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## On [V] on v

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Based on the expression of temporality in the nominal domain and its syntactic representation via the functional projections of Nominal Tense and Nominal Aspect, this article argues against the proposal that an extending-into-time perspective distinguishes the categorial feature [V] on little *v* from [N] on little *n* at LF. It demonstrates that supralelexical causation, instead of temporality, is the necessary interpretive perspective encoded in [V] on *v* and that little *n* and Voice do not share the causal nature of *v*. The force theory of causation is then employed to define causation in terms of a causal mechanism (i.e., a configuration of forces and a position vector). The force-theoretic approach to the causal nature of *v* explains how different flavors of this categorizer, that is,  $v_{\text{CAUSE}'}$ ,  $v_{\text{BECOME}'}$ ,  $v_{\text{DO}}$  and  $v_{\text{BE}'}$  refer to different patterns of force and position vectors in the causal apparatus provided by [V] on *v*.

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## 1 Introduction

Since the publication of Larson's (1988) analysis of ditransitive verbs as involving a layered V, the study of little  $v$  (or simply  $v$ ) has taken different forms. While Kratzer (1996) noted that a Voice head is responsible for the external argument (namely, agent) of a predicate, Chomsky (1995) first proposed the  $v$  head, which became an increasingly important topic and received considerable attention among linguists. Within Distributed Morphology,  $v$  is assumed to be a 'verbalizer', the head that transforms a category-neutral root into a verb. Harley (1995) and Marantz (1997) maintain that  $v$  must be present in unaccusative and unergative sentences as well as in transitive sentences. In other analyses,  $v$  has been thought of as encoding inner aspectual information (e.g., Folli & Harley 2005; Ramchand 2008; 2013). Much debate has followed since these first formulations, and many different functions have been attributed to  $v$ . I hardly attempt to summarize the diverse and insightful findings of the previous studies here. The objectives of this article are:

- To show that supralexicale causation (and not temporality) is the necessary interpretive perspective encoded in [V] on  $v$  (e.g., Wechsler 2005; Harley 2009; 2013a), and
- To argue, along the similar lines in Copley & Wolff (2014) and Copley & Harley (2015), for a force-theoretic approach to the causal nature of  $v$ .

Working in the framework of Halle & Marantz's (1993) Distributed Morphology, Panagiotidis (2009; 2011; 2013; 2015) proposes that a [V] feature on  $v$  imposes an extending-into-time perspective at LF, whereas an [N] feature on  $n$  imposes a sortal perspective at LF. In other words, Panagiotidis claims that the LF-interpretable categorial features [N] and [V], providing sortal and temporal perspectives, respectively, are what make the categorizers  $n$  and  $v$  semantically distinct. In section 2, after a brief summary of this proposal, I argue that defining temporality in nominals cannot be so easily dispensed with for three main reasons: (i) the time component in nominals provides the to-be-modified element for temporal modifiers, (ii) there is a temporal relation between predicates and their arguments, and (iii) a temporal setting is needed for the interpretation of epistemic adjectives. Then, based on evidence from the adjectival syntax, the morphological expression of time within the nominal domain and the fixed order of adjectives, I argue that the temporal dimension of nominals can be syntactically represented via Nominal Tense ( $T_N$ ) and Nominal Aspect ( $Asp_N$ ). On the basis of these arguments, I claim that temporality is not the distinctive feature of  $v$  and that Tense is not an exclusively verbal projection. In section 3 I demonstrate, with reference to the (un)grammaticality pattern found in the verbal and nominal forms of Marantz's (1997) "destroy", "grow" and "break" classes of roots, that *supralexicale causation* is the interpretive perspective encoded in  $v$ , but not in  $n$ . Here, the term "supralexicale causation" refers to the extra-root causal meaning, defined as an apparatus of

forces and a position vector. This causal apparatus licenses the linguistic expression of an external and/or internal cause not licensed by the roots alone. I further argue that Voice does not contribute to the causal meaning of the construction. My arguments rely on the theoretical assumptions of Phase Theory (Chomsky 2001; 2008; 2013) and the presence of Voice in the nominal domain. In section 4, after a short introduction to “make-a-difference” and “generative” theories of causation, following Wolff (2003; 2007; 2014), Copley & Wolff (2014) and Copley & Harley (2015), I take up a force-theoretic approach to the meaning of causation in terms of a causal apparatus that includes a configuration of various forces and a position vector. After this, I portray how this framework can be applied into the causal nature of  $v$  and how distinct flavors of  $v$ , namely  $v_{\text{CAUSE}}$ ,  $v_{\text{DO}}$ ,  $v_{\text{BECOME}}$  and  $v_{\text{BE}}$ , are differentiated in such an account. I dedicate section 5 to concluding thoughts and some issues for further research.

## 2 [V] on $v$ : A Temporal Feature?

In this section I briefly review Panagiotidis’ account of categorizers and categorial features, and provide several pieces of evidence against his proposal that [V] on  $v$  encodes an extending-into-time perspective.

### 2.1 LF-Interpretable Categorial Features

Adhering to Distributed Morphology (Halle & Marantz 1993; Marantz 1997; 2000; 2006; Harley & Noyer 1999; Embick 2000; among many others) and drawing on Embick and Marantz’s (2008) *Categorization Assumption*, that roots can appear in syntactic structures only as the complements of categorizers where they are assigned a category and become related to concepts, Panagiotidis (2009) points out that “‘noun’, ‘verb’ and ‘adjective’ are not categorial labels specified on lexical items in a pre-syntactic lexicon,” rather “roots are inserted *bare* in syntax and *the assignment of roots to categories* is a syntactic process” where “*categorizers* – a nominalizer ( $n$ ), a verbalizer ( $v$ ) and an adjektivizer ( $a$ ) – make them nouns, verbs or adjectives.”<sup>1,2</sup> Since nPs and vPs are phases, once they are constructed, they must receive phonological and semantic interpretations at the interfaces to the Sensory-Motor (SM) and Conceptual-Intentional (C-I) systems (e.g., Chomsky 2001; 2008). Panagiotidis (2009; 2011; 2013; 2015: Ch. 4) proposes that the (first) phase heads  $n$  and  $v$  are distinct categorizers because they bear different LF-interpretable categorial features,

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<sup>1</sup> Note that Embick & Marantz (2008: 6) consider  $n$  and  $v$  “category-defining functional heads,” whereas Panagiotidis (2009; 2011; 2013; 2015) believes that categorizers ( $n$  and  $v$ ) are the only possible “lexical” heads. While categorizers are “bundles of UG features bearing category,” functional heads are “bundles of UG features bearing *uninterpretable* categorial features” (Panagiotidis 2011: 366).

