

# Predicting the semantics of English nominalizations: a frame-based analysis of *-ment* suffixation

Lea Kawaletz & Ingo Plag

## Abstract

It has long been known that derivational affixes can be highly polysemous, exhibiting a range of different, often related, meanings. To account for this problem, it is commonly assumed that polysemy arises through the interaction of affix semantics with the meaning of the base (e.g. Plag 1998). This paper investigates the relationship between input semantics and output readings using the English nominal suffix *-ment* as a test case. From a sample of deverbal neologisms dating from the past 100 years, we investigate the largest semantic subclass of base verbs in the data set, i.e. PSYCH VERBS (Levin 1993). The analysis employs common semantic categories such as EVENT, STATE, RESULT and STIMULUS and formalizes the results with the help of frames (Barsalou 1992a, 1992b, Löbner 2013). It is shown that *-ment* almost exclusively attaches to verbs from two clearly defined sub-classes of PSYCH VERBS, i.e. AMUSE VERBS and MARVEL VERBS. Within these sub-classes, *-ment* derivatives can be merely transpositional in meaning (denoting EVENTS or STATES, depending on the kind of base verb), or the suffix can induce a metonymic shift to the participants STIMULUS and RESULT STATE, but not to EXPERIENCER. In the light of the frame analysis it becomes clear that, if the base verb denotes a complex PSYCH CAUSATION EVENT, shifts to the two sub-events are also possible, which calls into question the traditional concept of transposition. Our findings support an approach in which the semantics of a derivational process is conceptualized as its potential to induce particular metonymic shifts in the semantic representation of its bases.

## 1 Introduction<sup>1</sup>

In recent years, the semantics of derivational processes has attracted considerable attention, both as a special theme of conferences (e.g. International Morphology Meeting, Vienna 2012; Mediterranean Morphology Meeting, Dubrovnik 2013), and in major studies and collections (e.g. Trips 2009; Uth 2011; Bauer et al. 2013; Rainer et al. 2014), especially since the publication of the seminal *Morphology and lexical semantics* by Rochelle Lieber (Lieber 2004). However, a workable model of word-formation semantics is still under debate. Bauer et al. (2013, ch.29) formulate the problem as follows: “we must be able to account for the substantial evidence that affixes (or morphological processes, if the theorist prefers) are

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frequently semantically underspecified, and subject to polysemy and meaning extensions of various sorts.” In spite of attempts in the literature to develop a systematic theory of polysemy in word-formation, a number of issues are still unresolved. How can we account for existing meaning extensions or those encountered in new formations? What is the role of encyclopaedic knowledge in the semantic interpretation of complex words? And how do the semantics of base and derivative interact in order to produce the reading of a given derivative?

With regard to the predictability of the readings of EVENT/STATE/RESULT nominalizations, Bauer et al. (2013, 213f.) observe that there is a non-arbitrary relationship between the semantics of the base and possible readings of its derivative. For example, they find that STATE nominalizations most frequently derive from verbs denoting psychological states such as *exasperate* or *excite*. Unfortunately, these authors do not provide a general account of the input-output relationships.

In this paper we will study the relationship between base semantics and derivative readings in a systematic way by investigating a sample of deverbal neologisms derived with the suffix *-ment*. Our sample consists of 86 neologisms extracted from the *Oxford English Dictionary Online* (OED, 2013) and the *Corpus of Contemporary American English* (COCA, Davies 2008).

In particular, we will first describe the semantics of the input verbs, using the semantic classes developed by Levin (1993) and extended in the VerbNet project (Kipper et al. 2008). Second, we will describe the output semantics by applying common semantic categories such as EVENT, STATE, RESULTS, STIMULUS etc. Then, we will investigate the relationship between input semantics and output readings in the derivatives found in our sample. The analysis will be restricted to the largest semantic subclass of base verbs in the data set, that is, PSYCH VERBS (Levin 1993). The semantic categories will then be implemented in a frame-based approach (Barsalou 1992a,b; Löbner 2013). Frames are recursive attribute-value structures which serve to model mental representations of concepts as well as linguistic phenomena (cf. Petersen 2007), similar to formalisms known from frameworks such as HPSG (Pollard & Sag 1994) or LFG (Bresnan 1982).

It will be shown that, for the data in our sample, the polysemy of *-ment* derivatives can be described as a highly restricted set of shifts operating on the semantic representations of the bases. At a more abstract level, we demonstrate that frame theory provides a framework that can elegantly account for flexible, but restricted, interpretations of derived words.

## 2 Background

### 2.1 Affix polysemy

One of the central problems in word-formation research is the problem of polysemy, that is, why and how a given affix can create different types of meaning in its derivatives. An oft-cited case are AGENT, PATIENT, INSTRUMENT and INHABITANT nouns in *-er*, as in *writer*, *loaner*, *opener* and *Londoner*, respectively.

For further illustration of the issues involved, let us consider the different interpretations of nominalizations based on verbs. Apart from EVENT readings (e.g. *production* ‘the act of producing’), Bauer et al. (2013, ch.10) list the following readings (see, for example,

Roßdeutscher 2010; Roßdeutscher & Kamp 2010; Uth 2011 for similar problems in German and French nominalizations):

- (1) a. RESULTS (the outcome of VERB-ing): acceptance, alteration
- b. PRODUCTS (the thing that is created by VERB-ing): pavement, growth
- c. INSTRUMENTS (the thing that VERB-s): seasoning, advertisement
- d. LOCATIONS (the place of VERB-ing): dump, residence
- e. AGENTS (people or person who VERB-s): administration, cook
- f. MEASURE TERMS (how much is VERB-ed): pinch, deceleration
- g. PATHS (the direction of VERB-ing): decline, direction
- h. PATIENTS (the thing affected or moved by VERB-ing): catch, acquisition
- i. STATES (the state of VERB-ing or being VERB-ed): alienation, disappointment
- j. INSTANCES (an instance of VERB-ing): belch, cuddle

Although this list is already quite long it does not seem to be exhaustive. It seems that still other readings, such as the MANNER reading in (2), are possible.

- (2) She would shiver with cold, then sweat. Her **walk** became strange, first bent forward as she went, then all the way backward (COCA\_MAG\_2006)<sup>2</sup>

That (1) lists examples from different morphological categories such as *-ance*, *-ation* or conversion is not a coincidence. The different types of meaning extension occur within and across morphological categories and seem not to be restricted to particular categories, and even a single word can have more than one interpretation. Bauer et al. (2013) show, however, that certain types of interpretation are likely to occur with certain types of base verb. For example, instrument nominalizations derive from verbs denoting actions that require instruments of various sorts. These authors also demonstrate that deverbal nominalizations (like *-able*, as mentioned above) may reference not only syntactic arguments (i.e. subjects and objects), but also non-argumental entities. They demonstrate this by contrasting the nouns *embroidery* and *purchase* (p.212). *Purchase* can denote the entity that is transferred by the action of purchasing. It represents the object argument of the verb, more precisely, the THEME. In contrast, the derivative *embroidery* refers to a PRODUCT that is created by the action of embroidering, and does not denote the object argument of the verb.

Another example of derivational polysemy is the suffix *-ize*. Existing formal accounts have managed to explain the polysemy of the large set of forms that express different kinds of causative meanings (e.g. ‘locative’, *put (in)to X* or ‘resultative’, *make into X*, cf. Plag 1999, 125). Lieber (1998) and Plag (1999) used the decompositional framework of Lexical Conceptual Structures (Jackendoff (1983, 1990, 1991)), Lieber (2004) applied her own framework. However, in neither approach was there a satisfactory solution for what has been labeled ‘performative’ and ‘similative’ formations (*anthropologize*, *powellize*). It seems that a more flexible formalism is needed.

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<sup>2</sup>All attestations are referenced in the following way: Corpus, genre (if available), year of attestation (if available). In COCA, the following genres are distinguished: spoken (SPOK), fiction (FIC), academic (ACAD), magazine (MAG) and news (NEWS). For GloWbE, WebCorp and Google, the following additional categories are relevant: Online articles and blog posts (BLOG), comments and Facebook posts (COMM).

Cases like the ones just described raise the question of which kinds of interpretation are principally possible, given the meaning of the base and that of the affix. Is there a restricted set of semantic mechanisms that can account for derivational readings in a principled way? In general, it depends on the power of the analytical tools at hand whether the limits of what can be considered compositional can be determined. Lieber's (2004) theory is currently the most advanced in addressing these questions. This theory operates with a highly restricted set of semantic features ('skeleton') and conceptual knowledge representations ('body') that allow for meaning extensions and also for some flexibility in incorporating world knowledge. It is, however, not entirely clear how meaning extensions of affixes (or derivatives) come about in the first place, and how they could be formalized in this framework. Furthermore, the theory does not have a straightforward answer to the question of which kinds of meaning extensions are possible and which ones should be impossible. This is all the more so for deverbal derivation, where Lieber explicitly leaves open "exactly what the verbal body looks like" (Lieber 2004: 72).

In Lieber's theory, polysemy chiefly emerges through the mechanism of coindexation and violations of coindexation. The details of how such an approach tries to solve the polysemy problem are, however, problematic. First, it is not so clear under which circumstances violations of coindexation may or may not occur. Second, in addition to coindexation, some further mechanisms are needed, which are not clearly spelled out. Semantic features of the affix are introduced rather ad hoc (e.g. 'collective') and these features then interact with the meaning of the base to arrive at a particular interpretation. Metonymy is explicitly mentioned as part of this process, but the process itself is not formally modeled, but assumed as a given. In more general terms, Lieber postulates highly abstract skeletal features that often do not straightforwardly translate into the specification of the particular readings of individual derivatives. To spell out this translation mechanism would, however, be crucial for a better understanding of the semantic processes at work in the interpretation of complex words.

