Word Formation in Lexical Type Hierarchies

– A Case Study of *bar*-Adjectives in German –

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Abstract

This thesis describes a proposal for the treatment of derivation as part of a lexical component for HPSG. The system is not based on a 'syntax of words', but solely on a hierarchical structure of the lexicon. The approach is motivated by a detailed study of *bar*-adjectives in German. The analysis of data from corpora has shown that a word-syntax alone is not sufficient to cover the data. The proposed alternative explains phenomena of affixation by multiple inheritance in a hierarchy of lexical types (cf. Pollard & Sag 1987 or Krieger & Nerbonne 1992), without assuming category-marked lexical entries for affixes. The lexical types express generalizations about existing words and thus have the effect of eliminating redundant information in lexical entries. They explicitly serve as redundancy rules (cf. Jackendoff 1975), mainly giving structure to the lexicon and only secondarily being activated for productive word formation. By exploiting the fact that feature structures in HPSG are typed and type specifications can be recursive, the need for a separate mechanism for lexical rules is eliminated. The redundancy in the rule system disappears because the 'rules' form part of the hierarchy. The approach can account for regularities, subregularities, and exceptions elegantly, and makes the notion of 'word formation on the basis of the lexicon' precise. It is argued that this mechanism, which serves for explaining the problematic cases, can also handle the rest of the facts adequately, so that an additional word-syntactic treatment is not necessary.

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Contents

Introduction

In this thesis a proposal is made for the treatment of German derivational affixation. The approach is intended as part of a lexicon component for HPSG (HEAD-DRIVEN PHRASE STRUCTURE GRAMMAR, Pollard & Sag 1987, in press), and the analyses are consequently expressed in a typed feature formalism. In a highly lexicalized theory of grammar such as HPSG it is necessary to develop a sophisticated system of lexical representation that enables one to structure the information in lexical entries and express relevant generalizations, in order to avoid having to repeat predictable information.

But there is another motivation for work on the lexicon. Some kind of mechanism of productive word formation is needed, because it is impossible to list all words of a language. By using compounding and derivation it is possible to form an infinite number of new words from existing material, reminiscent of the situation known from syntax. In this thesis I will be concerned only with suffixation, and in particular study German adjectives ending in *-bar*, the English counterpart of which are adjectives in *-able*.[1] A typical example, which will be looked at in detail, is *lesbar* ('readable').

Note that it is not possible to list all these affixed words. The suffix *-bar*, for example, can also be attached to new words: when the verb *faxen* ('to fax') enters the language one can form *faxbar* from it. Some affixes can even be attached recursively, as in *Vorvorversion* ('pre-preversion') or *Ururgroßmutter* ('great-great-great-grandmother'), where no principled upper bound can be found on the number of times this is possible.

In this respect word formation resembles syntax, but there are also significant differences. Even complex words typically have to be listed, because their properties cannot be fully predicted from their parts. The fact that words tend to be stored as units explains why they have such a strong tendency to develop idiosyncrasies of all sorts, and in particular to drift semantically.

Two major approaches to an account for the regular aspects of word formation have been suggested in the linguistic literature: one is based on the arrangement of items, i.e. a WORD-SYNTAX; the other on processes, i.e. LEXICAL RULES.

The first approach could be called phrase-structural, and would for a complex word like *lesbar* posit the internal structure shown in (1):

(1) $[[\text{les}]_{\text{V}}[\text{bar}]_{\text{A}^{\text{af}}}]_{\text{A}}$

Here the first part is the verb *lesen*, and the second the affix *-bar*, with a phrase structure rule allowing the two to combine to yield a complex adjective, this category being determined by the suffix. An approach of this kind was proposed e.g. by Selkirk (1982).

[1] But note that they may have different properties, and of course the translations that will be given cannot necessarily be used to make the same point for English in each case.

The second approach is exemplified by e.g. Aronoff (1976) or Jackendoff (1975) (following Chomsky 1970), who assume lexical rules (or lexical redundancy rules). Here the affix is introduced syncategorematically in the rule, so in the corresponding structure (2), representing information about the word's derivation, the first part is still a verb, but the affix is added by the rule and is not itself marked for category.

(2) $[[\text{les}]_{\text{V}}\text{bar}]_{\text{A}}$

The approach which will be developed in this thesis is somewhere in the middle between these two (cf. section 5.4). It assumes an internal morphological structure for derived words similar to that in (2), but this structure is explicitly represented as part of the morphological features of a complex word, similar to the coding of phrase structure in a DTRS feature. But in contrast to (1) the affix is not a SIGN and not marked for category.

Bar-adjectives are standardly considered to be derived by a simple, highly productive rule: the suffix *-bar* can be attached to any transitive verb to form an adjective from it. Because of its predictable, rule-governed properties it is often seen as motivation for a word-syntactic account of derivation. In such an approach a derivational suffix is assumed to be the 'head' of the complex word and to determine its category in the same way as in compounding. Other—less regular—phenomena of word formation cannot be described in this way. They are usually not considered at all, or else argued to be handled by a separate, analogical module. It is not normally made clear what this component would look like, but still everything that is not 'principled' is associated with it.

A closer look at the data reveals that even *bar*-adjectives do not conform to such a simple pattern. First of all, there is a large number of LEXICALIZED *bar*-adjectives which only partly fit the description. But there are also frequent cases of PRODUCTIVELY FORMED new *bar*-adjectives not accounted for by the rule. A word-syntactic approach (same as one which posits a single lexical rule) would lose some of its elegance because it is not able to establish a connection between lexicalized, partly regular instances and the rule. It is even more problematic that it cannot account for the newly formed cases.

In a computational lexicon the need arises to arrive at a non-redundant representation for lexicalized, often partly idiosyncratic *bar*-adjectives. This is best accomplished in a hierarchy of some kind, expressing the relevant generalizations. In the case of *bar*-adjectives one such generalization would be that morphologically they have two parts, the first of which is a verb. Through the use of typing information it is then possible to relate this to the existing lexical entry for the verb. It is argued that precisely these patterns, which give structure to the lexicon, can also be used for productive word formation. If it is sufficiently clear what semantic effects will correspond to a particular process of affixation and what the necessary conditions on the 'input' are, the pattern can be 'activated'. This will be possible for marginal patterns, generalizing over a small number of existing words only and thereby achieving the effect of word formation by analogy. But the same mechanism can be used to explain highly regular processes as well. Here the pattern generalizes over a large, perhaps independently motivated class of 'inputs'—e.g. transitive verbs—giving the impression of a rule. An independent word-syntactic component is not needed.

The structure of the thesis is as follows. In the first section the relevant data will be presented, so that is becomes clear what phenomena have to be accounted for. Then in section 2 some characteristics of HPSG are summarized, which are necessary to understand the morphological approaches discussed later. The approach of Krieger & Nerbonne (1992) and Krieger (to appear) is described in section 3. This is the most extensive work on a morphological component for HPSG that I know of, and the present proposal will develop upon their idea of using lexical types as 'internal lexical rules'. In general though, their account could be more accurately classified as word-syntactic combined with an extended hierarchy. It will be shown that these two means are really independent, and each can capture regular derivation. The redundancies will be pointed out that arise when the two are combined, and in section 4 two possible strategies to avoid them are discussed. It will be argued that the TYPE HIERARCHY is well motivated by the data since there are empirical problems with a pure word syntactic approach. The claim is made that an expanded hierarchy is not only necessary but also sufficient, i.e. that a word-syntactic component on top of it is not needed. Finally in section 5 the proposed extended lexical inheritance hierarchy will be presented and discussed.

1 The Data

The data described in the following subsections comes from two sources. Previous studies on *bar*-adjectives by linguists such as Flury (1964), Gelhaus (1977), and Toman (1987), the collections in Fleischer (1992) and Kühnhold et al. (1978), and the reverse lists in Mater (1965), Brückner & Sauter (1984), and Muthmann (1991) will be taken into account, but most of the examples and all the statistical results are based on my own corpus work.

1.1 The Corpora

The largest of the corpora which I analyzed for *bar*-adjectives consists of more than 10 million words from newspaper articles, covering topics from a variety of areas. It was sampled by the IDS in Mannheim between 1985 and 1988. The other corpora are smaller and more specific. One consists of all 1991 volumes of the review journal 'Germanistik', another of the transcripts from the debates over the German constitution (verbatim and in summarized form). There is also some language acquisition data.

A summary of the analyzed corpora:

1. **Mannheim Newspaper Corpus**, 1985-1988; 10,766,759 Words, 17,297 Tokens, 836 Types[2]
2. **Rosengren Newspaper Corpus** (Rosengren 1977), 1966/67; 2,976,894 Words, 4346 Tokens, 343 Types (no context)
3. **Gelhaus Mannheim Corpus** (Gelhaus 1977), 1206 Tokens, 313 Types (no context)
4. **Wendekorpus** (mostly Newspapers), 1989/90; 488,563 Words, 661 Tokens, 152 Types
5. **'Germanistik'** 1991; 385,531 Words, 343 Tokens, 119 Types
6. **Summarized Transcripts**, 1948/49; 1,1 Million Words, 1630 Tokens, 97 Types
7. **Spoken Transcripts**, 1948/49; 2,8 Million Words, 2845 Tokens, 184 Types
8. **Language Acquisition Corpora**, spoken language
9. **Hermann Paul Dictionary**[3]

Alphabetically sorted KWIC indices (Key Word In Context) were printed for all but the second and third corpus. The data from these two is published

[2] Here 'type' is used as in 'type vs. token', where 'types' are kinds of *bar*-adjectives and 'tokens' the actual occurrences.

[3] This was used as a source of information on the etymology of the most common nontransparent *bar*-adjectives.

in Rosengren (1977) and Gelhaus (1977), including only frequency information. The frequencies were determined automatically for all the electronically available corpora[4], and those from the other corpora were added manually. Some statistical calculations were performed on these figures.

Most statistical analyses (apart from some comparisons) are based on the frequencies from the largest corpus only. The additional sources are used for quoting examples only, as they cannot be considered sufficiently representative. Some examples will illustrate the point:

- The most frequent *bar*-adjective in the review journal is—not surprisingly—*lesbar* ('readable'). It occurs as often as in the newspaper corpus, which is 50 times as large. Comparing the percentages, it is therefore 30 times more frequent in the review journal.
- In the summarized transcripts there are 142 tokens of the adjective *wählbar* ('eligible'). Although the newspaper corpus is ten times as large, it contains only 27 tokens of the word, so that overall the adjective is 51 times more frequent in the transcripts.
- The very rare word *bundesunmittelbar* ('directly accountable to the Federal government'), with only four tokens in the large newspaper corpus, is the second most frequent *bar*-adjective in the transcripts. It is obviously specific to this subject area.

For the same reason the frequencies were not summed up between all corpora in the appendices. There the *bar*-adjectives from all the corpora are listed, but the frequencies from the Mannheim Newspaper Corpus only are given. Although even this large corpus cannot be considered representative of 'the German language', it is at least a clearly defined subset of it, namely newspaper language as used between 1985 and 1988.

1.2 Form and Function of *bar*-Adjectives

As mentioned before, the prototypical *bar*-adjective is derived from a transitive[5] verb. The verb's accusative object becomes the adjective's 'subject' (or the modified nominal). A standard example is *lesbar* ('readable'):

[4] I would like to thank the IDS (Institut für Deutsche Sprache Mannheim) for providing me with the data from their Newspaper Corpus and Wendekorpus, the Max Niemeyer Verlag Tübingen for allowing me access to the 1991 volumes of their journal 'Germanistik' and the Hermann Paul Dictionary, the 'Forschungsstelle für Zeitgeschichte des Verfassungsrechts in Hannover' for their permission concerning the analysis of the data from the constitution debates, and people at the ZDV (Zentrum für Datenverarbeitung der Universität Tübingen), in particular W. Bader, for arranging some of this and helping with the processing of the data in TUSTEP.

[5] 'Transitive' is here and throughout to be understood as referring to verbs which have objects in accusative case.

(3) *Maria liest das Buch.*
Mary reads the book.

(4) *Das Buch ist lesbar.*
The book is readable.

In this respect *bar*-adjectives resemble passives. It is not normally possible to express the agent in a by-phrase:[6]

(5) * *Deutschland ist nicht von Maria mit Australien vergleichbar.*
Germany is not by Mary to Australia comparable.

What seems to be the former subject can occur in a *für*- or *von*-phrase under certain circumstances, as in (6) or (7)—see also section (1.6).

(6) *Der Kontostand ist von unseren Kunden jederzeit abrufbar.*
The balance is by our customers anytime inquirable.
'The balance is at any time inquirable for our customers.'

(7) *Die Lösung ist für alle Beteiligten annehmbar.*
The solution is for all involved acceptable.
'The solution is acceptable to all persons involved.'

Sometimes further complements can, observationally speaking, be inherited, i.e. the adjective combines for example with a PP headed by the same preposition that the verb selects for.

(8) *Maria verglich Deutschland mit Australien.*
Mary compared Germany to Australia.

(9) *Deutschland ist nicht mit Australien vergleichbar.*
Germany is not to Australia comparable.
'Germany is not comparable to Australia.'

The examples also show the second major effect of affixing -*bar*: a possibility operator is introduced into the semantics. So 'the book is readable' does not mean that 'the book is being read', but that it 'can be read'. A near paraphrase for (9) would be:

(10) *Man kann Deutschland nicht mit Australien vergleichen.*
One can Germany not to Australia compare.
'One cannot compare Germany to Australia.'

[6]Booij & van Haaften (1988) also observe that in general the overt expression of an agent is incompatible with property denoting adjectives.

What distinguishes the meaning of the sentence containing the adjective from the corresponding sentence including the modal auxiliary *can*, is the part of the semantics specific to adjectives. The general constraints on possible meanings for adjectives apply to the output of the *bar*-rule as well: they have to denote properties of a special kind. Adjectival properties are typically inherent to the object described, but certainly they are not true at a very short interval of time only (see Hamann 1991). So something is said to be *tragbar* ('portable') only when it is not particularly heavy—and not if there exists some human being strong enough to carry it. Also, a chair which is *zusammenklappbar* ('collapsible') is a particular kind of chair—and it is still such a chair in situations when for some reason it is not possible to collapse it (perhaps because someone is sitting on it). Therefore sentence (11) is not contradictory:[7]

(11) *Dies ist ein zusammenklappbarer Stuhl, aber im Moment kann man*
This is a collapsible chair, but at the moment can one
ihn nicht zusammenklappen.
it not collapse.
'This is a collapsible chair, but at the moment one cannot collapse it'.

These *bar*-adjectives also cannot readily be substituted into the consequent of conditional sentences, as in (12) vs. (13):

(12) *Wenn man sehr viel Kraft aufwendet, dann kann man den Stuhl*
If one very much force uses then can one the chair
zusammenklappen.
collapse.
'If one uses very much force one can collapse the chair.'

(13) ?? *Wenn man sehr viel Kraft aufwendet, dann ist der Stuhl*
If one very much force uses then is the chair
zusammenklappbar.
collapsible.
'If one uses very much force the chair is collapsible.'

The claim that the possibility operator in some sense focusses on the object has also been made by Flury (1964), who observes that the appropriateness as an object for the activity is in the foreground. This is further supported by the fact that (14) is a better paraphrase for (9) than (10) is.

(14) *Deutschland läßt sich nicht mit Australien vergleichen.*
Germany lets itself not to Australia compare.
'Germany does not compare to Australia.'

[7] These observations also indicate that without further refinements of the notion of possibility the logical formula $\lambda y[\Diamond\exists x[\alpha'(x,y)]]$ traditionally assumed for *bar*-adjectives, for example by Dowty (1979) or von Stechow (1990), is not sufficient.

The fact that *bar*-adjectives tend to express properties of objects—although admittedly more so when the objects are concrete—might also contribute to an explanation of why the example in (15) is ungrammatical, while the corresponding paraphrase in (16) is fine.

(15) * *In diesem Jahr ist der Urlaub nicht in Jugoslawien verbringbar.*
In this year is the holiday not in Jugoslavia spendable.

(16) *Man kann in diesem Jahr seinen Urlaub nicht in Jugoslawien verbringen.*
One can in this year one's holiday not in Jugoslavia spend.
'One cannot spend one's holiday in Jugoslavia this year.'

It does not make sense to think of 'not being spendable in a particular country' as a property of the holiday. This explains why *bar*-adjectives from verbs which subcategorize for an obligatory prepositional object are not very frequent, especially when there is no strong semantic connection to the PP object.

Also, properties expressed by adjectives should not be trivial. Because adjectives are normally used to further characterize something, they should contain a distinguishing characteristic. Therefore a sentence like (17) becomes much worse when one tries to transform it into (18):

(17) *Man kann den Präsidenten töten.*
One can the president kill.
'One can kill the president.'

(18) ?? *Der Präsident ist tötbar.*
The president is killable.

This is probably due to the pragmatic fact that every human being can be killed, so it is not a sensible property to attribute to someone. The sentence in (17), on the other hand, can be understood as part of a larger discourse in which killing the president is one option. It is also possible to modify the sentence, as in (19), while *bar*-adjectives do not readily allow for temporal, local, or manner modification when this would be required to license the adjective in the first place.

(19) *Man kann den Präsidenten nicht leicht in seinem Haus töten (weil*
One can the president not easily in his house kill (because
er so viele Leibwächter hat).
he so many bodyguards has).
'One cannot easily kill the president in his house (because he has so many bodyguards).'

Note that the situation becomes even worse when the adjective is used attributively:

(20) * *Amerika hat einen tötbaren Präsidenten.*
The US has a killable president.

One might at first think that such a pragmatic explanation cannot be correct, since other properties every human being trivially has, such as being *verletzbar* ('injurable'), can be found as *bar*-adjectives. But this word, for example, is either used with abstract entities, or if it refers to human beings it does not concern their physical properties but means something like 'oversensitive' or 'easily offendable'.

In general it has often been observed (e.g. by Flury 1964) that *bar*-adjectives allow complex statements to be expressed concisely. They are made available for attributive use, which also opens the possibility of combining them with other adjectives. This fits well with the fact that they are very frequently used in newspaper headlines and advertising.[8] They also form an example of the general tendency of expressing things passively, giving a good excuse for not specifying the agent.[9]

1.3 Overview of Existing *bar*-Adjectives

A brief look at the statistics from the corpora shows clearly that *bar*-derivation is indeed a highly productive process. In the large newspaper corpus more than half (435) of the different types of *bar*-adjectives occur only once or twice, thus contributing only 3.15% of the tokens. But there is also a limited number of very frequent, lexicalized *bar*-adjectives. In fact, 7% of the types (the 60 most frequent ones) account for 70% of the tokens. It seems clear that any serious account cannot simply list all *bar*-adjectives. In the only corpus-based study on the *bar*-adjectives of contemporary German published so far (Gelhaus 1977) 313 different types were found and it was claimed that a larger corpus was not likely to contain significantly more than that. But in the newspaper corpus alone there are almost three times as many different types, namely 836. All in all I have come across more than 1200 different *bar*-adjectives—see Appendix A for a complete list—and even this cannot be a final number. Many *bar*-adjectives were noticed in texts and spoken language that are not found in any of the corpora, and most of these are perfectly ordinary ones like *unterbrechbar* ('interruptible'), *einbaubar* ('installable'), *einhaltbar* ('keepable') or *abwandelbar* ('modifiable'). Also, subject specific terms like *passivierbar* ('passivizable') are not likely to come up in newspaper texts and are not found in the corpus. And it will always be possible to form *bar*-adjectives from new verbs such as *mailen* ('to send by e-mail'):

[8] In recent advertising the adjective *unkaputtbar* ('un-broken-able') appeared, describing a characteristic of plastic Coke bottles. This adjective was created not from a verb but from the adjective *kaputt*, resulting in a startling 'impossible' (but memorable) word.

[9] This might partly explain why e.g. politicians who want to avoid making direct commitments like to use adjectives like *durchführbar* ('feasible'): they do not have to promise they will really do it. And conversely, when something is claimed to be *undurchführbar* ('unfeasible') this is just a matter of fact, and few people will ask 'by whom' it cannot be done and why.

(21) *Ich muß meine Hierarchie noch in ein mailbares Format bringen.*
I must my hierarchy still into an e-mailable format bring.
'I still have to bring my hierarchy into an e-mailable format.'

Maybe Gelhaus' claim has to do with the fact that *bar*-derivation is more productive now than it was at the time his book was written.[10] His list does not include some *bar*-adjectives that are now very frequent, such as *nachvollziehbar* ('comprehensible'), *unverzichtbar* ('indispensible'), *durchsetzbar* ('achievable'), *vermittelbar* ('conveyable') and *abbaubar* ('decomposable')—but these are also rare in the 1966/67 corpus.

Vermittelbar is also not included in the DUDEN (1991), which is quite inconsistent in mentioning some rare and completely regular words like *erforschbar* ('explorable') or *undeklinierbar* ('indeclinable'), while not listing frequent ones like *verantwortbar* ('justifiable'), *erneuerbar* ('renewable'), *unvertretbar* ('insupportable'). *Erneuerbar* is, admittedly, a recent formation, but while it did not appear in the 1966/67 corpus it has been used in 1985 already.

Among the lexicalized *bar*-adjectives there are exceptions of all kinds.

- For some verbs ending in *-ig* this syllable is dropped, as in *entschuldigen* ('excuse')—*entschuldbar* ('excusable').
- Some *bar*-adjectives have an additional aspect of meaning: *eßbar* ('edible') implies that something can safely be eaten, *beeinflußbar* ('impressionable') that someone can easily be impressed or influenced.
- In some cases the interpretation is not quite one of possibility: *haftbar* ('liable'), *strafbar* ('punishable'), *ehrbar* ('reputable'), *zahlbar* ('payable'). The additional necessity aspect has become part of the lexical meaning of these adjectives.
- In quite a few cases the underlying verb is not a transitive one and the subject consequently does not correspond to an accusative object. Instead it may be an object in dative case, as in *unentrinnbar* ('inescapable') or a prepositional object, as in *verfügbar* ('available'). Sometimes the verb is reflexive, as in *auflösbar* ('soluble'), *regenerierbar* ('regenerable'), or *unbeirrbar* ('imperturbable').

[10] This is an impression one gets from the data, but it is not verifiable by calculating simple percentages since the corpora are of different sizes and it is difficult to determine what would be the corresponding frequency in the large corpus of a word that occurs once in the smaller corpus. The more types have been found already, the less likely it gets of course that one comes across a new one, while roughly the same number of tokens will be observed. The best thing to do if one wants to compare the productivity would be to take equally sized random subsets of both corpora. At least it can be seen from the figures that the use of *bar*-adjectives has increased, although the 'Wendekorpus' is an exception to this trend (which again shows that the size of a corpus, the type of text, and the kind of topics covered, should not be underestimated).