<sup>2</sup> For information on how much meaning a root encodes independently of its syntactic categorization, see Alexiadou & Lohndal (2017), and for more recent elaboration on the nature of roots, see Panagiotidis (2020).

namely [N] and [V].<sup>3</sup> He employs Baker's (2003) idea that category distinctions must correspond to *perspectives* on (concepts about) the world and argues that these features impose different perspectives, 'contexts', on concepts in their complements (i.e., in their phase domains). The interpretive perspective, in Panagiotidis' analysis, is necessary for the semantically underspecified and impoverished root to be interpreted at the C-I system. The categorial features [N] and [V] on the categorizers *n* and *v* persuasively "*close off* material associated with the root *exactly by providing it with a fundamental perspective for the conceptual systems to view it in*" (Panagiotidis 2009). [N] and [V], providing sortal and temporal perspectives, respectively, make the categorizers *n* and *v* semantically distinct, as described in (1).

- (1) LF-interpretation of categorial features  
 An [N] feature imposes a sortal perspective on the categorizer's complement at LF.  
 A [V] feature imposes an extending-into-time perspective on the categorizer's complement at LF.  
 (Panagiotidis 2015: 84, (7))

Baker (2003: 95) claims that nouns are semantically differentiated from verbs by "criteria of identity, whereby they can serve as standards of sameness." A criterion of identity marks nouns as kind-denoting and this lexical property gives rise to the idea that nouns encode referential power manifested as a referential index in syntax (Baker 2003: Ch. 3; cf. Wunderlich 1996). Identity is also considered to be a criterion of sortality by Prasada (2008). He notes that sortality incorporates three criteria: application, identity and individuation. The criterion of application "means that the representation is understood to apply to things of a certain kind, but not others. Thus, the sortal DOG allows us to think about dogs, but not tables, trees, wood or any other kind of thing," the criterion of identity "provides the basis for thoughts like dogs, [which] by virtue of being dogs, remain dogs throughout their existence," and the criterion of individuation states that "two instances of a kind are distinct because they are the kinds of things they are" (Prasada 2008: 6–8).

To explore what nominality means, Panagiotidis (2009; 2011: 371–372; 2013; 2015: 85–86) diverges from Baker's (2003) stance of regarding [N] as encoding kinds and employs Prasada's (2008) criteria of "application" and "identity" to define sortality. Following Acquaviva's (2009: 1) proposal that nouns are sorts, or kind-level entities, "defining the categories of entities in a speaker's conceptualization of the world," Panagiotidis then emphasizes that the sortal interpretive perspective of nominals grows out of *kinds*.<sup>4</sup>

To argue for the temporal perspective that [V] imposes on the root, following Uriagereka (1999) and referring to Ramchand's (2008) idea that "VP is the heart of the dynamic predicate,

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<sup>3</sup> According to Ramchand (2008), the phases headed by categorizers are *First Phases*.

<sup>4</sup> For the semantics of kinds, see Carlson (1977), Chierchia (1998), Müller-Reichau (2006), and references therein.

since it represents change through time,” Panagiotidis (2011: 372–373; 2013; 2015: 86–88) notes that verbal constituents are inherently (sub-)eventive by virtue of the temporal perspective contributed by the categorial feature [V] to event structures, and that Voice, Aspect and Tense exclusively combine with verbs because of the ‘extending into time’ perspective that [V] imposes on the root. In §2.2, I provide several pieces of evidence that nominal constituents possess temporal and aspectual interpretations. Also, I argue that including Tense and Aspect as functional projections in the nominal spine not only establishes links for the temporal and aspectual interpretations of noun phrases at the syntax-semantics interface but also explains the fixed order of epistemic and non-epistemic modal adjectives with respect to temporal adjectives (see also Ilkhanipour 2015; 2016). If my arguments are on the right track, then nominal constituents, like verbal constituents, are subject to Voice, Aspect and Tense systems. This ensures that a similar, if not precisely identical, extending-into-time perspective is available in the nominal domain and hence, temporality cannot introduce a plausible distinction between *n* and *v*.

## 2.2 Temporality in the Nominal Domain

Let us begin with Musan’s (1995) observation that noun phrases can be modified by various kinds of temporal expressions, as shown in (2), and that these temporal modifiers can modify nouns denoting life-time or temporary properties, as in (2a) and (2b), respectively.

- (2)
- a. clausal modifiers: [*The war when my grandfather was young*] lasted four years.
  - b. genitive modifiers: [*The sixties’ rebels*] are quite established today.
  - c. adverbial modifiers: [*The quarrel yesterday*] was totally superfluous.
  - d. adjectival modifiers: [*The present wife of Klaus*] is [*a former student of his*].
  - e. prepositional modifiers: [*The chancellor in 1989*] made some serious mistakes.
- (Musan 1995: 160, (1a–e))

Noun phrases can also be modified by aspectual adjectives, as shown in (3).

- (3) the *gradual/sudden* change in the climate

The temporal and aspectual modification of noun phrases, as in (2) and (3), leaves space for the hypothesis that nominals, like verbals, refer to situations that hold at certain times (see also Musan 1999).

Second, the unacceptability of the sentences in (4) can be best justified if we credit the arguments *my future job* and *the present president* with some temporal dimension modified by the temporal adjectives *future* and *present* (see also Enç 1987).

- (4)
- a. #Last week I was dismissed from my future job.
  - b. #The present president will be elected (president) shortly. (where every person can be president only once)

A relevant discussion of the temporal relation between predicates and their arguments can be found in Musan (1995; 1997; 1999) where EXISTENCE-IMPLYING predicates, including individual-level predicates (e.g., *to be from America*) and stage-level predicates (e.g., *to be happy*), are assumed to impose a presuppositional condition on their arguments' being in existence or alive;<sup>5</sup> the utterance *John is happy*, for instance, is acceptable only if John's lifetime (i.e., the "time" of John's existence in the present world) maps onto, or at least covers, the time of his being happy. This issue has been pointed out by Musan also in terms of noun phrases receiving temporally dependent or independent readings (Note that presuming a temporal dimension for noun phrases is crucial for Musan's discussion):

"A noun phrase occurrence is temporally dependent if and only if its situation time has to intersect with the situation time of the main predicate of its clause.

