

What about word meaning if syntax is the only generative component of languages?

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1 Introduction

- Syntactic approaches to word formation erase the distinction between that component of languages which is responsible for the formation of words – the generative lexicon – and that component which is responsible for the formation of sentences – the syntax.
- Since syntax as an independent module is needed anyway, for reasons of minimal design of the human language faculty and ontological parsimony of explanation, the syntactic approach to word formation is favoured over lexicalist approaches (cp. Embick [2004], Bruening [2014]).
- The focus of this paper is on the exploration of the consequences of the general assumption that word formation is entirely syntactic for the analysis of word meaning.

1.1 The principle of structural containment

- Central tenet of the syntactic approach to word formation: “the analysis and structures proposed for a form must also be contained within the analysis of any structure derived from that form” [Harley, 2009, p. 320].
- The *principle of containment* is in particular interesting with respect to the semantic interpretation of complex derived words because it dictates a strategy for the investigation of word meaning that is fundamentally different from the perceived tradition of lexical semantics in frameworks such as ‘event structure templates’ [Rappaport Hovav and Levin, 1998], ‘semantic forms’ [Bierwisch, 2007], ‘the generative lexicon’ [Pustejovsky, 1995] or ‘dot-types’ [Asher, 2011].
- In lexical semantics, word meaning is determined by
 - the syntactic category of a word and
 - 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]).
- According to the containment principle, meaning is determined relative to ‘families’ of derivational containment.
- The adequacy of the semantic interpretation of a word cannot be justified by appeal to syntactic category and features of the lexical class of that word alone.
- The semantic analysis of a given word according to the containment principle must be justified with respect to other words that are derived from structures and analyses contained in that word.
- Thus, the meaning of a word according to the containment principle lays square within the syntactic category and lexical class of that word.
- To exemplify the shift of the subject of meaning in DM-like approaches to word formation, consider the German root \sqrt{mal} (‘spot’, ‘mark’).

- \sqrt{mal} can be inserted into a structure that derives the verb *malen* (1-a) or the (somewhat outdated) noun *Mal* ('mark') (1-b).

- (1) a. Peter malt eine Blume.
Peter paint a flower
'Peter is painting a flower.'
- b. Das Mal des Bösen
the mark of the evil
'The mark of the evil'

- The root \sqrt{mal} can also be combined with a prefix like *be-*. Amongst others, the combination $\sqrt{mal+be-}$ can be used to derive a further verb *bemalen* (2-a) and an adjectival participle as in (2-b).

- (2) a. Peter bemalt die Wand.
Peter be.PREFIX.paint the wall
'Peter is painting the wall.'
- b. Die Wand ist bemalt.
The wall is be.PREFIX.paint.PTCP
'The wall is painted.'

- It is important to note that the encyclopedic meaning of the root \sqrt{mal} must be the same in (1) and (2) even if the structures and analyses in (1) and (2) are not related by containment.
- This is because the containment principle requires that there is no 'lexical ambiguity' of roots but that different meanings of roots correspond to structural differences of the syntactic and semantic context in which a root is inserted.
- As an additional desideratum, the structure and analysis of the constructions in (2) must be sensitive to the semantic difference between a verb in active Voice and an adjectival participle.
- Constructions from $\sqrt{mal+be}$ as in (2) but not the unprefix constructions from \sqrt{mal} in (1-a) can be suffixed with the nominalizer morpheme *-ung* to form a nominalization, see (3).

- (3) a. *Malung
paint.ung.NMLZ
'the painting'
- b. die Bemalung
the be.PREFIX.paint.ung.NMLZ
'the painting'

- According to the containment principle, the structure and analysis of $\sqrt{mal+be}$ in (2) must be contained in the structure and analysis of the derivation $\sqrt{mal+be+ung}$ in (3).
- The structure and analysis of $\sqrt{mal+be+ung}$ should exclude the derivation of an *-ung* nominalization from \sqrt{mal} .

1.2 The principle of structural disambiguation

- One and the same surface form derived from $\sqrt{mal+be+ung}$ can mean quite different things in different contexts, see (4).

- (4) a. Die Bemalung der Wand wurde unterbrochen.
the be.PREFIX.mark.ung.NMLZ of the.GEN wall was interrupted.EVENT

‘The painting of the wall was interrupted.’

- b. Die Bemalung der Wand besteht unverändert fort.
the be.PREFIX.mark.ung.NMLZ of the.GEN wall exist.STATE unchanged on
‘The painting of the wall remains unchanged.’
- c. Die Bemalung der Wand wurde entfernt.
the be.PREFIX.mark.ung.NMLZ of the.GEN wall was removed.OBJECT
‘The wall painting was removed.’

- In each of the examples in (4), *Bemalung* has a different denotation.
- In (4-a), the verb *unterbrechen* (‘to interrupt’) selects for direct objects that denote an event, as only events can be interrupted.
- Thus, as (4-a) as a whole is a coherent sentence, we can conclude that *Bemalung* in (4-a) denotes an event.
- In (4-b), the verb *fortbestehen* (‘to persist’) selects for a state denotation of fillers of its direct object argument slot and thus we can conclude that in (4-b) *Bemalung* denotes a state.
- Because only physical objects but not events and states can be removed, in (4-c) the verb *entfernen* (‘to remove’) selects for a result object denotation of *Bemalung*.
- If there is no generative lexicon, the denotational flexibility of words like *Bemalung* cannot be analyzed as a lexical ambiguity.
- Instead, the sortal ambiguity of *Bemalung* must be reconstructed in a way such that the different denotations of *Bemalung* correspond to different syntactic analyses of *Bemalung*.
- Let me call this requirement the *structural disambiguation principle*.
- In combination with the principle of containment, structural disambiguation requires that the different syntactic analyses of corresponding to the readings of *Bemalung* are intergradient, i.e. derived from each other in hierarchical order.
- Adopting the assumption that if word formation is driven by syntax only, so is the construction of word meaning, this paper develops a semantic analysis of the nominalization *Bemalung* according to structural containment and disambiguation.
- The present paper is thus more ambitious in its goals than previous work on semantics in DM (see e.g. the overview in Harley [2013]) which does not consider the semantic implications of structural containment and disambiguation.
- The next section introduces a diagnostics that identifies a hierarchy of semantic ‘building blocks’ of *Bemalung*.

