

Mono-eventive Verbs of Emission and their bi-eventive nominalizations*

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1. Introduction: Unaccusativity Diagnostics

In languages like German or Dutch, the distinction between unergative and unaccusative verbs is borne out by a number of syntactic tests. Unergative verbs appear in impersonal passives while unaccusative verbs do not (cf. Perlmutter (1978)). Unergative verbs select the perfect auxiliary *haben/hebben* (to have) while unaccusative verbs select *sein/zijn* (to be) (cf. Hoekstra (1984)). Unaccusative verbs allow for the adjectival use of their past participle but not unergative verbs (cf. Zaenen (1993)). The syntactic distinction between unergative and unaccusative verbs correlates with a difference in the semantic determination of telicity and agency (cf. Dowty (1991)) in that unaccusative verbs are typically telic and non-agentive while unergative verbs are atelic and agentive.

2. Verbs of Emission: Basic Data and Previous Work

Verbs of Emission (VoE) describe an event in which the single argument produces a certain effect such as sound, light, waves, smell, substances or movement. The empirical basis of this paper are English VoEs such as *germinate*, *radiate*, *ulcerate*, *hibernate* (in the original non-computer usage), *oscillate*, *pullulate*, *vascillate*, *shudder*, *twinkle*, *flicker*, *stink*, *bubble*, *gush*, *proliferate* and German VoEs such as *keimen* (to germinate), *strahlen* (to radiate), *bluten* (to bleed), *wirken* (to produce an effect), *strömen* (to flow), *knospen* (to bud), *quellen* (to expand by soaking a liquid), *wuchern* (to grow exuberantly), *funkeln* (to sparkle).

VoEs are known to be problematic for syntactic unaccusativity diagnostics. On the one hand, German VoEs are like unaccusative verbs in that they do not appear in impersonal passives (1a) and do not license the adjectival use of their past participle (1b). On the other hand, like unergative verbs, German VoEs select *haben* (have) as perfect auxiliary (1c). However, the validity of the impersonal passive diagnostics for VoEs has been questioned

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by Zaenen (1993), who argues that impersonal passives require protagonist control over the event described and thus, because VoEs are generally non-agentive, VoEs preclude impersonal passives for reasons independent of unaccusativity.

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| (1) a. *Es wurde geblutet.
it be.AUX.PASS bleed
'It was bled.'

b. *Der geblutete Peter.
The bleed.PERF Peter
'The bled Peter.' | c. Peter hat geblutet.
Peter have.AUX bleed.PRS.PRF
'Peter has bled.' |
|--|---|

VoEs are similarly problematic with respect to their semantic determination. Because VoEs are generally non-agentive and atelic, they fall inbetween the two classes of the traditional semantic classification of intransitive verbs as either telic and non-agentive or atelic and agentive. Rappaport Hovav & Levin (2000) argue that VoEs describe events which are internally caused because they involve a special kind of causation: "some property inherent to the argument of an internally caused verb is responsible for bringing about the eventuality it describes" (Rappaport Hovav & Levin 2000, p. 287). Accordingly, Rappaport Hovav & Levin (2000) identify VoEs as agentive and thus as mono-eventive and unergative. Reinhart (2002) argues for the contrary position that VoEs are what she calls 'theme unergatives', a class of verbs semantically indistinct from unaccusatives because "the event described by the unergative derivation *the diamond glowed* could not have just come about without some source of light - the 'external cause' of the glowing" (Reinhart 2002, p. 281).

3. Nominalizations of Verbs of Emission

In this paper, I argue that VoEs denote events whereas VoE nominals denote dispositions. I motivate my analysis by taking into account the syntax and semantics of nominalizations of VoEs, which to my knowledge has not been considered in the relevant literature. VoE nominals and their verbal counterparts are special in that they identify a type of causality which does not fit the predominant internal-external causation resp. Agent-Theme dichotomy. VoEs and VoE nominals describe a causal configuration in which internal causation of an emission (of light, blood) depends on external causation, the trigger of the emission (a source of light, a skin lesion).

