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Solving the bracketing paradox: an analysis of the morphology of German particle verbs[1]

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Inflectional affixes are sensitive to morphological properties of the stems of the verbs they attach to. Therefore it is reasonable to assume that the inflectional material is combined with both the verbal stem of simplex verbs and the verbal stem of particle verbs. It has been argued that this leads to a bracketing paradox in the case of particle verbs since the semantic contribution of the inflectional information scopes over the complete particle verb. I will discuss nominalizations and adjective derivation, which are also problematic because of various bracketing paradoxes. I will suggest a solution to these paradoxes that assumes that inflectional and derivational prefixes and suffixes always attach to a form of a stem that already contains the information about a possible particle, but without containing a phonological realization of the particle. As is motivated by syntactic properties of particle verbs, the particle is treated as a dependent of the verb. The particle is combined with its head after inflection and derivation. With such an approach no special mechanisms for the analysis of particle verbs are necessary.

1. Introduction

In German, there is a class of verbs – the so-called particle verbs – that can appear discontinuously in both syntax (1) and morphology (2).

(1) (a) daß der Fährmann Karl übersetzt.
that the ferryman Karl across.takes

[1] I have given talks about the morphology of German particle verbs in Tübingen at the Seminar für Sprachwissenschaft, in Stuttgart at the Institut für maschinelle Sprachverarbeitung (IMS), in Potsdam at the Institut für Linguistik/Allgemeine Sprachwissenschaft and at the HPSG 2001 conference in Trondheim. I thank Tübingen, Stuttgart and Potsdam for the invitation and the audiences of all four talks for discussion. Thanks to Berthold Crysmann, Kordula De Kuthy, Peter Gallmann, Anke Lüdeling, Andrew McIntyre, Christine Römer and Hans Uszkoreit for discussion, two anonymous *JL* referees for comments, and to Kordula De Kuthy, Detmar Meurers, Nicole Dehé, and Anke Lüdeling for supplying me with relevant literature. Thorsten Brants helped me to find the examples that are from the NEGRA corpus. I also want to thank Uta Waller, who helped me translate sample sentences from newspapers. The research carried out for this paper was supported by a research grant from the German Bundesministerium für Bildung, Wissenschaft, Forschung und Technologie (BMBF) to the DFKI project WHITEBOARD 'Multilevel Annotation for Dynamic Free Text Processing', FKZ 01 IW 002. The paper was completed at the Institut für Germanistische Sprachwissenschaft of the Friedrich-Schiller-University, Jena.

(b) Setzt der Fährmann Karl über?
takes the ferryman Karl across
'Does the ferryman take Karl across?'

While verb and particle are adjacent in (1a), the verb is in initial position in (1b) and separated from the particle. Similarly, whereas verb and particle are adjacent in (2a), they are separated by the *ge*-prefix of the *ge- -e*-nominalization in (2b).

(2) (a) Er rennt herum.
he runs around
(b) das Herumgerenne
the around.running
'the running around'

Ge- -e-nominalizations of particle verbs can be input to further morphological processes, as is shown by examples like (3), which supports the view that these nominalizations are formed in the morphology component.

(3) das Pseudo-Herumgerede
the pseudo.babble (Stiebels 1996: 40)

The interesting fact about nominalizations like the one in (2b) is that the semantic contribution of the *ge- -e* scopes over the semantic contribution of the complete particle verb, thus yielding a morphosemantic paradox.

In this paper I want to discuss several bracketing paradoxes of a similar kind and show how the problem of these apparent paradoxes can be solved. The analysis of the inflectional and derivational morphology of particle verb combinations is based on the analysis of the syntax of particle verb combinations developed in Müller (2000).

The paper is structured as follows: in the next section, I discuss apparent bracketing paradoxes in inflectional and derivational morphology. In section 3, I give a very brief introduction to the analysis of verbal complexes in German in the framework of Head-driven Phrase Structure Grammar developed by Pollard & Sag (1994). In section 4, I repeat the analysis of particle verb combinations in syntax that was suggested in Müller (2000) and, in section 5, I show how the morphological facts can be explained within these assumptions. In section 6, I discuss alternative proposals.

2. The phenomenon

The morphological facts that will be discussed in the following subsections suggest that inflectional and derivational material always attaches to the verbal stem in verb particle combinations. On the other hand, this material always scopes over the meaning contribution of the entire particle verb or

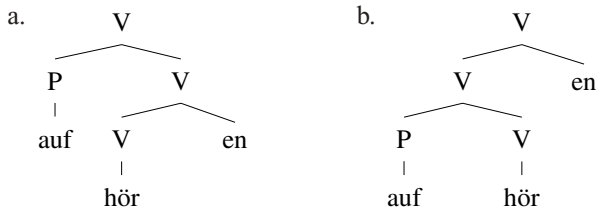

Figure 1
Alternative structures for *aufhören* 'end'

requires a certain argument structure that is not present in the base verb, but only in the particle verb.

In the following subsection, I discuss the first apparent paradox, which arises in inflectional morphology.

2.1 *Inflection*

Particle verbs always have the same inflection class as their base verb. This means that the inflectional suffix has to have access to the morphological features of the stem. This is easily accounted for in an analysis where inflectional material is combined with the stem before the particle is added, i.e., with a structure like the one in figure 1a. Bierwisch (1987: 163) argues that the meaning of the verb *aufhören* 'end' is not transparent with regard to the combination of *auf* and *hör-*, but that combinations of the form *auf-hör-t-est* and *auf-ge-hör-t* are transparent with regard to the combination of the meaning 'end' and the conceptual content of the inflectional affixes. He claims that one needs structures like the one in figure 1b because of this, and hence he reaches a structural paradox. Bierwisch (1987: 165), Stiebels & Wunderlich (1994: 934) and Stiebels (1996: 46) suggest rebracketing mechanisms to derive the structure in figure 1a from that in 1b. However, this paradox is not a real one, since the situation with idioms is similar as far as compositionality is concerned.[2] One cannot assume that a head that is part of an idiomatic expression is combined with all parts of the idiom before it is inflected. So one can continue to adopt the structure in figure 1a, assuming that the semantics of non-transparent particle verbs is constructed parallel to the semantics of (a certain class of) idioms.

[2] Bierwisch (1987: 166) gives examples from compounding that suggest that rebracketing may be needed and, of course, there are famous examples of a similar kind from English; but for the cases at hand a rebracketing mechanism is not necessary, as will be shown in section 5.

Stump (1991) discusses a wide variety of morphosemantic mismatches in English, Breton, Georgian and Sanskrit and suggests paradigm functions that allow inflectional or derivational material to attach to a head that is contained inside other material, i.e., he assumes a structure like the one in figure 1b. I will discuss his approach in section 6.2.

For an analysis of the 'transformational grammarian' paradox see Spencer (1988).

For transparent particle verb combinations I also assume the structure in figure 1a. I assume that the inflectional affix attaches to a stem that contains the information that it will combine with a particle, i.e., a stem that is subcategorized for a particle. This stem is licensed by a lexical rule that maps a simplex verb to a verb that selects a particle. The lexical rule is motivated by an analysis of the syntactic properties of particle verbs and will be explained in section 4. The stem that is licensed by the rule has the meaning of the complete particle verb combination although the exact meaning is not fully instantiated until the particle combines with the (inflected) stem. Since the semantic information that will be contributed by the particle is already accessible in the stem entry, the ending can scope over it. The exact details of this analysis will be made more precise once we have introduced the formal apparatus.

2.2 *Derivation*

Similar bracketing paradoxes seem to arise in derivational morphology. Some derivational affixes are sensitive to the argument structure of the head they combine with and some others are sensitive to the semantics of the heads they combine with, while some affixes are sensitive to both kinds of properties. In sections 2.2.1 and 2.2.2, I will examine the relevant forms of nominalization and adjective formation.

2.2.1 *Ge- -e-nominalizations*

The *ge- -e*-nominalization is the only discontinuous noun derivation in German; it consists of the prefix *ge-* and the suffix *-e*. The suffix *-e* is optional following the unstressed syllables *-er*, *-el*, *-en*, where it is usually suppressed for phonological reasons, as in *Rumgeeiere* (from Frankfurter Rundschau, 5.12.1998) vs. *Rumgeeier* (from Frankfurter Rundschau, 29.9.1998); see Olsen (1991: 351). *Ge- -e*-derivation is quite productive for transitive as well as intransitive simplex verbs. Deverbal *ge- -e*-nouns have the meaning of 'constant/repeated V-ing' and, usually, the connotation that the constant V-ing is somehow negatively evaluated.

Particle verbs also allow for *ge- -e*-derivation. It is interesting that the *ge-* separates the particle and the base verb: *Herum***ge***renne* 'repeated aimless running'. *Ge- -e*-nominalizations of particle verbs with the particle *herum* 'around' follow a productive pattern and are quite frequent.

As Lüdeling (2001: 106) notes, the interesting thing about these *Ge- -e*-nominalizations is that there again seems to be a bracketing paradox: if one combines the stem *renn-* with *ge-* and *-e*, one gets *Gerenne*, which means 'repeated or constant running' or, more technically, 'repeated running events'. However, *Herumgerenne* means 'repeated instances of aimless running events'. The 'aimless' part of the meaning is contributed by

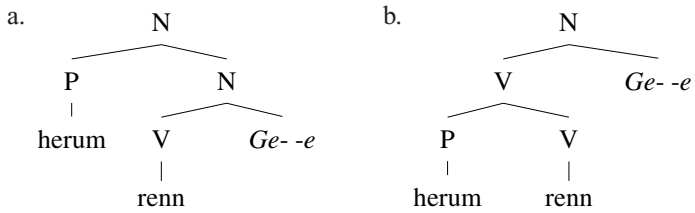

Figure 2
Alternative structures for *Herumgerenne* 'repeated aimless running'

herum.[3] This meaning of *Herumgerenne* would be expected if *ge- -e* were combined with the whole particle verb combination.

Lüdeling considers briefly an account whereby an abstract predicate is added to the semantic contribution of *rennen*, but dismisses this option since, according to her, it would not extend to listed particle verb combinations. I do not understand this argument, since the non-transparent forms are always the unproblematic ones in terms of scope relations. A lexical item that is subcategorized for a particle can be listed in the lexicon and the meaning contribution of the complete non-transparent particle verb is represented in this lexical item. Lüdeling suggests the analysis in figure 2b. It is unclear how the prefix *ge-* is supposed to appear between the particle and the verb without the assumption of rebracketing. In what follows, I will assume the structure in figure 2a. I assume that the stem *renn-*, used to derive *Herumgerenne*, already contains the information that it combines with a particle, although the exact semantic and syntactic contribution of the particle is still underspecified. The *ge- -e*-nominalization can, therefore, access the semantic contribution that will be instantiated by the particle and the right scope relations can be established.

Note that I do not claim that nouns like *Herumgerenne* are the result of compounding the *ge- -e*-nominalization of the simplex verb *renn-* with *herum* since – as McIntyre (2001c: 22) shows – double particles like *herum* do not appear in normal compounds: *herumkritisieren* vs. **Herumkritik*.

2.2.2 *Adjective derivation with* -bar

Derivation with *-bar* applies to transitive or ditransitive verbs that have an accusative object. The logical subject of the verb is suppressed and the accusative object is promoted to the subject of the adjective. There are also a few *-bar*-adjectives, such as *brennbar* 'flammable', which have an intransitive base verb, but these are listed in the lexicon (Riehemann 1998) and not

[3] This is not the only meaning that *herum* has. For other meanings and a way to express them formally see McIntyre (2001a, b).

derived by the productive rules. The *-bar*-suffix adds a modal meaning, usually possibility but sometimes also necessity.

Lüdeling (2001: 108) remarks that most of the *-bar*-derivations are derivations of listed particle verb combinations.[4] She compares coordinated structures with *-bar*-derivations of particle verb combinations that have both a non-transparent and a transparent reading and concludes that only the derivations from non-transparent particle verbs are well-formed. She discusses the examples in (4) and (5). (4) shows that *anbaubar* can only be formed with the fully lexicalized variant 'to cultivate' although the passive of *anbauen + können* with the meaning 'to build onto, to add', in the first part of (4b), is grammatical. A similar contrast holds for (5a) and (5b).

(4) (a) Können in Deutschland Bananen angebaut werden oder sind
can in Germany bananas cultivated be or are
sie hier nicht anbaubar?
they here not growable
'Is it possible to cultivate bananas in Germany or can't they be grown here?'

(b) *Kann der Schuppen hier angebaut werden oder ist er hier
can the shed here added be or is it here
nicht anbaubar?
not add + able
Intended: 'Can the shed be built as an extension here or can't an extension be built here?'

(5) (a) Kann dieser Kandidat aufgestellt werden oder ist er nicht
can this candidate nominated be or is he not
aufstellbar?
nominate + able
'Is it possible to put up this candidate or can he not be put up?'

(b) ??Kann der Weihnachtsbaum hier aufgestellt werden oder
can the Christmas.tree here up.put be or
ist er hier nicht aufstellbar?
is it here not up.put + able
Intended: 'Can the Christmas tree be put up here or is it impossible to put it up here?'

[4] Lüdeling (2001: 84) defines listedness in the following way: a simple or complex linguistic expression is listed, iff all terminal nodes are associated with phonological information. This definition means that the lexicon may consist of trees. Such a definition only makes sense for grammar models that assume operations on trees, since without such operations it cannot be explained why parts of a listed expression can be extracted. On particle extraction, see section 4.1. One can define listedness in a more theory-neutral way: a complex linguistic expression is listed, iff the phonological form of its parts is specified.