- Some *bar*-adjectives are formed from intransitive verbs: *brennbar* ('combustible').
- Sometimes the verb can only be used in certain syntactic environments, such as *absehbar* ('foreseeable') (*das läßt sich noch nicht absehen* vs. **ich sehe das Ende ab*).
- In some cases the first part is not the lexical entry of a verb. *Sichtbar* ('visible') means exactly what it would mean if it was derived form the verb *sehen* ('see'), not *sichten* ('sight', 'sift').
- For some *bar*-adjectives, such as *unabdingbar* ('indispensible'), there is no verb to which they could be related.
- There are some vestiges from the time when *bar*-adjectives were still compounds. The suffix originated as a verbal participle, with a nominal first part of the compound interpreted as its object. A still existing example is *fruchtbar* ('fertile', 'fruitful'). It was originally interpreted as 'bearing fruit'. Even these have something in common with the rule: they are adjectives and can serve as input for further affixation, namely *keit*-suffixation: *Fruchtbarkeit* ('fertility', 'fruitfulness'). Note that the suffix *-keit* can productively only attach to adjectives ending in either of the four suffixes *-bar*, *-lich*, *-sam*, and *-ig*, which has to be accounted for morphologically unless a satisfactory phonological explanation can be found.
- The two most frequent German words ending in *-bar*[11] are mainly used adverbially and have hardly anything to do with the others: *offenbar* ('obvious', 'obviously') and *unmittelbar* ('immediate', 'directly').

These facts show that complex words are not always interpretable in a completely compositional fashion and that lexicalization can result in semantic drift and the development of all sorts of idiosyncrasies. Very often the adjectives can be interpreted compositionally, but have institutionalized in a specialized meaning which corresponds to only one of the senses of the underlying verb. *Haltbar* ('keep-able', 'nonperishable') is used for food,[12] *unhaltbar* ('untenable') for positions, *absehbar* ('foreseeable') is mostly used in a fixed collocation with 'time' or 'future', *abbaubar* ('decomposable') mostly applies to chemical substances, and *vertretbar* ('justifiable', 'tenable') is used for points of view or theories, not normally for people (the verb *vertreten* can also mean 'to substitute for').

Of course, even if there is such a specialized meaning, it is still possible to use the word productively (in the case of *eßbar* this would mean without the 'safely'

[11] For a list of the most frequent *bar*-adjectives ordered by frequency see Appendix B.

[12] There is actually another interesting lexicalized form of *haltbar*, meaning roughly 'durable', where in the active sentence it is the subject that 'holds' the object: *die Nähte halten das Kissen zusammen* ('the seams hold the cushion together'), but it is also the subject that is said to be *haltbar*: *die Nähte sind haltbar* ('the seams are durable').

qualification in the semantics, corresponding more to 'eatable' than 'edible'), but this is much less common if not impossible in some attributive uses:

(22) * *Klar sind das eßbare Pilze, wenn man unbedingt Selbstmord*
Of course are these eatable fungi, if one absolutely suicide
begehen will.
to commit wants.

Many *bar*-adjectives have a preferred environment in which they occur frequently, such as *sich bemerkbar machen* ('to make oneself noticeable'), *erneuerbare Energiequellen* ('renewable sources of energy'), *untrennbar verbunden mit* ('inseparably linked with'), and *strafbare Handlungen* ('punishable deeds').

It is also interesting to note that some *bar*-adjectives occur only in modified form themselves: *abbaubar* ('decomposable') is an example. It seems that only in combination with an adverb like *biologisch* ('biologically') in *biologisch abbaubar* ('biodegradable'), or *nur sehr schwer* ('only to a very limited extent') this word meets the requirements of *bar*-adjectives to express a non-trivial property. For an analysis of this kind of modification some kind of event semantics seems to be needed.

1.4 New Formations

In this section the restrictions on possible 'input' verbs for *bar*-derivation will be examined by looking at the ample evidence provided by new formations from the corpora. It is assumed that infrequent words which one has not consciously heard before and which are not listed in dictionaries are too rare to have been learnt as exceptions.

In the linguistic literature it is often claimed that the correct generalization for new *bar*-adjectives is that they can freely be formed from any transitive verb. This is motivated by the observation that they can typically neither be formed from intransitive verbs, as illustrated in (23), nor from verbs which demand an object in dative case, as in (24), nor from reflexive verbs (25).

(23) * *Der Student ist arbeitbar.*
The student is workable.

(24) * *Der Freund ist helfbar.*
The friend is helpable.

(25) * *Ich bin irrbar.*
I am errable.

But the claim cannot be correct in this form, for two reasons:

1. *Bar*-adjectives cannot be formed from all transitive verbs.
2. *Bar*-adjectives can be formed from some non-transitive verbs.

In order to address the first problem, some authors, e.g. Toman (1987), have proposed further constraints on verbs serving as input for the *bar*-rule. It was claimed that the verbs have to be (weakly) intentional, which includes not only verbs in which the subject is an intentionally acting agent but also those where at least 'an effort can be made'. As examples he gives *erkennen* ('recognize'), *bemerken* ('notice') and *erraten* ('guess'). This constraint is intended to exclude examples such as ?*verbitterbar* ('embitterable'), ?*enttäuschbar* ('disappointable') and ?*überraschbar* ('surprisable'). While it is disputable whether these really should be excluded, it is clear that thematic restrictions in addition to the syntactic ones are needed to exclude **wiegbar* ('weighable'), **dauerbar* ('lastable'), **brauchbar* ('needable') (*brauchbar* **can** mean 'useful' of course) and **erzielbar* ('realizable'), as in (26), (27), (28) and (29). Indeed, it has often been observed that *bar*-adjectives can only be formed from verbs that can also be passivized.

(26) * *50 kg sind (von dem Koffer) wiegbar.*
50 kilos are (by the suitcase) weighable.

(27) * *Zwei Stunden sind (von dem Vortrag) dauerbar.*
Two hours are (by the talk) lastable.

(28) * *Hilfe ist (von Maria) brauchbar.*
Help is (by Mary) needable.

(29) * *Ein guter Preis ist (von dem Bild) erzielbar.*
A good prize is (by the picture) realizable.

But an absolute intentionality constraint would also wrongly exclude possible examples like *abbaubar* ('decomposable'), *resorbierbar* ('absorbable'), *regenerierbar* ('regenerable'), and *verformbar* ('deformable'):

(30) *biologisch leicht abbaubare Stoffe*
biologically easily decomposable substances
'easily biodegradable substances'

(31) *langsam resorbierbare Kohlehydrate*
slowly resorbable carbohydrates

(32) *regenerierbare Energie*
regenerable energy

(33) *selbst die härtesten Gesteine sind von Wasser verformbar*
even the hardest rocks are by water deformable
'even the hardest rock is deformable by water'

Furthermore, there seem to be other constraints at work. For phonological reasons stems ending in *-lich* (??*verherrlichbar* ('glorifyable')), or *-bar* itself (??*vereinbarbar* ('arrangeable')) or even ?*aufbahrbar* ('lay-out-able') cannot readily serve as input. But these restrictions are becoming less and less important for *bar*-formations: the words sound funny but are interpretable, and further restrictions such as an incompatibility with stems ending in *-ig*, which were still noted by Flury (1964) and Gelhaus (1977), are already violated by examples from the corpora (*vernachlässigbar* ('neglectable'), *verflüssigbar* ('liquefiable'), *bewältigbar* ('managable') and *rechtfertigbar* ('justifiable')). More importantly, there are pragmatic restrictions requiring that the property expressed by the *bar*-adjective be a non-trivial one: *unspielbar* ('unplayable') can be used only when talking about, say, a drama or a difficult piano piece, while it is hard to think of an appropriate context where *schlagbar* ('beatable (phys.)'), *tötbar* ('killable') or *haßbar* ('hatable') would be a sensible property of someone/something. If such a context can be found they should become possible. This seems to be a correct prediction: in the sense of 'beatable', *schlagbar* can be used:

(34) *Die Mannschaft ist nicht schlagbar.*
The team is not beatable.

(35) *Peter ist im Schach unschlagbar.*
Peter is at chess unbeatable.
'Peter is unbeatable at chess.'

Also, being not 'killable' for some reason might be a sensible thing to attribute to someone in a science-fiction context, or to a UNIX process.

While additional constraints on the input may in principle be found, it is impossible to account for adjectives derived from non-transitive verbs if the rule makes reference to an accusative object. But there are examples in the corpora for formations analogous to the 'irregular' cases mentioned in the previous section, excluding of course those where the semantic or morphological effect would not be predictable. Neither transitivity[13] nor intentionality are necessary conditions.

There are cases of newly formed words from intransitive verbs,[14] for example *verrottbar* ('rottable', 'decayable'),[15] from verbs with objects in the dative: *unausweichbar* ('inevitable') and from prepositional objects: *zugreifbar* ('accessible'). In quite a few cases the basis is a reflexive verb, e.g. *verformbar* ('deformable') (under the influence of water).

[13]It has been suggested to me that what is going on in these cases is a 'cognitive transitivization'—a suitable relation is induced from the intransitive one. While this might be quite convincing for an intuitive explanation, I do not see how it would be possible to express the restrictions on this process formally.

[14]According to van der Putten (1986), there are cases like this also with the corresponding Dutch suffix *-baar*, and Corbin (1987) has found 50 *able*-adjectives from intransitive verbs in French.

[15]It does not seem to be the case that all inchoatives can serve as 'input', **erblühbar* ('blossomable') and **verklingbar* ('fade-away-able') do not sound too good to me (though better than other intransitives).

In some of the exceptional cases the word seems to be formed from the existing negated word, *abdingbar* ('dispensible') seems to be directly derived from *unabdingbar* ('indispensible'), *verzichtbar* ('dispensible') from *unverzichtbar* ('indispensible'), *wägbar* from *unwägbar*, and *nahbar* ('approachable') from *unnahbar* ('unapproachable'). Sometimes the verbs exist only in certain forms. So *ausdenkbar* ('thinkable') can only be related to *nicht auszudenken*, *umstreitbar* ('disputable') to *umstritten*, *versehrbar* ('hurtable') to *unversehrt*, *lädierbar* ('destroyable') to *lädiert*, and *erwünschbar* ('desirable') to *erwünscht*.

Some *bar*-adjectives even have no independently existing verbal base at all. *Erdenkbar* ('thinkable'), *erschwingbar* ('affordable'), and *unwiederbringbar* ('irretrievable') are probably related to *erdenklich*, *erschwinglich*, and *unwiederbringlich* respectively, lexicalized words with roughly the same meaning. This kind of process could be responsible for some of the cases with non-transitive verbs as well; some cases the negated and/or corresponding *lich*-adjectives are lexicalized. Erben (1983) even speculates that existing English adjectives (like e.g. *unapproachable*) might have inspired the corresponding formations (*unnahbar*).

Note that ergativity will not help to explain the phenomenon of formations from non-accusative objects. While it is the case that most of the observed 'exceptions' violate syntactic constraints only and still conform to the semantic ones, it does not seem correct to completely abandon syntactic conditions. Not all 'theme' arguments of intransitive verbs can become the subject of a *bar*-adjective, as (36) and (37) show.[16]

(36) * *Das Glas ist brechbar.*
The glass is breakable. [17]

(37) * *Das Blatt ist fallbar.*
The leaf is fallable.

Here is a table of some more new *bar*-adjectives from non-transitive verbs:[18]

[16] It would be interesting to investigate whether the facts can be accounted for in an analysis along the lines suggested in Dowty (1991). Perhaps there just need to be a sufficient number (or a certain set) of agent and patient entailments, no matter whether they are expressed by one or two phrases. In some sense there may be an implicit cause (perhaps the sun) in *versiegbar* ('dry-up-able') but not in **verklingbar* ('fade-away-able') (although another reason for the impossibility of *verklingbar* might be the pragmatic fact that every sound can—and eventually will—fade away).

[17] Note that there is another verb, *zerbrechen* ('break'), which corresponds to the transitive use of 'break', and from which a *bar*-adjective **can** be formed.

[18] The frequencies (column F) are summed up between all corpora here; for those from the largest corpus see Appendix A. For three words which can also be used transitively (*aufladen*, *auflösen*, and *vererben*) only the intransitive/reflexive tokens have been counted. It is imaginable that their reflexive uses are facilitated by the fact that such a related word exists. *Erneuerbar* is included in this table although it is not really a 'rare' word, since it **is** a word that has been recently formed (it does not occur in the 1966/67 Newspaper Corpus).

Verb Class	bar-Adjective	Translation	F	Context
dative	*nahbar*	'approachable'	1	
	unausweichbar	'inevitable'	1	Wiedererkennen
	unentfliehbar	'inescapable'	1	Gefahr
	unentziehbar	'unwithdrawable'	2	
	unwidersprechbar	'unopposable'	1	
	unwiderstehbar	'irresistible'	1	
prepositional	*abstimmbar*	'votable'	1	Vorschlag (über)
	abstrahierbar	'abstractable'	1	(von)
	erinnerbar	'rememberable'	1	das Gestern (an)
	handelbar	'tradable'	4	Ware (mit)
	hantierbar	'handleable'	2	Werkzeug (mit)
	quantifizierbar	'quantifiable'	7	(über)
	unzweifelbar	'undoubtable'	1	unzweifelbar ein großes Talent (an)
	verzichtbar	'abstainable'	4	Sandoz-Präparate (auf)
	zugreifbar	'accessible'	1	logische Variable, Lexikon (auf)
reflexive	*abnutzbar*	'wearing-out-able'	1	
	amortisierbar	'amortizable'	1	
	assimilierbar	'assimilable'	1	
	aufladbar	'chargable'	1	elektrostatisch aufladbar
	auflösbar	'dissolvable'	2	
	aufrollbar	'unrollable'	1	
	ausweisbar	'identifying-oneself-able'	1	Person
	begebbar	'goable'	1	
	deformierbar	'deformable'	1	organische Masse
	entzündbar	'inflammable'	8	Stoffe
	erhärtbar	'corroboratable'	1	Verdacht
	erhellbar	'brightenable'	1	
	erneuerbar	'renewable'	37	Energiequellen
	konkretisierbar	'materializable'	2	Bedrohung
	vererbbar	'inheritable'	1	Merkmal in einem linguistischen Baum
	verflüchtigbar	'evaporatable'	1	
	verflüssigbar	'liquefiable'	1	
	verformbar	'deformable'	5	unter dem Einfluß von Wasser
	wandelbar	'convertible'	1	
	zersetzbar	'decomposable'	2	Naturstoffe
intransitive	*aufwallbar*	'surgable'	1	patriotisches Gemüt
	entflammbar	'inflammable'	7	Material
	ermüdbar	'tirable'	1	
	explodierbar	'explodable'	1	
	faulbar	'decayable'	1	
	kristallisierbar	'crystallizable'	1	
	mutierbar	'mutatable'	1	Gene als mutierbare Einheiten
	oxydierbar	'oxydizable'	1	
	schäumbar	'foamable'	1	
	schwimmbar	'floatable'	1	
	tropfbar	'drippable'	1	
	unausbleibbar	'inevitable'	1	
	ungerinnbar	'uncoagulatable'	1	Blut im Unterleib
	unsinkbar	'unsinkable'	7	Luxusschiff
	unverfallbar	'expirable'	1	Anwartschaften auf Pensionen
	unverjährbar	'lapsable'	1	
	unversiegbar	'dry-out-able'	1	Urquell aller Kultur
	unverwelkbar	'unwiltable'	1	
	verheilbar	'healable'	1	Wunde
	verlaufbar	'dispersable'	1	Farbe
	verwesbar	'rottable'	1	
	verrottbar	'decayable'	2	Abfälle
	verwitterbar	'crumblable'	1	
	zerknallbar	'burstable'	1	
	zerfließbar	'meltable'	1	

1.5 Argument Inheritance

Bar-adjectives offer a wealth of data on the question of when ARGUMENT INHERITANCE is possible and how it is best described. As Toman (1987) observes, prepositional objects (38) and in some cases even dative objects (39) can be 'taken over' by the adjective.

(38) *Diese Problematik ist von den übrigen Fragen nicht abgrenzbar.*
This difficulty is from the further questions not delimitable.
'This difficulty is not delimitable from the further questions.'

(39) *Die Tat war dem Angeklagten nicht nachweisbar.*
The deed was the(dat) accused not demonstrable.
'It was not demonstrable that the accused was guilty of the deed.'

There are some examples of this also in my corpora, for instance:

(40) ... *daß diese Viren auf Menschen übertragbar sein könnten.*
... that these viruses onto humans transferable be could.
'... that these viruses could be transferable to human beings.'

But not all oblique complements can be inherited. The view expressed in Toman (1987) is, for example, that prepositional objects of directional verbs cannot be inherited, and that forming *bar*-adjectives from such verbs is generally impossible. Two of his examples are:

(41) * *Die Vase ist auf den Tisch stellbar.*
The vase is onto the table puttable.

(42) * *Die Statue ist hinter der Wand versteckbar.*
The statue is behind the wall hidable.

This claim does not seem to be correct in its full generality, since examples like the following ones can be found which are perfectly acceptable:

(43) *Der Hebel ist nur nach links verstellbar.*
The handle is only to left adjustable.
'The handle is adjustable only to the left.'

(44) *Das Auto ist nach Deutschland importierbar.*
The car is to Germany importable.
'The car is importable to Germany.'

(45) *in den Schrank legbar*
into the wardrobe puttable

(46) *in eine Datei umleitbar*
into a file redirectable

(47) *an ein Modem anschließbar*
to a modem connectable

It is not yet clear just under what circumstances argument inheritance is possible. To me—and to everyone I have asked—the sentence in (42) becomes much better when it is pragmatically plausible, as in (48), where the statue might be too big to be fully hidden away.

(48) ? *Die Statue ist nicht hinter dem Sofa versteckbar.*
The statue is not behind the sofa hidable.
'The statue is not hidable behind the sofa.'

This difference in acceptability probably has to do with the negation, since it is easier to imagine contexts where it is for some reason **not** possible to hide something. Also, the fact that these properties are much more complex than those which adjectives typically express, might play a role.

In this context the question of ATTRIBUTIVE vs. PREDICATIVE use of *bar*-adjectives becomes relevant as well. Additional arguments are found much more frequently with predicative uses. Predicative *bar*-adjectives seem to retain a partly verbal character and to serve primarily a passivizing function. PP-arguments can be found to a much lesser extent with attributive adjectives. This might partly be explained by syntactic constraints on the complexity of APs. But it probably also has to do with the kinds of properties expressible by adjectives in general. Attributive adjectives have a considerably greater tendency to express directly observable, lasting and simple properties.

But note that in contrast to English (see Arnold & Sadler (1992) for a treatment of this and other facts about adjectives in English in an HPSG framework) additional PP-complements **can** be found with attributive adjectives in German, as (49), (50) and (51) show:

(49) *die von den übrigen Demonstranten abgrenzbare Gruppe von*
the from the other demonstrators delimitable group of
Gewalttätern
violent criminals
'the group of violent criminals, delimitable from the other demonstrators'

(50) *ein auf unterschiedliche Phänomene anwendbarer historisch-politischer*
a to different phenomena applicable historical-political
Ausdruck
expression
'a historical-political expression applicable to different phenomena'

(51) *eine mit einem Hauptschulabschluß vergleichbare Qualifikation*
a with an O-level comparable qualification
'a qualification comparable to O-level'

Note that the *bar*-adjectives which occur together with PP-complements can also be used without the corresponding argument position being syntactically filled. Examples of this are *vergleichbare Methoden* ('comparable methods'), *verwechselbare Gesichter* ('mix-up-able faces') or *diese beiden Vorschläge sind unvereinbar* ('these two proposals are incompatible'), where the semantically required second argument can be realized within a plural. In fact, I did not come across any *bar*-adjective with an obligatorily inherited PP-complement—cases like *beziehbar* ('relatable'), where it is impossible to say that two things are *beziehbar*, are not found among my data.[19]

(52) ??? *Deine Äusserung ist nicht auf Deinen Brief beziehbar.*
Your utterance is not to your letter relatable.

Although some of the facts seem to indicate an inheritance of arguments, it is open to debate whether this is the correct view of the facts. There are hardly any 'inherited' datives in the data—*ihm nicht verwehrbar* ('him not denyable'), *ihm vermittelbar* ('him conveyable'), *ihm nicht entwendbar* ('him not stealable') are not found for example. Although these do not seem completely impossible and negative evidence cannot be extracted from corpora, this suggests that allowing argument inheritance in general might not be the best way to go. Note that the adjective *vergleichbar* ('comparable') can occur with datives although the verb itself cannot (it selects the preposition *mit* ('with')):

(53) *vergleichbar dem Ansatz von ...*
comparable the(dat) approach of ...
'comparable to the approach of ...'.

This seems an idiosyncrasy exhibited by this word only, but a more detailed study would be needed of the kinds of prepositions selected by the adjectives to find out if indeed they are the same as the verb's in every case and whether this choice is idiosyncratic and cannot be explained semantically (cf. the work on linking by Büring 1991 or Wechsler 1991). Fanselow (1988 & 1991) for example argues in favor of a conceptual interpretation of these PPs parallel to those occurring with non-derived words. But Reis (1988) and Hoeksema (1992) both provide evidence for argument inheritance, although they acknowledge that non-syntactic mechanisms like semantic analogy play an important role as well.

1.6 Un—bar Adjectives

With respect to the possibility of argument inheritance, *bar*-adjectives which are prefixed by *un-* (referred to as *un—bar* adjectives here) are also very interesting. The semantics of *un-* seems to somehow close all open argument places, so that

[19]The two occurrences of *beziehbar* in the corpus are from another verb, the transitive 'move in'.

something that is *un-VERB-bar* cannot possibly be *VERB-ed* by anyone in any place at any time. This explains why in particular argument inheritance is not possible in *un—bar* cases: if something is, for example, *unanwendbar* ('inapplicable'), it cannot be applied to anything—if the inapplicability is limited to a certain object, ordinary negation has to be used (it might be contextually limited of course.)

This closing of argument places probably has to do with the fact that *un-* is a morphological, bound negation, having scope only over the adjective, so an *un—bar* adjective expresses a negative property someone has, and forms in some sense the antonym of the corresponding positive *bar*-adjective. *Un—bar* adjectives also presuppose the existence of the modified object more strongly than ordinary *nicht* negation.

So the difference between the semantics of *unverwechselbar* and *nicht verwechselbar* seems to be in the scope of the negation: *ihre Stimme ist unverwechselbar* ('her voice is unmistakable') is [¬(mistakable)](voice) while that of *ihre Stimme ist nicht verwechselbar* ('her voice is not mistakable') is ¬[(mistakable)(voice)] (Lenz 1991), leaving open the possibility of stating with what the voice cannot be mixed up.