2 Structural Disambiguation under Containment

2.1 What’s in a nominalization: the semantic perspective

- Since *Bemalung* is a word, the structural disambiguation of the sortal ambiguity of *Bemalung* must pertain to ‘building blocks’ of meaning that are smaller than the word or the unit of a lexical entry.
- As a first step towards revealing those building blocks of meaning that are efficacious in the constitution of the denotation *Bemalung*, I draw upon observations that Hamm and Solstad [2010] make about the behaviour of sortally ambiguous nominalizations in co-predication contexts.
- In contrast to the examples in (4), a co-predication context involves not one but two or more predicates with different selection restrictions that all take the same noun as an argument.

- More specifically, in the next examples, I introduce *Bemalung* as the argument of a predicate with a specific selection restriction and then use *Bemalung* 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 restrictions of the predicate in the antecedent.

(5) Die Bemalung₁ der Wand war anstrengend. Sie₁ bestand
 the be.PREFIX.mark.ung.NMLZ the.GEN wall was exhausting.EVENT. It persist.STATE
 jahrelang. Sie₁ wurde entfernt.
 for years. It was removed.OBJECT.
 ‘The painting of the wall₁ was exhausting. It₁ persisted for years. It₁ has been removed.’

- In (5), 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 result state denotation of *Bemalung* and for an anaphoric construction with *entfernen* (‘to remove’) that selects for a result 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 (6).
- In this case, *Bemalung* cannot function as the antecedent of an anaphoric construction that selects for an event (6-a) but only as the antecedent of an anaphoric construction that selects for an object denotation (6-b).

(6) a. *Die Bemalung der Wand₁ bestand jahrelang. Sie₁ war
 the be.PREFIX.mark.ung.NMLZ the.GEN wall persisted.STATE for years. It was
 anstrengend.
 exhausting.EVENT
 ‘The painting₁ of the wall persisted for years. It was exhausting.’

b. Die Bemalung₁ der Wand bestand jahrelang. Sie₁ wurde
 the be.PREFIX.mark.ung.NMLZ the.GEN wall remained.STATE for years. It was
 entfernt.
 removed.OBJECT
 ‘The painting of the wall₁ persisted for years. It₁ was removed.’

- If *Bemalung* is introduced in a context that selects for an object, *Bemalung* cannot serve as the antecedent of anaphoric constructions that select for events, see (7).

(7) *Die Bemalung₁ der Wand wurde entfernt. Sie₁ war
 the be.PREFIX.mark.ung.NMLZ the.GEN wall was renovated.OBJECT. It was
 anstrengend.
 exhausting.EVENT.
 ‘The wall painting₁ was renovated. It₁ was exhausting.’

- Finally, when *Bemalung* is introduced in the context of a predicate that selects for an object reading, it cannot serve as the antecedent of an anaphoric construction that selects for a result state, see (8).

- (8) *Die Bemalung₁ der Wand trocknete nicht. Sie₁ bestand jahrelang.
 the be.PREFIX.mark.ung.NMLZ the.GEN wall dried.OBJECT not. It persist.STATE for years.
 ‘The wall painting₁ did not dry. It₁ persisted for years.’

- Diagnosed typology and hierarchy of the building blocks of meaning contained in *Bemalung*:
 - (5) indicates that one configuration of building blocks in *Bemalung* must derive an event, result state and result object denotation.
 - (6) indicates that there is also a configuration of the building blocks of meaning of *Bemalung* which provides a result state and result object denotation but no event denotation.
 - (7) and (8) indicate that there is a configuration of building blocks which neither makes available an event denotation nor a result state denotation but just a result object denotation.
- The co-predication diagnostics targets the meaning of *Bemalung* as a word and thus doesn’t reveal the internal syntactic configuration of building blocks.
- To approach the syntactic realization of the building blocks of meaning in *Bemalung*, the next section takes a more detailed look at the derivation of *Bemalung* from the root \sqrt{mal} (‘mark’) with *be-* prefixation and *-ung* suffixation.

2.2 What’s in a nominalization: the morphosyntactic perspective

- In the analysis of Wunderlich [1987], the function of *be-* in (9-a) is to shift the location specified by the prepositional phrase in the unprefixated verb construction (10-a) into the direct object position.
- Thus, Wunderlich [1987] analyzes the *be-* morpheme as an instance of preposition incorporation that induces a passive-like transformation on the argument structure of the unprefixated verb that roughly corresponds to the *with-* variants in English *spray/load* alternations (Levin [1993]), cp. (9-b)/(10-b).

- (9) a. Peter beludt den Wagen mit Heu.
 Peter be.PREFIX.loaded the truck with hay
 ‘Peter loaded the truck with hay.’
 b. Peter loaded the truck with hay.
- (10) a. Peter ludt Heu auf den Wagen.
 Peter loaded hay on the truck
 ‘Peter loaded hay on the truck.’
 b. Peter loaded hay on the truck.

- The syntax and semantics of the *-ung* nominalizer morpheme has been investigated in Rossdeutscher and Kamp [2010] based on the DM-analysis of bi-eventive verbs proposed in Marantz [2005].
- Marantz argues that in a mono-eventive construction, the verbal root modifies the verbalizer *v* as in (11-a) whereas in a bi-eventive construction, a morphologically empty *v* is merged with an XP denoting a stative property as in (11-b).

- (11) a.
- b.

- Rossdeutscher and Kamp argue that *-ung* is a nominalizer morpheme that applies to bi-eventive

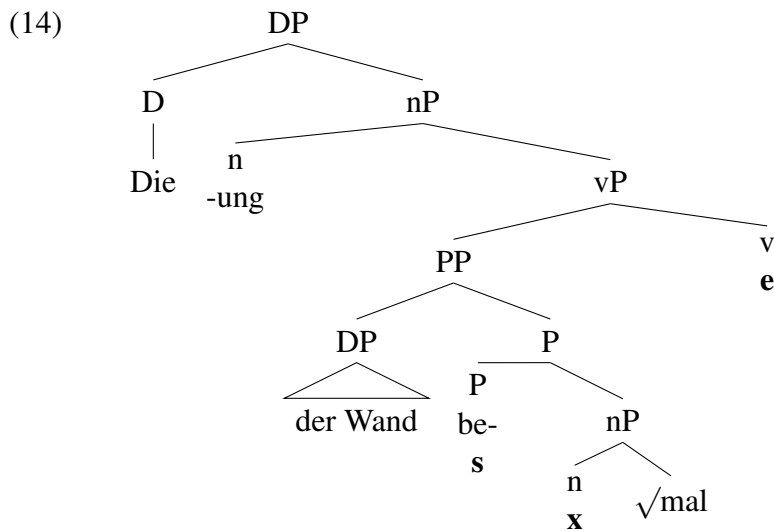
verb constructions but not to mono-eventive verb constructions.