While these data are interesting, their interpretation is not correct. The only thing these sentences show is that the use of the *-bar*-derivation of a productive form is odd if a *-bar*-derivation from a non-transparent particle verb is also available. The examples in (6) and (9) show that *-bar*-derivation is also possible with transparent particle verb combinations that follow a productive pattern.

Stiebels (1996) discusses six forms of the particle *an* that have different syntactic and semantic properties. To distinguish the different instances of this particle, she assigns indices to the various forms. The *an* in (6) is Stiebels' an_5 (Stiebels 1996: section 7.4.1).

(6) (a) Die Kneipen, Theater und Geschäfte müssen **anfahrbar**
the pubs theaters and shops must PART(to).drivable
bleiben.
remain
'The pubs, theaters and shops must remain accessible by car.'
(taz, 5.6.1997: 22)[5]

(b) Flughafen Schönefeld jetzt bei jedem Wetter **anfliegbar**
airport Schönefeld now at all weather PART(to).flyable
'Schönefeld Airport can now be accessed by plane in any weather.'
(taz, 4.2.1992: 22)

(c) Im ebenfalls unter dieser Adresse **ansteuerbaren**
in.the equally under this address PART(to).steerable
Diskussionsforum erntete diese Dienstleistung aber helle
discussion.forum harvested this service but light
Empörung.
indignation
'However, in the discussion forum which can also be accessed under this address, this service was strongly criticized.' (taz, 8.7.1999: 13)

(d) Dauerläufer, die in der Defensive ackern, ständig
continuous.runners who in the defensive slug.away always
anspielbar sind [...]
PART(to).playable are
'Those who never stop running, who slug away in the defense, are always ready for the ball [...]' (taz, 22.2.1999: 16)

This *an* signals that the action that is described by the base verb is directed to a thing or a person. The particle can be combined with intransitive agentive verbs. This pattern is highly productive. Examples are verbs of uttering, (7), and verbs that are used to express emotions, (8).

[5] *taz* is a newspaper that appears nation-wide in Germany (http://www.taz.de). The glosses and the translations of the German examples are my own.

(7) (a) Er quatscht sie an.
he gabs her PART(to)
'He chats her up.'
(b) Sie schrien ihre Nachbarn an.
they shouted their neighbors PART(to)
'They shouted at their neighbors.'
(c) Die Katze faucht Andreas an.
the cat hisses Andreas PART(to)
'The cat spits at Andreas.'

(8) (a) Sie lacht ihn an.
she laughs him PART(to)
'She smiles at him.'
(b) Er schmachtet die große Diva an.
he gazes.lovingly the great diva PART(at)
'He gazes at the great diva adoringly.'
(c) Er staunt den Akrobaten/den Dom an.
he marvels the acrobat the cathedral PART(at)
'He marvels at the acrobat/the cathedral.'

The *an* in (9) is Stiebels' an_6 (Stiebels 1996: section 5.2.3).

(9) Das Konzept sei zwar „grundsätzlich **andenkbar**".
the concept be actually in.principle PART.thinkable
'In principle, it is possible to start thinking about the concept.'
(taz, 6.11.1997: 2)

This version of *an* is the most productive of the particles and prefixes Stiebels examines in her study. An_6 expresses a partiality of the action that is described by the main verb. It can be combined with verbs that describe incremental or decremental processes, which makes an early termination plausible. The group of *an*-verbs can be divided into those where the *an* expresses a spatial relation, e.g. *anbohren* 'to begin to bore a hole', *anknabbern* 'to nibble', *anlecken* '(to begin) to lick', *annagen* '(to begin) to gnaw', and those where the *an* is a progressive marker, e.g. *andrucken* 'to start to print', *anlesen* 'to begin to read', *ansingen* 'to begin to sing'.

Concluding the discussion of *-bar*-derivations with particle verbs with *an*, it can be said that it is possible with productive particle verb combination patterns.

Before turning to the bracketing paradox of *-bar*-derivations, let us consider briefly particle verb combinations like *anfahren* 'to drive towards'. The noun phrase *die Geschäfte* 'the shops' in (10c) is licensed by the particle an_5. As (10b) shows, *die Geschäfte* is not an argument of *fahren*.

(10) (a) Er fährt.
he drives
(b) *Er fährt die Geschäfte.
he drives the shops
(c) Er fährt die Geschäfte an.
he drives the shops towards
'He drives towards the shops.'

Rather, the intransitive version of *fahren* that is used in (10a) is combined with the particle.

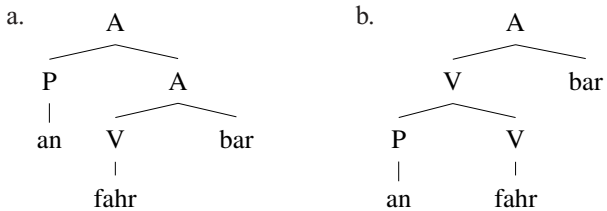

Figure 3
Alternative structures for *anfahrbar* 'reachable by car'

Having established that particle verb combinations that are the result of a productive process can take part in *-bar*-derivations, I am faced with another apparent bracketing paradox: there are particles, such as an_5 in (10c), that only combine with intransitive verbs and add an argument. On the other hand, *-bar* only combines with productively transitive verbs. If one assumes the structure in figure 3a, with *fahr-* being the stem of the intransitive form *fahren*, one has to explain why *-bar* can combine with intransitive verbs. Furthermore, the modal operator that is contributed by *-bar* scopes over the complete meaning of the particle verb. In light of pairs like (11), the structure in figure 3a seems implausible, since there is no way of deriving the meaning of the second word from the meaning of the first.

(11) (a) schaffbar 'do-able' $\not\rightarrow$ wegschaffbar 'possible to be got rid of, disposable'
(b) greifbar 'reachable' $\not\rightarrow$ angreifbar 'possible to be attacked'
(c) stellbar 'possible to stand/set up' $\not\rightarrow$ darstellbar 'possible to be represented, representable', einstellbar 'possible to set, employable', herstellbar 'possible to manufacture', vorstellbar 'imaginable'

Even worse, a *bar*-adjective without particle does not exist for the examples in (12).

(12) (a) *gleichbar $\not\rightarrow$ ausgleichbar 'possible to even out'
(b) *weisbar $\not\rightarrow$ nachweisbar 'possible to prove'

At first glance, figure 3b would seem to be the only option. Bierwisch (1987) and Stiebels & Wunderlich (1994) assume a uniform analysis for the

inflectional and derivational morphology of particle verbs where the inflectional and derivational material attaches directly to the verbal stem, i.e., the structure in figure 3a. Since an analysis that treats inflection and derivation in a uniform way rather than stipulating different structures for various morphological phenomena on a case-by-case basis is to be preferred, I also assume the structure in figure 3a. While this may seem to be problematic for the reasons mentioned above, it is not problematic in constraint-based theories. I assume that the stem in figure 3a contains a slot for the particle that will be added in a later step. The valence and the semantics of the whole combination is represented on the stem of the particle verb so that *-bar* may access it.

2.3 *Non-existing bases*

It has been noted by many researchers that there are particle verbs that have a base verb that cannot be used without the particle (for instance, *anstrengen* 'to strain' and **strengen*). Similarly there are particle verb formations (13a) and derivations (13b, c) where the derived base never appears without a particle.

(13) (a) Dose 'tin', eindosen 'to tin', but *dosen
(b) rauben 'to steal', ausrauben 'to rob', Ausraubung 'robbing', but *Raubung (Fleischer & Barz 1995: 173)
(c) ausbreiten 'to spread out', but *breiten, Ausbreitung 'out-spreading', but *Breitung (Paul 1920: 15)

This does not pose a problem if one assumes that the derivation applies to the linguistic object that represents the particle verb. Thus, if the *-ung*-nominalization applies to a lexical representation for *raub-* that contains the information that there will be a particle, the constraints that block the derivation of **Raubung* from the simplex base *raub-* do not apply to this lexical entry and the derivation succeeds. For the same reason, it is not necessary to list **strengen* in the lexicon as a verb that could appear without a particle. The lexicon contains a lexical entry for the verb stem *streng-* that selects the particle *an*. The stem is inflected and, after inflection, it is combined with the particle.

2.4 *Conclusions*

Inflectional affixes like *ge- -t* in *auf-ge-hör-t* and derivational affixes like *ge- -e* in *Herum-ge-renn-e* attach to the stem of the verb, although they scope over the meaning of the complete particle verb combination. A uniform treatment of both inflection and derivation, i.e., an approach where the affixes always attach to the verbal stem before the combination of particle and verb, is to be preferred over an approach that assigns structures on a case-by-case basis. An analysis that assumes that inflection and derivation applies to stems that contain the information about particles to be added later makes the right

predictions without any bracketing paradox and copes with the problem of non-existing bases.

3. The verbal complex

In this section, I address the analysis of the verbal complex. The analysis of the verbal complex is relevant because the analysis of particle verbs in section 4 uses basic techniques developed for the analysis of verbal complexes. I follow Müller (2000) in assuming that the particle in particle verb constructions should be analyzed as part of the predicate complex.

On the basis of fronting data and auxiliary flip examples like those in (14) and (15), Hinrichs & Nakazawa (1989) have argued that auxiliaries and modals form a predicate complex with the main verbs in German.

(14) Geholfen haben wird er dem Mann.
helped have will he the man
'He probably helped the man.'

Since German is assumed to be a verb second language, i.e., a language with exactly one constituent before the finite verb, examples like (14) are evidence for the existence of the constituent *geholfen haben*.

(15) (a) daß er dem Mann helfen müssen wird
that he the man help must will
'that he will have to help the man'
(b) daß er dem Mann wird helfen müssen
that he the man will help must
'that he will have to help the man'

The examples in (15) are easily explained by an analysis that assumes that *helfen* forms a complex with *müssen* and the result is embedded under *wird*, which is serialized either to the right or to the left of the embedded complex.

In Hinrichs & Nakazawa's analysis, *helfen* 'help' and the auxiliary *wird* 'will' form a verbal complex in examples like (16).

(16) daß er dem Mann [helfen wird]
that he the man help will
'that he will help the man'

When a verbal complex is formed, two verbs are combined and the resulting verbal complex inherits all arguments from both verbs. The new projection functions as a complex head.[6]

In their paper, Hinrichs & Nakazawa treat verbal complements as ordinary complements that are included in the SUBCAT list of their heads. It has,

[6] See also Bierwisch (1990) and Haider (1993) for similar analyses formulated in the GB framework.

however, proven to be useful to distinguish the verbal complement from other complements (Chung 1993; Rentier 1994; Müller 1997; Kathol 1998). For the purpose of representing the information about complements that form a predicate complex with their head, the feature VCOMP is introduced. Its value is a list that contains a *synsem* object if the verb selects for a dependent to form a complex with, and the empty list otherwise.

The description in (17) shows the CAT value for the stem entry of the future tense auxiliary *werden*.[7]

(17) *werden* 'will' future tense auxiliary

$$\begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{SUBCAT} & \boxed{1} \\ \text{VCOMP} & \langle \text{V}[\textit{bse}, \text{SUBCAT}\ \boxed{1}, \text{VCOMP}\ \langle\rangle] \rangle \end{bmatrix}$$

Werden selects a verb or a verbal complex via VCOMP. All arguments of this verbal complex ($\boxed{1}$) are raised.[8] The instantiations of the list $\boxed{1}$ may be the empty list. *Werden* does not assign thematic roles to dependents of the embedded verb. Therefore no reference to elements possibly contained in SUBCAT is necessary. Lexical entries for the perfect auxiliaries (*haben*/*sein*) are completely analogous to (17) except for the verb form of the selected verbal complex.

As Hinrichs & Nakazawa (1994) have shown, it is reasonable to assume a schema that licenses the verbal complex in addition to the head complement schema. I suggest the following schema, which licenses head cluster structures.

Schema 1 (*cluster schema*)
head-cluster-structure→

$$\begin{bmatrix} \text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VCOMP}\ \boxed{1} \\ \text{HEAD-DTR}|\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{VCOMP}\ \boxed{1} \oplus \langle \boxed{2} \rangle \\ \text{NON-HEAD-DTRS}\ \langle [\text{SYNSEM}\ \boxed{2}\ ] \rangle \end{bmatrix}$$

A head is combined with its verbal complement ($\boxed{2}$). The remainder of the VCOMP list ($\boxed{1}$) is passed up to the mother node. In our example, $\boxed{1}$ will be the empty list. The specification of the VCOMP value of the verbal complement of verbs like *werden* 'will' as the empty list ensures that the verbal complex that

[7] For explanatory purposes, I assume that both subjects and complements are represented on the SUBCAT list. The issues discussed in this paper are orthogonal to the representation of the subject. Representations like the ones suggested in Pollard & Sag (1994: chapter 9), Kiss (1995), or Pollard (1996) are also compatible with the analysis.

[8] The lexical entry as given in (17) admits multiple analyses of sentences containing this auxiliary since it is not specified that the verb that is embedded has to be lexical. Since it is not relevant to the rest of this paper, I have omitted the necessary specifications in lexical entries and in schema 1.

