What about lexical semantics if syntax is the only generative component of languages?
A case study on word meaning in German

Abstract This paper explores the semantic consequences of the principle of containment embodied by the popular assumption that word formation is entirely syntactic and that there is no generative lexicon. According to the principle of containment, the analysis and structure of a given form must also be contained within the analysis of any structure derived from that form. The implications of the containment principle for the analysis of word meaning are elucidated with a detailed case study of ambiguous German nominalizations. The resulting analysis of ambiguous German nominalizations is employed as a probe into the structure and analysis of contained constructions to derive novel insights about the syntax and semantics of adjectival participles in German.

Keywords Lexical Semantics · Syntax-Semantics Interface · Word Formation · Ambiguity · Nominalization · Participle · Adjectival Passive · Causatives · German

1 Introduction

Syntactic approaches to word formation erase the distinction between that component of languages which is responsible for the generation of words – the lexicon – and that component which is responsible for the generation of phrases and sentences – the syntax. Since syntax as an independent module is needed anyway, reasons of minimal design of the human language faculty and ontological parsimony of explanation favour the syntactic approach to word formation over lexicalist approaches (cp. Embick (2004); Bruening (2014)). Accordingly, word formation is entirely syntactic and there is no generative lexicon. Words are formed from roots’; atomic, non-decomposable and category-neutral elements which combine with features to build larger linguistic elements. A prominent representative of the syntactic account of word formation is ‘Distributed Morphology’ (DM, Halle and Marantz (1993); Marantz (1997); Alexiadou (2001)). The present paper refers to work in DM not

Address(es) of author(s) should be given
because of the specific theoretical assumptions about morphology DM embodies but rather because DM has been applied to a wide range of linguistic phenomena including those that constitute the empirical basis of this paper: nominalizations, causative verbs and adjectival participles. This is to say that the argument of this paper does not rest on assumptions specific to DM but rather on the general hypothesis that word formation is entirely syntactic. Consequently, the conclusions that I draw equally obtain for other frameworks that embody a syntax-only approach to word formation such as e.g. 'Exoskeletal syntax' (Borer, 2005, 2013) or ‘Nanosyntax’ (Starke, 2009).

1.1 The principle of containment

If there is no lexicon, then there are no lexical entries. In particular, there are no lexical entries in the form of templatic representations of word meaning that have been proposed in frameworks like ‘event structure templates’ (Rappaport Hovav and Levin, 1998), ‘semantic forms’ (Bierwisch, 2007) or ‘qualia structures’ (Pustejovsky, 1995). Since there is no principled reason that precludes the decomposition of lexical entries in the syntax (see e.g. Rappaport Hovav and Levin (1998) for discussion), the lack of a lexicon does not seem to pose a serious problem that would require further investigation. But the elimination of the lexicon is in fact a game-changer for the analysis of word meaning. In the tradition of Montague, formal semanticists have distinguished two types of ambiguity: lexical ambiguity and syntactic ambiguity. But if there is no lexicon, then there is no lexical ambiguity and thus all ambiguity must be syntactic. Treating polysemous words the same way as ambiguous sentences has two astonishing consequences. First, given that syntax by itself is unambiguous, the contribution of a morpheme must be constant throughout the derivation of the meaning of a word, just like the contribution of a word must be constant throughout the derivation of the meaning of a sentence. Second, sentence-level ambiguities like scope relationships can be resolved by reordering the constituents of an ambiguous sentence so as to obtain unambiguous paraphrases of the meaning of the respective sentence, the so-called readings of the sentence. For example, it is well established that the ambiguous sentence (1-a) has the two readings in (1-b) and (1-c).

(1)  
  a. Every man loves a woman.  
  b. There is a woman who is loved by every man.  
  c. For every man there is a woman he loves.

A similar reordering account of the ambiguity of words is precluded by the fact that the order of constituents – i.e. morphemes – in words is fixed and thus a polysemous word cannot be disambiguated by changing the order of its constituents. The only way in which the lack of lexical ambiguity can be compensated for under the assumption that syntax is the only generative component of language is to assume that the locus of the ambiguity of polysemous words is the hierarchy and order of its syntactic derivation. Polysemous words thus provide semantic motivation for what I call the principle of containment in the following, see (2).
What about lexical semantics if syntax is the only generative component of languages?

(2) "In a ‘pervasive syntax’ approach to morphologically complex forms, like that of Distributed Morphology, the analysis and structures proposed for a form must also be contained within the analysis of any structure derived from that form. That is, in the same way that the structural analysis for Mary left is contained within the structural analysis for John said that Mary left, the structure for marginalize must be contained within the structure for marginalization.” (Harley, 2009, p. 320)¹

From a theoretical point of view, the principle of containment dictates a strategy for the investigation of word meaning that is fundamentally different from the perceived tradition of lexical semantics. In lexical semantics, word meaning is constrained by a lexical entry comprising at least (a) the syntactic category of a word and (b) the membership of a word in a lexical semantic class (e.g. in the sense of the lexical semantic verb classes in Levin (1993) or the lexical semantic noun classes in Grimshaw (1990)). In contrast, the containment principle enforces a ‘constructivist’ approach of word meaning that is constrained relative to derivational ‘families’ of constructions originating from the same root. The focus on the derivational relation of constructions instead of lexical word classes shifts the subject of meaning from lexical entries to families of construction types of words and their meaning. Accordingly, the containment principle requires that the adequacy of the semantic interpretation of a word is not justified by appeal to syntactic category and features of the lexical class of that word but with respect to those other constructions that can be derived from or are contained in that word. As such, the meaning of a word according to the containment principle is situated squarely within the syntactic category and lexical class of that word.

1.2 A snippet of German data

To exemplify the shift of the subject of meaning in DM-like approaches to word formation I consider constructions from the German root √mal (‘spot’, ‘mark’). √mal can be inserted into a structure that derives the verb malen (3-a) or the noun Mal (‘mark’) (3-b).

(3) a. Peter malt eine Blume.  
   ‘Peter is painting a flower.’

b. Das Mal des Bösen  
   ‘The mark of the devil’

German has a productive system of prefixation. E.g., the root √mal can be combined with the prefix be, where be- in present day German roughly resembles the be-prefix in old English constructions such as begifted, benighted, bewigged, becharmed. The combination √mal+be derives a further verb bemalen (‘to bepaint’), see (4).

¹ It should be noted that because the syntactic analysis of a seemingly idiomatic meaning does not differ from the syntactic analysis of a compositional meaning, the containment principle obtains regardless of whether or not the meaning of a structure is idiomatic.
Wunderlich (1987) analyzes the function of the prefix be as an instance of lexical preposition incorporation. According to Wunderlich, the function of be in examples like (6-a) is to shift the location specified by the prepositional phrase in the unprefixed verb construction (5-a) into the direct object position. The resulting alternation between be-prefixed and unprefixed constructions resembles spray/load alternations in English (Levin (1993)), cp. (5-b)/(6-b).

Prefix-constructions from √/mal+be as in (4) but not the unprefixed constructions from √/mal in (3) can be suffixed with the nominalizer morpheme ungent to form a nominalization, see (7). Notably, according to the containment principle, the structure and analysis of √/mal+be in (4) must be contained in the structure and analysis of the nominalization in (7) derived from √/mal+be+ung.

To explain the difference in the licensing of ungent-nominalizations in (7), Roßdeutscher and Kamp (2010) argue that ungent-nominalization requires a bi-eventive input structure, adopting the syntactic account of bi-eventivity proposed in Marantz (2005). Marantz argues that in a mono-eventive construction the root √ modifies the verbalizer v as in (8-b), whereas in a bi-eventive construction, a morphologically empty verbalizer v is merged with a PP denoting a stative property as in (8-a).
Given the constraint on the formation of ung-nominalizations proposed by Roll-deutscher and Kamp, the prefix-verb bemalen has a bi-eventive construction and thus licenses – in a way to be detailed in this paper – an ung-nominalization whereas the unprefixed verb malen has a mono-eventive construction type which lacks an ung-nominalization.

Remarkably, one and the same surface form derived from √mal+be+ung can mean quite different things in different contexts, see (9).

(9) a. Die Bemalung der Wand wird unterbrochen.
    ‘The be-painting of the wall is interrupted.’

b. Die Bemalung der Wand besteht unverändert fort.
    ‘The wall be-painting persists unchanged.’

c. Die Bemalung der Wand wird renoviert.
    ‘The wall be-painting is renovated.’