- That is, mono-eventive verbs like *arbeiten* (to work) in (12) lack *-ung* nominalizations whereas bi-eventive verbs like *töten* (to kill) license *-ung* nominalizations, see (13).

(12)	a. arbeiten work ‘to work’ b. *Arbeitung work.ung.NMLZ ‘a working’	(13)	a. töten kill ‘to kill’ b. Tötung kill.ung.NMLZ ‘a killing’
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2.3 Structural disambiguation, first attempt

- Combining the insights gained so far, we could end up with a structural configuration of building blocks as outlined in (14).



- We correctly predict that the event reading of *Bemalung* makes also available the state and object reading.
- We also predict that the state reading of *Bemalung* makes available the object denotation but not the event denotation if the nominalizer *-ung* is applied to the PP substructure of (14) and thus no verbal functional layer is realized.
- But the analysis in (14) runs into a problem when we consider the object denotation of *Bemalung*.
- If *be-* correlates with the introduction of a result state, the state denotation of *Bemalung* is always present in the meaning of *Bemalung*.
- We would thus wrongly predict that the object denotation of *Bemalung* also makes available the state denotation.
- The problem cannot be encountered by simply assuming that *be-* introduces a state only in the state and event reading but not in the object reading.
- According to the containment principle, the contribution of a morpheme like *be-* must be constant throughout a derivation.
- And according to the principle of structural disambiguation, we need to separate the *be-* morpheme from the introduction of a state denotation to be able to make the correct predictions for the object reading of *Bemalung*.

- In next section, I propose an alternative plan for the analysis of *Bemalung* that renders possible structural disambiguation under the containment principle.

2.4 Structural disambiguation, second attempt

- Initial doubt about the analysis of *be-* as an instance of preposition incorporation is created by the fact that a considerable number of *be-*verbs occurs (more or less) exclusively in the form of a participle (cp. Günther [1974]), see (15).

- (15)
- Der Berg ist bewaldet.
the mountain is be.PREFIX.forest.PTCP
'The mountain is forested.'
 - Der Fuß ist beschuht.
the foot is be.PREFIX.shoe.PTCP
'The foot is shod.'
 - Der Redner ist begabt.
the speaker is be.PREFIX.gift.PTCP
'The speaker is gifted.'
 - Der Richter ist besorgt.
the judge is be.PREFIX.concern.PTCP
'The judge is concerned.'
 - Die Witwe ist begütert.
the widow is be.PREFIX.asset.PTCP
'The widow is prosperous.'

- Because the *be-*constructions in (15) appear only as participles, none of the *be-*constructions in (15) alternates with a prepositional construction. Consequently, *be-* cannot in general be the result of the incorporation of a preposition.
- The fact that many *be-*verbs occur only as participles suggests an analysis according to which *be-* indeed functions as a participle morpheme.
- In fact, there is strong morphological support for the analysis of *be-* as a participle rather than an incorporated preposition: the *be-* prefix is in complementary distribution with the standard German participle morpheme *ge-*.
- *be-* constructions realize the same range of participle constructions as the standard *ge-* participle. *be-* and *ge-* occur in complementary distribution in verbal participles as in (16-a) and (16-b), adjectival participles as in (17-a) and (17-b) and pronominal participles as in (18-a) and (18-b).

- (16)
- Peter hat (eine Blume) gemalt.
Peter has (a flower) ge.PREFIX.paint.PTCP
'Peter has painted (a flower).'
 - Peter hat *(die Wand) bemalt.
Peter has *(the wall) be.PREFIX.paint.PTCP
'Peter has painted the wall.'

- (17)
- Die Blume ist gemalt.
the flower is ge.PREFIX.paint.PTCP
'The flower is painted.'
 - Die Wand ist bemalt.
the wall is be.PREFIX.paint.PTCP

‘The wall is painted.’

- (18) a. Die gemalte Blume
the ge.PREFIX.painted.PTCP flower
‘the painted flower’
b. Die bemalte Wand
the be.PREFIX.painted.PTCP wall
‘the painted wall’

- The analysis of *be-* as being similar to that of a participle morpheme rather than a prepositional element would not only explain the complementary distribution of *be-* and *ge-*.
- Most importantly to the goal of this paper, the analysis of *be-* as a participle morpheme provides a way to tease apart the *be-* morpheme and the introduction of result states by a prepositional phrase, an important step towards the structural disambiguation of *Bemalung* under the containment principle.
- But what exactly is the building block of meaning realized by *be-* in *Bemalung*?
- In the next section, I approach an answer to this question by taking a closer look at the function of nominalization.

2.4.1 Analyzing nominalization as transformation and reification

- The predominant analysis of the function of nominalization is that “nominalization transforms a sentence into a noun phrase” [Vendler, 1967, p. 125] and thus that nominalizations are “noun-like versions of sentences” [Lees, 1960, p. 54].
- The assumption of this intimate relation of nominalizations and their underlying sentences allows to transfer information from a sentence to its nominalization.
- A well-known example is Grimshaw [1990], who argues that argument-projecting nominals can be identified with the same diagnostics that are used to identify complex event structure in sentences.
- I adopt a similar strategy to identify the function of the *be-* morpheme in *Bemalung*: in the following I infer the structure and analysis of *Bemalung* from the properties of sentences formed with the verb *bemalen* as in (16-b) or the participle *bemalt* in (17-b).
- But the transformatory function of nominalization can also be employed the other way round to transfer information from a nominalization to its underlying sentence.
- One prominent example for this direction of information transfer is the identification of the logical form of action sentences put forward in Davidson [1967].
- Davidson adopts a proposal by Reichenbach [1947] according to which the function of the transformation of a given expression into a noun phrase is to make available a quantifiable discourse referent that represents the transformed expression.
- Instances of such transformations are called *reification*. Ontologically, reification transforms an abstract entity – e.g. a proposition – into the concrete and ‘material’ denotation of a nominalization.
- For example, Davidson [1967] argued that the nominalization in (19-b) is the reification of the sentence (19-a) and that the reified nominal *flight* in (19-b) makes available a quantifiable (material) discourse referent for an event that is not overtly expressed (resp. available only in an abstract sense) in the verb *to fly*.

- (19) a. Amundsen flew to the Northpole.
b. A flight by Amundsen to the Northpole.

- According to these considerations on the syntactic and semantic function of nominalization, the

function of the *-ung* nominalizer morpheme is

- to transform a sentence (or sentence-like structure) into a noun phrase and
 - to reify the meaning of a sentence (or sentence-like structure) as a quantifiable discourse referent.
- When these assumptions about the function of nominalization are taken together with the principles of containment and structural disambiguation, the structure and analysis of the different readings of *Bemalung* is determined by the structure and analysis of those sentences (or sentence-like structures) which the nominalizer transforms into a noun phrase and reifies as the denotation of *Bemalung*. The next section spells out an analysis along this line of thought in more detail.