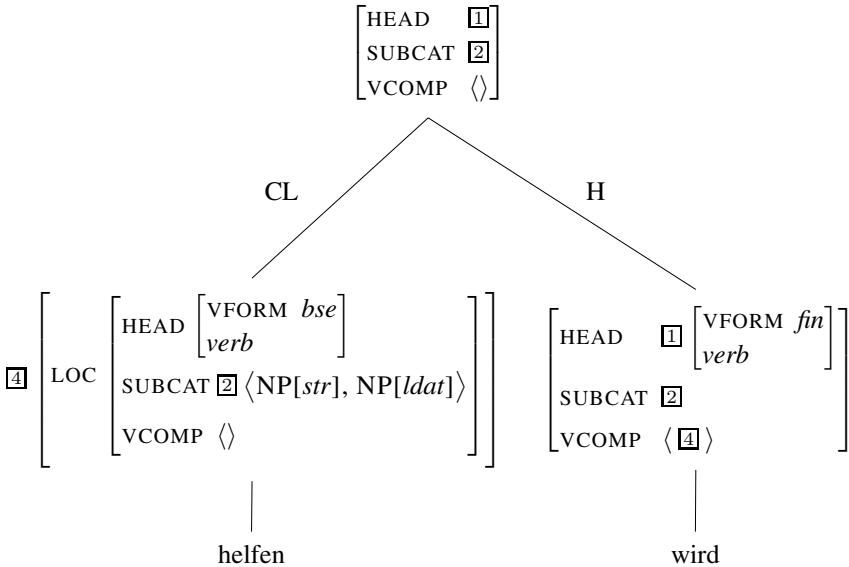

Figure 4
Analysis of the verbal complex *daß er dem Mann helfen wird* 'that he will help the man'

is embedded under *werden* is complete, i.e., sentences like (18b), where the verb under *haben* 'to have' is missing, are ruled out.

(18) (a) daß er dem Mann [[geholfen haben] wird]
that he the man helped have will
'that he will have helped the man'
(b) *daß er dem Mann haben wird
that he the man have will

How the analysis of the verbal complex in (16) works in detail is shown in figure 4.[9] The future auxiliary *wird* embeds the infinitive *helfen* (a verb with VFORM *bse*). Since no complements get saturated in head-cluster-structures, the SUBCAT list of the head is identical to the SUBCAT list of the mother. Because of this constraint, the SUBCAT list of *helfen wird* 'help will' is identical to the SUBCAT list of *wird*. *Helfen wird* is a complex head that is combined with its arguments in normal head complement structures. After this brief exposition of the analysis of German verbal complexes, I now sketch the analysis of particle verb combinations.

[9] The *str* in the lexical entry for *helfen* stands for structural case. Structural case is assigned by a Case Principle that is similar to the one suggested by Yip, Maling & Jackendoff (1987): in verbal environments the first NP in the SUBCAT list that has structural case is realized as nominative and the second NP with structural case is realized as accusative. For a formalization of the Case Principle see Meurers (1999, 2000: section 10.4.1.4.), Przepiórkowski (1999).

4. The syntax of particle verb combinations

In Müller (2000, 2002), I show that it seems reasonable to treat particles as elements that take part in predicate complex formation.[10] In these publications, I provide fronting data and linearization data, some of which will be presented in condensed form in sections 4.1 and 4.2, respectively.

4.1 *Fronting*

Particles can be fronted, although this is often denied. Claims about non-frontability have been made by Bierwisch (1963: 103), Kiss (1994: 100), Olsen (1997: 307), Eisenberg (1999: 306), Zifonun (1999: 227) and others. Due to space limitations I cannot discuss them here, but see Müller (2002). Usually, fronted particles are contrasted, or a focus on the verb as a whole is established.

(19) (a) **Los ging** es schon in dieser Woche.
PART went it already in this week
'It already started this week.' (taz, 10.11.1995: 4)

(b) **Vor hat** er das jedenfalls.
PART (before) has he this in.any.case
'He plans (to do) that anyway.' (taz, 15.7.1999: 19)

(c) **Auf fällt**, daß …
PART falls that
'It is noticed that …' (Duden 1991: 62)

Müller (1999: section 19.1.2; 2002) provides further fronting examples from corpora with particles that are homophonous with nouns, adjectives, and adverbs.

A non-finite particle verb cannot be fronted without its particle:[11]

(20) *Schlafen wird Karl ein.
sleep will Karl PART
'Intended: 'Karl will fall asleep.'

The examples of particle fronting in (19) are parallel to examples where verbs or adjectives are fronted (cf. Müller 1999: chapter 18):

(21) (a) Erzählen wird er seiner Tochter ein Märchen.
tell will he his daughter a fairytale
'He will tell his daughter a fairytale.' (Haftka 1981: 720–721)

[10] Höhle (1982) suggested using a single rule for the combination of particle and verb and for the combination of verbs in the verbal complex. Höhle dealt mainly with morphological problems and the syntactic properties of the particle verb constructions were not explored in detail.

[11] See, for instance, Haftka (1981: 721), Höhle (1982: 101), Olszok (1983: 127) and Lötscher (1985: 212) for similar examples.

(b) Treu will Karl seiner Frau sein.
faithful wants Karl his wife be
'Karl wants to be faithful to his wife.'

In (21a), only the verb *erzählen* is fronted. The complements of this verb remain to the right of the finite verb in the so-called *Mittelfeld*. (21b) is an example of a fronted adjective. The example in (20) is parallel to the examples in (22).

(22) (a) *Müssen wird er ihr ein Märchen erzählen.
must will he her a fairytale tell
Intended: 'He will have to tell her a fairytale.'
(b) *Sein will Karl seiner Frau treu.
be wants Karl his wife faithful
Intended: 'Karl wants to be faithful to his wife.'

The generalization about these ungrammatical examples is that if a part of the predicate complex is fronted (alone or with adjuncts or complements), all parts of the predicate complex that are governed by a fronted head have to be fronted together with the head. Thus, in (22a), for example, *müssen* governs *erzählen*. If *müssen* is fronted, *erzählen* has to move as well. If particles are analyzed as parts of the predicate complex, the ungrammaticality of (20) is explained.

4.2 *The right sentence bracket*

It can be observed that particles behave similarly to verbs and adjectives in respect to serialization. They are located at the right periphery of a clause in the so-called right sentence bracket (cf. Drach 1937: 55). To see this, consider the control verb *vorschlagen* 'suggest', which can appear discontinuously.

(23) (a) Karl schlägt der Frau vor, in die Stadt zu gehen.
Karl beats the woman PART into the town to go
'Karl suggests to the woman to go to town.'
(b) *Karl schlägt vor der Frau, in die Stadt zu gehen.

If serialization of the particle in adverb positions were possible, orders like those in (23b) should also be possible, since they are possible with adverbs, as (24) shows.

(24) (a) Karl überredete die Frau gestern, in die Stadt zu gehen.
Karl persuaded the woman yesterday into the town to go
'Karl persuaded the woman to go to town yesterday.'
(b) Karl überredete gestern die Frau, in die Stadt zu gehen.

But this is not the case. (23b) is ruled out as an instance of multiple extraposition of an NP and a VP. NP extraposition as such is rather marked, and

together with an extraposed infinitive the sentence becomes unacceptable. This suggests that particles occupy the same position as non-finite verbs in sentences that do not contain a finite particle verb, as in (25).

(25) Er hat den Hund geschlagen.
he has the dog beaten
'He beat the dog.'

The particle marks the right sentence boundary. If the particle + verb combination is licensed by the same grammar rule as the auxiliary + verb combination in (25), the facts can be explained easily.

4.3 *Separation of particle and verb in head-final contexts*

The examples in (26) and (30) seem to contradict the assumption that particle and verb form a predicate complex, since the particle and the verb are not adjacent parts of the right sentence bracket in these examples. Let us consider (26) first.

(26) Andrew Halsey ist auf dem Weg von Kalifornien nach
Andrew Halsey is on the way from California to
Australien weit ab vom Kurs gekommen.
Australia far off from.the course come
'On the way from California to Australia Andrew Halsey strayed way off course.' (taz, 4.10.1999: 20)

Here, the meaning of the particle *ab* is further specified by a *von*-PP. Usually such further specifications can be provided by PPs with a preposition that is homophonous or near-homophonous with the particle, as in (27).

(27) (a) Er legte die Folie auf den Projektor auf.
he laid the transparency on the projector on
'He placed the transparency on the overhead projector.'
(b) Er warf die Briefe in den Briefkasten ein.
he threw the letters in the letterbox in
'He posted the letters.'

There are no particle verbs in German that have *von* as the particle; *ab* is used instead (Fourquet 1974; Stiebels 1996: 86, 94). If the particle *ab* is to be further specified, a *von*-PP is used, as in (26).

Phrases of the form *weit* + *ab* + *von*-PP can also appear as normal adjuncts as in (28), and it could be argued that (26) is an instance of the same construction.

(28) Weitab vom Zentrum [...] eröffnete Alfred Bauer [...] am 6. Juni
far.off from.the center opened Alfred Bauer at 6 June

das Filmfest im alten Titania-Palast aus den 20er-Jahren.
the film.festival in.the old Titania-Palace from the twenties
'Far from the center, Alfred Bauer opened the film festival in the old 1920s Titania Palace on 6 June.' (taz berlin, 5.2.2000: 25)

In (28) this phrase specifies the location of *eröffnen*. That the *ab* in (26) is really part of a particle verb and not part of an adjunct, as in (28), becomes clear once we compare (26) with (29), where the *ab* + *von*-PP has been omitted; the sentence without *ab* has a totally different meaning.

(29) Er ist auf dem Weg von Kalifornien nach Australien gekommen.
he is on the way from California to Australia come
'He came on the way from California to Australia.'

This shows that *ab* in (26) really is a part of a particle verb. The particle is further specified by a *von*-PP and, therefore, the *ab* is not adjacent to *gekommen*. However, the phrase *weit ab vom Kurs* is adjacent to *gekommen*. Sentences like (26) are unproblematic for analyses that assume that particle and verb are combined in syntax.

In (30), the particles are separated from their verb by a locative PP.

(30) Ich weiß, daß die Sonne auf im Osten und unter im
I know that the sun PART(up) in.the east and PART(under) in.the
Westen geht.
west goes
'I know that the sun rises in the east and sets in the west.'
(Lüdeling 2001: 51)

But, as Lüdeling (2001: 51) notes, these examples arise by focus split. That it is possible to interrupt certain parts of the predicate complex was also shown by examples with adjectives in Müller (1999: section 18.4.3). Lüdeling (2001: 50) shows that interruption of resultative predicates in resultative constructions is also possible. Again, a syntactic analysis of particle verbs that treats the particles as part of the predicate complex can explain the data.

Grewendorf (1990: 99) gives the German example in (31), where the particle verb *anfing* 'to start' appears discontinuously in a head-final context.

(31) Heut im Traum sah ich sie wieder
Und von allen Bergen ging solches
Grüßen zu mir nieder
Daß ich an zu weinen fing
that I PART to cry caught
'I saw her in my dream again today, and the mountains gave me such a welcoming feeling that I started to cry.'
(Joseph von Eichendorff, *Erinnerung*, *Gedichte [Ausgabe 1841]*, Eichendorff-W. Vol. 1, p. 77)

It is tempting to count this example as an intentional breach of the rules since it is quoted from a poem, but such word order is attested in some German dialects. Werner (1994: 356) gives the examples in (32), attested in the north-west of Sonneberg/Thuringia.

(32) (a) a … hot aa ze schimpfm gfanga
he has PART to get.angry caught
'He started to get angry.'
(b) die ham … auf zu arwettn ghört
they have PART to work heard
'They stopped working.'
(c) ham sa groud aa mit assn gfanga
have they just PART with eat caught
'Did they just start to eat?'

In (32) the phase verbs *angefangen* 'started' and *aufgehört* 'stopped' appear discontinuously. The embedded verb intervenes between the base verb of the matrix verb and the particle that belongs to the matrix verb. Furthermore, Werner (1994) discusses sentences like those in (33), in which a particle verb is embedded under a modal, (33a), or under a perfect auxiliary and a modal, (33b, c). The particle verb appears discontinuously, with the particle occurring at the left periphery of the verbal complex.[12]

(33) (a) so ham sich die Leut oumüßploug
so have self the people PART.must.struggle
'people had to struggle so much' (Werner 1994: 349)
(b) Wos da sich ölles aahotmüßhör!
what there self all PART.has.must.hear
'All these things he had to listen to!' (Werner 1994: 355)
(c) wall e in Brander vollstn ümhotwöllstimm
because he the Brander completely PART.has.want.to.tune
'because he wanted to change Brander's mind completely'
(Werner 1994: 355)

Werner (1994: 355) argues that these orderings follow the pattern in (34).

(34) (a) weil er in die Stadt/fort geht
because he into the town away goes
'becuase he goes to town/away'

[12] Similar constructions can be found in Dutch, where particle and verb also may be serialized discontinuously. Koster (1975: 126) provides the following example:

(i) omdat Carol hem op kon bellen
because Carol him PART can call
'because Carol can call him'

(b) weil er in die Stadt/fort hat müssen gehen[13]
because he into the town away has must go
'because he had to go to town/away'

Particle verbs developed historically from adverb + verb combinations. The canonical position of adverbs is in front of the verbal complex. Most of these adverbs changed their meaning and the combinations became lexicalized. In the East Franconian/Thuringian dialect, the canonical order with respect to modals is preserved. The fact that particle and verb may be separated even in head-final contexts in Standard German and especially in German dialects is easily explained by a syntactic analysis, as opposed to a morphological analysis.

In the following subsections, I provide the basic lexical entries for non-transparent particle verbs and discuss lexical rules that allow templates to be derived for some prototypical particle verbs that are the result of productive particle verb combinations. The combination of particle and verb in syntax is licensed by the head cluster schema, introduced in section 3.

4.4 *Lexical entries for particle verbs*

(35) shows the lexical entry for the non-transparent particle verb *vorhaben* 'to plan'.

