

Argument Structure and Case Assignment in German*

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1 Introduction

Case is a means of linking items in utterances. Its realization varies both within and between languages. Within a single language its realization may vary according to syntactic environment. Across languages different means (morphological, positional, lexical) are used to express case. In GB-Theory this has led to a distinction between structural and inherent argument positions and to differentiating between syntactic case and its (in German morphological) realization.

Not only the realization of case but also the availability of argument positions may depend on the syntactic construction (consider argument reduction phenomena such as the passive) and on the morphological form of the heads (e.g. finite verb forms vs. participles). Argument structure and case assignment are thus topics which are closely related to each other.

After presenting data on German we will investigate argument structure at different levels (syntactic, semantic, lexical) and show how the principles of case assignment can be stated in terms of the interaction between the representation of argument structure at these levels. It will be demonstrated how this approach accounts for a broad range of phenomena.

The work described here forms part of the grammatical basis for the system *VIE-DU*, a natural language consulting system, aiming both at linguistic generality and implementability.

2 Case in German

German usually makes use of inflectional case to express the relation between a predicate and its thematic dependents. The thematic roles assigned via case are selected by the

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predicate. We use the term *complementation* for this kind of relation.

- (1) a. Der Mann sucht den Hund
The man_{nom} looks for the dog_{acc}
'The man is looking for the dog'
- b. Der Mann ist mir nicht bekannt
The man_{nom} is me_{dat} not known
'The man is not known to me'
- c. Der Freund meines Vaters
The friend_{nom} my father_{gen}
'My father's friend'

In (1), *nom*, *gen*, *dat* and *acc* stand for *nominative*, *genitive*, *dative* and *accusative* case, respectively. The predicates determining the cases are of the category verb in (1a), adjective in (1b) and noun in (1c).

The morphological realization of case may or may not vary with the syntactic construction. If case remains constant in different syntactic environments we speak of *inherent* or *lexical* case. Examples are given in (2).

- (2) a. Der Mann ist mir nicht bekannt
The man_{nom} is me_{dat} not known
'The man is not known to me'
- b. der mir nicht bekannte Mann
the me_{dat} not known man_{nom}
'the man not known to me'

Mir is assigned dative case irrespective of the position of the adjective phrase as part of a noun phrase or a sentence.

If case varies according to the syntactic environment, we speak of *structural* case:

- (3) a. Der Installateur kommt
the plumber_{nom} comes
'The plumber is coming'
- b. Der Mann läßt den Installateur kommen
The man lets the plumber_{acc} come
'The man orders the plumber to come'
- c. das Kommen des Installateurs
the coming the plumber_{gen}
'the coming of the plumber'

In (3a) the agent of *kommen*, *der Installateur*, is assigned nominative case, whereas *Installateur* receives accusative case marking in the causative construction of (3b) and genitive in the nominalization environment of (3c).

In addition to structural and inherent case we may speak of *prepositional* case where, for example, a verb subcategorizes for a certain preposition which has been stripped of its inherent semantic meaning.

- (4) a. Der Mann wartet auf den Installateur
 The man_{nom} waits on the plumber_{acc}
 ‘The man is waiting for the plumber’
- b. das Warten auf den Installateur
 the waiting on the plumber_{acc}
 ‘the waiting for the plumber’

As the above examples show, the four morphological cases of German appear in different distributions and bear different functions in different environments.

3 Theoretical Approaches

To give an account of case assignment we first list some general observations on the notion *Case*.

- Case is a means of linking items in utterances, in particular a marking of syntactic argument structure
- Case is closely connected with thematic structure
- Languages differ in their realization of case (morphologically, positionally, lexically)
- Some cases vary according to their syntactic environment, others do not.

In the following sections we give a short overview of various theoretical treatments of case. We evaluate these approaches in the light of the above observations, modifying and integrating them to provide an implementable approach to case assignment.

3.1 Case in Generative Grammar

In the Government-Binding approach to syntax (Chomsky 1981, 1986) Case Theory is considered a submodule of Grammar. A short summary of the properties of Case Theory is given in Chomsky (1986).

“Case theory determines the properties of Case-marking. We distinguish between the structural Cases, nominative and objective, assigned in terms of S-structure position, and the inherent Cases, oblique and genitive, assigned at D-structure and associated with θ -marking by the uniformity condition. [...] we distinguish Case-assignment at D-structure from Case-realization at S-structure for genitive Case [...]” (p. 202f.)

This formulation of Case Theory has several shortcomings for our purposes:

- Verbs in German may assign inherent case¹
- The list of cases, esp. the inherent cases, is too small to cover languages with a rich case system
- The realization of genitive case in English is rather idiosyncratic and should follow from more general principles
- It seems unclear why the distinction between structural and inherent case is one of assignment at different levels (D- and S-structure)
- The connection between case Theory and θ -Theory is not given in sufficient detail, although there is some discussion of replacing case Theory completely by θ -Theory and other independent principles.

An approach within the general GB-framework that overcomes some of these problems is advocated in Haider (1985, 1986).

Haider “propose[s] a way of handling case that depends crucially on the distinction between case indices, supplied by a lexical element, and their realization in the syntactic structure.” (Haider 1985, sect. 5) He relates θ -assignment and case by the

(5) *Case Criterion*²

Case is a function that maps θ -roles onto arguments.

This function is composed of two subfunctions: (1) θ -roles to case indices, (2) case indices to NPs. In addition, there is a *realization function* that is a morphological or structural ‘spelling-out’ of the case index at the NP.

Haider’s distinction between *structural* and *lexical* case indices is made in terms of how rigidly case is assigned with respect to structural context: *structural* cases vary with the context, *lexical* cases do not. Structural indices are realized under government conditions, lexical indices as specific morphological cases.

He also proposes a condition that constrains the realization of case (Haider 1985, sect. 3.3):

(6) *The Realization Principle*

If a functional element F assigns structural indices then one of these indices has to be realized externally.³

With his proposal Haider overcomes several of the problems noted above:

- Verbs may assign inherent case

¹as Chomsky also notes on p. 219

²(Haider 1985, p. 8), corrected

³The index i of an argument is realized externally with respect to a functional element F (with index set k) if the index i , $i \in k$, is not realized by F^k .

- Structural and inherent (lexical) case is not defined in terms of D- and S-structure
- The connection between case and θ -roles is made explicit
- There is an open-ended list of lexical cases

Haider still leaves some questions open:

- How can case be seen as an instance of a more general notion of relation between syntactic positions?⁴
- If case is a function, how is the uniqueness assumption justified (given counterexamples)?
- How can case be linked to a more general notion of thematic arguments?

3.2 Thematic Relations

The principles of θ -Theory in GB are not uncontroversial. Jackendoff (1987) has argued that the θ -Criterion (roughly, there is a one-to-one correspondence between syntactic argument positions and thematic roles) must be considerably weakened, given examples exhibiting NPs with more than one θ -role, or multiple NPs with a single θ -role.⁵

Jackendoff develops conceptual representations (including differentiating between different tiers, such as thematic and temporal, with linkings) where thematic roles are identified by argument positions in relations occurring within these conceptual structures. Coreferentiality between arguments is achieved by “an asymmetrical relation of *argument binding*, which obtains between a *binding argument* (or *binder*) and one or more *bound arguments* (or *bindees*).” Thus he arrives at “a more adequate version of what the θ -Criterion is intended to express. In essence, each index linking syntactic and conceptual structure in a lexical entry now appears only once in the conceptual structure. All other θ -roles that the coindexed NP holds will be expressed by arguments bound to the indexed conceptual constituent.” (Jackendoff 1987, p. 403f.)