According to standard assumptions of lexical semantics, in (9), Bemalung has a different denotation in each of the examples: Bemalung is ambiguous with respect to the ontological sort of its denotation. The difference is testified by the compatibility of Bemalung with verbs each of which selects for a different sort to which the denotation of its direct object argument slot indicated in the glossing of the respective verb must belong. The methodology of probing for the sort of denotations with selection restrictions goes back at least to Vendler (1967) and has become a central diagnostics for the ‘metaphysics’ (Bach, 1986) of word meaning, see e.g. Jackendoff (1988); Pustejovsky (1995); Asher (2011). Following the diagnostics employed in Ehrich and Rapp (2000), in (9-a), the verb unterbrechen (‘to interrupt’) selects for direct objects that denote an event, as only events can be interrupted. To facilitate the interpretation of examples, I represent the selection restrictions of a predicate in the gloss as an annotation with EVENT, STATE or OBJECT, respectively. In (9-b), the verb bestehen (‘to persist’) selects for a state reading of Bemalung. Finally, because only objects but not events or states can be renovated, in (9-c) the verb renovieren (‘to renovate’) selects for an object denotation of Bemalung.

1.3 The principle of structural disambiguation

In lexical semantics, the sortal ambiguity of Bemalung can be analyzed as a lexical ambiguity in that Bemalung is mapped to a disjunction of three different lexical entries, each of which captures a particular denotation sort, see e.g. Ehrich and Rapp.
(2000). But if there is no lexicon, the ambiguity of words like Bemalung cannot be analyzed as a lexical ambiguity. Instead, the sortal ambiguity of Bemalung must be reconstructed in such a way that the different denotations of Bemalung correspond to different syntactic analyses of Bemalung. Let me call this requirement the structural disambiguation principle. Importantly, structural disambiguation is subject to the containment principle. Syntactically, containment requires that the structures of Bemalung employed for structural disambiguation are intergradient, i.e. derived from each other in hierarchical order. Semantically, containment requires the interpretation of the combination of the root √mal and the prefix be to be constant throughout structural disambiguation.

1.4 Goals and outline of the paper

I believe that even the introductory discussion of the small snippet of data from German introduced above illustrates the main challenge for a serious interpretation of the hypothesis that word formation is entirely syntactic. The principles of containment and structural disambiguation impose a fine-meshed system of semantic and syntactic constraints and dependencies. If syntax is the only generative component of languages, the resolution of this system of constraints and dependencies cannot take place in the lexicon or draw on the stipulation of lexical rules but must be part of the semantic interpretation of syntactic structure. In its attempt to solve such a system of constraints and dependencies imposed by the containment principle in an exemplary analysis of a phenomenon that has been central to the development of lexical semantics – i.e. the ontological flexibility of nouns – the present paper is more ambitious in its goals than previous work on semantics in DM which does not consider the semantic implications of structural containment (see e.g. the overview article Harley (2013) but also the pioneering work on ung-nominalizations in Roßdeutscher and Kamp (2010)). Given these considerations, it is important to note in advance that the goal of this paper is not to provide arguments for or against the hypothesis that syntax is the only generative component of languages but that the goal of this paper is to explore the semantic consequences of this hypothesis.

In the first part of the paper, I develop a detailed account of the structural disambiguation of the nominalization Bemalung under containment. To this end, section 2 considers the semantic behavior of Bemalung in copredication contexts and argues that be functions as the adjectivizing head of a participle construction contained in the nominalization. The second part of the paper discusses in detail the fact that structural disambiguation of Bemalung under containment enforces a distinction of two types of participle constructions in German: a ‘high’ participle which is derived from the associated verb and a ‘low’ participle which is contained in the associated verb (section 3). In section 4 I relate the resulting split analysis of participle constructions in German to previous approaches to German adjectival participles in the literature. Section 5 concludes.
2 Structural Disambiguation under Containment

2.1 The lexical perspective on semantic containment

Since Bemalung is a word, the structural disambiguation of the readings of Bemalung must pertain to ‘building blocks’ of meaning that are smaller than the word resp. its lexical entry. As a first step towards revealing which building blocks are efficacious in the constitution of the denotation of Bemalung, I draw upon the observations that Hamm and Solstad (2010) make about the behavior of sortally ambiguous nominalizations in co-predication contexts. In contrast to the examples in (9), a co-predication context involves not one but two or more predicates with different selection restrictions that all take the same noun phrase as an argument. More specifically, in the next examples, I introduce Bemalung as the head of an argument of a predicate with a specific selection restriction and then use this argument as the antecedent of an anaphoric construction that functions as the argument of a predicate with a selection restriction that is different from the selection restriction imposed by the predicate in the antecedent. As a starter, consider the data in (10).

(10) Die Bemalung₁ der Wand war anstrengend.
"The be-painting of the wall₁ was exhausting."

In (10), the initial predication of Bemalung with anstrengend (‘exhausting’) selects for an event denotation of the nominalization. The event denotation serves as the antecedent of an anaphoric construction with bestehen (‘to persist’) that selects for a state denotation of Bemalung and for an anaphoric construction with renovieren (‘to renovate’) that selects for the object denotation of Bemalung. Things are different when Bemalung is introduced as the direct object of a predicate that selects for a state denotation as in (11-a) or an object denotation as in (11-b) In this case, Bemalung cannot function as the antecedent of an anaphoric construction that selects for an event.

(11) a. Die Bemalung₁ der Wand bestand
"The wall be-painting₁ persisted unchanged."

b. Die Bemalung₁ der Wand wurde
"The wall be-painting₁ was renovated."
If *Bemalung* is introduced as the direct object of a verb that selects for a state denotation, then *Bemalung* can function as the antecedent of an anaphoric construction that selects for an object, see (12).

(12) Die Bemalung₁ der Wand bestand
    the be.PRFX.mark.ung.NMLZ the.GEN wall persisted.STATE
    unverändert fort. Jetzt wurde sie renoviert.
    unchanged on. Now was it renovated.OBJECT.

   'The wall painting₁ persisted unchanged. Now it₁ was renovated.'

Although the ontological distinction between objects and states is common practice in lexical semantics, the actual linguistic diagnosis of the separation of object denotation from state denotation is quite cumbersome. There is a trivial state denotation associated with any object; namely the state of persistent existence in time. Consequently, the verb *unverändert fortbestehen* (‘to persist unchanged’), which serves as the linguistic diagnostics for state denotation according to Ehrich and Rapp (2000) also takes direct objects which are above suspicion of denoting a state, see e.g. (13).

(13) Die Polizeistation bestand unverändert fort.
    'The police station persisted unchanged.'

Moreover, verbs that select for an object denotation of their direct object like *renovieren* (‘to renovate’) often entail a change in their direct object and thus rule out anaphoric reference with state-selecting predicates like *unverändert fortbestehen* (‘to persist unchanged’); if an object is renovated, it cannot persist unchanged. One goal of this paper is to come up with an account of the distinction between objects and states that is not afflicted by these problems. For the time being, in the example (14), I took great care to rule out the interfering effects of change of state verbs and temporal existence and following the judgements of my informants, (14) indicates that when *Bemalung* denotes an object, it cannot serve as the antecedent of an anaphoric construction that refers to a state.

(14) Die Bemalung₁ der Wand hat viele Preise
    the be.PRFX.mark.ung.NMLZ the.GEN wall has many prices
    gewonnen. #Sie bestand unverändert fort.
    won. It persisted.STATE unchanged on.

   'The wall painting₁ won many prices. #It₁ persisted unchanged.'

Summing up, (10) indicates that one configuration of building blocks in *Bemalung* must derive an event, state and object denotation. Another configuration of building blocks indicated by (11-a) and (12) derives a state and an object denotation but no event denotation. The final configuration of building blocks that is indicated by (11-b) and (14) is one which derives an object denotation but neither an event nor a state denotation. All in all, the behavior of *Bemalung* in co-predication contexts indicates that semantic containment in *Bemalung* is asymmetric. This asymmetry reproduces the natural order of things: an event causes a change of state and that state manifests itself in an object - but not the other way round. Schematically, the semantic containment of building blocks of meaning is structured as in (15).
Taking these tried and tested insights from lexical semantics as a starting point, the goal of the remainder of this section is to derive the hierarchy in (15) from an analysis of *Bemalung* that satisfies the containment principle, i.e. without reference to a lexical specification of its asymmetric ambiguity.