There is a vast literature on the syntax of English nominalizations (e.g. Lees 1963; Chomsky 1970; Pullum 1991; Yoon, James Hye Suk 1996; Grimshaw 1990; Alexiadou 2001; Baker 2003; Heyvaert 2003; Lieber & Baayen 1999 among many others) but this literature is largely restricted to syntactic properties arising from the argument structure of the base verb. But as shown, for example, by Lieber & Baayen (1999) and Bauer et al. (2013), the semantic possibilities of such nominalizations go much beyond the referencing of arguments, and a satisfactory account of the full range of the semantics of nominalizations is still not available. Bauer et al. (2013) describe and illustrate many patterns and classify large amounts of pertinent data accordingly, but there is no study available yet which comprehensively systematizes and formally models the referencing properties of each of these morphological processes. Such an account would also answer the question of how the meaning of potential bases interacts with these referencing properties in principled ways. This paper addresses these questions using a small data set from one morphological category as a case study.

## 2.2 The suffix *-ment*

This suffix was very productive between the 15th and 17th centuries (see Marchand 1969, Lindsay & Aronoff 2013). While *-ment* is held by many researchers to be unproductive in

contemporary English (e.g. Bauer 1983, 55; Bauer 2001, 8f.; Schmid 2011, 112), a recent corpus study has shown that numerous “novel or low-frequency words” (Bauer et al. 2013, 199) can indeed be identified in COCA and the BNC (*British National Corpus*). This finding strongly suggests that even today speakers make use of this suffix to coin new nouns.

The suffix mainly attaches to verbs, but we find it also on other categories, such as adjectives (*foolishment*), nouns (*illusionment*), and bound roots (*compartment*, see Bauer et al. 2013, 198).

What are possible interpretations of *-ment* derivatives? Using the terminology of Bauer et al. (2013), we find a large range of readings attested: events (*assessment*), results (*containment*), states (*contentment*), products (*pavement*), instruments (*entertainment*) and locations (*embankment*).

## 3 Methodology

### 3.1 Data

Because of *-ment*'s high productivity between the 15th and 17th centuries, contemporary English derivations in this suffix are very frequent. However, these are mostly long since established words such as *government* (first attested in 1484 according to the OED), *development* (1756) or *department* (c.1450). Lexicalized words such as these are well-known to show all kinds of idiosyncrasies which are not related to actual speaker knowledge or intuition (see Plag 1998). In our study, however, we seek to investigate the productive derivational process of affixation with *-ment*. In other words, we want to know how speakers of contemporary English employ the suffix to form new words. This is why we investigate neologisms instead of established formations.

In order to identify neologisms, we used both the OED and corpora. The OED is an exceptional resource for identifying neologisms since it gives dates of first citation for every meaning nuance of every listed lemma. Furthermore, with a database of currently 600,000 words and 3 million quotations (OED 2013, accessed April 17, 2014), the OED attempts universal coverage. Thus, those neologisms which have come to some noticeable use in the English language also appear in this dictionary. The *OED Online* (2013) is updated regularly and is thus a beneficial tool for the investigation of current language development.

Neologisms were obtained using the interface provided by the OED (2013). We extracted all words ending in the orthographic string <ment>. In order to reach a sizable number of attestations, we included neologisms with first citations dating from 1900 to today (see, for example, Plag 1999 for a similar procedure). The categories *Headword* and *Lemma* were searched. This way, also nouns which are listed only under their corresponding base verb could be identified. From the resulting list of raw data, all those words were removed which did not contain the suffix *-ment* (e.g. *bioelement*). In a second step, we eliminated all forms which were derived by any word-formation process other than suffixation (e.g. prefixation on a lexicalized base with *-ment* as in *disempowerment*, or blends such as *edutainment*). Thirdly, we restricted ourselves to verbal bases, which is the base type *-ment* most frequently attaches to, and eliminated all non-deverbal nominals from our dataset (e.g. *foolishment*). Lastly, those neologisms were excluded which can be considered to be highly lexicalized. These were identified by surveying their frequency in the *Corpus of Global Web-Based English*

(GloWbE), which contains 1.9 billion words. For instance, *bemusement* is first attested in 1907 and is now highly frequent, especially in British English, listing a total of 469 tokens in GloWbE, which is far beyond the frequency range of the other derivatives (between 0 and 10 tokens).

After these revisions of the data, 18 deverbal nouns remained which were coined by means of derivation with *-ment* between 1900 and 1961. The fact that there are no new attestations after 1961 gives rise to the interpretation that *-ment* may have become completely unproductive. However, a different image presents itself when looking at large contemporary corpora such as COCA.

A second method to find neologisms is to extract *hapax legomena* from a large corpus such as COCA (Davies 2008-). Hapax legomena (or *hapaxes*, for short) are words which occur only once in a given corpus. It has been shown that the greatest number of neologisms in a corpus appear precisely among these hapaxes (see Plag 2003, 68). In our context this means that the number of hapaxes with *-ment* correlates with the number of neologisms formed with this affix, indicating its productivity. This measure has been termed the *hapax-conditioned degree of productivity* (Baayen 1993). Note that we do not claim that every hapax actually is a neologism: they can also represent very rare forms, archaisms, non-transparent ad hoc inventions and typing errors. The size of the corpus is crucial in this respect; it has been shown that the larger the corpus, the more reliably hapaxes can help predict the probability of new forms (see Baayen & Renouf 1996, Baayen 2009). In other words, the larger the corpus, the higher the proportion of neologisms among the hapaxes.

With more than 450 million words written and spoken between 1990 and 2012, COCA is an appropriately large corpus for the identification of hapaxes as potential neologisms. Using the web interface we searched for all those words which end in the strings <ment> or <ments> and which have a frequency of 1 to 3. The reason why we not only included hapaxes but also dis and tris legomena in this initial search is that results may be corrupted due to various reasons. For instance, *musement* is listed with a frequency of 2 in COCA, but one of the attestations is actually *bemusement* with a wrongly placed space. By initially including dis and tris legomena we increased the chances of finding all pertinent forms. After filtering the raw data according to the four criteria already listed above for the OED neologisms, it was necessary to examine the context of each hapax. This way, we excluded attestations which were not English, such as French quotations within an otherwise English text, as well as obvious mistakes. Finally, we excluded those formations from our analysis which cannot be regarded as neologisms. For instance, *concernment* is a dis legomenon in COCA, but its first appearance, according to the OED, is attested in the year 1621, while the most recent attestation dates to 1879. That this derivative can be regarded as an archaism is supported by the type of attestations, which were found mostly in Bible verses and philosophical treatises.

After filtering the corpus data, we arrived at 68 usable hapaxes which were produced between 1990 and 2012 (the complete range of the corpus). From this number we can deduce two things: First, *-ment* is not as unproductive today as has recently been stated, and as is indicated by the last attestation date given in the OED as 1961. Secondly, the OED can contribute valuable data but should not be seen as an exhaustive resource for neologisms. The data set resulting from the corpus study presents a list of types which are understandable in context, but cannot (yet) be regarded as established enough to be recorded in a dictionary. The complete, filtered dataset, consisting of both OED neologisms

and COCA hapaxes, amounts to 86 types. Next, these were categorized semantically.

## 3.2 Semantic classification

We were interested to see which output readings are possible given the 86 attested base verbs in combination with *-ment*. Therefore, both input verbs and output nouns were categorized semantically. This way, we were able to generalize over the data as well as cluster it. We will discuss each classification in turn.

### 3.2.1 Categorization of base verbs

For English verbs, the most comprehensive classification can be found in the VerbNet project (version 3.2<sup>3</sup>, Kipper et al. 2008), which continues the work of Levin (1993). We decided to use these classification systems because they are comprehensive, well-established and have been shown to be very useful in research on the semantics and syntax of verbs and their derivatives.

Levin (1993) and VerbNet are based on the assumption that a verb's meaning influences its syntactic behavior. Levin classifies over 3,000 English verbs applying both semantic and syntactic criteria. All verb classes are described by a listing of members, the syntactic alternations these verbs allow, and additional comments on their semantic and syntactic peculiarities.

In VerbNet, the Levin classes have been extended and partly revised, both qualitatively and quantitatively. VerbNet currently covers 6088 verbs in 109 major verb classes, many of them featuring further subclasses. Compared to Levin (1993), the added classes have allowed researchers to reclassify or cross-list a number of verbs more adequately, as for instance *convince*, an AMUSE VERB which is now also listed in new class named 'FORCE VERBS'. In VerbNet, each class is described as follows (see Kipper et al. 2008): a list of members, thematic roles for their predicate-argument structure, selectional restrictions on the arguments (e.g. an [+animate] EXPERIENCER)<sup>4</sup>, as well as so-called 'frames', which in VerbNet consist of both syntactic descriptions and semantic predicates. These frames in part correspond to the alternations listed in Levin (1993). For instance, the following frame "NP V ADV-Middle" for AMUSE VERBS goes back to the property "Middle Alternation" in Levin (1993, 190):

#### NP V ADV-Middle (VerbNet)

Example "Little children amuse easily."

Syntax EXPERIENCER V ADV

Semantics PROPERTY(EXPERIENCER, PROP) ADV(PROP)

#### Middle Alternation (Levin)

a. "The clown amused the little children."

b. "Little children amuse easily."

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<sup>3</sup>Accessible at <http://verbs.colorado.edu/~mpalmer/projects/verbnet/downloads.html>

<sup>4</sup>While traditionally (see Saeed 2009, 154, Taylor 2002), EXPERIENCERS are [+animate] per definition, in VerbNet there are classes which allow for EXPERIENCERS to be either [+animate] or [+organization]

Most base verbs in our data set could be assigned straightforwardly to a class since they were listed in the VerbNet database in their relevant senses ( $\approx 54\%$ ). For the remaining verbs ( $\approx 46\%$ ), we relied on suitable synonyms listed in VerbNet. For instance, the word *bumfuzzle* is not listed, but its synonym *confuse* is a member of the AMUSE class. Since *bumfuzzle* matches the semantic and syntactic descriptions given for verbs in this class, we coded it as a member as well. Those verbs from the dataset which could be assigned to any of the VerbNet classes were subsequently coded for their thematic roles, as these roles feature prominently in the nominalizations.