A noun phrase occurrence is temporally independent if and only if its situation time does not have to intersect with the situation time of the main predicate of its clause." (Musan 1999: 622)

Third, the acceptability of (5b) in contrast to the unacceptability of (5c) with regard to the situation uttered in (5a) indicates that the noun phrase *the probable winner* is subject to temporality: the winner is the 'probable' winner only before the game finishes. As soon as the game is over, the probable winner is not anymore the 'probable' winner; she/he is the winner or the loser. Put it precisely, the epistemic adjective *probable* is only compatible with noun phrases whose existence time is not in the past of the reference time.<sup>6</sup>

- (5)    a. The probable winner started clapping.  
       b. The game had not yet finished when the probable winner started clapping.  
       c. #The game had finished when the probable winner started clapping.

So, the modification of noun phrases with temporal expressions, the temporal relation between predicates and their arguments and the incompatibility of epistemic adjectives with noun phrases located in the past of the reference time provide evidence for considering some extending-into-time perspective for nominals.<sup>7</sup> In the remainder of this subsection, I suggest that Nominal Tense

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<sup>5</sup> For details on individual-level and stage-level predicates see Kratzer (1989).

<sup>6</sup> Compare the discussion of modal adjectives here with Wunderlich (1996: sec. 4–5) who proposes that the category of nouns lacks a possible world component and consequently is not subject to modality. Note, however, that Wunderlich does not claim that nouns lack a time component altogether, but that nouns express the more static or permanent properties, whereas verbs express the more dynamic or temporary properties. (I would like to thank an anonymous reviewer for bringing Wunderlich's work to my attention and to Dieter Wunderlich for sending me a copy of his article.)

<sup>7</sup> An anonymous reviewer, following Acquaviva (2009), pointed out that when combined with temporal expressions, nominals behave differently from verbal constituents. While I do agree with the reviewer in that temporal (and

( $T_N$ ) and Nominal Aspect ( $Asp_N$ ) are two functional heads in the extended projection of the nominal spine. I do not attempt to argue that  $T_N$  and  $Asp_N$  have the same featural specification or semantic properties as their clausal counterparts (Recall that D(eterminer) and its clausal counterpart C(omplementizer) do not have the same syntactic and semantic properties.); however, on the basis of evidence from the location-in-specifier approach to adjectival syntax, the morphological expression of time within the nominal domain, and the fixed order of modal adjectives with respect to temporal adjectives, I indicate that Tense and Aspect do combine with nominals. I argue this even though the combination of temporal markers with nominal constituents results in idiosyncratic, non-compositional readings (see also Alexiadou 2001: 59–66 and Alexiadou 2005 for interesting pieces of evidence for and against Nominal Tense).<sup>8</sup>

In accordance with Cinque’s (1994; 2010) and Scott’s (2002) proposal that adjectives are base-generated in the specifiers (Specs) of distinct functional projections to which they are associated, I consider the location of temporal adjectives (e.g., *present* and *former* in (2d)) to be Spec, $T_N$ P and the location of aspectual adjectives (e.g., *gradual* in (3)) to be Spec, $Asp_N$ P. Nominal Tense and Nominal Aspect are then two functional projections that not only provide the necessary space for temporal and aspectual adjectives but also contribute to the external and internal temporal interpretation of nouns (See also Alexiadou 2001: 51–56 for arguments on  $AspP$  in nominals).

Further, according to Lecarme (1996; 2004; 2008), Sadler and Nordlinger (2001) and Nordlinger and Sadler (2003; 2004a; 2004b), among others, nominals are inflected for tense, aspect and mood in a number of languages. Examples (6) and (7) are two instances from Halkomelem and Guaraní. In these languages, the same set of affixes mark tense on nominals and verbal predicates. Nominal past tense, for example, encoding meanings such as ‘former, ex-, late (dead)’ temporally locates the nominal. When used with a possessed inanimate noun, as in (7), the temporal marker indicates that the possession relation was in the past, or that the possessed item has been destroyed (Burton 1997: 67–68).<sup>9</sup>

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also aspectual) properties of nominals are different from those of verbals (which is an interesting topic for further research), I believe that, as indicated in examples (4) and (5), the idea that temporal constitution is inessential for nominal reference is untenable (contra Acquaviva 2009).

<sup>8</sup> The reviewer also noted that “the existence of a temporal expression does not entail Tense.” Interestingly, this is not the case only with nominals; the same point has been extensively discussed with regard to the expression of time in the verbal domain in tenseless languages (see Bittner 2005; Smith 2005; Tonhauser 2011; among others).

<sup>9</sup> Tonhauser (2006; 2007) argues that nominal temporal markers in Paraguayan Guaraní are aspect (and not tense) markers. It is beyond the scope of this paper to decide on aspect/tense analysis of nominal temporal markers in this language. However, it bears emphasizing that even with the aspect analysis, the temporal dimension of nominals can be held up since “[a]spect is also a grammatical system relating to time, ... [where] the speaker may choose how to describe the internal temporal nature of a situation” (Saeed 2009: 119).



- (6) te sqwemá:y-elh (Halkomelem)  
 the dog-PST  
 ‘the dead dog’  
 (Sadler and Nordlinger 2001)
- (7) che-róga-kue (Guarani)  
 1SG-house-PST  
 ‘my former house’  
 (from Nordlinger and Sadler 2004a)

The morphological expression of time within the nominal domain provides evidence for the idea that Tense does *not* exclusively combine with verbs (contra Panagiotidis 2011: 373; 2013; 2015: 88).

Moreover, the study of temporality in the nominal domain provides an exciting opportunity to advance our knowledge of the possible orders of adjectives. In her research, Ilkhanipour (2015; 2016) assumes that, through the appearance of, for instance, temporal adjectives,  $T_N$  represents the time of existence or occurrence of the modified noun. She argues that much like the position of epistemic and root modals with regard to Tense in the verbal spine, epistemic and root modal adjectives (e.g., *probable* and *reliable*, respectively) occupy different positions in the nominal spine with regard to  $T_N$ . This hierarchy is illustrated in (8).

- (8) [Mod<sub>epis.N</sub>P [T<sub>N</sub>P [Mod<sub>root.N</sub>P

Ilkhanipour (2015; 2016) discusses that the Persian adjective *qæbli* ‘previous’ is ambiguous: it may be interpreted as a temporal or ordinal adjective, the latter associated with the highest functional projection in the nominal domain (see also Scott 2002). She points out that when *qæbli* ‘previous’ occurs with an epistemic adjective, such as *?ehtemali* ‘probable’, it can be interpreted only in the specifier of the ordinal projection, as in (9a), and not as a temporal adjective, as in (9b). Importantly, the unacceptability of (9b) follows from the fact that the past temporal adjective *qæbli* ‘previous’ yields the certainty of being a winner and this leaves no way for the probability-denoting adjective *?ehtemali* ‘probable’ to be interpreted.