And indeed *un—bar* adjectives characteristically do not allow for argument inheritance, in the whole corpus I have found only a few examples, most of which do not sound particularly good to me. The one I found most acceptable is (54):

(54) ? *Er ist unvergleichbar mit anderen Komponisten seiner Zeit.*
He is incomparable to other composers of his time.

The only *un—bar* adjective that freely allows such a PP 'inheritance' is a highly idiosyncratic one: *unvereinbar* ('incompatible'). This adjective means roughly what *unvereinbarbar* would mean (if it was not phonologically odd and nonexistent). Also, the verb is rarely used in its base form—it normally occurs in collocations such as *das läßt sich nicht vereinbaren mit*. So it is questionable whether the occurrence of *mit*-phrases with *unvereinbar* (as in: *mit diesem Grundsatz unvereinbar* ('with this principle incompatible')) should really be described as a case of direct argument inheritance, in particular in view of the fact that it is almost the only such case.

Ordinary *bar*-adjectives in some cases allow the expression of the former subject, normally the 'agent', in an additional *für-* or *von*-phrase.[20] The question is whether it is interpreted directly as the agent (after all, the verb's selectional restrictions seem to be obeyed), or whether the interpretation comes in indirectly (cf. Höhle (1978) for such a suggestion with respect to passives).

In the case of *un—bar* adjectives such agent expressions occur much less frequently, and *von*-phrases do not occur at all.

[20]Actually, there are also cases of 'agents' in dative objects: *auch dem nicht-Musiker erkennbar werden* ('become recognizable also to the non-musician').

Most examples of *für*-phrases seem to be ambiguous in the sense that the *für*-phrase can also be interpreted as just specifying from which perspective something has the given adjectival property.

(55) *für den Präsidenten unantastbar*
for the president untouchable

(56) *für Metalldetektoren unauffindbar*
for metal detectors undetectable

(57) *für den Gesetzgeber nicht unlösbar*
for the legislator not insoluble

(58) *Frauenarbeit ist für Männeraugen unsichtbar*
women's work is for men's eyes invisible

(59) *die für einen Normalbürger unvorstellbare Summe von 20 Milliarden Mark*
the for an average citizen inconceivable sum of 20 billion marks
'the sum of 20 billion marks, inconceivable for an average citizen'

(60) *für viele ist es unvorstellbar, daß ...*
for many is it inconceivable that ...
'for many it is inconceivable that ...'

Also, fairly parallel cases can be found with non-derived adjectives:

(61) *für den Präsidenten heilig*
for the president sacred

(62) *für Metalldetektoren verborgen*
for metal detectors hidden

(63) *für den Gesetzgeber nicht sehr problematisch*
for the legislator not very problematic

(64) *Frauenarbeit ist für Männeraugen nicht existent*
women's work is for men's eyes non-existent

(65) *die für einen Normalbürger ungeheuer große Summe von 20 Milliarden Mark*
the for an average citizen tremendously large sum of 20 billion marks
'the sum of 20 billion marks, tremendously large for an average citizen'

(66) *für viele ist es ein kleines Wunder, daß ...*
for many is it a small miracle that ...
'for many it is a small miracle that ...'

Here the *für*-phrases cannot be interpreted as supplying agents, and it is worth investigating to which extent the strategies used for their interpretation can also account for the other cases. The fact that seemingly inherited phrases can also be found with non-derived words, and thus match the complementation possibilities of the target category, has also been observed by Hoekstra & van der Putten (1988) and Fanselow (1988).

Note that even some *bar*-adjectives not formed from verbs can occur with these phrases:

(67) *für uns ist unabdingbar ...*
for us is indispensible ...

In one case, if anything, it has to be interpreted as a theme, not agent, since the doctors of the following example are (dative) object, not subject of the verb *zumuten*.

(68) *die vor allem für Krankenhausärzte unzumutbare rechtliche*
the in particular for hospital doctors unacceptable legal
Unklarheit
unclarity
'the legal unclarity, unacceptable in particular for hospital doctors'

This is also supported by the observation that *von*-phrases—which are normally seen as a more direct form of agent phrase—do **not** occur with *un—bar* adjectives.

(69) * *Siegfried ist von Peter unverwundbar.*
Siegfried is by Peter invulnerable.

A calculation has been made of the percentage of tokens of *bar*-adjectives that are prefixed by *un-*. Their total share is about 38% and the percentage among the attributive uses is 51%. The most frequent *bar*-adjectives occurring only prefixed by *un-* are *unbeirrbar* ('imperturbable'), *unleugbar* ('undeniable'), *unverkennbar* ('unmistakable') and *unverrückbar* ('unmovable'). The corresponding non-negated words can probably be formed by analogy as has happened already with some others that occurred only with the prefix in the large corpus, but without it in some other corpus: *unabdingbar* ('indispensible'), *unbelehrbar* ('uninstructable'), and *unüberhörbar* ('unignorable'). It would be interesting to analyze more closely the semantic conditions for this kind of negation, which could be done by inspecting the lists of those *bar*-adjectives occurring exclusively together with the prefix *un-*, or without the prefix only. Some examples of this latter kind are *abbaubar* (‘decomposable’), *feststellbar* (‘ascertainable’), *verfügbar* (‘available’), and *spürbar* (‘perceptible’). If a given *bar*-adjective is always modified, like *abbaubar*, this might be one reason for the impossibility of *un*-prefixation which would have to be tested further. The length or complexity of the *bar*-adjective probably plays a role as well, for example in explaining the impossibility of **unwiederverwertbar* (‘unreusable’).

1.7 Attributive versus Predicative Uses

There are *bar*-adjectives which occur almost exclusively in predicative position: *vereinbar* (‘compatible’) is an example (occurring 89 times, 88 out of which predicatively). Also, sentences in which the *bar*-adjective does not occur with a noun but a *daß*-clause, cannot be transformed (*Es ist nicht vorstellbar, daß* ... (‘It is not conceivable that ...’).

In principle all *bar*-adjectives which can be used attributively can also be used predicatively. But there seems to be a tendency for newly formed cases with an exceptional nature (from intransitive verbs or non-intentional ones) to be used attributively. This might be due to the fact that a predicative adjective can be replaced more readily by a corresponding verbal paraphrase. When an attributive adjective is needed, in order to be coordinated with other adjectives for instance, there is a much stronger incentive to form a new word, even if it does not completely conform to ‘the norm’. The word *verrottbar* (‘decayable’) for example—which is not completely regular because the underlying verb is intransitive—occurs in coordination with two other adjectives in the corpus (70):

(70)	*sortieren*	*in*	*verbrennbaren,*	*verrottbaren*	*und*	*wiederverwertbaren*
	sort	into	burnable,	decayable,	and	reusable
	Müll					
	rubbish					

Statistical analyses were conducted on the proportions of predicative and attributive uses among occasional and lexicalized *bar*-adjectives. The criterion for being ‘occasional’ was an occurrence in the corpus between one and three times, and that for being ‘lexicalized’ between 10 and 500 times. The numbers are based on the automatically calculated frequencies of inflected and uninflected forms only (which does not discount adverbial uses). The result was 56% attributive uses among the occasional words vs. 46% among the lexicalized forms. It is not clear whether it is worthwhile doing a more precise calculation since the observed tendency among rare words might be counterbalanced by some very frequent and preferably attributively used adjectives. It would be more interesting to take into account only the occasional words of an exceptional nature—among these, attributive uses indeed appear to be more frequent. But this is not a statistically sound result since rare words are by definition too infrequent to provide a solid basis for this type of statistical calculation.

Although this has not been looked at in detail, it should not be forgotten that many *bar*-adjectives can also be used adverbially. For some this is even the preferred, if not only, way in which they can occur: *unrettbar verloren* ('irrecoverably lost') is an example.

1.8 Further Characteristics of the Data

Further interesting information could be extracted from the reverse list: verbs whose stem ends in *-ier* contribute for instance 185 types, which is 22%.[21] Among them are some which violate syntactic conditions. These are for example *hantierbar* ('handleable'), *abstrahierbar* ('abstractable') and *amortisierbar* ('amortizable'), showing formations from prepositional objects and reflexive verbs. *Kommunizierbar* ('communicable') seems to be an exception of yet another kind: the verb exists but cannot be used transitively. Still the implicit topic of the communication can become the subject of the *bar*-adjective.

It is also striking that only about 200 of the types have non-complex stems. It would need checking to ascertain whether this is semantically motivated (prefixed verbs being more specific in their meaning). In particular a comparison would need to be made with the frequencies of the corresponding verbs. This was not possible for reasons explained before.

Formations with *wieder-* and *weiter-* are very popular at the moment: *wiederverwertbar* and *weiterverwendbar* (both meaning 'reusable') are concepts that were not needed so much a few years ago.

In some cases there are corresponding adjectives in *-lich* (*veränderlich* ('changeable'), *unersetzlich* ('irreplaceable'), *unausweichlich* ('inescapable')). These are lexicalized, and new *-lich* formations of this kind are not productively possible. Semantically they exhibit an even stronger focus on the object, consequently there are forms from intransitive verbs as well. This increased orientation towards the object shows e.g. in the fact that *von*-phrases are much worse if not totally impossible with *lich*-adjectives: *von den Benutzern veränderbar* ('modifiable by the users') vs. **von den Benutzern veränderlich*. It remains to be seen whether there is some kind of BLOCKING effect in these cases. Probably the formation of a *bar*-adjective is not blocked completely by the *lich*-adjective since there is normally a fine but noticeable difference in meaning. Perhaps the fact that *-lich* is no longer productive explains partly why in some cases *bar*-adjectives are formed when an adjective is needed from an intransitive verb.

Sometimes there is a (near) paraphrase with a modal passive, as in (72).

(71) *Das Ende war absehbar.*
The end was foreseeable.

[21] It would need to be checked whether this is any different from the percentage of verbs with this ending. This is difficult because tagged corpora of German are rare, and in particular a list of all verbs from the analyzed corpus was not available.

(72) *Das Ende war abzusehen.*
The end was to be foreseen.

It would also be interesting to see under what circumstances this is possible. It does not always work, as (73) shows.

(73) *Das Buch ist zu lesen.* ≠ *Das Buch ist lesbar.*
The book is to be read. The book is readable.

This seems to be due to the preferred reading in which it is an order (the modal passives can have an interpretation of possibility or necessity). Note also that the paraphrase in (72) is not a complete one: there seem to be some valid inferences only. If something is in principle not foreseeable, it cannot be foreseen. If something can be foreseen, it is foreseeable. But if something cannot be foreseen, it may or may not be foreseeable in principle. And if something is foreseeable in principle (e.g. the next eclipse of the sun), it may or may not be possible to foresee it in a given situation (without the necessary knowledge and equipment). Paraphrases with *zu* seem better when the adjective is modified by *leicht*, as e.g. in *leicht nachweisbar - leicht nachzuweisen* ('easily demonstrable'). It is not possible though when the adjective is modified by other adverbs, such as *statistisch belegbar* ≠ *statistisch zu belegen* ('statistically verifiable').

In so far as this is possible given the limited amount of data available on spoken language, a short comparison of the use of *bar*-adjectives in spoken vs. written language can be made. The debates about the German constitution are available in (near) spoken and written form, so that a roughly comparable set of data exists. Although the corpora are rather small and the subject is very specific, some differences can still be noticed. The *bar*-adjective *furchtbar* ('terrible', 'terribly') is used 49 times (16 times out of which adverbially and reaffirmingly) in the spoken language corpus, while it is not found in the written corpus at all. This is in accord with the findings in Ruoff (1981) where the most frequent *bar*-adjectives in the data of spoken German are *furchtbar* ('horrible'), *wunderbar* ('wonderful') and *dankbar* ('thankful') (highly irregular and lexicalized ones). More important is the observation that exceptional new formations seem to be more frequent in spoken language. There are, for example, words newly formed on the basis of intransitive verbs, e.g. *aufwallbar* ('surgable') (used with *Gemüt* ('feelings') in this case). *Abdingbar* ('dispensible') seems to have been formed from *unabdingbar* ('indispensible'), since there is no verb from which it could have been derived. This is also the case for *erwünschbar* ('desirable'), where only *erwünscht* ('desired', 'welcome'), but not *erwünschen* ('desire') exists. While irregular formations seem more frequent in spoken language, the overall usage of *bar*-adjectives is much higher (about one-third) in the written language data, when the size of the corpora is taken into consideration.

Some examples from the language acquisition corpora fit nicely into the picture. The words frequently used in spoken language are produced first, and the first productive uses involve inherent properties of concrete objects (*waschbar* ('washable') and *zusammenklappbar* ('collapsible')). Because of the limited number of tokens from these corpora they cannot really be used as evidence and will not be considered further.

1.9 Summary and Implications

The analysis of the data, in particular the observations in sections (1.3) and (1.4), strongly supports the view that word formation differs from syntax in that frequent words are not derived 'on-the-fly' every time they are produced, but are stored as units even if they have an internal structure. Once a word is lexicalized it can undergo semantic drift, and acquire idiosyncrasies of all kinds. Every formalism should provide a means of stating this idiosyncratic information, and at the same time make precise which parts are predictable and correspond to aspects of a productive rule. This is not only necessary on a descriptive level, where otherwise information would have to be repeated redundantly. It is also possible to form new words on the basis of existing 'subregular' ones, in cases where it is sufficiently clear how the new word would relate to its stem, and how it would be interpreted. This kind of word formation according to patterns determined by a small set of existing words, and sometimes even by analogy to only one word, is needed even for a full account of *bar*-derivation. It is widely acknowledged that such a process is the basis of some other kinds of word formation processes. Since it was shown that even the highly regular *bar*-derivation cannot be described adequately by a single rule, it will be argued that such a rule is best seen as a special case, a very general regularity among existing words. So the analysis of the corpora has uncovered some characteristics of the data from which demands on a formalism for lexical representation can be derived.

2 HPSG

As stated in the introduction, I will develop an account for some of the empirical observations from the previous sections within an HPSG framework. In this section a very brief overview of HPSG will be given, and some notation will be explained. More details can be found in chapter 1 of Pollard & Sag (in press).

HPSG is a linguistic theory integrating and further developing ideas from other theories such as GPSG (Gazdar et al. 1985), LFG, Categorial Grammar, GB, and Situation Semantics. It emphasizes the need for integration of partial information from various linguistic (and in principle also non-linguistic) sources in an order-independent way: the grammar is formulated as a declarative system of constraints.

2.1 Typed Feature Structures

The fundamental objects of linguistic analysis in HPSG are signs, modelled by feature structures. This allows for the parallel representation of phonological, syntactic, semantic, and other information. Feature structures can be described by AVMs (attribute-value-matrices), sets of pairs of attributes and their values, which can be complex themselves. One can think of feature structures as directed and connected graphs with a root and labeled edges. The edges correspond to the attributes, while the values are the nodes.

The feature structures employed in HPSG are TYPED.[22] The type indicates what sort of object is being described, with the types being partially ordered by subsumption. This allows generalizations to be expressed elegantly. In the following hierarchies—the one developed by Krieger & Nerbonne and my own—more inclusive types will be higher in the ordering, i.e. will be a supersort of others which contain more information. When they are mentioned, types are shown in italics in the top left corner of an AVM. But they are also frequently left out, when not important for the point to be illustrated.

Feature structures which model linguistic objects have to be totally well-typed and sort resolved (Carpenter 1992b): all appropriate attributes have to be specified, and all types have to be minimal. AVMs in contrast, which can also provide partial descriptions, only have to be well-typed, i.e. their type restricts which attributes are appropriate and of what type their values are.

Two paths in a feature structure can lead to the same node. This is called structure sharing, and is the central explanatory mechanism in HPSG. It is indicated by boxed numerals in AVMs, and involves TOKEN IDENTITY.

Some more notation: Subscripts (such as $\boxed{5}$ in figure 5 on page 36) refer to INDICES, TAGS with colons before them (such as $\boxed{7}$ in figure 4 on page 34) to the

[22] Now the term SORTED is mainly used, but I will stick to Krieger & Nerbonne's terminology in order to avoid confusion.

whole CONTENT. Sets are enclosed in curly brackets and lists in angle brackets, with $\langle\ \rangle$ denoting the empty list.

These descriptions are specified for the lexical entries and combined into more complex representations with the hierarchical structure of a phrase being coded in a DTRS feature. To be well-formed, phrases have to obey all universal and language specific principles and instantiate one of the rule schemata.

The syntactic valence is expressed in a feature called SUBCAT in Pollard & Sag (1987), most of Pollard & Sag (in press), and also in Krieger & Nerbonne (1992). The feature SUBCAT has as value a list of objects of type *synsem*, containing syntactic and semantic information but not the hierarchical internal structure of what is subcategorized for. Elements on the subcategorization list are not ordered by their surface order in sentences but according to an obliqueness hierarchy, with the least oblique element (usually the subject) coming first.

In what Pollard & Sag call HPSG III, i.e. chapter 9 of Pollard & Sag (in press), separate features for subject (SUBJ) and complements (COMPS) are assumed, following a suggestion by Borsley (1987). This changed conception of valence will be used in my own analyses.

The Subcategorization Principle ensures that elements with which the head has already combined are removed from the SUBCAT list, similar to cancellation in categorial grammar. The Head Feature Principle guarantees that the value of the HEAD feature is shared between a phrase and its head, while the Semantics Principle does the same for the CONTENT value (ignoring quantifiers here). The CONTENT of verbs and their projections is a *psoa*, a parameterized-state-of-affairs. Adjuncts select their head via the value of the MOD feature, and the content is projected from the adjunct, not the head.

Some of the principles, or rather their morphological counterparts as proposed by Krieger & Nerbonne (1992), will be described in more detail in the next section.

The interaction of these principles ensures that as a side-effect of subcategorization the semantic argument positions are filled. In Nerbonne (1991) and (1992) the semantic aspects are developed in more detail, and the advantages are emphasized of representing syntactic, semantic and other information in parallel: it becomes possible to express interactions of all kinds in a flexible way.

2.2 The Lexicon

As more and more information is relocated in the lexicon and lexical analyses are given for phenomena previously treated in the syntax (see e.g. Sag et al. (1992) and other suggestions in this collection), it is necessary to develop theories of lexical organization. Hierarchically structured lexicons allow elegant and compact representation of linguistic information. To this end TEMPLATES were developed by Shieber (1986). Alternatively, types, relational abstractions, or parametric sorts have been used, for an overview and comparison of these mechanisms see

Johnson & Rupp (1992) and Rupp (1992).

There is an ongoing debate as to whether one needs to allow non-monotonic inheritance or whether it is possible to dispense with defaults. Flickinger et al. (1985) and Flickinger (1988) have used defaults, while Pollard & Sag (1987) and Carpenter & Pollard (1991) try to remain monotonic. Default inheritance systems for lexical representation such as DATR (Evans & Gazdar 1990, Gibbon 1992) are motivated by the fact that exceptions abound in the lexicon, and that compact descriptions even for subregularities and exceptions can be achieved by allowing information to be overridden. But as Kilbury (to appear) notes, a system in which all information is defeasible cannot be used for classifying objects, and it is also necessary to be able to represent strict information. In view of this and further arguments in Calder (1991) it seems an advantage rather than a drawback of the approaches of Bouma (1991) and Carpenter (1992a) that defaults need to be explicitly coded. But even this can be problematic as it might depend on the perspective which information is to be treated as strict. In default approaches it is also difficult to handle additional regular uses. These issues will not be discussed further here since defaults are not needed in the proposed approach. For a detailed survey of existing inheritance systems see Daelemans et al. (1992).

3 The Krieger & Nerbonne Approach

I will now describe the system developed in Krieger & Nerbonne (1992) and Krieger (to appear) a little more closely, because my ideas were directly inspired by it, and it is also the most extensive work on a morphological component based on typed features structures that I know of.

3.1 The General Architecture

In their paper 'Feature-based inheritance networks for computational lexicons' Krieger & Nerbonne present an approach exploiting the advantages of inheritance hierarchies (see section 2.2). They suggest using a hierarchy with multiple default inheritance. This proposal is probably motivated by the insight that hierarchical structures can elegantly capture lexical generalizations of all kinds. In particular, lexicalized *bar*-adjectives which do not completely match the rule can still be associated with it. This is required in order to capture the partial relationship and to avoid having to repeat predictable information in lexical entries. As has been shown, the data does call for such an account, since there is no clear separation of completely regular and totally exceptional cases, even with new words.

In addition to their hierarchy of lexical types, the authors develop a word-syntactic approach to derivational phenomena.[23] They assume that affixes have their own lexical entries, complete with categorial features, and propose that affixes combine with their stems according to principles resembling the syntactic ones. These principles are associated with the lexical types in order to state well-formedness conditions on lexical items. They are therefore part of the hierarchy and can be seen as internal lexical rules,[24] making it unnecessary to assume a separate mechanism for lexical rules outside of the independently needed formalism.

An account that can describe the facts using only typed feature structures, which are available already, is surely desirable. This aspect of their approach will be taken over, and developed further. But it is not a priori clear that a word-syntactic approach to morphology is to be preferred: while it would be nice if word formation was subject to the same principles as syntax, this is an empirical question.

In the next subsections their approach to derivation will be summarized, some aspects which need further clarification will be pointed out, and it will be made

[23] Note that the main purpose of their paper was to present the formalism, and the examples are primarily given to illustrate what can be done within the framework.

[24] The authors even say that the lexical rules **are** lexical entries. This seems misleading, as their function is rather to give structure to the lexicon. If the lexicon is viewed as more than just a simple list of words, it makes sense to see the well-formedness conditions as part of the lexicon, but not as lexical entries.

clear in what respects an approach combining a word-syntax and an inheritance hierarchy leads to redundancies.

3.2 The Treatment of Derivation

The first thing Krieger & Nerbonne do to account for derivation is to extend the HPSG type hierarchy by introducing lexical subtypes of *word* as e.g. *complex* words and *adjectives* (see figure 1). Because a word can be both complex and an adjective, the hierarchy has to allow for multiple inheritance. An example for this are the complex *bar*-adjectives *bar-comp-adj*, which share with other complex words the additional feature MORPHS (or DTRS, as in Krieger (to appear)), used for representing the internal structure of the word, and also share with other adjectives the restrictions specific to this class of words, e.g. typical adjectival morphological, syntactic and semantic properties (being gradable, expressing properties, modifying nouns, etc.).