3 Reconstruction at the Syntax-Semantics Interface

3.1 Syntax and Semantics

- The syntactic structures I employ in this section follow principles of minimalist syntax of phrase structure with move and merge Chomsky [1995]. Incorporation is governed by the head movement constraint Travis [1984].
- For the semantic interpretation of syntactic structure, I use a variant of Discourse Representation Theory (DRT, Kamp et al. [2011]).
- The basic representational unit of DRT is a so-called Discourse Representation Structure (DRS), a pair of a discourse universe U and a set of conditions imposed on entities from U .
- I will not provide a model-theoretic semantics for the interpretation of DRS but refer the reader to Kamp et al. [2011].

I distinguish different types of discourse variables:

- Existentialized discourse referents which are represented in the discourse universe
 - Discourse variables which are represented in a ‘variable store’ in front of a DRS
 - Placeholder discourse referents for argument slots resp. predicates which are represented as λ -bound discourse referents
- Composition of DRSs is governed by applying λ -conversion and consequent DRS merge at each node of the syntactic structure.
 - λ -conversion proceeds on discourse variables from left to right. I complement the semantic interpretation of a syntactic structure by λ -conversion with principles for the introduction of discourse referents.
 - Particular sorts of discourse variables are introduced by functional heads as specified in (20).

- (20)
- a. Verbalizer v introduces a discourse variable for an event: e
 - b. Prepositionalizer P introduces a discourse variable for a for state: s
 - c. Adjectivizer a introduces a discourse variable for a property: p
 - d. Nominalizer n introduces a discourse variable for an object: x

- Discourse variables are introduced by functional heads by establishing a conceptual relation (i.e. a conceptual primitive in lexical decomposition terms) between the introduced discourse referents and the complement XP of the functional head which introduces the discourse variable.
- The formal function of conceptualization is to existentialize that discourse variable as a discourse referent in relation to which a new discourse variable is introduced.
- In the following, the term *conceptualization* refers to the introduction of a conceptual relation in one of the structural configurations in (21).
- If the sort of the input and output of an function is variable, I represent discourse referents and

‘Kastelruth is the most painted village of South Tyrol’

- Given that the prenominal participle in (23-b) is interpreted as a property-denoting adjective, there seems to be an important difference between the property denotation in (23-b) and the object denotation of the nominalization *Bemalung*.
- Consider the contrast in (26).

- (26) a. Die bemalte Wand wurde entfernt (*ohne die Wand zu beschädigen).
the be.PREFIX.paint.PTCP wall was removed (*without the wall to damage)
‘The painted wall was removed (without damaging the wall).’
- b. Die Bemalung der Wand wurde entfernt (ohne die Wand zu beschädigen).
the be.PREFIX.paint.ung.NMLZ of the wall was removed (without the wall to damage)
‘The wall painting was removed (without damaging the wall).’

- In the verbal description (26-a) the wall is removed.
- But what is removed in (26-b)?
- The prepositional analysis of *be-* suggests that the answer to this question is straightforward: what is removed in (26-b) is the paint which becomes applied to the wall in the verbal construction (27).

- (27) Peter bemalte die Wand mit Farbe.
Peter be.PREFIX.paint the wall with paint.
‘Peter painted the wall with paint’

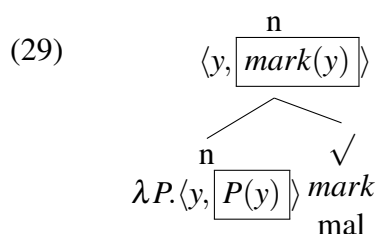
- As straightforward as the identification of the object denotation with the material from which the painting is made seems, it suffers from the same defect as the prepositional analysis of *be-*.
- Consider the semantic form (28) for the object denotation of *Bemalung* proposed in [Ehrich and Rapp, 2000, p. 297].

- (28) Bemalung: $(\lambda y)\lambda z[DO((x,y)r) \wedge BEC((APPL((z,y)s))e)]$

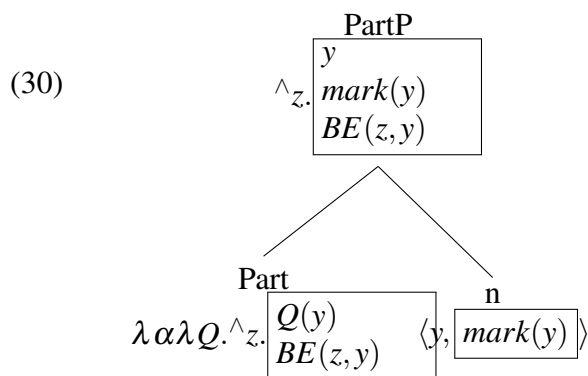
- In (28) the object denotation z is inseparably tied to introduction of a state denotation s , namely that state which results from the application of z to y .
- As has been argued in section 2.3, the analysis conflates the state and object reading and should thus be dismissed in favour of a separation of the state and object reading of *Bemalung*.
- But the conflation of objects and states is not the only weak spot of analyses like (28) that draw their motivation from the prepositional analysis of *be-*.
- The identification of a painting with the material from which it is made is intuitively implausible because a painting has properties that the paint from which it is made does not have.
- E.g., a painting can be beautiful without the paint from which it is made being beautiful. Or, a painting can show a person without the paint from which it is made showing a person.
- Observations of this kind have been central to the development of more fine-grained approaches to object denotation like e.g. the theory of objects as dot-types, see Pustejovsky [2001], Asher [2011].
- Under a dot-type analysis, the object denotation of *Bemalung* is a complex bundle of properties, among them physical but also functional, informational, perceptual or aesthetical properties.
- The analysis of the object denotation in terms of complex properties provides the missing link

between the object denotation of *Bemalung* and the denotation of the prenominal participle in (23-b).