- (9) a. bærænde-ye ?ehtemali-ye qæbli (Persian)  
 winner-EZ probable-EZ previous  
 ‘the previous probable winner’  
 (Ilkhanipour 2016: 153, (27))



- b. #bærænde-ye qæbli-ye ?ehtemali (Persian)  
 winner-EZ previous-EZ probable  
 ‘#the probable previous winner’  
 (from Ilkhanipour 2016: 154, (30))

The idea so far is that Tense, Aspect and Modality are not exclusively verbal projections and that temporality is not the property that distinguishes *v* from *n*. Before setting out to discuss the causal nature of *v*, I wish to address two problematic aspects of Acquaviva’s (2008; 2009) non-temporal account of nouns. Panagiotidis’ depriving *n* from temporality is rooted in Acquaviva’s proposal that reference to temporal constitution is inessential for nouns (including continuants and occurents). There are two main points to be considered here:

First, Acquaviva (2008; 2009) takes *collection*, *growth* and *destruction* as nominalizations with deverbal interpretation (and not nouns). He claims that while these nominals are morphosyntactically nouns, their lexical semantics is entirely determined by the event- and argument-structure of the verbs *to collect*, *to grow* and *to destroy*. Contra this point of view and following Chomsky (1970; 1995; 2020) and Marantz (1997), I believe that nominals like *collection*, *growth* and *destruction* (as opposed to *-ing* gerunds) are never verbs at any stage in the derivation (see also Grimshaw 1990; Siloni 1997; Harley & Noyer 2000; Alexiadou 2001; Borer 2003). The difference in the argument structure of *growing* and *growth* in (10a–b) can be explained if we consider *growing* a nominalization, a mixed projection involving both *v* and *n*, and *growth* a noun with  $\sqrt{\text{GROW}}$  directly merged with *n* (see §3.1 for an explanation of the grammaticality pattern in (10); and see Schoorlemmer 2001; 2002 for details on mixed projections).

- (10) a. John’s/John growing tomatoes  
 b. \*John’s growth of tomatoes

Second, based on examples (11a–b) from Simons (1987), Acquaviva (2009: 2–3) writes that:

“nouns allow speakers to describe events unfolding in time as if they were complete entities that acquire and lose properties over time. We know that *argument* or *wedding* describe events, but we can speak of them as if they could undergo changes in time, as in [(11)]:”

- (11) a. The argument was calm at first, then it became heated.  
 b. The wedding moved from the church to the bride’s parents’ house.  
 (Simons 1987: 134)

The problem here is that Acquaviva takes into account only the ‘existence/change in time’ of noun phrases and neglects their ‘time of existence/change’. While the former allows speakers to see the referent of the noun phrase as a complete entity existing, moving or changing on

the timeline represented by the clausal tense (as in (11)), the latter provides a timeline where the entity/situation comes into existence/starts, develops and vanishes. Although the time of existence/change is usually implied and is recovered in the context of use, it may be explicitly stated via temporal and aspectual markers (affixes, adjectives, etc.). The time clash between the time of the occurrence of the subject argument and the time provided by the clausal Tense in (12) signifies the temporal dimension of noun phrases (see also examples (4a–b) above).

(12) #The argument of *tomorrow* was calm at first, then it became heated.

These points show, as well put by Acquaviva (2009: 3) himself, the conclusion that “verbal reference has a temporal dimension built in [...] [while] nominal reference does not, and can do without such a dimension even when referring to occurrents [I]ike all negative conclusions [...] is wide-ranging but also *weak*. It means that we cannot just apply to nouns the semantic decomposition that works for verbs. It does *not* mean that event structure never plays any role in the lexical semantics of nouns, but that it is not its fundamental ingredient.” (*Italics mine*)

In section 3, I will argue that supralelexical causation is the necessary interpretive perspective that *v* imposes on the root.

### 3 [V] on *v*: A Causal Feature

Panagiotidis’ (2009; 2011; 2013; 2015) account is based on the sortal/temporal distinction between *n* and *v*, and thus it fails to acknowledge the significant role that *v* plays in determining the argument structure of various constructions, including, most importantly, causative constructions. Wechsler (2005: 193) points out that “what is right about the little *v* hypothesis and its predecessors is the idea of a generalized grammatical source for agency or causation, apart from the inherent lexical meanings of particular verbs.” In this section, I show that supralelexical causation is the interpretive perspective encoded in *v*, but not in *n* nor in Voice.

#### 3.1 Causation: Not in *n* But in *v*

To argue that *v*, unlike *n*, introduces supralelexical causation, particularly when the root does not introduce an external and/or internal cause, I makes use of Marantz’s (1997) categorization of roots, reiterated in (13).

(13)	<u>root</u>	<u>class</u>
	√DESTROY	change of state, not internally caused (so, implies external cause or agent)
	√GROW	change of state, internally caused
	√BREAK	result (of change of state)

As shown in (14), verbs of the “destroy” class are generally only transitive while nouns of this class can be transitive or intransitive. Verbs of the “grow” class are either transitive or intransitive while the relevant nouns are only transitive, as shown in (15). And verbs of the “break” class are either transitive or intransitive while nouns of the same class do not take any arguments, as shown in (16) (Marantz 1997).

- (14) a. The enemy destroyed the city.  
 b. \*The city destroyed.  
 c. the enemy’s destruction of the city  
 d. the city’s destruction by the enemy
- (15) a. John grew tomatoes.  
 b. Tomatoes grew.  
 c. \*John’s growth of tomatoes  
 d. the tomatoes’ growth
- (16) a. John broke the glass.  
 b. The glass broke.  
 c. \*John’s break of the glass  
 d. \*the glass’s break

A possible explanation of the (un)grammaticality pattern in (14)–(16) is proposed by Alexiadou (2001: 154–155):

[...] whenever a root denotes an externally caused event such as  $\sqrt{\text{DESTROY}}$ , the specifier of D can be interpreted as an external causer (agent). On the other hand, roots like  $\sqrt{\text{GROW}}$  which denote an activity that occurs spontaneously, thus being internally caused, do not permit the external causation interpretation of the specifier of D [...]. This accounts for the unavailability of transitive nominalizations with verbs like *grow* entering the causative alternation. Crucially,  $\sqrt{\text{GROW}}$  can receive an agentive interpretation only if it is inserted under a syntactic causative head.