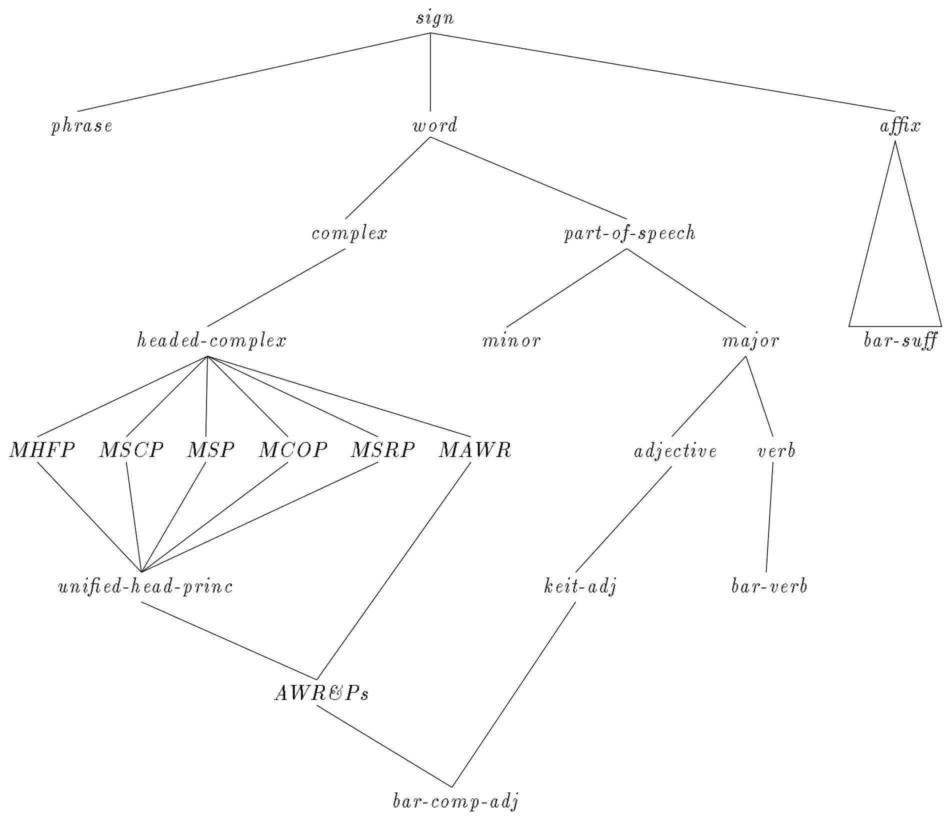

Figure 1: The hierarchy as in Krieger (to appear)

The authors also assume that the type *affix* is a 'sister' type of *word* and *phrase*, and introduce the type *bar-suff* as a subtype of *affix*.[25] This is the

[25]The triangle indicates that *bar-suff* is not an immediate subtype of *affix*: a whole hierarchy

lexical entry for this suffix, in which it is marked as an adjective, has a possibility operator in its semantics and subcategorizes for a *bar-verb*. Notice also that there is a type *bar-verb*, which is meant to cover all verbs that can combine with the suffix -*bar*.

There is also a rule, the Head-Complement-Rule, which is responsible for ensuring that word-internal structures are binary branching, and that in the case of derivation the parts are of the appropriate type (*affix* and *word* respectively).

In the constraints on *bar-comp-adj* the authors specify that these comprise a *bar-suff* and a *bar-verb*. One reason for introducing such a type is that a lexical entry then can be seen as its instance, inheriting all the necessary information from above. It is also useful for describing further affixation elegantly: the suffix -*keit* e.g. can be used to form nominalizations from adjectives, but only from those with either of the suffixes -*bar*, -*lich*, -*sam*, or -*ig*.

As mentioned before, the principles are part of the hierarchy as well. They can be understood as well-formedness conditions on complex words, which all have to meet the constraints. The morphological head feature principle says e.g. that the head value of the affix has to be the same as that of the mother. This is in line with proposals by linguists such as Williams (1981), Selkirk (1982), Di Sciullo & Williams (1987), and Olsen (1990), which have in common that the affix is the 'head' and thus determines the category of the complex word. The principles are mostly morphological counterparts of the HPSG syntactic principles and are briefly summarized below:

1. The Constituent Ordering Principle determines the order of the morphological constituents and their surface realization. This task is handed over to the complex function **order-constituents**.
2. The Morphological Head Feature Principle is very similar to the one familiar from syntax: the head features are shared between the mother and the head daughter ($\boxed{2}$ in figure 2).
3. The Semantics Principle is also hardly changed: the semantics of the complex word is structure-shared with that of the head ($\boxed{3}$ in figure 2).
4. The Subcategorization Principle differs significantly: only binary structures are admitted and the new subcategorization list has to be calculated by a complex function.

The connection between the word-syntactic part and the hierarchy is achieved by associating the principles with the right type: because all words of type *headed-complex* are subject to them they can be understood as declarative filters on the well-formedness of instances of this lexical type. All these principles taken together result in the constraint on the type *headed-complex* shown in figure 2.[26]

of affixes is developed in Krieger (to appear).

[26]It is assumed here that the principles are to be seen as constraints on all *headed-complex*

$$\left[\begin{array}{l} \textit{headed-complex} \\ \text{MORPH|FORM } \textbf{order-constituents } (\boxed{1}) \\ \text{SYN|LOC} \left[\begin{array}{l} \text{LEX } + \\ \text{SUBCAT } \textbf{construct-subcat } (\boxed{1}) \\ \text{HEAD } \boxed{2} \end{array}\right] \\ \text{SEM } \boxed{3} \\ \text{MORPHS } \boxed{1} \left[\begin{array}{l} \textit{morph-head-struct} \\ \text{HEAD-MORPH} \left[\begin{array}{l} \textit{affix} \\ \text{SYN|LOC} \left[\begin{array}{l} \text{SUBCAT } \boxed{4} \\ \text{HEAD } \boxed{2} \end{array}\right] \\ \text{SEM } \boxed{3} \end{array}\right] \\ \text{COMP-MORPH } \boxed{4} \left[\,\textit{word}\,\right] \end{array}\right] \end{array}\right]$$

Figure 2: The rule and all the principles taken together

Bar-adjectives are a subtype of this and at the same time a subtype of adjective, thereby inheriting all the relevant constraints. The local constraints imposed on the class of *bar*-adjectives are given in figure 3. The resulting AVM for a *bar*-

$$\left[\begin{array}{l} \textit{bar-comp-adj} \\ \text{MORPHS} \left[\begin{array}{l} \text{HEAD-MORPH } \left[\,\textit{bar-suff}\,\right] \\ \text{COMP-MORPH } \left[\,\textit{bar-verb}\,\right] \end{array}\right] \end{array}\right]$$

Figure 3: The local constraints on *bar*-adjectives

adjective can be found in figure 4. The structure-sharing indicated with $\boxed{7}$ is part of the lexical entry of *bar-suff*: the semantics of the *bar-verb* is put into the scope of the possibility operator of the suffix.

3.3 Aspects that Need to be Made More Precise

Two main aspects of this approach need to be made precise. The first has to do with the status of the type *bar-verb*. It is not made clear where exactly in the hierarchy to locate this type. The second concerns the information contained in the function **construct-subcat**.

The authors introduced the type *bar-verb* presumably because they were aware of the fact that the class of verbs 'subcategorized' for by the suffix -*bar* is not an independently motivated one. Such an auxiliary type is needed if one wants to pursue a word-syntactic approach, because in the lexical entry for the suffix one must state which verbs it can combine with. But the class in question is not

words, as can be concluded from the presentation in the text. The hierarchy given in Krieger & Nerbonne would then have to be slightly modified to correctly reflect this: if all *headed-complex* words are subject to the principles, these should be higher up in the hierarchy. As it stands, nothing would exclude *headed-complex* words which conform to only some (or even none) of the principles.

$$
\left[\begin{array}{l}
\textit{bar-comp-adj} \\
\text{MORPH|FORM } \textbf{concat}\ (\boxed{1}, \boxed{2}) \\
\text{SYN|LOC} \left[\begin{array}{l} \text{LEX } + \\ \text{SUBCAT } \textbf{construct-subcat}\ (\boxed{5}) \\ \text{HEAD } \boxed{3} \end{array}\right] \\
\text{SEM } \boxed{4} \\
\text{MORPHS } \boxed{5} \left[\begin{array}{ll}
\text{HEAD-MORPH} & \left[\begin{array}{l}
\textit{bar-suff} \\
\text{MORPH|FORM } \boxed{2}\text{“}\textbf{bar}\text{”} \\
\text{SYN|LOC} \left[\begin{array}{l} \text{SUBCAT } \boxed{6}\,\textit{bar-verb}:\boxed{7} \\ \text{HEAD } \boxed{3}\left[\text{MAJ } \mathbf{A}\right] \end{array}\right] \\
\text{SEM } \boxed{4} \left[\begin{array}{l} \text{OPERATOR } \diamond \\ \text{SCOPE } \boxed{7} \end{array}\right]
\end{array}\right] \\
\text{COMP-MORPH } \boxed{6} & \left[\begin{array}{l}
\textit{bar-verb} \\
\text{MORPH|STEM } \boxed{1}\text{“}\textbf{les}\text{”} \\
\text{SYN|LOC|LEX } + \\
\text{SEM } \boxed{7} \left[\begin{array}{l} \text{RELN } \mathbf{read'} \\ \text{SOURCE} \\ \text{THEME} \end{array}\right]
\end{array}\right]
\end{array}\right]
\end{array}\right]
$$

Figure 4: The AVM for *lesbar* as in Krieger & Nerbonne (1992)

a natural one, which could be induced by positive evidence stemming from its members themselves. Furthermore, other classes of this kind would be needed to account for other derivational phenomena: *lich-verb*s, *sam-verb*s, etc. Such artificial classes will not be included in the analysis suggested in this thesis.

Another problem is that even with the help of such a class it is not possible to establish a connection to *bar*-adjectives such as *sichtbar* (where the first part is not the verbal stem to which the adjective is related semantically) or ones derived from nouns. These would either require stipulating a separate lexical entry for this affix or they could not be viewed as morphologically complex. Neither solution seems desirable. Even when considering verbs as stems only, and even supposing that all *transitive verb*s were *bar-verb*s, so that the latter could subsume the former, there would be a problem. When constructing the new subcategorization list, reference would have to be made to the accusative object of the underlying verb. It is not stated explicitly in the paper, but probably the function **construct-subcat**, which is used to derive the SUBCAT list of the complex verb from that of the underlying verb, depending on what the affix is, was supposed to be defined in this way.

In an approach using a complex function like **construct-subcat** this problem could perhaps be avoided by making the function even more complex, referring to the accusative object for transitive verbs, the subject for intransitive ones or the dative or prepositional object, as required. But if the linguistic information hidden away in this complex function is made explicit, this will become impossible.

In his paper on 'Derivation without Lexical Rules', Krieger (to appear) argues that complex functions should be avoided as much as possible, and he develops an approach in which the effect of **construct-subcat** is encoded directly in the feature structures (and the function **order-constituents** is reduced to simpler ones as well). He achieves this by making a distinction between morphological and syntactic subcategorization. It then becomes possible to pass the syntactic features of the affix directly on to the mother, including the subcategorization information. This can be seen in figure 5, where $\boxed{7}$ expresses the relevant structure-sharing.

The lexical entry—as shown in (74)—could still be minimal, being appropriately expanded by inheritance.

(74) $lesbar = bar\text{-}comp\text{-}adj \sqcap \left[\text{DTRS}|\text{WORD } lesen\right]$

Because *lesbar* is a subtype of *bar-comp-adj*, it is known that it has two parts, a *bar-suff* and a *bar-verb* (which in this case is *lesen*), the lexical entries of which are included in the appropriate places. Part of the lexical entry for the suffix specifies that it morphologically subcategorizes for a *bar-verb*. One half of the MORPHOLOGICAL SUBCATEGORIZATION PRINCIPLE ($\boxed{3}$) ensures that this is the same as the WORD daughter. The second part of the *MSCP* ($\boxed{7}$) passes the syntactic subcategorization information from the suffix up to the mother, and the *MHFP* ($\boxed{8}$) does the same for the HEAD features. The subcategorization information which is to be passed up is determined within the lexical entry of the suffix, which specifies that the verb's OBJ is put into the SUBJ attribute ($\boxed{11}$), and that the remaining complements are inherited ($\boxed{12}$). Furthermore the semantics of the verb ($\boxed{9}$) is put into the scope of the possibility operator in the semantics of the suffix, which is then set equal to the complex adjective's content by the SEMANTICS PRINCIPLE ($\boxed{10}$). Note that for all these principles to work correctly, it is necessary that all the adjectival syntactic and semantic information has to be present in the lexical entry for the suffix.

Krieger also considers an approach of double subcategorization, where not only the affix selects its complement, but also the verb its affix. This mechanism is used to code exceptions by stating that e.g. the verb *sehen* cannot combine with the suffix -*bar*. This circumvents an account of blocking and fails to capture that words 'blocked' in this way are sometimes still used.[27]

The order of the constituents is determined by an auxiliary feature CORD in his approach. This also seems too complicated because it can be made to follow from the type of the affix (*prefix* or *suffix*) directly. Because of the explicit coding of the information that was contained in the functions before, the AVM resulting from his approach is slightly more complex.

One problem with this approach is that the features of the suffix are somewhat

[27]Double subcategorization has been suggested by Kilbury (1992) for a different purpose, representing existing *bar*-adjectives as verbs selecting for the affix, and potential ones by specifying for which verbs the affix selects. In this case idiosyncratic properties of the derived words have to be represented with the root lexeme's entry, which is what Kilbury does in his paradigmatic approach.

$$
\left[\begin{array}{l}
\textit{bar-comp-adj} \\
\text{MORPH|FORM } \textbf{realize-surface}\ (\boxed{1}, \boxed{2}) \\
\text{SYN|LOC} \left[\begin{array}{l} \text{LEX } + \\ \text{HEAD } \boxed{8} \\ \text{SUBCAT } \boxed{7} \end{array}\right] \\
\text{SEM } \boxed{10} \\
\text{CORD } \boxed{1}\ \left\langle \boxed{3}, \boxed{4} \right\rangle \\
\text{DTRS } \boxed{2} \left[\begin{array}{l}
\textit{affix-word-struct} \\
\text{AFFIX } \boxed{4} \left[\begin{array}{l}
\textit{bar-suff} \\
\text{MORPH} \left[\begin{array}{l}
\text{POS } \textbf{right} \\
\text{FORM } \text{“}\textbf{-bar}\text{”} \\
\text{ACAT } \textbf{Suffix} \\
\text{SUBCAT } \boxed{3} \left[\begin{array}{l}
\textit{bar-verb} \\
\text{SYN|LOC|SUBCAT} \left[\begin{array}{l} \textit{subcat-info} \\ \text{OBJ } \boxed{11} \\ \text{COMPS } \boxed{12} \end{array}\right] \\
\text{SEM } \boxed{9}
\end{array}\right]
\end{array}\right] \\
\text{SYN|LOC} \left[\begin{array}{l}
\text{HEAD } \boxed{8} \left[\text{MAJ } \textbf{A}\right] \\
\text{SUBCAT } \boxed{7} \left[\begin{array}{l} \textit{subcat-info} \\ \text{SUBJ } \boxed{11} \\ \text{OBJ } \textbf{NIL} \\ \text{OBJ2 } \textbf{NIL} \\ \text{COMPS } \boxed{12} \end{array}\right]
\end{array}\right] \\
\text{SEM } \boxed{10} \left[\begin{array}{l} \text{OPERATOR } \diamond \\ \text{SCOPE } \boxed{9} \end{array}\right]
\end{array}\right] \\
\text{WORD } \boxed{3} \left[\begin{array}{l}
\textit{bar-verb} \\
\text{MORPH|STEM } \text{“}\textbf{les}\text{”} \\
\text{SYN|LOC} \left[\begin{array}{l}
\text{LEX } + \\
\text{HEAD|MAJ } \textbf{V} \\
\text{SUBCAT} \left[\begin{array}{l} \textit{subcat-info} \\ \text{SUBJ } \textbf{NP}_{\boxed{5}} \\ \text{OBJ } \boxed{11}\ \ (\textbf{NP})_{\boxed{6}} \\ \text{OBJ2 } \textbf{NIL} \\ \text{COMPS } \boxed{12} \left\langle \ldots \right\rangle \end{array}\right]
\end{array}\right] \\
\text{SEM } \boxed{9} \left[\begin{array}{l} \text{RELN } \textbf{read}' \\ \text{SOURCE } \boxed{5} \\ \text{THEME } \boxed{6} \\ \ldots. \end{array}\right] \\
\text{CORD } \left\langle \boxed{3} \right\rangle
\end{array}\right]
\end{array}\right]
\end{array}\right]
$$

Figure 5: The AVM for *lesbar* according to Krieger (to appear)

$$\begin{bmatrix} \textit{bar-suff} \\ \text{PHON ``}\textbf{bar}\text{''} \\ \text{SYNSEM|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD } \textit{adjective} \\ \text{VAL} \begin{bmatrix} \text{SUBJ } \textbf{NP}{:}\boxed{8} \\ \text{COMPS } \left\langle \begin{bmatrix} \text{LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD } \textit{transitive} \\ \text{VAL|COMPS } \langle \textbf{NP}[\text{acc}]{:}\boxed{8} \mid \boxed{5} \rangle \end{bmatrix} \\ \text{CONT } \boxed{9} \end{bmatrix} \end{bmatrix} \mid \boxed{5} \right\rangle \end{bmatrix} \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{OPERATOR } \diamond \\ \text{SCOPE } \boxed{9} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Figure 6: The lexical entry for *-bar* along the lines of Gerdemann (in press)

contradictory. On the one hand it obligatorily subcategorizes for a verb and is a subtype in a separate affix hierarchy. On the other hand the suffix syntactically subcategorizes for an NP and has the ordinary semantics of adjectives, from which one should conclude that it is an instance of type *adjective* (and of type *word*).

These contradictions can be avoided when one adopts a categorial approach along the lines of Gerdemann (in press). He does not distinguish between morphological and syntactic subcategorization, but instead applies to derivation the mechanism of subcategorization inheritance developed for auxiliaries by Hinrichs & Nakazawa (in press). The status of the suffix is then no longer dubious: it is something that has to combine with a verb to form an adjective. The complements list of the underlying verb is inherited and appended to that of the affix. It then becomes possible to use the same principles as in syntax: there is no longer a need to make changes to the subcategorization principle. How the lexical entry for the suffix *-bar* could look in such an approach is shown in figure 6.[28]

It is possible to express more complex relationships within such an approach, and if one separated case marking from subcategorization, as suggested by Gerdemann in his paper, the account would become simpler as well.

Even with this approach some problems remain.[29] It is not only the case that parts of words tend to impose stronger semantic restrictions; there are also conditions not known at all from syntax: the normal subcategorization principle does not allow access to phonological information and to the internal constituent

[28]This looks somewhat less elegant than the example used by Gerdemann himself (*-ness*), since in the case of *-bar* it is not possible to simply 'append' the complete subcategorization list. To be precise, the vertical bar is to be understood as separating the first element of a list from the rest, not as a list append.

[29]The most obvious technical one here is that crucially the order of elements on the complements list has to be as it would be in categorial grammar: the first element is the first thing to combine with. In terms of obliqueness this corresponds to the order as in Pollard & Sag 1987 in the case of the suffix (combining first with the stem and then appending things to its own list of complements). But for the complements of the verb the order is reversed, as in Pollard & Sag (in press).

structure of what is subcategorized for. But reference to the internal structure is needed in word formation, as some affixes combine only with morphologically simple stems (*entflecken* ('de-stain'), **entfettflecken* ('de-grease-stain')) and others only with complex stems, sometimes even requiring a particular other suffix in their base (Hoeksema 1988). Another aspect in which morphological structures seem to differ from syntactic ones—though not from those of all syntactic theories—is that they are claimed to be exclusively binary branching. Even if this is not a universal constraint, it surely is a tendency that should be captured.

Although it would be possible to make the necessary changes to accommodate word-formation-specific needs it can be asked whether the obvious differences do not indicate that one should not try to collapse the two. All this seems to indicate that word formation differs from syntax after all.[30]

Most problematic from the point of view of the data is the fact that every word syntactic approach needs to state the subcategorization requirements of the affix explicitly. The location of *bar-verb* with respect to other verb classes in the hierarchy is not clear from figure 1, but in Krieger's approach the class of verbs with which the suffix -*bar* can combine is restricted to transitive verbs because direct reference is made to the accusative object (OBJ). This has been shown to be empirically questionable in section (1.4). There are not only lexicalized exceptions to it which might be treated using defaults,[31] but also new words not meeting these requirements.

3.4 Redundancies Arising from a Combined Approach

In what follows it will be explained where I see information being duplicated in the approach presented by Krieger & Nerbonne, and for what reasons. The affix -*bar* is assumed to have its own lexical entry. The words resulting from the combination of this suffix with a verb are integrated into the hierarchy as subtypes of *bar-comp-adj*. This type is a subtype of *headed-complex* and *adjective* (figure 1), so that it will inherit all the relevant constraints.

In at least two respects this approach, which combines an extended hierarchy with a word-syntax, leads to redundancies, given a lexical entry as the one for *lesbar* in (74):

1. Because the lexical entry is specified as being a subtype of *bar-comp-adj*, the categorial information is on the one hand inherited from the supertype *adjective*, but can also be derived via the MORPHOLOGICAL HEAD FEATURE PRINCIPLE from the information on the affix.

[30] Conversely, Zwicky (1992) also comes to the conclusion that essentially no characteristics of syntax beyond those he called the 'determinant' (being a predictor of category) in Zwicky (1985) carry over to morphology.

[31] Even this seems a problem in a realistic large-scale computational application because it is unlikely that one will manage to include all exceptions to all rules into the lexicon—a mechanism for handling words that are new to the system is needed as well (Light 1992).

The first source of the information is needed for partly idiosyncratic cases, as these are adjectives even if they cannot be analyzed as subject to the head principle (*fruchtbar* ('fertile')). This corresponds to the view that the categorial status of derived and non-derived words can be directly read off their distribution in sentences, which also works in the case of zero-derivation (or conversion).

2. The fact that *bar-suff* obligatorily subcategorizes for *bar-verb*s is directly encoded in its lexical entry in a special attribute MORPH|SUBCAT, but is also expressed by the fact that it occurs only as the second part of words of type *bar-comp-adj*, the first part of which has to be a *bar-verb* (cf. figure 3).

The authors go on to propose that lexicalized and partly regular *bar*-adjectives be treated as instances of this type. This results in a further redundancy:

3. While it is already known that there is a *bar-comp-adj lesbar* ('readable'), the verb *lesen* ('read') still has to be marked as a *bar-verb*.