(35) (*vor*)*hab*- 'to plan', non-transparent particle verb

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}]_{\boxed{1}}, \text{NP}[\textit{str}]_{\boxed{2}} \rangle \\ \text{VCOMP} & \langle \text{PART}[\textit{vor}] \rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{ARG1} & \boxed{1} \\ \text{ARG2} & \boxed{2} \\ \textit{vorhaben} & \end{bmatrix} \end{bmatrix}$$

The semantic contribution of the particle verb is not computed compositionally from the meaning of the verb and the particle when they are combined in the sentence, but is represented as the CONT value of the stem. The form of the particle that has to be combined with the (inflected) stem is fully specified in the lexical entry as the VCOMP element.

I follow Olsen (1999: 238) and McIntyre (2001b: 44) in assuming that particles like *vor* are not prepositions, but are related to prepositions by lexical redundancy rules. The particles are selected like other complements that form a complex with their head via VCOMP. Figure 5 shows the analysis for (36), where the verb is in final position.

[13] This is the order of the elements in the verbal complex in Thuringian. In Standard German, it is *hat gehen müssen*.

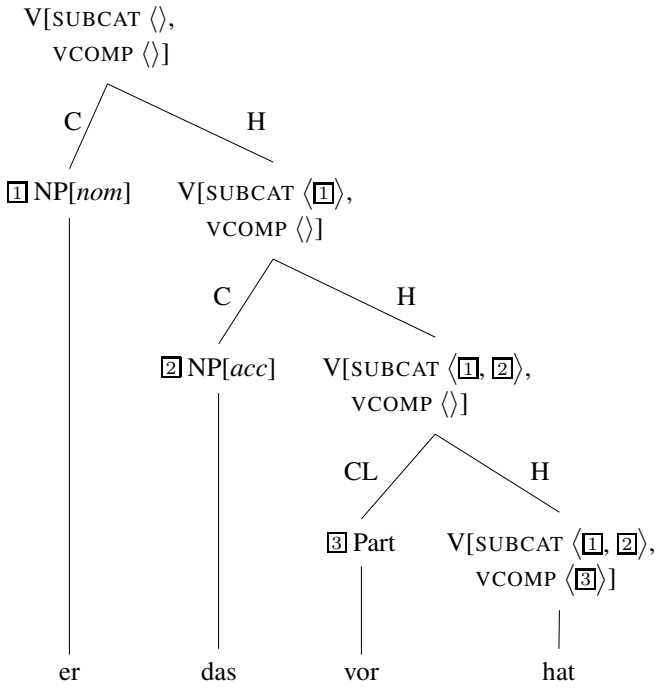

Figure 5
Analysis of *weil er das vorhat* 'because he plans to do this'

(36) weil er das vorhat
because he that PART(before).has
'because he plans to do this'

Particle and verb are combined in a head cluster structure and then the accusative object and the subject are combined with the head in further projections licensed by the head complement schema. (See Müller (2000: 222) for an analysis of verb-initial sentences.)

Since particles are selected via VCOMP, the possibility of fronting is explained. The extraction of particles is parallel to known cases of partial verb phrase fronting. It is not necessary to assume that extractions like that in (37) are extractions out of words, as it would be if we assumed that *festzustehen* 'to be certain' is a word a part of which is fronted.

(37) **Fest** scheint auf jeden Fall **zu stehen**, daß …[14]
PART seems on any case to stand that
'In any case, it seems to be certain that …'

[14] Reis (1976: 68) discusses this sentence in the context of the raising verb *scheinen*, but she mentions the fact that a particle is fronted.

Examples like (20) above are excluded since *wird* selects a verb with an empty VCOMP list. The form of *schlafen* in this sentence contains a description of the particle in its VCOMP list and, therefore, cannot function as a filler in a non-local dependency (see Pollard & Sag (1994: chapter 4) for a treatment of non-local dependencies in HPSG).

Having shown how non-transparent particle verb combinations can be analyzed, I now turn to transparent particle verbs that follow a productive pattern and can be analyzed compositionally. In what follows, I give some example analyses of transparent particle verbs that are representative of certain classes of particle verb combinations.

(38) includes examples where the particle is an aspectual marker. The particle does not change the argument structure of the verb. (38c) shows that it is impossible to have an additional NP complement that is not selected by the base verb. (38d–e) show that transitive verbs cannot be combined with the particle *los* if the object is expressed.

(38) (a) Er lacht.
he laughs

(b) Er lacht los.
he laughs PART
'He starts to laugh.'

(c) *Er lacht sie los.
he laughs her PART

(d) *Er liest das Buch los.
he reads the book PART
Intended: 'He starts to read the book.'

(e) Er liest los.
he reads PART
'He starts to read.'

The particle an_5 behaves differently. As the examples in (10) above show, an_5 licenses an additional argument. The base verb must be intransitive and agentive (Stiebels & Wunderlich 1994: 950). This suggests that the particle is responsible for the argument structure of the complex verb. An_5 adds an argument, but *los* does not. Both particles can combine with intransitive verbs only. Furthermore, the particle selects the semantic class of the base verb. It is inadequate to analyze the particle as the head of the particle verb, as was suggested by Trost (1991: 438), since the particle is embedded under the verb in the predicate complex, as argued above. I therefore suggest treating particles like *los* and *an* as lexical adjuncts. Since they are adjuncts, they can impose their selectional restrictions on the head they combine with and can modify the meaning of their head. Since they are analyzed as lexically introduced dependents, they can contribute to the argument structure of the lexical object. This contribution is made by argument composition, a technique that was demonstrated in section 3, where I introduced the

analysis of verbal complexes. In the version of HPSG that was developed by Pollard & Sag (1994), adjuncts select the head they modify via the MOD feature. Since MOD has a *synsem* object as its value, both syntactic and semantic properties of the modified head can be selected. On the other hand, syntactic properties of particle verbs suggest treating the particle as an element of the verbal complex (see sections 4.1 and 4.2). I unify these two insights and analyze the particles in (10) and (38) as subcategorized modifiers. The lexical rule in (39) takes a verb with the empty list as VCOMP value as input and produces a new lexical item that is subcategorized for a particle.[15]

(39) Lexical rule for productive particle verb combinations

$$\begin{bmatrix} \text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{SUBCAT } \boxed{1} \oplus \boxed{2} \\ \text{VCOMP} & \left\langle \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MOD } \boxed{3} \\ \textit{particle} \end{bmatrix} \\ & \text{SUBCAT } \boxed{2} \\ & \text{VCOMP } \langle\rangle \end{bmatrix} \\ \text{CONT } \boxed{4} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{CONT } \boxed{4} \end{bmatrix} \\ \text{LEX-DTR} & \begin{bmatrix} \text{SYNSEM } \boxed{3} & \begin{bmatrix} \text{LOC}|\text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{SUBCAT} & \boxed{1} \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \end{bmatrix} \\ \textit{stem} \end{bmatrix} \\ \textit{stem} \end{bmatrix}$$

The rule applies to all verbs with an empty VCOMP value. The output of the rule is a verb that selects a particle. Whether the resulting verb is actually used in an analysis depends on the presence of a particle that can be combined with this verb. The valence requirements of the output verb are determined by the particle: the SUBCAT value of the particle is attracted by the output verb. The rule licenses verbal stems that select particles that modify the base verb semantically. This is indicated by the structure sharing of the MOD value of the particle and the SYNSEM value of the input verb ($\boxed{3}$).[16]

[15] Note that the lexical rules as given in this article are abbreviations. The values of features that are mentioned neither in the LEX-DTR nor in the mother are assumed to be structure-shared, i.e., to be identical.

[16] The rule in (39) is, in a certain way, similar to the Adjunct Introduction Lexical Rule that van Noord & Bouma (1994) employ: as in their rule, an adjunct is introduced into a valence feature list.

Note that I do not claim that all particle verb combinations follow this pattern. Stiebels & Wunderlich (1994: 930) identified five different types of particle verb constructions where the particle is related to a preposition. Only one type is dealt with here. The other cases can be dealt with with similar lexical rules.

Particles like those in (10) and (38) have the form of adjuncts. They select their head via MOD. The entry for *los* is shown in (40).

(40) *los* (aspectual marker)

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MOD} & \text{V}[\text{SUBCAT}\ \langle \text{NP}[\textit{str}] \rangle, \text{CONT}\ \boxed{1}] \\ & \textit{particle} \end{bmatrix} \\ \text{SUBCAT} & \langle\rangle \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{ARG} & \boxed{1} \\ \textit{begin} & \end{bmatrix} \end{bmatrix}$$

This particle modifies an intransitive verb (SUBCAT = $\langle\ \rangle$) and encapsulates the semantics of this verb ($\boxed{1}$) under the relation it contributes (*begin*). When lexical items that are licensed by the lexical rule in (39) are combined with the particle, they take the semantic contribution from the particle. This is ensured by the structure sharing $\boxed{4}$ in (39).

Figure 6 shows the representation of valence information in an analysis of *losfahren* 'start to drive', where the particle *los* is combined with a lexical item licensed by the particle verb lexical rule on the basis of the lexical entry for the intransitive version of *fahr-* 'to drive' in (41).

(41) *fahr-* 'to drive'

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}]_{\boxed{1}} \rangle \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{AGENT} & \boxed{1} \\ \textit{fahren} & \end{bmatrix} \end{bmatrix}$$

The particle verb lexical rule applies to the stem entry of *fahr-* and licenses a lexical item that contains a particle in VCOMP. The licensed lexical item is a stem that has to be inflected before it can be combined with the particle. Since inflection has not been dealt with yet, inflection is not represented in figure 6. The details of inflection will be explained in section 5.1 below. The concatenation of the SUBCAT value of the input verb ($\boxed{1}$) and the SUBCAT value

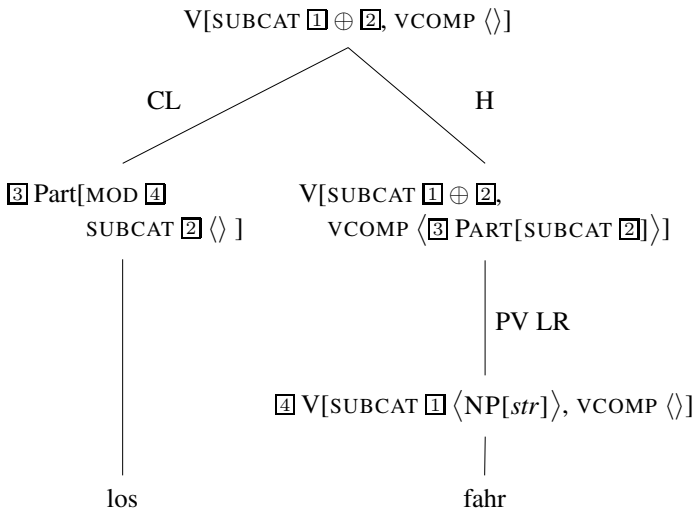

Figure 6
Combination of *los* and *fahren* (valence information)

of the selected particle (2) is identical to the SUBCAT value of the output of the lexical rule. This technique of argument attraction is the same as in section 3, where we discussed the analysis of the verbal complex. In the next step, the verb is combined with the particle *los* in a head cluster structure (schema I in section 3). Since *los* has no element in SUBCAT, 2 is the empty list. Therefore, the SUBCAT value of the verb *fahren* that is subcategorized for a particle is a list that contains an element that is identical to the subject of the simplex verb *fahren*. Since the SUBCAT value of the mother is identical to the SUBCAT value of the head daughter in head cluster structures, the SUBCAT value of the complete particle verb is also 1⊕2 and hence the SUBCAT value of *losfahren* is identical to the SUBCAT list of *fahren*, hence *losfahren* is an intransitive verb.

Since the particle verb lexical rule identifies the MOD value of the particle with the SYNSEM value of the base verb (4 in figure 6), the particle *los* can access properties of the base verb it attaches to and can hence also impose constraints on the length of the SUBCAT list of the base verb. It can, therefore, be ensured that *los* attaches to intransitive verbs only.

Now consider the representation of semantic information in the analysis of *losfahren*, which is shown in figure 7 on the following page. The particle verb lexical rule applies to *fahr-* and licenses a lexical item that selects a particle whose MOD value is identical to the input of the rule (3). Therefore this particle can access the semantic information contributed by the base verb. The output of the lexical rule has a CONT value that is identical

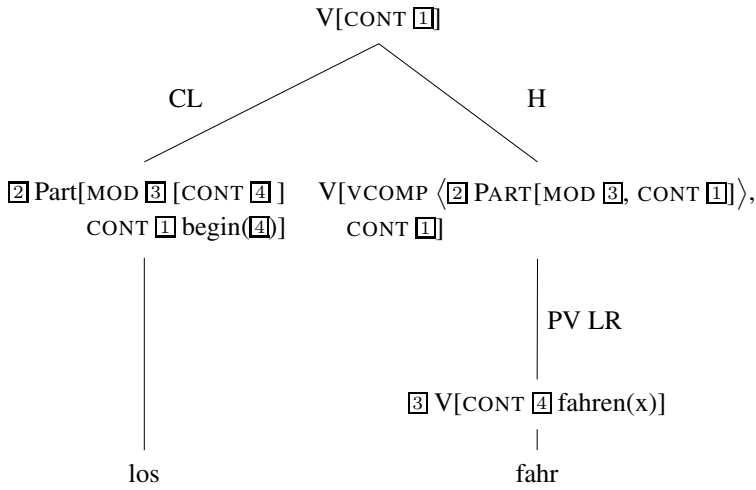

Figure 7
Combination of *los* and *fahren* (semantic information)

to the CONT value of the particle (1). The actual value is not constrained by the feature description of the lexical entry that selects the particle. The only thing one knows at this point is that there will be a particle and that it will contribute some meaning. In the next step, the verb that selects for the particle is combined with the particle. This combination is licensed by the head cluster structure schema 1. The semantics principle ensures that the meaning contribution of the head in the head cluster structure is identical to the meaning contribution of the mother, hence 1 is the CONT value of the complete particle verb. The actual value of 1 is determined by the particle. In the case of *los*, the particle contributes the *begin* relation. The argument of the *begin* relation is the semantic contribution of the base verb: *fahren*(x). The particle can access the meaning contribution of the base verb since the MOD value of the particle is identified with the SYNSEM value of the base verb (3). In the lexical entry (40) for *los* above, it is specified that the CONT value of the modified element is the argument of the *begin* relation. The full semantic contribution of the particle in figure 7 is, therefore, *begin*(*fahren*(x)), where x is linked to the agent of *fahren*. Since this meaning contribution is identified with the meaning of the verb selecting for the particle and also with the meaning of the entire particle verb, the meaning of the verb as a whole is also *begin*(*fahren*(x)).