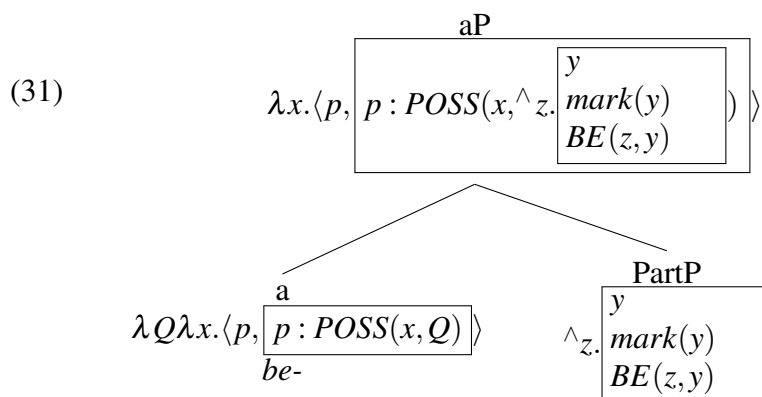
- The object denotation of *Bemalung* (23-a) reifies the property denoted by the attributive use of the participle in (23-b) and the structure of the object denotation of *Bemalung* is derived by nominalization of the structure of the prenominal use of the participle *bemalt* ('painted').
- Let me reproduce the informal discussion of *-ung* nominalizations derived by *be*-prefixed constructions in a detailed analysis at the syntax-semantics interface.
- The first step of the derivation is to insert the root $\sqrt{\text{mal}}$ into a n(oun)P template, giving rise to the object-denoting underived nominal *Mal* ('the mark, the spot'), see (29).



- A property is derived from the structure and analysis in (29) when (29) is merged with a participle phrase PartP as in (30).
- I discuss the spell-out of PartP (a suffix *-t*) in the next section in combination with adjectival participles.
- Semantically, the head Part is analyzed as a function from individuals to possible worlds and represented with the intensional abstraction operator \wedge .



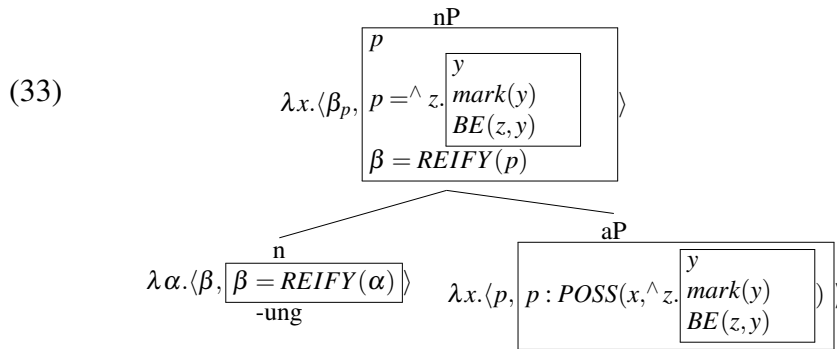
- *be*- functions as the head of an adjective Phrase aP that introduces a discourse referent that bears the property introduced by PartP in (30).



- If derivation would stop at this point, the output would be the structure and analysis of the property-denoting attributive use of the participle *bemalt* as in (32).

(32) Die bemalte Wand
 the be.PREFIX.paint.PTCP.ADJ
 ‘the painted wall’

- Assuming as in Roßdeutscher and Kamp [2010] that the domain of the nominalizer *-ung* is the variable store of its complement structure, if the aP in (31) is nominalized with *-ung*, we get the object reading of *Bemalung* in which the property denoted by aP is reified as the complex-property-as-object denotation of *Bemalung*.
- Depending on how fine-grained the ontology of objects is, the exact specification of β depends on the selection restrictions of the predicate which takes β as an argument.
- But as (33) derives a word, we could in principle invoke the fine-grained account of denotation provided in the theory of dot-objects to model β .
- I get by with these details by indicating a coarse type of β with a subscript for a property p , a state s or an event e .



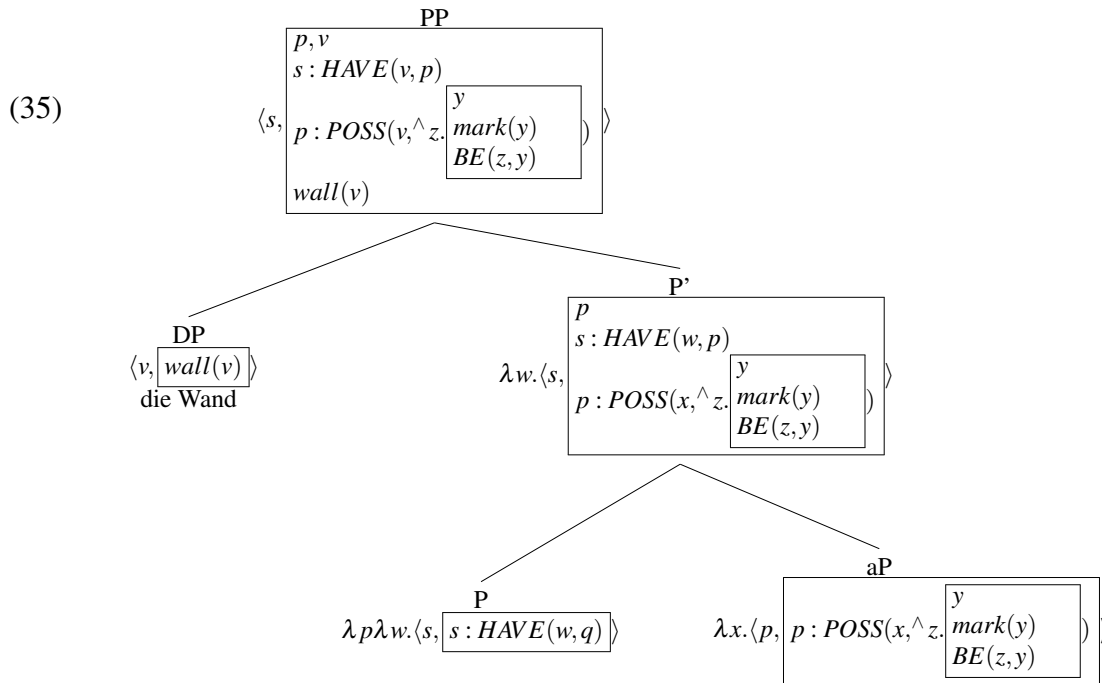
3.3 State denotation

- Next, consider the pair of sentences in (34). (34-a) describes the state of affairs of the wall being painted with an adjectival participle construction.
- Similar to the reification of events by nominalization, I propose that the state of affairs described by the stative adjectival participle (34-a) is reified as a quantifiable variable by the state denotation of *Bemalung* in (34-b).