Categorization turned out to be problematic for two base verbs in the data set. *Outplace* and *trace* (as base for the first constituent of the compound *tracement oils*) could not be assigned to any of the verb classes. Apart from these two individual cases, a more general issue is also worth pointing out. Thus, many verbs are polysemous and listed in more than one category. In our subset of PSYCH VERBS, this was the case with *worry*. It can be used both transitively and intransitively. Therefore, Levin (1993) cross-lists it in two sub-categories of PSYCH VERBS, namely as an AMUSE and as a MARVEL VERB (see Table 2 for definitions of both). Furthermore, it is also listed in another major category which is introduced in VerbNet, that of CARE VERBS. In actual language use, the semantic differences resulting in such cross-listings are often too fine-grained to be identifiable in an attested derivative. Thus,, it most often remains unclear whether *worry* as a base verb for *-ment* should be analyzed as a MARVEL, AMUSE or CARE VERB in a given specific context. However, generalizing over corpus data from additional corpora (see also section 3.2.2), it can be concluded that *wor- riment* behaves like other *-ment* derivatives on AMUSE VERB bases, so that *worry* will be treated as an AMUSE VERB in the following. This is a case which shows that it is indispensable to gather as much corpus data as possible in order to make sensible statements about a lexeme's behavior.

The 86 attested base verbs in our dataset belong to 24 major classes. The two largest classes are PSYCHOLOGICAL VERBS (16 types, here PSYCH VERBS) and VERBS OF CHANGE OF STATE (11 types). The number of types in the other classes ranges between 1 and 7. In this study, we will concentrate on the analysis of the 16 PSYCH VERBS and their corresponding derivatives, which we will call PSYCH NOUNS.

### 3.2.2 Categorization of derived nouns

For the classification of the semantics of the derivatives we have made use of categories established in previous research. However, there is a great variety of approaches around with quite diverse terminology, so some clarification is in order.

In deverbal nominalization, EVENTS are often distinguished from RESULTS (see e.g. Grimshaw 1990), or from STATES on the one hand and OBJECTS on the other (see Barque et al. 2011). Moreover, it has been observed that EVENTS and STATES share certain semantic and syntactic properties (see, for example, Filip 1999). Therefore, these two have been subsumed under the hyperonym EVENTUALITY (see Bach 1986, Ehrich & Rapp 2000). This seems to be the category that has been described as the default semantics for many deverbal nominalizations, including all *-ing* nominals (see e.g. Bauer et al. 2013, 207, Roy & Soare 2012 for some general discussion). Further distinctions between different kinds of eventualities are frequently drawn on grounds of conclusivity, agentivity and durativity, introducing notions such as PROCESS and ACTION (see Sil et al. 2010). Elsewhere, a distinction

has been made between simple and complex EVENTS (see e.g. Grimshaw 1990).

The suffix *-ment* has been described as a transpositional affix, attaching to verbs and yielding a semantically equivalent noun (see Lieber 2004, 38). According to Beard (1995, 165-8, see Spencer 2010 for a more recent treatment), lexical derivation is transpositional if it only changes the syntactic category without inducing a meaning change. As was mentioned before, the most easily accessible reading for deverbal nominalizations is often an EVENT formed with *-ing* such as, for instance, *cheering*. Here, the grammatical category is changed from verb to noun but the (EVENT) semantics remains. Likewise, a STATE verb can be transposed into a STATE noun such as *suffering*. In these two cases, the same affix *-ing* yields two different readings, which can both be described as results of transposition. For the output of *-ment* derivation we can also assume that dynamic PSYCH VERBS would standardly lead to EVENT readings and stative PSYCH VERBS as bases would lead to STATE readings of the derivative.

For the analysis of the transpositional readings we will make use of the standard semantic categories EVENT and STATE. The term EVENT very generally designates phenomena which are observable and take place at a specific time and place (see Sil et al. 2010, 108). EVENTS exhibit a temporal extension which is clearly delineated by a starting point and an end point. We furthermore adopt the category of ACTION for those EVENTS with a conscious, possibly intentional, AGENT. STATES, on the other hand, are regarded as non-dynamic and homogeneous. They can have a temporal extension, but without natural boundaries. For now, we will assume that transposition constitutes a mere category shift, but see section 6 for some further discussion of this assumption.

Apart from the transpositional categories, further possible meanings for deverbal nominalizations include the (semantic and/or syntactic) arguments of the base verb (see, for example, Bauer et al. 2013, 38). In VerbNet, four roles are applied in the PSYCH VERB category to describe these: EXPERIENCER, STIMULUS, RESULT and ATTRIBUTE. ATTRIBUTE is only applied in the subcategory of ADMIRE VERBS, of which none is attested in our dataset. Therefore, we can disregard this role. The three remaining categories are listed in Table 1 with their definitions as given in the VerbNet Annotation Guidelines (p. 20-21) and examples from VerbNet frames for MARVEL, APPEAL and AMUSE verbs (the latter incorporated by *bore<sub>v</sub>*).

Table 1: Semantic categories applied in the semantic description of PSYCH NOUNS

Semantic Role	Definition	Example
EXPERIENCER	Patient that is aware of the event undergone.	we marveled at the magnificence of her gifts. (COCA, Essence 2012)
STIMULUS	Cause in an event that elicits an emotional or psychological response	That's why folk art appeals to me (COCA, Country Living 2012)
RESULT	Goal that comes into existence through the event	the campaign bored me silly. (GloWbE, GB G no date )

For our purposes, we can take over these definitions with one modification. The category of RESULT can be further specified as RESULT STATE, as RESULT STATES are generally defined

as states which come into existence through an event (see, for instance, Osswald 2005; Brandtner 2011; Ehrich & Rapp 2000 for discussion and application of this term).

For our study, semantic classification proceeded in two steps. First, the meaning of each attestation was subsumed under the definition of one of the categories defined above. Second, substitution tests were applied to substantiate the classification, taking into account the differing syntax of OBJEXP and SUBJEXP VERBS. *V-ment* was thus considered to express a certain semantic category if it could be replaced by one or more of the following expressions, respectively:

- EVENT: *V-ing someone, event in which something V-s someone, or event in which something causes someone to V PREP something*
- STATE (for SUBJEXP nouns): *State of V-ment or V-ing PREP something*
- RESULT STATE (for OBJEXP nouns): *State of V-ment, being V-ed or having been V-ed*
- STIMULUS: *V-ing influence, something which V-s someone, or something someone V-s PREP*
- EXPERIENCER: *Someone who is being V-ed, Someone who has been V-ed, or someone who has been caused to V (PREP something)*

*PREP* indicates the respective preposition which has been defined as obligatory for MARVEL VERBS (for instance, *marvel over*). Some of the substituting expressions are, admittedly, a bit clumsy. This way, however, they are general enough to be appropriate in very different contexts. It is important to note that the substitution does of course not only have to work syntactically, but also semantically - the sentence still has to make sense.

A general problem that occurred when trying to assign a given derivative to one of the semantic classes is ambiguity. For instance, *abusement* is defined in the OED with the following senses: “The action or an act of abusing or being abused, abuse; deception. Also: a source of abuse or deception.” Such ambiguity is problematic when investigating hapaxes, which are by definition attested only once in a given corpus. Two scenarios are conceivable. In one scenario, the hapax is unambiguous in the given context. In this case, it is impossible to know which further readings are conceivable. In another scenario, the hapax can be ambiguous due to a context that allows different interpretations, so that it remains unclear which meaning the speaker intended.

In order to deal with this problem we extracted further attestations of each hapax from other corpora such as WebCorp (Renouf et al. 2006), GloWbE (Davies 2013), or Google. While web-search tools such as Google unarguably exhibit certain shortcomings for serious linguistic investigation (e.g. unlimited corpus size, no data organization, no annotation), it has also been shown that they can be a convenient indicator for innovative language use (see Diemer 2011, and the papers in Hundt et al. 2006). By including further corpora, we were able to investigate a wider range of usages for each type, covering a larger range of possibilities. The problem of ambiguity and the identification of actual speaker intention is of course a general issue when working with corpus data. In this study, when several readings were possible for any given attestation, all of these were regarded as conceivably valid usages of the given noun.

A similar problem presents itself with the dictionary data. Although the OED aims at wide coverage, for obvious reasons it does not include every meaning variant ever attested. Therefore, our OED-based data was also supplemented with corpus data from the corpora listed above. This way, a number of innovative usages were also identified.

## 4 The semantics of psych verbs

According to Levin (1993, 189), PSYCH VERBS typically take two arguments: EXPERIENCER and STIMULUS. Traditionally, the projection of these participant roles as either subject or object of the verb serves as a basis to subdivide English PSYCH VERBS further.<sup>5</sup> Levin (1993) arrives at a fourfold distinction based on this criterion in combination with transitivity (see Table 2). Table 3 summarizes the thematic roles which are represented in the predicate-argument structure of these different types of PSYCH VERBS in VerbNet. Note that not all of these roles describe syntactic arguments. The ATTRIBUTE in constructions with ADMIRE VERBS is not an argument, and the RESULT STATE indicated by AMUSE VERBS is not syntactically represented.