What I wish to highlight in the quote above is the role of “a syntactic causative head.” If we admit that the verbalizer *v*, and not the nominalizer *n*, assigns the interpretive perspective of (supralexical) causation to the category-neutral root, the (un)grammaticality pattern in (14)–(16) will be justified. This account allows the necessary causal relation to be established for the argument(s) involved in causation externally (as in (15a)), internally (as in (16b)) or both externally and internally (as in (16a)) in the verbal domain. On the other hand, the (un)grammaticality of the nominal use of these roots (i.e., where  $\sqrt{P}$  is the complement of the nominalizer *n*) reveals that *n* is not capable of providing the root with the supralexical causal

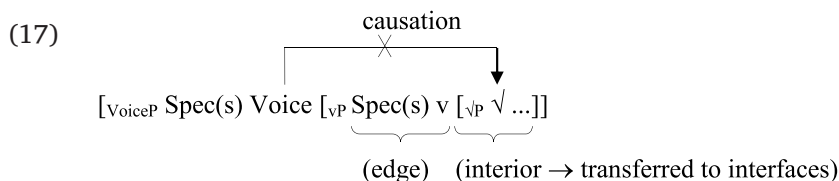
meaning; only the arguments involved in the inherent (lexical) causal relation set by the root are semantically licensed; for *destruction*, these arguments are *the enemy* and *the city*, and for *growth*, it is *tomatoes*. There is not any internal causal relation in *break* and hence no argument is licensed in its nominal form.

Another candidate for the determination of causal meaning is Voice (see Alexiadou et al. 2015, for instance). Following a substantial literature, in §3.2 I concede the idea that Voice and *v* are two separate projections. Based on the theoretical assumptions of Phase Theory and the presence of Voice in the nominal domain, I argue that Voice does not contribute to the causal meaning of the construction.

### 3.2 Causation: Not in Voice But in *v*

Voice and *v* are two distinct projections. Based on the interaction of applicative and causative morphology, the existence of two kinds of causatives, and the interaction of passive and verbalizing morphology in Hiaki, Harley (2013a) argues for a tripartite internal structure of the verb phrases, made up of VoiceP, *v*P and a lexical projection ( $\sqrt{P}$  or VP). She cogently distinguishes the external-argument introducing projection VoiceP (Kratzer 1996), which makes no lexical-semantic contribution, from *v*P whose head hosts causative and verbalizing morphology (Marantz 1997) (see also Pylkkänen 2002; Collins 2005; Alexiadou et al. 2006; 2015; Alexiadou & Doron 2012; Harley 2013b; Merchant 2013; Ilkhanipour & Sugawara 2016; among many others).

Concerning our discussion here, one may claim that the head responsible for the introduction of supralexicale causation is Voice. Two arguments can be put forth against this: first, according to Chomsky's (2001; 2008; 2013) Phase Theory, once a phase (CP or *v*P) is constructed, its *interior* (i.e., its complement) is transferred to the interfaces. After interpretation, this complement material is treated as stored and becomes unavailable for further syntactic computation – it becomes “impenetrable.” However, the *edge* of the phase, that is, the head with anything merged to it and the specifier(s) can be modified in the next higher phase. Let us consider the *v*P phase. As soon as *v*P is fully formed, the complement of *v* is transferred to the C-I system and becomes unavailable to any higher head, namely Voice; therefore, Voice cannot impose a causal perspective onto the complement of *v*. This is illustrated in (17) (cf. Travis 2013; for the Voice-*v* order see Cinque 2013 and Harley 2013a).



A counter-argument may arise here: upon the  $\nu$ -to- $v$  movement (i.e., internal merge), as is the case of incorporating the root into  $v$  (see, e.g., Harley 2007), the root escapes the interior and becomes available to Voice, so that Voice can determine the causative meaning of the sentence. This is not tenable: Voice obviously does not play any role in determining the internal cause, as is the case of *The glass broke* (16b). Moreover, even if the incorporation account is valid, a copy of the root should stay in the interior of the phase and be transferred to the C-I system for the full interpretation of the  $\nu$ P (or VP) event. This interior copy of the root will not be available to Voice and cannot be dedicated a causal perspective from outside of the phase.

The second argument against the causal interpretation of Voice comes from the presence of Voice in the nominal domain. Based on the presence of manner adverbs (that bear a tight relation to VoiceP) and the morphological reflex of the inclusion of Voice in process nominals, Alexiadou (2001: 47–50) concludes that “process nominals contain a domain that shows clear verbal properties.” While I find Alexiadou’s evidence for VoiceP in nominals quite convincing, I do not regard VoiceP as an exclusively “verbal” projection. In fact, Alexiadou does not distinguish Voice from  $\nu$  in her analysis of functional projections in the nominal domain (see Alexiadou 2001: 56–57, 112; Alexiadou 2019; Yatsushiro & Alexiadou 2020) and this is where my account begins to diverge from hers; I believe that Voice and  $\nu$  are two separate projections and that Voice can be present independent of  $\nu$ . If my account is on the right track, it also deviates from the way of the inclusion of Voice in nominals as presented in Borer (2003), Alexiadou et al. (2007), Sichel (2007), Embick (2010), Anagnostopoulou & Samioti (2013) and Bruening (2013). In their analyses, the presence of Voice is dependent on the presence of  $\nu$ , as shown in (18) below. (For earlier studies on the properties of passive nominals, see Cinque 1980; Anderson 1983; Higginbotham 1983; Grimshaw 1990; Giorgi & Longobardi 1991; Picallo 1991; Longobardi 2001; among others).

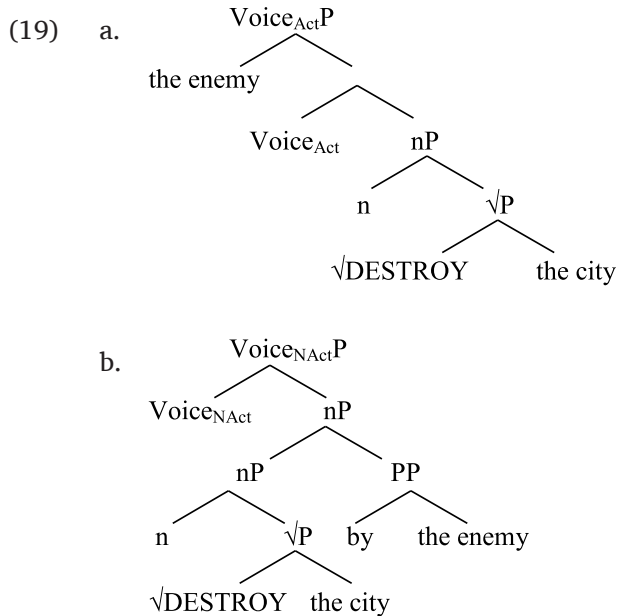
(18) [ nP [ (VoiceP) [  $\nu$ P [  $\nu$ P ]]]]

In lieu of (18), I assume that in the nominal domain, VoiceP is a projection above nP. Consequently, the two different argument structures in *the enemy’s destruction of the city* (14c) and *the city’s destruction by the enemy* (14d) mirror those of their sentential counterparts. The Active Voice head (Voice<sub>Act</sub>) provides the necessary space (i.e., its Spec) for the external argument, while the Non-Active Voice (Voice<sub>NAct</sub>) leaves out the external argument, so that it is introduced in a *by*-phrase. (19) illustrates the Voice projection in the nominal domain.<sup>10</sup> In (19a), the external argument *the enemy* is located in Spec, Voice<sub>Act</sub>, whereas in (19b), the Non-Active Voice does not

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<sup>10</sup> It is beyond the scope of this study to examine the interaction of the nominal Voice with the Possession Phrase or any other genitive case assigner (see Alexiadou 2001 and references therein).

project a Spec and hence the external argument is added to the construction as the complement of the preposition *by*.