### 2.2 Structural disambiguation, first attempt

The containment of building blocks diagnosed in section 2.1, Wunderlich’s analysis of *be* as an incorporated preposition and the constraint of Rossdeutscher and Kamp on the formation of *ung*-nominalization point towards a certain syntactic structuring of building blocks. If we adopt the rather standard assumption of syntactic approaches to word formation that functional heads in the syntax are responsible for the introduction of a particular sort of discourse referents, e.g. that the verbalizer head *v* introduces a discourse referent *e* for an event and that the nominalizer head *n* introduces a discourse referent for an object *x*, the event and object building blocks of *Bemalung* would correspond to the verbal and nominal functional layer, respectively. But what is the functional layer in the syntax associated with the state building block in *Bemalung*? Remember that the constraint on *-ung* nominalization proposed by Roßdeutscher and Kamp (2010) suggests that unlike the unprefixed verb *malen* (‘to paint’), *bemalen* has a bi-eventive construction type. We may thus conclude that the prefix *be* is the head of the stative PP required for the bi-eventive construction according to (8-a). Consequently, the state denotation *s* of *Bemalung* would correlate with a prepositional functional layer. All in all, we would end up with a structural configuration of building blocks as outlined in (16), which is basically the syntactic analysis of *be*-prefixed *ung*-nominalizations that are ambiguous between an event, state and object reading proposed in Roßdeutscher and Kamp (2010).

(16)

![Diagram of the syntactic analysis of *be*-prefixed *ung*-nominalizations](image-url)
While Roßdeutscher and Kamp (2010) do not aim at structural disambiguation – they derive the different readings of the ambiguous *ung*-nominalization from the same syntactic structure – it seems as if the analysis in (16) can be made to account for structural disambiguation with little effort. With (16), we already correctly predict that the event reading of *Bemalung* makes available the state and object readings. If the nominalizer *ung* is applied to the stative PP substructure of (16) before the verbal functional layer is realized, we also predict that the state reading of *Bemalung* makes available the object denotation but not the event denotation. But the analysis in (16) runs into a problem when we consider the object denotation of *Bemalung*. If *be* correlates with the introduction of a state, the state denotation of *Bemalung* is always present in the meaning of *Bemalung*. We would thus – given the asymmetry of containment identified by co-predication – wrongly predict that the object denotation of *Bemalung* also makes available the state denotation. Notably, the problem cannot be encountered by simply assuming that *be* introduces a state only in some readings of *Bemalung* but not in others. According to the containment principle, the analysis of a morpheme like *be* must be constant throughout the same derivation. There are a number of further conceptual and empirical issues that speak against the analysis in (16) as being the appropriate rendering of *Bemalung* under the assumption that syntax is the only generative component of languages. First, (16) fails to account for yet another ambiguity of nominalizations like *Bemalung*. According to Grimshaw (1990), the genitive DP *der Wand* in (9) is an argument of *Bemalung* only in the event reading (9-a) of *Bemalung*. If syntax is the only generative component of languages, the difference between argument-taking and non-argument nominals must be syntactic, see e.g. Alexiadou (2001), and thus the appropriate structural disambiguation of *Bemalung* requires at least two intergradient analyses. Second, in the absence of a lexicon, an analysis according to which *be*-prefixed constructions result from a lexical rule of preposition incorporation is not viable. Third, the prepositional analysis of *be* fails to account for a large number of *be*-constructions which do not alternate with a prepositional construction, cp. e.g. (17) and the discussion in Dewell (2015).

the king *be*.-punish the criminal with hits  
‘The king *be*-punishes the criminal with hits’

b. *Der König straft Hiebe an/auf den Verbrecher  
the king *be*.-punish hits at/on the criminal  
‘*The king punishes hits at/on the criminal.’

c. Die Bestrafung des Verbrechers  
the *be*-punish.ung.NMLZ of the criminal  
‘The punishment of the criminal’

Finally, a significant number of *be*-prefixed constructions occurs exclusively in the form of participles and thus does not partake in verbal alternations at all, cp. e.g. (18). Remarkably, *ung*-nominalizations are not precluded in this case, a fact which I will discuss in some detail in section 5.

she *be*-gift the speaker
‘She be-gifts the speaker
b. Der Redner ist begabt.
the speaker is be.PRFX.gift.PTCP
‘The speaker is be-gifted.’
c. Die Begabung des Redners
the be.PRFX.gift.ung.NMLZ of the speaker
‘The giftedness of the speaker’

Before I address the problems with (16), an inevitable preparative to the appropriate analysis of Bemalung under the containment principle is to set forth in more detail how the many-sorted ontology of denotations underlying the ambiguity of Bemalung figures in the syntactic approach to word formation that is adopted in the present paper.

2.3 Syntax and the ontology of denotations

In the introductory discussion of the readings of Bemalung, the object denotation of Bemalung was said to be identified by the selection restrictions of the verb renovieren (‘to renovate’), as only objects but not events or states can be renovated. But a non-temporal reading of Bemalung does not only occur with renovieren, but also e.g. with to show, see (19).

(19) Die Bemalung der Wand zeigt Maria Himmelfahrt.
‘The wall painting shows the assumption of Mary.’

In (19), the wall painting denotes an object not with respect to the material from which it is made but with respect to the information that the wall painting encodes. Notably, the two ‘aspects’ of object denotation that are selected by the verbs to renovate and to show are distinct from each other. A wall painting can show the assumption of Mary without the paint from which it is made showing the assumption of Mary. The different appearances of the object denotation of nominals rule out a simple correlation of the object denotation of nominals with corporeal physical entities. Instead, to account for the ontological complexity of noun phrase denotation, Asher (2011) decomposes the ‘monolithic’ objects denoted by noun phrases into so-called dot-objects. Dot-objects are structured category-less bundles of first-order properties, each of which represents an aspect under which an object denotation can be perceived, e.g. as a material object or as an informational object. As would seem natural, in such a fine-grained account of the denotation of noun phrases, the relation between dot-objects and those objects that can be counted or quantified over becomes non-trivial. However, as these intricacies are not relevant to the concerns of this paper, I refer the reader to the discussion in Asher (2011) and postulate that the object denoted by a noun phrase is derived from an underlying dot-type without further comment.

The problem of the non-trivial relation between syntactic categories and category-less meaning appears in an aggravated form in frameworks like DM where it is assumed that the smallest unit of a derivation is a root √ that is devoid of a syntactic category.
Because the same root can appear under different syntactic categorizing heads, the meaning of a root by itself cannot unambiguously encode category-specific meaning. Furthermore, as roots by themselves can be observed only when they appear under a categorizing head, the meaning of roots is difficult to assess and in fact is subject to controversial discussion in the literature, see e.g. Harley (2014) and replies therein. Acknowledging the complexity of the matter, in the following I am not concerned with constraints on the formation and meaning of words that must be attributed to the meaning of roots. Instead, I focus on those aspects of the formation and meaning of words that can be accounted for structurally and thus are targeted by the containment principle. That is, I refrain from a detailed investigation of those factors of the meaning of roots that license resp. rule out the insertion of a root in a certain syntactic and semantic context, but refer the reader to Roßdeutscher (2014) for discussion.

I assume that the basic semantic function of the syntactic categorization of a root is to select for certain aspects of the meaning of a root and to introduce a quantifiable variable that refers to the object characterized by the aspects of root meaning selected. I propose, you might say, to analyze root meaning in parallel to the dot-object analysis of the denotation of noun phrases envisaged above. If root meaning is structured similar to dot-objects, then syntactic categorization selects for certain aspects of the dot-object associated with the root as the denotation of that syntactic category. If the syntactic categorizer of a root is nominal, I say that the resulting noun phrase denotes an object without making any commitment about the object denoted being a (corporeal) ‘thing’. I account in the same way for the insertion of a root into a verbal syntactic context. The verbalizer selects for certain aspects of root meaning and introduces a variable for an event that refers to the aspects selected. Importantly, in the non-lexical approach of word meaning pursued in this paper, denotations may not only be introduced when a syntactic categorizer operates on a root meaning but also when morphologically empty categorizers act upon complex complement structures. For example, causative events are introduced in a bi-eventive construction when the verbalizer selects for a state-denoting phrase that characterizes the introduced event in terms of its causal effects.

Nominalization figures into the outlined account of the relation between syntactic categorization and meaning in a peculiar way. Nominalization does not introduce a denotation by itself but according to rather standard assumptions “transforms a sentence into a noun phrase” (Vendler, 1967, p. 125). The intriguing effect of transforming a sentence into a noun phrase has been popularized by the analysis of the logical form of action sentences put forward in Davidson (1967). Consider the sentence in (20-a) and the nominalization in (20-b).