Thematic roles have also been treated in the Situation Semantics framework (cf. Barwise and Perry 1983, Barwise 1987, Barwise 1989) by Larson (1988). Larson uses *thematic situation types* (event-types) that correspond largely to Jackendoff’s conceptual representations. Events are collections of facts made up of space-time location, relations, individuals and a polarity value. Event-types replace one or more of their constituents with indeterminates that must be anchored to an entity. To model a thematic relation, the notion of *complex indeterminate* or *role* is used: if E is an event-type and \mathbf{x} is an indeterminate of E , then $\mathbf{r} = \langle \mathbf{x}, E \rangle$ is a *role*.

Constraints are a special kind of event-type of the form

$$(7) \quad \langle \langle \textit{involves}, E_1, E_2; 1 \rangle \rangle$$

⁴He only considers case assignment by verbal elements (including adjectives).

⁵cf. Jackendoff 1987, p. 381f.

‘Involves’ is a primitive relation which holds just in case every actual event of type E_1 is an event of type E_2 . Larson relates verbs of motion with event-types that in turn are linked (by *involves*) to a thematic situation type E_{GO} . Roles of E_{GO} may now be associated with the lexical entry of the motion verb.

The approaches given cover the semantics of thematic relations reasonably well. What is lacking is

- an explicit syntactic formulation of the structure to which the role is linked
- conditions under which a change in syntactic argument structure corresponds to a change in semantic argument structure.

3.3 Case in HPSG

In the HPSG approach⁶ the linking between syntactic and semantic argument structure via case is coded in the SUBCAT feature. This list-valued feature contains ‘three kinds of information: functional information (e.g. the order of the elements on the SUBCAT list); formal information (specification for values of the attribute SYNTAX); and semantic information (specifications for values of the attribute SEMANTICS).’ (PS1, p. 129)

A lexical entry for *nieste* would look like (8).

$$(8) \quad \left[\begin{array}{l} \text{PHON} \quad \textit{nieste} \\ \text{SYN|LOC} \quad \left[\begin{array}{l} \text{HEAD} \quad \left[\begin{array}{l} \text{MAJ} \quad V \\ \text{VFORM} \quad \textit{fin} \end{array} \right] \\ \text{SUBCAT} \quad \left\langle \left[\begin{array}{l} \text{SYN|LOC|HEAD} \quad \left[\begin{array}{l} \text{MAJ} \quad N \\ \text{CASE} \quad \textit{nom} \end{array} \right] \end{array} \right] \right\rangle \end{array} \right] \\ \text{SEM|CONT} \quad \left[\begin{array}{l} \text{REL} \quad \textit{sneeze} \\ \text{SNEEZER} \quad \boxed{1} \end{array} \right] \end{array} \right]$$

Using the *Subcategorization Principle* the SUBCAT list is reduced step by step, thus assigning the appropriate case to the respective first element of the list. In Kiss (1991) an additional feature named SUBJ is introduced to carry the external argument of non-finite verb forms. Kiss also uses the terms *structural* and *lexical* case without further explanation.

In PS2 the SYN and SEM features are rearranged into a SYNSEM feature for various reasons, but nothing essential is altered for the SUBCAT list. We will follow the SYNSEM format in our analysis.

In the HPSG formulations given above we note the need for further specification of

- the notions of structural, lexical case and external argument
- a modularization of phenomena packed into the SUBCAT list
- the principles of case assignment in general

⁶described in Pollard and Sag (1987) and (to appear), henceforth referred to as PS1 and PS2

4 Syntactic and Semantic Argument Structure

Syntactic and semantic argument structures are closely related. Indeed, according to the θ -Criterion, there is a one-to-one correspondence between syntactic and semantic/thematic argument places. There are however obvious problems with this point of view. Syntactically, there are arguments, such as the *es* in weather verb constructions, with no corresponding semantic argument place. Semantically, optional and implicit arguments need not have a syntactically strictly subcategorized counterpart.

We want to analyze Case as one of the means for linking syntactic and semantic argument structure. In general we follow Haider’s Case Criterion (5) and break up the linking into smaller parts. To achieve this, the representations for the levels to be linked are presented in the form of lexical, syntactic and semantic argument structures. The admissible correspondences between these levels are formulated as constraints on feature structures.

4.1 Background Assumptions

The analysis is formulated in the format of PS2. Unless explicitly stated we assume the principles and schemata presented there. In particular we rely on the *Head Feature Principle* percolating head features, the *Semantics Principle* combining contents of constituents and the *Subcategorization Principle*, which we present here in our restricted version because of its importance for argument structure and case assignment.

$$(9) \quad \left[\begin{array}{l} \text{SYNSEM} [\text{LOC}|\text{CAT}|\text{SUBCAT} \boxed{1}] \\ \text{DTRS} \left[\begin{array}{l} \text{HEAD-DTR} [\text{SYNSEM}|\text{LOC}|\text{CAT}|\text{SUBCAT} \boxed{1} \oplus \langle \boxed{2} \rangle] \\ \text{COMP-DTR} [\text{SYNSEM} \boxed{2}] \end{array} \right] \end{array} \right]$$

The treatment of long distance dependencies (traces), control and adjuncts in our analysis follows the direction given in PS1 and PS2. Our main deviations from the model presented there are the inclusion of more information on the argument structure by the addition of an ARGS feature, a different treatment of word order and, most significantly, a treatment of the morphological level in a fashion analogous to the syntactic level (carrying over the HFP, SubcatP and SemP) replacing the lexical rules of PS1 by rule schemata and principles.

4.2 Outline of the Analysis

For our analysis we start out with two distinct argument lists, one syntactic, the other semantic. A specific lexical entry selects a type of syntactic argument structure and a type of semantic argument structure, specifying also the links between them.

The notion *type* is used when different lexical entries exhibit generalizations with regard to structure. The semantic parts of the German lexical entries for *helfen* and *unterstützen* (both with the meaning ‘to help’), for example, may be considered identical, these in turn may be considered specializations of a general entry for agentives.

On the syntactic side there is room for generalizations along the lines of the classic transitive/intransitive distinction (which should not be taken literally, as our treatment below shows).

A lexical entry specifies subsets of the syntactic and semantic arguments and defines a linking via syntactic and semantic properties.⁷ The syntactic properties are termed abstract case indices (in the sense of Haider (1985)), the semantic properties are termed thematic roles (in the sense of the complex indeterminates of Larson (1988)).

Assuming the Case Criterion (5) we are on our way to formulate the first part of the mapping—from thematic roles to case indices. To achieve this we have to define the admissible properties of the structures and to find a representation for them.