Now consider what happens if we combine the particle verb entry for *fahren* with the entry for *an*. The lexical entry for the particle an_5, given in (42), differs from the one for *los* in licensing an additional argument.

(42) *an*$_5$ (direction)

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MOD} & \text{V}[\text{SUBCAT}\ \langle \text{NP}[\textit{str}] \rangle, \text{CONT}\ \boxed{1}] \\ & \textit{particle} \end{bmatrix} \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}]_{\boxed{2}} \rangle \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{ARG1}\ \boxed{1} \\ \text{ARG2}\ \boxed{2} \\ \textit{directed-towards} \end{bmatrix} \end{bmatrix}$$

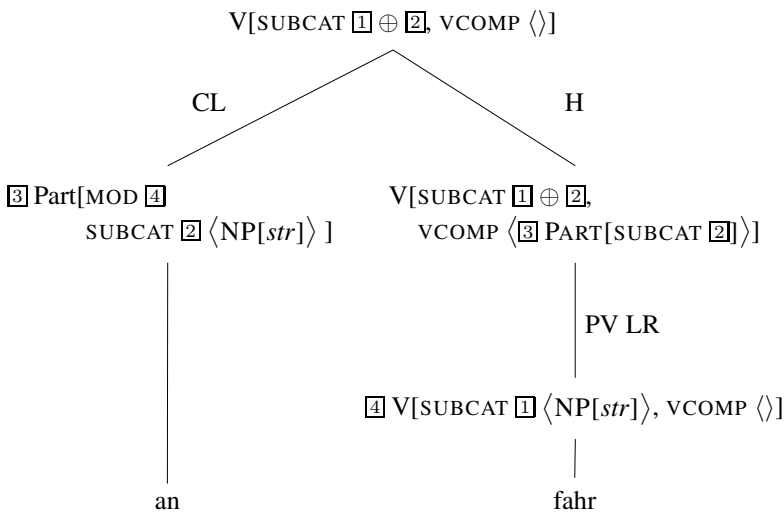

Figure 8
Combination of *an* and *fahren* (valence information)

The additional argument – an NP bearing structural case – is represented as an element in the SUBCAT value. This element is linked to an argument of the *directed-towards* relation ($\boxed{2}$). The other argument of this relation is identified with the content provided by the base verb.

Figure 8 shows the valence representations in the analysis of the combination of the particle *an* with *fahren*. This figure is parallel to figure 6, which shows the analysis of *losfahren*. The only difference is that *an* has an element in SUBCAT. Therefore $\boxed{1}\oplus\boxed{2}$ is a list that contains two NPs with structural case, i.e., *anfahren* is a transitive verb. The composition of the meaning of *anfahren* is completely analogous to the meaning composition for *losfahren*, shown in figure 7.

Having shown how productive particle verb combinations with adjunct-like particles can be accounted for, I now turn to the morphology of particle verbs and show that the analysis presented above does not lead to paradoxes.

5. Morphology

There are two basic approaches to inflectional and derivational morphology. The first is called 'Item-and-Arrangement (IA) approach', 'Morpheme-based approach', or 'Word Syntax approach'. It is assumed that words consist of morphemes that are form–meaning pairs. Such morphemes are combined in a way that is similar to what is known from syntax. The alternative proposal is called 'Item-and-Process (IP) approach'. Here it is assumed that stems are related to other stems or to words by realizational rules.[17] Affixes are not elements of the lexicon. The phonological material that is contributed by an affix in the IA model is introduced, in the IP model, in the process that derives a form from a given stem or word. For a comparison of the two approaches see Hockett (1954) and Anderson (1988).

As an example consider the inflected form *fragt* 'asks', which consists of the stem *frag*- and the ending -*t*. In a morpheme-based approach both the stem and the ending are morphemes and it is assumed that both bear meaning. The word *fragt* has the structure *frag* + *t*. In an IP approach there is no lexical entry for -*t*. Instead the form *fragt* is licensed by a process that relates the stem to the fully inflected word (*frag* ⇒ *fragt*). The information that -*t* is an appropriate ending for the present tense is contained in the definition of the relation that relates the stem to the word.

In the HPSG paradigm both IA and IP analyses have been developed: Trost (1991, 1993), Krieger & Nerbonne (1993), Krieger (1994), Lebeth (1994) and van Eynde (1994: chapter 4) propose an affix-based approach, and Pollard & Sag (1987: section 8.2), Orgun (1996), Riehemann (1998), Ackerman & Webelhuth (1998), Kathol (1999), and Koenig (1999)[18] use lexical rules that relate stems to other stems or words.

One advantage of the IP view is that one does not have to stipulate zero morphemes for cases of zero inflection or conversion. Another advantage is that the stipulation of subtractive morphemes is not necessary. Hockett (1954: 224) discusses cases from Chinese and French where a shorter form is regarded as derived from a longer, more basic one; *bon* vs. *bonne* is the French example. A morpheme-based analysis would have to stipulate an abstract entity that has some meaning, but no phonological form. If it is combined with some other element, phonological material of this element is deleted. On the IP view, on the other hand, there is just a mapping

[17] See Becker (1993) for a proposal that does not assume stems, but relates words to words.

[18] For non-HPSG-based approaches see, for instance, Dowty (1979: 304), Stump (1991), Aronoff (1994).

from *bonne* to *bon*, and the fact that something is deleted is encoded in this mapping.

A morpheme-based analysis of German nominalizations can be found, for instance, in Bierwisch (1989). Bierwisch uses an abstract morpheme /Ablaut/. If a stem is combined with this morpheme, the result is an object with an appropriately modified phonology.

In order to avoid zero morphemes and subtractive morphemes, I propose a lexical rule-based analysis in what follows.

5.1 *Inflection*

The lexical rule in (43) is used to derive inflected lexical items from items that are listed in the lexicon or that have been derived by other lexical rules that map uninflected lexical items to other uninflected lexical items. Thus, it can be used to derive *fährst* from various forms of *fahr-* 'to drive'. One entry for *fahr-* is the one listed. Another is derived by the rule for productive particle verb combinations (see (39) above), and can be used in sentences like *Er fährt los* 'he starts to drive'.

(43) Lexical rule for the 2nd person singular, present

$$\begin{bmatrix} \text{PHON} & f(\boxed{1}, \langle\, st \,\rangle) \\ \text{SYNSEM} & \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{VFORM} & fin \\ & verb \end{bmatrix} \\ \text{SUBCAT} & \boxed{2} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{SOA} & \boxed{3} \\ & present \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{LEX-DTR} & \begin{bmatrix} \text{PHON} & \boxed{1} \\ \text{SYNSEM|LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & verb \\ \text{SUBCAT} & \boxed{2}\,(\langle \text{NP}[str]_{2,sg} \rangle \oplus \boxed{}) \end{bmatrix} \\ \text{CONT} & \boxed{3} \end{bmatrix} \\ & stem \end{bmatrix} \\ \textit{2nd-inflected-verb} & \end{bmatrix}$$

This lexical rule produces a finite form from the stem that may be basic or derived. The function *f* combines the phonological representation of the rule input ($\boxed{1}$) with the ending *-st*. The function may add, delete or change phonological material if necessary. For instance, the combination of *red-* and *-st* is *redest* 'talk (2nd sg.)'. The VFORM value is instantiated appropriately and the uninflected stem is required to have a subject, i.e. an NP[*str*] as its first element in the SUBCAT list. (The remainder of the list is not important, as indicated by the empty box.) The NP[*str*] is constrained to be second person

singular. The meaning of the input ($\boxed{3}$) is embedded under the *present* relation.[19] The agreement information is directly represented on the subject. The rule in (43) is a subtype of a general lexical rule for the formation of finite verbs. For other forms of the inflectional paradigm, there will be other subtypes that add other phonological information to the stem and enforce different agreement features on the subject. For subjectless verbs and verbs with clausal subjects, there is a version of the rule in (43) that adds a third person singular ending to the phonology value of the stem without imposing agreement constraints on a dependent.

The two lexemes for *fahr-* mentioned above cannot be used in syntax since they are of the wrong type: they are not subtypes of *word*; only the output of lexical rules for inflection is. If the rule in (43) is applied to the listed entry for the simplex verb *fahr-* in (41), the result is (44).

(44) *fährst* 'drive'

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{VFORM} & \textit{fin} \\ & \textit{verb} \end{bmatrix} \\ \text{SUBCAT} & \left\langle \text{NP}[\textit{str}]_{\boxed{1}\ 2,sg} \right\rangle \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{SOA} & \begin{bmatrix} \text{AGENT} & \boxed{1} \\ \textit{fahren} & \end{bmatrix} \\ \textit{present} & \end{bmatrix} \end{bmatrix}$$

Figure 9 on the following page shows what happens if the inflection lexical rule is applied to the output of the particle verb lexical rule. In the output of the particle verb lexical rule the CONT value is structure-shared with the CONT value of the particle ($\boxed{5}$). This CONT value is embedded under the *present* relation in the output of the inflection lexical rule. When a particle is combined with the inflected form of *fahr-*, the actual semantic contribution gets instantiated. In the case of an_5 the semantic contribution is *directed-towards* ($\boxed{4}$, $\boxed{6}$), where $\boxed{6}$ is linked to the NP that is licensed by an_5 and $\boxed{4}$ is the semantic contribution of the base verb.

The participle inflection is dependent on the stress pattern of the verb: if the first syllable is stressed, the participle is formed with *ge-*, (45a); if it is not stressed, the *ge-* is omitted, (45b).

[19] This representation of tense is a simplification. It can be replaced by a more appropriate analysis; see Sag & Wasow (1999) for a representation using Minimal Recursion Semantics (MRS).

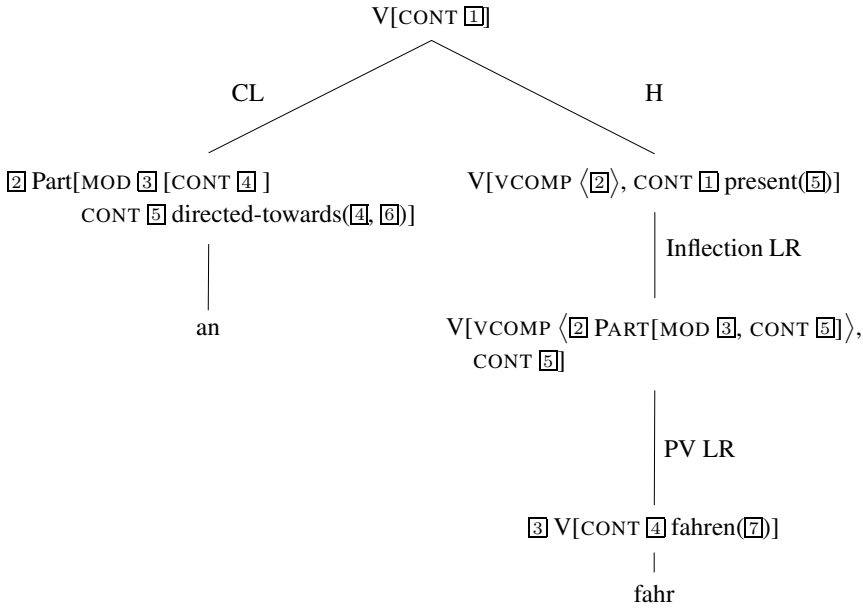

Figure 9
Inflection of *fahr-* and combination with an_5

(45) (a) gerédet 'talked', geárbeitet 'worked'
(b) diskutíert 'discussed', krakéelt 'made a racket'

The distribution of *ge-* is the same for simplex and particle verbs. Therefore it is sufficient to assume that the lexical rule that licenses the participle form is sensitive to the phonological form of the base verb. The phonological contribution of the particle that will be combined with the verb is totally irrelevant for the distribution of *ge-*. Since the form of the particle does not matter as far as the phonology of the participle inflection is concerned it is unproblematic that the particle and the base verb are discontinuous in verb-initial sentences.

Geilfuss-Wolfgang (1998) develops an OT analysis for the distribution of *ge-*, including the distribution in particle verbs. He tries to capture the data on a purely phonological basis. In order to achieve this he has to stipulate four constraints, one of which is specific to *ge-* and another one specific to particle verbs. Such stipulations are not necessary in the approach suggested in this paper.

5.2 *Derivation*

In the following subsections I will show how *ge- -e*-nominalizations and *-bar*-derivations can be analyzed without producing the bracketing paradoxes discussed in section 2.

5.2.1 Ge- -e-*nominalizations*

There are various ways in which the arguments of a verb can be realized after nominalization has been applied. The subject or object of the verb can be realized as a *von*-PP, (46a), or as a postnominal genitive NP, (46b), or it may be left implicit, (46c).

