject.

Under our raising spirits perspective, the interesting question is what happens when the subject is realized as part of the verbal complement, i.e., in those circumstances under which in the previously discussed constructions case was assigned to a raised spirit. Example (297) shows that the finite verb can assign nominative case to the embedded NP just like it did to the locally realized NP in the ordinary passivization of an AcI construction in (296).

(297) [Ein / ?*Einen Hammer fallen gelassen] wird hier eigentlich nie.
a-N / *a*-A *hammer fall let is here usually never*
'Usually, no one ever drops a hammer here.'

From this we conclude that an NP which is not assigned lexical case always shows the structural case assigned by the highest case assigner to which it could be raised.

Note, however, that at least some speakers hesitate to totally rule out the accusative NP for example (297). For these speakers our conclusion that only the highest case assignment is possible would predict that accusative case is only possible if there was no raising link established by the passive auxiliary. This seems plausible since *werden* can construct to form subjectless, impersonal passives, as exemplified in (298).

(298) Hier wurde früher viel getanzt.
here was back.then a.lot danced
'Here people danced a lot back then.'

While such subjectless passives are usually taken to arise only when no direct object with structural case of the lower verb exists, the examples in (299)–(301) show that there appear to exist certain exceptions to this regularity.

(299) a. Damals wurde den Talmud gelesen bis zum Umfallen.
back-then was the Talmud read until to fall-over
'Back then the Talmud was read for a very long time.'

b. Hier wurde den Tango getanzt bis spät in die Nacht.
here was the tango danced until late in the night
'Here people danced tango until late at night.'

(300) a. Im Urlaub wird immer Muscheln gegessen.
during vacation is-SG *always mussels*-PL *eaten*
'During vacation one usually eats mussels.'

b. Montags wird Hemden gebügelt. Dienstags wird Socken gestopft.
on-Mondays is-SG *shirts*-PL *ironed on-Tuesdays is*-SG *socks*-PL *mended.*
'Monday is the day for ironing shirts. Tuesdays the socks are mended.'

(301) a. Jetzt wird nicht gemotzt sondern den Tag genossen!
Now is not complained but the-A *day enjoyed*
'Now isn't the time to complain but to enjoy the day!'

b. Jetzt wird aber endlich die Zähne geputzt![18]
Now is-SG *but finally the teeth*-PL *brushed*
'It's high time to brush your teeth!'

In (299) the accusative NPs *den Talmud* and *den Tango* seem to have escaped promotion to the subject. In (300), the plural NPs *Muscheln*, *Hemden*, and *Socken* are case ambiguous in form. But since they fail to show number agreement with the finite verb they too must have remained accusative object NPs. Finally, the imperative sentences in (301) also exhibit such accusative case marking or number mismatch.

We take one of the characteristics of all of these examples to be that the accusative case NP can only receive a 'generic' reading. There is a clear contrast between (302a), where a 'non-referential' reading is possible, and the ungrammatical (302b), where a 'referential' reading is forced.[19]

(302) a. ? Hier wird den Hintern versohlt.
here is the-A *bottom hit*
'Here someone's bottom is hit.'

b. * Hier wird den Hintern von Karl versohlt.
here is the-A *bottom of Karl hit*
'Here Karl's bottom is hit.'

[18]Example due to Christian Fortmann (p.c.).

[19]The ditransitive use of *versohlen* has the same effect of fixing the reading of (i), even though here it becomes clear that 'referential' is not quite the right term for the relevant NP interpretation.

(i) Hier wird niemandem der / *den Hintern versohlt.
here is nobody the-N / *the*-A *bottom hit*
'Here nobody is hit on the bottom.'

While it is beyond the scope of this chapter to further investigate the properties of this construction,[20] the data discussion above should be sufficient to motivate that the (marginal) acceptability of the accusative case marked NP in example (297) can be explained as involving a subjectless passive along the lines of the examples discussed above. Such passivizations do not involve a raising link for a subject. We can thus maintain our conclusion that an NP which is not assigned lexical case always shows the structural case assigned by the highest case assigner to which it could be raised.

Remote passive. Turning to another instance of passivization, it was discovered by Höhle (1978, pp. 175ff) that it is possible to passivize sentences headed by the subject-oriented equi verb *versuchen* so that the accusative object of the verbal complement in an active sentence (303a) becomes the subject in the passive counterpart (303b).

(303) a. wenn Karl den Wagen zu reparieren versucht
when Karl the-A *car to repair tries*
'when Karl tries to repair the car'

b. wenn der Wagen zu reparieren versucht wird
when the-N *car to repair tried is*
'when it is attempted to repair the car'

The construction is usually referred to as distant, long or *remote passive* (*Fernpassiv*) in the literature.[21] While such passivization is not generally possible with subject-oriented equi verbs, at least with *versuchen* (*try*) the construction appears to be widely accepted. Interestingly, the construction is not limited to subject-oriented verbs as can be seen from the example (304a) attributed to Tilman Höhle in Haider (1990a, pp. 128f), in which the dative object-oriented equi verb *erlauben* (*permit*) is passivized. Askedal (1988, p. 13) pointed out the parallel example (304b) from Stefan Zweig as presented by Bech (1955, §350).

[20]We are not aware of an investigation of the range of data which allow accusative objects with structural case to escape passivization. Certain examples are discussed as (*object*) *incorporation* by Kroch and Santorini (1991, p. 295) and Abraham (1995, pp. 110ff). The latter also mentions that other examples resist such an analysis.

[21]See, for example, Kiss (1995a, sec. 3.3.1.4), Pollard (1994, pp. 276 and 288ff), Kathol (1995, sec. 4.4.2 and p. 280), and St. Müller (1999, sec. 15.3.6) for a discussion of remote passive in an HPSG context. Thanks to Adam Przepiórkowski for pointing out the relevance of this construction for our discussion.

(304) a. Der Erfolg wurde uns nicht auszukosten erlaubt.
the success was us not enjoy allowed
'We were not allowed to enjoy our success.'

b. Keine Zeitung wird ihr zu lesen erlaubt.
no newspaper is her to read permitted
'She was not permitted to read the newspaper.'

The subject-oriented equi verb *versuchen* and the object-oriented equi verb *erlauben* have in common that they optionally construct coherently.[22] In a sentence like (305), where coherence is enforced by fronting a verbal cluster, the object of the verbal complement has to receive nominative case.

(305) [Zu reparieren versucht] wurde der / *den Wagen.
*to repair try was the-*N / *the-*A *car*
'Someone tried to repair the car.'

The fact that only the nominative case assignment is allowed suggests that passivizing a verb coherently selecting a verbal complement forces a structural case NP argument (if one exists) of the verbal complement to become the subject.

In an obligatorily incoherent construction like sentence (306), where the verbal complement is extraposed, the structural case NP argument of the verbal complement cannot receive nominative case.

(306) Obwohl versucht wurde, *der / den Wagen zu reparieren
*even though tried was the-*N / *the-*A *car to repair*
'Even though it was tried to repair the car'

In other words, we conclude with Kiss (1995a, p. 136) that passivization of an equi verb can only affect the object of a verbal complement if the equi verb and its complement combine coherently.

The conclusions drawn above predict that constructions which have two analyses, one coherent and one incoherent, allow for both case assignments. The examples in (307) show that this prediction is correct.

[22]Readers not familiar with the notion of coherence introduced by Bech (1955) are referred to part one of this thesis. Further discussion on an HPSG background can be found in Kiss (1994, 1995a); Stechow (1984), Evers (1975, p. 49–52) and Grewendorf (1991, p. 263–274) provide discussions assuming a principles and parameters setup.

(307) a. wenn der / den Wagen zu reparieren versucht wird
*when the-*N / *the-*A *car to repair tried is*
'when it is attempted to repair the car'

b. [Der / Den Wagen] wird zu reparieren versucht.
*the-*N / *the-*A *car is to repair tried*
'It is attempted to repair the car.'

That this is on the right track can nicely be illustrated by inserting material which disambiguates the coherence/incoherence of example (307a). In (308a) we enforce an incoherent construction by inserting the adverbial expression *noch einmal* in between the two verbal heads. In (308b), on the other hand, the adverb *verzweifelt* modifying *versucht* is inserted in between *zu reparieren* and its complement *den Wagen*, enforcing a coherent construction. In both cases, only one kind of case assignment is possible.

(308) a. wenn *der / den Wagen zu reparieren noch einmal versucht wird
*when the-*N / *the-*A *car to repair still once tried is*
'when it is attempted to repair the car one more time'

b. wenn der / *den Wagen verzweifelt zu reparieren versucht wird
*when the-*N / *the-*A *car desperately to repair tried is*
'when it is desperately attempted to repair the car'

In anticipation of a discussion in section 4.2 addressing the question which theoretical interpretation of the raising spirits hypothesis is most promising, let us point out here that the revised raising spirits hypothesis of the form 'a spirit receives case when it cannot be raised further', which resulted from the discussion of the passivized AcI construction above, puts a restriction on the analysis of coherence. In the standard analysis of coherent constructions in HPSG, following Hinrichs and Nakazawa (1989) the arguments of the verbal complement are raised to become arguments of the verbal head. Thereby an NP of the lower verb can be raised to become an argument of the higher verb – which is parallel to the idea in the principles and parameters paradigm of Haider (1993, sec. 9.3) who speaks of 'Vereinigung der Argumentstrukturen [Unioning of the argument structures]'.[23] Based on this analysis of coherence in HPSG, Kiss (1995a) and Pollard (1994, pp. 288ff) propose that the remote passive construction be

[23]All of these proposals can be understood as incorporating the idea of functional composition from categorial grammar (Geach, 1970). As far as we know, it was first applied to German by Johnson (1986). The HPSG formulation of argument attraction

analyzed by allowing passivization to turn an NP which has been raised to the higher verb as a result of cluster formation into the subject. The danger of incompatibility with our revised raising spirits hypothesis lies in the details of the argument raising relationship encoding coherence, as one could propose to analyze optionally coherent verbs like *versuchen* as always establishing a link to raise the arguments of their verbal complement, independent of whether complements are actually raised (in a coherent construction) or not (in an incoherent construction). Under such an analysis one would then incorrectly predict the example with an optionally coherent verb constructing incoherently shown in (309a) (repeating (306)) to be parallel to a sentence where a subject-to-subject raising verb introduces a raising link without overtly making use of it like (309b) (repeating (270)).

(309) a. Obwohl versucht wurde, *der / den Wagen zu reparieren
*even.though tried was the-*N / *the-*A *car to repair*

b. Obwohl damals anfing, der / *den Mond zu scheinen
*even.though back.then begun the-*N / *the-*A *moon to shine*

To be compatible with the raising spirits idea of assigning case only to those elements which cannot be raised further, an incoherent construction must therefore be analyzed as absence of a raising relation, independent of whether the same verb could also construct coherently in a different sentence.

An even stronger conclusion can be derived from the observation illustrated by (310) that a remote passive is not possible when a full VP constituent is fronted.

(310) [*Der / Den Wagen zu reparieren] wurde lange Zeit versucht.
*the-*N / *the-*A *car to repair was long time tried*

The fact that only the accusative case is possible is parallel to the incoherent VP extraposition case we saw in (309a). The striking difference, however, is that whereas VP extraposition is an indicator for incoherence (311a), VP topicalization is also possible for obligatorily coherent verbs (311b).

as a lexical specification differs from the original functional composition rule of categorial grammar on which it was modeled in that it is the head of the construction which inherits the subcategorization requirements of its complement. In functional composition and apparently also in the approach of Haider (1993), the subcategorization requirements of the complement are transferred to the mother of the construction.

(311) a. * weil er lieber nicht will [einen Frosch küssen]
because he rather not wants a frog kiss

b. [Einen Frosch küssen] will er lieber nicht.
a frog kiss wants he rather not

'He prefers not to kiss a frog.'

It thus would be incorrect to interpret (310) as showing that optionally coherent verbs have to construct incoherently when their full VP complement is fronted.