4.3 Semantic Argument Structure

The semantic content of a lexical entry is formulated in the framework of Situation Semantics. The Described Object (a term borrowed from Gawron and Peters 1990) is usually associated with a parametric state-of-affairs or infon. Infons consist of a relation, an argument vector, and a polarity.

In addition, the parameters of the Infon are labeled with role names chosen from the set of (allegedly universal) roles of the fine-grained theory given in Jackendoff (1987).⁸ The properties of the semantic structure that are accessible to the linking function between syntactic and semantic argument positions are these thematic role labels.

As an example we give the semantic part of the lexical entry for *helfen* and *unterstützen*.

$$(10) \quad \left[\begin{array}{l} \text{PARAMS } \langle \boxed{1}, \boxed{2} \rangle \\ \text{ROLES } \left[\begin{array}{l} \text{AGENS } \boxed{1} \\ \text{PATIENS } \boxed{2} \end{array} \right] \\ \text{INFONS } \left\{ \left[\begin{array}{l} \text{REL } \textit{help} \\ \text{ARGS } \langle \boxed{1}, \boxed{2} \rangle \end{array} \right] \right\} \end{array} \right]$$

4.4 Syntactic Argument Structure

The main structure encoding the available syntactic arguments is the SUBCAT list. We maintain the classical version of this list in order to preserve the format of the standard syntactic operations and principles. The only modification we make is to the origin of the SUBCAT list: it is *not* inherited from the lexicon directly but constructed from lexical information by a set of principles.

Some information that is implicitly encoded in the order of the elements of the SUBCAT list has to be factored out for our analysis.

To motivate this step, let's take a look at some features used in PS2. The features MOD, SPEC and EXT-ARG are introduced to specify information on some aspects of the argument

⁷those subsets.

⁸The question of universality and uniqueness of thematic roles is of no concern to our theory, as the same parameter may be labelled with different role names.

structure of phrases (modifiers, markers and control structures). In Kiss (1991), Kathol (1991), Pollard (1991) the features SUBJ and ERG (for subject and ergative argument) are introduced. The possible appearance of these features is restricted by the type of category.

Thus, different aspects of argument structure are already present in the grammatical forms. We propose to provide a proper place for information dealing with argument structure by introducing a head feature ARGS combining the otherwise scattered features. The associated sort for the value of ARGS provides a way of constraining the appearance of features.

In our analysis we take up the distinction between structural and lexical arguments, introducing them as the list-valued features STRUCT and LEX under ARGS (among MOD etc.⁹). For the structural arguments the distinction between the external and the internal argument is also given with the associated wellformedness condition.

$$(11) \quad \left[\begin{array}{c} \text{ARGS} \left[\begin{array}{cc} \text{STRUCT} & \boxed{1} \oplus \boxed{2} \\ \text{INT} & \boxed{1} \\ \text{EXT} & \boxed{2} \end{array} \right] \end{array} \right]$$

Now the syntactic structures of *hilft* and *unterstützt* can be given as (12) and (13).

$$(12) \quad \begin{array}{c} \text{hilft} \\ \text{cat} \end{array} \left[\begin{array}{c} \text{HEAD} | \text{ARGS} \left[\begin{array}{c} \text{STRUCT} \langle \boxed{1} \rangle \\ \text{EXT} \langle \boxed{1} \rangle \\ \text{INT} \langle \rangle \\ \text{LEX} \langle \boxed{2} [\dots \text{CASE } 3] \rangle \end{array} \right] \\ \text{SUBCAT} \langle \boxed{1}, \boxed{2} \rangle \end{array} \right]$$

$$(13) \quad \begin{array}{c} \text{unterstützt} \\ \text{cat} \end{array} \left[\begin{array}{c} \text{HEAD} | \text{ARGS} \left[\begin{array}{c} \text{STRUCT} \langle \boxed{1}, \boxed{2} \rangle \\ \text{EXT} \langle \boxed{1} \rangle \\ \text{INT} \langle \boxed{2} \rangle \\ \text{LEX} \langle \rangle \end{array} \right] \\ \text{SUBCAT} \langle \boxed{1}, \boxed{2} \rangle \end{array} \right]$$

4.5 Lexical Argument Structure

Assuming the Case Criterion, the case indices are supplied by a lexical element—the assignments can be appropriately defined at the lexical level—whereas the realization of these indices takes place at the syntactic level.

In addition to the assignment of case indices there are various morphological rules (in German) that operate on the argument structure. These rules often exhibit a very similar structure to the rules operating at the syntactic level. To handle these phenomena in a general way it would be desirable to use the same formalism at the syntactic and morphological/lexical level instead of employing different rule types as in PS1.

⁹but not including the features SUBJ and ERG.

We will therefore assume a similar structuring of the syntactic and morphological information in our analysis, an approach that is also advocated by Krieger (1991).

Morphological elements have SUBCAT lists of their own that govern the combination of morphemes (e.g. a stem and a suffix, where the suffix is considered to be the head). The ARGS features specify the lexical properties of the arguments: i.e. which arguments are STRUCTural, which ones are LEXICAL. STRUCT contains information as to whether an argument is designated (as external argument) or not (DA), and which type of LEXICAL argument is used, INHERent, PREPositional or SENTential. This information is encoded as list-valued features on the HEAD|ARGS feature structure. Morphological combination rules and principles achieve argument reduction processes etc.

Examples of the argument structure at the morphological level for the verbal stems *helf-* and *unterstütz-* are given below.

$$(14) \quad \begin{array}{cc} \textit{helf-} & \textit{unterstütz-} \\ \left[\begin{array}{ll} \text{STRUCT} & \langle \boxed{1} \rangle \\ \text{DA} & \langle \boxed{1} \rangle \\ \text{LEX} & \langle \boxed{2} \rangle \\ \text{INHER} & \langle \boxed{2} [\dots \text{CASE } \beta] \rangle \end{array} \right] & \left[\begin{array}{ll} \text{STRUCT} & \langle \boxed{1}, \boxed{2} \rangle \\ \text{DA} & \langle \boxed{1} \rangle \\ \text{LEX} & \langle \rangle \end{array} \right] \end{array}$$

Rules combining morphs are defined on the MORPHSEM level. Lexical Insertion is carried out by a set of rule schemata and principles that link the SYNSEM and MORPHSEM feature structures. Here also the construction of the SUBCAT list takes place (enabling syntactic processes to use this feature then for phrase construction etc.). Which of a head's arguments are used to construct the syntactic SUBCAT list is dependent on its category.