Note that the external argument is semantically licensed by the root  $\sqrt{\text{DESTROY}}$  and the Active Voice only provides a syntactic position for its merger. The ungrammaticality of *\*John's growth of tomatoes* (15c) and *\*John's break of the glass* (16c) is not due to the lack of syntactic position but to the deficient semantic licensing; neither the nominalizer *n* nor the roots  $\sqrt{\text{GROW}}$  and  $\sqrt{\text{BREAK}}$  semantically license an external cause.

To sum up, in this section I illustrated that  $\nu$  (or more precisely, [V] on  $\nu$ ) encodes causal meaning and that supralexicial causation contributes to the semantic licensing of the external and internal arguments in the verbal domain. Different types or flavors of  $\nu$  (i.e.,  $\nu_{\text{CAUSE}}$ ,  $\nu_{\text{DO}}$ ,  $\nu_{\text{BECOME}}$ ,  $\nu_{\text{BE}}$ ) as proposed by Folli & Harley (2005; 2007) and Harley (2008; 2009), however, may appear to cast doubt on the account presented here: one may assume that only  $\nu_{\text{CAUSE}}$  or at most  $\nu_{\text{CAUSE}}$  and  $\nu_{\text{BECOME}}$  (and not  $\nu_{\text{DO}}$  and  $\nu_{\text{BE}}$ ), encode causation. I will turn back to this after elaborating on the notion of causation, what it denotes and how it is represented in  $\nu$  in section 4.

## 4 On the Nature of Causation in $\nu$

The literature on causation and the causal language is vast and burgeoning. Causation has been a central topic in the study of human learning, reasoning, perception, and language. Researchers have distinguished “singular” from “general” causation, “intentional” from “physical” causation, “direct” from “indirect” causation, “lexical” from “periphrastic” causation, and so forth. The linguistic study of causal connectives and auxiliaries has also revealed insights into human

categorization of causality (see, among others, Wolff 2003; 2007; 2014; Sloman 2005; Sanders & Sweetser 2009; Swanson 2012; Copley & Wolff 2014; Sloman & Lagnado 2015, and references therein). Copley & Wolff (2014: 53) write that “a cognitive and linguistic conversation on causation is now possible, and that this conversation is likely to advance the long-term goal of integrating linguistic theory with the science of the mind.” This section straddles the frontier between cognitive psychology and linguistics focusing on causation as a conceptual relation instantiated linguistically, via little *v*.

#### 4.1 What Is Causation?

There are two broad theoretical views of causation:

- (i) “Make a difference” theories of causation: The theories that are based on this view assume that “causation can be judged without appealing to the particular mechanism relating cause to effect” and claim that “A causes B if A’s occurrence makes a difference to B’s occurrence in one way or another” (Walsh & Sloman 2011: 23, 21). This view underlies counterfactual (e.g., Lewis 1973; 1986; 2000) as well as covariation (e.g., Cheng 1997) and manipulability (e.g., Pearl 2000; Woodward 2004) theories of causation (see Walsh & Sloman 2011: 23–24 for an overview of these theories, and Copley & Wolff 2014: 13–23, and Wolff 2014: §5.3 for problematic phenomena for dependency theories of causation).
- (ii) “Generative” theories of causation: According to this view, “A causes B if some quantity or symbol gets passed in some way from A to B” (Walsh & Sloman 2011: 21). With reference to the actual causal process linking the cause to the effect (or the causer to the causee), the theories that are based on this view propose that “causal relations are not just stipulated but rather represent mechanisms in the world that take input (causes, enablers, disablers, preventers) and generate outputs (effects)” (Sloman & Lagnado 2015: 227).

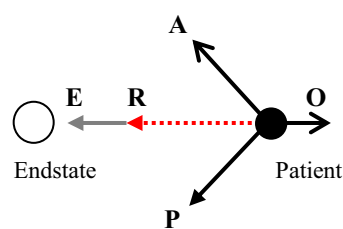
Briefly, while “make a difference” theories, based on the idea that a cause is something that makes a difference to the effect, disregard how the effect is brought about, “generative” theories of causation (i.e., causal process theories) rely on the idea that causation involves a process of transmission or exchange of some conserved quantity, such as energy, momentum, force or information, along a causal pathway from the causer to the causee (see Shultz 1982; Salmon 1984; 1994; Dowe 2000).

Wolff (2007) notes that “make a difference” theories, *dependency models* in his terms, cannot distinguish CAUSE from ENABLE, overdeterminate the cause, sometimes identify non-causal factors as causal, and as such, are better viewed of as tests for causation, not accounts of its



representation in the mind. “Generative” theories of causation, studied as *physicalist models*, on the other hand, reduce causal relationships to dynamics (i.e., the invisible properties of an event, namely the underlying energies and forces that give rise to the motions) rather than kinematics (i.e., the visible properties of an event: the shapes, sizes, positions, points of contact, etc.). The dynamics of an event enter directly into the conception of causation as they are central to causation in the actual world, and thus physicalist models put forth a better understanding of causal relations. Physicalist models, however, much like dependency models, do not distinguish causation from other kinds of relationships (Wolff 2007). To solve this problem, Wolff and his colleagues propose the *force theory* of causation (introduced as the *dynamics model* of causation), a physicalist model based on Talmy’s (1988) theory of force dynamics (Wolff & Zettergren 2002; Wolff 2003; 2007; 2014; Wolff & Song 2003; Wolff et al. 2005; Wolff et al. 2010).