Table 2: Types of PSYCH VERBS according to Levin (1993, 188-193)

	Experiencer is the subject	Experiencer is the object
<b>Transitive Verbs</b>	ADMIRE VERBS: <i>The tourists admired the paintings.</i>	AMUSE VERBS: <i>The clown amused the children.</i>
<b>Intransitive verbs with PP complements</b>	MARVEL VERBS: <i>Megan marveled at the beauty of the Grand Canyon.</i>	APPEAL VERBS: <i>This painting appeals to Malinda.</i>

Table 3: Semantic roles for PSYCH VERBS in VerbNet

	EXPERIENCER	STIMULUS	RESULT	ATTRIBUTE
AMUSE VERBS	+	+	+	-
ADMIRE VERBS	+	+	-	+
MARVEL VERBS	+	+	-	-
APPEAL VERBS	+	+	-	-

As has been indicated above, there are 16 base verbs in the dataset which can be categorized as PSYCH VERBS. These are the AMUSE VERBS *affright*, *bumfuzzle*, *confound*, *dumbfound*, *endull*, *enrage*, *enrapture*, *nonplus*, *perturb*, *reassure*, *upset*, *soothe*, *stagger*, and the MARVEL VERBS *approve (of)* and *muse (over)*. As discussed above, the verb *worry (about)* is cross-listed in both subcategories in VerbNet and will be treated as an AMUSE VERB.

AMUSE VERBS are characterized in Levin (1993, 191) as describing “the bringing about of a change in psychological or emotional state”. Furthermore, following the widely employed terminology introduced in Pesetsky (1995), AMUSE VERBS can be described as OBJECT EXPERIENCER (henceforth OBJEXP) verbs. This entails that they are transitive verbs which realize the EXPERIENCER as object and the STIMULUS as subject. As can be seen in Table 3, this is the only subgroup of PSYCH VERBS the description of which includes the thematic role RESULT in VerbNet.

<sup>5</sup>In languages that are morphologically richer than English, this subdivision is often based on case, see e.g. Klein & Kutscher (2005) for German, and Varchetta (2010) for Italian.

MARVEL VERBS belong to the SUBJECT-EXPERIENCER class and comprise verbs describing mental states (see Levin 1993, 192). It seems, however, that some members such as *rhapsodize* or *muse over* are more akin to ACTIONS. All members are intransitive and express the STIMULUS in a prepositional phrase headed by different prepositions. Some verbs in this category, such as *worry*, can be used transitively and are therefore cross-listed in VerbNet.

It seems uncontroversial that OBJEXP PSYCH VERBS can be regarded as causatives and thus as complex events. However, there has been a debate in the literature whether SUBJEXP PSYCH VERBS also fall into this category (Grimshaw 1990; Pustejovsky 1995; Geuder 2000; Härtl 2001). Empirical research has shown that also SUBJEXP PSYCH VERBS can indeed be regarded as (implicit) causatives. Thus Härtl (2001) presents evidence that the STIMULUS is regarded as equally causative in both OBJEXP and SUBJEXP VERBS. In VerbNet, the problem is addressed in the frames describing the verb classes: The STIMULUS in the AMUSE VERB class is introduced with the predicate CAUSE, while for MARVEL VERBS we find IN REACTION TO. In the present study, we assume that AMUSE VERBS can be considered as a type of causative, while conceding that they might differ in the degree or kind of causality from prototypical causatives such as *push* or *kick*. As will be discussed below (see section 6), some MARVEL VERBS imply a causation event, while others don't.

## 5 Semantic analysis

This section presents the results of our corpus and dictionary study, discussing the semantic categories attested in our dataset. The semantics of the base verbs and of the derivatives will be considered in turn.

### 5.1 Input Semantics

With respect to input semantics it is quite striking that, in our dataset, *-ment* has a preference for AMUSE VERBS (14 types, including the cross-listed *worry*). ADMIRE and APPEAL VERBS are not attested as bases for neologisms, and MARVEL VERBS are represented by two types. This raises the question whether this behavior of *-ment* neologisms is peculiar to our newly coined forms or whether it is of a more general nature. We tested this by counting how many of all the PSYCH VERBS listed in VerbNet are attested in combination with *-ment* in COCA. As can be seen in Figure 1, the observation does indeed reflect a general tendency for *-ment* on PSYCH VERB bases. In this bar chart, numbers of PSYCH base verbs attested with and without *-ment* in COCA are given by subcategory. The ratio between “attested” and “not attested” is indicated by the differently shaded areas (dark gray for number of attestations, light gray for number of unattested combinations). While a rounded 21% of all AMUSE VERBS listed in VerbNet are attested with the suffix in COCA, the ratio is much lower for ADMIRE, MARVEL and APPEAL VERBS (5%, 7% and 0%, respectively). Raw numbers are given in boxes inside the bars.

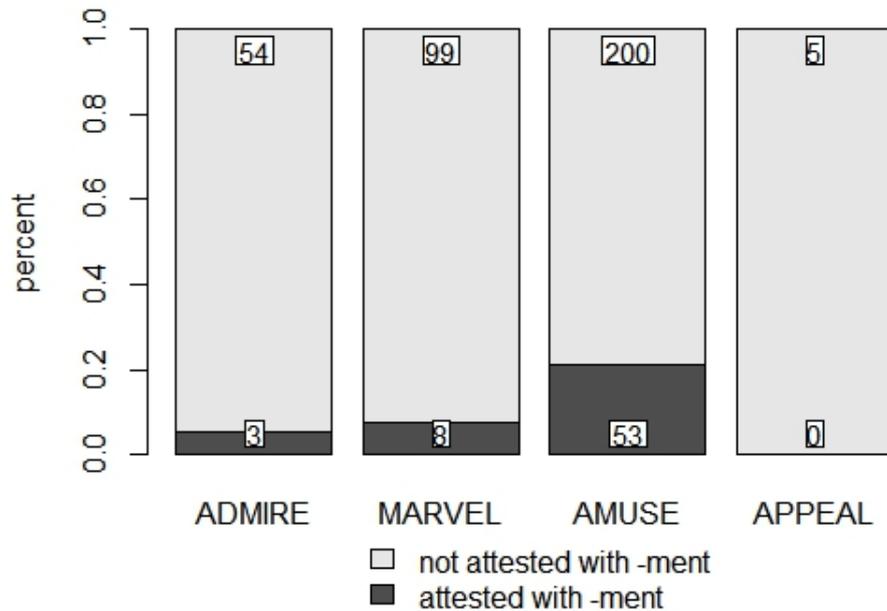


Figure 1: COCA attestations of PSYCH VERB bases with *-ment* by verbal sub-category

AMUSE verbs have a significantly higher proportion of *-ment* formations than the three other categories (e.g. AMUSE vs. MARVEL verbs:  $\chi^2=9.7$ ,  $df=1$ ,  $p=0.002$ ) This preference of *-ment* for AMUSE VERBS may have several different reasons. First of all, the class of APPEAL VERBS is very small. It contains only five verbs, three of which are extremely rare or not attested at all in COCA. It is therefore not surprising that no *-ment* attestations can be found, especially since this suffix shows only little productivity. Secondly, an exploration of other derivatives with these bases suggests that both MARVEL and ADMIRE VERBS exhibit a preference for other nominalization processes. A large proportion of MARVEL VERBS form nouns by conversion (*sorrow*, *freakout*) and ADMIRE VERBS seem to prefer *-ation* (*reaffirmation*, *adoration*, *detestation*), but are also found in V→N conversion (*mistrust*, *grudge*).

## 5.2 Output Semantics

With regard to AMUSE VERB bases, our dataset can be described as uniform since all derivatives end up in the same semantic categories: EVENT (transposition), RESULT STATE or STIMULUS. No attestations for EXPERIENCER could be identified. Among the attested categories, RESULT STATES exhibit a much higher token frequency than the other two. Example (3) gives an attestation for this semantic category, while (4) and (5) exemplify STIMULUS and EVENT, respectively. Example (6) can be categorized as an ACTION.

- (3) RESULT STATE

I know a lot of our compatriots also feel the same angst, consternation and **confoundment**. (GloWbE\_ART\_2012)

(4) STIMULUS

The Education Secretary arrived having just..made her first big policy declaration - dressed up as a **reassurance** to Middle England that A-levels will be retained and that other exams may be made harder. (OED\_NEWS\_2005)

(5) EVENT

Don Thomas has been spending quite a bit of time there lately—offering autographed catalogs to outdoorsy, ideally ultimate playing, [...], handles **bumfuzzlements** in stride, [...] genus femininum. (Google\_BLOG\_2010)

(6) ACTION

On apartheid South Africa, he called for the “constructive **enragement**” of economics sanctions (COCA\_NEWS\_2010)

It has been noted above that not all attestations can be unambiguously assigned to one semantic category only. Especially the distinction between EVENT and STIMULUS has proved to be challenging, with many ambiguous attestations (cf. example (5)). We will address this issue in section 6.

In contrast to the homogeneous group of AMUSE VERBS, the case is not as clear with MARVEL VERBS. First of all, the verb class itself is heterogeneous with regard to the semantics of its members. Thus, as was mentioned above, it includes mostly stative verbs, but also a number of dynamic ones. The two attested verbs in our dataset represent both categories: While *approve of* is stative, *muse over* can be paraphrased both as ‘to be pensive’ (STATE) and as ‘to ponder’ (ACTION), with an inclination toward the second reading.<sup>6</sup> This polysemy is also indicated by the derivatives *muse* forms with *-ment*. Both a STATE reading and an EVENT (ACTION) reading are attested (see examples (7) and (8), respectively), and both readings are transpositional. The latter seems to be more frequent, especially in blog titles such as “Musements and ponderations of a neurofool [sic]”<sup>7</sup>.

(7) A cock was crowing in the distance. He studied the countryside with **musement**. # Here forms were gentle on the eye. (GloWbE\_BLOG\_2012)

(8) In his maturity, Royce also installed the Will to Interpret at the heart of his new method of philosophizing by “interpretive **musement**.” (COCA\_ACAD\_1991)

Apart from these transpositional readings, *musement* is also attested in a STIMULUS reading. While no context could be identified that unambiguously exhibits this reading, there are a number of examples which can be interpreted as either STIMULUS or ACTION, especially in puns including some combination of *amusement* and *musement*, such as in example (9).