Thus, the combination of the verbal stem *unterstütz* with the 3rd person singular present suffix *-t* is given in a familiar head-complement structure—including the Head Feature and Subcat Principles at the morphological level—below.¹⁰

¹⁰Since the combination of the PHON values is not simply the concatenation of stem and affixes but may also involve phenomena such as elision, umlaut etc. this part of the analysis interacts with a specialized morphological component based on an extended two-level morphology (Trost (1991)).

$$(15) \quad \begin{array}{c} \begin{array}{c} \text{PHON} \quad \text{"unterstützt"} \\ \text{MORPHEM} | \text{CAT} \quad \begin{bmatrix} \text{HEAD} \quad \boxed{\text{H}} \\ \text{SUBCAT} \quad \langle \rangle \end{bmatrix} \end{array} \\ \text{morph} \quad \swarrow \quad \searrow \quad \text{H} \\ \quad \quad \quad \text{C} \quad \quad \quad \begin{array}{c} \text{PHON} \quad \text{"t"} \\ \text{MORPHEM} | \text{CAT} \quad \begin{bmatrix} \text{HEAD} \quad \boxed{\text{H}} \quad \begin{bmatrix} \text{MAJ} \quad \text{vfin} \\ \text{ARGS} \quad \boxed{3} \end{bmatrix} \\ \text{SUBCAT} \quad \langle \boxed{\text{C}} \rangle \end{bmatrix} \end{array} \\ \begin{array}{c} \text{PHON} \quad \text{"unterstütz"} \\ \text{MORPHEM} \quad \boxed{\text{C}} \quad \begin{bmatrix} \text{CAT} \quad \begin{bmatrix} \text{HEAD} \quad \begin{bmatrix} \text{MAJ} \quad \text{vstem} \\ \text{ARGS} \quad \boxed{3} \quad \begin{bmatrix} \text{STRUCT} \quad \langle \boxed{1}, \boxed{2} \rangle \\ \text{LEX} \quad \langle \rangle \\ \text{DA} \quad \langle \boxed{1} \rangle \end{bmatrix} \end{bmatrix} \\ \text{SUBCAT} \quad \langle \rangle \end{bmatrix} \end{array} \end{array} \end{array}$$

5 The Principles of Case Assignment

Given the representation of the different levels we are in a position to give a formulation of the principles of Case assignment in accordance with the Case Criterion. These principles of Case assignment form part of the linking constraints for the different levels.

5.1 Thematic Roles and Case Indices

The assignment of thematic roles to case indices is contained in the lexical entry. The semantic argument structure is linked via structure sharing of the indices in the *ROLE* attribute to the syntactic case indices of the *ARGS* attribute. Consider again the examples *helfen* and *unterstützen*:¹¹

$$(16) \quad \begin{array}{c} \text{helf-} \quad \begin{bmatrix} \text{CAT} | \text{ARGS} \quad \begin{bmatrix} \text{STRUCT} \quad \langle \text{XP}_{\boxed{1}} \rangle \\ \text{LEX} \quad \langle \text{XP}_{\boxed{2}} \rangle \end{bmatrix} \\ \text{CONT} | \text{ROLES} \quad \begin{bmatrix} \text{AGENS} \quad \boxed{1} \\ \text{PATIENS} \quad \boxed{2} \end{bmatrix} \end{bmatrix} \\ \text{unterstütz-} \quad \begin{bmatrix} \text{CAT} | \text{ARGS} \quad \begin{bmatrix} \text{STRUCT} \quad \langle \text{XP}_{\boxed{1}}, \text{XP}_{\boxed{2}} \rangle \\ \text{AGENS} \quad \boxed{1} \\ \text{PATIENS} \quad \boxed{2} \end{bmatrix} \end{bmatrix} \end{array}$$

This form of the lexical entry constitutes the first mapping of the Case Criterion.

¹¹XP _{\boxed{i}} stands for a phrase XP with semantic index i

5.2 Case Indices and Phrases

The second part of the Case Assignment function is syntactic. The relation between the lexical/morphological structure and a zero-level syntactic structure is subject to correspondence principles that link the lexically given and the syntactically realized argument structures. As the syntactic realization of arguments is constrained by the SUBCAT list—and the Subcat Principle—the construction of the SUBCAT list is central to this second part of the Case Criterion.

The constraints on “lexical insertion” fall into the categories of

1. linking morphological and syntactic categories

The lexical entry selects the possible syntactic categories to the corresponding morphological categories from a list of possible pairs (language specifically defined).

2. linking MORPHSEM|ARGS and SYNSEM|ARGS

The morphological ARGS features are linked to the syntactic ones: the STRUCT and LEX lists are shared. No further information is necessary for LEX elements, as their case values are already defined lexically, but for the STRUCT elements the values for EXT and INT (as syntactic notions) have to be determined following the Realization Principle. (One of the existing structural arguments has to be realized externally; if there is a designated argument, then this must be the external argument). If the syntactic category is a possible modifier, the MOD feature has to be constructed (for a more detailed analysis see below).

3. constructing the SUBCAT list

The construction of the SUBCAT list is dependent on the syntactic category of the head, which includes information about whether it is a predicate/functor or an argument. Thus argument categories have an empty SUBCAT list and pass on their ARGS to their prospective governor. Full predicates such as finite verbs construct their SUBCAT list by concatenating the structural and lexical arguments:

$$\left[\begin{array}{c|c} \text{HEAD|ARGS} & \left[\begin{array}{c} \text{STRUCT} \boxed{1} \\ \text{LEX} \quad \boxed{2} \end{array} \right] \\ \hline \text{SUBCAT} & \boxed{1} \oplus \boxed{2} \end{array} \right]$$

In this way the argument structures are linked. For the spelling out of Case we have to assign morphological case and/or positional information.

Morphological case assignment is dependent on the type of argument—structural or inherent. Inherent case is determined in the lexicon—the elements of the LEX list already bear case information. This partitioning is part of the universal grammar. Language specific parameters determine the properties of the inherent arguments. For German we assume the inherent cases *Genitive*, *Dative* and *Accusative*. The status of accusative as an inherent case seems to be not quite clear. In our framework prepositions assign inherent

case, therefore inherent accusative is necessary. Other constructions that require inherent accusative are

- (17) a. *Ihn* *dürstet*.
 Him_{acc} is thirsty
 ‘He is thirsty’
 b. *Die Mutter* *lehrte* *ihre Tochter* *ein neues Lied*
 The mother_{nom} taught her daughter_{acc} a new song_{acc}

where *ihn* and *ihre Tochter* have no possibility of case alternation (e.g. in passivization). To exemplify the assignment of inherent case we show the rule for dative assignment.

$$(18) \quad morphsem \left[CAT|HEAD|ARGS|INHER \langle XP_{[CASE \ 3]} \rangle \right]$$

where:

$$XP_{[CASE \ i]} = synsem \left[LOC|CAT|HEAD \left[\begin{array}{l} MAJ \quad case-bearing-category \\ CASE \ i \end{array} \right] \right]$$

Structural case assignment depends on the syntactic configuration—in particular on the category of the case assigner and the status of the argument as external or internal. In German only V, N and Infl (finite verbs) are structural case assigners. The case assignment principles are quite simple: verbs and nouns assign case to their internal arguments (accusative and genitive respectively), finite verbs to their external arguments (nominative):

$$(19) \quad synsem \left[CAT|HEAD \left[\begin{array}{l} MAJ \quad V \\ ARGS|INT \langle XP_{[CASE \ 4]} \rangle \vee \langle \rangle \end{array} \right] \right]$$

$$(20) \quad synsem \left[CAT|HEAD \left[\begin{array}{l} MAJ \quad V_{fin} \\ ARGS|EXT \langle XP_{[CASE \ 1]} \rangle \vee \langle \rangle \end{array} \right] \right]$$

Morphological case assignment is only part of the story. We also have a general rule for left directional categories (in German: verbs, adjectives and postpositions) which is a constraint that may also apply in contexts other than case assignment (note that no mention is made of case in the rule).

$$(21) \quad left-gov \left[\begin{array}{l} PHON|BOUND \left[\begin{array}{l} LEFT \boxed{1} \\ RIGHT \boxed{3} \end{array} \right] \\ DTRS \left[\begin{array}{l} HEAD-DTR|PHON|BOUND \left[\begin{array}{l} LEFT \boxed{2} \\ RIGHT \boxed{3} \end{array} \right] \\ COMP-DTR|PHON|BOUND \left[\begin{array}{l} LEFT \boxed{1} \\ RIGHT \boxed{2} \end{array} \right] \end{array} \right] \end{array} \right]$$

An analogous constraint for government to the right is attached to phrasal categories of the type Noun and Preposition.