This is a problem because membership in the class of *bar-verb*s has to be explicitly stated, since it does not constitute an otherwise needed, natural class—not all transitive verbs can combine with this suffix, and some non-transitive verbs can. Since it is not possible to subsume the class of transitive verbs under *bar-verb*, every *bar*-adjective newly encountered would require the verbal hierarchy to be restructured.

4 Strategies for Avoiding the Redundancies

There are two possible strategies that could be taken to avoid the redundancies. These will be briefly described and discussed in the following sections. The first—and the one the authors would be most likely to take—is to get rid of the type *bar-comp-adj*, which is not needed in a pure word-syntactic approach. For completely regular derivations it would suffice to treat them as instances of type *headed-complex*. All the necessary information would then follow from the principles and lexical entries. An interesting alternative is to augment the information associated with the type *bar-comp-adj* by that of the affix, thereby eliminating the need to have a separate lexical entry. This would also express the generalization embodied in the semantics principle more directly: the part of the semantics contributed by the affix is directly associated with the complex word. The affix cannot surface on its own because it does not have an independent semantics.

4.1 No Lexical Types for Complex Words

A first thought would be to do away with lexical types of the '*bar-comp-adj*'-kind and pursue a pure word-syntactic approach. However, further reflection indicates that not having such an inheritance hierarchy has serious drawbacks.

The analysis of the data has shown that the predictions of a word-syntactic account—that there should be a clearly definable class of words with which a given suffix can combine—cannot be upheld. First of all, there are not only exceptions, but also subregularities among lexicalized *bar*-adjectives (cf. section 1.3), which should be captured in order to avoid having to repeat predictable information in lexical entries. In these cases it could be argued that accounting for the relationship is not strictly necessary because there are only a finite number of lexicalized words, which could in principle be listed with full specifications. But this would miss relevant generalizations and would fail to capture native speakers' intuitions that these words are indeed complex.

But the most important evidence from the data concerns the finding that there are quite a few cases of new *bar*-adjectives which do not conform fully to the regular pattern (cf. section 1.4). These *bar*-adjectives, formed from verbs with dative objects (*unausweichbar*), prepositional objects (*zugreifbar*), intransitive verbs (*entflammbar*), reflexive verbs (*zersetzbar*), or non-verbs (*abdingbar*) are clearly too rare to ever have been learnt as exceptions. Yet they have been used, and are fully comprehensible.[32] These words obviously constitute counterexamples to the prediction that -*bar* can only combine with transitive verbs. So any word-syntactic approach with a single *bar*-affix would have to assume an

[32]Some of them sound a bit unusual though—maybe in a computational system one would not want to generate them—but one would definitely have to be able to analyze them, and they are part of human word formation systems. This 'novelty' effect, which is unknown from syntax, also indicates that word formation should not be seen as part of syntax.

arbitrary class of *bar-verbs*. Note that this problem carries over to a lexical rule approach which postulates a single lexical rule for *bar*-affixation. Even if an artificial class of verbs was assumed, it would be still not be clear which argument becomes the subject. It is unlikely that a non-syntactic generalization (in terms of internal/external arguments, thematic roles or whatever) will be found that covers all and only the verbs from which *bar*-adjectives have been and can be formed, i.e. that provides the necessary and sufficient conditions. Also, the semantic similarity to the rule that words like *sichtbar* ('visible') have, could then still not be expressed.

Inheritance hierarchies are particularly well-suited for expressing relationships of all kinds. They cannot only be used to encode fully productive rules, but also to describe lexicalized, partly idiosyncratic forms and patterns going back to rules which have (diachronically) become inactive. They therefore offer the possibility of accounting for fully and partly productive rules, as well as for word formation in analogy to inactive patterns in a uniform fashion.

Because the rules are conceived of as generalizations emerging from existing lexical entries (cf. also Bybee 1988), the relationship of lexicalized forms to the rule is expressed in a very direct way. For a computational lexicon the 'irregular' forms cannot simply be ignored, because they will be the words most likely to occur. Lexicalized forms, which normally exhibit idiosyncrasies in at least one respect, are also the ones most frequently used. As mentioned above, only 60 different *bar*-adjectives account for about 70% of the occurrences in the corpus.

It is even necessary to have lexical entries for some regular, frequently used *bar*-adjectives, in order to be able to distinguish between actual and possible words and to have a place to locate specializations in meaning (see the discussion of cases like *haltbar* in section 1.3). Apart from psycholinguistic evidence which points in this direction there are also morphological reasons for this assumption. As Rainer (1988) and Becker (1990) observe, even frequent words which are the predictable output of a productive rule can block other words in some cases. So storage is important independently of idiosyncrasy, although in most cases some unpredictable aspect is involved as well. Furthermore, if complex words were formed anew every time they are used, it would be difficult to explain why words have a tendency to drift semantically, while sentences in general do not.

Because of the hierarchical structure of the lexicon this will not be too costly, as nothing more needs to be given than the information that a word exists and is regular. While the primary function of the types is that of eliminating redundancy in lexical entries, it is necessary to also allow for their activation, since there clearly are 'occasional' uses of *bar*-adjectives which should (and could) not all be listed.

It thus seems natural to take the primary role of lexical rules to be that of giving structure to the existing lexicon, to serve as 'redundancy rules' in the sense of Jackendoff (1975). This is made completely obvious in my approach, as far as I know for the first time. The emerging patterns can then be used to make precise how word formation by analogy works. Given all this, an additional word-syntactic approach for only a special case, forming a subpart of what has been achieved already, is not needed.

4.2 No Lexical Entries for Affixes

The second alternative is to abandon the word-syntactic part of the approach, and in particular not to assume lexical entries for affixes. This seems a promising line of research, not suffering from the limitations that a strict separation of regularities and exceptions is subject to. There is clear evidence that such a division line cannot be found. There are pragmatic, semantic, syntactic and morphological (maybe even phonological) constraints on the well-formedness of *bar*-adjectives. Instead of applying in an all-or-nothing fashion there seems to be a continuum, starting from prototypical *bar*-adjectives captured well by a word-syntactic approach via intermediate cases where only one constraint is violated to those words which are not accepted by some speakers because of too many mismatches.[33] *Verrottbar* ('decayable') is such an example: it is not equally acceptable to all speakers.

While it would be possible to mimic the principles of a word-syntactic approach in a hierarchy, there are good reasons not to. The semantics principle, for example, could be modeled by requiring an affix to occur in one lexical type only, which must have a unique semantics. This does not in general seem to be justified by the data. The suffix -*bar* for example has a different semantics in *haftbar* ('liable'), implying that one in fact 'is' (not: 'can be') responsible. But it is still necessary to relate it to the other cases for the purposes of further suffixation (or allomorphy rules, which are probably needed in the case of other affixes). It is also desirable to relate the semantic part of the *bar*-rule to that of the rule for *lich*-adjectives, some of which have the same or at least a very similar meaning. This becomes even more obvious when nominalizations are considered. As Beard (1988 & 1990) observes, the semantic constraints seem to be independent of the various morphological manifestations of the rule.

Since in this approach there is no notion of a 'head' of a word, at least not for affixations, it is no problem that some affixes do not obey this scheme. There is no reason why a prefix could not be the head of a word in the sense of 'determining' its category, as it seems to be in some verbalizations. As Bauer (1990) has shown, most aspects of the notion 'head' are not particularly useful in derivational morphology and evidence for what is the head of a word is contradictory. The criterion most relevant to morphology, that of feature-percolation, seems to indicate that in general the affix should be the head of a word. But feature-

[33]The varying judgements about the possibility of a particular word could have to do with the differences in the precise content of the mental lexicons of the speakers and the generalizations that they have formed. The approach may well reflect how the child comes to acquire knowledge about the 'rule': by detecting similarities among existing words in its language, using them to structure the mental lexicon and to make predictions about further input.

percolation works without problems only for categorial features, which is also the most trivial aspect. If even more complex features can be influenced by the base, and others have no source within the word at all, determining category seems a minor problem.

Nevertheless some explanation is needed for the observation that almost all suffixes (apart from the well-known Spanish and Dutch[34] diminutives, which do not affect the part-of-speech of the words of different categories to which they can attach) seem to determine the category of the resulting word, while there are often cases of prefixes which are 'transparent' in this respect. It is to be expected that affixes are category-specific, as they normally have a clear semantic contribution to make. After all, most of them originated as the second part of a compound. If they do not 'have the same meaning' they are not analyzed as the same suffix.[35] But why are affixes with a semantics that is sufficiently general to be applicable to members of more than one major word class normally attached to the left of a word? Note that a head-approach does not give an explanation either, it merely describes the facts. It is not the purpose of this thesis to investigate possible reasons,[36] but it seems clear that they should be sought instead of attributing the effect to a principle of Universal Grammar.[37] After all, the phenomenon is a tendency only and the generalization is clearly learnable.

There is nothing that would speak against non-binary structures in this approach. If the binary nature of morphological objects was indeed a valid empirical observation, which I doubt it is, it would have to be explained somehow. Note that again in a word-syntactic approach this is merely stipulated, or claimed to be part of the innate knowledge. But there is evidence from both compounding and derivation that ternary structures are needed for the adequate description of some of the data. An example for a putative ternary structure in derivation is the 'circumfix' in *Ge-schrei-e* ('screaming'). Relevant com-

[34]The fact that such a phenomenon exists in Dutch, and that here the evidence seems much more compelling than in Spanish and Italian, has been brought to my attention by T. Höhle.

[35]Presumably no one would propose to treat the *-ant* in *tolerant* ('tolerant') and *Fabrikant* ('manufacturer') as the same suffix.

[36]One of the relevant factors—pointed out to me by A. Kathol—is probably that in a sense 'Today's morphology is yesterday's syntax'. In German, syntactic heads are typically found on the right. Negation, as involved in *un*-prefixation which can apply to nouns and adjectives alike, is typically realized in a position preceding them in syntax. The same holds for prepositions and it is also worth considering whether there is an influence of prefixes' ending up at the beginning of a word of 'the wrong category' by a process of verbalization or nominalization. Bauer (1990) claims that languages which have only prefixes always have verb+object in VPs and preposition+noun in PPs, and languages with object+verb and postpositions are always exclusively suffixing. While the 'exclusively' does not seem true for all such languages there apparently **is** such a tendency, and it would be interesting to find out whether suffixes in these languages can be 'transparent'.

[37]If the notion of head was really innate and the child simply had to determine the positional parameter it should not be the case that there are formations like *puller-wagon* for a person pulling a wagon or *breaker-bottle* for a person breaking a bottle, well after the child has found out that in simple compounds the head is on the right (cf. Clark & Barron 1988, summarized in Olsen 1992). German data would be interesting here, because of the distinguishable articles.

pounds are *Zwischenrippenstück*[38] ('inter-rib-piece'), *Hinterglasmalerei* ('behind-glass-painting'), *Allparteienregierung* ('all-party-government') or *schwarz-rot-gold* ('black-red-golden').

Instead of assuming a genetic endowment for restricting possible complex words to ones with a binary structure, it seems more interesting to investigate further which are the possible strategies for interpreting complex words.[39] The observed morphological tendencies might well follow from properties of the conceptual system. For the time being, the binary structure of complex words is in my approach expressed as a constraint on all complex words, having exactly the same effect as Krieger & Nerbonne's rule.

[38]This example is due to M. Reis.

[39]Noun-noun compounds for example are generally formed to further describe something denoted by the head noun by relating it to the other noun. It is of course easiest, and normally sufficient, to relate it to only one other concept. Indeed, most interpretation strategies, as for example functional application, the 'located-at' relation or the 'part-of' relation, allow for only one additional part. An exception is the coordination relation, which indeed seems to allow for ternary structures, although contexts where one further characteristic is not sufficient for unambiguous reference are hard to construct. It is interesting that the 'dvandva' of Sanskrit seem to allow such compounds freely. In the case of *Zwischenrippenstück* the 'located-at' relation seems to be specified further by the preposition. It would be interesting to see whether such a compound can be formed in all cases where the relation between the two nouns that would normally be induced is the wrong one.

5 The Proposed Inheritance Lexicon

My own approach, focusing on the development of the hierarchy only, is shown in figure 7. It represents a classificatory system for *bar*-adjectives, developed bottom-up from the data. The mechanism underlying inheritance is simple unification, not default inheritance as in Krieger & Nerbonne. It would therefore be directly implementable in a monotonic system such as TFS (Zajac 1992). Strictly speaking then, it is a subsumption hierarchy, but this can be seen as a special case of inheritance. The latter term, known from knowledge representation, expresses more overtly the fact that information once specified for a class is inherited by all other classes lower in the hierarchy. Default inheritance is not needed and in fact unwanted in this approach. It would not be clear which generalizations would be formed and of which rule they would be treated as a partly overriding subtype: if all information is defeasible there is no way to decide how to classify an object (cf. section 2.2).

Of crucial importance for the approach is the concept of multiple inheritance. Words are cross-classified according to different criteria, at the top level for example by their morphological complexity and part-of-speech. The problems arising with multiple inheritance when combined with a default system do not arise in this approach. It is not necessary to resolve conflicts, since none should arise. Because inheritance is monotonic, one does not need to give preference to more specific information. One notational detail about the hierarchy: the 'boxed' attribute names were also used in Pollard & Sag (1987), and indicate according to which features words are cross-classified—they are not types themselves.

5.1 An Explanation of the Hierarchy

In this approach there is also a lexical type for *bar*-adjectives which corresponds to Krieger & Nerbonne's *bar-comp-adj*. It is called *reg-bar-adj* (for 'regular *bar*-adjectives'). This can be seen as a generalization over existing lexical entries—even many of the lexicalized *bar*-adjectives can be subsumed under this type because they are regular apart from a specialized or additional meaning.

All the constraints (local and inherited) associated with regular *bar*-adjectives (*reg-bar-adj*) under the new conception without a separate lexical entry for the suffix are shown in figure 8. Where exactly they come from will be explained in the next section.

The availability of lexical types such as Krieger & Nerbonne's *bar-comp-adj*, and the possibility to impose local constraints on them, makes it possible to achieve the first of the desirable effects mentioned above, i.e. to eliminate the need for a separate lexical entry for the suffix. The syntactic and semantic information can be attributed directly to the complex adjective. Therefore it is no longer necessary to have a separate lexical entry for the suffix and to treat it as a *sign*. The 'category' of the suffix is that of a bound adjective, not by stipulation,

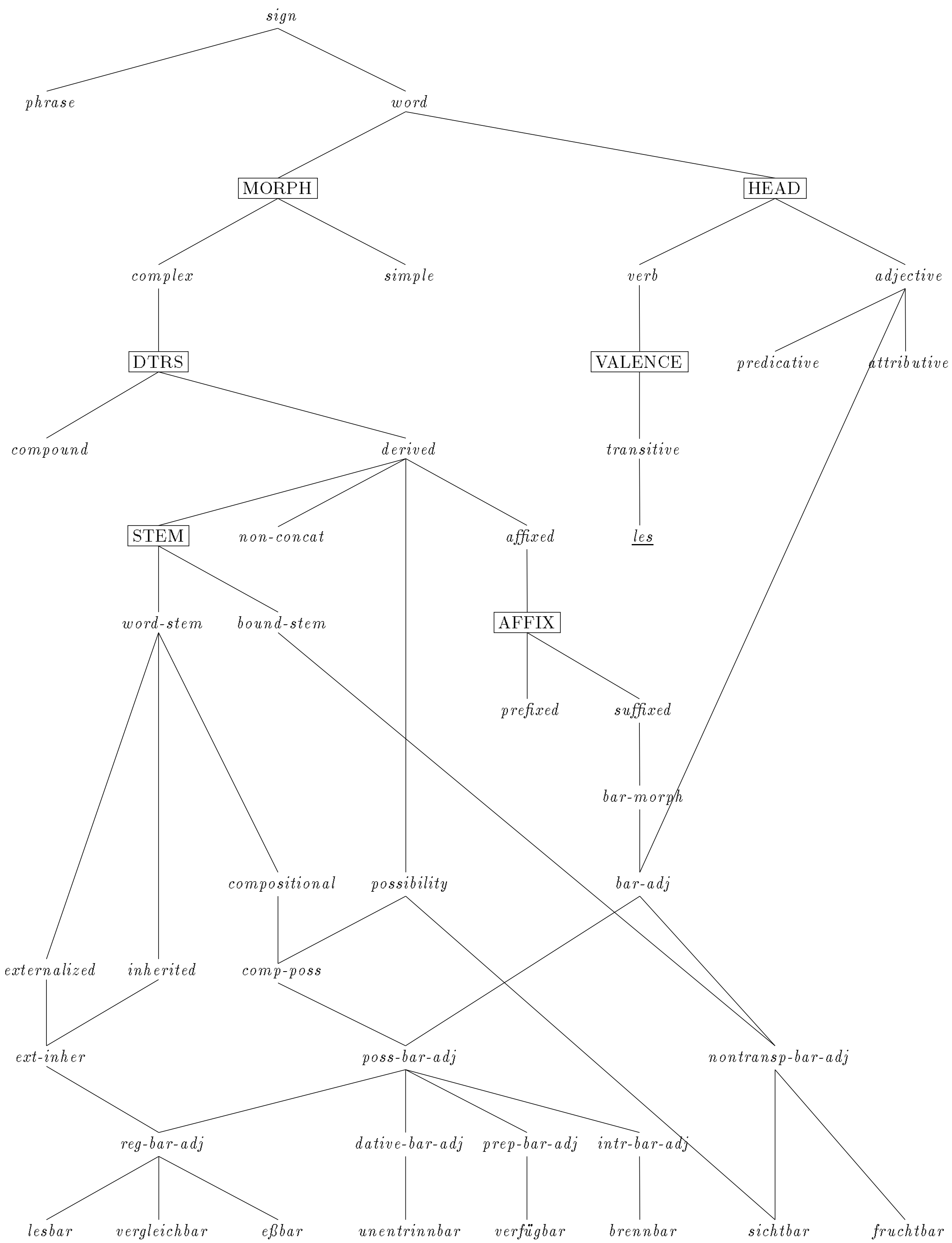

Figure 7: The lexical inheritance hierarchy

but because it occurs as part of a complex adjective only, without having any independent existence as a word (Bierwisch (1989) also observes that *-bar* **is not** an adjective, but is used to form adjectives). If such a representation is associated with a hierarchy similar to that of Krieger & Nerbonne (figure 1), the approach makes approximately the same predictions as a word-syntactic one.

$$\left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{reg-bar-adj}} \\
\text{MORPH} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{complex}} \\
\text{BASE} & \textbf{cond-concat}\;(\boxed{1}, \boxed{2}) \\
\text{DTRS} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{affixed}} \\
\text{STEM} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{transitive}} \\
\text{MORPH|BASE} & \boxed{1} \\
\text{SYNSEM|LOC} & \left[\begin{array}{ll}
\text{CAT|VAL|COMPS} & \langle \textbf{NP}[\textbf{acc}]{:}\boxed{4} | \boxed{5} \rangle \\
\text{CONT}\ \boxed{6} & \left[\begin{array}{ll}
\text{QUANTS} & \langle\ \rangle \\
\text{NUC} & \left[\begin{array}{ll}
\text{RELN} & \\
\text{AGENT} & \\
\text{THEME} & \boxed{3}
\end{array}\right]
\end{array}\right]
\end{array}\right]
\end{array}\right] \\
\text{AFFIX} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{suffix}} \\
\text{FORM} & \boxed{2}\ \ \text{“\textbf{-bar}”}
\end{array}\right]
\end{array}\right]
\end{array}\right] \\
\text{SYNSEM|LOC} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{ll}
\text{LEX} & + \\
\text{HEAD} & \textit{adjective} \\
\text{VAL} & \left[\text{COMPS}\ \boxed{5}\right] \\
\text{SUBCAT} & \langle \textbf{NP}_{\boxed{3}}{:}\boxed{4} | \ldots \rangle
\end{array}\right] \\
\text{SEM-CONTR} & \left[\begin{array}{ll}
\text{QUANTS} & \langle\ \rangle \\
\text{NUC} & \left[\begin{array}{ll}
\text{RELN} & \left[\begin{array}{ll}
\text{OPERATOR} & \diamond \\
\text{SCOPE} & \boxed{6}
\end{array}\right] \\
\text{ARG} & \boxed{3}
\end{array}\right]
\end{array}\right]
\end{array}\right]
\end{array}\right]$$

Figure 8: Constraints on regular *bar*-adjectives

As mentioned above, it would be possible to interpret this as the analogue of a lexical entry for the affix. But a hierarchy of lexical types offers interesting alternatives. The information can be viewed as being inherited from multiple sources, as can be seen in figure 7.

I will now describe in detail which constraints are supposed to be associated with each of the types, so that it becomes clear which part of the information in figure 8 (*reg-bar-adj*) originates where. The constraints associated with the three types at the top of the hierarchy would be as in figure 9.

Here the feature BASE is assumed to contain the uninflected form of the word, with the inflectional affixes being included in the FORM feature according to the information from the PARADIGM attribute (for recent paradigmatic approaches to inflectional morphology see Calder (1990) and Gibbon (1992)).

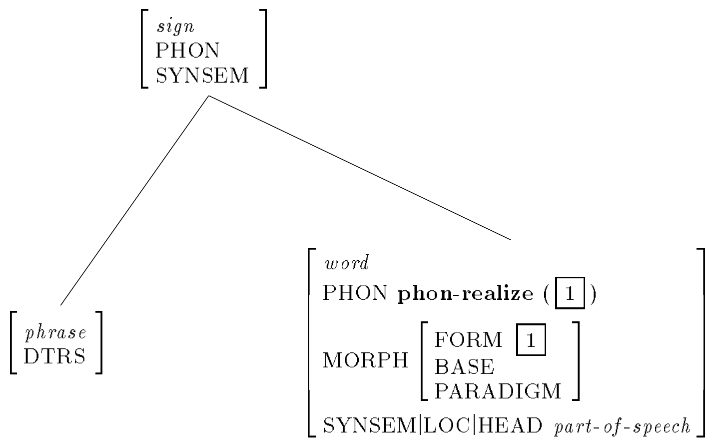

Figure 9: The sign hierarchy

Adjectives come in two subtypes, predicative and attributive ones. The information common to both can be seen in (75).

(75)
$$\begin{bmatrix} \textit{adjective} & \\ \text{MORPH} \ldots & \\ \text{SYNSEM|LOC} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{HEAD} & \textit{adjective} \\ \text{VAL} & \begin{bmatrix} \text{COMPS} \end{bmatrix} \\ \text{SUBCAT} & \langle \text{NP}_{\boxed{1}} \ldots \rangle \end{bmatrix} \\ \text{SEM-CONTR} & \begin{bmatrix} \text{QUANTS} & \langle\ \rangle \\ \text{NUC} & \begin{bmatrix} \text{RELN} & \\ \text{ARG} & \boxed{1} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Because predicative and attributive adjectives have a common semantic core, but nevertheless a different overall structure, it is not possible to express this relationship by simple inheritance. But one can define an auxiliary feature SEM-CONTR[40] to contain the shared information.[41] This feature will be inherited by both subtypes, and is available for subsequent structure-sharing with whichever feature-structural position it is needed in.