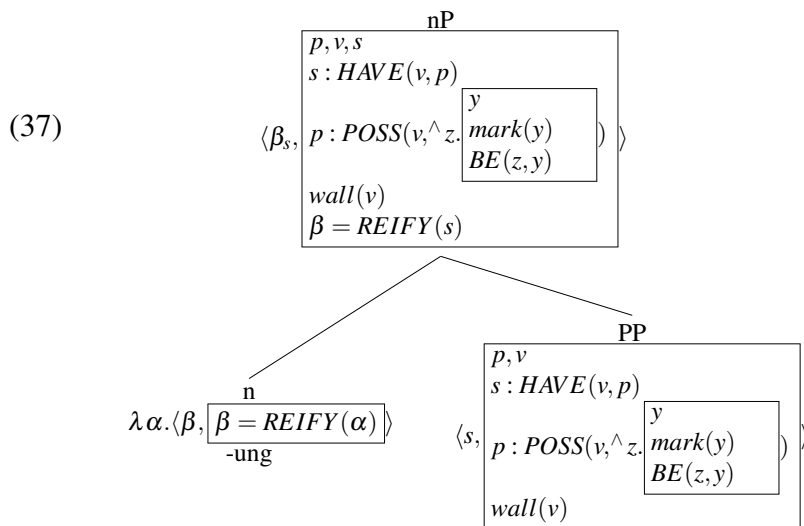
(34) a. Die Wand ist seit Jahren bemalt.
 the wall is for years be.PREFIX.paint.PTCP
 ‘The wall is painted for years.’

b. Die Bemalung der Wand besteht seit Jahren.
 the be.PREFIX.paint.ung.NMLZ of the wall exists for years
 ‘The painting of the wall exists for years.’

- In order to not interrupt the argument of this section, I delay detailing this proposal until the next section 4.
- To derive the state denotation of *Bemalung* from the aP-structure in (31), a resultative PP with an empty head is merged with (31) as in (35).



- The head of the PP introduces a discourse referent for a state and conceptualizes the property p denoted by the aP as being indicative for that state in which the DP in the specifier of PP is – namely that it has the property p^2 .
- (35) derives the adjectival participle use of *bemalt*.
- The state reading of the adjectival participle is reified by the denotation resulting from nominalizing (35) with *-ung* as in (37).



²To identify the bearer of the adjectival property and the bearer of the PP-state, I make use of a semantic composition rule in the spirit of predicate modification proposed in Heim and Kratzer [1997], see (36).

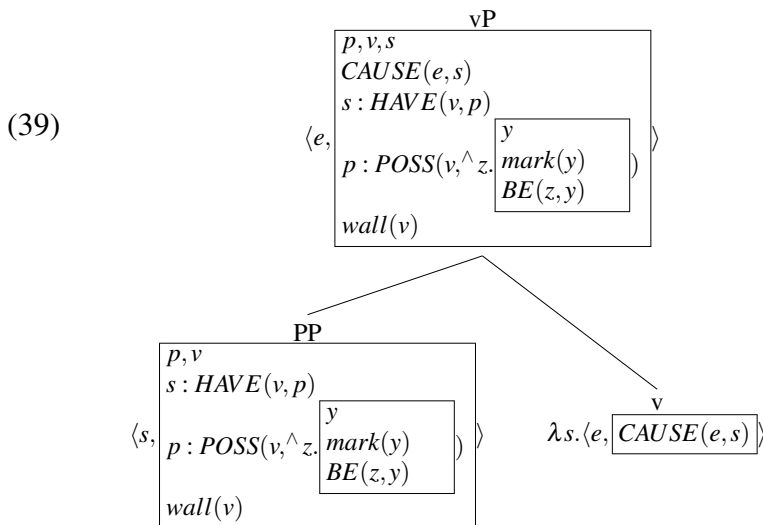
(36) $\lambda x.P(x) \text{ MOD } \lambda y.Q(y) \rightarrow \lambda x.P(x) \wedge Q(x)$

3.4 Event denotation

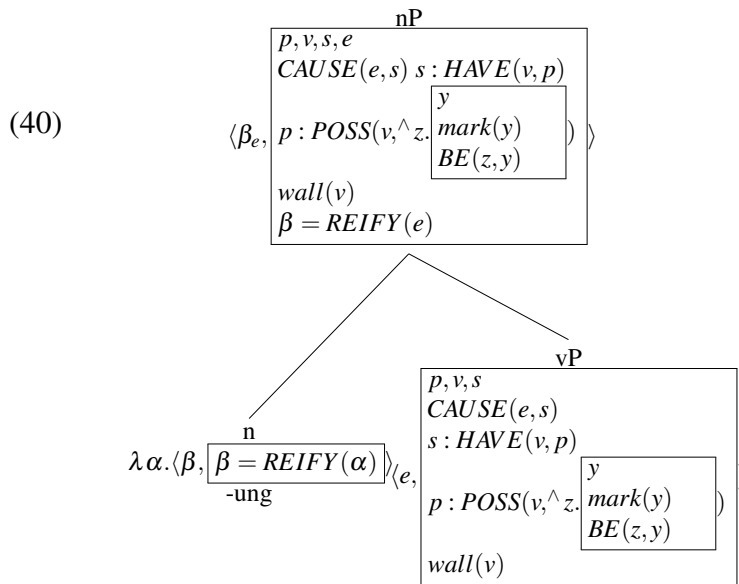
- Finally, consider the pair of sentences in (38), which I propose to indicate the derivation of the event denotation of *Bemalung*.

- (38) a. Peter hat die Wand schrittweise bemalt.
 Peter has the wall be.PREFIX.paint.PTCP stepwise
 ‘Peter painted the wall step-by-step.’
- b. Die schrittweise Bemalung der Wand durch Peter
 the stepwise be.PREFIX.paint.ung.NMLZ of the wall by Peter
 ‘Peter’s stepwise painting of the wall.’

- The verbal construction (38-a) describes an action of Peter which causes the wall to be painted with something in which the result state of the action described manifests itself.
- According to the Davidsonian analysis of action sentences, the description of Peter’s action in (38-a) is reified by that event which the nominalization (38-b) denotes.
- The transformation of a sentence by a nominalization affects the argument structure of the sentential predicate in that (38-b) suppresses the external argument of (38-a) [Grimshaw, 1990] resp. renders the Voice head defective and passive [Alexiadou, 2001].
- Given that *Bemalung* denotes an event, the external argument of the verbal description can be reintroduced with a *durch* (‘by’)-PP in the nominalization, see (38-b).
- The event denotation of *Bemalung* is derived from the PP-structure in (35) by merging the PP with a vP as in (39).
- *v* introduces an event *e* and the target state *s* introduced by the PP is conceptualized as the result state of the wall caused by *e*.
- In the structural analysis in (39), the DP in the specifier of PP becomes the internal argument of vP and receives a theme interpretation in the structural position Spec,Comp,vP. (39) can be further extended with higher verbal projections like Voice to derive the active transitive use of *bemalen*.