For German it has been argued that deverbal eventive *-ung* nominalizations are a diagnostic for a bi-eventive construction of the base verb: "a verbal construction has an *-ung* nominalization if and only if the verb is constructed bi-eventively." (Roßdeutscher 2010, p. 106). Consequently, given that bi-eventivity of intransitive verbs correlates with unaccusativity (cf. Rappaport Hovav & Levin (2000)), unergative verbs such as *arbeiten* (to work) are expected to lack *-ung* nominalizations, see (2) as opposed to bi-eventive *töten* (to kill) in (3).

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|--------------------|-----------------|
| (2) a. arbeiten | (3) a. töten |
| work | kill |
| ‘to work’ | ‘to kill’ |
| b. *Arbeitung | b. Tötung |
| work.ung.NMLZ | kill.ung.NMLZ |
| ‘working’ | ‘killing’ |

This fact about German -*ung*-Nominalization can be seen as a special case of a more general correlation between nominalization and unaccusativity, as “across languages event nominals are [...] derived from unaccusative predicates, but not from unergative ones” (Alexiadou 2001, p.78). Given these observations, event denotation of derived nominals can be considered a diagnosis of unaccusativity and bi-eventivity of the underlying intransitive predicate. Event denotation in nominals can be diagnosed e.g. by the possibility of ‘verb-like’ modification of the nominal with adverbials such as *constant* or *frequent* (Grimshaw (1990), Alexiadou (2001)). Event denotation of nominals has also been found to be relevant to the question whether nominals have argument structure or not, in that only event nominals have argument structure. Furthermore, a Theme interpretation of a nominal argument is always possible (e.g. Alexiadou (2001) for English, Ehrich & Rapp (2000) for German).

If, as the literature suggests, VoEs are unergative and event nominalizations are derived only from unaccusative verbs, we would expect that VoEs don't have derived event nominalizations. This expectation is not borne out. (4a)-(4f) are examples of English eventive *-ion* nominalizations derived from VoEs. (4g)-(4j) are examples of German eventive *-ung* nominalizations derived from VoEs, see also e.g. Sichel (2010) for similar data from Hebrew. Even more surprisingly, VoE nominals do not accept *by*-PPs (English) or *durch*-PPs (German) to express causers; rather, the causer has to be expressed in the form of a genitive argument and genitive arguments of such nominals can never be interpreted as Themes.

- (4) a. the constant germination of the plant (*by-PP)
b. the constant radiation of the caesium (*by-PP)
c. the constant ulceration of the wound (*by-PP)
d. the constant hibernation of the bear (*by-PP)
e. the constant oscillation of the pole (*by-PP)
f. the constant pullulation of the plant (*by-PP)

g. die anhaltende Blutung der Wunde (*durch-PP)
the constant bleed.ung.NMLZ the.GEN wound (*by-PP)
'the constant bleeding of the wound (*by-PP)'

h. die anhaltende Wirkung der Tablette (*durch-PP)
the constant effect.ung.NMLZ the.GEN pill (*by-PP)
'the constant effect of the pill (*by-PP)'

i. die anhaltende Strahlung des Caesiums (*durch-PP)
the constant radiate.ung.NMLZ the.GEN caesium (*by-PP)
'the constant radiation of the caesium (*by-PP)'

- j. die anhaltende Keimung des Samens (*durch-PP)
 the constant germinate.ung.NMLZ the.GEN plant (*by-PP)
 ‘the constant germination of the seed (*by-PP)’