The puzzle can be resolved by assuming that, different from the regular raising verbs, which always establish the raising relation independent of whether an element is actually raised, a coherently constructing verb only establishes an argument raising relation in case an argument of the lower verb is actually raised to form a verbal cluster. Or in terms of the metaphor of this chapter, coherence never introduces spirits.[24] This difference could also be used to explain why in contrast to passivization of NPs raised by ordinary subject-to-subject raising verbs, remote passivization of an NP attracted by a coherently constructing equi verb is only a marked, not generally accepted option.

The generalization reached in the last paragraph predicts that nominative case assignment should be possible when we change sentence (310) so that the coherently selecting verb *versucht* is part of the fronted constituent as shown in (312).

(312) [Der / Den Wagen zu reparieren versucht] wurde lange Zeit.
*the-*N / *the-*A *car to repair tried was long time*

This is so since in this construction *versucht* can form a coherent verbal cluster with *zu reparieren* and attract the NP so that it can undergo passivization as argument of the higher verb. The prediction appears to be correct as the occurrence of a nominative case marked NP in (312) is at least much better than the nominative case option in (310).

Coherently constructing ergative verbs. Haider (1993, sec. 9.3) relates the remote passive to an interesting case conversion occurring in coherent constructions, namely with ergative predicates embedding an infinitival

[24] The question whether coherence never *introduces* spirits or whether it never even *raises* spirits already introduced by a raising verb below is difficult to answer empirically and depends on the precise analysis of passive one chooses.

complement. His examples with *gelingen* in (313) illustrate this phenomenon.[25]

(313) a. daß ihm auf Anhieb gelang, *der / den Brief zu entziffern
that him at first.try succeeded the-N / the-A letter to decipher
'that he managed to decipher the letter at first try'

b. [Zu entziffern gelungen] ist mir der / *den Brief auf Anhieb.
to decipher succeeded is me the-N / the-A letter at first.try

In the incoherent construction in (313a), the complete non-finite complement of *gelang* is extraposed. The object included in this non-finite complement has to occur in accusative case, as expected. In the coherent construction in (313b), the head of the non-finite complement as part of a verbal cluster is topicalized without its object, which is realized in the Mittelfeld bearing nominative case.

We can make sure that coherence is the decisive factor behind the case alternation using a minimal pair which only differs with respect to the order of elements in the Mittelfeld as illustrated in (314).

(314) a. obwohl er / *ihn mir nicht zu entziffern gelungen ist
even.though he / him me not to decipher succeeded is

b. obwohl mir *er / ihn zu entziffern nicht gelungen ist
even.though me he / him to decipher not succeed is

The example (314a) is a coherent construction as can be seen from the wide scope of the negation and the interleaved order of *mir* as object of *gelungen* and *er* as that of *zu entziffern*. Changing these two factors by untangling the objects and placing the negation in-between the two verbs as in (314b) results in an incoherent construction in which the object of *zu entziffern* has to bear accusative case.

Regarding the topicalization of the complete verbal complement, which in example (311b) on page 307 was illustrated as option for both incoherent and coherent constructions, only the accusative case can show up (Haider, 1993, p. 269), which is parallel to the remote passive example (310) repeated here as (315b).

[25] Parallel examples with *gelingen* are discussed on the handout of a talk held by Tilman Höhle in Trondheim and Konstanz, October 1985. Askedal (1983, pp. 185ff) mentions the construction with *freistehen* (*be allowed to do something*). Other verbs mentioned by Haider (1993, sec. 9.3) are *schwerfallen* (*find something difficult*) and *glücken* (*manage to do something*).

(315) a. [*Er / Ihn zu entziffern] ist mir nicht gelungen.
he / him to decipher is me not succeeded

b. [*Der / Den Wagen zu reparieren] wurde lange Zeit versucht.
the-N / the-A car to repair was long time tried

This is expected based on the conclusion we drew in the remote passive discussion, namely that the option of a coherent construction – such as the one between *gelungen* and *zu entziffern* in (315a) – does not establish a raising relation which could mediate grammatical relations such as case. Argument raising as encoding of coherence thus differs from the raising relations of traditional raising predicates, which we showed to be established independent of whether an argument is actually raised or not.

A closer look at the comparison between remote passive and the ergative verbs shows, however, that the two phenomena are not entirely parallel. As illustrated in (316a), nominative case assignment to the embedded NP does not occur even if the ergative verb is included in the fronted constituent, which contrasts with the remote passive case we saw in (312) repeated here as (316b).

(316) a. [*Er / Ihn zu entziffern gelungen] ist mir nicht.
he / him to decipher succeeded is me not

b. [Der / Den Wagen zu reparieren versucht] wurde lange Zeit.
the-N / the-A car to repair tried was long time

With respect to the most deeply embedded verb, both NPs are ordinary objects. The subjects of the controlled infinitival verbs are not overtly expressed (= PRO). Both topicalized constituents are headed by verbs (*versuchen*, *gelingen*) which can construct coherently or incoherently. In the incoherent case, the two examples are parallel and only the accusative case is possible for the NP as object of the embedded infinitive.

The difference arises in the coherent case, where the NP in the remote passive example (316b) bears nominative case, whereas the NP in the ergative verb case example (316a) shows up in accusative case. As a result of argument raising as encoding of coherence, the NP in both examples is represented as an argument of the higher verb (*gelingen*, *versucht*). Focusing on the remote passive example first, there are two analyses to consider, depending on the analysis of passive one favors (cf., sec. 3.3). Either the NP is the subject of the passive participle *versucht* and *wurde* is analyzed as a subject-to-subject raising predicate establishing a raising relation for that subject. Or the NP is the object of the past participle *versucht* and *wurde* is an object-to-subject raising predicate establishing a raising relation with the NP in that way. Under the raising spirits hypothesis both analyses thus correctly entail the nominative case assignment.

Turning to the coherent analysis of the ergative verb example (316a), argument attraction as encoding of coherence turns the object NP of *zu entziffern* into an argument of *gelungen*, but not into the subject of that verb. The subject-to-subject raising verb *ist* therefore does not establish a raising relation with this NP, so that the NP has to bear accusative case.

3.5. The case of unexpressed subjects. To determine the application domain of the theory of structural case we propose in section 4, in this last empirical section we need to take a look at the case of unexpressed subjects. St. Müller (1998) reminds us of the test of Höhle (1983, sec. 6) who shows with the help of the floating quantifier *einer nach dem anderen* that the unrealized (or not overtly realized) subject of an infinitival complement of an equi verb, i.e., PRO in the principles and parameters terminology, bears nominative case. In (317), the accusative NP *den Burschen* is the logical subject of the extraposed non-finite verbal complement. The floating quantifier *einer nach dem anderen* contained in the verbal complement obligatorily bears nominative case, which suggests that whatever represents the logical subject in the extraposed infinitive clause bears nominative case too.

(317) Ich habe den Burschen geraten, im Abstand von wenigen Tagen einer
I have the-A boys advised in distance of few days one-N
/ *einen nach dem anderen zu kündigen.
/ one-A after the other to quit
'I advised the boys to quit their job, one after the other within a few days time.'

As should be expected, the nominative case surfaces only in infinitival complements of equi predicates. In raising constructions like the AcI shown in (318), no floating quantifier in nominative case is possible as the unrealized subject of the infinitival complement is raised to become the object of the AcI verb so that no unrealized subject in nominative case is present.

(318) Der Dirigent läßt den Tenor, den Alt und den Sopran *einer / einen
the conductor lets the tenor the alto and the soprano one-N / one-A
nach dem anderen vorsingen.
after the other sing
'The conductor asks the tenor, the alto, and the soprano to sing one after the other.'

A related observation is made by Bech (1955, §190), who remarks that in (what we would call) dative-object oriented equi constructions, predicative complements and elements which are related to the understood subject of the infinitive with *als* (*as*) or *wie* (*as*) never show case agreement with the controlling dative NP, but have to occur in nominative case. A parallel argument is made by Gert Webelhuth (HPSG list, 18. July 1995) for *als*-phrases functioning as appositions to NPs. As shown in (319), the apposition agrees in case with the NP.[26]

(319) a. Als Vorsitzender / *Vorsitzenden darf er das Kommittee ernennen.
as chair-N / chair-A can he the committee nominate
'As chair he can nominate the committee.'

b. Ich habe ihm als Vorsitzendem / *Vorsitzender im Namen aller
I have him as chair-D / chair-N in name.of all
Anwesenden zu seiner Wiederwahl gratuliert.
people.present to his re-election congratulated
'I congratulated him, who is the chair, on his re-election in the name of everyone present.'

Just like with the floating quantifier *einer nach dem anderen* discussed above, the *als*-phrase in an infinitival complement of an equi verb has to appear in nominative if it is interpreted as apposition to the logical subject (320), whereas in an AcI construction as far as we can tell only the accusative case is possible (321).

(320) a. Er hatte geplant, als Vorsitzender / *Vorsitzenden das Kommittee
he had planned as chair-N / chair-A the committee
zu ernennen.
to nominate
'He, who is the chair, had planned to nominate the committee.'

[26]There are some exceptions to this case agreement requirement for appositions. According to Grebe (1959, §991) they, however, all involve genitive or very rarely dative NPs, an apposition to which can surface in nominative case.

b. Ich habe ihn gebeten, als Vorsitzender / *Vorsitzenden die Sitzung
I have him asked as chair-N / *chair*-A *the meeting*
zu eröffnen.
to open
'I asked him, who is the chair, to open the meeting.'

(321) Sie lassen ihn als *Vorsitzender / Vorsitzenden immer so lange reden
they let him as chair-N / *chair*-A *always so long talk*
wie er will.
as he likes
'They always let him, who is the chair, talk as long as he likes.'

We thus conclude that there is significant evidence for assuming that the unrealized subject of the infinitival complement of an equi verb (= PRO) bears nominative case.

3.5.1. *A brief excursion into default case.* A possible alternative to assuming that nominative case is assigned to the unexpressed subject of incoherently selected infinitives would be to follow the tradition of Jakobson (1936, sec. III), who views the nominative case not as a representation of a particular marking like the accusative case, but rather as a representation of the unmarked. One could interpret this to mean that examples like the ones shown in (317) and (320) do not require nominative case assignment to the unrealized subject of the infinitive. Instead, either the unrealized subject could be understood as bearing nominative as a kind of "default case" when no case is assigned and the floating quantifier would show agreement with this case. Or one could claim more directly that in the absence of an overt subject NP, the floating quantifier *einer nach dem anderen* bears nominative case, a situation similar to third person singular morphology surfacing on the finite verb when no subject is present (cf., example (272) on page 292).

As Adam Przepiórkowski pointed out to me, in Polish and other Slavic languages there is one class of case agreeing elements which always show instrumental case when they are realized in the absence of a subject they could agree with, whereas another class of case agreeing elements apparently shows up in dative in such cases (Franks, 1995). If both classes of elements are indeed to be analyzed as exhibiting case agreement, the existence of two distinct cases showing up on case agreeing elements when no overt subject is present is problematic both for a theory assigning case to representations of the not-overtly-realized subjects as well as for the idea of a default case surfacing on elements which are not assigned case.

The situation thus seems to support the idea that at least for one of the classes of normally case agreeing elements, a member of this class exhibits a specific case whenever no element to agree with is present. Different from German the case exhibited by an element in those environments could then plausibly depend on the lexical class of the element.

An aspect which appears to be problematic for any proposal not analyzing the case of case agreeing elements like the ones we discussed above as ordinary case agreement with an NP even in case no NP is overtly present is that person and number agreement between the upstairs controlling NP and the agreeing element in the non-finite clause has to be accounted for. For example, the floating quantifier *einer nach dem anderen* always requires a plural referent and the *als*-appositions show number and person agreement. If representations of empty subjects are used to mediate person and number agreement from the controlling NP to the agreeing element in the embedded clause, it seems highly plausible that case agreement with these empty subjects also takes place as with overtly realized subjects.