(9) Passage des perles Style over fifty; delights, (a)**musements** and resources for women (WebCorp\_BLOG\_2014)

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<sup>6</sup>That *muse over* does possess an ACTION reading can be tested with *Aktionsart* tests, for instance, its use in an imperative construction (“Muse over this!”).

<sup>7</sup><http://neurofoolishmusings.blogspot.de/>

*Approvement*, the other attested derivative of a MARVEL VERB, can also express the transposed sense of STATE, as can be seen in example (10). The noun can furthermore be found in ACTION readings (see (11)); however, it is more likely that the base verb for these attestations is the transitive *approve* in the sense paraphrased in the OED as “To pronounce to be good, commend”. No attestations for STIMULUS could be found for this noun.

- (10) What happened is people who were looting, and thieves and hooligans, once they receive the **approvement** from the press, they will just draw the V sign and then continue their looting. (COCA\_NEWS\_2003)
- (11) Apparently in lack of experts willing to support their ideas they rephrase comments of critics in such a way that it sounds like **approvements**. (WebCorp\_BLOG\_2004)

Table 4 summarizes our findings for output readings attested for the different base verb types.

Table 4: Readings attested in derivations with *-ment* on PSYCH VERB bases

	transposition					
	EVENT	STATE	STIMULUS	RESULT STATE	EXPERIENCER	
AMUSE VERBS	+	-	+	+	-	
MARVEL VERBS						
<i>approve of</i>	(?)	+	-	-	-	
<i>muse over</i>	+	+	+	-	-	

How can we interpret our results? It does not come as a surprise that RESULT STATE readings are much more common than STIMULUS and EVENT readings in nouns based on AMUSE VERBS. In fact, it is unexpected that STIMULUS and EVENT are attested at all, since it has been claimed that OBJEXP nominalizations “uniformly lack all causative force” (Pesetsky 1995, 71). Pesetsky (1995, 72) gives two examples, stating that *annoyance* and *amusement* both denote ‘the state of being annoyed/amused’, while not being able to express ‘the process of making annoyed’ and ‘something amusing someone’, respectively. These two readings would correspond to our EVENT and STIMULUS categories. Pesetsky admits that some OBJEXP nominalizations are used to refer to something else than STATES, namely objects, but puts these readings aside as being “sharply distinct” from those with a STATE reading (p. 72). However, especially for such frequent derivations as *amusement* and *annoyance*, STIMULUS and EVENT readings can easily be found by identifying plurals of the pertinent lexemes in large corpora. (12) exemplifies an (object) STIMULUS reading of *amusement* such as acknowledged by Pesetsky, while (13) presents the noun as an EVENT, contra Pesetsky. *Bumfuzzlements*, from our dataset, can be interpreted both as an EVENT and as a STIMULUS in (14), repeated from (5). Pluralization, as Pesetsky claims, is a property OBJEXP PSYCH NOUNS may resist (p. 72). Nevertheless, in our research, it has turned out to be a convenient means to easily identify EVENT and STIMULUS readings.

- (12) No federal agency regulates portable **amusements**, and no state employee inspects mobile rides. (COCA\_NEWS\_2012)

- (13) Today’s evangelicals dance, listen to popular music, partake in public **amusements** and diversions, and attend the theater (COCA\_ACAD\_2010)
- (14) Don Thomas has been spending quite a bit of time there lately—offering autographed catalogs to outdoorsy, ideally ultimate playing, [...], handles **bumfuzzlements** in stride, [...] genus femininum. (Google\_BLOG\_2010)

While RESULT STATES are very common in nominalizations based on AMUSE VERBS, we do not find them at all for MARVEL NOUNS. This can be explained by the semantics of the base verbs. Naturally, both classes can produce a STATE reading in their nominalizations. However, the nature of this output as well as the way to get there are different: For AMUSE VERBS, the STATE is the RESULT which is brought forth by their nature as causatives. For prototypical MARVEL VERBS, the STATE is merely the result of transposition; no causation as such is involved (but see section 6 on less prototypical MARVEL VERBS).

The finding that EXPERIENCER readings cannot be derived from PSYCH VERBS with *-ment* may have different reasons. First of all, in English this reading is usually formed with the suffix *-ee* (or *-er* for SUBJEXP verbs). We might therefore be dealing with a simple blocking effect. Furthermore, said restriction may originate either in the properties and preferences of PSYCH VERBS, or in those of *-ment*. The first option can easily be tested by investigating whether PSYCH VERBS can in principle be the basis for derived EXPERIENCER nouns. In English, the usual suffix for PATIENT and EXPERIENCER nominalizations is *-ee*. While the combination AMUSE VERB + *-ee* may not be described as a highly productive derivational process, it is nevertheless possible to generate EXPERIENCER readings by applying this process, as example (15) demonstrates. This formation is mostly attested in a direct juxtaposition with its STIMULUS counterpart V + *-er*. In the case of MARVEL VERBS, the arrangement is exactly converse: *-er* is used to express the EXPERIENCER, while *-ee* can express the STIMULUS. This behavior, which can be seen in example (16), is due to the fact that *-er* and *-ee* are not actually “agent” and “patient” suffixes, as might be intuitively assumed. Rather, they are much better described as “subject-” and “object-referencing”, respectively (see Bauer et al. 2013, 38).

- (15) What often happens is that individuals often reciprocate these roles so that at one time a partner may, for example be the “soother” and at another time assume the role of the “**soothee**”. (WebCorp\_BLOG\_2014)
- (16) The word *sufferee* actually exist [sic] and psychologists and counsellors do use it often to denote the causative agent of the **sufferer**. Hope this helps! (Google\_COMM\_2011)

To summarize, PSYCH VERBS in principle allow EXPERIENCER semantics in their nominalizations, so that the constraint cannot be traced back to the properties of the verbal bases alone.

The question thus remains whether the constraint may be part of the representation of *-ment*. In the pertinent descriptive accounts of English derivation (e.g. Marchand 1969), there is no mention of *-ment* evoking EXPERIENCER semantics with any type of verbal base. Likewise, in a random corpus search (including different base verbs + *-ment* in COCA, WebCorp, GloWbE and Google) no positive evidence for *-ment* deriving an EXPERIENCER reading could be found. In fact, no reading which is typically associated with a [+human], or even just [+animate], referent (such as AGENT or RECIPIENT) could be identified. This

leads to the conclusion that the constraint prohibiting a shift to EXPERIENCER readings when nominalizing PSYCH VERBS with *-ment* may be due to the suffix disallowing [+animate] formations. Melloni (2011, 115&237) observes the same for Italian nominalizations in *-mento*: a shift to an EXPERIENCER reading is not possible since the target has to be inanimate and non-sentient. Instead, Italian makes use of its present participle suffix to express sentient categories such as AGENT and EXPERIENCER. With regard to PSYCH VERBS in English, however, a putative constraint against [+animate] readings does not seem to hold so easily: The STIMULUS can be instantiated by anything, including [+animate] entities, as exemplified in (17).

- (17) I'm awfully sorry to be such a **disappointment** to you. . . . please believe that you can't possibly want for me to be a winner more than I do. (WebCorp\_BLOG\_1992)

This issue may be related to the question of what actually is the cause, or the STIMULUS, of a given RESULT STATE. In example (17), it is apparently not the person itself who is a disappointment, but rather their behavior, a character trait, some state of mind, etc. While it could be speculated that this might always be the case with seemingly [+animate] STIMULI, in a corpus study such as the present one this is not unambiguously deducible from the contexts of the attestations. In any case, animacy is clearly required in the semantic category EXPERIENCER, while with STIMULUS this does not seem to be so clear. It can therefore only be said that *-ment* exhibits a strong preference for [-animate] referents, and further research is needed to clarify the status of this preference.

The third interesting issue is the shift to STIMULUS readings. With Italian *-mento* derivatives, this output category is limited to a small number of PSYCH nominals, namely those which usually only transpose into a STATE (and not an EVENT) reading (see Melloni 2011, 115). Melloni gives *divertimenti* ('amusements') as an example. This seems to be similar to our findings: Although AMUSE VERB nominalizations are attested as EVENTS, too, there is a strong prevalence of STATE readings. MARVEL VERBS, on the other hand, are per se STATE verbs which produce STATE nominalizations. The question then arises why *approvement* is not attested in a STIMULUS reading, while *musement* is. While this finding may simply be a data issue, it could also be speculated that it is related to the heterogeneous behavior of the verbs in this class, including the question of causation and the difficult nature of the STIMULUS argument as mentioned above. As has been mentioned above, *muse over* is polysemous between a STATE and an ACTION reading, while *approve of* is purely stative. Moreover, the class is diverse with regard to causation; de facto, more active readings seem to involve more causative STIMULI. Consider examples (18) and (19). While in (18) *muse over* appears caused and active, it is harder to argue that, in (19), 'punishment' caused the EXPERIENCER to approve. Punishment just resulted in approval. This finding is also not absolute, however, as example (20) seems to indicate.

- (18) That monumental display of remorse and penitence made me **muse over** the circumstances that necessitated the open apology. (WebCorp\_BLOG\_2014)
- (19) The issue about punishment is not whether Dante **approved of** it but whether his attitude to it is one of inflexible bigotry. (COCA\_ACAD\_2011)
- (20) The news **caused approval** in some quarters and concern in others (WebCorp\_BLOG\_2013)

It seems that corpus data is inconclusive in this matter, especially given the fact that our dataset only includes two types. Expanding the dataset would therefore be the next step in order to shed light on this issue.