4. Conditional Causality: Dispositions

Rappaport Hovav & Levin (2000) observe that in VoEs a “*reaction* of the argument is the source of the eventuality” where the eventuality described by a VoE “comes about because of *internal physical characteristics* of its emitter argument”(italics added, (Rappaport Hovav & Levin 2000, p. 287)). Reinhart (2002) argues that *reactions* cannot come about *just* because of internal physical characteristics. Instead, the eventuality described by VoE comes about as a reaction to circumstances *external* to the emitter argument. As already indicated, the truth of the matter seems to me that the event described by VoEs are of a complex causal structure which involves both an external cause and a causally relevant internal physical structure which enables the external cause to produce the described effect (e.g. that of producing *radiation*). Rappaport Hovav & Levin (2000) and Reinhart (2002) each describe just one part of this causal complex, thereby both failing to capture its essential complexity, of internal causality as dependent on external causality. Such relations of conditional causality are called *dispositions*. To avoid confusion, it is important to be careful about the terminology in which to describe dispositional properties. Dispositional properties (e.g. *fragile*) *reside* or are *instantiated* in an object, waiting to be *triggered* by external circumstances. Dispositional properties are opposed to *manifested* properties (e.g. *shattered*). Manifested properties identify a state of affairs which obtains at the event time. Dispositional properties cannot be observed directly but only via their *manifestations*. The standard analysis of dispositional adjectives such as *fragile* is the so-called Simple Conditional Analysis (SCA) represented by a biconditional of the form *x has the disposition to shatter when struck iff x would shatter when struck*, i.e. (5a)↔(5b), see Choi (2012).

- (5) x is fragile
- a. x has the disposition to shatter when struck
 - b. x would shatter when struck

But how do VoEs and VoE nominals relate to the SCA analysis? Given that verbs like *hibernate* identify events¹ and the SCA characterizes properties of objects, the SCA cannot be a characterization of the meaning of the verb *hibernate* as it stands. Instead, *hibernate* describes the manifestation of the disposition to hibernate, i.e. an event in which the disposition to hibernate has been triggered by a drop in food supply. That is, in contrast to property-denoting adjectives like *fragile*, VoEs *presuppose* that the triggering conditions for the manifestation of the disposition obtain: if x is hibernating, food supply must have

¹In what follows, I ignore the generic interpretation of VoEs, mainly because genericity is not specific to VoEs. However, under its generic interpretation *hibernate* denotes the disposition to hibernate whereas under its specific reading, it denotes the manifestation of this disposition. The formal semantics proposed in section 6 can account for both the generic and the non-generic reading.

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dropped, which suggests that (6) is the correct semantic characterization of the VoE *hibernate*.

- (6) $x \text{ is hibernating} \rightarrow x \text{ is hibernating when the food supply has dropped}$

Against this background, consider VoE nominals like *hibernation*. According to (4), VoE nominals pass tests for event denotation based on event modification. But consider the challenging data from tests based on event location (7a),(7b) and event aspect (7c), (7d) (cp. Grimshaw (1990), Alexiadou (2001)).

- (7) a. *The hibernation of the bear at midnight
 b. *Die Wirkung der Tablette um Mitternacht
 the effect.NMLZ the.GEN pill at midnight
 ‘the effect of the pill at midnight’
 c. ? The hibernation of the bear for/in one year
 d. ?Die Wirkung der Tablette für/in drei Stunden
 the effect.NMLZ the.GEN for/in three hours
 ‘the effect of the pill for/in three hours’

The mixed results of event diagnosis in VoE nominals indicate that event modification on the one hand and event location and aspect on the other test for different properties of the denotation of nominals. (4) shows that event modifying descriptions like *constant* or *frequent presuppose* that the described event took place. In contrast, evaluation of temporal location and aspectual class of an event description do not presuppose this. Rather, they assert that the nominal *denotes* an event. Since, contrary to their verbal counterparts, VoE nominals denote *dispositions* and not *manifestations* of these dispositions, I predict event location and aspect modifiers to be problematic with these nominals, as (7) shows.

In sum, VoEs denote events (e.g. a hibernating event), while VoE nominals denote dispositions (e.g. the disposition to hibernate). I propose to characterize the semantic relation between VoEs and VoE nominals as in (8). Since in the right conjunct of (8), the verb *hibernate* is in the scope of the modal verb, (8) captures the fact that *hibernation* does not presuppose that the triggering conditions obtain.