In order to capture the relationship between the subject of a predicative adjective and the noun modified by an attributive one, it is necessary to use another auxiliary feature.[42] The 'old' subcategorization list is still needed for binding

[40]This feature has been introduced by Kathol (in press) to account for adjectival passives. Although it is not independently needed, this seems preferable to the alternative to go back to traditional directional lexical rules.

[41]This conception of adjectival semantics leads to complex relations in the case of *bar*-adjectives, as can be seen in figure (8).

[42]In this case it might be possible though to use the SUBJ feature to contain shared information, and somehow stop attributive adjectives from requiring a SUBJ in addition to their MODified N′.

phenomena and can probably be used for this purpose.[43]

Predicative adjectives inherit from this type, and take over the semantics of the first element on the SUBCAT list into their own SUBJ feature ($\boxed{2}$ in 76). They also adopt the value of SEM-CONTR for their own semantics, which is an ordinary *psoa*.

(76)
$$\left[\begin{array}{ll} \text{MORPH} \ldots & \\ \text{SYNSEM|LOC} & \left[\begin{array}{ll} \text{CAT} & \left[\begin{array}{l} \text{HEAD } \textit{predicative} \\ \text{VAL} \left[\text{SUBJ } \langle \textbf{NP}{:}\boxed{2} \rangle\right] \\ \text{SUBCAT } \langle \textbf{NP}{:}\boxed{2} | \ldots \rangle \end{array}\right] \\ \text{CONT } \boxed{3} & \\ \text{SEM-CONTR } \boxed{3} & \end{array}\right] \end{array}\right]$$

For attributive adjectives, on the other hand, it is stated in (77) that the semantics of the first element on the SUBCAT list is the same as that of the MODified N′. They also integrate the value of SEM-CONTR as part of the RESTRICTION on the INDEX (at least this is an approximation for the case of intersective adjectives, of which most *bar*-adjectives are examples).

(77)
$$\left[\begin{array}{ll} \text{MORPH} \ldots & \\ \text{SYNSEM|LOC} & \left[\begin{array}{ll} \text{CAT} & \left[\begin{array}{ll} \text{HEAD} & \left[\begin{array}{l} \textit{attributive} \\ \text{MOD } \textbf{N}'{:}\boxed{2} \left[\begin{array}{l} \text{INDEX } \boxed{1} \\ \text{RESTR } \boxed{4} \end{array}\right] \end{array}\right] \\ \text{SUBCAT} & \langle \textbf{NP}{:}\boxed{2} | \ldots \rangle \end{array}\right] \\ \text{CONT} & \left[\begin{array}{l} \text{INDEX } \boxed{1} \\ \text{RESTR } \left\{ \boxed{3} \right\} \cup \boxed{4} \end{array}\right] \\ \text{SEM-CONTR } \boxed{3} & \end{array}\right] \end{array}\right]$$

Further constraints—not given here—would have to include pragmatic ones such as the fact that adjectives typically express lasting, non-trivial properties. Also I have not given the morphological information, which would have to include inflectional endings and comparative and superlative forms.

Turning to the morphological part of the hierarchy, the constraints imposed on the types are the following: All *complex* words have a feature path MORPH|DTRS, all *derived* words a feature path MORPH|DTRS|STEM, and all *affixed* ones a feature path MORPH|DTRS|AFFIX. Common to all suffixed words is the constraint (78):

[43]This of course works only if SUBCAT is **not** defined as a simple concatenation of SUBJ and COMPS.

(78)
$$\begin{bmatrix} \textit{suffixed} & \\ \text{MORPH} & \begin{bmatrix} \text{BASE} & \textbf{cond-concat}\ (\boxed{1}, \boxed{2}) \\ \text{DTRS} & \begin{bmatrix} \text{STEM} & \begin{bmatrix} \text{MORPH|BASE} & \boxed{1} \end{bmatrix} \\ \text{AFFIX} & \begin{bmatrix} \textit{suffix} & \\ \text{FORM} & \boxed{2} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

I have put **cond-concat** here, although for *bar*-adjectives, which in this respect are fairly regular, the little morphophonological variation that does exist (e.g. dropping of *-ig* as in *entschuldbar*) could probably be expressed directly (cf. Bird 1992 for an approach to phonology compatible with HPSG).

Next is the part of the hierarchy having to do more directly (but not exclusively) with *bar*-derivation. In this hierarchy the morphological and the semantic part of the rule are separated on one level, so that the respective constraints on the input can be stated individually and do not have to be repeated for other suffixes sharing the same morphology or semantics only (cf. Beard 1988 & 1990, and Jackendoff 1975). There is a morphological part, shown in (79), consisting of a morphological effect (and perhaps morphological constraints), which may in principle be the same for different affixes with the same morphological form.[44]

(79)
$$\begin{bmatrix} \textit{bar-morph} \\ \text{MORPH|DTRS|AFFIX|FORM ``}\textbf{-bar}\text{''} \end{bmatrix}$$

There is also a semantic effect (80), which may be subject to some constraints, and which is shared by different means of derivation. Adjectives ending in *-lich* would have this information in common with *bar*-adjectives. A more detailed study of the kind of possibility involved is likely to result in a contextual relativization by ‘with respect to’ (Kratzer 1978). The quantifier list within the scope of the modal operator has to be empty—all quantifiers take wide scope over the modal operator.

(80)
$$\begin{bmatrix} \textit{possibility} & \\ \text{SYNSEM|LOC|SEM-CONTR|NUC|RELN} & \begin{bmatrix} \text{OPERATOR} & \Diamond \\ \text{SCOPE|QUANTS} & \langle\ \rangle \end{bmatrix} \end{bmatrix}$$

The fact that the underlying stem’s semantics is put into the derived forms scope (81) is common to all compositionally derived words. Note that this results in a complex relation, which has to do with the overall structure the semantics should have, i.e. the adjective being attributed as a whole.

[44] A purely morphological generalization is needed to explain similarities that are independent of the typical semantics of the affix. The semantically non-transparent words *kostbar* (‘valuable’, ‘precious’) or *sonderbar* (‘strange’) nevertheless behave in the same way as the more regular ones from the point of view of *keit*-suffixation (cf. *Kostbarkeit* (‘preciousness’, ‘treasure’) and *Sonderbarkeit* (‘strangeness’)).

(81) $$\begin{bmatrix} \textit{compositional} \\ \text{MORPH|DTRS|STEM|SYNSEM|LOC|CONT } \boxed{1} \\ \text{SYNSEM|LOC|SEM-CONTR|NUC|RELN|SCOPE } \boxed{1} \end{bmatrix}$$

The syntactic[45] effect is twofold. The subject of the adjective can correspond to an an underlying accusative object (82):

(82) $$\begin{bmatrix} \textit{externalized} \\ \text{MORPH|DTRS|STEM } \begin{bmatrix} \textit{transitive} \\ \text{SYNSEM|LOC|CAT|VAL|COMPS } \langle \textbf{NP[acc]}\text{:}\boxed{1} | \ldots \rangle \end{bmatrix} \\ \text{SYNSEM|LOC|CAT|SUBCAT } \langle \textbf{NP}\text{:}\boxed{1} | \ldots \rangle \end{bmatrix}$$

Further complements may be inherited (83):

(83) $$\begin{bmatrix} \textit{inherited} \\ \text{MORPH|DTRS|STEM|SYNSEM|LOC|CAT|VAL|COMPS } \langle \textbf{NP} | \boxed{1} \rangle \\ \text{SYNSEM|LOC|CAT|VAL|COMPS } \boxed{1} \end{bmatrix}$$

There are further thematic restrictions on possible *bar*-adjectives, expressed in figure 8 as the ordinary thematic roles THEME and AGENT, which have to hold of the object and subject of the underlying verb respectively. Note that the AGENT is not linked to a syntactically realized argument in the *bar*-adjective, but is because of its underspecification implicitly existentially quantified (Nerbonne & Krieger 1992).[46] This thematic role notation is to be understood as a shorthand only, and it would be interesting to investigate the possibility of associating them with proto-entailments (Dowty 1991). This would mean locating the names for the roles only in types—or perhaps nowhere: it seems to be the case that for *bar*-derivation only a certain number of entailments (affectedness or incrementality of the 'patient' and causation or sentience of the 'agent') have to hold. In any case it seems more promising to relate these notions to a typology of situations/events than to treat them as primitives.

Under the standard HPSG and situation-semantic practice of labelling roles individually depending on the relation involved (so that 'read' has a READER role, 'write' a WRITER etc.), it is not possible to represent any generalizations at all (a point also made in Engdahl 1990), which does not seem any more desirable

[45]It would be conceptually clearer and more elegant to use only the semantic information and explain the remaining phenomena via the same kind of linking-rules that are assumed to be independently needed for establishing the relation between the semantic argument structure and the complementation possibilities of a given verb (Wechsler 1992). Whether this is possible is not at all obvious: some idiosyncratic information, such as the choice of a particular preposition out of a range of semantically possible ones, seems to be inherited. An investigation of this is unfortunately not possible within the limits of this work, although *bar*-adjectives do provide a rich source of data that is relevant to the issue.

[46]It is actually worth considering whether a (restricted) universal quantification would not be more appropriate for an explanation of some of the empirical observations.

than a fixed set of primitive roles. Notice that while it would be a very interesting result if it could be shown that these entailments generalize to the 'irregular' cases, it is unlikely that it will be possible to state absolute constraints (for a similar conclusion with respect to unaccusativity in German see Kathol (1992)). While the prototypical verb that can undergo *bar*-derivation has a volitionally acting subject, there are exceptions (though the number of entailments that hold may well correlate with the degree of acceptability of the adjective).

The local constraints for partly regular cases, where the subject has an origin different from an accusative object, are (84), (85), and (86).

(84) $\left[\begin{array}{l} \textit{dative-bar-adj} \\ \text{MORPH|DTRS|STEM|SYNSEM|LOC|CAT|VAL|COMPS} \ \langle \textbf{NP[dat]}{:}\boxed{1} | \ldots \rangle \\ \text{SYNSEM|LOC|CAT|SUBCAT} \ \langle \textbf{NP}{:}\boxed{1} | \ldots \rangle \end{array}\right]$

(85) $\left[\begin{array}{l} \textit{prep-bar-adj} \\ \text{MORPH|DTRS|STEM|SYNSEM|LOC|CAT|VAL|COMPS} \ \langle \textbf{PP}{:}\boxed{1} | \ldots \rangle \\ \text{SYNSEM|LOC|CAT|SUBCAT} \ \langle \textbf{NP}{:}\boxed{1} | \ldots \rangle \end{array}\right]$

(86) $\left[\begin{array}{l} \textit{intr-bar-adj} \\ \text{MORPH|DTRS|STEM|SYNSEM|LOC|CAT|VAL|SUBJ} \ \langle \textbf{NP}{:}\boxed{1} \rangle \\ \text{SYNSEM|LOC|CAT|SUBCAT} \ \langle \textbf{NP}{:}\boxed{1} | \ldots \rangle \end{array}\right]$

The lexical entries for regular *bar*-adjectives could then be minimal: they are instances of type *reg-bar-adj* and have associated with them only the information from which verb they are derived. Note that for the type name of the lexeme I decided to use the uninflected stem form. The lexical entry for *vergleichbar* would be as in (87):

(87) $\left[\begin{array}{l} \textit{vergleichbar} \\ \text{MORPH|DTRS|STEM} \ \ \textit{vergleich} \end{array}\right]$

Notice that within the formalism it is not possible to express that the type of a lexical entry should always correspond to its phonology (unless multiple lexemes with the same phonology have to be distinguished). But if such a meta-constraint about type names was assumed it would follow via the connection between the two PHON attributes which lexeme a given *bar*-adjective is related to, so that even this would not need to be stated.

The entries for lexicalized instances of *dative-bar-adj*, *prep-bar-adj* and *intr-bar-adj* would be analogous. Idiosyncratic information can be added to lexical entries, as e.g. in (88):

(88) $\left[\begin{array}{l} \textit{eßbar} \\ \text{MORPH|DTRS|STEM} \ \ \textit{ess} \\ \text{SYNSEM|LOC|SEM-CONTR|NUC|RELN|MODIFIER} \ \ \textit{safely}' \end{array}\right]$

Note that I have added an additional feature (MODIFIER) here, which should not be a problem since lexical entries are treated as types anyway. Since for a more detailed analysis of lexical semantics several features will probably have to be distinguished anyway, it would also not be implausible to have this feature on a higher level than that of individual lexical entries. But this additional aspect of meaning might also be represented differently, perhaps using conventional implicatures. Since adjectives are treated as adding restrictions to the index of the noun they modify, it is possible to express selectional restrictions by restricting e.g. semantic aspects of the modified noun (available in the MOD feature) and linking these to specializations in the adjective.

For partly regular cases only the relevant differences need to be listed, as in (89):

$$(89)\quad \begin{bmatrix} \textit{sichtbar} & \\ \text{MORPH|DTRS|STEM} & \begin{bmatrix} \textit{bound-stem} \\ \text{MORPH|BASE ``}\textbf{sicht-}\text{''} \end{bmatrix} \\ \text{SYNSEM|LOC|SEM-CONTR|NUC|RELN|SCOPE|NUC|RELN} & \textit{see}' \end{bmatrix}$$

Exceptional cases like *fruchtbar* would have lexical entries like (90):

$$(90)\quad \begin{bmatrix} \textit{fruchtbar} & \\ \text{MORPH|DTRS|STEM} & \begin{bmatrix} \textit{bound-stem} \\ \text{MORPH|BASE ``}\textbf{frucht-}\text{''} \end{bmatrix} \\ \text{SYNSEM|LOC|SEM-CONTR|NUC|RELN} & \textit{fertile}' \end{bmatrix}$$

By inheritance the information in (87) is expanded to that in figure 10. This AVM also demonstrates a case of 'argument inheritance'. The verb *vergleichen* ('compare') subcategorizes for an additional prepositional object, which is inherited by the adjective. Note that the inherently case-marked objects are inherited completely, while the relationship of the derived subject to the underlying accusative object is mediated by sharing of the semantics only (in contrast to Krieger). Case is not taken over along with the semantics.

Splitting up independent constraints on one level in this way has several advantages. First of all, they can be re-used for the description of related data, as indicated above. Secondly, it is made absolutely precise in which respect a given word is regular and how much it has in common with other words. This makes it possible to express subregularities without using defaults. They constitute alternative patterns, which share certain supertypes with the regular *bar*-pattern, but differ in others. The *bar*-adjectives from intransitive verbs for example are morphologically and semantically regular, but not syntactically: the subject of the adjective is related to the underlying subject, not object.

This mechanism, which was developed to account for lexicalized subregularities, can now also be used to explain new formations according to these patterns. They can be activated if the information contained in them is specific enough to predict the syntax and semantics of the resulting word correctly. The more

$$
\begin{bmatrix}
\textit{vergleichbar} & \\
\text{MORPH} & \begin{bmatrix}
\text{BASE} & \text{“}\textbf{vergleichbar}\text{”} \\
\text{DTRS} & \begin{bmatrix}
\text{STEM} & \begin{bmatrix}
\textit{vergleich} & \\
\text{MORPH|BASE} & \text{“}\textbf{vergleich-}\text{”} \\
\text{SYNSEM|LOC} & \begin{bmatrix}
\text{CAT|VAL|COMPS} & \langle \textbf{NP}[\text{acc}]{:}\boxed{4} \mid \boxed{5}\,\textbf{PP}[\text{mit}] \rangle \\
\text{CONT} & \boxed{6} \begin{bmatrix}
\text{QUANTS} & \langle\ \rangle \\
\text{NUC} & \begin{bmatrix} \text{RELN} & \textit{compare}' \\ \text{AGENT} & \\ \text{THEME} & \boxed{3} \end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix} \\
\text{AFFIX} & \begin{bmatrix} \textit{suffix} & \\ \text{FORM} & \text{“}\textbf{-bar}\text{”} \end{bmatrix}
\end{bmatrix}
\end{bmatrix} \\
\text{SYNSEM|LOC} & \begin{bmatrix}
\text{CAT} & \begin{bmatrix}
\text{LEX} & + \\
\text{HEAD} & \textit{adjective} \\
\text{VAL} & \begin{bmatrix} \text{COMPS} & \boxed{5} \end{bmatrix} \\
\text{SUBCAT} & \langle \textbf{NP}_{\boxed{3}}{:}\boxed{4} \mid \ldots \rangle
\end{bmatrix} \\
\text{SEM-CONTR} & \begin{bmatrix}
\text{QUANTS} & \langle\ \rangle \\
\text{NUC} & \begin{bmatrix}
\text{RELN} & \begin{bmatrix} \text{OPERATOR} & \diamond \\ \text{SCOPE} & \boxed{6} \end{bmatrix} \\
\text{ARG} & \boxed{3}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$

Figure 10: The AVM for *vergleichbar*

instances in the lexicon are analyzed according to this pattern, and the more frequent these are, the more likely it is that the pattern will actually get used. This explains why some of them sound a bit odd: some of the constraints associated with the prototypical words ending in *-bar* are violated, and the pattern is less prominent.

This goes beyond what can be expressed with a single lexical rule per affix, and implements the notion of 'word formation on the basis of the lexicon', depending crucially on the presence of parallel cases among lexicalized forms. Such a mechanism is even more important for other affixes in German, like e.g. *-ig*, the analogical nature of which is widely acknowledged.[47] The indication that such a mechanism is also needed for regular *-bar* is even stronger evidence in favor of it.

To sum up, the proposed approach has the following characteristics:

1. The suffix itself is not an adjective, but it occurs as part of adjectives and therefore indirectly indicates the category of the complex word.

2. The fact that the affix cannot surface on its own, but is a 'bound morpheme', follows directly, because it does not have a lexical entry but forms the second

[47]The importance of analogy for word formation is recognized for example in Motsch (1977 & 1988), Reis (1983), Olsen (1988), and Becker (1990), and from a more psycholinguistically oriented perspective in Derwing (1990) and Derwing & Skousen (1989).

part of a particular type of words only.

3. The syntactic and semantic information is attributed directly to the complex word, without mediation via the affix.

4. There is an internal structure to derived words, with the first part being an existing sign (lexical entry of the verb in this case), but the affix being introduced syncategorematically in the type.

5. The constraints come from multiple sources, allowing the explicit representation and new formation of partially regular words.

6. There is no lexical type for *bar-verbs*, but only actually existing *bar*-adjectives and ones that are predicted to be possible by the generalizations expressed in the type for regular *bar*-adjectives.

7. The mechanism underlying inheritance is simple unification, not default inheritance.

5.2 The Nature of the Lexical Types

This section is concerned with the exact nature of the lexical types that can be found in the hierarchy. Note that in the top part of my hierarchy the cross-classification is always keyed to some feature (shown in the boxes), with the top-level distinction corresponding to one at the more deeply embedded level of this feature. This can be seen for example in the constraints on adjectives in (75): the described object is an adjective because of the value of its SYNSEM|LOC|HEAD attribute (and the fact that it is a word), but the top-level type is still needed because constraints of the required kind cannot otherwise be expressed in the HPSG formalism as it is normally seen.

With respect to the embedded type it is only possible to state restrictions on its internal structure (e.g. that it has a MOD attribute), but not to refer to information outside of it. Only appropriateness conditions are associated with types—but if the syntactic, semantic, pragmatic, and morphological restrictions all adjectives are subject to have to be expressed, it is necessary to make reference to features that are embedded within others, to specify the atomic values of certain features, to use structure-sharing, and in particular to refer to the values of features external to the structure of the given type.

This seems to indicate either that the type information on the embedded level is not needed, or that the formalism is too weak in not allowing this kind of constraint to be expressed.

In a formalism such as the one developed by King (1992 & to appear), it is not necessary to treat the type *adjective* as a subtype of *word*, because more general implications with complex antecedents are allowed. Antecedents are not restricted to a top-level type, so implications can be stated with respect to the embedded type—if a *word*'s SYNSEM|LOC|HEAD is of type *adjective*, then the word's syntactic information is of a certain kind etc. An example is shown in (91).[48]

(91) $\begin{bmatrix} \textit{word} \\ \text{SYNSEM|LOC|CAT|HEAD} \quad \textit{adjective} \end{bmatrix}$

$$\Rightarrow \begin{bmatrix} \text{SYNSEM|LOC|CAT|SUBCAT} \ \langle \text{NP}_{\boxed{1}} \ \ldots \rangle \\ \text{SYNSEM|LOC|SEM-CONTR|NUC|ARG} \ \boxed{1} \end{bmatrix}$$

This also has the advantage that constraints common to adjectival words and phrases can be expressed in the same way. In this kind of formalism words are being cross-classified according to the types which are the values of their features. There is not one big multiple inheritance hierarchy, but several smaller ones, in each of which the immediate subtypes partition their supertype. The minimal subtypes of a given type (called varieties) are pairwise disjoint and exhaustive.

Since this kind of implication is not available in the standard HPSG formalism I introduced corresponding top-level types. Indeed it makes sense to think of the class of *adjectives* or *suffixed* words[49] as (lexical) subtypes of *word*. I still used the box-notation to indicate along which dimension the classification is being done and where there would be partitions: every word is either complex or simple, but no word can be complex and simple at the same time.

Notice that in this hierarchy (and in Krieger & Nerbonne's) some of the 'types' (all those which can inherit multiply and which are not cross-classified with the box-notation in figure 7, and e.g. *MHFP* in Krieger & Nerbonne) cannot naturally be seen as being keyed to the subtype of a particular attribute's value (although it would of course always be possible to introduce a new feature and use its atomic value for this purpose).

These 'types' are more like templates, which can associate complex information with a name for future reference and are used to structure lexical entries. This also makes sense in view of the fact that in most feature logics the number of types is assumed to be finite, which is a problem if all lexical entries are types as well.[50] But treating lexical entries as types is not only common, but also seems necessary in the absence of an additional template mechanism. One needs to be

[48]Note that this is not written in the syntax used by King, but adapted to the AVM notation used throughout this thesis.

[49]At the moment I do not state any constraints on derived words which could not be expressed with appropriateness conditions alone, since in my approach the DTRS feature is seen as part of morphology, not as a top-level feature. Therefore, if preferred, the complexity dimension would not need to be made a top-level distinction.