- If (39) is nominalized, the variable for an event in the variable store of (39) is reified as the event denotation of *Bemalung*, see (40).
- The existentialized state can only be conceptualized as the result of the described event.



4 Adjectival participles of prefix-constructions

- In this section, I elaborate in more detail the proposed syntax and semantics of the adjectival participle that underlies the state denotation of *Bemalung*.
- For setting up an analysis according to which the state denotation of an *-ung* nominalizations as in (34-b) is the transformation and reification of an adjectival participle construction as in (34-a), it is of great importance to note that the formation of participles in German is different for prefix-constructions and non-prefix-constructions.
- Unprefixed constructions as in (41-a) form their adjectival participle with the participle prefix *ge-* as in (41-b) but not participles of prefix-constructions as in (41-c),(41-d).
- Notably, the standard participle prefix *ge-* is in mutually exclusive distribution with prefixes like *be-*.

- (41)
- Peter leert den Eimer.
Peter empty the bucket
Peter is emptying the bucket.
 - Der Eimer ist geleert.
The bucket is ge.PREFIX.empty.PTCP
The bucket is emptied
 - Die Wand ist bemalt.
The wall is be.PREFIX.paint.PTCP
The wall is painted
 - Peter bemalt die Wand.
Peter be.PREFIX.paint the wall
Peter is painting the wall.

- The difference in the formation of German participles is in particular relevant with respect to the principle of structural containment.
- (41-b) is a form derived from (41-a) by prefixation with *ge-* and thus the structure and analysis of *leeren* is contained in the structure and analysis of (41-b).
- But the form of (41-c) is - as far as the prefix is concerned - the same as that of (41-d) and thus

there is no morphological evidence for whether (41-c) is derived from (41-d) or not. But there is evidence from containment.

- If it is true that the active use of the verb *bemalen* in (41-d) denotes an event, then the structure and analysis of (41-d) must contain a verbal functional layer that introduces an event.
- If – as is generally agreed – adjectival participles that select *sein* (‘to be’) as a copula do not denote an event but a state, according to containment, both the structure and analysis of the active verb and the adjectival participle are contained in the structure and analysis of the derived nominalization *Bemalung*.
- According to structural disambiguation the structure which derives a state denotation of *Bemalung* but not an event denotation is contained in the structure which derives an event and a state denotation.
- Consequently, the structure and analysis of the adjectival participle is contained in the structure and analysis of the active verb.
- In other words, the event denotation of (41-d) must be derived from the state denotation of (41-c) in the same way as the event denotation is derived from the state denotation of *Bemalung*.
- I conclude that adjectival participles of German prefix-verbs are not derived from verbs but from adjectival constructions.
- This conclusion runs counter to a fundamental assumption that is shared by both lexicalist (e.g. Wasow [1977], Levin and Rappaport [1986], Kratzer [2000]) and syntactic (e.g. Embick [2004], Bruening [2014]) approaches to adjectival participles.
- As the term ‘adjectival passive’ that is often used to refer to adjectival participle constructions suggests, adjectival participle constructions as in (41-c) are traditionally analyzed as adjectives that are derived from the participle of a verb.
- The structure and analysis of adjectival participles of prefix-constructions that my analysis suggests is not as far-fetched as it seem at first glance
- I will motivate the plausibility of my proposal by considering in more detail (a) some prominent previous accounts of adjectival participles and event-related modifiers (b) widespread assumptions about the lexical semantics of non-deadjectival bi-eventive verbs.

4.1 Previous approaches to German adjectival participles

- The proposed analysis of adjectival participles relates to Maienborn [2005, 2007] and subsequent work in a straightforward way.
- Maienborn and colleagues argue that states denoted by copula constructions (like adjectival participles) and stative verbs are ‘Kimian States’ that are ontologically poorer than ‘Neo-Davidsonian’ states.
- Kimian states are not defined relative to a (Neo-)Davidsonian event but Kimian states “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].
- The characterization of the state denoted by an adjectival passive as a Kimian state matches exactly to the structure and analysis of the state denotation of *Bemalung* I argued for, according to which the state denotation of *Bemalung* is defined independently of a causing event.
- I also argued that the state denotation of *Bemalung* is derived from a property-denoting adjectival construction.
- As such, the analysis proposed is fully compatible with the Kimian-state approach to adjectival participles.
- But the analysis proposed improves on Maienborn’s original proposal in that it provides a semantic

explanation for why in participles of bi-eventive prefix-verbs, the property Q is identical to the result state of the verb.

- According to the syntactic approach to word formation, resultative verbs are decomposed with a bi-eventive construction as in (11-b) in which the result state is introduced by a PP.
- I argued that the state denoting PP of bi-eventive constructions *Bemalung* must be further decomposed in that the state denoting PP itself is derived from a property-denoting AP.
- Thus, in bi-eventive constructions, the property Q predicated of the internal argument of an adjectival participle is identified with the state denotation of the adjectival participle because the state denotation of the adjectival participle is derived from Q.
- The derivation of the stative meaning of adjectival participles from properties is also relevant to the analysis of yet another feature of 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 established data from Rapp [1997] in (42).

- (42) a. Die Zeichnung ist von einem Kind angefertigt.
 The painting is by a child an.PRTC.ge.PREFIX.make.PTCP
 ‘The drawing is made by a child.’
- b. Der Mülleimer ist (*von meiner Nichte) geleert.
 The dust bin is (*by my niece) ge.PREFIX.empty.PTCP
 ‘The dust bin is (*by my niece) emptied.’

- In the analysis proposed there is no event denotation at all in adjectival participles of prefix-constructions.
- However, unlike lexicalist approaches that similarly deny that event denotation is retained in the derivation of adjectival participles but assume that adjectival participles are derived from verbs (e.g. Rapp [1997], Meltzer-Asscher [2011]) the analysis I proposed considers the stative denotation of adjectival participles to be derived from properties.
- This feature of my analysis nicely connects with the analysis of suitable inputs to adjectival participles in Gehrke [2015].
- According to Gehrke’s generalization 2, “only verbs that are associated with a change of state along a scale can appear in German adjectival participles.” [Gehrke, 2015, p.909].
- The proposed analysis can also be used to reconstruct Gehrke’s analysis of the restrictions on event-related modifiers.
- Gehrke explains restrictions on modifiers of adjectival participles 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]
- Under the present analysis, this characterization of the acceptability of modifiers of adjectival participles can be reproduced as an instance of abductive inference (see Douven [2011]), i.e. an inference from an observation to the explanation of the observation.
- More precisely, the analysis proposed suggests that the integration [Schlücker, 2005] or incorporation [Gehrke, 2015] of adjectival participles and their modifiers 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.
- Because in abductive inference a conclusion does not follow logically from the premises, the inference of a vP and thus the licensing of event-related modifiers from an adjectival participle heavily

relies on world knowledge, as has often been noted.