- (8) hibernation of $x \rightarrow x$ would hibernate when the food supply were to drop

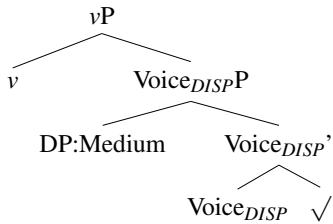
What makes VoEs special from this perspective is that the denotations of their nominalizations are different from their verbal counterparts: VoE nominals such as *hibernation* describe a *disposition* which could be triggered by appropriate external circumstances. In contrast, the VoEs themselves describe the *manifestations* of dispositions which are triggered by the appropriate conditions. The discussion of VoEs shows a difference between the linguistic description of dispositions through adjectives and verbs. For dispositional adjectives, there is no corresponding verb but the nominalization (e.g. *fragility*) describes the

disposition (e.g. *to shatter when struck*). For VoEs there is no corresponding adjective but the nominalization (e.g. *hibernation*) describes the disposition (e.g. *be likely to hibernate when the food supply has dropped*). Interestingly enough, it is dispositional adjectives like *fragile* that Reinhart (2002) brings up in her argument against Rappaport Hovav & Levin (2000)'s proposal to correlate unaccusativity with internal causation in VoEs. Reinhart's point is that world knowledge does "not distinguish a glowing event from an event of a glass breaking" (Reinhart 2002, p. 282). From the perspective of this paper, the relevant difference is not between a verb describing a glowing event and a verb describing a breaking event but between a nominal describing a disposition - the glowing of a diamond - and a nominal describing an event - the breaking of a glass. The next section spells out a formal analysis which teases apart the relevant difference in VoEs and their nominalizations.

5. Syntax and Argument Structure of Verbs of Emission

The argument structure in VoEs and their nominalizations is special: a bear is a Theme of *hibernate* insofar as the bear undergoes a directed change 'into' *hibernation* when the disposition is triggered by external circumstances. But once the disposition manifests itself, the bear becomes the immediate cause and thus the Agent of the event described by *hibernate*. That is, the thematic role of the single argument slot of a VoE is both Agent and Patient (or neither), a role which I would like to call *Medium*, an argument which has a disposition which is waiting to be triggered by external circumstances. To assign a Medium interpretation to VoEs arguments systematically, I employ a constructionalist syntax à la Hale & Keyser (1993) in which argument structure is determined by structural positions in the syntax rather than lexical theta-grids and word formation is entirely syntactic (Halle & Marantz (1993)). I follow the standard assumption that the Agent is in Spec, Voice and the Theme in Spec, Comp, vP. Accordingly, I propose that the Medium argument conflates Agent and Theme interpretation and is thus assigned to DPs which are in the specifier of Voice *and* in the specifier of the complement XP of vP, capturing the dual function of the single arguments of VoEs and their nominalizations. This configuration gives rise to a syntactic analysis of VoEs as in (9), where Voice and *v* are arranged upside down. In (9), the verbalizer *v* selects for Voice and Voice merges with the root √. Root merge with Voice also explains Rappaport Hovav & Levin (2000)'s observation of strong restrictions on possible fillers of the single argument slot of VoEs given that Voice demarcates the domain of special meaning.

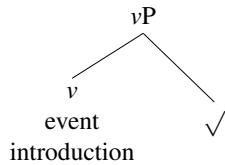
(9)



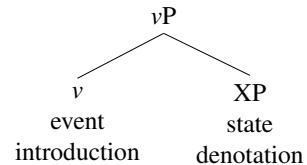
6. A Switch Semantics for Mono- and Bi-eventive Constructions

The semantic interpretation of the syntax in (9) is based on Roßdeutscher (2010)'s interpretation of Marantz (2005)'s syntactic account of mono- and bi-eventivity. Roßdeutscher (2010) distinguishes two semantic construction types of verbs, a mono-eventive construction as in (10a) and a bi-eventive construction as in (10b). A bi-eventive construction comes about via merge of a morphologically empty *v* and a state-denoting XP whereas in a mono-eventive construction the root is merged with *v*.