A conclusive discussion of the Jakobsonian view of nominative as absence of case marking and the ideas mentioned above is beyond the scope of this chapter as it would involve a detailed investigation of the motivation and consequences of a default case with respect to general case assignment and agreement phenomena in German and cross-linguistically. Beside the Slavic facts, the multiple case possibilities for subjects and case agreeing elements in Icelandic (Andrews, 1982; Sag et al., 1992) would appear to constitute a further interesting test case for the adequacy of a default case analysis. In addition to these open empirical issues causing us not to pursue this alternative further at this point, the choice also relates to the grammar architecture we want to formalize our proposal in. Trying to incorporate the idea of a default case which surfaces when no case is assigned would be an obstacle for working out an HPSG proposal in section 4, as the HPSG architecture proposed by Pollard and Sag (1994) and formalized in King (1989, 1994) for well-motivated reasons does not include non-monotonic devices such as defaults. Note, however, that often the formalization of situations intuitively involving default behavior does not require defaults in the formal sense.[27]

[27] Non-monotonic devices would, for example, not be needed to formalize the idea that a normally case agreeing element bears a specific 'default case' when no element it could agree with is present. Since the formal setup for HPSG of King (1989, 1994) provides full (classical) negation, all that is needed to formalize this is a statement

3.5.2. *Non-finite copula constructions.* Another instance involving unrealized subjects of infinitives which do not fall under the classes discussed so far are non-finite copula constructions like the one shown in (322).

(322) [Ein / *Einen Held zu sein] macht Spaß.[28]
*a-*N / *a-*A *hero to be is fun*
'It's fun to be a hero.'

The question raised by this example is where the predicative complement *ein Held* of the copula *zu sein* receives its case from. One possibility argued for by St. Müller (1999, pp. 272ff) is that the copula assigns lexical nominative to its predicative complement. The alternative, suggested for example by Gert Webelhuth (HPSG list, 17. July 1995), builds on the assumption we argued for in the last section, namely that a subject of an infinitive not involved in raising is structurally assigned nominative case. The subject complement of the copula construction then bears (structural) nominative through case agreement with the unrealized subject.

Trying to determine whether the nominative case is lexical or structural by embedding the construction under an AcI verb unluckily provides no conclusive result. On the one hand, the examples (323) and (324) show that the predicative complement can be realized in nominative case.

(323) Laß den wüsten Kerl [...] meinetwegen ihr Komplize sein.[29]
*let the-*A *wild-*A *guy for.all.I.care her-*N *accomplice be*
'For all I care let this wild guy be her accomplice.'

(324) Baby, laß mich dein Tanzpartner sein.[30]
*baby let me-*A *your-*N *dancing.partner be*
'Baby, let me be the one you dance with.'

On the other hand, at least for certain examples it seems to be possible for the predicative complement to show up in accusative case as well (325), and St. Müller (1999, p. 272, fn. 11) himself admits that Drosdowski (1995, §1259) mentions this possibility as common in Switzerland and an archaic use in standard German, which is reflected in the idiomatic example (326)

ensuring case agreement if a case bearing element is available within a certain domain and the 'default case' when this is not the case.

[28]Example due to Gert Webelhuth (HPSG list, 17. July 1995).

[29]Example due to Grebe (1966, §6925, cited after St. Müller 1999).

[30]Example due to St. Müller (1999, p. 273).

or a literature example by Herman Hesse (327), both taken from Grebe (1959, §1196).

(325) Sie ließen den alten Betrüger Vorsitzender / ?Vorsitzenden werden.
*they let the-*A *old cheater chair-*N */ chair-*A *become*
'They permitted the old cheater to become the chair.'

(326) Er läßt den lieben Gott einen guten Mann sein.
*He lets the-*A *kind god a-*A *good-*A *man be*
'He does not bother with the details (idiomatic).'

(327) Die Nacht [...] umarmt mich sanft und läßt mich ihren Freund und ihren Bruder sein.
*The night embraces me softly and lets me-*A *her-*A *friend and her-*A *brother be*
'The night embraces me softly and lets me be her friend and brother.'

The only possible conclusion, as far as we see, is that in copula constructions both the possibility of lexical nominative assignment and the option of the predicative complement sharing the case of the subject must be available. Even though this conclusion has nothing to say on the conditions under which what variant is possible (for which kind of speakers), it is sufficient to explain why in sentences in which a constituent containing the subject, the copula, and the predicative complement has been topicalized, the predicative complement can in certain cases bear both cases. This is illustrated by (328), which has the same case assignment possibilities as (325).

(328) [Den alten Betrüger Vorsitzender / ?Vorsitzenden werden] ließen sie dann trotzdem.
*the-*A *old-*A *cheater chair-*N */ chair-*A *become they let then anyway*
'They then permitted the old cheater to become the chair anyway.'

The nominative case reflects the lexical case assignment possibility. For our main issue the accusative case assignment is more interesting. As we showed in section 3.2, the raising spirits hypothesis correctly predicts for AcI constructions that the accusative case marked subject of the non-finite complement can be part of the fronted constituent. The possibility to analyze the copula as ensuring case agreement between the subject and the predicative complement is therefore sufficient to explain why the predicative complement in (328) can be realized in accusative case.

4. Theoretical consequences

In sections 3.1 through 3.3 we argued that the case assignment and subject-verb agreement data make it plausible to assume that raising establishes local grammatical relations regardless of where the NP to be raised is realized. On the basis of interactions in complex constructions discussed in section 3.4, this was made more precise by determining that independent of where the NP is realized, the local case assignment relations are only established at the highest place to which the NP or its spirit can be raised.

In the remaining part of the chapter, we want to develop these ideas into a theoretical proposal which we will couch in the framework of HPSG (Pollard and Sag, 1994). We show that the raising spirits idea can be integrated into HPSG in a straightforward and general way and that it interacts properly with a theory of case assignment.

4.1. A basic theory for spirits in HPSG.

4.1.1. *Subcategorization in HPSG.* In traditional HPSG (Pollard and Sag, 1994, ch. 1–8), the subcategorization information of a word is represented in the sign itself, as shown in the partial lexical entry for the ditransitive verb *gibt* (*gives*) in figure 1.

$$\begin{bmatrix} \text{PHON } <\textit{gibt}> \\ \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{SUBCAT } \left\langle \text{NP, NP, NP} \right\rangle \end{bmatrix}$$

Figure 1. Subcategorization information in the lexical entry of *gibt*

The Subcategorization Principle of Pollard and Sag (1994, p. 399) shown in figure 2 ensures that when a word which is licensed by such an entry combines with one or several of its arguments, (the SYNSEM value of) each argument has to be identical to one of the subcategorization requirements of that word. The constituent resulting from this combination then bears only the subcategorization requirements of the head daughter which were not already realized. This cancellation mechanism, reminiscent of categorial grammar, is illustrated by the sketch of an analysis of a simple German verb-last sentence in figure 3.[32]

$$\begin{bmatrix}\textit{phrase}\\ \text{DTRS } \textit{head-struc}\end{bmatrix} \rightarrow \begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{SUBCAT } \boxed{1} \\ \text{DTRS } \begin{bmatrix} \text{HEAD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{SUBCAT } \boxed{1} \oplus \boxed{2} \\ \text{COMP-DTRS } \textit{synsems2signs}\left(\boxed{2}\right) \end{bmatrix}\end{bmatrix}$$

Figure 2. The Subcategorization Principle of Pollard and Sag (1994)[31]

[31]The principle is shown in an AVM notation instead of the text of the original. As usual, $\oplus$ stands for the append relation concatenating two lists. The relation *synsems2signs* takes a list of synsems and returns a list of signs as its result argument. It is straightforwardly defined as:

$$\textit{synsems2signs}(\langle\rangle) := \langle\rangle.$$
$$\textit{synsems2signs}\left(\left\langle \boxed{1} \mid \boxed{2} \right\rangle\right) := \left\langle \begin{bmatrix}\text{SYNSEM } \boxed{1}\end{bmatrix} \mid \textit{synsems2signs}\left(\boxed{2}\right)\right\rangle.$$

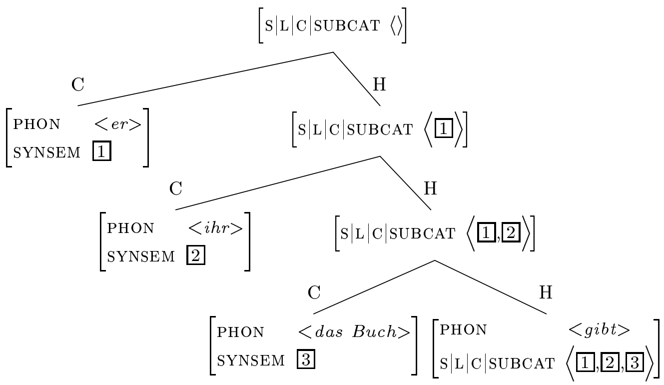


Figure 3. SUBCAT percolation in an analysis of a simple verb-last sentence: "(*daß*) *er ihr das Buch gibt* [(*that*) *he her the book gives*]"

4.1.2. *The spirits appear on the scene.* To formalize the idea of spirits as representations of already realized constituents, we need to change the Subcategorization Principle so that instead of removing all information about an argument that has been realized, we only check off the subcategorization requirement but keep (at least some of) the subcategorization information on that argument around. A metaphorical way of thinking about this is that there are two ways of going through a store with a shopping list: The traditional Subcategorization Principle corresponds to tearing off a piece of the shopping list every time one has put that item

[32]For space reasons we here and in the following sometimes abbreviate attribute names by their first letters and SUBCAT by SUBC.

into the shopping cart. The alternative we propose now is to check off an item on the list once we have picked it up – which has the advantage of still being able to check something about an item on the list later, for example what kind of chocolate bar we wanted to buy, without going through the whole shopping cart to look for it. For our case, this advantage corresponds to being able to check local grammatical relations like case with the checked-off element on the local SUBCAT list instead of having to look trough the tree for the realized argument.

Technically, we realize the idea of marking elements as realized instead of removing them from the SUBCAT list by introducing two subtypes of *local*, namely *realized* and *unrealized*.[33] The idea is that all subcategorization requirements start out in the lexicon as *unrealized* and are turned to *realized* by the modified Subcategorization Principle in figure 4 once they are realized syntactically.[34]

$$\begin{bmatrix} \textit{phrase} \\ \text{DTRS } \textit{head-struc} \end{bmatrix} \rightarrow \begin{bmatrix} \text{SYNSEM|LOC|CAT|SUBCAT } \boxed{1} \oplus \textit{mark-realized}\left(\boxed{2}\right) \oplus \boxed{3} \\ \text{DTRS } \begin{bmatrix} \text{HEAD-DTR|SYNSEM|LOC|CAT|SUBCAT } \boxed{1} \oplus \boxed{2} \oplus \boxed{3}\, \textit{list}\left(\begin{bmatrix}\text{LOC } \textit{realized}\end{bmatrix}\right) \\ \text{COMP-DTRS } \textit{synsems2signs}\left(\boxed{2}\right) \end{bmatrix} \end{bmatrix}$$

FIGURE 4. Modified Subcategorization Principle[35]

Comparing the original Subcategorization Principle in figure 2 on page 316 with the version modified so as to introduce spirits in figure 4, the important change is that the tag $\boxed{2}$ representing the list of arguments which are

[33]We introduce the distinction at the level of local objects since we are not aware of examples showing that the realization status of an element is not mediated by non-local dependencies (which only identify local values).

[34]I would like to thank Adam Przepiórkowski for pointing out several bugs in an earlier formulation of this principle and suggesting how to fix them. Note that what is encoded in this principle differs from the encoding of realizedness in Przepiórkowski (1999), where an attribute REALIZED is used to record in each argument whether it has been *locally* realized, whereas here the new subtypes we introduce record whether the argument is realized anywhere.

[35]The relation *mark-realized* is defined as follows:

$$\textit{mark-realized}(\langle\rangle) := \langle\rangle.$$

$$\textit{mark-realized}\left(\left\langle \begin{bmatrix} \text{LOCAL} & \begin{bmatrix} \textit{unrealized} \\ \text{CAT } \boxed{1} \\ \text{CONT } \boxed{2} \end{bmatrix} \\ \text{NONLOC } \boxed{3} \end{bmatrix} \middle|\, \boxed{4} \right\rangle\right) := \left\langle \begin{bmatrix} \text{LOCAL} & \begin{bmatrix} \textit{realized} \\ \text{CAT } \boxed{1} \\ \text{CONT } \boxed{2} \end{bmatrix} \\ \text{NONLOC } \boxed{3} \end{bmatrix} \middle|\, \textit{mark-realized}\left(\boxed{4}\right) \right\rangle.$$

realized, in the modified principle also occurs in the specification of the SUBCAT list of the mother instead of being left off from this list as in the original principle. To keep track of which elements have been realized, the relation *mark-realized* changes the local subtype of the *synsem* objects on the list $\boxed{2}$ from *unrealized* to *realized*. In light of the fact that spirits of already realized elements stay on the SUBCAT list, an additional tag $\boxed{3}$ is needed to carry over those spirits to the SUBCAT list of the mother which are already realized as part of the head daughter.