6 Consequences and Interactions

The assignment of case presented so far is highly modularized: small, general constraints are attached to different sorts of feature structures and interact to give the linking between the realization of a phrase and its role in the semantic interpretation. The constraints apply not only to syntactic and semantic structure, but also to the lexicon, restricting the form of lexical entries. By parametrization of the constraints (e.g. the possible inherent cases, the directionality of a category's arguments) even cross-linguistic generalizations can be captured.

To illustrate the power of the analysis we now give a more detailed description of several phenomena connected with case assignment and argument structure.

6.1 Finite Sentences

We start out with the standard case of a finite sentence such as (1a), repeated here for convenience.

- (22) Der Mann sucht den Hund
 The man_{nom} looks for the dog_{acc}
 'The man is looking for the dog'

The verbal stem *such-* is associated with a predicate 'search' with argument roles AGENT and GOAL. The syntactic argument structure consists of two structural arguments; the designated structural argument is linked to AGENT and the other structural argument is linked to GOAL. The combination of the stem with *-t* results in a finite verb with the same argument structure. Lexical insertion gives a SUBCAT list containing the two structural arguments, with an external (the lexically designated) and an internal argument. The internal argument is assigned accusative case by the verb, the external argument nominative because of finiteness. To see the functioning of positional assignment, let us first consider the subordinate counterpart of (22):

- (23) ...weil [der Mann den Hund sucht]
 ...because [the man_{nom} the dog_{acc} looks for]
 '...because the man is looking for the dog'

Verbs (such as *sucht*) govern to the left, therefore it is possible to apply the Subcat Principle twice to arrive at a complete analysis. In main clauses the phenomenon of verb second interferes (the analysis given here is only a rough sketch since V2 is outside the scope of this paper). Assuming a structure as:

- (24) [Der Mann]₁ [sucht]₂ [_t₁ den Hund _t₂]

where the subscripts on the traces correspond to structure sharing of the SYNSEM values, the same analysis as for the subordinate clause (23) can be maintained: nominative is assigned to the trace and inherited by the preposed noun phrase, the positional restriction is only on the trace, whereas the positional restrictions on the preposed noun phrase result from the standard filler mechanism.

6.2 Argument Reduction

In German a class of verbs permit the reduction of structural arguments with a corresponding change in thematic role assignment and case assignment.

- (25) a. Der Kellner zerbricht das Glas.
The waiter_{nom} breaks the glass_{acc}
‘The waiter breaks the glass’
b. Das Glas zerbricht.
The glass_{nom} breaks
‘The glass breaks’

Zerbrechen has two structural arguments, one of which must be designated. The argument reduction process as a lexical rule has access to the property DA (designated argument) with the result that the DA is removed. The linking of the remaining structural argument to the thematic role PATIENS remains intact.

This differing behaviour with respect to case assignment falls out from general principles without any further stipulations. In (25a) the DA (*der Kellner*) is mapped to external argument position and receives nominative case in the tensed context. The remaining structural argument (*das Glas*) is realized internally receiving accusative case via the verb. The reduced version (25b) lacks a DA. By the Realization Principle the only structural argument (*das Glas*) must be realized externally and is thus assigned nominative case.

An interesting case is the verb *kochen*, where a second structural argument may or may not be present. This verb may also undergo the reduction of the designated argument

- (26) a. Hans kocht eine Suppe.
Hans_{nom} cooks a soup_{acc}
‘Hans makes a soup’
b. Hans kocht.
Hans_{nom} cooks
‘Hans is cooking’
c. Die Suppe kocht.
The soup_{nom} cooks
‘The soup is boiling’

Even if one is tempted to assign different semantic predicates to (26b) and (26c) the verb may have the same syntactic argument structure and correct case assignment functions automatically for b) and c).

6.3 Temporal and Modal Auxiliaries

In German, tenses are expressed by morphological means only in the case of present and past, resulting in finite verb forms. The analysis for case assignment for the simple tenses

was presented in the preceeding section. The formation of the other tenses is achieved by a combination of auxiliaries and nonfinite verb forms.

Temporal and modal auxiliaries exhibit the property of selecting a specific verb form and attracting the argument structure of the subcategorized verb, which is an argument of the auxiliary. In our analysis we distinguish between the syntactic property of being an argument and being a predicate for categories that may otherwise be identical at the morphological level. Thus, Participle II (PII) and infinitives have forms which can be used as arguments, where the SUBCAT list is empty but argument structure information is preserved in the ARGS feature structure—and thus accessible to the selecting auxiliaries. Note that the empty SUBCAT list is also in accord with the maximal projection principle in GB—only maximal projections (saturated signs in HPSG terms) may be used as arguments. Now consider the form of the PII of *geholffen* und *unterstützt*.

$$(27) \quad \begin{array}{l} \text{geholffen} \\ \text{cat} \end{array} \left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \text{MAJ } p2 \\ \text{ARGS} \left[\begin{array}{l} \text{STRUCT } \langle \boxed{1} \rangle \\ \text{LEX } \langle \boxed{2} \rangle \end{array} \end{array} \right] \end{array} \right] \\ \text{SUBCAT } \langle \rangle \end{array} \right] \\ \text{unterstützt} \\ \text{cat} \left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \text{MAJ } p2 \\ \text{ARGS} \left[\begin{array}{l} \text{STRUCT } \langle \boxed{1}, \boxed{2} \rangle \\ \text{LEX } \langle \rangle \end{array} \right] \end{array} \right] \\ \text{SUBCAT } \langle \rangle \end{array} \right] \end{array}$$

Structures for infinitives are defined analogously. The tense auxiliaries now have the general structure:

$$(28) \quad \left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \text{MAJ } aux-v \\ \text{ARGS} \left[\begin{array}{l} \text{STRUCT } \boxed{1} \\ \text{LEX } \boxed{2} \oplus \langle \dots \left[\begin{array}{l} \text{MAJ } selected \\ nonfinite \text{ form} \\ \text{ARGS} \left[\begin{array}{l} \text{STRUCT } \boxed{1} \\ \text{LEX } \boxed{2} \end{array} \right] \end{array} \right] \rangle \end{array} \right] \end{array} \right] \end{array} \right]$$

The resulting SUBCAT list is a function of the verbal form of the auxiliary itself—in the case of a finite auxiliary STRUCT and LEX are appended. The verbal cluster *hat geholffen* after filling the PII position via the Subcat Principle results in the same open argument positions as *hilft*—the structural external argument with nominative case and an lexical, inherent argument position with dative.