(10) a.



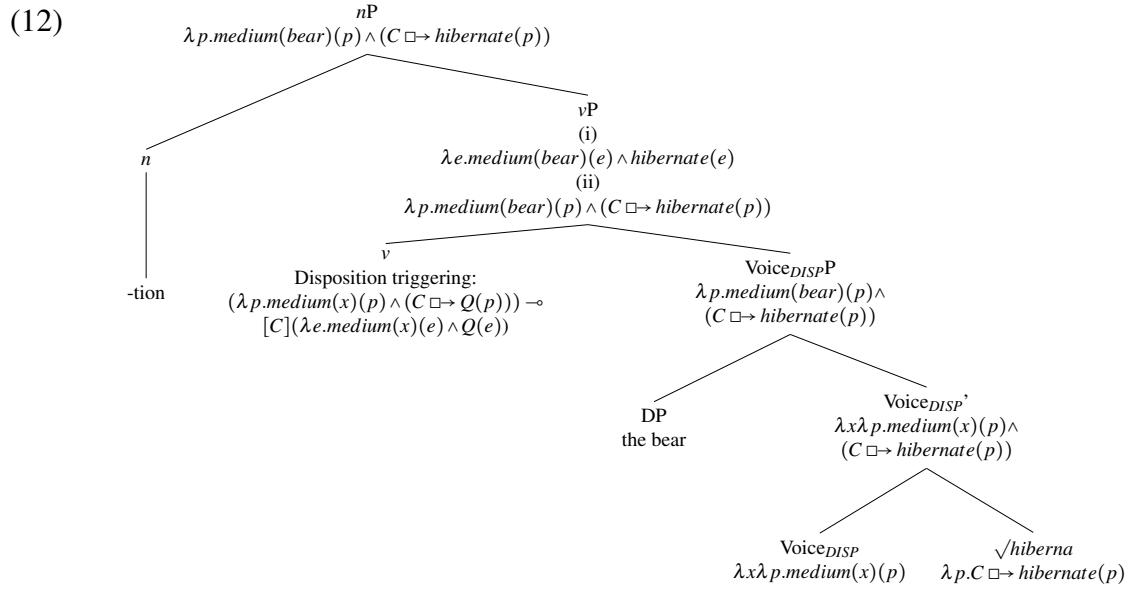
b.



To formalize the analysis of VoEs in (6) and their nominalizations (8), I employ the linear logic implication \multimap (when dispositions are triggered, they are ‘used up’) and the dynamic box operator ‘[]’(see Steedman (2002)) to model the causal relation between the nominal VoE disposition and the event identified by the VoE. ‘[]’represents a necessary causal accessibility relation between possible worlds. Using Lewis (1973)’s counterfactual operator ‘ $\Box \rightarrow$ ’and representing the disposition trigger as *C*, I propose (11) as the semantics of VoEs such as *hibernate*.

- (11) $\lambda p. \text{medium}(\text{bear})(p) \wedge (C \Box \rightarrow \text{hibernate}(p))$
 ‘if a bear hibernated when food supply dropped
 $\multimap [C] \lambda e. \text{medium}(\text{bear})(e) \wedge \text{hibernate}(e)$
 then, when food supply drops, it hibernates’

The implication scheme in (11) serves as a ‘switch’between the mono-eventive construction of VoEs and the bi-eventive construction of VoE nominals, depending on whether the triggering conditions *C* obtain or not. Given that VoEs denote events (but see footnote 1) and have a mono-eventive construction type, the semantic function of *v* is to introduce an event by triggering the conditional disposition of the Medium. In contrast, the conditional disposition of the Medium remains untouched by *v* in VoE nominals which consequently have a bi-eventive construction type. (12) gives the analysis of (4d) up to *nP*. (i) represents the verbal semantics of *hibernate* at *vP* in which the disposition is triggered by the pre-supposition of event denotation that the triggering conditions *C* obtain (e.g. a drop of food supply), where the event *e* is introduced by *v*. (ii) represents the semantics of *vP* that is passed on to the nominalizer *n* in which the disposition does not manifest itself. \sqrt and Voice are composed according to Kratzer (1996)’s event identification rule applied to properties *p*.