Under the modified percolation of subcategorization requirements, the analysis of the example we sketched in figure 3 on page 317 now looks as shown in figure 5. As a convenient notation we have represent all *synsem*

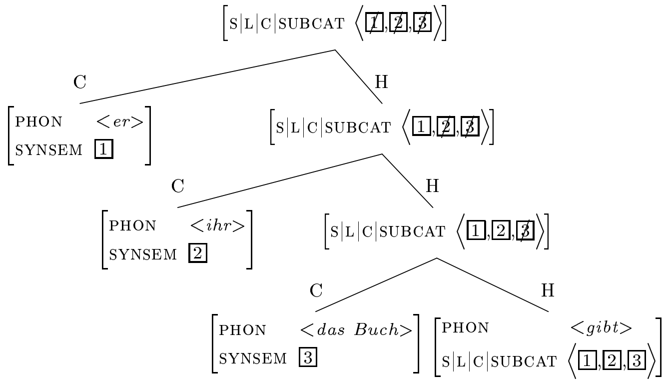


FIGURE 5. Modified SUBCAT percolation introducing spirits in the analysis of: "(*daß*) *er ihr das Buch gibt* [(*that*) *he her the book gives*]"

objects with a LOCAL value of type *realized* as boxes which have been crossed out. Note that different from the traditional picture, the highest mother of the tree in figure 5 locally represents the *synsem* information of all realized arguments on its SUBCAT list.

4.1.3. *Raising spirits.* Having formalized the representation of spirits and how they percolate in the domain of their head, we only need to remind ourselves of the HPSG treatment of raising and equi to see that nothing else is needed in order for the spirits to penetrate the local head domain whenever the head is selected by a raising verb.

Pollard and Sag (1994, pp. 132ff) propose to analyze the regularities involving raising and equi predicates as a result of their lexical properties.

Pollard (1996, pp. 299f), Kiss (1995a), Heinz and Matiasek (1994, p. 229), Hinrichs and Nakazawa (1994a) and others adopted this lexical analysis of control constructions for German. While the analyses differ in various respects, the central idea can be illustrated by the following lexical entries.[36] The lexical entry of an equi verb like *versuchen* (*try*) in figure 6 identifies the semantic index ($\boxed{1}$) of the subject requirement of its verbal complement with that of its own subject requirement and assigns a semantic role to this index.

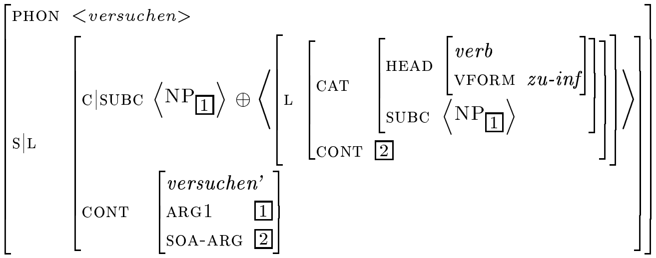


FIGURE 6. Lexical entry of a subject-oriented equi verb in HPSG

The lexical entry of a raising verb like *anfangen* (*start*) shown in figure 7, on the other hand, identifies the entire subject requirement list of the non-finite complement with its own subject requirement list. Furthermore, it assigns no semantic role to its subject.

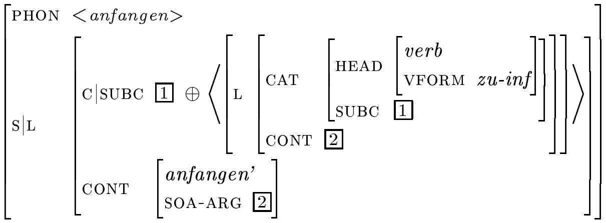


FIGURE 7. Lexical entry of a subject-to-subject raising verb in HPSG

Combining this traditional HPSG analysis of raising and equi verbs with our modified subcategorization principle is sufficient to permit spirits to

[36]The issue of argument raising as encoding of coherence is ignored here. We will come back to this point in section 4.2.

percolate from one head domain to another whenever they are embedded by a raising verb. Figure 8 illustrates this with an analysis of the example (270) we discussed on page 291.

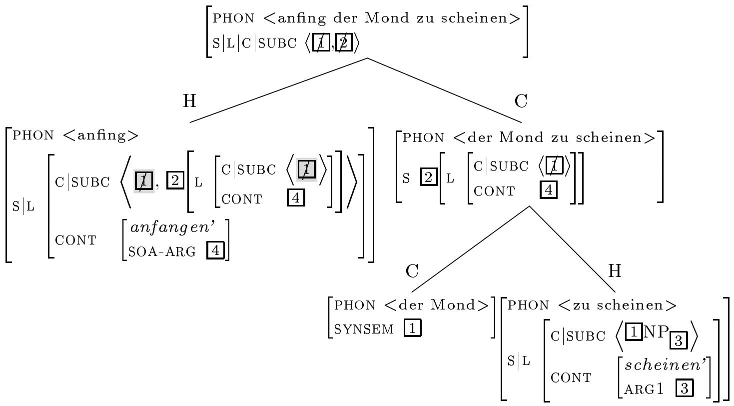


FIGURE 8. A simple example for raising of spirits: "(*obwohldamals*) *anfing, der Mond zu scheinen*"

The central aspect is that even though the verbal complement selected by the raising verb *anfing* is already realized as part of the extraposed[37] verbal complement, the subcategorization requirement for the subject is still raised by *anfing* and identified with its own subject requirement as shown by the specification highlighted in grey. Note that the spirit $\boxed{1}$ of the subject of the embedded verb has thus left its local head domain solely by virtue of being selected by a raising verb. In particular, no non-local mechanism like the SLASH percolation employed in HPSG for non-local extraction phenomena is involved.

4.1.4. *Case assignment.* Having clarified the introduction and percolation of spirits as marked elements on the SUBCAT list of signs, we are ready to show that the existence of such spirits permits a straightforward formulation of case assignment.

Taking up the principles and parameters tradition of structural case assignment, Heinz and Matiasek (1994) and other HPSG proposals argue that a case theory for languages like German needs to make use of information on where an argument is syntactically realized. While certain

[37]We here ignore the question how to generally capture extraposition phenomena, an issue which is largely orthogonal to the point discussed here.

arguments of a head always surface with a specific case, which can therefore be assigned in the lexical entry of the head (*lexical case*), the case of other arguments depends on the syntactic configuration in which they are realized and thus has to remain underspecified in the head's lexical entry (*structural case*).[38]

In addition to the aspect that certain arguments *have to* be assigned case based on where the argument is realized, a different aspect of structural case assignment is that other arguments *can* be assigned case in this way, i.e., without requiring lexical specification. The interest in this aspect is based on an understanding of the lexicon as the locus of idiosyncratic stipulations which should be avoided whenever possible. This perspective is also reflected in the terminology *predictable* vs. *unpredictable* case, where the former corresponds to all cases which can be resolved based on structural regularities and the latter refers to the cases which cannot be assigned based on syntactic information alone but require knowledge of lexical specification. As we saw in part two of this thesis, though, the grammar architecture of HPSG includes rich data structures for words and supports the formulation of lexical generalizations over these structures by implicational principles. In an HPSG setup it thus seems unmotivated to emphasize which cases can be predicted on syntax information alone.

Returning to the HPSG proposals for resolving structural case, it is clear that assigning the correct case to arguments which do not receive lexical case requires some syntactic information. The HPSG proposals differ with respect to exactly what information is needed and how it becomes available to the case principle resolving syntactic case. Heinz and Matiasek (1994) propose a case principle resolving the case of a sign in the syntactic structure in which that sign is realized. This follows from the fact that the case principle of Heinz and Matiasek (1994, pp. 209f) assigns case to an element on the head daughter's SUBCAT list which is required to be missing from the SUBCAT list of the mother. Przepiórkowski (1999), on the other hand, presents a case principle which assigns case on the argument structure of a sign in a way that is only indirectly informed about whether the sign is syntactically realized. For this Przepiórkowski introduces an attribute REALIZED which records in the elements on the argument structure whether an element has been realized locally. The

[38]We here restrict ourselves to two structural cases arising in verbal environments, nominative and accusative. We are agnostic as to whether a complete structural case theory should also include the dative.

proposal by St. Müller (1996b) in essence can be viewed as a hybrid between these two kinds of approaches. On the one hand, Müller's case assignment principle is similar to that of Heinz and Matiasek (1994) in that it refers directly to (the ARG-ST value as *cat* attribute of) the daughters structure, i.e., the syntactic realization. On the other, it shares with the approach of Przepiórkowski (1999) the fact that case is assigned to elements on the ARG-ST, which for St. Müller (1996b) includes representations of those elements which have been extracted by a lexical rule as part of a traceless theory of unbounded dependencies.

We believe that the data we presented in section 3 provide important evidence for the assumption that case assignment should not directly be linked to the syntactic realization of a sign as, e.g., in the theory of Heinz and Matiasek (1994). While we propose to keep a representation of already realized subcategorization requirements, nothing short of syntactically realizing such spirits as some kind of phonologically empty elements would make it possible to stick with a case principle running on syntactic realization – and we are not aware of any motivation for the syntactic realization of such empty elements. Essentially following the view of Przepiórkowski (1999), we thus reject the idea that it is the syntactic realization which causes structural case to be resolved. We instead propose to assign case to all subcategorization requirements which are not selected by a raising predicate. For the verbal heads we are concerned with in this chapter, the two statements in figure 9 are sufficient to assign case.

> **Nominative case assignment**
> In an utterance, the least oblique subcategorization requirement with structural case of each verb which is not raised from that verb receives nominative case.
>
> **Accusative case assignment**
> In an utterance, each non-least oblique subcategorization requirement with structural case of each verb which is not raised from that verb receives accusative case.

FIGURE 9. A Case Principle for verbal environments

Let us explain these two statements in detail. First, we follow standard HPSG in assuming that the subcategorization requirements of a head are ordered according to a hierarchy of obliqueness. While the motivation for this hierarchy is discussed in Pollard and Sag (1994), here it is sufficient to note that this obliqueness ordering on the subcategorization requirements allows us to identify the subject as the least oblique argument.[39] Second, we follow Heinz and Matiasek (1994) and others in assuming that the lexical entry of each verb specifies which of its arguments bears a lexical case and which a structural case, where structural case is an underspecified marking which in verbal environments can resolve to nominative or accusative.

Having clarified what we in figure 9 on the page before meant by 'the (non-)least oblique subcategorization requirement with structural case', we are left to explain the restriction that we only assign case to a verb's argument 'which is not raised from that verb'. We showed in section 3.4 that we only want to assign case to a subcategorization requirement on the highest subcategorization frame it can be raised to. Given a particular verb the subcategorization requirements of which we want to assign case to, we thus only assign case to those required arguments which are not raised by a predicate selecting that verb. In other words, given a particular verb, we only assign case to those of its subcategorization requirements which are realized as part of that verb's head projection or not realized at all.

Finally, let us point out that the two parts of the case principle are exactly parallel, in particular the nominative case assignment does not make reference to finiteness. In accordance with the conclusion of section 3.5 we thus also assign nominative case to the unrealized subject of the non-finite complement of equi verbs. They thus differ from the subjects of the non-finite complements of raising verbs which due to the restriction discussed in the last paragraph are not assigned case with respect to the verb from which they are raised.