According to the force theory, causation is associated with configurations of forces and an endstate vector.<sup>11</sup> Causal interactions involve an affector and a patient, and are described at two levels of analysis. At the category level, cause-related concepts are specified in terms of three dimensions: the tendency of the patient for the endstate, the presence of concordance (or opposition) between the affector and the patient, and progress toward the endstate. At the computational level, these three dimensions are redescribed in terms of patterns of forces, or vectors. Four types of force vectors are relevant: **A** represents the direction of the force exerted on the patient by the affector; **P** represents the direction of the force generated by the patient itself or its resistance to change; **O** represents the direction of the summation of the remaining other forces acting on the patient; and **R** represents the direction of the resultant force acting on the patient. In addition to these four forces, vector **E** specifies the mental representation of the patient’s location with respect to an endstate. Figure 1 is a schematization.



**Figure 1:** Forces associated with the affector, **A**, patient, **P**, and other forces, **O**, combine to produce a resultant force, **R**, that is directed toward the endstate, as specified by the position vector, **E**. (Wolff 2007: Figure 2).

<sup>11</sup> A force can be presented as a vector since it has a magnitude, a direction and a point of origin (Gärdenfors 2014: 140). Vectors are indicated in boldface.

The relationship between the category level and the computational level is as follows. The tendency of the patient for the endstate is the result of the collinearity of **P** and **E**, concordance of the affector and the patient is the result of the collinearity of **A** and **P**, and progress toward the endstate is the result of the collinearity of **R** and **E** (Wolff 2007).

What I wish to subjoin to Wolff and his colleagues' force theory here is the idea of *profiling* from Langacker's Cognitive Grammar. This will be used to differentiate the distinct flavors of  $\nu$  in §4.2. Langacker (1991; 2009) proposes that speakers, employing the conventional conceptualizations of language and cognitive processes (*construal* in his terms), can have different active characterizations of events including action chains where energy is transmitted from one entity to another. One type of the speaker's construal is profiling, which allows her/him to choose to give special prominence to (or single out as a kind of focus of attention) certain segments (i.e., substructures, including entities and/or interactions) of an action chain. Profiling is well applicable to the causal apparatus in Figure 1; different patterns of forces or composites of diverse forces and the endstate vector can be profiled, that is, different substructures of the causal apparatus can be chosen by the speaker to receive enhanced prominence. For instance, the speaker can construe the causal scene, profiling **P**, but not **A**, and possibly **R** and **O**, as is the case for *Tomatoes grew* (15b) and *The glass broke* (16b). I will get back to the details of this issue in the next subsection.

How the force theory of causation decomposes CAUSE to a finer level of detail, as explained above, and how speakers construe a causal event or scene in alternative ways give us the opportunity to plausibly account for the causal nature of [V] and to differentiate the four flavors of  $\nu$ . In §4.2 I will deal with these issues.

## 4.2 A Force-Theoretic Approach to $\nu$

Not all theories of causation can address the causal distinction between  $n$  and  $\nu$ . In order to accommodate this difference, a theory of causation must be capable of elucidating the ungrammaticality of *\*John's growth of tomatoes* (15c) and *\*John's break of the glass* (16c) in contrast to the grammaticality of *John grew tomatoes* (15a) and *John broke the glass* (16a). The causer *John* and the effect *grow/break* are the only elements necessary for "make a difference" theories to be satisfied. Both of these elements are present in (15c) and (16c), as well as in (15a) and (16a). Thus, causation as defined by these theories cannot distinguish  $\nu$  from  $n$ .

If our definition of causation involves a causal mechanism, as "generative" theories do, however, the causal distinction between  $n$  and  $\nu$  will be expounded;  $\nu$  encodes the necessary supralexical causal pathway from cause to effect, hence the grammaticality of (15a) and (16a), while  $n$  is not able to provide any causal relation supralexically, hence the ungrammaticality of (15c) and (16c). Thus, so far, we can conclude that the categorial feature [V] on  $\nu$  establishes the necessary causal process/mechanism/pathway from cause to effect. However, two questions still

remain to be discussed: first, what is the nature of the causal mechanism as encoded in [V]? And second, how can the different flavors of  $v$  be distinguished?

To answer these questions, I resort to the force theory of causation as alluded to above. There are two main reasons for pursuing this theory: first, the fine decomposition of the causal mechanism proposed in the force theory gives us the ability to discern how linguistic elements might correspond to units of cognition (here forces and the position vector, as illustrated in Figure 1). Second, the force theory of causation has been employed in the study of language and argued to be more suited to some linguistic data; Copley & Wolff (2014), for instance, argue that a force-theoretic framework offers us a better understanding of three linguistic phenomena: (i) defeasible causation in non-culminating accomplishments, (ii) agency through dispositions, and (iii) representations of causal chains. Copley & Harley (2015) also use the concept of force (i.e., input of energy) to account for the problem of non-culmination. They further apply the force theory to the composition of Vendlerian eventuality types (Vendler 1957) and discuss that stative predicates are predicates of situations, while dynamic predicates are predicates of forces. In the remainder of this section, I submit, along the similar lines as Copley & Harley, that the force theory of causation yields new insight into the causal nature of  $v$  and tells us how distinct flavors of  $v$ , namely  $v_{\text{CAUSE}}$ ,  $v_{\text{DO}}$ ,  $v_{\text{BECOME}}$  and  $v_{\text{BE}}$  can be differentiated. The proposal here differs from Copley & Harley's (2015) study in two respects: first, while Copley & Harley make use of the force theory to decompose basic Vendlerian eventuality types and replace event and world arguments with force and situation arguments, in this paper I use the force theory to differentiate  $v$  from  $n$  and attempt to apply this theory to distinct flavors of  $v$  by employing the idea of profiling. Second, Copley & Harley, employing the tools of formal semantics, come to a type-theoretic distinction between forces and situations at the syntax-semantics interface. Here, I do not use any linguistic tools to describe the nature of [V] on  $v$  or to distinguish different flavors of  $v$ ; understanding dynamic and stative situations as introduced in the force theory of causation in terms of a causal apparatus (Figure 1) and the speaker's profiling of different substructures of this apparatus are parts of the speaker's extra-linguistic cognitive capacity that, I attempt to show, provides the bases for differentiating verbal and nominal constituents.

According to Folli & Harley (2005; 2007) and Harley (2009), all flavors of  $v$  serve the verbalizing function although they express distinct structural properties and different meanings to do with the initiation, or lack thereof, of the verbal event. The activity-denoting  $v_{\text{DO}}$  selects for an agent and can take a nominal complement, while  $v_{\text{CAUSE}}$  with a causer external argument requires a small clause complement.  $v_{\text{BECOME}}$  and the stative  $v_{\text{BE}}$ , on the other hand, select for a small clause complement and do not take any external argument. Harley (2009) also points out that  $v_{\text{CAUSE}}$  and  $v_{\text{BECOME}}$ , unlike  $v_{\text{DO}}$  and  $v_{\text{BE}}$ , involve some change of state.