(20)  

a. Amundsen flew to the Northpole.

b. A flight by Amundsen to the Northpole

Following Davidson, (20-a) and (20-b) describe the very same action of Amundsen. But (20-a) differs importantly from (20-b) in the way in which this action is referred to. The noun a flight refers to Amundsen’s action by itself as a quantifiable variable for an event whereas Amundsen’s action in (20-a) figures as a non-referential event argument of the verb to fly that can be modified by adverbs but not quanti-
What about lexical semantics if syntax is the only generative component of languages?

fied or counted. Given that (20-a) and (20-b) describe the same event, the difference between referential and non-referential arguments cannot be an ontological distinction concerning the event described by itself. Accordingly, the semantic analyses of *a flight* and *to fly* do not differ with respect to the event described but with respect to whether the event figures as a referential argument (i.e. the object denoted by the noun *flight*) or as a non-referential argument that contributes to the semantic specification of a predicate (e.g. as the action the agent of which is the subject of the verb *to fly*).

Analyzing nominalization as a transformation of sentence-like expressions has important consequences for the analysis of ambiguous nominalizations like *Bemalung* under the containment principle. As the syntactic structure of the expression that are transformed by a nominalization must be contained in the structure of that nominalization, the structure of the different readings of *Bemalung* must correspond to different structures of the expressions that *Bemalung* transforms. Second, because the meaning of a nominalization is the same as that of the expression of which it is the transormation, the different meanings of *Bemalung* must correspond to different meanings of the expressions transformed by *Bemalung*. Taken together, these two points imply that the event reading of *Bemalung* transforms the structure of an event-denoting expression, the state denotation of *Bemalung* transforms the structure of a state-denoting expression and the object denotation of *Bemalung* transforms the structure of an object-denoting expression. Moreover, because the structure and analysis of a transformed expression is contained in the nominalization, the hierarchy of semantic containment identified for *Bemalung* also specifies a relation of containment for the structures and analyses of the event-denoting, state-denoting and object-denoting expressions that are transformed by the different readings of *Bemalung*. Consequently, as the object denotation of *Bemalung* is contained in all readings of *Bemalung*, the analysis of *Bemalung* must start with the identification of that expression derived by √*mal+be* which is transformed by nominalization into the object denotation of *Bemalung*.

2.4 Approaching the adjectival core of the analysis

The co-predication data showed that the minimal structure realized by √*mal+be* that underlies the object denotation of *Bemalung* neither contains an event-introducing verbal functional layer nor a state-introducing PP. This finding heavily constrains the search space for that expression which is transformed by the object denotation of *Bemalung*. As no noun *das Bemal* (‘the be-paint’) can be derived by √*mal+be*, the only viable expression that remains as a possible source for the transformation of the object denotation of *Bemalung* is an adjectival construction devoid of a temporal dimension of meaning. Comparatives are one way to enforce the absence of structure and meaning related to temporality in adjectives. Thus, comparative adjectival constructions from √*mal+be* identify the minimal structure and meaning realized by √*mal+be*. (21) is but one of many examples in which we find a superlative adjective derived from √*mal+be*.
(21) Der Maler ist nun 29 Jahre alt und beginnt sein ambitioniertes Programm, das Kastelruth in das bemalteste Dorf Südtirols verwandeln sollte. 'The painter is 29 years old now and starts with his ambitious program that would turn Kastelruth into the most be-painted village of South Tyrol.'

(21) is an example of a superlative construction from √mal+be which is – as required by semantic containment – devoid of dynamic or stative temporality. The adjectival status of the minimal realization of √mal+be finds further support in data involving un-prefixation as in (22).

(22) die unbemaltesten Armeen des Turniers trafen ausgerechnet im Finale aufeinander. 'the most un-be-painted armies of the tournament encountered each other just in the finals.'

The categorization of the minimal structure that is realized by √mal+be as an adjectival construction is reinforced by examples as in (23), where the nominalization Bemalung itself is prefixed with un.

(23) ... ob ich [Tupolev] jemals in einer anderen als dieser Unbemalung gesehen habe ... if I had ever seen it [the Tupolev] in another than this un-be-painting 4

The un-prefixated nominalization in (23) lacks the sortal ambiguity that Bemalung exhibits but only has the object reading and thus shows that the object reading of Bemalung must be the transformation of an adjectival construction.

All in all, the argument developed in this section suggests that the expression that is transformed by the object reading of the nominalization Bemalung (24) is the structure and analysis of the adjective bemalt in (25) that underlies superlative and un-prefixation constructions.

(24) Die bunte/*sauere Bemalung der Wand 'The colorful/* sour wall be-painting'

2 www.hotelwolf.it/de/traditionelle-fassadenmalerei.asp
3 http://www.forum.middenheim.de/YaBB.pl?board=allgemein&action=display;num=1158427446
4 The example is from an internet forum for plainspotters and refers to the different paintings of Tupolev airplanes. http://www.dus-spotter.de/index.php/Thread/349-DUS-und-die-Tupolevs/?pageIndex=4
What about lexical semantics if syntax is the only generative component of languages?

(25) Die bunt/*sauer bemalte Wand
the colorful/*sour be.PRFX.paint.PTCP wall
‘The colorfully/*sour be-painted wall’

To establish (24) as the transformation of (25) a potential concern about the ontological similarity of the denotation of the nominalization in (24) and the denotation of the adjective in (25) needs to be cleared up. In section 2.3 I pointed out that the technical term ‘object’ denotation should not be confused with the way in which the natural language expression ‘object’ is used to describe corporeal things. Instead, I assume that object denotation dissolves into structured bundles of first-order properties. On closer inspection, the same argument concerning the decomposition of the denotation of noun phrases applies to the denotation of adjectival phrases. To account for the acceptability of modification with adjectives like colorful but not e.g. sour, we need to assume that the property denotation of the attributive participle in (25) has a complex ‘internal’ structure, comprising first-order properties like color, material or information but not taste. Accordingly, the same bundle of first-order properties that figures as the referential argument of the nominalization also figures as a non-referential argument of the adjective and we are safe to consider (24) as the transformation of (25).

Given that the category of the minimal structure that is realized by √mal+be is adjectival and that √mal can only be instantiated as a nominal root phrase, we can conclude that be functions as the head of an adjectival phrase. But what kind of adjectival phrase does be head? To approach this question, it is useful to consider in more detail the construction to which be is prefixed in the examples (21), (22) and (25). Notably, the attributive adjectives in (21), (22) and (25) bear the German marker for participle morphology, i.e. a suffix t inserted between the root √mal and the adjectival inflectional resp. superlative morphology. Consequently, be adjectivizes a ‘de-nominal’ participle derived from the nominal root phrase which instantiates √mal.

Concluding, the minimal structure realized by √mal+be which is contained in all of the readings of Bemalung is that structure and analysis of the attributive participle which is contained in the superlative unbemaltest in (22).

The discussion in this section established that be functions as the head of an adjectival phrase, the internal structure of which is determined by semantic containment and the transformation analysis of nominalization as a participle derived from a nominal root phrase. To assess this conclusion in more detail, the next section presents an explicit reconstruction of the readings of Bemalung at the syntax-semantics interface.

2.5 Implementing structural disambiguation under containment

In this section, I cast the analysis of the readings of Bemalung under containment in an explicit reconstruction at the syntax-semantics interface. The syntactic structures I employ follow principles of minimalist syntax of phrase structure with move and merge (Chomsky, 1995). Incorporation is governed by the head movement constraint (Travis, 1984). Argument structure is projected in the syntax and the thematic interpretation of arguments is determined by their syntactic position (Harley, 2011).
Participle morphology is a spell-out of a feature [+part] according to the rule in (26), where [+part] is spelled out as a suffix $t$ in the presence of the feature (bundle) $+a$ and $+P$ associated with adjectival phrases resp. resultative PPs and empty elsewhere.

\[ [+\text{part}] \rightarrow / -t / / +a \]
\[ \rightarrow / -t / / +P \]
\[ \rightarrow / \emptyset / / \text{elsewhere} \]

(26)

As regards the semantic interpretation of syntactic structures, I use Discourse Representation Theory (DRT) as a logical form formalism and the $\lambda$-calculus for semantic composition, roughly following the approach of Roßdeutscher and Kamp (2010). The basic representational unit of DRT is a so-called Discourse Representation Structure (DRS), a pair of a universe $U$ (a set of discourse referents) and a set of DRS-conditions. For a formal definition of the syntax and semantics of the DRS language I refer the reader to (Kamp et al., 2011). In the following, I focus on those amendments to the standard syntax and semantics of the DRS language that are necessary to deal with the semantic interpretation of the syntactic structure of words under the assumption that there is no generative lexicon. I assume a set $D_{\text{ref}}$ of mutually disjoint sets of sorted discourse referents.