## 6 A frame-based model of *-ment* suffixation

It has been frequently argued that nominalization can be explained on the basis of metonymy (see, for example, Radden & Kövecses 1999, Panther & Thornburg 2002, Martsa 2013, Schulzek 2014). In this sense, metonymy can be defined as a meaning shift which involves that “the reference of a lexeme is shifted from the potential referents of the lexeme to something that is in the broadest sense part of, or thematically linked to, these potential referents” (Schulzek 2014, 222). Based on this central insight we will model the observed readings as shifts in a frame as introduced by Barsalou (1992a,b) and further developed in, for example, Petersen (2007) and Löbner (2013). In this approach, frames are attribute-value structures which serve to model mental representations of concepts as well as linguistic phenomena, similar to the attribute-value formalisms known from frameworks such as HPSG (Pollard & Sag 1994) or LFG (Bresnan 1982). The specific formalisms will be introduced and explained as we go along.

In this frame-based approach, attributes are functional in the mathematical sense. The attribute-value structures are recursive and they allow for structure sharing (value identities of attributes). A frame can be given as an attribute-value-matrix or as a frame graph with directed arcs (i.e., arrows) representing attributes, and nodes representing their respective values. For instance, a frame for the concept ‘car’ could include an attribute labeled *engine* which can be specified by a value such as *4-cylinder*. This example also shows that the values by which an attribute can be specified are subordinate concepts of this attribute (Barsalou 1992b, 43). In Petersen’s frame approach, the resulting taxonomy is incorporated in the type signature underlying each frame (cf. Petersen 2007, Def. 8 and Fig. 9).

In order to model the process of nominalization with *-ment* on AMUSE and MARVEL VERB bases, we apply an approach in which the semantics of the base verbs and that of the resulting nouns are modeled in separate frames. The semantics of a morphological process can then be described as its potential to alter the frame of the base verb, which results in the noun frame. As mentioned above, we adopt the view pertinent in the literature that OBJEXP PSYCH VERBS can be regarded as causatives. The representations given in Figures 2 to 4 build on earlier work on causation frames (e.g. Kallmeyer & Osswald 2013; Osswald & Van Valin 2014). These figures depict partial frames for AMUSE VERBS and their possible nominalizations (exemplified by *bumfuzzlement*). Each frame should be read from top to bottom: From the complex causation event via its sub-events to their participants. In the following, we will refer to attributes and their labels in small caps and to nodes and their labels in italics.

### 6.1 AMUSE VERBS

Figure 2 presents a partial frame for the semantic interpretation of AMUSE VERBS. In this frame, the referent node is labeled *psych causation*. This indicates that AMUSE VERBS refer to the whole, complex event of psychological causation, which is modeled here as consisting

of two sub-events: a CAUSE and an EFFECT.

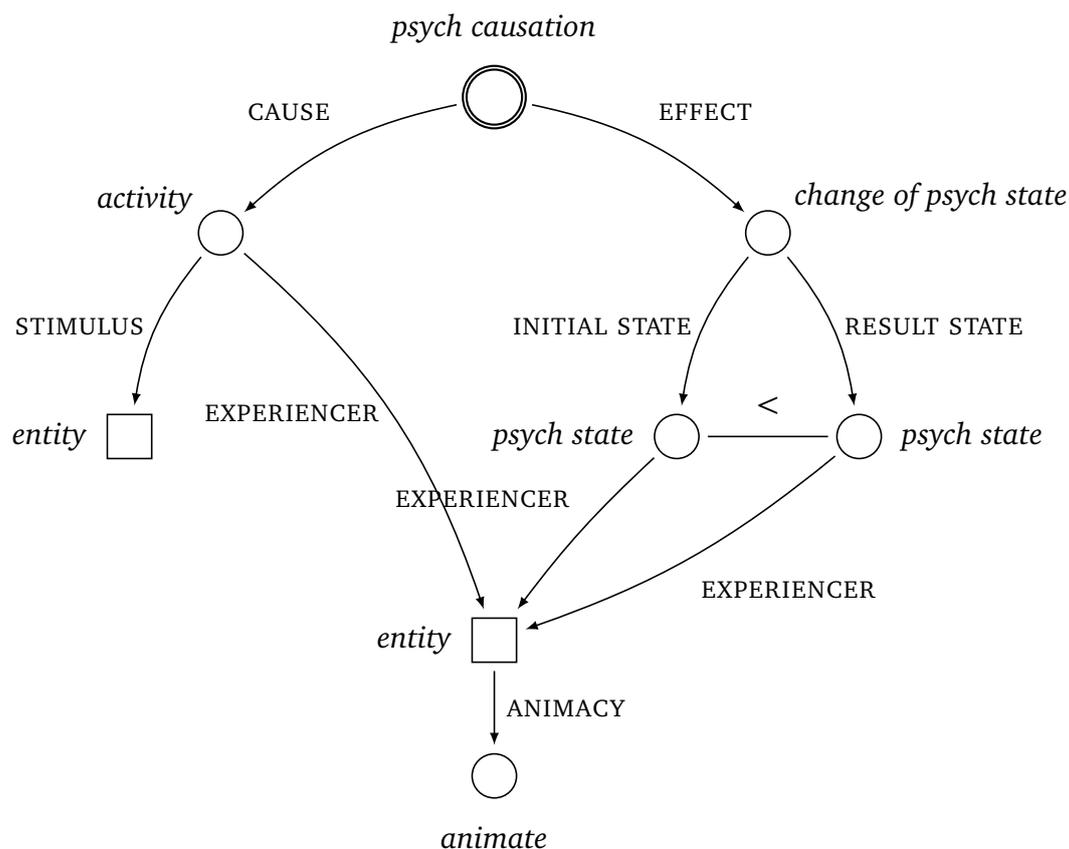


Figure 2: Partial causation frame for AMUSE VERBS

The CAUSE is an *activity* which has two participants, the STIMULUS and the EXPERIENCER, and the EFFECT is a *change of psych state* in the EXPERIENCER *entity*. Note that, in contrast to the ACTION category, the *activity* type does not stipulate an AGENT attribute but rather a more general ACTOR. “Activity” is regarded here as a subtype of EVENT, alongside MOTION and CAUSATION (cf. Kallmeyer & Osswald 2013, Fig.16). In the case of PSYCH VERBS, the involved ACTOR is, more concretely, a STIMULUS. The STIMULUS and EXPERIENCER attributes both have the value *entity*. This type should be considered as a very general concept, basically denoting ‘anything’. The STIMULUS *entity* is not specified any further since anything (a person, an action, a smell...) can stimulate the EXPERIENCER. For the EVENT subcategory of ACTION as defined above, the STIMULUS would by definition be specified as an *agent*. The value used to describe EXPERIENCER is an *entity* which is further specified as [+animate]. Both the STIMULUS and the EXPERIENCER *entity* are arguments of the verb and therefore depicted as rectangular nodes.

The EFFECT of the *psych causation* is that a *change of psych state* occurs, from an INITIAL STATE to a RESULT STATE. The fact that these two states exist consecutively is represented by the relational operator “<”. It should be noted that the RESULT STATE must not be identical to the initial one. Not only do they occur consecutively, but they are also of a different type (in a type-theoretical sense). This relation is not depicted in the frame itself but must be determined by means of an additional constraint that RESULT STATE is *P* while the INITIAL

STATE is  $\neg P$ . For instance, the RESULT STATE is *bumfuzzled*, while the INITIAL STATE is *not bumfuzzled*. Lastly, it should be noted that the frames depicted here are only partial, as they omit all information that is not immediately relevant for our discussion. For example we omit arcs that straddle nodes, as these arcs are taken to be implied. For example, we omit the arc from *change of psych state* to the EXPERIENCER entity to avoid unnecessary clutter.

Figure 3 presents a frame for possible shifts during the process of nominalization of AMUSE VERBS with *-ment*.