This general form applies not only to the perfect auxiliaries *haben* und *sein* in selecting a PII, but also to the future auxiliary *werden* in selecting a bare infinitive and all other modals such as *sollen*, *müssen* etc. which exhibit the same behaviour as *werden*. Therefore we arrive at the correct analysis for

- (29) a. Hans hat dem Mann geholfen (*present perfect*)
 b. Hans hatte dem Mann geholfen (*past perfect*)
 c. Hans wird dem Mann helfen (*future*)
 d. Hans soll dem Mann helfen (*modal*)

But note that there is also the *future perfect* form

- (30) Hans wird dem Mann geholfen haben
 Hans will the man helped have
 ‘Hans will have helped the man’

This double compound form requires no additions to our analysis: the argument structure of *geholfen* is attracted by *haben*, which is a nonfinite form used as an argument. The whole resulting argument structure is attracted by *wird*, which assigns nominative case to the external argument of *helfen*.

6.4 Raising and Control

This same argument inheritance mechanism can also be applied in the case of raising and control. In raising constructions as with the raising verb *scheinen* in

- (31) a. Hans scheint dem Mann zu helfen.
 Hans seems the man_{dat} to help.
 ‘Hans seems to be helping the man’
 b. Hans scheint den Mann zu unterstützen.
 Hans seems the man_{acc} to help.
 ‘Hans seems to be helping the man’

the entry for *schein-* is

$$(32) \left[\begin{array}{c} \text{ARGS} \left[\begin{array}{c} \text{STRUCT } \boxed{1} \\ \text{LEX } \boxed{2} \oplus \left\langle \left[\dots \text{HEAD} \left[\begin{array}{c} \text{MAJ } \textit{zu-inf} \\ \text{ARGS} \left[\begin{array}{c} \text{STRUCT } \boxed{1} \\ \text{LEX } \boxed{2} \end{array} \right] \right] \right] \right\rangle \end{array} \right] \end{array} \right]$$

The semantic part of this entry links the AGENT of *scheinen* with the semantic value of the external argument of the subcategorized infinitival phrase (as in the analogous control case). Here, the cases are assigned via *scheinen*. For the interaction with passive see below.

Control is to be treated along the lines advocated by Pollard and Sag in PS2 (see also Kiss 1991): controlling verbs are classified under the sorts *influence*, *commitment* and *orientation*. Depending on this classification, a semantic role is selected that controls the external argument of the complement psOA. External argument in Pollard & Sag’s analysis is defined semantically. Our analysis differs only in one respect: the controlled argument is the syntactically external argument. Consider:

- (33) a. Die Frau überzeugt den Mann zu kommen.
 The woman_{nom} convinces the man_{acc} to come
 ‘The women convinces the man to come’
- b. Der Mann wird überzeugt zu kommen.
 The man_{nom} is convinced to come
 ‘The man is being convinced to come’

and the structure for *überzeugt*

$$(34) \left[\begin{array}{c} \text{CAT|HEAD} \\ \text{CONT} \end{array} \left[\begin{array}{c} \text{MAJ } V_{fin} \\ \text{ARGS} \left[\begin{array}{c} \text{STRUCT} \langle \text{XP}_1, \text{XP}_2 \rangle \\ \text{LEX} \left\langle \left[\begin{array}{c} \dots \text{HEAD} \left[\begin{array}{c} \text{MAJ } zu-inf \\ \text{ARGS|EXT} \langle \text{XP}_2 \rangle \end{array} \right] \right] \right\rangle \\ \dots \text{CONT} \text{ } 3 \end{array} \right] \right] \end{array} \right] \\ \text{ROLES} \left[\begin{array}{c} \text{INFLUENCER } 1 \\ \text{INFLUENCED } 2 \\ \text{SOA-ARG } 3 \end{array} \right] \end{array} \right]$$

In (33a) the INFLUENCED role occupied by *den Mann* controls the external argument of *kommen* by the same principle as in (33b). The difference in case and syntactic argument position is irrelevant for the controller and is achieved by the set of principles presented so far. But the examples in (35) show that the controlled argument cannot be determined on semantic grounds alone.

- (35) Seine Eloquenz erlaubte dem Mann, trotz mangelnder Befähigung
 ‘His eloquence enabled the man, ... in spite of his poor abilities’.
- a. ...zu wählen.
 to vote
- b. ...gewählt zu werden.
 to be elected

- (36) Seine Haltbarkeit erlaubte dem Glas,
 Its durability enabled the glass
- a. ...trotz hoher Beanspruchung nicht zu zerbrechen.
 despite heavy use not to break
 ‘Its durability prevented the glass from breaking despite heavy use.’
- b. ...trotz hoher Beanspruchung nicht zerbrochen zu werden.
 despite heavy use not to be broken
 ‘Its durability prevented the glass from being broken despite heavy use.’

- c. ...die getroffene Vase zu zerbrechen.
 the struck vase to break
 ‘Its durability enabled the glass to break
 the vase which it struck.’

In (35) and (36) the complement infinitives have the same thematic structures, but argument modifications such as the passive in (35b) and (36b) and the DA reduction in (36a) promote another role to the external argument in concordance with our analysis. The different interpretation of the controlled argument (in (35a) the ELECTOR, in (35b) the ELECTED) is now a simple consequence of our analysis.

Another consequence is the exclusion of (37a) in contrast to the semantically equivalent (37b).

- (37) a. *Der Mann beabsichtigt, ihm nicht zu grauen.
 The man_{nom} intends him_{dat} not to be frightened
 ‘The man intends not to be frightened’
 b. Der Mann beabsichtigt, kein Grauen zu verspüren.
 The man_{nom} intends no fear_{acc} to feel
 ‘The man intends to feel no fear’

In (37a) *grauen* has no external argument and the unification simply fails, whereas the external argument of *verspüren* in (37b) may be controlled by *der Mann*.

6.5 Modification

So far we have discussed participles (and infinitives) only as arguments. In constructions like (38), participles may also function as predicates which are a special type of modifier.

- (38) a. Die Trommel schlagend zogen die Musikanten umher.
 The drum_{acc} beating roved the musicians_{nom} around
 ‘The musicians roved about beating the drum’
 b. Geschlagen verließ die Mannschaft das Spielfeld.
 Beaten left the team_{nom} the field_{acc}
 ‘Beaten, the team left the field’

The present participle (PI) and the perfect participle (PII) are modifying verbal projections, but also have an argument structure of their own. The construction of the necessary argument structure and SUBCAT list is achieved in the interface between lexicon and syntax depending on the verbal form. Both participle types used as modifiers receive a MOD feature with a verbal value. The difference lies in the construction of the SUBCAT list and thus in the resulting case assignment. For PI, the SUBCAT list is simply the concatenation of the second structural argument with the lexical arguments, and the ‘control’ restriction that the first structural argument controls the external argument of the modified phrase. Thus we have the following structure for *schlagend*:

$$(39) \quad \left[\begin{array}{c} \text{MAJ } p1 \\ \text{head} \left[\begin{array}{c} \text{MOD} \left\langle \left[\dots \text{HEAD} \left[\begin{array}{c} \text{MAJ} \quad \text{verbal} \\ \text{ARGS} | \text{EXT XP}_{[3]} \end{array} \right] \right] \right\rangle \\ \text{ARGS} \left[\begin{array}{c} \text{STRUCT} \langle [1], [2] \rangle \\ \text{EXT} [1] \text{XP}_{[3]} \\ \text{INT} [2] \end{array} \right] \end{array} \right] \end{array} \right]$$

Now in (38a) *die Trommel* receives accusative case by the standard mechanism (internal argument by V) and the ACTOR role of *schlagen* is identified with *die Musikanten*.