\[ D_{\text{ref}} = X \cup P \cup S \cup E \cup Q \cup \text{Root}, \]
\[ X \] is a set of discourse referents for objects: $x, y, z, \ldots$
\[ P \] is a set of discourse referents for properties: $p, p_1, \ldots, p_n$
\[ S \] is a set of discourse referents for states: $s, s_1, \ldots, s_n$
\[ E \] is a set of discourse referents for events: $e, e_1, \ldots, e_n$
\[ Q \] is a set of discourse referents for DRSs: $Q, Q_1, \ldots, Q_n$
\[ \text{Root} \] is a set of discourse referents for names of properties: $\sqrt{}, \sqrt{1}, \ldots, \sqrt{n}$

I use Greek lower case letters $\alpha, \beta, \ldots$ to represent discourse referents for which no specific sort is indicated. I distinguish the following types of occurrences of discourse referents distinguished by their binding status. The discourse referents occurring in $U$ are understood as existentially quantified within all conditions of the DRS within the scope of the existential quantifiers (as standard in DRT). In addition the DRS may be preceded by a ‘variable store’, a finite list of discourse referents: the discourse referents in the store are unbound; they occur as arguments in conditions of the following DRS and are waiting to be bound at same later stage of the DRS construction. Only the DRS itself is subject to model-theoretic interpretation, much like a free variable formula whose free variables are the discourse referents in the store. What counts to model-theoretic interpretation are DRSs that represent the meaning of a word. Within the framework used here this means that no further constructions steps can be applied to the DRS that represents the word. If at this point, there still remain discourse referents in the store of the representation, these will be all existentially bound (by transferring them to $U$) before the structure that derived that DRS is sent off to morphological spell-out.

The basic principle of semantic composition is the conversion of $\lambda$-bound discourse referents against discourse referents from the store of a DRS, processing the store from left to right. I introduce additional principles of the syntax-semantics interface
alongside the discussion of the running example of this paper, beginning with the structure and analysis of the property reading of *Bemalung* in (29). To facilitate discussion, I label nodes and leaves of the derivation with circled numbers.

(28) 

\[
\begin{array}{c}
\text{nP (3)} \\
\text{( y, mark(y))} \\
\text{n (2)} \\
\text{\lambda, \sqrt{\gamma(y)}} \\
\text{\sqrt{\gamma (1)}} \\
\text{\sqrt{\gamma (\text{mark,□})}} \\
\text{mal}
\end{array}
\]

The derivation of *Bemalung* proceeds bottom-up and starts out from merging the root \(\sqrt{\\text{mal}}\) attached to node ① with a nominal head \(n\) attached to node ②, deriving the noun *Mal* (*mark*) ③, see (28). According to earlier discussion, I leave the semantics of roots unspecified (the empty DRS \(\Box\) attached to ①) and represent only the formal contribution of a root, i.e. the predicate constant on the variable store of ①. The nominal head ② introduces a discourse referent \(y\) from \(X\) which is kept in the variable store of the DRS at ② for later processing. The first step of semantic composition in (28) converts the \(\lambda\)–bound referent for a name of a property \(\sqrt{\gamma}\) of the DRS attached to ② against the name for a property *mark* from the variable store of the empty DRS at ①. One thing that (28) could be used for when the unbound discourse referent \(y\) in the store of the DRS at ③ is existentialized is to derive the semantics of the spell-out of the structure in (28) as the noun *Mal*. This semantics is the result of the selection of those aspects of the encyclopedic meaning associated with the root \(\sqrt{\\text{mal}}\) that is imposed on \(\sqrt{\\text{mal}}\) by the category \(n\) of node ②; my makeshift treatment of the instantiation of roots outlined in section 2.3 sets the exact nature of this specification aside.
If derivation continues, the analysis of *be*-prefixation I am proposing is captured by the operations that combine (3) and (4) into (5), see (29). There are three operations invoked in this computation step: (1) $\lambda$-abstraction over the unique discourse referent $y$ in the store of the DRS at (3) (2) intensionalising the predicatation $mark(y)$ to the denotation $^\downarrow mark(y)$ of the properties it expresses (using the intension-forming operator $^\downarrow$ of (Montague, 1973)) and (3) functional application of the representation in (4) to the result of this abstraction. In plain words, the semantic function of the head Part (4) is to turn the denotation of the noun *Mal* (‘mark’) into the property of being a mark, i.e. into a function that returns for each time and world the extension of the predicate *mark*. According to the analysis of *be* as an adjectivizer, the next step in the derivation merges PartP (5) with the head a (6) of an adjectival phrase aP (7). The adjectivizer (6) introduces a new property discourse referent into the store of (6) and prefixes the DRS with a $\lambda$-bound discourse referent that the adjective predicates to be the bearer of $p$. In prose, the semantic purpose of adjectivization of (5) is to turn the property described by ‘being a mark’ into a predicate that holds of an individual $x$ iff $x$ ‘has’ the property of ‘being marked’. I represent the thematic relation ‘$x$ bears the property $p$’ with the predicate $POSS(\mathcal{Q}(a), +_{part})$. There are three different ways in which the derivation can proceed from (7). First, sending the aP structure to spell-out existentializes the property $p$ and yields an attributive participle construction. Second, if an *ung*-nominalizer is inserted right above aP as in (8), following the elaborations in section 2.4 the object denotation of *Bemalung* is derived. Third, if derivation continues, the derivation of the state denotation of *Bemalung* proceeds by extending the aP (7) derived in (29) with a stative P head as in (30).
The stative head $P_9$ introduces a discourse variable for a state $s \in S$. Semantically, $P_9$ ‘stativizes’ the property $p$ from the store of $7$ to the effect that $s$ is specified as the state of $x$ bearing $p$. Having a property $p$ for a certain time implies that this property is instantiated, i.e. that the variable $p$ in the store of the DRS at $7$ is existentially bound and thus ends up in the universe of the DRS $10$. The stative head $P$ projects a DP in its specifier. The denotation of this DP fills the open argument slot $x$ of the adjectival phrase by $\lambda$-conversion and we arrive at the PP $11$. Again, there are three options to proceed from PP. First, we can send $11$ to spell-out, arriving at the stative predicative participle in (31) in which the unbound state discourse referents at $11$ is existentially bound by the copula $sein$ (‘to be’) according to Maienborn (2007b). To keep the discussion focused, a detailed analysis of the resulting adjectival participle construction is postponed until sections 3 and 4.

(31) Die Wand ist bemalt.
    the wall is be.PRFX.paint.PTCP
    ‘The wall is be-painted.’

Second, the nominalizer $8$ can be added to the structure in $11$ to derive the state denotation of Bemalung as in (32).
(32) Die Bemalung der Wand besteht unveränderter: 
the be.PREFIX.paint.ung.NMLZ of the wall persists.STATE unchanged on.
‘The wall be-painting persists unchanged.’

Third, if derivation continues, according to standard assumptions about derived event nominals (see Alexiadou (2001)), the event reading of Bemalung (33) is the transformation of the verbal event description (34).

(33) Die schrittweise Bemalung der Wand durch Peter 
the stepwise be.PREFIX.paint.ung.NMLZ of the wall by Peter 
‘Peter’s stepwise be-painting of the wall.’

(34) Peter hat die Wand schrittweise bemalt. 
Peter has the wall step by step be.PREFIX.paint 
‘Peter be-painted the wall step-by-step.’

Extending (30) with a verbal functional layer yields the structure and analysis in (35).

(35)

The verbalizer v introduces a variable for an event e ∈ E and takes a state s as an argument. It relates e with s by predicating e to be the cause of the coming into existence of the state s. Thus, the state s is existentialized in the DRS that arises from composing the PP (11) with v. As required by the distinction between argument-taking and non-argument taking nominals, the DP in the specifier of P (the complement of vP) receives a thematic interpretation as the theme of the event. If the ung-nominalizer (8) is added, the event variable in the store of the DRS attached to node (12) is existentialized and serves as the event denotation of Bemalung. If derivation continues with higher verbal projections like Tense and Voice, the verb bemaßen is derived.
Summing up: as it stands, the proposed structure and analysis of *Bemalung* implements the intended structural disambiguation under containment. We derived in the syntax an analysis of *Bemalung* according to which the semantic representation of the event denotation of *Bemalung* contains the semantic representation for the state denotation, which in turn contains the semantic representation for the object denotation. To separate the prefix *be* from the introduction of a state, I argued that *be* serves as the adjectival head of a participle. Semantic containment located the participle as contained in the structure and analysis of the verb *bemalen*. Before I elaborate on this finding in more detail, I conclude this section with a discussion of the empirical scope of the proposed analysis of *be*-prefixation.