[50]Every given set of lexical entries is finite, of course, and it is probably not necessary to create type names for occasionally used, productively formed words. And how the diachronic process of lexicalization and the acquisitional one of learning new words are handled is a different issue. But I suspect most logicians would still be worried about having as many types as there are words in the vocabulary of a language.

able to unambiguously refer to a particular lexeme, for example when idiosyncrasies are preserved under further derivation. The formal similarity between words and generalizations across them will actually be an advantage if analogy is to be taken seriously. Since templates are a simpler means of abstraction than types (Rupp 1992) they can always be integrated into the type hierarchy as top-level types with complex constraints.

It has been asked whether the duplication of type information on the embedded and top levels does not indicate that there are too many tools available, and that one of them should be eliminated. Maybe the best thing to do is to try and find a principled way to choose from them, as both have their advantages. On the one hand it seems natural to say that there are different kinds of words: complex words and simple words, but also adjectives, verbs etc. Cooper (1990) suggests to use classifications of this top-level kind, but not to type embedded feature structures.

But typing of parts of feature structures has several advantages. It puts limits on expressible kinds of generalizations, and appropriateness conditions on possible attributes and their values can be imposed, so that negative information can be expressed. If one knows that these, and only these attributes are appropriate, a distinction can be made between underspecified and inappropriate features. Also, and most crucially for my approach, the possibility is created of relating parts of words to other lexical entries without recourse to a separate mechanism of lexical rules, although this could probably also be achieved in a suitable template system. Because the first daughter (in suffixed words) is the complete lexical entry of the underlying verb, the necessary semantic and syntactic information (e.g. choice of preposition) is available and can be referred to. It is this mechanism of recursive type specification that makes it possible to cope with derivation using only inheritance—it has been amply illustrated by Krieger & Nerbonne that naive inheritance (in the case of *bar*-adjectives an inheritance from the suffix and the verb) will not suffice.

5.3 Conditions for 'Activation': Degrees of Productivity

If the lexicon was formerly seen as a big disjunction of lexical entries it is now a disjunction of the lexical entries and the productive patterns. Viewed from the perspective of the hierarchy, in addition to the existing lexical entries these patterns have to be minimal types as well. If such a pattern (for example *bar-pattern* as a subtype of *reg-bar-adj*) does not have any subtypes but contains as its part a non-minimal other top-level type (in this case *transitive*), this type can be further instantiated, subject to the other restrictions expressed in *reg-bar-adj*. This is made possible by recursive type specifications, allowing words to contain other words as their parts.

It was mentioned before that some of the generalizations which have been formed and give structure to the existing lexicon can be used to account for productive word formation.

This section is concerned with the question of how it can be determined which of them should be classified as productive. Note that this issue is not even addressed in most approaches, where it has to be stipulated with the rule—if there is a way of analyzing lexicalized outputs of synchronically unproductive rules at all.

One type of generalization can be excluded right away: if no predictions are made about the semantic changes that correspond to a given morphological change, a pattern cannot be used for production. According to this reasoning the degree of productivity should decrease with the specificity embodied in the respective generalization.

Also, some information is needed that defines what words or stems are appropriate inputs. Patterns which are highly restricted with respect to possible inputs, and therefore are seemingly not very productive (Kastovsky 1986), do not pose any problems.

Now it becomes clear why there is no strict separation between productive and non-productive rules, but a gradual transition between the two. The degree of productivity depends on the kinds of constraints imposed on the input: whether they are of a purely syntactic nature, or combined with additional semantic and morphological conditions. Because the 'rule' is composed of a morphological, a semantic and a syntactic part, it is possible to also describe new formations which violate some of the constraints. It is easiest to tolerate a morphological deviation: ??*vereinbarbar* sounds odd, but is perfectly comprehensible.

If one wants to make use of this and come as close as possible to human performance it would be necessary to include all the patterns, and perhaps associate them with information about priority with respect to their use.

But for the purposes of an actual computational implementation one might want to draw a line somewhere in order to stop the system from 'creatively' forming new words by analogy. One way in which this might be done is to use only the types which in their function as redundancy rules include a sufficiently large number out of the class of their input verbs.

One could also think of an algorithm using information about the number and frequency of words analyzed by each type, making only the most prominent pattern the one according to which new words are to be generated. This would come close to an implementation of the idea of inductively forming and using generalizations. The need to include frequency information is also emphasized by Bybee (1988). But it cannot be the only criterion since there are unproductive affixes (e.g. -*lich*) in which nevertheless a large number of existing words end. These would require an even more complex algorithm taking into consideration also the semantic coherence of words ending in a particular suffix. For a discussion of different influences affecting the compositional interpretation of complex words see e.g. van Marle (1988). It is questionable though, whether information such as knowledge of the frequency with which new words with a particular affix have been encountered can ever be integrated into an algorithm of this kind.

Note that determining the productive patterns is complicated by the decision not to treat subregularities as overriding subclasses. It would be worth considering whether defaults could be allowed in a highly restricted way, allowing only some of the prototypical semantic entailments not to hold. On the other hand, the work that has to be done when determining the productive patterns in a non-default approach has in a sense been done already as part of the construction of the default hierarchy. Here the linguist also uses information about the number of instances of a type and their frequency in order to determine what is the default case and what is an exception.

Some cases, in which a word should be 'possible' according to this reasoning, but is actually not used much, can be explained by semantic blocking: if a word with exactly the same semantics that the new one would have already exists in the language, there is no need to form an additional one (for a related view of blocking see Copestake 1991). A relevant example would be ?*sehbar* ('seeable') which is blocked almost completely by *sichtbar* ('visible').

These strategies lie outside of the hierarchy itself—but at least the patterns are there and do not have to be stipulated independently of existing lexical entries. Also, in contrast to traditional lexical rules, the patterns have the same formal status as other descriptions of feature structures, which are available in the formalism anyway.

Independently of how the 'regular' patterns to be used in an implementation are determined, it is an advantage that all the generalizations that are obtained from the data can in principle be used for parsing, i.e. for analyzing a new complex word.

5.4 Relation to Lexical-Rule Approaches and to a 'Syntax of Words'

This section will briefly explain how the proposed treatment of derivation relates to others, especially the two outlined in the introduction. The early attempts of accounting for word formation with transformations (for *bar*-adjectives see e.g. Abraham 1970) and recent syntactic analyses (e.g. von Stechow 1990) will not be considered here. For detailed comparisons of the main approaches to morphology, see Olsen (1989) and Spencer (1991).

My approach has in common with word-syntactic ones, for example Selkirk (1982), Höhle (1982) and Olsen (1986a), that derived words have an internal structure. This is motivated by facts from coordination (*eß- und trinkbar* ('eat- and drinkable') or *lösch- und bespielbar* ('erase- and retapable'))[51], and by the

[51] This does not seem to work with bound stems, which suggests that **some** additional information will probably have to be reintroduced to the affix.

need to be able to distinguish between derived and non-derived words.

On the other hand there is no lexical entry for the affix, an aspect that the approach has in common with process-based proposals which view derivation as a relation between lexical entries (Jackendoff (1975), Aronoff (1976), Pollard & Sag (1987), Flickinger (1988), Zwicky (1989) and Anderson (1992)). While it would be possible to describe *bar*-suffixation as a purely phonological effect in a hierarchy of the proposed kind, it does not seem desirable to do so.

The new conception offers the interesting possibility of treating derivation, which is somewhere in the middle between inflection (for which a process-based view seems preferable) and compounding (for which a word-syntactic one does) as being in the middle. It seems independently necessary to regard words as parts of other words for compounding, so there is nothing particularly strange about viewing the stem of a derived word as an independent word that forms part of the complex one. On the other hand, there is no need to view the affix as being a sign of its own, when it obviously is not. So the internal structure of the word *lesbar* would not be $[[\text{les}]_V[\text{bar}]_A]_A$ as in a word-syntactic approach,[52] but instead $[[\text{les}]_V\text{bar}]_A$ as in some of the lexical-rule approaches, where the internal structure of a word is seen as corresponding to its derivational relationship. The difference is that in my approach the structure is explicitly represented, with the suffix being an 'item', though not a sign. The approach can thus be related to a categorial approach in which affixes could be seen as a kind of functor item. But because the suffix is introduced syncategorematically in the hierarchy, it becomes a plausible alternative that there is no such thing as 'the' lexical entry for the affix (but rather various types of words ending in the 'same' unit on different levels).

More recently such a 'middle'-position, assuming internal structure without a word-syntax, has been taken by Motsch (1987) and Carstairs-McCarthy (1992),[53] and it derives further plausibility from the fact that derivational patterns typically developed from compounds. It should not be surprising that there are intermediate cases, where the second part of a compound is still an existing word, but exhibits some characteristics of an affix. An example would be *Wesen* ('animate being'), still interpretable in the sense of the simplex in *Fabelwesen* ('mythical creature'), but no longer in *Schulwesen* ('school system'). The first step in the direction of becoming an affix[54] would be specialization in meaning and formation of a series of words analyzed according to the same pattern. When the connection to the independent word is lost completely, changes in the morphological shape of the new affix can also take place. But it is plausible to assume that only

[52]Advocates of word syntactic approaches differ in whether they assume A or A^{af} as the category for the suffix.

[53]A. Spencer also argued for a similar view in a talk in Stuttgart (summer 1992).

[54]As mentioned already in section (1.3) the suffix *-bar* for example originated as the verbal second part of a compound, with the first part being a noun. The development into a proper suffix was probably facilitated by ambiguous cases like *nutzbar* ('usable'), *zierbar* ('decoratable'), *strafbar* ('punishable'), or *wandelbar* ('changeable') where the first part could be either a noun or a verb.

the status of the second part of the complex word changes and not the whole structure. The stem can still be seen as a part of the complex word, as it was before. Further evidence for not treating the affix as a lexical entry with its own category and semantics comes from the fact that the process of becoming an affix is directional.[55] If a suffix had essentially the same status as the second part of a compound does, there would be no reason why it should not be possible for the affix to become a free word again.

The main connection between the present proposal and previous morphological research then seems to be through the notion of 'redundancy rule'. As suggested by Jackendoff (1975) and further developed in Bochner (1988),[56] the main function of lexical rules is that of giving structure to the system of existing lexical entries. They clearly have this function in the present approach, as they are used to reduce the amount of redundant information in lexical entries. Predictable information in lexical entries does not contribute to the 'independent information content' of the lexicon, and at the same time the problem of 'redundancy in the rule system' is solved. This is due to the fact that the (declarative) 'rules' themselves are part of the hierarchy. The information associated with the type of regular *bar*-adjectives by inheritance from its supertypes was summarized in figure 8. This roughly corresponds to the traditional rule and can be activated to serve that purpose.

[55]Thanks to M. Reis for pointing this 'one-way street' effect out to me.

[56]Motsch (1987, 1989 & 1990) also argues for a reconsideration of redundancy rules.

Conclusions

To sum up, I have proposed a system for lexical representation which uses lexical types organized into a hierarchy with monotonic multiple inheritance. Using these methods it becomes possible to view the constraints on *bar*-adjectives as being inherited from multiple sources, and thus to describe exceptions, partial regularities, and all sorts of idiosyncrasies which abound in the lexicon in an elegant, non-redundant way. The patterns which are formed when stating generalizations across lexical entries in order to structure them, can be seen as (declarative) lexical redundancy rules in a very direct way. They can then be used for productive word formation, accounting for regular affixation just as well as a word-syntax, without assuming independent lexical entries for affixes or arbitrary verb-classes such as *bar-verb*. Derived words have an internal morphological structure without treating the affix as a sign. The syntactic and semantic information is attributed directly to the complex word. Affixes are not explicitly marked for category, nor do they include subcategorization information—they are 'bound morphemes' because they do not have lexical entries of their own. In addition the approach captures the relationship that some subregular lexicalized words have to the regular *bar*-adjectives, and it is in principle possible to also account for new formations which are not completely regular.

There are several avenues of further research that could be taken from here. It would be necessary to do some more empirical work, i.e. analyze the data a bit more closely. In particular I would like to look at the thematic entailments that hold for the arguments of the *bar*-adjectives found in the corpora, and see whether the particular ones proposed by Dowty (1991) for argument selection can also help to express interesting generalizations in the area of word formation. It would be interesting if it was possible to generalize across grammatical relations in this way. In this context I would also like to develop a better account of the semantics of *bar*-adjectives within the HPSG framework, which comprises as many as possible of the observations and intuitions mentioned in the section on the data; unfortunately this was well outside the scope of this thesis.

It would be interesting to see whether the approach would generalize readily to other processes of affixation, which should be the case since it is better suited to cope with analogical and other 'messy' data than is a word-syntax. It seems to be possible within this approach to make formal sense of analogical word formation and to model intermediate cases between compounding and derivation (Olsen 1986b & 1988). This looks promising since it might be possible to make precise where exactly the differences and similarities are. To a large extent this has still to be done, and it remains to be seen whether all of the data found for example in Plank (1981) can be dealt with satisfactorily.

An actual implementation of the approach would also be very interesting from at least two perspectives. It would probably help to clarify many of the open issues discussed in section (5.2) and section (5.3), and it would become clear whether or not any of the proposed strategies with respect to productivity are feasible. If this implementation was carried out as part of a larger system it could also be tested whether the predictions of the approach are correct, and how empirically adequate it really is.

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Appendix A: Alphabetical List of All *bar*-Adjectives from the Corpora[57]

abänderbar	
abbaubar	46
abberufbar	
abbildbar	1
abdichtbar	
abdingbar	
abdruckbar	1
abfragbar	4
abgrenzbar	10
abhörbar	1
abklappbar	
ableitbar	3
ablenkbar	
ablesbar	21
ablösbar	3
abnehmbar	2
abnutzbar	
abrufbar	28
absägbar	
abschaffbar	1
abschaltbar	2
abschätzbar	14
abschließbar	5
abschraubbar	1
abschreibbar	
abschreitbar	1
absehbar	300
absetzbar	26
absprengbar	
abstimmbar	1
abstrahierbar	
abstreitbar	1
abteilbar	
abtrennbar	1
abtretbar	
abwählbar	2
abwälzbar	1
abwandelbar	
abwaschbar	3
abwehrbar	1
abweisbar	2
abwendbar	4
abwerfbar	
abzählbar	1
abziehbar	9
achtbar	17
adaptierbar	
addierbar	
adressierbar	1
adsorbierbar	1
affizierbar	
ahnbar	3
ahndbar	1
aktivierbar	3
akzeptierbar	3
amortisierbar	
analysierbar	3
änderbar	1
anerkennbar	
anfahrbar	
anfaßbar	3
anfechtbar	16
angebbar	
angreifbar	19
anklagbar	1
anlegbar	1
annehmbar	26
anpaßbar	1
anrechenbar	12
anregbar	1
anrufbar	1
anschätzbar	1
anschaubar	2
anschließbar	3
ansehbar	1
ansetzbar	1
anspielbar	
ansprechbar	18
ansteckbar	
ansteuerbar	
antastbar	3
anwählbar	
anwendbar	42
assimilierbar	
assoziierbar	1
atembar	1
ätzbar	
aufbaubar	1
aufblasbar	11
auffindbar	12
aufführbar	1
aufhebbar	2
aufklappbar	4
aufklärbar	3
aufknöpfbar	
aufladbar	5
auflösbar	5
aufnehmbar	1
aufrollbar	1
aufrufbar	1
aufrüstbar	1
aufschiebbar	1
aufspürbar	3
aufstellbar	
auftaubar	2
aufteilbar	
aufwallbar	
aufweisbar	
aufzeigbar	1
ausbaubar	2
ausbeutbar	2
ausdehnbar	3
ausdenkbar	
ausdeutbar	2
ausdrückbar	
auseinanderschiebbar	
ausfahrbar	2
ausfällbar	
ausfaltbar	
ausführbar	1
ausfüllbar	
aushakbar	
aushaltbar	1
ausklappbar	1
ausknöpfbar	
auslegbar	
ausleihbar	
auslesbar	
auslotbar	
ausmachbar	1
ausmeßbar	1
ausnutzbar	1
ausräumbar	
ausreizbar	1
ausrollbar	1
ausrottbar	1
ausrüstbar	
ausschaltbar	1
ausschöpfbar	1
ausschwenkbar	
aussprechbar	
ausstellbar	2
aussteuerbar	1
austauschbar	38
auswaschbar	3
auswechselbar	3
ausweisbar	
auswertbar	2
auszahlbar	1
ausziehbar	
automatisierbar	
bannbar	1
beanstandbar	
beantwortbar	
bearbeitbar	1
bebaubar	2
bedienbar	
beeindruckbar	2
beeinflußbar	15
beendbar	1
beerbbar	1
befahrbar	3
befolgbar	
beförderbar	1
befragbar	1
befühlbar	1
befüllbar	1
begebbar	

[57] The frequencies are those from the largest corpus, the Mannheim Zeitungskorpus. The examples from the other texts have been included as well (to give a total of 1226 different *bar*-adjectives observed), but the frequencies were not added (for a justification of this see section (1.1).

begehbar	30
begreifbar	18
begrenzbar	1
begründbar	16
behaltbar	
behandelbar	15
behebbar	9
beheizbar	5
beherrschbar	46
beibringbar	
beilegbar	1
beitreibbar	2
belastbar	20
belegbar	16
belehrbar	
beleihbar	1
belüftbar	1
bemalbar	
bemannbar	2
bemerkbar	148
benennbar	4
benutzbar	12
beobachtbar	12
berechenbar	47
beschaffbar	1
beschränkbar	
beschränktkonvertierbar	
beschreibbar	14
beschriftbar	
beseitbar	
besetzbar	9
besiegbar	1
bespielbar	4
bestehbar	1
besteuerbar	1
bestimmbar	12
bestreitbar	2
bestückbar	
bestverfügbar	2
betreffbar	
betretbar	7
beugbar	
bewältigbar	1
beweisbar	17
bewertbar	1
bewohnbar	15
bezahlbar	19
beziehbar	2
bezifferbar	1
bezweifelbar	
bezwingbar	
biegbar	
bilanzierbar	1
bildbar	
brauchbar	124
brechbar	
bremsbar	1
brennbar	38
brikettierbar	
bundesunmittelbar	4
codierbar	
computerlesbar	6
dämpfbar	
dankbar	207
darstellbar	16
datierbar	2
dechiffrierbar	1
deduzierbar	
definierbar	7
deformierbar	1
dehnbar	11
deklinierbar	1
denkbar	505
deponierbar	1
desinfizierbar	
destillierbar	
deutbar	2
diagnostizierbar	4
dienstbar	19
differenzierbar	
digitalisierbar	1
direktempfangbar	2
dirigierbar	1
diskutierbar	3
dislozierbar	1
disponierbar	
dokumentierbar	2
dosierbar	3
dränierbar	
drehbar	2
dressierbar	
druckbar	3
duldbar	4
durchdringbar	1
durchführbar	16
durchhaltbar	
durchhörbar	2
durchmeßbar	1
durchschaubar	28
durchscheinbar	
durchschwimmbar	
durchsetzbar	51
durchstechbar	1
editierbar	
ehrbar	21
einbaubar	
einbettbar	
einbindbar	1
eindämmbar	2
eindrückbar	
einfangbar	
einfühlbar	1
einführbar	
eingebbar	
eingrenzbar	4
einhaltbar	
einholbar	2
einkalkulierbar	1
einklagbar	13
einknöpfbar	
einlesbar	
einlösbar	1
einordbar	
einplanbar	1
einprägbar	
einrichtbar	
einschaltbar	1
einschätzbar	3
einschiebbar	
einschlagbar	
einschränkbar	1
einsehbar	16
einsetzbar	38
einsparbar	
einstellbar	5
eintauschbar	
eintippbar	1
eintreibbar	1
einziehbar	1
elektrisierbar	
empfangbar	19
empfindbar	1
entdeckbar	1
entfernbar	3
entflammbar	7
entlehnbar	
entlüftbar	1
entnehmbar	
enträtselbar	2
entriegelbar	1
entscheidbar	3
entschlüsselbar	1
entschuldbar	5
entwirrbar	3
entzifferbar	4
entzündbar	8
erdenkbar	1
erfahrbar	35
erfaßbar	14
erforschbar	
erfragbar	
erfüllbar	4
erhaltbar	1
erhärtbar	1
erhellbar	
erinnerbar	1
erkennbar	465
erklärbar	41
erlangbar	
erlebbar	14
erlernbar	6
erlösbar	
ermeßbar	1
ermittelbar	1
ermüdbar	
ernährbar	
erneuerbar	37
erpreßbar	12
erratbar	
errechenbar	1
errechnenbar	1
erregbar	6
erreichbar	143
erschaffbar	
erschließbar	2
erschöpfbar	
erschütterbar	6
erschwerbar	
erschwingbar	
ersetzbar	4
ersteigbar	
ertragbar	1
eruierbar	
erwartbar	
erweichbar	
erweiterbar	1
erwerbbar	1
erwiderbar	
erwünschbar	
erzählbar	5
erzeugbar	
erziehbar	4
erzielbar	23
erzwingbar	