There are a variety of options for formalizing the case principle of figure 9 on the preceding page in HPSG, in particular with respect to the check whether an argument is raised higher or not. If one wants to be able to check in the lexical specification of each verb whether an argument is raised from it or not, one has to record this syntactic information within the subcategorization requirement. This can be done parallel to the idea of the REALIZED attribute proposed by Przepiórkowski (1999) which records

[39] Note that this does not yet differentiate between the subjects of ordinary and those of ergative verbs. To make this additional distinction, one can follow Heinz and Matiasek (1994) in introducing the notion of *designated argument* (Haider, 1985a, 1986) into HPSG.

as part of each subcategorization requirement of a lexical head whether it is realized as part of this head's head domain. While this is an attractive option, which as far as we see is compatible with the raising spirits idea, we want to explore a different possibility which allows us to provide a formalization directly corresponding to the case principle we expressed as prose above. The proposed formalization does not introduce additional attributes for recording syntactic properties lexically, at the cost of having to refer to these syntactic properties by consulting the syntactic structure – a tradeoff which we believe to be without empirical consequences. As formal language we make use of RSRL (Richter et al., 1999; Richter, in preparation), an extension of the SRL language for HPSG defined by King (1989, 1994).

In figure 10, we show that each of the passages in the nominative case assignment rule corresponds directly to a subterm of the implicational statement.

In an utterance,	$\textit{unembedded-sign}$
	$\wedge$
the least oblique subcategorization requirement ($\boxed{3}$) with structural case of each verb ($\boxed{1}$)	$\forall \boxed{1}\ \boxed{1}\begin{bmatrix} \textit{word} \\ \textsc{s}\mid\textsc{l}\mid\textsc{c} \begin{bmatrix} \textsc{head}\ \boxed{2}\textit{verb} \\ \textsc{subc}\mid\textsc{first}\ \ \boxed{3}\big[\textsc{l}\mid\textsc{c}\mid\textsc{h}\ \ \boxed{4}\big[\textsc{case}\ \ \textit{struc}\big]\big] \end{bmatrix} \end{bmatrix}$
	$\wedge$
which is not raised from that verb	$\neg\exists \boxed{5}\ \boxed{5}\begin{bmatrix} \textsc{subc}\ \ \textit{member}\big(\big[\textsc{l}\mid\textsc{c}\mid\textsc{head}\ \ \boxed{4}\big]\big) \wedge \\ \qquad\ \ \textit{member}\big(\big[\textsc{l}\mid\textsc{c}\mid\textsc{head}\ \ \boxed{2}\big]\big) \end{bmatrix}$
	$\rightarrow$
receives nominative case.	$\boxed{3}\big[\textsc{l}\mid\textsc{c}\mid\textsc{h}\mid\textsc{case}\ \ \textit{nom}\big]$

FIGURE 10. Formalizing nominative case assignment

To formalize the concept of an 'utterance', we make use of the subclassification of *sign* into *unembedded-sign* and *embedded-sign* as introduced and motivated by Richter (1997). In RSRL, quantification is restricted to substructures of the particular linguistic object described. The first conjunct of the principle in figure 10 thus fixes that the principle talks about case assignment relative to an unembedded sign, or more properly speaking, it does so with respect to each unembedded sign.

The second conjunct of the principle then refers to each verbal word ($\boxed{1}$) which occurs in this unembedded sign that has a least oblique[40] argument ($\boxed{3}$) marked as structural case[41] receiving.

The third conjunct serves to exclude such elements $\boxed{3}$ which are raised from the SUBCAT list of a verb $\boxed{1}$. This is expressed by checking whether there is an element $\boxed{5}$ in the unembedded sign which has a subcategorization frame on which both the verb $\boxed{1}$ and its argument $\boxed{3}$ are present. In that case, the element $\boxed{5}$ would be the subcategorization frame of a head which has raised the argument $\boxed{3}$ from the verb $\boxed{1}$, in which case we do not want to assign case to $\boxed{3}$ with respect to the verb $\boxed{1}$. Since this check also needs to catch *projections* of the verb $\boxed{1}$ and since the *local* subtype of the argument $\boxed{3}$ changes to record that it has been realized (cf., sec. 4.1.2), the actual condition in the third conjunct of figure 10 is not formulated in terms of $\boxed{1}$ and $\boxed{3}$ being members of the same SUBCAT list, but by referring to the HEAD values of $\boxed{1}$ and $\boxed{3}$, namely $\boxed{2}$ and $\boxed{4}$.[42]

Once the antecedent of the nominative case assignment principle in figure 10 on the preceding page is satisfied, i.e., once it has identified the least oblique structural case marked arguments $\boxed{3}$ of verbal words $\boxed{1}$ such that $\boxed{3}$ is not raised from the verb $\boxed{1}$, then the consequent of the principle assigns nominative case to each such element.

The principle assigning accusative case shown in figure 11 on the next page is exactly parallel to the one for nominative case assignment just discussed. The only difference is that instead of the least oblique argument which we picked out as the FIRST element on SUBCAT for the nominative case assignment, this time the element $\boxed{3}$ we want to assign case to can be any of the members of the REST of the SUBCAT list. Compared to the nominative case principle in figure 10 on the preceding page, the principle assigning accusative case in figure 11 on the next page thus makes use of an

[40]As mentioned above, we follow Pollard and Sag (1994) in assuming that the SUBCAT list which encodes the subcategorization requirements is ordered by increasing obliqueness. The FIRST element under SUBCAT thus is the least oblique argument.

[41]The type *struc* in figure 10 on the preceding page is an abbreviation for the type *structural-case* of which *nominative* and *accusative* are defined to be subtypes.

[42]The necessity to refer to the HEAD values instead of the *synsem* objects directly is illustrated in the discussion of figure 12 on page 328. Note that this use of the HEAD values assumes that the HEAD values of different head projections are never (accidentally) token identical, which could be explicitly enforced by a constraint on unembedded signs.

In an utterance,	*unembedded-sign*
	$\wedge$
each non-least oblique subcategorization requirement ($\boxed{3}$) with structural case of each verb ($\boxed{1}$)	$\forall \boxed{1} \forall \boxed{3} \; \boxed{1}\begin{bmatrix} \textit{word} \\ \text{S\|L\|C} \begin{bmatrix} \text{HEAD } \boxed{2}\textit{verb} \\ \text{SUBC\|REST } \textit{member}\left(\boxed{3}\left[\text{L\|C\|H } \boxed{4}\left[\text{CASE } \textit{struc}\right]\right]\right) \end{bmatrix} \end{bmatrix}$
	$\wedge$
which is not raised from that verb	$\neg\exists \boxed{5} \; \boxed{5}\begin{bmatrix} \text{SUBC } \textit{member}\left(\left[\text{L\|C\|HEAD } \boxed{4}\right]\right) \wedge \\ \textit{member}\left(\left[\text{L\|C\|HEAD } \boxed{2}\right]\right) \end{bmatrix}$
	$\rightarrow$
receives accusative case.	$\boxed{3}\left[\text{L\|C\|H\|CASE } \textit{acc}\right]$

FIGURE 11. Formalizing accusative case assignment

additional universal quantifier to pick out all non-first elements on SUBCAT with structural case. Note that both principles make use of the negated existential condition which excludes elements from receiving case that are raised from the verb under discussion to a higher subcategorization frame.

4.1.5. *Two examples.* Let us illustrate these two parts of our case principle and its interaction with the subcategorization principle modified so as to introduce spirits with two example analyses. In figure 12 on the following page we see the analysis assigned to the example (262) from the very beginning of the chapter.[43] In this example nominative case is assigned to a subject embedded in a fronted non-finite constituent. The fronted constituent $\boxed{2}$ consisting of the non-finite verb *gewonnen* which has realized its subject *ein Außenseiter* ($\boxed{1}$) is related by the standard non-local feature mechanism of HPSG to a trace at the extraction site ($\boxed{3}$).[44] The finite verb *hat* selects the trace as its verbal complement, and since *hat* is a subject-to-subject raising verb, it identifies the spirit of the

[43]To abstract over the nature of verb-second and the structure of the Mittelfeld we follow Pollard (1996) in assuming a flat Mittelfeld and obtain verb-second by simple linearization in this local tree.

[44]For reasons of presentation, we here use a trace based version of an unbounded dependency theory. Our theory could equally well be combined with a traceless account

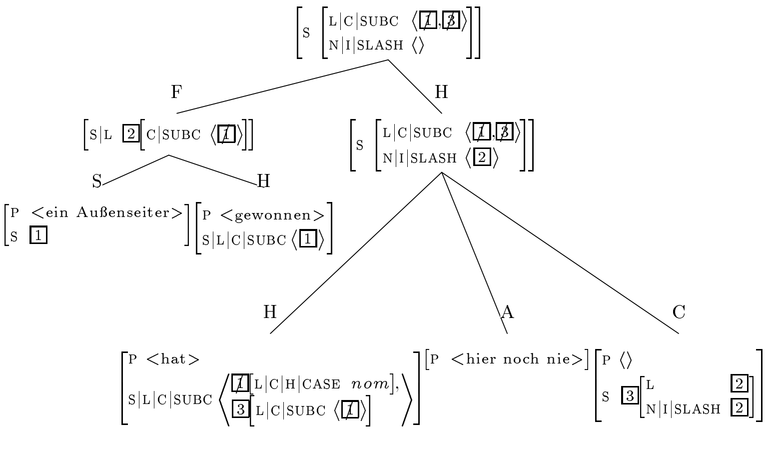


FIGURE 12. An example for nominative case assignment to a spirit

subject ($\boxed{\mathit{1}}$) of (the trace of) the verbal complement with its own subject requirement.

So how does the case theory we just formulated assign nominative case to the subject fronted as part of the non-finite constituent? The case principle does not apply to $\boxed{1}$ on the SUBCAT list of the verb *gewonnen*. This is so since *gewonnen* is the head of a constituent that (via its trace) is selected by the raising verb *hat* which identifies $\boxed{\mathit{1}}$ as an argument to be raised further.[45] Zooming in on the other occurrence of a verb, we see that the spirit $\boxed{\mathit{1}}$ of the subject occurs as first element on the SUBCAT list of *hat*. Since *hat* is not selected by another raising predicate identifying $\boxed{\mathit{1}}$ as an argument to be raised further, the case principle of figure 10 on page 325 assigns nominative case to $\boxed{\mathit{1}}$ as the first element on the SUBCAT list.

To showcase the accusative case assignment, let us return to example (275) on page 293 which is an instance of a sentence in which an AcI verb assigns accusative case to an argument fronted as part of a non-finite complement. Figure 13 on the facing page shows how this sentence is analyzed under

of extraction; but see section 6.4 of chapter 9 for some discussion of the choice between unbounded dependency approaches in the context of argument raising.

[45] Note that $\boxed{1}$ and $\boxed{\mathit{1}}$ differ with respect to their local subtypes. This is the motivation for only requiring identity of HEAD values in the negated existential conjuncts of our case principle in the figures 10 on page 325 and 11 on the preceding page.

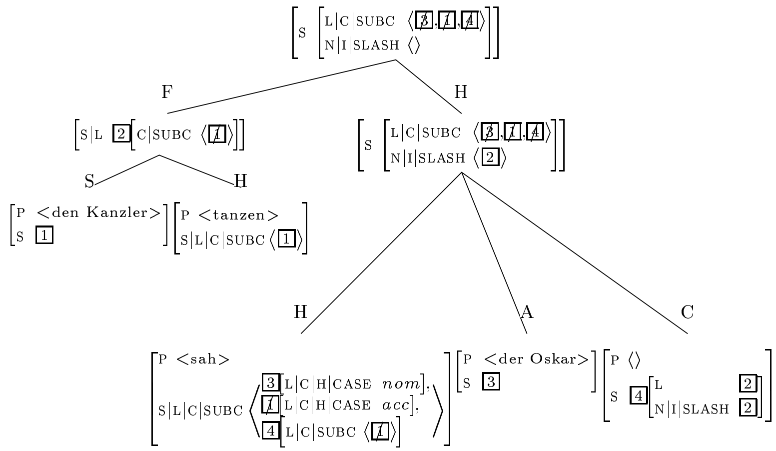


FIGURE 13. An example for accusative case assignment to a spirit

our theory. Parallel to the previous case, the subject requirement $\boxed{1}$ on the SUBCAT list of the fronted verb *tanzen* is not assigned nominative case, since the fronted constituent is selected by the subject-to-object raising verb *sah* which raises $\boxed{1}$ to become its object. Since *sah* is not selected by a raising predicate, our case principle assigns nominative case to its subject and accusative case to the second element on the SUBCAT list.