### 2.6 Generalizing the analysis

To what extent can the analysis of *Bemalung* proposed be considered a general pattern for the analysis of *be*-prefixed *ung*-nominalizations in German? The answer to this question is twofold. Syntactically, the structure proposed for *Bemalung* generalizes in a straightforward manner to a large number of *be*-prefixed *ung*-nominalizations derived from nominal root phrases (cp. classes 2,4,5 of the corpus study on *be*-prefixed *ung*-nominalizations in Roßdeutscher (2010)) in which only the *be*-prefixed construction but not the unprefixed construction has an *ung*-nominalization. Semantically, the most challenging aspect of generalizing the analysis of *be*-prefixed *ung*-nominalizations proposed in the present paper is that even if two *ung*-nominalizations have the same syntactic analysis, this does not imply that they have the same meaning. Before I elaborate on the intricate semantics of *be*-prefixed *ung*-nominalizations in more detail, let me clear up two potential classes of counterexamples to the claim that the syntactic analysis proposed for *Bemalung* constitutes a general pattern for the formation of *be*-prefixed *ung*-nominalizations. First, there are relatively few examples where *ung*-nominalizations exist for both the unprefixed and the *be*-prefixed construction (class 3 of Roßdeutscher (2010)), see e.g. the pair of *Besteigung* (‘ascent’) in (36) and *Steigung* (‘slope’) in (37).

(36) die anstrengende Besteigung des Berges
    the exhausting be.PRX.ascent.ung.NMLZ the GEN mountain
    ‘the exhausting ascent of the mountain’

(37) die Steigung der Strasse
    the slope.ung.NMLZ the GEN street
    ‘the slope of the street’

Unprefixed -*ung* nominalizations as in (37) are often remnants of early high German constructions where the constraints on the licensing on *ung*-nominalizations were quite different than in present day German (Demske, 2002). Moreover, given the lack of derivational specification, the meaning of non-prefixed -*ung* nominalizations is to a large extent determined by the meaning of the root. Accordingly, (37) is restricted in its usage to the description of the steepness of pathways. The central role of root meaning for unprefixed *ung*-nominalizations is confirmed by the analysis in Roßdeutscher (2010), who lists over ten different types of the meaning of nominal
root phrases in unprefixed -ung nominalizations, among them e.g. spatial regions, material objects, rules, natural elements or summations. According to these considerations, unprefixed ung-nominalizations are licensed by (rather accidental) non-structural factors. Because the structural analysis of be-prefixed ung-nominalizations proposed in the present paper is insensitive to non-structural factors of word formation, I conclude that nothing speaks against a syntactic analysis of Besteigung in parallel to Bemalung.

The second type of possible counterexamples to the analysis proposed are be-prefixed constructions which Roßdeutscher (2010) claims to lack an -ung nominalization. Such a negative characterization of be-prefixed constructions that definitively lack an ung-nominalization is difficult to maintain given the productivity of both be-prefixation and ung-nominalization. In fact, Google search turns up examples of ung-nominalizations for all the be-prefixed constructions which according to Roßdeutscher (2010) lack an ung-nominalization. But one of many telling examples is Belachung (‘the laughing at sth.’) in (38).

(38) a. lachen
   laugh.V  ‘to laugh’

b. *die Lachung
   the laugh.ung.NMLZ  ‘the laughing’

c. belachen
   be.PRFX.laugh  ‘to laugh at sb./sth.’

d. ?die Belachung
   the be.PRFX.laugh.NMLZ  ‘the be-laughing’

An example involving Belachung is given in (39), where Belachung refers to a sound-track for a TV comedy show containing recorded laughter of the audience.

(39) Ab Folge 6 oder 7 gab es keine Belachung mehr.
   since episode 6 or 7 exist there no be.PRFX.laugh.NMLZ longer
   ‘Since episode 6 or 7 there is no longer a laugh track.’

While it appears that the syntactic analysis proposed for Bemalung constitutes the general pattern according to which be-prefixed ung-nominalizations are formed, no similar conclusion can be drawn for the semantic interpretation of be-prefixed ung-nominalizations. To illustrate the widely separated meanings that be-prefixed ung-nominalization exhibit even if they have the same syntactic analysis, it is telling to compare in some more detail the nominalization Besteigung as in (36) with the running example of this paper Bemalung. Similar to the simplex noun Mal (‘mark’) derived from the root √mal, a simplex noun Steige (‘slopes’) can be derived from √steig. The noun Steige has a quite special spatial meaning: it denotes a steep path leading up a mountain. This aspect of the meaning of the root √steig is present in the

5 http://forum.cinefacts.de/140752-switch-auf-dvd-7-print.html
denotation of a non-temporal object reading of Besteigung – a pathway – that can be modified with degree adjectives like steil (‘steep’), see (40).

(40) die extrem steile Besteigung der Marbichlerspitze
‘the extremely steep ascent of the Marbichlerspitze’

Pathways as in (40) come into existence by (regularly) travelling a certain route, just like the object denoted by the noun Mal that is associated with the root \(\sqrt{mal}\) comes into existence through an event of marking. Consequently, besides the pathway-dimension, the meaning of the root \(\sqrt{steig}\) must also specify the type of events that are constitutive of pathways by themselves. Presumably, it is the eventive dimension of the meaning of the roots \(\sqrt{steig}\) and \(\sqrt{mal}\) that is selected as the relevant aspect of root meaning that underlies the event denotation of the corresponding ung-nominalizations. While there are simplex derivations from the roots \(\sqrt{steig}\) and \(\sqrt{mal}\) that reveal an eventive and objective dimension of their meaning, there is no similarly simple diagnosis for a stative dimension of meaning in those roots. That is, the state reading of Besteigung is similarly difficult to diagnose and separate from the object reading as the state reading of Bemalung. While for Bemalung, the state denotation was difficult to separate from the temporal existence of objects, the state reading of Besteigung is difficult to separate from the goal of the pathway, although the top of the mountain in (41) certainly constitutes the result state and thus the goal of the ascension of the mountain.

(41) Die Besteigung führt auf den Gipfel des Montblanc.
‘The ascent leads to the top of Montblanc.’

I believe that the discussion of Besteigung in relation to Bemalung makes comprehensible why in this paper I focused on structural aspects of word formation and word meaning but largely ignored the impact of root meaning and other non-structural factors. Root meaning, as it figures in the fine-grained differences between steep ascents as in (40) and colorful wall paintings but also in unprefixed ung-nominalizations, raises intricate questions about the relation between conceptual-ontological and linguistic knowledge that go far beyond the scope and aims of the present paper.

3 High and low participles in German

To appreciate in its entirety the structure and analysis of participles enforced by structural disambiguation under containment, it is important to take into account that the formation of participles in German is split. Adjectival participles of prefix-constructions like bemalen are derived with the suffix \(-t\). In contrast, unprefixed verbs like malen (and also particle verbs like anmalen (at.PRT.paint, ‘to paint sth.’)) have to combine with a dedicated prefix \(ge\)- in order to derive an adjectival participle marked with \(-t\), see (42).

\[http://www.hikr.org/tour/post109274.html\]
(42) a. Die Blume ist *(ge)malt.
   'The flower is ge-painted.'

   b. Die *(ge)malte Blume
   'the ge-painted flower'

The morphological surface of the constructions in (42) indicates that the structure and analysis of √mal is contained in the structure and analysis of √mal+ge+t. Consequently, unlike be-prefixed participles which I argued to be contained in the verbal construction for semantic reasons, unprefixed verbs like malen are contained in their adjectival participles, see (42). We thus arrive at a structure of adjectival participles of unprefixed constructions as in (43), where the adjectival participle is derived from vP.

(43)

The structure of the participle construction in (43) is the same as for be-prefixed constructions except for one decisive difference. The input structure to the formation
of ‘high’ participles is not a nominal phrase as in the ‘low’ participles discussed for be-prefixed constructions but a verbal phrase. Consequently, the property derived by the participle is not an intension of a noun but an intension of a verb. Like the prefix be, the prefix ge functions as an adjectivizer of PartP7.