(46) (a) das Angebrülle von Norbert
the PART(at).screaming from Norbert
'Norbert's screaming at somebody' (taz, 15.10.1993: 6)

(b) das Rumgeheule der FDP
the PART(around).shouting of.the FDP
'the FDP's whining' (taz, 7.1.1998: 3)

(c) das Herumgerenne
the PART(around).running
'the running around' (taz, 1.2.1999: 16)

Rather than giving a detailed account of the various ways in which arguments can be realized, I will consider the case where all arguments are suppressed. The main purpose of this section is not to provide all the details of argument realizations in nominal environments, but rather to show how g*e*- -*e*-nominalizations can be accounted for without a bracketing paradox. The lexical rule in (47) can be used to derive nominalizations like the one in (46c).

(47) Lexical rule for g*e*- -*e*-nominalizations

$$\begin{bmatrix} \text{PHON} & f(\langle ge \rangle, \boxed{1}, \langle e \rangle) \\ \text{SYNSEM} & \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{noun} \\ \text{SUBCAT} & \langle \text{DET} \rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{2} \begin{bmatrix} \text{PER} & \textit{3} \\ \text{NUM} & \textit{sg} \\ \text{GEN} & \textit{neu} \end{bmatrix} \\ \text{RESTR} & \left\{ \begin{bmatrix} \text{INST} & \boxed{2} \\ \text{SOA} & \boxed{3} \\ & \textit{repeated-event} \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{LEX-DTR} & \begin{bmatrix} \text{PHON} & \boxed{1} \\ \text{SYNSEM} & \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT}\vert\text{HEAD} & \begin{bmatrix} \textit{verb} \end{bmatrix} \\ \text{CONT} & \boxed{3} \end{bmatrix} \end{bmatrix} \\ & \textit{stem} \end{bmatrix} \\ & \textit{ge-e-derived-noun-stem} \end{bmatrix}$$

Again, *f* is a function that combines the PHON value of the input with *ge*- -*e*. The -*e* is optional if it follows the unstressed syllables -*er*, -*el*, -*en* as, for

instance, in *Rumgeballer* 'the shooting around'. The result of the rule application is a noun stem. This stem has to be inflected before it can be used in syntax. Zero-inflection gives nominative, dative and accusative; appending an *-s* results in genitive.

The rule in (47) applies to all verbs. The valence properties of the nominalized verb are ignored since this lexical rule licenses only the bare noun with a determiner without any complements that could be inherited from the verb. Following Pollard & Sag (1994: chapter 1) and Demske (2001), I assume that the noun selects a determiner, i.e., I assume an NP analysis rather than a DP analysis, but the rule in (47) could easily be changed. For a DP analysis in HPSG see Abb (1994). A special variant of a DP analysis can be found in Netter (1994) and Netter (1998).

Since nouns derived by *ge- -e*-nominalization are neuter, the lexical rule licenses a noun that has a referential index with the GEN(DER) value *neu*. *Ge- -e*-nominalizations do not have plural forms (Bierwisch 1989: 34). Since the number is also specified in the output of the lexical rule, plural inflectional affixes cannot be combined with stems licensed by (47). The referential index ($\boxed{2}$) is identical with the value of the INST feature of the *repeated-event* relation.

Consider first *Gerenne* as it is derived from the verb *renn-* without a particle. The entry for *renn-* is analogous to the one for *fahr-* in (41). It is given in (48).

(48) *renn-* 'run'

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}]_{\boxed{1}} \rangle \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{AGENT} & \boxed{1} \\ \textit{rennen} & \end{bmatrix} \end{bmatrix}$$

If this lexical entry is fed into (47), the result is (49).

(49) *Gerenne-* 'repeated running'

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{noun} \\ \text{SUBCAT} & \langle \text{DET} \rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{IND} & \boxed{2} \begin{bmatrix} \text{PER} & \textit{3} \\ \text{NUM} & \textit{sg} \\ \text{GEN} & \textit{neu} \end{bmatrix} \\ \text{RESTR} & \left\{ \begin{bmatrix} \text{INST} & \boxed{2} \\ \text{SOA} & \begin{bmatrix} \text{AGENT} & \boxed{} \\ \textit{rennen} & \end{bmatrix} \\ \textit{repeated-event} & \end{bmatrix} \right\} \end{bmatrix} \end{bmatrix}$$

The agent of *rennen* is not linked to any element in the valence representation and hence the value of the AGENT feature in (49) is represented as an empty box.

Next I want to discuss the analysis of *Herumgerenne*. Like *los*, the particle *herum* as used in *Herumgerenne* attaches to intransitive verbs only, as (50) shows.

(50) (a) Karl rennt/hüpft herum.
Karl runs jumps around
(b) Karl liest in dem Buch herum.
Karl reads (in the) book around
(c) *Karl liest das Buch herum.
Karl reads the book around

There are several meanings of *herum*. The one that is of interest here adds a component to the meaning of the base verb, namely that the action is aimless.

(51) *herum* 'around'

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \begin{bmatrix} \text{MOD} & \text{V}[\text{SUBCAT}\ \langle \text{NP}[\textit{str}] \rangle, \text{CONT}\ \boxed{1}] \\ \textit{particle} & \end{bmatrix} \\ \text{SUBCAT} & \langle\rangle \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{SOA} & \boxed{1} \\ \textit{aimless} & \end{bmatrix} \end{bmatrix}$$

The analysis of *Herumgerenne* is shown in figure 10.

To derive *Herumgerenne* we first have to apply the lexical rule (39) for productive particle verb combinations to the entry for *renn-*, listed in the lexicon. The result is a lexical item that selects a particle via VCOMP ($\boxed{2}$). The meaning contribution of this particle ($\boxed{5}$) is identified with the meaning of the lexical item that is licensed by the particle verb lexical rule. The nominalization lexical rule applies to this item and encapsulates the semantic contribution under the *repeated-event* relation. In the next step, the noun is combined with the particle. Since the noun is the head in a head cluster structure, its meaning contribution ($\boxed{1}$) is identical to the meaning contribution of the mother. The meaning contribution of the particle is now known. Via its MOD value the particle can access the semantic contribution of the base verb ($\boxed{4}$) and can embed this under the *aimless* relation. The result is *aimless* (*rennen*($\boxed{7}$)). Since this semantic contribution is embedded under *repeated-event* by the nominalization rule, we get *repeated-event*(*aimless*(*rennen*($\boxed{7}$))), and hence the correct semantic representation.

Having dealt with inflection and with *ge- -e*-nominalization, I turn now to the most difficult part of the analysis: the *-bar*-derivation.

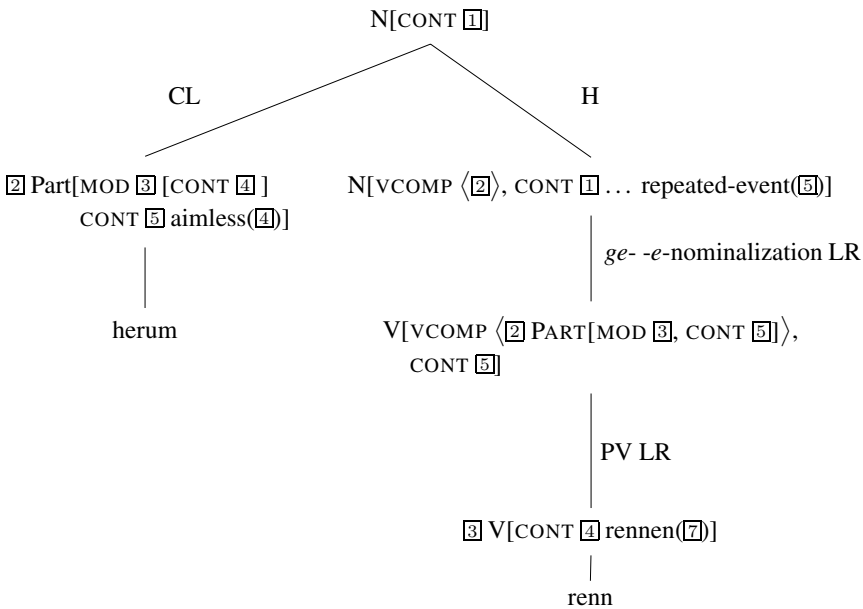

Figure 10
Analysis of *Herumgerenne* 'repeated aimless running'

5.2.2 *Adjective derivation*

The *-bar*-derivation with particle verbs is the most difficult part of the analysis since syntactic constraints and proper scope relations are both relevant to it.

Riehemann (1998) assumes a schema for *-bar*-derivation that is similar to the following:

(52) Lexical rule for the derivation of adjectives with *-bar*

$$\begin{bmatrix} \text{PHON} & \boxed{1} \oplus \langle\, \textit{bar} \,\rangle \\ \text{SYNSEM} & \begin{bmatrix} \text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{adj} \\ \text{SUBCAT} & \langle \boxed{2}\,\text{NP}[\textit{str}] \rangle \oplus \boxed{3} \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{SOA} & \boxed{4} \\ \textit{modal-op} & \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{LEX-DTR} & \begin{bmatrix} \text{PHON} & \boxed{1} \\ \text{SYNSEM}|\text{LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}], \boxed{2}\,\text{NP}[\textit{str}] \rangle \oplus \boxed{3} \end{bmatrix} \\ \text{CONT} & \boxed{4} \end{bmatrix} \\ \textit{stem} & \end{bmatrix} \\ \textit{reg-bar-adj-stem} & \end{bmatrix}$$

This lexical rule applies to a transitive verb and promotes the accusative object to the subject of the adjective. This process is similar to passivization. The rule in (52) is a subtype of a type that specifies the subject demotion that is common to all passive-like constructions. The result of this lexical rule is a stem that must go through an inflection lexical rule in order to become a word that can take part in syntactic combinations. An inflectional rule that does not add phonological material produces a lexical item that can be used predicatively in copula constructions. Other rules that add phonological material license the attributive forms, which are inflected and can be used prenominally.[20]

To start with a simple example, I show what happens with a transitive verb without particle. The feature description in (54) corresponds to the transitive use of *fahren* as in (53).

(53) Sie fährt ein Auto mit geringem Spritverbrauch.
she drives a car with low gas.consumption

(54) *fahr-* 'to drive'

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}]_{\boxed{1}}, \text{NP}[\textit{str}]_{\boxed{2}} \rangle \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{AGENT} & \boxed{1} \\ \text{THEME} & \boxed{2} \\ \textit{fahren} & \end{bmatrix} \end{bmatrix}$$

The rule in (52) promotes the object of *fahren* to the subject of the adjective. The subject of *fahren* is suppressed.

(55) *fahrbar-* 'possible to drive'

$$\begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{adj} \\ \text{SUBCAT} & \langle \text{NP}[\textit{str}]_{\boxed{2}} \rangle \\ \text{VCOMP} & \langle\rangle \end{bmatrix} \\ \text{CONT} & \begin{bmatrix} \text{SOA} & \begin{bmatrix} \text{AGENT} & \boxed{1} \\ \text{THEME} & \boxed{2} \\ \textit{fahren} & \end{bmatrix} \\ \textit{modal-op} & \end{bmatrix} \end{bmatrix}$$

[20] See also Koenig (1999: 118) for a similar proposal for the interaction of inflection and derivation.

This entry can be used to analyze phrases like (56).

(56) der fahrbare Untersatz
the possible.to.drive underneath.put
'wheels'/'the car' (taz, 3.20.1999: 30)

In what follows I demonstrate what happens if the *-bar*-derivation lexical rule is applied to the lexical item that is licensed by the particle verb lexical rule. I split the discussion into two parts, first discussing valence properties and then the semantics.

V[SUBCAT $\boxed{1} \oplus \boxed{2}$, VCOMP $\langle$PART[SUBCAT $\boxed{2}$]$\rangle$]

PV LR

V[SUBCAT $\boxed{1}\langle$NP[*str*]$\rangle$, VCOMP $\langle\rangle$]

fahr

Figure 11
Application of the particle verb lexical rule to *fahr-*

Figure 11 shows the application of the particle verb lexical rule. The result of the rule application is a lexical item that has an underspecified SUBCAT value. The actual value is constrained by the particle once the particle is combined with its head.

The *-bar*-derivation lexical rule requires its input to have an object NP with structural case. Since the output of the particle verb lexical rule is compatible with this requirement, the *-bar*-derivation lexical rule can apply to it. This is shown in figure 12. The SUBCAT value of the input to the *-bar*-derivation is constrained to be a list that starts with two NP[*str*] ($\langle$NP[*str*], $\boxed{3}$ NP[*str*]$\rangle \oplus \boxed{4}$). Since the SUBCAT value of the input to the *-bar*-derivation in figure 12 is the concatenation of the SUBCAT value of the simplex verb and the SUBCAT value of the particle in VCOMP, only particles that have an NP[*str*] at the first position of their SUBCAT list may combine with the result of the *-bar*-derivation.

Figure 13 shows the combination of *an*$_5$ and *fahrbar*. The particle has an NP[*str*] in its SUBCAT list ($\boxed{2}$). Therefore the concatenation of $\boxed{1}$ and $\boxed{2}$ is a list that contains two NP[*str*]. The second NP[*str*] is identified with the element $\boxed{3}$, which is raised to subject by the *-bar*-derivation lexical rule. Since there are just two NPs in the concatenation of $\boxed{1}$ and $\boxed{2}$, $\boxed{4}$ is the empty list. Therefore the adjective *anfahrbar* has as the only element on its SUBCAT list the element that was introduced by the particle. Hence, the NP licensed by the particle is the subject of the adjective.

Interestingly, this analysis not only derives (57a) but also blocks (57b).