4.2. Towards a more restrictive theory of spirits. The theory formalized in the last section captures the raising spirits hypothesis we argued for on the basis of the data presented in section 3: local relations are established with elements on the highest subcategorization frame to which an element could be raised. To capture this idea, it was sufficient to modify the HPSG architecture of Pollard and Sag (1994) essentially in only one place, the percolation of subcategorization information. While this results in a very general and straightforward theoretical rendition of the intuitions behind spirits, the general nature of the modified subcategorization principle treating all arguments on a par has the disadvantage of, in principle, allowing every head to refer to any property of any argument realized as part of its complement. Going over the empirical motivation for spirits again, a more restrictive option for introducing spirits seems to be available. If one adopts a subject-to-subject raising analysis of passives instead of an object-to-subject raising one, it appears to be sufficient to introduce only spirits of subjects. For non-subject arguments one could therefore return to the more constrained traditional setup, in which the properties of an argument cannot be accessed as part of the local properties of the verbal constituent in which the arguments are realized.

While this motivation for considering an alternative proposal capturing the raising spirits idea could be considered a theoretical issue without (immediate) empirical consequences, there also is an empirical issue which forces us to consider an alternative to the basic formalization proposed in the previous section. In section 3.4.2 we established that an argument is assigned case only by the highest case assigner to which it could be raised. In the discussion of remote passivization as part of the same section, we then showed that argument raising as encoding of coherence has to be distinguished from the raising relation established by the traditional raising predicates. While the traditional raising relation is always established, independent of whether the argument is actually raised or not (which gave raise to the notion of 'spirit'), argument raising as encoding of the merging of subcategorization requirements in a coherent construction does not raise arguments onto the head's requirements if they are already realized as part of the verbal complement, i.e., coherence never introduces 'spirits'.

This explains, for example, that the nominative case is unavailable in (329a) whereas it is available in 329b.[46]

(329) a. [*Der / Den Wagen zu reparieren] wurde lange Zeit versucht.
*the-*N / *the-*A *car to repair was long time tried*

b. [Der / Den Wagen zu reparieren versucht] wurde lange Zeit.
*the-*N / *the-*A *car to repair tried was long time*

In (329a), the fronted verbal complement of the optionally coherent verb *versuchen* contains the argument *den Wagen.* We saw in the discussion of the example (311b) on page 307, as well as the more general one in section 1.4.4 of chapter 2 that topicalization of the complete VP complement is an option which is also available to verbs which can only construct coherently. The sentence in (329a) thus has an analysis in which *versucht* coherently selects the topicalized constituent. The unavailability of the nominative can therefore be taken to show that the coherence of a combination alone is not sufficient for establishing a raising relation transferring the case assignment.

[46]These examples repeat the ones we mentioned as (310) on page 306 and (312) on page 307. Further related examples are discussed as (309a) and (309b) on page 306.

In (329b), the fronted constituent is ambiguous between two structures. Either *versucht* combines incoherently with the full VP *den Wagen zu reparieren*, or *versucht* raises the argument *der Wagen* of *zu reparieren* and both verbs combine in a verbal cluster which then realizes *der Wagen.* Once argument raising as encoding of coherence has raised the NP onto the valence representation of *versucht*, the lexical raising relation established by the passive auxiliary thus is sufficient to assign nominative case.

Having refreshed our memory on what we intend the theory to achieve, we only need to introduce argument raising as encoding of coherence into the basic raising spirits theory we defined in the previous section to see that it falls short of the desideratum. Extending the lexical entry of the optionally coherent equi verb *versuchen* we had defined in figure 6 on page 320 with an argument raising specification in the tradition of Hinrichs and Nakazawa (1989), we obtain the revised entry for *versuchen* in figure 14.

$$\begin{bmatrix} \text{PHON} & \langle \textit{versuchen} \rangle \\ \text{S|L} & \begin{bmatrix} \text{C|SUBC} & \langle \text{NP}_{\boxed{1}} \rangle \oplus \boxed{3} \oplus \left\langle \left[\text{L} \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \textit{verb} & \\ \text{VFORM} & \textit{zu-inf} \end{bmatrix} \\ \text{SUBC} & \boxed{3} \oplus \langle \text{NP}_{\boxed{1}} \rangle \end{bmatrix} \\ \text{CONT} & \boxed{2} \end{bmatrix} \right] \right\rangle \\ \text{CONT} & \begin{bmatrix} \textit{versuchen'} & \\ \text{ARG1} & \boxed{1} \\ \text{SOA-ARG} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

FIGURE 14. Lexical entry of an optionally coherent equi verb

In a traditional HPSG setup, i.e., without spirits, the tag $\boxed{3}$ represents those argument requirements of the verbal complement, which were not already realized as part of the verbal complement. These argument requirements are then added to the argument requirements of *versuchen.*[47]

In the basic raising spirits setup we defined in the previous section, we modified the subcategorization principle so that it keeps a representation of the already realized arguments around (sec. 4.1.2). This has the effect that a verb such as *versuchen* always selects a verbal complement which still has all its arguments on its SUBCAT list, the ones that are already realized are only marked as spirits. With respect to the ordinary argument

[47]The operator $\oplus$ stands for the append relation, i.e., list concatenation.

raising specification as part of the lexical entry of *versuchen* we saw in figure 14, the effect is that in a coherent construction, all arguments of the verbal complement are raised, some of them as ordinary arguments, some of them as spirits. This, however, is exactly the situation we set out to avoid: argument raising in this setup establishes a raising relation for all arguments of a coherently selected verb, independent of whether the argument is realized as part of the verbal complement or not.

There are two ways to overcome this situation in order to obtain a theory which captures our original intentions. Either we change the argument raising specification so that it no longer raises spirits.[48] Or we return to the original subcategorization principle so that subcategorization requirements are discharged in the traditional way. Spirits as representations of those elements which could be raised by a traditional raising predicate then have to be introduced in a different, more restricted way. Introducing spirits only for subject requirements is such a more restricted option, and as we saw at the beginning of this section, this option would also be preferable on theoretical grounds. In the remaining part of this chapter we therefore explore this possibility.

4.2.1. *Splitting* SUBCAT *and the realizability of subjects.* As a first step, we need to adopt a more elaborate representation of valence requirements. For ease of exposition, we so far based our discussion on a basic setup with a single representation for all subcategorized for elements, the SUBCAT list as used in Pollard and Sag (1994, ch. 1–8). The uniform representation of all arguments also allowed us to remain silent about when a non-finite verb can form a constituent with its subject. To provide a more complete theory, in particular one that only introduces subject spirits as suggested above, firstly we should replace this setup with a representation distinguishing subject requirements from other valence requirements in a straightforward way. And secondly, we need to introduce a mechanism which can be used to determine when a subject can be realized as part of a non-finite projection.

For both of these tasks we can build on previous HPSG proposals. Pollard and Sag (1994, ch. 9) follow Borsley in proposing distinct valence

[48]This option, which we do not explore here, has an ad-hoc technical and a more interesting general aspect. Technically it is straightforward to stipulate that spirits never undergo argument raising. One simply changes the lexical argument raising specification to only raise non-spirits, which can be identified by their *local* subtype. The more interesting general aspect would involve exploring alternatives to the lexical argument raising specification as encoding of coherence.

attributes for subjects and complements. For German, Pollard (1996) and Kiss (1995a) suggest to encode the subject requirement of non-finite verbs separate from the other requirements. Both argue that the subject of a non-finite verb is never realized and thus their theory does not permit realization of the separately encoded subject requirement of non-finite verbs. Kiss (1995a) actually goes as far as making SUBJ a *head* feature so that the Head-Feature Principle percolates the subject requirement along the entire non-finite head projection. A lexical rule deriving finite verbs from non-finite ones then ensures that the subject requirement is added to the other, realizable subcategorization requirements of finite verbs.

In light of the fact that most of the data we discussed in this chapter contradict the assumption that subjects of non-finite verbs can never be realized, we cannot carry over the proposals of Pollard (1996) and Kiss (1995a) as they stand. On the other hand, the idea of Kiss (1995a) to introduce SUBJ as a *head* feature nicely captures the insight that subjects (but not objects) are visible from outside a verbal projection. In addition to our raising spirits data this is independently argued for by Höhle (1997).

The idea to use a lexical rule as the means for integrating the subject into the list of realizable arguments is equally attractive. Rather than licensing finite verbs in this way, we use it to license (the subclass of) non-finite verbs which can combine with a subject. Using a lexical rule for this purpose is attractive since it provides us with a well-defined locus for encoding the conditions under which the subject requirement can be integrated with the other valence requirements in order to be realizable. Such a *subject integration lexical rule* thus eliminates the incorrect assumption that subjects can always be realized which was underlying the basic raising spirits theory we formulated above. At the same time it permits us to concentrate on the task we defined in the introduction, the case assignment issue in those examples in which a subject can actually be realized in a non-finite projection. Even though we thereby leave the exploration and integration of the other factors restricting the occurrence of subjects in non-finite environments to future research, we are confident that they can ultimately be integrated as restrictions on which non-finite verbal words can undergo the subject integration lexical rule.

In figure 15 on the following page. we see a first version of a lexical rule integrating the subject requirements with the complement requirements in order for the subject to be realizable. Note that while the lexical rule appends the (possibly empty) subject valence requirement to the SUBCAT list, it does not remove the subject requirement from the SUBJ value but

$$\begin{bmatrix} \textit{word} & \\ \text{S}\mid\text{L}\mid\text{C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{VFORM} & \neg\textit{fin} \\ \text{SUBJ} & \boxed{1}\end{bmatrix} \\ \text{SUBCAT} & \boxed{2}\end{bmatrix}\end{bmatrix} \mapsto \begin{bmatrix}\text{S}\mid\text{L}\mid\text{C} & \begin{bmatrix}\text{H}\mid\text{SUBJ} & \textit{mark-realized}\left(\boxed{1}\right) \\ \text{SUBCAT} & \boxed{1}\oplus\boxed{2}\end{bmatrix}\end{bmatrix}$$

FIGURE 15. Subject integration lexical rule

only marks it as realized. Recursive application of this rule is ruled out since *mark-realized* requires a list of *unrealized* elements and turns it to a list of *realized* ones.

To obtain the full picture, we also provide a version of a finitivization lexical rule in figure 16. Just like in our subject integration lexical rule,

$$\begin{bmatrix} \textit{word} & \\ \text{PHON} & \boxed{1} \\ \text{S}\mid\text{L}\mid\text{C} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{VFORM} & \textit{bse} \\ \text{SUBJ} & \boxed{2}\end{bmatrix} \\ \text{SUBCAT} & \boxed{3}\end{bmatrix}\end{bmatrix} \mapsto \begin{bmatrix}\text{PHON} & \textit{bse2fin}\left(\boxed{1},\boxed{2}\right) \\ \text{S}\mid\text{L}\mid\text{C} & \begin{bmatrix}\text{HEAD} & \begin{bmatrix}\text{VFORM} & \textit{fin} \\ \text{SUBJ} & \boxed{2}\end{bmatrix} \\ \text{SUBCAT} & \boxed{2}\oplus\boxed{3}\end{bmatrix}\end{bmatrix}$$

FIGURE 16. A finitivization lexical rule

the subject requirement is added to the beginning of the SUBCAT valence. And just like in the non-finite case, we do not remove the subject from the SUBJ attribute. Since there are no raising verbs selecting finite projections with possibly unrealized subjects, this is not required for the raising spirits phenomena but for the already mentioned subject visibility data discussed in Höhle (1997).[49] Note that if there is no subject requirement, $\boxed{2}$ is the empty list, and thus the SUBCAT list contains only the complements. The relation *bse2fin* transforms the base form into a finite form agreeing with the person and number of the subject, if there is one, and with the third person, singular in subjectless constructions.