To conclude, structural disambiguation under containment enforces a distinction between two types of participles in German. The first type is a low participle derived below an eventual verbal functional layer. The main motivation for the structure and analysis of low participles came from semantic containment. The second type of participle is a high participle derived from an existing verbal functional layer. The structure and analysis of high participles was argued to be indicated by morphological containment. In the next section of this paper I elaborate the distinction of high and low participles in German with a detailed discussion of morphosyntactic containment in low participles and semantic containment in high participles.

4 The semantics of participles

Readers familiar with the literature on (German) participles will have noted that low participles run counter to a fundamental assumption shared by approaches to adjectival participles independently of whether word formation is perceived as a lexical (e.g. Wasow (1977); Levin and Rappaport (1986); Kratzer (2000)) or a syntactic process (e.g. Embick (2004); Bruening (2014)). As suggested by the term ‘adjectival passive’ that is often used to refer to adjectival participle constructions, adjectival participle constructions are traditionally analyzed as adjectives that are derived from verbs. In contrast, the structure and analysis of low participles I argued for is contained in the corresponding verb and thus the verb is derived from the adjectival participle. However, the split analysis of participles I have argued for is not as far-fetched as it may seem at first glance but has surprisingly close parallels with the two most prominent approaches to German adjectival participles in the literature.

4.1 Kimian states

The proposed analysis of adjectival participles relates to Maienborn (2005) and subsequent work in a straightforward way. Maienborn argues that states denoted by copula constructions (like adjectival participles) are ‘Kimian States’, states that are ontologically poorer than ‘Neo-Davidsonian’ states. Kimian states are not defined relative to a (Neo-)Davidsonian event but “are to be understood as reifications for the exemplification of a property Q at a holder x and a time t.” (Maienborn, 2009, p. 41). Notably, this characterization of the states denoted by predications involving adjectival participles matches exactly the structure and analysis of low participles, according to which the state denoted by a predication involving a low participle is derived not

7 A welcome side-effect of the distinction between low and high participles in German that I have argued for is that it may explain the mutually exclusive distribution of ge and prefixes like be. If prefix-constructions in German are licensed by [+part]-structures, adding more than one prefix to a derivation is blocked for reasons of parsimony: the contribution of a [+part] structure that would license an additional prefix is empty if [+part] has already been specified by the first prefix-licensing participle.
from a causing event but from a denominal property. But Maienborn’s proposal for Kimian states also accords with the analysis of high participles of mono-eventive constructions in which the state denotation of the participle is derived from an event property. In fact, Maienborn’s proposal for the semantics of the zero-adjectivizer in adjectival participles in (44) can be easily decomposed in the proposed analysis of adjectival participles. The property \( Q \) in (44) corresponds to the property \( p \) derived by the adjectivization of the Participle phrase in (29) and (43), respectively. The state \( s \) in (44) corresponds to that state that is derived by the extension of the property-denoting adjectival phrase with a state-denoting PP in (30) and (43), respectively.

\[
\lambda P \lambda x \lambda s \exists e [s : Q(x) \land res(e, s) \land P(e)]
\]

4.2 Event kinds

The distinction between low and high adjectival participles is relevant to the analysis of yet another much-discussed feature of German adjectival participles. German adjectival participles allow for modifiers that resemble the modification of event-denoting verbal passives, albeit in a very restricted way, see the conveyed judgments from Rapp (1997) in (45).

(45) a. Die Zeichnung ist von einem Kind angefertigt.
    The painting is by a child an.PRTC.ge.PRFX.made.PTCP
    ‘The drawing is made by a child.’

b. Der Müllêimer ist (*von meiner Nichte) geleert.
    The dust bin is (*by my nice) ge.PRFX.empty.PTCP
    ‘The dust bin is (*by my nice) emptied.’

Generally, event-related modifiers are restricted by what (McIntyre, 2015, p. 941) calls the State Relevance Hypothesis. They “are unacceptable in adjectival participles unless they contribute to the description of the state expressed by the participle or of the theme during the interval during which this state holds.” The contribution of event-related modifiers is elaborated in Gehrke (2015) by appeal to the fact that “the participle and the noun together name the state that could have resulted (in a broad sense) from an institutionalised activity” (Gehrke, 2015, p. 33). From the perspective on low participles advanced in this paper, Gehrke’s characterization of the acceptability of modifiers of adjectival participles can be reproduced in my analysis as an instance of abductive inference (see Douven (2011)), i.e. an inference from an observation of a property of the internal argument of the participle (e.g. that the wall is be-painted) to the explanation of the observation (e.g. that someone has be-painted the wall). More precisely, my analysis suggests that the ‘integration’ (Schlücker, 2005) or ‘incorporation’ (Gehrke, 2015) of modifiers into adjectival participles and the generic character of these modifiers is a reflection of the fact that modifiers in adjectival prefix-participles are licensed by the abduction of a ‘well-established’ (Gehrke, 2015) verbal functional layer with which the structure and analysis of adjectival participles could be extended in order to explain how the state denoted by the adjectival participle could have come about. In abductive inference, a conclusion does not follow
What about lexical semantics if syntax is the only generative component of languages? 

logically from the premises. Thus, the inference of a vP and the consequent licensing of event-related modifiers from an adjectival participle heavily relies on world knowledge. Because the inferred verbal functional layer cannot be more specific than the premises provided by the adjectival participle, event-related modifiers are in general generic resp. pertain to event kinds as argued in Gehrke (2015). For high participles, the licensing of event-related modifiers depends on whether or not event properties can be recovered from properties of the internal argument of the participle. As an illustration, consider the contrast in (46).

   the letter is by children ge.PRFX.write.PTCP  
   ‘The letter is written by children.’

b. Der Brief ist (*von Fussballspielern) geschrieben.  
   the letter is (*by soccer players) ge.PRFX.write.PTCP  
   ‘The letter is written (*by soccer players).’

Agent modification in (46-a) is acceptable if e.g. it is established background knowledge that children write letters clumsily. If that is the case, properties of the letter are indicative of the agent of the event. In contrast, (46-b) is out because no similarly indicative property of letters is associated with the writing of letters by soccer players. That is, in line with Gehrke (2015), the inference of an appropriate property that ultimately licenses event-related modifiers must take off from ‘events-of-letter-writing-by-X’ rather than ‘events-of-letter-writing’. If event-related modifiers in high participles are licensed by the creative inference of properties, this may also explain why often the purpose of high participles is the creation of a property of the adjectival argument that incorporates the specifics of the agent, instrument or manner which was involved in the creation of that property. The purpose of adjectival participles to create ‘ad-hoc’ properties that invite the interpreter to invoke her world knowledge to extrapolate the relevant property that links an event-related modifier to the internal argument of an adjectival participle has been central to the analysis of adjectival participles in Maienborn (2007a) and subsequent work.

4.3 Low participles and change of state verbs

I conclude this section with a remark on a possible connection between the analysis of be-prefixed constructions in German and the analysis of change of state verbs like to break in English. The basic problem is that change of state verbs like to break – unlike change of degree verbs like to flatten – do no specify a designated result state although they clearly entail change. Adopting DM as a framework of analysis, Embick (2009) proposes that break-type roots appear in a mono-eventive construction the result state of which is the "state caused by a breaking event = broken" (Embick, 2009). As Beavers and Koontz-Garboden (In Press) argue, such a mono-eventive analysis of change of state verbs is troublesome because it renders ad absurdum the constitutive semantic property of mono-eventive constructions, i.e. the lack of a result state. But Embick’s proposal that the result state of to break is the state of being broken links to the analysis of be-prefixed constructions in German developed in this paper in an
interesting way. Notably, the predicate broken which according to Embick (in turn adopting a proposal in von Stechow (1996)) characterizes the result state of to break is the participle of the derivational family associated with √break. If change of state verbs are bi-eventive and a bi-eventive construction emerges via the combination of a morphologically empty vP and a state-denoting XP, the result state of a bi-eventive verb like to break must be located below vP. Accordingly, it stands to reason that the result state of break-type verbs is specified by the same type of low participle – although with a morphologically empty adjectivizer – that I argued to be involved in be-prefixed constructions in German. Extending this line of reasoning, the parallel between low participles in be-prefixed constructions and the analysis of break-type verbs may be rooted in the type of denominal participle constructions I proposed. Initial support for a denominal analysis of break-type verbs comes from the fact that the derivational family of many break-type verbs contains zero-derived nouns like e.g. to break→a break, to crack→a crack or to cut→a cut. Moreover, Beavers and Koontz-Garboden (In Press) consider a denominal state predication to be essential to the meaning of the root √break, see their lexical decomposition analysis in (47).