Adj[SUBCAT ⟨3⟩ ⊕ 4, VCOMP ⟨PART[SUBCAT 2]⟩]

| -*bar*-derivation LR

V[SUBCAT 1 ⊕ 2 = ⟨NP[*str*], 3 NP[*str*]⟩ ⊕ 4,
VCOMP ⟨PART[SUBCAT 2]⟩]

| PV LR

V[SUBCAT 1 ⟨NP[*str*]⟩, VCOMP ⟨⟩]

|

fahr

Figure 12
Application of the -*bar*-derivation lexical rule to *fahr*- with particle in VCOMP

(57) (a) die anfahrbaren Geschäfte
the PART.drivable shops
'the shops that can be accessed by vehicle'
(b) *die losfahrbaren Geschäfte
the PART.drivable shops
Corresponding to: '*the shops that can be started to drive'
(c) ?die losfahrbaren Autos
the off.drivable cars
'the cars that can be driven off'

The reason is that *los* does not introduce arguments. Since *los* only combines with intransitive verbs, the result of such a combination is, again, an intransitive verb. Although there is a form for *fahrbare*, it cannot be combined with *los* since the constraint imposed by the -*bar*-derivation lexical rule (1⊕2 = ⟨NP[*str*], 3 NP[*str*]⟩⊕4) would be violated: 1⊕2 would contain just one element.

Note that (57c) has a marginal resultative reading for *losfahrbar*, with the resultative predicate *los* 'off'. A context would be ten cars that are stuck in the snow and some of them can be freed by driving. This form of *losfahrbar* can also be derived with the lexical rule (52), but then it will be derived from an entry for *fahr*- that is the result of the resultative predicate lexical rule (see Müller 2000: 224), and not from a lexical item that is licensed by the particle verb lexical rule. The lexical item with the resultative meaning cannot be used in an analysis of (57b), since the selectional restrictions of the resultative predicate *los* block the combination with *Geschäfte*.

Now consider the representation of semantic information in the analysis, shown in figure 14. The particle verb lexical rule introduces a particle

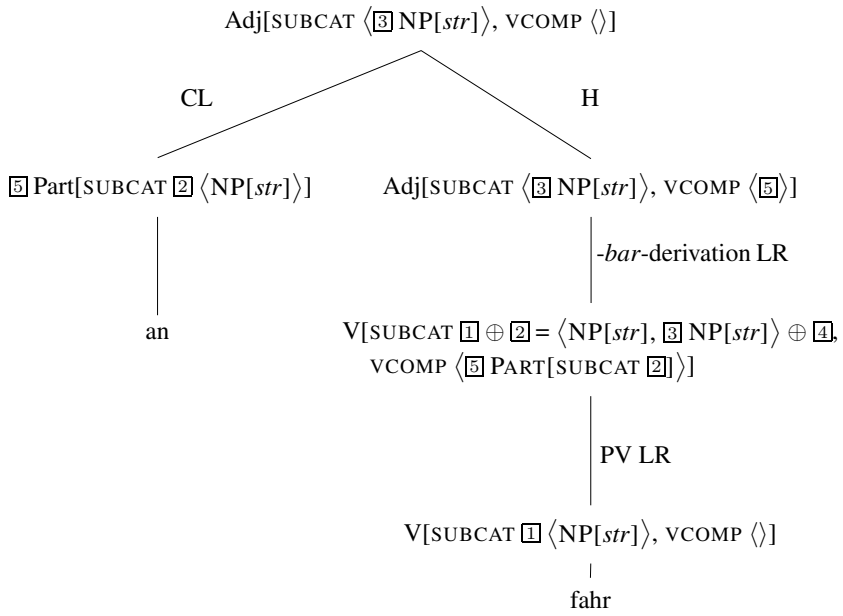

Figure 13
Combination of *an*$_5$ and *fahrbar* (valence information)

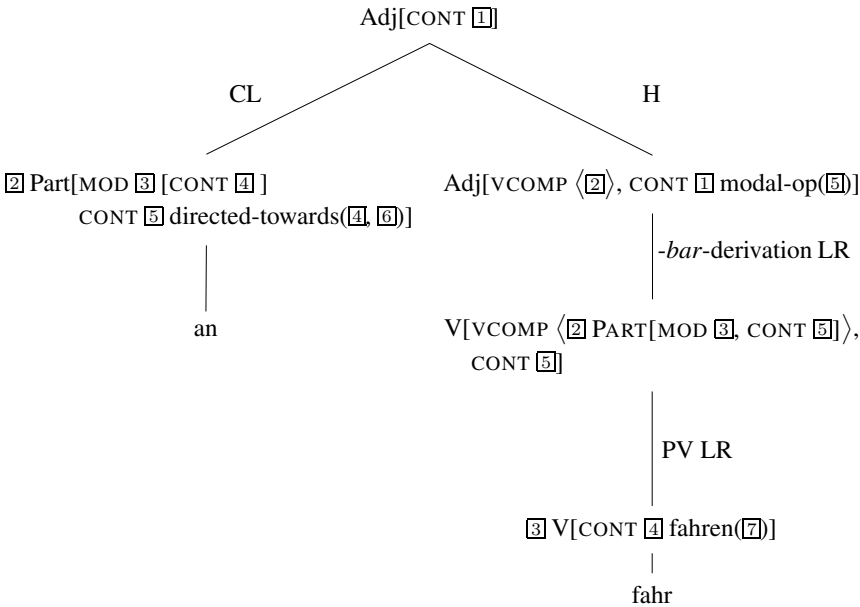

Figure 14
Combination of *an*$_5$ and *fahrbar* (semantic information)

into the VCOMP list that selects the input representation via MOD (3). In the output of the lexical rule, the CONT value of the output (5) is structure-shared with the CONT value of the particle in VCOMP. The *-bar*-derivation lexical rule embeds this CONT value under *modal-op*. At this point, no particle is present and therefore the value of 5 is not constrained. In the next step the particle is combined with *fahrbar*. The particle has the form of an adjunct. Its MOD value (3) is identified with the stem *fahr-* since this is so specified in the VCOMP value (2). Therefore the particle *an* can access the semantic contribution of the base verb *fahr-* and integrate it into the semantic contribution of the particle. The result is *directed-towards*(4, 6), where 4 stands for *fahren*(7), i.e., we get *directed-towards* (*fahren*(7), 6). 6 and 7 are linked to the object and subject of *anfahren*, respectively.

Only after combining *an* and *fahrbar* is it clear what the value of 5 is. This value is an argument of the *modal-op* relation that was contributed by the *-bar*-derivation. Since *fahrbar* is the head of *anfahrbar*, the meaning of *anfahrbar* is identical to the meaning of *fahrbar* (1).

Elements that are derived from particle verbs can undergo further morphological processes:

(58) (a) unannehmbar
unacceptable
(b) das Pseudo-Herumgerede
the pseudo.babble (Stiebels 1996: 30)

In (58a), *annehmbar* is prefixed with *un-* and in (58b) *Herumgerede* is combined with *Pseudo-*. Therefore it is necessary for the schema that combines the particle with the derived adjective or noun to apply in the morphology component. The result is then the basis for combination with elements like *un-* or *Pseudo-*.

6. Alternatives

In this section I discuss alternative proposals for the analysis of particle verbs. The first two deal explicitly with alleged bracketing paradoxes. The account suggested by Stiebels & Wunderlich (1994) draws on Williams' (1981) notion of lexical relatedness and will be discussed in section 6.1. The second analysis was suggested by Stump (1991) and deals with morpho-semantic mismatches in general (section 6.2). In section 6.3, I discuss the assumption of discontinuous lexical entries and, in section 6.4, a discontinuous morphology, as suggested by Crysmann (1999) for Fox. Finally I discuss Ackerman & Webelhuth's (1998) approach to particle verbs in section 6.5.

6.1 *Rebracketing and lexical relatedness*

Stiebels & Wunderlich (1994: 935) and Stiebels (1996: section 3.2.1) assume the structure in (59) for nominalizations like *Einführung* 'introduction'.[21]

(59) [ein [[führ]$_V$ ung]$_N$]

They assume a notion of lexical relatedness that is similar to that proposed by Williams (1981):

(60) *Lexical relatedness*
A compound of the structure [P [α V β]$_X$], where X is a noun or adjective formed from a verb (with α, β as possible derivation affixes), may be interpreted as if α, β were applied to the respective verb [P V]. α and β may be (phonologically) empty.

As they note, this principle violates strict compositionality: they assume that *Führung* 'leadership', *Gabe* 'gift' and *sehbar* 'watchable'[22] are parts of the words *Einführung* 'introduction', *Abgabe* 'delivery' and *absehbar* 'conceivable', respectively.

Stiebels & Wunderlich argue that such a postponed interpretation is needed for other cases of compounds too, since – according to them – *Aufsteher* 'riser' is ungrammatical and *Frühaufsteher* 'early.riser' is grammatical.

-*er*-nominalizations are used to refer to a certain discourse referent in a situation. Since 'to get up' is not a property that discriminates between people, the noun *Aufsteher* 'up-getter, riser' as such is strange. However, Lüdeling (2001: 101) provides a context where the property of getting up discriminates between people and therefore can be used without further specification: the situation is a hospital where a certain group of patients is allowed to get up during the day while the others have to stay in bed. In this situation it is possible to refer to a member of the first group as *Aufsteher* 'person who gets up' and to a member of the second group as *Liegenbleiber* 'person who does not get up'. This shows that *Aufsteher* is not ungrammatical and therefore such examples do not count as independent evidence for a postponed interpretation in Stiebels & Wunderlich's sense. On page 939 they discuss the data in (61):

(61) (a) bieten ≈ Gebot 'offer'
(b) verbieten ≈ Verbot 'forbid/ban'
(c) anbieten ≈ Angebot 'offer'
(d) aufbieten ≈ Aufgebot 'exert/exertion'

[21] For a general discussion of Stiebels & Wunderlich's account see also McIntyre (2001c). In the following section, I will focus on their arguments regarding lexical relatedness.

[22] *Sehbar* is often discussed as an example for blocking, i.e., it is claimed that the word *sehbar* does not exist. However, only the sense 'visible' is not available.

Verbieten is a prefix verb and *anbieten* and *aufbieten* are particle verbs. The root noun related to *bieten* is *Bot*, which was subject to a prosodically triggered *ge*-prefixation in West Germanic. The prefixed root noun *Verbot* is listed and therefore the *ge*-prefixation does not apply. The nominalizations of particle verbs are formed with *Gebot*. Stiebels & Wunderlich conclude from this that *Angebot* and *Aufgebot* are compounds that are formed from *Gebot* and a preposition. However, the data are also compatible with the analysis presented in the previous section: the *ge*-prefixation applies to a stem that contains a representation of the particle in its valence lists. No lexical relatedness is needed.

That *leadership* (*Führung*) should have anything to do with *introduction* (*Einführung*) is highly implausible and any analysis that does not have to make such assumptions should be preferred over Stiebels & Wunderlich's. Furthermore, in their approach, it is not only the interpretation that must be postponed, but also the evaluation of other constraints. Stiebels & Wunderlich do not have a solution to the problem of non-existent bases (see section 2.3): to derive *Ausbreitung* 'spreading' they have to assume **Breitung* as part of the analysis. Apart from this, it is not clear when the passive-like suppression of the subject should apply in *-bar*-derivations. In their view, the *-bar*-derivation applies to an intransitive verb and the particle is combined with the result later. Only then does the additional argument introduced by the particle become available. As was discussed in the data section, *-bar*-derivation applies productively only to transitive verbs.

6.2 *Paradigm functions*

Stump (1991) suggests so-called paradigm functions that relate stems to stems or stems to words (roots to roots and roots to words in his terminology). These functions may be defined in a way that allows inflectional or derivational material to attach to a head contained in a more complex structure. With such a definition he can account for Pesetsky's (1985) *unhappier* puzzle: in general, the comparative suffix joins with short adjectives and does not attach to trisyllables, so a bracketing [[un-happy]er] is not possible since *unhappy* is trisyllabic. Because of the shortness constraint, [un[happi-er]] is the only available structure, but semantically one needs the first structure. For this comparative formation, Stump defines paradigm functions that attach the comparative ending to the head inside [un-happy]. As was mentioned in footnote 2 above, he also allows combinations of derivational material with heads in complex structures. On page 714, he remarks that, in derivational paradigms in which the derived member belongs to a syntactic category distinct from that of the base member, the derived member generally fails to allow the kind of structure where the inflectional or derivational material attaches to the head. He remarks that nouns derived from particle verbs are exceptions (*hang on*→*hanger-on*, *pass by*→*passer-by*). In the

previous section, it was shown how similar German examples can be handled without violating Stump's generalization. For *-bar*-derivation, one does not need [[an-fahr]-bar] and *ge- -e*-nominalization can be handled without the *ge- -e* attaching to the head inside [herum-renn]. The account that was presented in the previous section has another advantage over an imaginable application of Stump's proposal to German particle verbs: it can deal with particle verbs like *eindosen* 'to tin', which are not derived from base verbs. A verb **dosen* does not exist (see section 2.3). In the approach presented in the last section, *eindosen* is derived from the noun *Dose* 'tin'. The result of the application of a lexical rule is a verbal stem that selects the particle *ein*. This stem has to be inflected. In an adaption of Stump's approach to German particle verbs, the inflectional material could not attach to a HEAD since the category of *eindosen* (V) differs from *Dose* (N) and therefore *eindosen* is headless (see Stump's definition of head on page 681). This means that an adaption of Stump's approach cannot provide a uniform treatment of German inflection and derivation for all classes of particle verbs where the inflectional or derivational material attaches to the stem directly.