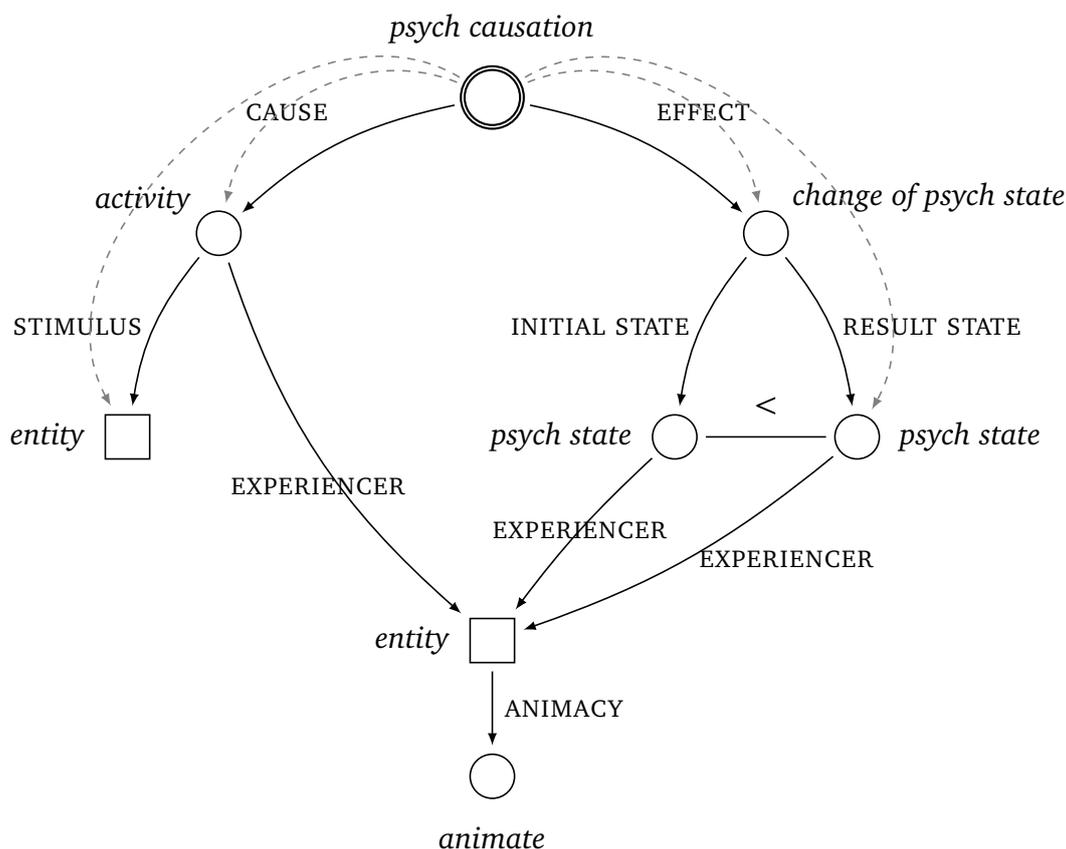


Figure 3: Partial frame for *-ment* nominalizations based on AMUSE VERBS

The noun frame in Figure 3 does not differ from the verb frame if the output reading is purely transpositional. In this case, reference stays on the same node. If the new reading is non-transpositional, we see shifts of the reference node, as indicated by the dashed arrows in Figure 3. The reader may note that this frame includes not only the shifts to STIMULUS and RESULT STATE as discussed so far, but also shifts to the two sub-events *activity* and *change of psych state*. To understand this, consider the following example (21), repeated from (6):

- (21) On apartheid South Africa, he called for the “constructive **enragement**” of economics sanctions (COCA\_NEWS\_2010)

In this attestation, *enragement* can have an activity interpretation, which means that the referential node has shifted from the top node denoting the whole psych causation event

with its cause and effect to the *activity* node below it.<sup>8</sup> Similarly, it is possible to identify attestations which represent shifts to the *change of psych state*, such as (22).

- (22) In her own case, Miss Reuben said, the **enragement** began when a professor told her that it really wouldn't matter if she finished her doctoral thesis.  
(Google\_Mag\_1972)

To sum up our results in the light of this analysis, we find clear evidence for shifts to the event participants *STIMULUS* and *RESULT STATE* as well as to the causing and the caused subevents, labeled *activity* and *change of psych state*, respectively. Transposition in the classical sense, on the other hand, seems to be attested only when the context underspecifies possible shifts. This ties in very well with a recent observation by Lieber that, as soon as the specific semantic characteristics of a syntactic category are represented in a formal framework (such as Lieber's skeleton and body model, or the frame-based model presented in this paper), the notion of 'transposition' cannot be maintained (Lieber 2014). She argues that affixes "can never be purely transpositional in the traditional sense: the very fact of changing category invariably presupposes some non-trivial semantic change." (p.1)

Figure 4 applies our frame representation to a specific example, namely the noun *bumfuzzlement* in a *RESULT STATE* reading. This frame differs from that in Figure 3 in two respects: Firstly, it is more specifically labeled. Secondly, the meaning shift from the verb to the noun is indicated by a shift from the original referential node, labeled *bumfuzzle event*, to the node specifying the *RESULT STATE* as *bumfuzzled*.

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<sup>8</sup>It will have to be determined in further research whether all *ACTION NOUNS* based on *PSYCH VERBS* behave like this.

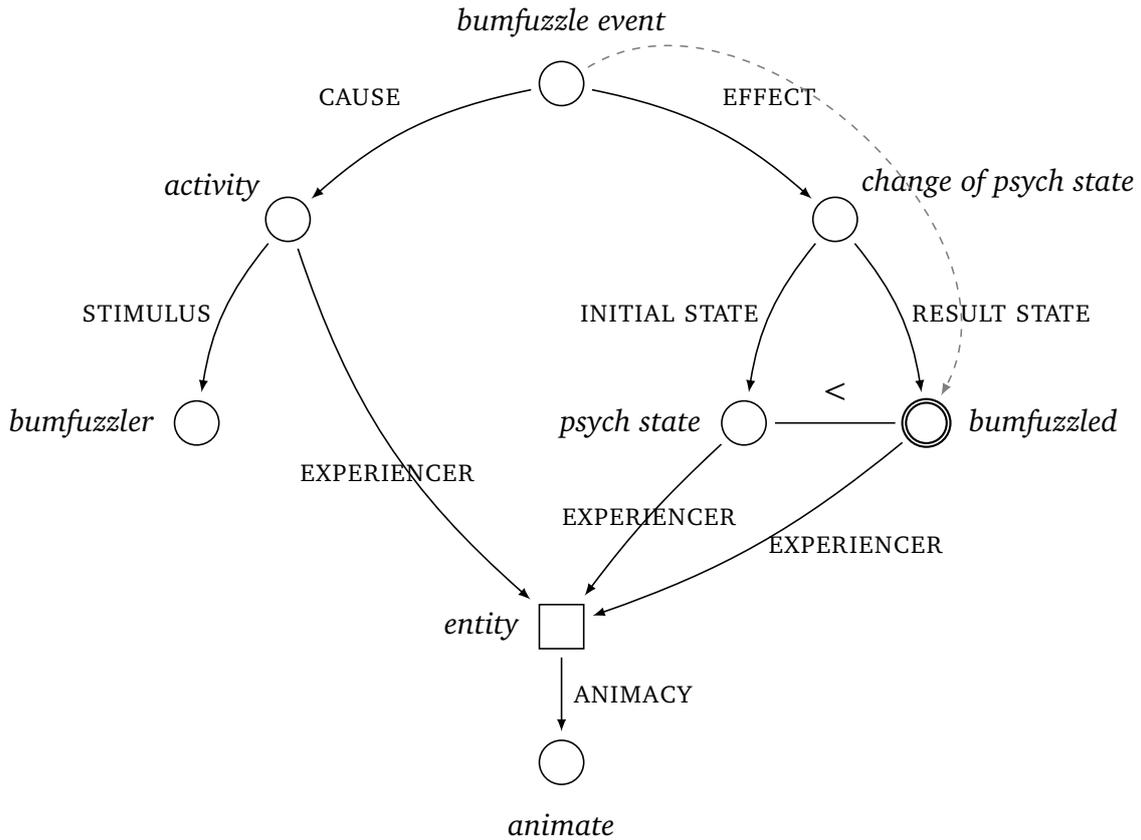


Figure 4: Partial frame for the nominalization *bumfuzzlement* in a RESULT STATE reading

The frame-based implementation of shifts raises the question if there are any principled restrictions as to which nodes can be targeted by shifts. And indeed such restrictions have been proposed. Importantly, in order for a shift of reference to be successful, a condition which has been termed *bidirectional functionality* has to be fulfilled (see Schulzek 2014, 229). This restriction entails that there have to be directed arcs in both directions between the original and the target referent node. In other words, the relation between two nodes has to be functional in both directions. Note that the original and the target node do not have to be adjacent to one another. The path between them can span more than one arc, and bidirectional functionality has to apply to every step on the way if this is the case. The need for this restriction results from the fact that, by definition, each node in the frame has to be reachable from the central node. If reference is shifted metonymically in a given utterance, it is important for understanding that the shift can be uniquely identified. For instance, unique reference would not be given if a speaker referred to a student as *the university*, since there is more than one student at a university, and thus more than one *student* node in a university frame. Note that bidirectional functionality can also be generated by a context which is sufficiently restricted (see Löbner 1985, 316). Schulzek (2014, 230) gives as an example a student who competes in a race as a representative of his university's team. Since all other students are thus excluded as possible referents, a sentence such as (23) is interpretable.

(23) Heinrich-Heine-University won the race.

The context of a psych causation event is quite restricted. Staying with the example of the clown amusing the children, we are “zooming in” to just part of the situation, excluding other factors such as a walking action in which the clown may be involved, or the one child which is scared by the clown. In this psych causation, we would argue that bidirectional functionality is indeed given for every relevant node in the frame, that is, every node we do find a shift to. For instance, there is exactly one STIMULUS involved in this activity, and while it may be involved in further activities, these are excluded here by context. On the other hand, a shift to the INITIAL STATE may not be possible because it is not bi-uniquely linked to the original central node. While the *change of psych state* has some INITIAL STATE which is defined as “not bumfuzzled”, there is no functional relation in the other direction. The “not bumfuzzled” state does not imply any change of psych state since it only exists as such in retrospect. Likewise, the EXPERIENCER in our psych causation event will be in more than one psych state before. Again, there is no bi-unique link between both nodes. Thus, our frame analysis may explain why *-ment* cannot produce an INITIAL STATE reading in PSYCH VERBS.<sup>9</sup>

Given the absence of any EXPERIENCER readings with *-ment*, it is obvious that shifts are not possible to all of the nodes which are bi-uniquely connected to the central node in the verb frame. As has also been observed by Schulzek (2014, 236), further restrictions are bound to exist. In the case of EXPERIENCER readings, we have argued that *-ee* and *-er*, being more salient in this semantic category, may exert some kind of blocking effect. In a frame approach, this could be modeled by weighting the attributes in frames which depict the properties of affixes. For instance, a frame for *-ee* would contain primary attributes for PATIENT and THEME and secondary attributes for AGENT, EXPERIENCER and STIMULUS (see Bauer et al. 2013, 231 for an overview of the primary and secondary domains of nominal suffixes in English). With such a frame for each nominal suffix of English, predictions could be made about which affix is most likely to form certain semantics. Combined with base verb frames, these predictions would be even more accurate. Apart from the potential blocking effect of *-ee* for EXPERIENCER readings we speculated that, depending on how the STIMULUS is defined, *-ment* may indeed completely disallow [+animate] referents. If this were the case, which would have to be asserted in future research, this fact could be incorporated by a general type restriction on *-ment*, again represented in a frame which describes this suffix.