eßbar	17
explizierbar	
explodierbar	
exportierbar	1
extrapolierbar	1
fahrbar	23
fälschbar	1
fangbar	
färbbar	
faselbar	
faßbar	32
faulbar	
fehlbar	9
fernladbar	
festlegbar	3
festschreibbar	1
feststellbar	40
filetierbar	
filtrierbar	
finanzierbar	29
findbar	1
fixierbar	2
flammbar	
flektierbar	
flößbar	
formalisierbar	
formbar	2
formulierbar	2
fortführbar	1
freisetzbar	4
freiverfügbar	1
freßbar	1
fruchtbar	161
fühlbar	36
führbar	4
furchtbar	163
gangbar	26
generalisierbar	2
genießbar	11
gerichtsverwertbar	4
gestaltbar	11
gewinnbar	1
glaubbar	
greifbar	120
haftbar	51
haltbar	63
hämmerbar	
handelbar	4
handhabbar	12
hantierbar	1
harmonisierbar	1
haubar	
hebbar	
heilbar	43
heiratbar	
heizbar	
herabklappbar	
herausholbar	
herauslesbar	
herausnehmbar	1
heraussprengbar	
heraustrennbar	1
herleitbar	1
herstellbar	12
hinnehmbar	14
hinterfragbar	1
hintergehbar	
hochachtbar	4
hochbelastbar	2
hochschraubbar	
holbar	1
hörbar	78
identifizierbar	14
implantierbar	1
importierbar	1
individualisierbar	2
injizierbar	5
inspizierbar	1
instrumentalisierbar	2
inszenierbar	2
integrierbar	7
interessierbar	1
interpretierbar	8
inventarisierbar	5
isolierbar	1
jagbar	
jagdbar	2
justierbar	
kalkulierbar	38
kapitalisierbar	
kaskadierbar	
kaubar	
kaufbar	1
kittbar	1
klagbar	
klappbar	1
klärbar	1
knautschbar	1
knetbar	
kombinierbar	2
kommerzialisierbar	1
kommunizierbar	1
komparierbar	
kompensierbar	2
kompostierbar	14
konfigurierbar	
konjugierbar	
konkretisierbar	2
konservierbar	
konstatierbar	1
konstruierbar	
konsumierbar	13
kontrollierbar	44
konvertierbar	2
kopierbar	1
koppelbar	
korrigierbar	8
korrumpierbar	3
kostbar	223
kränkbar	1
kreuzbar	
kristallisierbar	
kritisierbar	2
kühlbar	1
kündbar	8
kurierbar	1
lächerbar	
ladbar	
lädierbar	
lagerbar	3
landesunmittelbar	1
lebbar	7
lebensunmittelbar	1
legierbar	
legitimierbar	3
lehnbar	
lehrbar	4
leichtverwertbar	
leistbar	1
leitbar	
lenkbar	3
lernbar	5
lesbar	39
lieferbar	19
liquidierbar	
liquidisierbar	
lokalisierbar	2
lösbar	41
löschbar	2
loslösbar	
lötbar	
machbar	158
magnetisierbar	1
mähbar	
malbar	
mangelbar	
manipulierbar	23
manövrierbar	
maschinenlesbar	38
mechanisierbar	1
melkbar	
merkbar	5
meßbar	71
mischbar	
mißbrauchbar	2
mißdeutbar	
mitteilbar	2
mittelbar	107
mobilisierbar	2
modellierbar	
modifizierbar	2
modulierbar	1
montierbar	
motivierbar	
mutierbar	1
nachahmbar	1
nachbaubar	
nachbildbar	
nachempfindbar	1
nacherlebbar	2
nacherzählbar	2
nachfühlbar	2
nachfüllbar	2
nachholbar	
nachkontrollierbar	
nachprüfbar	28
nachrüstbar	1
nachspielbar	1
nächsterreichbar	1
nachvollziehbar	75
nachweisbar	102
nahbar	1
nambar	
nennbar	
neutralisierbar	1
nicht-abbaubar	1
nicht-verpflanzbar	
nichtabsehbar	
nichtausstellbar	1
nichtbrennbar	1
nichtdurchschaubar	
nichterneuerbar	1
nichteßbar	1
nichtflektierbar	

nichtformulierbar	1
nichtgradierbar	
nichtkompostierbar	1
nichtkonvertierbar	
nichtplanbar	
nichtregenerierbar	2
nichtrückzahlbar	1
nichtspaltbar	2
nichtverwertbar	2
nichtvollziehbar	1
nichtwahrnehmbar	
normierbar	
notierbar	
nutzbar	79
objektivierbar	3
offenbar	1698
öffenbar	1
operierbar	1
opferbar	
organisierbar	3
oxydierbar	
parametrisierbar	
paraphrasierbar	1
passierbar	1
passivierbar	
patentierbar	4
personenbeziehbar	1
pfändbar	15
photographierbar	2
planbar	11
polymerisierbar	
portierbar	
postierbar	
prägbar	
praktizierbar	6
präsentierbar	1
präzisierbar	1
produzierbar	1
programmierbar	7
prüfbar	3
psychotherapierbar	1
qualifizierbar	1
quantifizierbar	6
quellbar	
rauchbar	
räumbar	
realisierbar	43
rechenbar	1
rechtfertigbar	
recycelbar	4
reduzierbar	2
reformierbar	
regelbar	6
regenerierbar	10
regierbar	1
registrierbar	1
regulierbar	2
reichsunmittelbar	
reitbar	
reizbar	13
rekonstruierbar	7
reparierbar	4
repräsentierbar	1
reproduzierbar	6
resorbierbar	6
resozialisierbar	3
restaurierbar	1
rettbar	
revidierbar	2
rezensierbar	1
rezipierbar	2
rezyklierbar	3
riechbar	1
rollbar	1
rüberbringbar	
ruchbar	29
rückfahrbar	1
rückführbar	1
rückgewinnbar	1
rückhaltbar	1
rückholbar	5
rückzahlbar	7
rügbar	
rührbar	
sagbar	5
sammelbar	
sangbar	
schaltbar	3
schandbar	2
schätzbar	2
schaubar	
schäumbar	
scheidbar	
scheinbar	611
schiebbar	1
schiffbar	2
schlachtbar	
schlagbar	1
schließbar	
schmeckbar	1
schmelzbar	1
schmiedbar	
schneidbar	
schreibschützbar	
schulbar	
schüttbar	1
schweißbar	1
schwenkbar	6
schwerabbaubar	1
schwereinstellbar	1
schwererziehbar	2
schwerübertragbar	1
schwervermittelbar	10
schwimmbar	
sehbar	2
selektierbar	
separierbar	
setzbar	
sichtbar	850
siedelbar	
simulierbar	1
singbar	1
sonderbar	123
spaltbar	57
spannbar	
speicherbar	7
speicherprogrammierbar	3
sperrbar	
spezifizierbar	
spielbar	2
sprechbar	3
spreizbar	
sprengbar	
spürbar	325
stapelbar	2
startbar	1
steckbar	
stehlbar	
steigerbar	5
steuerbar	13
steuerprogrammierbar	1
stillbar	3
störbar	
strafbar	135
strapazierbar	
streckbar	
streichbar	1
streitbar	63
stürzbar	
substantivierbar	
substituierbar	2
subsumierbar	1
suggerierbar	
sühnbar	
superhaltbar	
suspendierbar	
synthetisierbar	
tanzbar	10
tastbar	7
tauschbar	
täuschbar	3
teilbar	7
teleskopierbar	1
testbar	1
therapierbar	5
tiefladbar	
tilgbar	
tolerierbar	16
tragbar	82
transferierbar	1
transportierbar	6
trennbar	3
triggerbar	
trinkbar	3
tropfbar	
überbietbar	1
überblickbar	1
überbrückbar	4
übererregbar	
überholbar	
überhörbar	
überlebbar	1
übernehmbar	1
überprüfbar	16
überschaubar	131
überschlagbar	1
überschreitbar	1
übersehbar	11
übersetzbar	2
übersteigbar	
überstimmbar	1
übertragbar	67
übertreffbar	
überwachbar	1
überwindbar	4
umerziehbar	
umgehbar	1
umgrenzbar	
umkehrbar	11
umklappbar	5
umlegbar	2
umreißbar	1
umrüstbar	2
umschaltbar	2

umschreibbar	
umsetzbar	9
umstellbar	
umstreitbar	1
umtauschbar	
umwandelbar	1
unabänderbar	3
unabdingbar	66
unablegbar	
unableitbar	
unablösbar	
unabschätzbar	2
unabschließbar	3
unabsehbar	42
unabsetzbar	3
unabstimmbar	1
unabwälzbar	
unabweisbar	35
unabwendbar	37
unanfechtbar	13
unangreifbar	16
unannehmbar	15
unansprechbar	1
unantastbar	35
unanwendbar	
unanzweifelbar	
unaufdeckbar	
unauffindbar	10
unaufgebbar	1
unaufhaltbar	4
unaufhebbar	11
unaufhellbar	
unaufklärbar	1
unauflösbar	16
unaufrechenbar	1
unaufschiebbar	15
unausbleibbar	
unausdenkbar	2
unausführbar	
unaushaltbar	1
unausleihbar	1
unauslöschbar	2
unauslotbar	1
unausrottbar	12
unaussagbar	
unaussprechbar	1
unaustilgbar	
unaustragbar	
unausweichbar	1
unbeantwortbar	2
unbebaubar	2
unbedruckbar	
unbeeinflußbar	5
unbefahrbar	
unbefragbar	1
unbegreifbar	3
unbegründbar	1
unbehandelbar	1
unbeherrschbar	3
unbeirrbar	48
unbeißbar	1
unbekehrbar	1
unbelangbar	1
unbelehrbar	30
unbemerkbar	
unbenutzbar	6
unberechenbar	93
unberührbar	7
unbeschreibbar	1
unbesiegbar	9
unbespielbar	1
unbestechbar	
unbestellbar	
unbestimmbar	8
unbestreitbar	77
unbetretbar	3
unbeugbar	
unbewohnbar	28
unbezahlbar	14
unbezähmbar	1
unbezifferbar	2
unbezweifelbar	9
unbezwingbar	2
unbrauchbar	77
unbrennbar	3
undankbar	29
undefinierbar	17
undeklinierbar	
undenkbar	106
undeutbar	3
undifferenzierbar	1
undigitalisierbar	1
undiskutierbar	2
undurchdringbar	
undurchführbar	7
undurchschaubar	37
uneinholbar	5
uneinklagbar	
uneinlösbar	2
uneinnehmbar	1
uneinschätzbar	1
uneinsehbar	1
uneintreibbar	1
unentfliehbar	
unentrinnbar	16
unentscheidbar	2
unentschuldbar	2
unentwirrbar	7
unentziehbar	1
unentzifferbar	3
unerfüllbar	14
unergründbar	1
unerhellbar	
unerkennbar	2
unerklärbar	7
unerlösbar	1
unermüdbar	
unerrechenbar	1
unerreichbar	53
unerschütterbar	2
unersetzbar	15
unerwähnbar	
unerweisbar	
unerzählbar	1
unerziehbar	
uneßbar	1
unexplodierbar	
unfahrbar	
unfaßbar	37
unfehlbar	6
unfinanzierbar	2
unfruchtbar	59
unfühlbar	
ungangbar	2
ungenießbar	21
ungerinnbar	1
ungreifbar	2
unhaltbar	53
unheilbar	118
unhemmbar	
unhinderbar	
unhörbar	12
unidentifizierbar	1
unimitierbar	1
universalisierbar	1
unkalkulierbar	28
unknackbar	
unkontrollierbar	33
unkorrigierbar	3
unkündbar	11
unkurierbar	1
unlenkbar	1
unlesbar	6
unleugbar	20
unlösbar	59
unmerkbar	1
unmeßbar	3
unmißbar	
unmißverstehbar	
unmittelbar	1081
unnachahmbar	1
unnahbar	18
unnennbar	2
unnützbar	1
unobjektivierbar	
unpassierbar	7
unpfändbar	9
unphotographierbar	1
unplanbar	1
unqualifizierbar	
unrealisierbar	2
unregierbar	10
unregistrierbar	1
unreparierbar	1
unrettbar	6
unrezitierbar	1
unsagbar	16
unschätzbar	36
unscheinbar	89
unschlagbar	12
unschmelzbar	
unsichtbar	203
unsinkbar	5
unspaltbar	
unspielbar	8
unsteuerbar	2
unstillbar	21
unstörbar	1
unstreitbar	3
unstürzbar	
unteilbar	13
unterbietbar	
unterbrechbar	
unterdrückbar	1
unterscheidbar	13
unterschreibbar	
untersuchbar	1
untherapierbar	1
untilgbar	
untragbar	28
untrennbar	43
untrinkbar	
unüberbietbar	4
unüberblickbar	

unüberbrückbar	19
unüberholbar	
unüberhörbar	50
unüberprüfbar	2
unüberschaubar	34
unüberschreitbar	
unübersehbar	165
unübersetzbar	6
unübersteigbar	1
unüberstimmbar	1
unübertragbar	1
unübertreffbar	2
unübertretbar	1
unüberwindbar	15
unüberzeugbar	
unumgehbar	
unumkehrbar	6
ununterdrückbar	2
ununterscheidbar	9
unveränderbar	6
unverantwortbar	6
unverbaubar	
unverbesserbar	1
unverbrennbar	1
unverdaubar	
unverdrängbar	1
unvereinbar	73
unverfallbar	1
unverführbar	1
unvergeßbar	1
unvergleichbar	19
unverhüllbar	
unverifizierbar	1
unverjährbar	
unverkaufbar	
unverkennbar	108
unverletzbar	1
unverleugbar	
unverlierbar	3
unvermeidbar	72
unvermeßbar	1
unvermietbar	2
unvernichtbar	
unverrückbar	19
unversetzbar	
unversicherbar	2
unversiegbar	1
unversöhnbar	
unverstehbar	1
unversteuerbar	
unvertretbar	19
unverwechselbar	114
unverwelkbar	
unverwertbar	3
unverwindbar	
unverwischbar	
unverwundbar	11
unverwüstbar	
unverzehrbar	
unverzeihbar	
unverzichtbar	149
unvollendbar	
unvollziehbar	
unvoraussehbar	1
unvorhersehbar	26
unvorstellbar	138
unwägbar	12
unwählbar	1
unwandelbar	10
unwechselbar	1
unwelkbar	
unwiderlegbar	18
unwiderrufbar	3
unwidersprechbar	
unwiderstehbar	
unwiederbringbar	2
unwiederholbar	10
unzählbar	4
unzähmbar	1
unzerreißbar	3
unzerstörbar	11
unzertrennbar	
unzumutbar	94
unzustellbar	2
unzweifelbar	1
urbar	2
variierbar	5
veränderbar	15
verantwortbar	43
verarbeitbar	1
verbesserbar	
verbindbar	
verbrennbar	3
verdaubar	1
verdichtbar	
verdoppelbar	
verdrängbar	1
vereinbar	89
vererbbar	16
verfahrbar	1
verfilmbar	2
verflüssigbar	
verfolgbar	2
verformbar	3
verfügbar	280
verführbar	4
verglasbar	
vergleichbar	498
verheizbar	2
verhütbar	2
verifizierbar	4
verkabelbar	1
verkettbar	
verknüpfbar	1
verkraftbar	5
verkürzbar	
verlängerbar	2
verletzbar	11
verlierbar	1
vermarktbar	1
vermehrbar	5
vermeidbar	78
vermietbar	2
vermittelbar	39
vermutbar	
vernachlässigbar	8
vernehmbar	9
vernetzbar	1
vernichtbar	
verrechenbar	1
verrottbar	2
verschiebbar	6
verschließbar	4
verschlüsselbar	1
verschwenkbar	1
versehrbar	1
verseifbar	
versenkbar	3
versetzbar	
versicherbar	9
verspinnbar	
verstehbar	12
verstellbar	13
vertauschbar	2
verteilbar	1
vertonbar	
vertragbar	1
vertretbar	190
verwandelbar	3
verwechselbar	3
verwendbar	44
verwertbar	68
verwesbar	
verwirklichbar	1
verwitterbar	
verwundbar	24
verzehrbar	2
verzichtbar	4
verzinsbar	2
visualisierbar	1
vollendbar	
vollstreckbar	3
vollziehbar	11
vorausberechenbar	
vorausbestimmbar	
vorauskalkulierbar	1
voraussagbar	1
vorausschaubar	
voraussehbar	19
vorfindbar	1
vorhersagbar	5
vorhersehbar	36
vorschlagbar	
vorstellbar	133
vorweisbar	3
vorwerfbar	5
vorzeigbar	15
wägbar	1
wählbar	27
wahrnehmbar	44
wandelbar	15
wartbar	
waschbar	1
wasserverdünnbar	1
wegfegbar	
weglaßbar	
wehrbar	
weiterentwickelbar	
weiterverwendbar	1
widerlegbar	5
widerrufbar	1
wiederaufbereitbar	1
wiederaufladbar	2
wiederbefüllbar	1
wiederbeschreibbar	1
wiedereinführbar	
wiedererkennbar	1
wiedererweckbar	1
wiedergewinnbar	1
wiederherstellbar	3
wiederholbar	17
wiederverwendbar	30
wiederverwertbar	34
wißbar	

wunderbar	312	zitierbar	1	zurückziehbar	
wünschbar	7	züchtbar	1	zusammendrückbar	
zahlbar	4	zugreifbar		zusammenfaltbar	1
zählbar	6	zukaufbar	1	zusammenklappbar	
zauberbar		zuknöpfbar		zusammenlegbar	
zerfließbar		zulaßbar		zusammenschaltbar	
zerknallbar		zumutbar	132	zusammenschiebbar	
zerlegbar	2	zündbar		zusammenstellbar	
zerreibbar		zuordenbar	1	zuschaltbar	1
zerreißbar		zuortbar	1	zuschreibbar	
zersetzbar	2	zurechenbar	5		
zerstörbar	3	zurückdatierbar	1		
zertrennbar	1	zurückführbar	1		
ziehbar		zurückklapppbar			

Appendix B: List of the Most Frequent *bar*-Adjectives Ordered by Frequency[58]

offenbar	1698
unmittelbar	1081
sichtbar	850
scheinbar	611
denkbar	505
vergleichbar	498
erkennbar	465
spürbar	325
wunderbar	312
absehbar	300
verfügbar	280
kostbar	223
dankbar	207
unsichtbar	203
vertretbar	190
unübersehbar	165
furchtbar	163
fruchtbar	161
machbar	158
unverzichtbar	149
bemerkbar	148
erreichbar	143
unvorstellbar	138
strafbar	135
vorstellbar	133
zumutbar	132
überschaubar	131
brauchbar	124
sonderbar	123
greifbar	120
unheilbar	118
unverwechselbar	114
unverkennbar	108
mittelbar	107
undenkbar	106
nachweisbar	102
unzumutbar	94
unberechenbar	93
unscheinbar	89
vereinbar	89
tragbar	82
nutzbar	79
hörbar	78
vermeidbar	78
unbestreitbar	77
unbrauchbar	77
nachvollziehbar	75
unvereinbar	73
unvermeidbar	72
meßbar	71
verwertbar	68
übertragbar	67
unabdingbar	66
haltbar	63
streitbar	63
unfruchtbar	59
unlösbar	59
spaltbar	57
unerreichbar	53
unhaltbar	53
durchsetzbar	51
haftbar	51
unüberhörbar	50
unbeirrbar	48
berechenbar	47
abbaubar	46
beherrschbar	46
kontrollierbar	44
verwendbar	44
wahrnehmbar	44
heilbar	43
realisierbar	43
untrennbar	43
verantwortbar	43
anwendbar	42
unabsehbar	42
erklärbar	41
lösbar	41
feststellbar	40
lesbar	39
vermittelbar	39
austauschbar	38
brennbar	38
einsetzbar	38
kalkulierbar	38
maschinenlesbar	38
erneuerbar	37
unabwendbar	37
undurchschaubar	37
unfaßbar	37
fühlbar	36
unschätzbar	36
vorhersehbar	36
erfahrbar	35
unabweisbar	35
unantastbar	35
unüberschaubar	34
wiederverwertbar	34
unkontrollierbar	33
faßbar	32
begehbar	30
unbelehrbar	30
wiederverwendbar	30
finanzierbar	29
ruchbar	29
undankbar	29
abrufbar	28
durchschaubar	28
nachprüfbar	28
unbewohnbar	28
unkalkulierbar	28
untragbar	28
wählbar	27
absetzbar	26
annehmbar	26
gangbar	26
unvorhersehbar	26
verwundbar	24
erzielbar	23
fahrbar	23
manipulierbar	23
ablesbar	21
ehrbar	21
ungenießbar	21
unstillbar	21
belastbar	20
unleugbar	20
angreifbar	19
bezahlbar	19
dienstbar	19
empfangbar	19
lieferbar	19
unüberbrückbar	19
unvergleichbar	19
unverrückbar	19
unvertretbar	19
voraussehbar	19
ansprechbar	18
begreifbar	18
unnahbar	18
unwiderlegbar	18
achtbar	17
beweisbar	17
eßbar	17
undefinierbar	17
wiederholbar	17
anfechtbar	16
begründbar	16
belegbar	16
darstellbar	16
durchführbar	16
einsehbar	16
tolerierbar	16
überprüfbar	16
unangreifbar	16
unauflösbar	16
unentrinnbar	16
unsagbar	16
vererbbar	16
beeinflußbar	15
behandelbar	15
bewohnbar	15
pfändbar	15
unannehmbar	15
unaufschiebbar	15
unersetzbar	15
unüberwindbar	15
veränderbar	15
vorzeigbar	15
wandelbar	15
abschätzbar	14
beschreibbar	14
erfaßbar	14
erlebbar	14
hinnehmbar	14
identifizierbar	14

[58] This is a list of *bar*-adjectives up to frequency 5, i.e. of the 303 most frequent ones, with the frequencies again from the largest corpus only.

kompostierbar	14	unwandelbar	10	regelbar	6
unbezahlbar	14	unwiederholbar	10	reproduzierbar	6
unerfüllbar	14	abziehbar	9	resorbierbar	6
einklagbar	13	behebbar	9	schwenkbar	6
konsumierbar	13	besetzbar	9	transportierbar	6
reizbar	13	fehlbar	9	unbenutzbar	6
steuerbar	13	umsetzbar	9	unfehlbar	6
unanfechtbar	13	unbesiegbar	9	unlesbar	6
unteilbar	13	unbezweifelbar	9	unrettbar	6
unterscheidbar	13	unpfändbar	9	unübersetzbar	6
verstellbar	13	ununterscheidbar	9	unumkehrbar	6
anrechenbar	12	vernehmbar	9	unveränderbar	6
auffindbar	12	versicherbar	9	unverantwortbar	6
benutzbar	12	entzündbar	8	verschiebbar	6
beobachtbar	12	interpretierbar	8	zählbar	6
bestimmbar	12	korrigierbar	8	abschließbar	5
erpreßbar	12	kündbar	8	aufladbar	5
handhabbar	12	unbestimmbar	8	auflösbar	5
herstellbar	12	unspielbar	8	beheizbar	5
unausrottbar	12	vernachlässigbar	8	einstellbar	5
unhörbar	12	betretbar	7	entschuldbar	5
unschlagbar	12	definierbar	7	erzählbar	5
unwägbar	12	entflammbar	7	injizierbar	5
verstehbar	12	integrierbar	7	inventarisierbar	5
aufblasbar	11	lebbar	7	lernbar	5
dehnbar	11	programmierbar	7	merkbar	5
genießbar	11	rekonstruierbar	7	rückholbar	5
gestaltbar	11	rückzahlbar	7	sagbar	5
planbar	11	speicherbar	7	steigerbar	5
übersehbar	11	tastbar	7	therapierbar	5
umkehrbar	11	teilbar	7	umklappbar	5
unaufhebbar	11	unberührbar	7	unbeeinflußbar	5
unkündbar	11	undurchführbar	7	uneinholbar	5
unverwundbar	11	unentwirrbar	7	unsinkbar	5
unzerstörbar	11	unerklärbar	7	variierbar	5
verletzbar	11	unpassierbar	7	verkraftbar	5
vollziehbar	11	wünschbar	7	vermehrbar	5
abgrenzbar	10	computerlesbar	6	vorhersagbar	5
regenerierbar	10	erlernbar	6	vorwerfbar	5
schwervermittelbar	10	erregbar	6	widerlegbar	5
tanzbar	10	erschütterbar	6	zurechenbar	5
unauffindbar	10	praktizierbar	6		
unregierbar	10	quantifizierbar	6		