For PII an argument reduction process applies: the designated argument is removed and the resulting argument, now external, is used to control the external argument of the modified phrase. If no structural argument is left, a structure of this type cannot be constructed. Thus the analysis for *geschlagen* to be used in (38b) is

$$(40) \quad \left[\begin{array}{c} \text{MAJ } p2 \\ \text{head} \left[\begin{array}{c} \text{MOD} \left\langle \left[\dots \text{HEAD} \left[\begin{array}{c} \text{MAJ} \quad \text{verbal} \\ \text{ARGS} | \text{EXT XP}_{[2]} \end{array} \right] \right] \right\rangle \\ \text{ARGS} \left[\begin{array}{c} \text{STRUCT} \langle [1] \rangle \\ \text{EXT} [1] \text{XP}_{[2]} \end{array} \right] \end{array} \right] \end{array} \right]$$

As this process removes the *designated* argument we have as a result the difference between the verbs *aufwachen* and *schlafen*, both having only one argument.

- (41) a. Eben erst aufgewacht nickte er gleich wieder ein.
 just woke up he nodded off to sleep again
 ‘Having just woke up he nodded off to sleep again’
 b. *Eben erst geschlafen nickte er gleich wieder ein.
 just slept he nodded off to sleep again
 ‘Having just slept he nodded off to sleep again’

The difference results from the structural argument being designated in the case of *schlafen* and not being designated in the case of *aufwachen*.

Both PI and PII also have an (adjectivally) inflected form in German. This inflected form may only be used as a modifier for nominals, a property they share with adjectives. The structure assigned to these noun-modifying participles is quite analogous to the structure of verb-modifying uninflected forms with the exception that the argument controlled by the external argument of the participle is the modified phrase itself rather than its external argument. Thus we have

- (42) a. der die Trommel schlagende Musikant
 the the drum_{acc} beating musician
 ‘the musician beating the drum’

- b. die geschlagene Mannschaft
 the beaten team
 ‘the beaten team’

by virtue of the following assigned structures for *schlagende* and *geschlagene*:

$$(43) \quad \text{head} \left[\begin{array}{l} \text{MAJ } p1attr \\ \text{ARGS} \left[\begin{array}{l} \text{MOD } \langle \text{XP}_{[3]} \rangle \\ \text{STRUCT } \langle [1], [2] \rangle \\ \text{EXT } [1] \text{XP}_{[3]} \\ \text{INT } [2] \end{array} \right] \end{array} \right]$$

$$(44) \quad \text{head} \left[\begin{array}{l} \text{MAJ } p2attr \\ \text{ARGS} \left[\begin{array}{l} \text{MOD } \langle \text{XP}_{[2]} \rangle \\ \text{STRUCT } \langle [1] \rangle \\ \text{EXT } [1] \text{XP}_{[2]} \end{array} \right] \end{array} \right]$$

The same principles now exclude (45b) in contrast to the grammatical (45a) (cf. (41))

- (45) a. der eben erst aufgewachte Mann
 the just woke up man
 ‘the man who had just woken up’
 b. *der eben erst geschlafene Mann
 the just slept man
 ‘the man who had just been sleeping’

Note that, attributively used, inflected adjectives possess the same structure (they have no designated argument) and are analyzed in the same fashion, giving for example:

- (46) der mir nicht bekannte Mann
 the me_{dat} not known man
 ‘the man not known to me’

Note also that the principle of DA-reduction also applies to verbs with lexical arguments resulting in:

- (47) a. das ihm zugestoßene Unglück
 the him_{dat} happened accident
 ‘the accident which happened to him’
 b. *der ihm geholfene Mann
 the him_{dat} helped man
 ‘the man who had helped him’

6.6 Lexical vs. Syntactic Rules

If we assume that syntactic processes are completely regular, but lexical rules may have exceptions, some phenomena, such as auxiliary selection and passive formation, have to be relegated at least partially to the lexicon. What we want to do in our analysis is to keep the regularities but make them sensitive to lexically specifiable parameters. If there is only a small set of parameters, and the effect of a parameter switch is also a switch in regular behaviour, dialectal and regional variation (as observed with the phenomena mentioned above) can be accounted for by only small changes in the grammar—a result that is clearly desirable.

6.6.1 Auxiliary Selection

German verbs select either *haben* or *sein* for the formation of perfect tense. The association of auxiliary selection with semantic properties given in most traditional grammars is untenable:

- (48) a. Hans hat Maria geholfen.
 Hans_{nom} has Maria_{dat} helped
 ‘Hans helped Maria’
 b. Hans ist Maria zu Hilfe gekommen.
 Hans_{nom} is Maria_{dat} to aid come
 ‘Hans came to Maria’s aid’

Nevertheless, the choice is not random: verbs with a designated argument select *haben*, those without select *sein*. The observation that transitive verbs always select *haben* is now a consequence of the Realization Principle. The generalization is captured in a lexical rule that selects the auxiliary according to the presence or absence of a designated argument. The rule must be lexical because of its dependence on the *lexical* feature of designation.

Exceptions to regular behaviour are encoded by the standard practice of subtyping lexical entries into regular and irregular—for those marked irregular the auxiliary to be used has to be given explicitly. In this way the exceptional behaviour of:

- (49) a. Ich bin eine Runde gelaufen.
 I_{nom} am a lap_{acc} run
 ‘I have run a lap’
 b. Ich bin mit ihm die Arbeit durchgegangen.
 I_{nom} am with him the work_{acc} gone through
 ‘I went through the work with him’

which are the (to our knowledge) only exceptions in the auxiliary selection of transitives can be dealt with. But note that regular phenomena such as DA removal mentioned above, usually result in a regular auxiliary switch as well. As a consequence of DA removal, we expect the selection of *sein* for the reduced construction and *haben* for the unreduced construction, which is exactly what occurs:

- (50) a. Der Kellner hat das Glas zerbrochen.
 The waiter_{nom} has the glass_{acc} broken
 ‘The waiter has broken the glass’
 b. Das Glas ist zerbrochen.
 The glass_{nom} is broken
 ‘The glass has broken’

6.6.2 Passive

In German we have two passive constructions, the *agentive* passive formed with *werden* and the *stative* passive formed with *sein* (51b).