## 6.2 MARVEL VERBS

The frame introduced in Figure 2 for AMUSE VERBS can, in a slightly modified form, be used to represent a subset of the MARVEL VERBS, namely those that are considered to result from causation (see again our above discussion and the findings in Härtl 2001).

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<sup>9</sup>In fact, both in English and in any language the authors can think of, these cannot be marked morphologically. In English, the initial state can be expressed in the semantics of a lexeme (e.g. *deactivate*) or clarified by context (“The clown managed to amuse the scared children”).

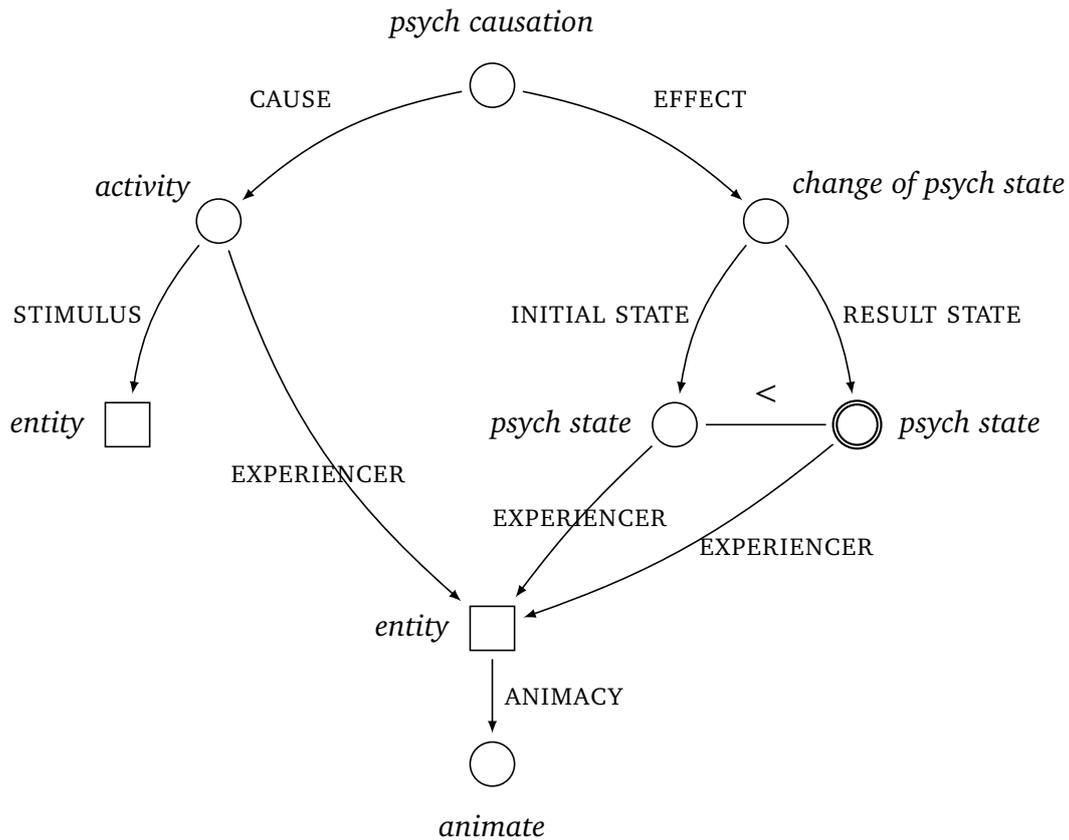


Figure 5: Partial frame for MARVEL VERBS presupposing a causative event

Reference in this frame (shown in Figure 5), is on the node representing the value of the RESULT STATE attribute. This indicates that MARVEL VERBS are state verbs. The entities representing STIMULUS and EXPERIENCER are, again, arguments of the verb and thus given with rectangular shape. For the sake of clarity, we have abstained from sketching the respective arcs from the *psych state* node towards these. It is interesting to note that the frame representation of the passive forms of AMUSE VERBS (such as *being amused*, *being aroused* or *being upset*) would correspond to the one in Figure 5.

As already hinted at above, not all MARVEL VERBS listed in VerbNet fit into this causation frame. Verbs which do not seem to presuppose causation are, for instance, *approve of* or *beware of*. These need to be depicted in a different frame, such as the one in Figure 6.

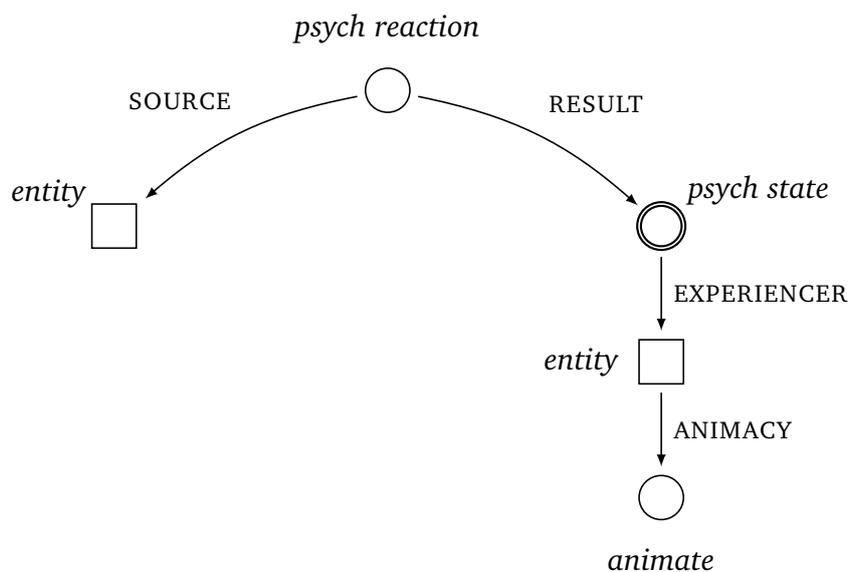


Figure 6: Partial frame for stative MARVEL VERBS

This frame differs from the causation frames in Figures 2 and 5 in several points. First, no causation is depicted. Instead, we find a simple event, which we have termed ‘psych reaction’. This label reflects the terminological distinction between the predicates CAUSE and IN REACTION TO in VerbNet. Note that the STIMULUS is still present in the semantics of the verb and thus part of the frame.

An interesting question would be whether there is an empirically provable difference between caused and non-caused SUBJEXP PSYCH VERBS. A testable indicator may be the presence or absence of a STIMULUS reading in nominalizations with *-ment*, assuming that the two verbs in our dataset actually reflect more general patterns. Accordingly, the presence of a STIMULUS would indicate a stronger, causative bond, while its absence would reflect the fact that the bond is weaker, and of the type ‘psych reaction’. Further research will be needed in order to determine whether this is the case, and whether such a ‘psych reaction’ frame is indeed justified, or just a relic of the limited MARVEL VERB data in our dataset.

Starting from the two different frames we depicted for the two groups of MARVEL VERBS (caused/complex vs. non-caused/in-reaction-to/simple), we can now discuss the frames of their respective nominalizations. One problem with this is that we do not know whether the behavior of the two only forms in our data set, *musement* and *approvement*, reflects general tendencies found in nominalizations based on MARVEL VERBS. Therefore, the following statements merely refer to the *approvement* frame and the *musement* frame, with the prospect that these may correspond to more general caused and non-caused MARVEL-nominalization frames.

Since *approvement* is only attested in a transpositional STATE reading, its noun frame is identical to the frame of the base verb (see Löbner 2013), and as such is in accordance with Figure 6. The apparent constraint that prohibits a shift to the entity representing the STIMULUS is not inherent in the frame as it is, since bi-unique relations can be assumed between this node and the central node. Ad hoc, one could assume that the type of frame (‘psych reaction’) generally precludes such a shift. This would have to be tested with further data, that is, more MARVEL VERBS, or other verb classes which feature a similar semantics

(e.g. FLINCH VERBS).

If the frames for AMUSE VERBS and for causative *muse over* are indeed identical, the same shifts should be possible in nominalizations on both base types. This does seem to be the case for *musement*. There is a shift to the entity representing the STIMULUS, and we also find this noun in an EVENT/ACTION reading. Above, we speculated that this is due to the polysemous nature of the verb, which can be interpreted both statively and actively, depending on the context. Further research will show whether only these polysemous MARVEL VERBS can also be regarded as caused. If in this class there are unambiguously attested stative verbs which presuppose causation but do not allow shifts to the event node, we would have to find a way how to formalize this in frames.

## 7 Conclusion

In this paper we have investigated a small subset of *-ment* productively formed derivatives of the 20<sup>th</sup> and 21<sup>st</sup> centuries to see how the polysemy found in this morphological category can be better understood. The analysis of the semantics of input and output has shown that *-ment* has clear preferences for certain types of base verb, and that the resulting derivatives show a well restricted set of possible readings.

Thus, among PSYCH VERBS the suffix *-ment* has a clear preference to attach to AMUSE VERBS, which may be best explained by base-driven morphological restrictions of the other sub-classes (e.g. ADMIRE VERBS prefer *-ation*).

On the output we find transpositional readings, i.e. from STATE verb to *state* nouns and from EVENT verb to EVENT noun. We also find RESULT STATE readings and STIMULUS readings, but no EXPERIENCER reading is attested. Notably, these shifts are not restricted to the arguments of the base verbs, i.e. STIMULUS and EXPERIENCER in the case of AMUSE verbs, but can also target non-argumental components of the semantic representation.

The frame-based analysis has demonstrated how these readings result from clearly defined shifts in the semantic structure of the respective base words. The differences between different (sub-)classes of verbs thus arise naturally from the differences in the verbal frames.

Future work will have to show whether this kind of formal approach can be extended to larger data sets of *-ment* derivatives and to other kinds of nominalizations, or indeed all kinds of derivational morphological processes.

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