4.2.2. *Verbal entries in the modified setup.* On the basis of this setup, raising verbs can now be defined to establish a link to the head attribute SUBJ of the verbal complement as shown in figure 17 on the facing page. The relevant change is that the identification of subject requirements now

[49]Marking the subject requirement of finite verbs as realized in the output of the finitivization lexical rule parallel to the subject integration rule is not necessary, though.

$$\begin{bmatrix} \text{PHON} & \langle \textit{anfangen} \rangle \\ \text{S}\mid\text{L} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{VFORM} & \textit{bse} \\ \text{SUBJ} & \boxed{1}\end{bmatrix} \\ \text{SUBCAT} & \boxed{2} \oplus \left\langle \begin{bmatrix} \text{L} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{VFORM} & \textit{zu-inf} \\ \text{SUBJ} & \boxed{1}\end{bmatrix} \\ \text{SUBCAT} & \boxed{2}\end{bmatrix} \\ \text{CONT} & \boxed{3}\end{bmatrix}\end{bmatrix}\right\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix}\textit{anfangen'} & \\ \text{SOA-ARG} & \boxed{3}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

FIGURE 17. A subject-to-subject raising verb in the modified setup

makes use of the new *head* feature SUBJ. Note that the tag $\boxed{2}$ remains in order to encode that an optionally coherent verb like *anfangen* can attract the unrealized complements of its verbal complement in order to form a verbal cluster with that verbal complement.

A lexical entry for a subject-to-object raising verb like *sehen* (*to see*) is shown in figure 18.[50]

$$\begin{bmatrix} \text{PHON} & \langle \textit{sehen} \rangle \\ \text{S}\mid\text{L} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{VFORM} & \textit{bse} \\ \text{SUBJ} & \left\langle \text{NP}_{\boxed{1}} \right\rangle\end{bmatrix} \\ \text{SUBCAT} & \boxed{2} \oplus \boxed{3} \oplus \left\langle \begin{bmatrix} \text{L} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix}\textit{verb} & \\ \text{VFORM} & \textit{bse} \\ \text{SUBJ} & \boxed{2}\end{bmatrix} \\ \text{SUBCAT} & \boxed{3}\end{bmatrix} \\ \text{CONT} & \boxed{4}\end{bmatrix}\end{bmatrix}\right\rangle \\ \text{CONT} & \begin{bmatrix}\textit{sehen'} & \\ \text{ARG1} & \boxed{1} \\ \text{SOA-ARG} & \boxed{4}\end{bmatrix}\end{bmatrix}\end{bmatrix}$$

FIGURE 18. A subject-to-object raising (=AcI) verb in the modified setup

[50]In the figure, $\text{NP}_{\boxed{1}}$ is an abbreviation for the description $\begin{bmatrix}\text{LOC} & \begin{bmatrix}\textit{unrealized} & \\ \text{CAT} & \begin{bmatrix}\text{HEAD} & \textit{noun} \\ \text{SUBCAT} & \langle\rangle\end{bmatrix} \\ \text{CONT} & \begin{bmatrix}\text{INDEX} & \boxed{1}\end{bmatrix}\end{bmatrix}\end{bmatrix}$.

4.2.3. *Introducing, percolating and assigning case to spirits.* With an attribute percolating subject requirements along the head projection and a lexical rule integrating subjects into the list of realizable arguments for (certain) non-finite verbs in place, the question how spirits as representations of already realized subjects are introduced and percolated can be given a new, more restrictive answer: A subject requirement is percolated along the entire head projection, independent of where it is realized. Raising verbs identify this subject requirement with their own subject or object (AcI) requirement, which allows subject requirements to penetrate their head domain and receive case on the subcategorization list they were raised to, independent of whether the subject was already realized as part of the non-finite projection. But different from the basic raising spirits theory defined in section 4.1, we no longer need to modify the 'traditional' Subcategorization Principle of figure 2 on page 316 to percolate spirits through the tree. Instead, we only need to ensure that elements marked as already realized which appear on SUBCAT as the result of raising are simply ignored. This is ensured by the revised version of the 'traditional' Subcategorization Principle shown in figure 19. Note

$$\begin{bmatrix} \textit{phrase} \\ \textsc{dtrs}\ \ \textit{head-struc} \end{bmatrix} \rightarrow \begin{bmatrix} \textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{subcat}\ \ \boxed{1} \\ \textsc{dtrs}\ \begin{bmatrix} \textsc{head-dtr}|\textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{subcat}\ \ \boxed{1} \oplus \boxed{2} \bigcirc \textit{list}\Big(\begin{bmatrix}\textsc{loc}\ \ \textit{realized}\end{bmatrix}\Big) \\ \textsc{comp-dtrs}\ \ \textit{synsems2signs}\big(\boxed{2}\big) \end{bmatrix} \end{bmatrix}$$

FIGURE 19. Revised 'traditional' Subcategorization Principle

that the only change is the addition of a possibly empty list of realized elements occurring shuffled (◯) into, i.e., interspersed with, the other elements on the SUBCAT list of the head daughter.

Summing up, the existence of subject spirits in this revised setup derives from the observation that (at least certain properties of) subjects are visible when looking at a saturated verbal projection combined with the lexical existence of raising verbs establishing links to the subjects of their verbal complements made visible in this manner.

Case assignment. Finally, we need to change the formalization of the prose in the two implicational statements in figure 10 on page 325 and figure 11 on page 327 to fit the new feature geometry. Let us first focus

on the negated existential conjunct occurring in both statements. This conjunct is supposed to ensure that case is only assigned if the argument is not raised further. The way we formalized this was by checking whether (the HEAD value of) an argument appears on the same subcategorization list as (a projection of) the head it is selected by. In other words, we check whether the argument and its head are 'selected as sisters' somewhere in the utterance. Having split up subcategorization into two attributes, this check is slightly more complex to express so that we factor it out in the relation *selected-as-sisters* defined in figure 20. The three-place

$$\begin{array}{l} \textit{selected-as-sisters}\big(\boxed{1},\boxed{2}\big) := \textit{on-subj-or-subcat}\big(\boxed{1}\big) \wedge \textit{on-subj-or-subcat}\big(\boxed{2}\big). \\ \textit{on-subj-or-subcat}\big(\boxed{1}\big) := \Big[\textsc{h}|\textsc{subj}\ \ \textit{member}\Big(\big[\textsc{l}|\textsc{c}|\textsc{head}\ \ \boxed{1}\big]\Big)\Big]. \\ \textit{on-subj-or-subcat}\big(\boxed{1}\big) := \Big[\textsc{subcat}\ \ \textit{member}\Big(\big[\textsc{l}|\textsc{c}|\textsc{head}\ \ \boxed{1}\big]\Big)\Big]. \end{array}$$

FIGURE 20. Making explicit what it means to be selected as sisters

relation *selected-as-sisters* holds if the *head* values passed as first and second argument occur on the SUBJ or SUBCAT list of the *category* that is the result argument.

The implicational statement assigning nominative case can then be reformulated as shown in figure 21. Compared to the original formalization

In an utterance,	*unembedded-sign*
	$\wedge$
the least oblique subcategorization requirement ($\boxed{3}$) with structural case of each verb ($\boxed{1}$)	$\forall \boxed{1}\ \boxed{1}\begin{bmatrix} \textit{word} \\ \textsc{s}|\textsc{l}|\textsc{c}\ \ \Big[\textsc{head}\ \boxed{2}\begin{bmatrix} \textit{verb} \\ \textsc{subj}\ \Big\langle \boxed{3}\big[\textsc{l}|\textsc{c}|\textsc{h}\ \ \boxed{4}\big[\textsc{case}\ \ \textit{struc}\big]\big]\Big\rangle \end{bmatrix}\Big] \end{bmatrix}$
	$\wedge$
which is not raised from that verb	$\neg\exists \boxed{5}\ \ \boxed{5}\textit{selected-as-sisters}\big(\boxed{4},\boxed{2}\big)$
	$\rightarrow$
receives nominative case.	$\boxed{3}\big[\textsc{l}|\textsc{c}|\textsc{h}|\textsc{case}\ \ \textit{nom}\big]$

FIGURE 21. Revised nominative case assignment

in figure 10 on page 325 there are two changes. First, the subject requirement is no longer picked out as the first element of SUBCAT but as the single SUBJ element.[51] And second, we have replaced the check for sister selection in the negated existential conjunct with our newly defined relation.

Two similar changes are required in the re-formalization of the accusative case assignment which is shown in figure 22. Firstly, to pick out the non-

In an utterance,	*unembedded-sign*
	$\wedge$
each non-least oblique subcategorization requirement ($\boxed{3}$) with structural case of each verb ($\boxed{1}$)	$\forall \boxed{1} \forall \boxed{3}$ $\boxed{1}\left[\begin{array}{l} \textit{word} \\ \text{S}\lvert\text{L}\rvert\text{C} \left[\begin{array}{l} \text{HEAD } \boxed{2}\textit{verb} \wedge \neg \left[\text{SUBJ}\lvert\text{L}\rvert\text{C}\rvert\text{H } \boxed{4}\right] \\ \text{SUBC } \textit{member}\left(\boxed{3}\left[\text{L}\lvert\text{C}\rvert\text{H } \boxed{4}\left[\text{CASE } \textit{struc}\right]\right]\right) \end{array}\right] \end{array}\right]$
	$\wedge$
which is not raised from that verb	$\neg\exists \boxed{5}$ $\boxed{5}\textit{selected-as-sisters}\left(\boxed{4},\boxed{2}\right)$
	$\rightarrow$
receives accusative case.	$\boxed{3}\left[\text{L}\lvert\text{C}\rvert\text{H}\rvert\text{CASE } \textit{acc}\right]$

FIGURE 22. Revised accusative case assignment

subject arguments from the SUBCAT list, we cannot take any member of the rest of the list as in the original formulation. Instead, we take any list member which does not match the subject requirement (if there is one) of the verbal word. And secondly, the new relation is used to check for sister selection.

Concluding the re-formalization of case assignment, one should keep in mind that the prose which is being formalized by the two implicational statements was not changed in any way. The need to revise our formalization purely resulted from the change in the underlying data structure, i.e., the way we encode different subcategorization requirements.

[51] Note that ergative verbs are also assumed to encode their subject under SUBJ. The issue of singling out the designated argument in a separate attribute DA to account for argument reduction phenomena such as the passive as proposed by Heinz and Matiasek (1994) in the tradition of Haider (1986) is independent of our split valence encoding.

Two examples. Now that the relevant parts of the revised theory are introduced, let us take another look at the two examples we discussed for the basic raising spirits setup (pp. 328–329).

Figure 23 illustrates the analysis assigned by our revised theory to the example in which nominative case has to be assigned to a spirit.

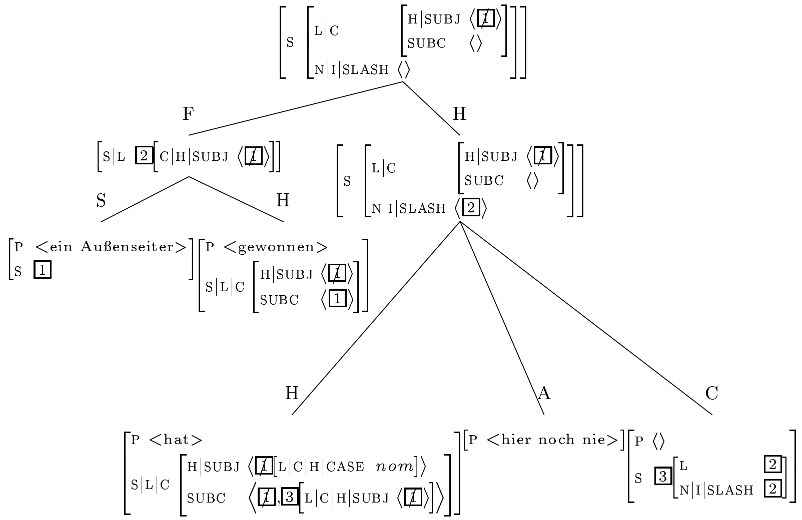


FIGURE 23. Revised analysis of nominative case assignment to a spirit

Starting with the fronted constituent, the fronted non-finite verb *gewonnen* is licensed by the subject integration lexical rule we defined in figure 15 on page 334. As a result, the subject requirement $\boxed{\mathit{1}}$ on SUBJ, which as head value percolates along the entire fronted head projection, has a *realized* local value.