- (51) a. Die Mannschaft wird geschlagen.
 The team_{nom} is beaten
 ‘The team is being beaten’
 b. Die Mannschaft ist geschlagen.
 The team_{nom} is beaten
 ‘The team is beaten’

Which verbs undergo passivization is largely determined by lexical factors and also subject to regional variation—for example the passivizability of *erhalten* (‘to get’) depends on the dialect under consideration. Thus the possibility of passivization is a lexical property, but, given passivizability, the associated argument structure is completely regular—it is the DA reduction process used in the analysis for PII as a verbal modifier.

The passive construction is triggered by the two auxiliaries *werden* and *sein* with the structures given below:

$$(52) \left[\begin{array}{c} \text{HEAD} \\ \left[\begin{array}{c} \text{MAJ } aux-v \\ \text{ARGS} \left[\begin{array}{c} \text{STRUCT } \boxed{1} \\ \text{LEX } \boxed{2} \oplus \end{array} \right] \end{array} \right] \end{array} \right] \left\langle \left[\dots \left[\begin{array}{c} \text{MAJ } p2pass \\ \text{ARGS} \left[\begin{array}{c} \text{STRUCT } \boxed{1} \\ \text{LEX } \boxed{2} \end{array} \right] \end{array} \right] \right] \right\rangle \right]$$

The argument structure is attracted by the respective passive auxiliary. Note that the structure associated with the stative passive interpretation for *sein* is the structure also used for the predicative copula—the same syntactic rules thus apply in (53a) and (53b):

- (53) a. Die Mannschaft ist geschlagen.
 The team_{nom} is beaten
 ‘The team is beaten’
 b. Die Mannschaft ist schlecht.
 The team_{nom} is bad
 ‘The team is bad’

Nominative case is assigned according to the principles given above by the finite form of the copula, and the linking to semantic roles is mediated by the lexical entry.

Another consequence of our analysis can be shown by considering optional raising verbs such as *versuchen* ('to try'):

- (54) a. Der Wagen wurde zu reparieren versucht
The car_{nom} was to repair tried
- b. *Den Wagen wurde zu reparieren versucht
The car_{acc} was to repair tried
- c. *Es wurde versucht, der Wagen zu reparieren
It was tried, the car_{nom} to repair
- d. Es wurde versucht, den Wagen zu reparieren
It was tried, the car_{acc} to repair
'The repair of the car was attempted'

As mentioned before, raising verbs inherit the arguments of their complement. In the case of *versuchen*, in its raising version (54a,b) the designated argument of the subordinate *reparieren* is removed and *der Wagen*, now acting as external argument, is assigned nominative case by the finite form of the auxiliary *wurde*. Accusative case cannot be assigned due to the lack of an internal argument. In the non-raising version (54c,d) case assignment is accomplished via *reparieren*, a non-finite form (unable to assign nominative) with an internal argument, thus *der Wagen* receives accusative case-marking.

A related phenomenon is the case of *lassen* in (55):

- (55) a. Der Mann läßt den Buben den Weg kehren
The man_{nom} lets the boy_{acc} the path_{acc} sweep
'The man has the boy sweep the path'
- b. ? Der Bub wird den Weg kehren gelassen
The boy_{nom} is the path_{acc} sweep let
'The boy is allowed to sweep the path'

Here we have an interaction between control and passivization. The INFLUENCED role of *lassen* controls the external argument of the complement. In (55a) the bearer of the INFLUENCED role shows up as internal argument to *lassen* and thus is assigned accusative case. In passivization, the bearer of the INFLUENCED role shows up as external argument and receives nominative case as in (55b).

We haven't yet given an analysis for simple cases such as (56) and (57):

- (56) a. Der Berater unterstützt den Kunden
The consultant_{nom} supports the customer_{acc}
- b. Der Kunde wird unterstützt
The customer_{nom} is supported

- (57) a. Der Berater hilft dem Kunden
 The consultant_{nom} helps the customer_{dat}
- b. Dem Kunden wird geholfen
 The customer_{dat} is helped
- c. * Der Kunde wird geholfen
 The customer_{nom} is helped

The variation between (56) and (57) are consequences of the different argument structures of *unterstützen* and *helfen*, in particular the linking of the PATIENT/HELPED role to a structural (56) and a lexical (57) argument position. In the case of *unterstützen* there are two structural arguments, therefore the bearer of the PATIENT role shows up with accusative case in the active version (56a) and, after DA removal, with nominative case in the passive version (56b). The lexical dative case of the PATIENT with *helfen* is unmodified in the active/passive variation. But—as no structural argument is left after DA removal—nominative case cannot be assigned in the passive version.

This phenomenon is also a special case of ‘subjectless’ sentences in German, a sentence type which is not excluded by our formulation of case assignment. Nominative case is assigned to an *existing* external argument by a finite form. Therefore the sentences in (58) are all grammatical—there is simply no structural argument present.

- (58) a. Mir graut
 Me_{dat} frightened
 ‘I am frightened’
- b. Hier wird getanzt
 Here is danced
 ‘There is dancing here’

In (58a) *grauen* is a verb without structural arguments, and in (58b) the structural argument is removed by passivization. Until now, we have left out a constraint on passivization, namely that passivization depends on the existence of a designated argument. This constraint excludes

- (59) * Hier wird angekommen
 Here is arrived
 ‘There is arriving here’

as well as repetitive application of passivization.

Another interaction between passivization as a constraint on structural cases and inherent case assignment allows us to account for (60):¹²

- (60) a. Der Professor lehrt den Studenten
 The professor_{nom} teaches the student_{acc}
 jede Woche einen neuen Ansatz
 each week a new approach_{acc}
 ‘The professor teaches the student a new approach each week’

¹²The example is due to Pollard (1991).

- b. ? Den Studenten wurde jede Woche
 The student_{acc} was each week
 ein neuer Ansatz gelehrt
 a new approach_{nom} taught
 ‘A new approach was taught to the student each week’
- c. * Der Student wurde jede Woche
 The student_{nom} was each week
 einen neuen Ansatz gelehrt
 a new approach_{acc} taught

In German, we have at most two structural arguments. Therefore one of the accusative arguments in (60a) has to be lexical (on the necessity of lexical accusative see above). The THEME of *lehren* occupies a structural argument position and thus may carry nominative or accusative case, whereas *den Studenten* is assigned lexical accusative, does not undergo passivization and thus may not surface as a nominative in (60c).

7 Summary

In our approach to argument structure and case assignment we have tried to extend the HPSG framework in a conservative manner—incorporating some GB related ideas whilst preserving the overall benefits of the HPSG approach.

In particular, we have shown how various phenomena connected with argument structure can be analyzed by the interaction of a few general principles.

The framework reflects the distinction between syntactic and morphological case as well as the distinction between structural and inherent argument positions. Case assignment is broken up into a linking of semantic and syntactic argument structure and its realization in a given environment.

The principles of case assignment to structural and lexical positions interact with other (possibly parametrized) principles such as

- directionality of government
- auxiliary structure
- control
- designated argument reduction
- modifier constraints

to account for a broad range of phenomena such as passivization, auxiliary selection, argument reduction in the *schmelzen* class, absolutive constructions, long distance passives, ergativity etc.

The framework also extends to different realizations of Case by morphological, positional and lexical means and thus is not confined to use in a grammar of German.

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