- Furthermore, because the inferred verbal functional layer cannot be more specific than the premises provided by the adjectival participle, it is expected that event-related modifiers are in general generic, as argued by Gehrke [2015] .
- A morphological argument for the presence of an eventive verbal layer in adjectival participles has been brought up in the DM-based analysis of adjectival participles in Alexiadou et al. [2014]. Alexiadou and colleagues argue for the presence of Voice in adjectival participles (and thus implicitly for the derivation of adjectival participles from verbs) with stem alternations in causative/anticausative constructions.

- (43) a. Hans versenkt das Schiff.
 Hans ver.PREFIX.low the ship
 ‘Hans is sinking the ship’
 b. Das Schiff versinkt.
 The ship ver.PREFIX.sink
 ‘The ship is sinking’

- There are in principle two options to explain the difference in (43) within a framework like DM, i.e. a further verbal functional layer or Voice.
- [Alexiadou et al., 2014, p. 123] reject the former option because “there are no empirical arguments for an additional verbal layer in causatives” and thus both causatives and anticausatives are to be analyzed as bi-eventive.
- However, only the construction in (43-a) but not the construction in (43-b) has an *-ung* nominalizations, see (44).

- (44) a. Die Versenkung des Schiffs
 the ver.PREFIX.low.ung.NMLZ of the ship
 ‘the sinking of the ship’
 b. *Die Versinkung des Schiffs
 the ver.PREFIX.sink.ung.NMLZ of the ship
 ‘the sinking of the ship’

- As has already been mentioned, Roßdeutscher [2010], Roßdeutscher and Kamp [2010] argue that “a verbal construction has an *-ung* nominalization if and only if the verb is constructed bi-eventively.” [Roßdeutscher, 2010, p. 106].
- According to this diagnostics, (43-a) but not (43-b) is bi-eventive and there is an additional – causal – verbal layer in causatives that anticausatives lack.
- Accordingly, the presence of Voice (and a verbal functional layer) is not the only explanation of the stem alternation in (44).
- As such, the present account of adjectival participles is not affected by the argument of Alexiadou et al. [2014].
- (I have developed an alternative explanation of the stem alternation (44) based on a comparison of *be*-prefixed *-ung* nominalizations and *-ung* nominalizations derived from adjectives proper, which is in part 2 of the paper).

4.2 The lexical semantics of non-deadjectival Change of State verbs

- If semantically, bi-eventive verbs of the type discussed in the previous sections are derived from participles, in a framework like DM in which word formation is entirely syntactic, the semantic

derivation of bi-eventive verbs from ‘denominal’ participles entails that such bi-eventive verbs are also morphologically derived from participles.

- This conclusion obviously runs counter to morphological analyses of German participles endorsed also in DM-based analyses like von Stechow [1998] in which participles are generally morphological derivations from verbs.
- To see why such a morphological analysis is untenable for general semantic reasons, it is useful to consider previous analyses of bi-eventive verbs and their participles that – like the running example of this paper *bemalen* – are not derived from an adjective proper.
- Consider the German particle verb *aufpumpen* (‘to pump up, to inflate’) and its lexical analysis in (45) as proposed in Kratzer [2000].

(45) $\lambda x \lambda s \lambda e [pump(e) \wedge event(e) \wedge inflated(x)(s) \wedge cause(e)(s)]$

- What leaps to the eye in (45) is that the result state argument *s* of the verb *aufpumpen/to inflate* is identified with the participle of that verb, i.e. *inflated*, just as I argued it to be the case for *bemalen*.
- Similarly, assuming DM as a framework, Embick [2009] proposes that the result state of *to break* is the “‘state caused by a breaking event’ = broken”.
- Because in frameworks like DM the only place to derive participles like *inflated* or *broken* is in the syntax, an analysis of non-deadjectival bi-eventive verbs along the lines proposed by Kratzer or Embick – i.e. according to which causative semantics emerges via the combination of *v* and a result state – requires that non-deadjectival bi-eventive verbs are not only semantically but also morphologically derived from their participles.
- This leads to an intriguing problem of morphological analysis, for which – given the scope and aims of this paper – I can do no more than offer a broad-stroked analysis.
- The basic problem for an implementation of the morphology of non-deadjectival bi-eventive verbs the result state of which is a participle is that the suffixation part of participle morphology, i.e. the affix *-t* is not present in the morphology of German present tense inflection, e.g. in the first person singular (46) while, as has been argued, semantically, the participle meaning must be present.

(46) Ich bemale die Wand.
 I be.PREFIX.paint.1.SG.PRS the wall
 ‘I paint the wall.’

- One way to deal with this problem would be to assume that the PF spell-out of the [+PART] feature associated with the head Part is empty in the context of a present tense feature but *-t* elsewhere.
- Leaving the detailing of such an analysis to future work, a nice prediction of such an account of participle morphology would be that it explains why German prefixes like *be-* are in mutual distribution with the dedicated participle morpheme *ge-* given that the feature [PART] is already valued at vP.

5 Outlook

- In the second part of the paper, I generalize the findings that I just presented.
- I defend the assumptions that I have been making about the number and type of readings of *-ung* nominalizations and the interpretation of post-nominal genitives.
- I evaluate the proposal against the corpus-based study in Roßdeutscher [2010] and show that the proposed analysis and structure of *Bemalung* is the general pattern of the syntax and semantics of *be-*prefixed *-ung* nominalizations in German and even more generally, outlines the structure and

analysis of denominal bi-eventive verbs in German.

- The remaining type of bi-eventive verb constructions in German are deadjectival verbs, which I analyze in a degree semantics framework Kennedy and Levin [2008].
- Among the further topics I discuss are e.g. an alternative explanation of stem alternation in anticausatives and a new approach to the interpretation of reflexively marked anticausatives.
- By comparing the resulting exhaustive typology of bi-eventive constructions in German with mono-eventive verbs and *ge*-participles, I argue that bi-eventivity is determined early in the derivation, i.e. by the predication of a property of an individual (whereas *ge*-participles and mono-eventive verbs predicate properties of events).
- (If you are interested, drop me a line and I will be happy to send you the manuscript.)

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