The second effect of the lexical rule is that the subject requirement $\boxed{1}$ is also encoded as a realizable argument on the SUBCAT list. The case of the subject is not resolved with respect to the fronted verbal word since the spirit of the subject requirement $\boxed{\mathit{1}}$ is raised by the subject-to-subject raising verb *hat* which thus selects both the non-finite verbal complement and the subject spirit as tested by the *selected-as-sisters* condition of the case principles. The finite verb-second element *hat* as subject-to-subject raising verb identifies the SUBJ attribute of (the trace of) its verbal complement with its own SUBJ attribute. Since the subject requirement encoded on SUBJ is not raised any further, it is assigned nominative case by our revised case principle of figure 21 on page 337.

As a finite verb, *hat* is licensed by the finitivization lexical rule (figure 16 on page 334) and therefore also encodes the subject on its SUBCAT list. Since the subject requirement has a *realized* local value, though, the revised traditional subcategorization principle (figure 19 on page 336) neither percolates this value higher, nor can it be realized.

Compared to the basic raising spirits analysis of this example we discussed under figure 12 on page 328, the revised setup is more restrictive in that it does not represent the subcategorization requirement for the verbal complement ($\boxed{3}$) at the two finite phrasal mother nodes.

Turning to the accusative case example, the revised analysis is illustrated in figure 24. Just like in the nominative case example discussed above,

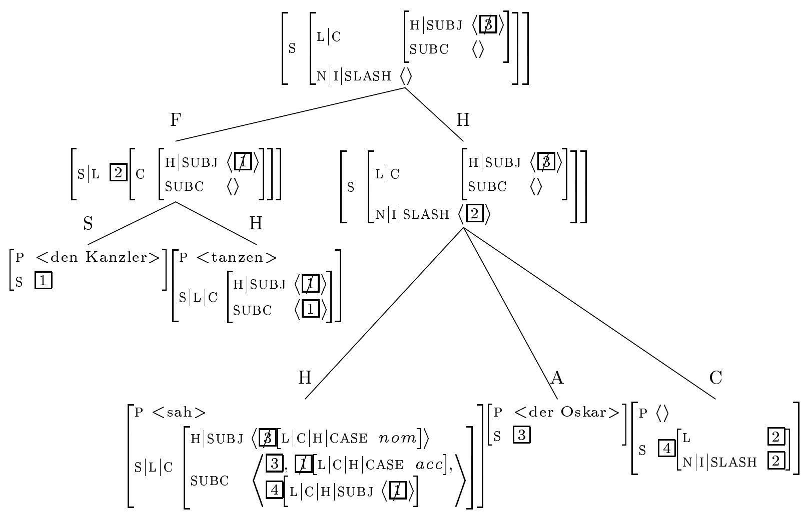


FIGURE 24. Revised analysis of accusative case assignment to a spirit

the fronted non-finite verb *tanzen* is licensed by the subject integration lexical rule (figure 15 on page 334), which results in the subject valence requirement being encoded both as a realizable argument on SUBCAT and as a spirit on the *head* feature SUBJ. And just as in the previous example,

the subject is not assigned case with respect to the non-finite verbal word since it is selected by a raising predicate, but this time by the subject-to-object raising verb *sah*.

The finite verb-second verb *sah* is licensed by the finitivization lexical rule and thus includes its own subject as a realizable argument on SUBCAT in addition to the encoding under SUBJ to which nominative case is assigned by our case principle. The only non-subject argument with structural case on the SUBCAT list of *sah* is the raised spirit $\boxed{\mathit{1}}$. Since it is not raised further our case principle resolves its case to accusative.

4.2.4. *Which properties of arguments survive as spirits?* An issue we glossed over when merging the traditional HPSG theory of control with the modified subcategorization percolation introducing spirits concerns the question which properties of an argument survive as spirit. To capture that equi verbs have to select a verbal projection with an unrealized subject, in the traditional HPSG setup the lexical entry of an equi verb selects a verbal complement having a single subcategorization requirement left. This single remaining element restriction is well-motivated since an equi verb needs to identify its subject index with that of the subject of the verbal complement – a requirement which can only be made locally if the subject requirement has not yet been realized and therefore is locally visible when the verbal complement is selected.

Under the raising spirits setup, even subjects which are realized remain visible in this way so that there is no independent motivation for having to require the first list element to bear an *unrealized* LOCAL value. Just as before, one would like this to fall out from the intuition that spirits mediate grammatical information but cannot be assigned a semantic role. This could be captured by encoding spirits as representations of selected properties only. In particular, such a selection should not include the semantic index in order to rule out the possibility of assigning a semantic role to an argument already realized as part of a complement. In the traditional HPSG setup, however, subject-verb agreement as one of the relations we showed to be mediated by spirits is expressed via the semantic index. The only way to express that the semantic index of a spirit is unavailable even though subject-verb agreement is ensured would thus be to separate the encoding of subject-verb agreement from the semantic index – an undertaking which has been argued for on independent grounds by Kathol (1999).

5. Summary

We started our investigation with the observation that for certain non-finite constructions in German it appears to be necessary to ensure non-local nominative case assignment and agreement relations. Instead of contemplating a new non-local mechanism for establishing these relations, we observed that such extended relations are only possible when mediated by a lexical element, a raising predicate. This finding was confirmed by an empirical overview of raising constructions covering subject-to-subject raising, AcI constructions analyzed as subject-to-object raising, and stative and agentive passives analyzed either as subject-to-subject or as object-to-subject raising. Taking a closer look at sentences in which several raising constructions interact, we showed that local grammatical relations like case assignment are only established on the highest subcategorization frame to which an argument could be raised. In light of the fact that these raising relations are independently motivated, the remaining question we set out to answer in the rest of this chapter was how already realized subcategorization requirements can be made visible to the traditional raising relations.

In the first of the two encodings we proposed as answers to this question, this was accomplished by modifying the traditional Subcategorization Principle of HPSG so as to mark realized complements rather than eliminating them from the list of subcategorization requirements. Since the subcategorization requirements corresponding to already realized arguments, the so-called 'spirits', are represented in the same way as ordinary subcategorization requirements (except for their local subtype), they take part in all grammatical relations without requiring further changes. They can be raised when their verbal head is selected by a raising predicate and they can be assigned case by a version of an HPSG case theory which does not make case assignment directly dependent on argument realization.

The first encoding is a general and straightforward theoretical rendition of the intuitions behind spirits. The general nature of the modified subcategorization principle treating all arguments on a par, however, has the disadvantage of eliminating the idea that selection is a local phenomenon which does not in general have access to arguments embedded inside a constituent.

As a more restrictive alternative respecting this insight, we therefore proposed a revised theory introducing only spirits of subjects. Making subjects the special case is attractive, as they have independently been argued to be visible from outside the saturated verbal projection. The existence of the linguistic representation we call subject spirits thus is the result of the interaction of two independently motivated linguistic observations. First, the observation that (at least certain properties of) subjects are visible when looking at a saturated verbal projection. And second, the existence of raising verbs as a special lexical class of verbs establishing local links to the subject requirements of their verbal complements.

While the formalization we provide of the raising spirits idea can surely be improved on, the idea of subject spirits appears to be a valuable concept in that it shows that one can reduce the apparently non-local variants of case assignment and subject-verb agreement to an interaction of the traditional local variants of these relations with the raising relations introduced by a well-established lexical class of verbs.

CHAPTER 11

Summary

In this thesis we investigated lexical generalizations in the syntax of German non-finite constructions under three perspectives: empirical, formal, and theoretical. Empirically, we provided an overview of the key phenomena by assuming a general notion of head-complement constructions as basis and examining the data along the properties expected for this basic syntactic skeleton. This organization of the empirical domain highlighted the fact that the diverging syntactic properties of different non-finite constructions are rooted in different lexical classes of verbal complement taking verbs. We showed that attempts to derive these lexical classes or their properties provide interesting approximations, but fail to take the whole range of data into account. Making the approximate characterizations of lexical classes follow from deeper 'explanations' therefore would not result in an empirically adequate theory; and the alternative of explicitly limiting the theory to a core of cases in lack of a clear methodology for distinguishing the core from the periphery in essence cuts linguistics lose from being an empirical science. The current state of affairs thus requires the lexical stipulation of at least the following four traditional properties: the status a verb governs, the optional/obligatory (in)coherence of the verbal head's combination with the verbal complement, the coefficient of the verb, and the control-level at which the controller relates to the verbal head.

Having illustrated the importance of lexical classifications, in the second part of the thesis we turned to a discussion of the place of lexical specification in the linguistic architecture of HPSG and the formal mechanisms needed to express lexical generalizations. We showed that once the ontology declared in the signature is rich enough to single out the relevant subclass of words with a description, it is straightforward to formulate implicational statements parallel to the principles constraining subclasses of phrases in traditional HPSG. While such lexical principles characterize the properties of a particular lexical class, a second kind of generalization relating different lexical classes is traditionally expressed by lexical rules. To lift lexical rules onto the same formally explicit and well-defined level as the general HPSG architecture, in the main chapters of part two we developed a specification language for lexical rules and showed how it can be interpreted in terms of the formal architecture for HPSG defined by King (1989, 1994).

In part three, we then turned to the theoretical interpretation of some of the central aspects of the syntax of German non-finite construction. Our work here can be interpreted as following the tradition of Kiss (1995a) in that both his and our proposal are HPSG approaches strongly influenced by the empirical observations and classifications of Bech (1955). Viewing our work in terms of this tradition, part three can be seen to address a number of empirical phenomena not dealt with or left as problems by Kiss (1995a), in particular: the upper-field phenomenon in a way naturally extending to two problematic alternative linearizations, the irregular status assignments including the substitute *zu*-infinitive, the partial fronting phenomena with partial constituents of different categories and partiality resulting from missing complements or adjuncts, and an extension of the coverage to object-oriented verbs in addition to the subject-oriented verbs focused on by Kiss (1995a). On the more theoretical side, we showed how certain constituents can be licensed for topicalization only in response to the variable constituency challenge arising from the restricted availability of full VP complements for obligatorily coherent verbs. Finally, we addressed the occurrence of certain subjects as part of non-finite constructions, which requires a change in the traditional percolation of subject requirements and its particular rendering proposed by Kiss (1995a), and we showed that the apparently non-local case assignment and agreement phenomena arising in these constructions can be derived from a combination of local lexical properties, the identification of valence requirements as part of the lexical specification of raising verbs. This establishes two distinct kinds of lexical relations on valence specifications: the raising relation as part of the lexical specification of a particular class of verbs is established independent of the syntactic context whereas argument attraction as option introduced for coherent verbs only establishes a relation in a particular construction in which an argument is actually raised.

Other aspects come into the foreground if one views part three as developing out of the empirical and formal issues we presented in the first two parts. In chapter 8, we picked up the empirical discussion structured along the properties expected of general head-complement constructions

to show that viewing upper-field verbs as functional elements outside of the regular hypotactic chain results in a verbal complex structure which is much closer to the properties expected for general head-complement structures. Furthermore, we argued that the alternative upper-field linearizations we discussed as part of the empirical overview in part one require a theoretical interpretation in terms of (at least partly) right-branching verbal complex structures and that the percolation of finiteness in these structures needs to be distinguished from that of the non-finite status.

Making use of the formal possibilities for expressing lexical generalizations in the HPSG paradigm discussed in part two, we showed in chapter 9 how the argument raising mechanism introduced into HPSG as encoding of coherence by Hinrichs and Nakazawa (1989) can be generalized to arise as part of a lexical principle mapping the argument to the valence structure. The theory licensing verb-first and verb-second structures in chapter 8, on the other hand, is based on a lexical rule relating verb-initial verbs to verb-last occurrences to formalizes the idea that verb-initial verbs can correspond to verb-last elements in the upper or the lower-field.

In sum, this thesis is a collection of empirical observations and formal and theoretical building blocks which we hope will contribute to a better understanding of the syntax of non-finite verbal construction in German.

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