7. Unaccusativity Diagnostics Revisited: Predictions from Dispositions

From the analysis in (12), a number of predictions about the behaviour of VoEs and their nominalizations can be derived. First, active Voice checks for *haben* (have) as an auxiliary in perfect formation and blocks the introduction of an agent with a *durch-/by*-PP. This also accounts for the fact that the *by itself* test (13b)-(13c) is out. It should be noted, however, that VoEs allow for a *from*-PP introducing the trigger of the disposition.

- (13) a. The vase broke by itself
 b. Her cheeks glowed (*by itself)/from the cold
 c. Jane trembled (*by herself)/from anger

Alexiadou (2001)'s generalization that event nominals can only be derived from unaccusatives is preserved in that VoE nominals do not denote events but pass tests for complex event structure accidentally. Finally, dispositions are conditionalized resp. potential properties of objects. Consequently, it is to be expected that tests based on the predication of manifested properties generally fail for VoE. This is the case, as the data in (14) shows. Unlike unergatives, VoEs do not allow for middle constructions, as in (14a) and (14f). Like for unergatives, no adjectival use of the perfect participle of VoEs is possible, as in (14b) and (14g). Unlike unergatives, VoEs do not allow for resultative constructions with a reflexive in the object position, as in (14c) and (14h). Unlike unaccusatives, no resultative constructions of VoEs are possible, as in (14d), (14e) and (14i), (14j).

- (14) a. *The bear hibernates itself easily
 b. *The hibernated bear
 c. *The bear hibernated itself well rested
 d. *The bear hibernated well rested

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- e. *A drop in temperature hibernated the bear well rested
- f. *Die Tablette wirkt sich leicht.
The pill take effect REFL easily
'The pill took effect itself easily.'
- g. *Die gewirkte Tablette
The effected pill
'The effected pill'
- h. *Die Tablette wirkte sich gesund.
The pill took effect REFL healthy
'The pill took effect itself healthy.'
- i. *Die Tablette wirkte aus
The pill took effect out
'The pill took effect out'
- j. *Die Tablette wirkte den Patienten gesund.
The pill took effect the patient health.
'The pill took effect the patient healthy.'

8. Beyond Verbs of Emission: Conclusion and Outlook

I have proposed an analysis of VoE predicates according to which VoE nominals denote dispositions and are bi-eventive whereas their verbal counterparts denote events and are mono-eventive. I have remained silent on whether VoEs are unergative or unaccusative. But the mixed results of unaccusativity diagnostics could be considered as systematically singling out VoEs as a distinct class of intransitive verbs besides those classes of unergative and unaccusative verbs. In fact, the analysis at the syntax-semantics interface that I have proposed treats VoEs as a class of verbs that are neither unaccusative nor unergative and 'Medium Verbs' may be a more accurate term for what Perlmutter (1978) called 'Emission Verbs'. To conclude, I would like to mention two problems that are closely related to the question what status should be ascribed to Medium Verbs. First, Neo-Davidsonian event semantics focuses on actual events but does not incorporate any straightforward way to represent potential events such as dispositions. Such an event semantics is therefore quite limited in the range of causal configurations that it can represent. The analysis of Medium Verbs proposed here suggests that this range is too limited. Second, Medium Verbs show that the fundamental dichotomy of external/internal causation resp. Agent/Theme argument roles may not be sufficient to deal with the whole range of causal configurations that play a role in our common-sense understanding and linguistic description of the world. It may well be the case that, when taking into account that there may be more to causality than just actual and unconditional causation of an effect in a Theme by an Agent, more phenomena of the type exemplified by Medium Verbs will become visible to us.

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