6.3 *Discontinuous lexical entries*

In a grammar that allows for discontinuous constituents, it is tempting to assume that particle verbs are discontinuous lexical entries. This has been suggested by Wells (1947: 106), for instance; see also McCawley (1982: 91). Kathol (1995: 244–248) formalizes this idea using the constituent order domains that were introduced into the HPSG framework by Reape (1992, 1994, 1996). Kathol suggests the following lexical entry for the non-transparent particle verb *aufwachen* 'wake up':

(62) *aufwachen* 'wake up' (cf. Kathol 1995: 246)

$$\begin{bmatrix} \ldots|\text{HEAD}\ \boxed{1}\ \begin{bmatrix} verb \end{bmatrix} \\ \ldots|\text{VCOMP}\ \langle\rangle \\ \text{DOM}\ \left\langle \begin{bmatrix} \langle\ wachen\ \rangle \\ \ldots|\text{HEAD}\ \boxed{1}\ \begin{bmatrix} verb \end{bmatrix} \\ \ldots|\text{VCOMP}\ \langle \boxed{2} \rangle \end{bmatrix} \right\rangle \bigcirc \left\langle \begin{bmatrix} \langle\ auf\ \rangle \\ \text{SYNSEM}\ \boxed{2}\ \begin{bmatrix} \ldots|\text{HEAD}\ \begin{bmatrix} \text{FLIP}\ - \\ sepref \end{bmatrix} \end{bmatrix} \end{bmatrix} \right\rangle \end{bmatrix}$$

This lexical entry represents syntactic structure in the lexicon. The DOM value is identical to the DOM value that would result from a combination of particle and verb in syntax. The empty circle stands for a combination of two lists. Elements of one of the combined lists can appear between elements of the other list as long as the relative order of the elements in the lists is preserved. In the case of (62), this means that either *auf* precedes *wachen* or *wachen* precedes *auf*. Kathol's approach has the advantage that a feature that ensures that the base verb selects the right particle, i.e., *auf* instead of *vor*

or something else, is not necessary. A similar analysis was suggested for idioms by Nunberg, Sag & Wasow (1994: 513). Idiom parts can be listed in the unordered domain list of a lexical entry with the correct representation of the non-compositional semantics. Both approaches are problematic since they cannot explain why particles and idiom parts can be fronted. Kathol distinguishes between compositional and non-compositional particle verbs and assumes that the compositional ones are licensed by his verb complex schema and non-compositional ones are listed in the form of lexical entries like (62).

As has been shown in Müller (2002), transparent and non-transparent particle verbs allow for the fronting of the particle (see also section 4.1). I therefore suggest that all particle verbs are represented in the same way and that fronting is restricted by general conditions for fronting and not by different lexical representations for different classes of particle verbs.

For German it is usually assumed that verb second is to be analyzed as extraction, i.e., as a nonlocal dependency. Nonlocal dependencies are analyzed by percolation mechanisms in HPSG (Pollard & Sag 1987, 1994). Lexical entries like (62) represent an object that would be the result of a syntactic combination licensed by the predicate complex schema. An extraction of material out of this lexical entry is not possible. The only way to use lexical representations like (62) and nevertheless allow for particles to be fronted is to completely revise the analysis of non-local dependencies. Mechanisms for liberation of domain elements that can explain all data that have been discussed so far would have to be devised. As yet, no such analysis exists.

A further disadvantage of Kathol's proposal is that the fact that particle verbs form a predicate complex is not represented in their lexical entries. The VCOMP value of *aufwachen* in (62) is the empty list. It is not obvious how the formation of resultative constructions with particle verbs like those in (63) can be blocked.

(63) #daß sich Karl müde herumliest
that self Karl tired PART(around).reads
Intended: 'that Karl gets tired by reading aimlessly'

In the analysis developed in this article the particle is selected via VCOMP. As argued in Müller (2000: 224), the resultative construction lexical rules require an input with an empty VCOMP list. Since the VCOMP list of particle verbs contains the particle, it is correctly predicted that particle verbs cannot be input to a lexical rule that licenses resultative constructions; see also Müller (2000: 227) on this point.

6.4 *Linearization-based morphology*

Crysmann (1999) developed an account for morphosyntactic paradoxes in Fox that uses linearization domains for the representation of stems and

inflectional and derivational material. With such an approach, it is possible to combine Kathol's representation of particle verbs (discussed in the previous section) with a morphology component that circumvents the paradoxes. The participle *aufgewacht* 'woken up' can be analyzed as the result of a lexical rule application to a lexical item that contains *auf* and *wach* in a list of morphological objects. The lexical rule adds the morphological objects *ge-* and *-t* to this list. Linearization rules ensure that the *ge-* and *-t* attach to the verbal stem.

It is interesting that such a solution is possible within the HPSG framework, but I have shown that the additional machinery that would be needed to guarantee the proper linearization of the inflectional and derivational material, and the extra list for the representation of morphological material, is not justified. Furthermore, this proposal has, of course, the problems discussed in section 6.3 since it is based on Kathol's analysis.

6.5 *Ackerman & Webelhuth (1998)*

Ackerman & Webelhuth (1998) develop a theory of complex predicates that integrates assumptions from both LFG and HPSG. The authors use a separate valence feature PART. The value of this feature is a list which contains a particle if the verb occurs in verb-initial position and which is empty when the verb occurs in final position. Their lexical entry for *an*+*ruft* is shown in (64), in a notation adapted to that used throughout the paper.

(64) (*an*)*ruft* verb-initial version (cf. Ackerman & Webelhuth 1998: 334–335)

$$\begin{bmatrix} \text{PHON} & \langle\, \textit{ruft} \,\rangle \vee \langle\, \textit{anruft} \,\rangle \\ \text{SYNSEM|LOC|CAT} & \begin{bmatrix} \text{SUBCAT} & \langle \text{NP}[\textit{str}], \text{NP}[\textit{str}] \rangle \\ \text{PART} & \langle \text{PART}[\textit{an}] \rangle \vee \langle\rangle \end{bmatrix} \end{bmatrix}$$

The proper distribution of the particle in both the valence feature and the phonological representation is ensured by type constraints that rule out the cases with a phonological representation *anruft*+particle *an* and the phonological representation *ruft* without a particle. With the types computed, (64) is equivalent to (65) and (66). (65) is the entry that is needed for clauses with the finite verb in the left sentence bracket.

(65) (*an*)*ruft* (following Ackerman & Webelhuth 1998)

$$\begin{bmatrix} \text{PHON} & \langle\, \textit{ruft} \,\rangle \\ \text{SYNSEM|LOC|CAT} & \begin{bmatrix} \text{SUBCAT} & \langle \text{NP}[\textit{str}], \text{NP}[\textit{str}] \rangle \\ \text{PART} & \langle \text{PART}[\textit{an}] \rangle \end{bmatrix} \\ \textit{partld-lci} \wedge \textit{second-lci} & \end{bmatrix}$$

For the verb final case, Ackerman & Webelhuth do not select the particle via a valence feature, but have the phonological contribution of the particle integrated in the phonological representation of the lexical entry.

(66) *anruft* verb final version (following Ackerman & Webelhuth 1998)

$$\begin{bmatrix} \text{PHON} \langle \textit{anruft} \rangle \\ \text{SYNSEM|LOC|CAT} \begin{bmatrix} \text{SUBCAT} & \langle \text{NP}[\textit{str}], \text{NP}[\textit{str}] \rangle \\ \text{PART} & \langle\rangle \end{bmatrix} \\ \textit{compound-lci} \end{bmatrix}$$

Thus, the disjunctive specification in (64) is equivalent to two separate lexical entries. The representation of particle verbs which I suggested in section 4 is free of disjunctions. One single lexical entry for each particle verb is sufficient. In section 10.2.2 of their book, Ackerman & Webelhuth argue at length against theories that stipulate two lexical entries for particle verbs, whether related by lexical rules or not. Of course, two lexical rules that derive two lexical entries from one representation in a stem lexicon can be reformulated as one lexical rule producing a disjunctively specified output, and that is what Ackerman & Webelhuth did. Thus, if their argument has any force at all, it is an argument against their own theory.

The lexical entry in (66) states that particle and verb constitute a single object that may not be split up. As should be clear from the discussion of the data in section 4.2, there are several problematic aspects of such an approach. Firstly, it cannot explain why the particle may appear separated from the verb, even in verb final sentences. Example (26), repeated for convenience as (67), shows that the particle (*ab* in this sentence) can appear non-adjacent to its base verb.

(67) Andrew Halsey ist auf dem Weg von Kalifornien nach
Andrew Halsey is on the way from California to
Australien weit ab vom Kurs gekommen.
Australia far off from.the course come
'On the way from California to Australia Andrew Halsey strayed way off course.' (taz, 4.10.1999: 20)

This example further shows that there are particles that have a 'syntactic life' in that they can be modified. This fact is not accounted for by Ackerman & Webelhuth's approach at all. Apart from that, they cannot explain the separation of verb and particle in Thuringian verbal complexes.

In addition, consider the sentences in (68).

(68) (a) **Schicht** hat von denen keiner **gearbeitet**.
PART(shift) has of those nobody worked
'None of them has worked shifts.' (Spiegel, 48/1999: 35)

(b) **Dagegen** ist **zu halten**, daß […]
this.against is to hold that
'As an argument against this, it has to be said that …'
(in the main text of Heringer 1973: 93)

(c) **Fest** scheint auch **zu stehen**, daß […]
PART(solid) seems also to stand that
'It seems to be certain that …' (in the main text of Engel 1977: 219)

In these sentences, the particle is fronted and the base verb is non-finite. In Ackerman & Webelhuth's approach such non-finite particle verbs are analyzed as words. Therefore Ackerman and Webelhuth would have to assume extraction out of words to explain these sentences.

Ackerman & Webelhuth do not deal with resultative constructions in their book at all. But, if they assume a lexical rule for resultative constructions, the impossibility of particle verbs appearing in resultative constructions would have to be enforced by stipulating the value of PART as the empty list in the lexical rule for resultative constructions. But this stipulation does not help in the case of verb-last particle verbs, since the particle is not contained in the valence list of verb-last verbs. The only way to block a resultative predicate lexical rule from applying is to stipulate that it does not apply to words of the type *compound-li*. This means that they have to stipulate two different reasons for why particle verbs cannot be input to resultative predicate lexical rules. The iteration of particles as in (69d) has to be excluded too and again there will be two different reasons why the iteration of particles is impossible.

(69) (a) weil Maria lacht
because Maria laughs

(b) weil Maria loslacht
because Maria PART.laughs
'because Maria starts to laugh'

(c) weil Maria Karl anlacht
because Maria Karl PART.laughs
'because Maria smiles at Karl'

(d) *weil Maria Karl anloslacht
because Maria Karl PART.PART.laughs
Intended: 'because Maria starts to smile at Karl'

(69b, c) show combinations of the particles *los* and *an* with an intransitive verb like the one in (69a). *An* can attach to an intransitive verb and form a transitive verb. In principle, it should be possible to combine *an* with the intransitive verb *loslachen*, but this is excluded, as (69d) shows. The reading that (69d) would have is not semantically implausible. That structural factors are responsible for the ungrammaticality of particle iteration is also shown by McIntyre's (2001c: 26) examples in (70).

(70) (a) *herumangeben
around.show off
Intended: 'show off around'
(b) herumprahlen
around.boast
'boast around'

The verbs *angeben* and *prahlen* are semantically similar. The reason for the ungrammaticality of (70a) is that *angeben* is a particle verb and hence cannot be combined with a further particle.

In the approach presented in this paper, the fact that particles cannot be iterated and the fact that particles and resultative predicates are mutually exclusive follow from the fact that the productive rules add to the same valence list (i.e. VCOMP) that has to be empty in the input of the rules (Müller 2000: 225). Furthermore, it must be noted that with their use of a separate valence feature for particles, Ackerman & Webelhuth do not capture the similarities between verbal complexes and particle verb combinations.

Ackerman & Webelhuth (1998: 333) assume the following morphological pattern for particle verb compounding:[23]

(71) Morphological pattern for particle verb compounding (Ackerman & Webelhuth 1998: 333)

$$\begin{bmatrix} \text{MS} & \begin{bmatrix} \text{POS} & \boxed{5} \\ \text{PHON} & \boxed{3} + \boxed{4} \\ \text{INFL} & \boxed{6} \end{bmatrix} \\ \text{MDTR} & \begin{bmatrix} \text{MS} & \begin{bmatrix} \text{POS} & p \\ \text{PHON} & \boxed{3} \\ & \textit{part-word} \end{bmatrix} \end{bmatrix} \\ \text{MDTR2} & \begin{bmatrix} \text{MS} & \begin{bmatrix} \text{POS} & \boxed{5} \\ \text{PHON} & \boxed{4} \\ \text{INFL} & \boxed{6} \\ & \textit{simplex-word} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

They assume that a fully inflected particle verb like *anruft* is created by compounding the particle with the fully inflected word form *ruft*, which bears the same inflectional features (INFL) as the resulting compound.

This approach cannot account for particle verb combinations with non-existent base verbs like *eindosen* 'to tin' (see section 2.3 above). Since there is no verb **dosen*, it cannot be used for compounding in a schema like (71).

[23] I have omitted their LME feature; POS stands for 'part of speech' and INFL for 'inflection'.

7. Summary

In this paper, an account for particle verbs has been developed that treats particles as part of the predicate complex. The particle is selected by the same valence feature as other complements that form a complex with their head. The lexical rules licensing particle verbs that follow a productive pattern do not combine two adjacent elements but rather, for every input entry, they license another lexical item that has the potential to combine with a particle. Since matrix verb and particle do not form one single object, the matrix verb may appear in clause-initial position separated from the embedded particle, or the matrix verb may appear clause-finally and the particle adjacent to it or located between other syntactic material of the clause.

I have developed an approach to inflectional and derivational morphology that handles the data without powerful devices like rebracketing or discontinuous morphology. Inflection and derivation apply to stems directly, and the particle is attached to fully inflected signs by an instance of the same single grammar rule, whether in morphology or in syntax.

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