\[(47) \quad [\sqrt{\text{crack}}] = \lambda x \exists s[\text{has-fissure'}(x,s) \land \exists e'[\text{become'}(e',s)]]\]

As regards the lexical primitive has-fissure, one might wonder whether – given that a crack is a synonym for a fissure – the state described by has-crack is the same as that state which would be realized linguistically by the participle x is cracked. If this step of the argument is tenable, then the proposal made in this paper concerning the role of low participles in denominal bi-eventive constructions embodies the lexicalist analysis of Beavers and Koontz-Garboden (In Press) while maintaining the assumption that word formation is entirely syntactic. But as one of the few explicit proposals concerned with root meaning, (47) is telling in another respect that has been central to this paper. The become component of (47) signifies the complex nature of root meaning that I discussed among others with respect to the ung-nominalization Besteigung in section 2.6. I argued that one of the many aspects of the meaning of the root √steig is an eventive component which underlies the constitution of a pathway via regular transition of a certain route. Similarly, one of the many aspects of the meaning of the root √crack must be an eventive component that underlies the constitution of a break through the application of a certain amount of force to that object in which the break materializes. Still, to account for the meaning of √crack, (47) would have to be amended with a specification of the objective aspect of the meaning of √crack that figures e.g. in the meaning of to mend a crack.

All in all, I take the elaborations of this section to indicate that a further exploration of the parallels between denominal bi-eventive constructions in German and English is a promising task for future research.

5 Summary and Outlook

The main goal of this paper was to explore semantic consequences of the hypothesis that word formation is entirely syntactic. I started out with an analysis of ambiguous German ung-nominalizations according to structural disambiguation under
containment, a principle that is enforced by the assumption that syntax is the only generative component of natural languages and that there is no generative lexicon. Following standard assumptions about the function of nominalization, I implemented structural disambiguation of ambiguous nominalizations like Bemalung based on a parallel syntactic and semantic analysis of nominalizations and the expressions which they transform into noun phrases that adheres to the asymmetry of semantic containment identified by co-predication. In the analysis proposed, the structure and analysis of the event reading of Bemalung is a transformation of a verbal construction, the state reading of Bemalung is a transformation of a predicative participle and the object reading transforms an attributive participle. Each of the expressions that are transformed by one of the readings of Bemalung is an unambiguous description of an event, a state or a description of an object and thus constitutes a disambiguating paraphrase of the meaning of Bemalung. In plain words, the requirement that all ambiguity must be structural was accomplished by identifying the ambiguity of Bemalung with the different structures and analyses indicated by disambiguating paraphrases of Bemalung. Identifying the ambiguity of Bemalung first and foremost with disambiguating paraphrases instead of different ontological sorts of denotations gets a grip on the problematic identification of the ambiguity of Bemalung with selection restrictions of verbs discussed with respect to the distinction between the state and object reading of Bemalung in section 2.1. I propose, you might say, by equating the readings of Bemalung with disambiguating paraphrases, to bypass the elusive role of ontology in the lexical analysis of the ambiguity of Bemalung. For example, in the analysis proposed, the denotation of the state reading of Bemalung is the same state that is described by the predicative participle ist bemalt (‘is be-painted’) pre-eminently not because Bemalung and ist bemalt refer to the same ontological sort of states but because the state reading of Bemalung and the state described by ist bemalt are derived from the same structure and analysis of √be+malt. The methodological punchline of this structural account of polysemous words like Bemalung is a shift of the locus of the ambiguity from ontology – i.e. the denotation of distinct ontological sorts – to natural language itself – the containment hierarchy of distinct linguistic constructions.

The structural disambiguation of ung-nominalizations like Bemalung gives rise to a distinction between two types of participle constructions in German: low participles that are derived independently from an eventual verbal functional layer and high participles that are derived from an existing verbal functional layer. The emergence of such cross-connections between nominalizations and participles which at first glance may seem completely unrelated from a lexicalist perspective is a direct consequence of the shift induced by the hypothesis that syntax generates both words and sentences. If there is no lexicon, the focus of attention cannot be on the lexical analysis of words but instead must center on derivational families of constructions originating in the same root. One immediate consequence of the redirection of attention is that the gravitational center of lexical analysis – the templatic structure of events – looses its central status in the analysis of word meaning. Low participles are one example for which I argued that they are defined independently of event structure. Bi-eventivity might be another such example. I argued that the analysis of be-prefixed -ung nominalizations according to structural disambiguation under containment requires that
the input structure to -ung nominalization need not contain verbal functional projections. But I also assumed with Roßdeutscher and Kamp (2010) that input structures to -ung nominalization are bi-eventive. If bi-eventivity is understood as a property of verbal functional projections, this raises the question for how bi-eventivity can figure as a constraint on -ung nominalizations in the absence of such projections. It could be posited as a makeshift that such structures can always be expanded by adding projections up to and including a morphologically empty verbal projection. Such a purely morphological conception of bi-eventivity might be intuitively appealing under the assumption that word formation is entirely syntactic. But it raises the question how a morphological approach of bi-eventivity can fulfil its designated semantic purpose (cp. the semantic definition of bi-eventivity in Rappaport Hovav and Levin (1998); Kratzer (2005)). In addition, a morphological account of bi-eventivity would fail to account for those participles that have -ung nominalizations and thus are bi-eventive although they cannot be extended with a verbal functional projection, as was discussed e.g. with respect to (18). In the light of these considerations, it is difficult to maintain bi-eventivity as an event property. Rather, the argument of this paper suggests that bi-eventivity is determined early in the derivation before event-denoting and state-denoting functional structure materializes. The core structure underlying the bi-eventive construction of be-prefixed expressions in German has been identified as that of an adjective that predicates a property of an individual. In contrast, mono-eventive constructions and high participles predicate properties of events. One might thus speculate whether the licensing of an adjectival construction that denotes a property of an individual is a sufficient condition for a bi-eventive construction, in particular because the main type of bi-eventive verbs in German are deadjectival constructions like glätten (‘to flatten’) that also predicate properties of individuals. The distinction between the predication of properties of individuals and properties of events mirrors a distinction that Parsons (1990) draws with respect to the relation between events and their result states in verbal constructions. Parsonian ‘resultant’ states are conceptualized from properties of an event and cannot be determined by inspecting the theme of the event itself, they are ‘formal result states’ in the terminology of Roßdeutscher (2000). In contrast, ‘target states’ à la Parsons are conceptualized from properties of the theme of a verb and thus can be determined by inspection of the theme, they are ‘conceptual result states’ according to Roßdeutscher (2000). A sufficient semantic criterion for the bi-eventivity of a construction that the argument of this paper suggests is the licensing of an adjectival construction that denotes a ‘target property’, i.e. a property of an individual as opposed to ‘resultant properties’ of events. A telling illustration of this hypothesis about bi-eventivity – which would then actually render the notion of ‘bi-eventivity’ a misnomer – is the lack of adjectival participles with prototypically mono-eventive unergative verbs like lachen (‘to laugh’), see (48).

8 The irreversibility of resultant states that Kratzer (2000)’s interpretation of Parsons (1990) highlights is thus not a property of the stativity of adjectival participles but pertains to the fact that the property predicated in resultant states is not a property of the theme but of the event. The irreversibility of resultant states is thus a consequence of the fact that events cannot be undone.
What about lexical semantics if syntax is the only generative component of languages?  

(48) a. *der gelachte Peter  
    the ge.PRFX.laugh.PTCP Peter  
    ‘the laughed Peter’  
b. *Peter ist gelacht  
    Peter is ge.PRFX.laugh.PTCP  
    ‘Peter is laughed’  

Given the scope and aims of this paper, I have to leave a detailed assessment of this sketch of a semantic account of bi-eventivity in the absence of verbal functional structure to future research.

The main conclusion concerning the analysis of word meaning that this paper embodies is that the shift of the subject of meaning in a framework in which syntax is the only generative component compels a shift in the concepts employed in the analysis. More precisely, if the lack of a generative lexicon also entails the absence of a theory of lexical semantics, the alternative plan that the syntactic approach to word formation offers is to recast (lexicalist) insights about word meaning in terms of families of construction types structured by derivational relationships at the syntax-semantics interface. This paper can be understood as a small step towards such a ‘constructivist’ account of word meaning that can keep up with the high demands and promises of a unified account of the generative component of natural languages.

References


What about lexical semantics if syntax is the only generative component of languages?


Travis, Lisa. 1984. Parameters and effects of word order variation. PhD diss, MIT.