In order to uphold the analysis in which  $v$  encodes a causal mechanism and simultaneously make this analysis responsive to different flavors of  $v$ , it suffices to highlight the prominence that the speaker chooses to give to specific vectors or particular patterns of forces (in the spatial schema provided by  $v$ ) by employing distinct flavors of  $v$ . While the categorial feature [V] on  $v$  introduces the apparatus illustrated in Figure 1 above (i.e., a conventional conceptualization in language), different flavors of  $v$  reflect the speaker's alternate ways of profiling the (causal) scene.

$v_{\text{CAUSE}}$  reflects the speaker's accentuation of the process of the exchange of energy. At the computational level of analysis,  $||\mathbf{A}||$  and  $||\mathbf{P}||$  (double vertical lines denote magnitude) are greater than zero, but  $||\mathbf{R}||$  and  $||\mathbf{O}||$  can equal zero (see also Wolff 2007). Take, for instance, *John grew tomatoes* (15a) and *John broke the glass* (16a). In these sentences,  $v_{\text{CAUSE}}$  provides the positive  $||\mathbf{A}||$  which is not available in the roots  $\sqrt{\text{GROW}}$  and  $\sqrt{\text{BREAK}}$ . In contrast, the nominal forms *\*John's growth of tomatoes* (15c) and *\*John's break of the glass* (16c) lack  $v$ , a supralexic causal apparatus, and thus lack the positive  $||\mathbf{A}||$  necessary for the semantic licensing of an external cause (i.e., an affector in the force theory). Full profiling of the causal apparatus is observed for  $v_{\text{CAUSE}}$ ; the patient's initial and endstate positions, the affector's force and its concordance or opposition with the patient's force and other forces (if any) are all profiled imaging some progress toward the endstate via the transmission of energy from the affector to the patient (i.e., a full-fledged causal mechanism).

$v_{\text{BECOME}}$  reflects the speaker's focus on the patient's change toward the endstate. At the computational level of analysis,  $\mathbf{A}$  is not defined,  $||\mathbf{P}||$  is greater than zero, but  $||\mathbf{R}||$  and  $||\mathbf{O}||$  can equal zero. Consider *The glass broke* (16b). In this sentence,  $v_{\text{BECOME}}$  provides the positive  $||\mathbf{P}||$  which is not available in the root  $\sqrt{\text{BREAK}}$  (remember from (13) that  $\sqrt{\text{BREAK}}$  encodes only the result of the change of state). The nominal *\*the glass's break* (16d), in contrast, lacks the causal apparatus altogether and thus cannot involve the patient-related force (cf. Gärdenfors 2014).

So far, I have illustrated that a force-theoretic definition of causation as encoded in [V] on  $v$  sets forth the grammaticality pattern in (15) and (16). As noted above, for  $v_{\text{CAUSE}}$  and  $v_{\text{BECOME}}$ , it is possible that  $||\mathbf{R}||$  and  $||\mathbf{O}||$  do not equal zero. This is, in fact, the case of verbs of maintaining, such as *keep* and *stay* in (20a–b), which are dynamic but do not provoke a change of any kind.

- (20) a. The gloves keep my hands warm.  
b. My hands stay warm.

Following Talmy (1988), Copley & Harley (2015) propose that *keep* and *stay* (and other verbs of maintaining, like *sit*, *stand*, *lie*, *sleep*, etc.) involve a force that maintains a property's truth from one situation to the successor situation, against a tendency otherwise. To put this in terms of the force theory, in *keeping* and *staying*, there are  $v_{\text{CAUSE}}$  and  $v_{\text{BECOME}}$ , respectively, such that  $||\mathbf{R}||$  and  $||\mathbf{O}||$  do not equal zero, but the summation of the forces' magnitude is zero and the transition

is trivial as the endstate is the same as the initial state of the patient (see also Copley & Harley 2015).

Now let us see how the force-theoretic approach to  $v$  accounts for  $v_{DO}$  and  $v_{BE}$ .  $v_{DO}$ , as exemplified in (21), incises the initiation of a force on behalf of the affector (cf. Copley & Harley's (2015)  $v_{OCCUR}$ ).

(21) The winners dance.

Here, what is crucially profiled is vector **A** whose magnitude is greater than zero. Other segments of the causal apparatus provided by [V] on  $v$  are not involved in typical cases of activity situations. However, this does not mean that other vectors cannot be linguistically activated. See, for instance, (22) where a secondary predicate provokes the endstate vector **E**.

(22) The winners dance, some even to their deaths.

The stative  $v_{BE}$ , as in (23), makes a prominent reference to the position of the patient, that is to say, the position vector, as defined in the causal apparatus explained above, is profiled. (Note that the term "position" covers not only the patient's spatial status but also its mental, social, etc. state of being, as well as its property attributions.)

(23) The winners are excited.

There are two points to be clarified here: first,  $v_{BE}$  is different from the *stay*-type  $v_{BECOME}$  in that for  $v_{BE}$  other vectors (i.e., force vectors) and their magnitudes are not relevant and thus are not profiled, while for *stay* the interaction of forces and their total zero magnitude are of paramount importance; for *stay* there are at least two profiled forces exerted in opposite directions by the patient on the one side and by some other source on the other. The summation of the magnitude of these forces equals zero resulting in the sameness of the patient's initial and endstate positions. Second, defining  $v_{BE}$  as referencing the stable position of the patient does not make it synonymous to  $n$ . [N] on  $n$  does not provide the apparatus illustrated in Figure 1 and thus is not capable of referring to the position of the patient in such an apparatus.

To sum up, [V] on  $v$  provides a configuration of forces and a position vector, that is, a causal mechanism/apparatus. Different flavors of  $v$  then reflect the speaker's profiling of different substructures of this apparatus, that is, patterns of forces or the position vector. It should be noted that, although similar results can be found in Copley & Harley (2015), according to the present proposal, we can identify different flavors of  $v$  at an extra-linguistic level: different flavors of  $v$  encode and activate different patterns of forces regardless of the complements they will take at the linguistic level. Copley & Harley's dual nature of forces as conceptual forces (perceived inputs of energy) and linguistic forces (functions from situations to situations), on

the contrary, leads them to differentiate distinct flavors of  $v$  (all, except one ( $v_{BE}$ ), of which are predicates of forces) only when they are involved in different linguistic contexts, for instance, when they take different types of arguments:  $v_{BECOME}$  is a predicate of forces that takes a predicate of situation, syntactically represented as a small clause, as its arguments, and  $v_{CAUSE}$  ( $v_{APPEAR}$  in Copley & Harley) is another predicate of forces that takes an entity, the internal argument, as its argument, for instance.

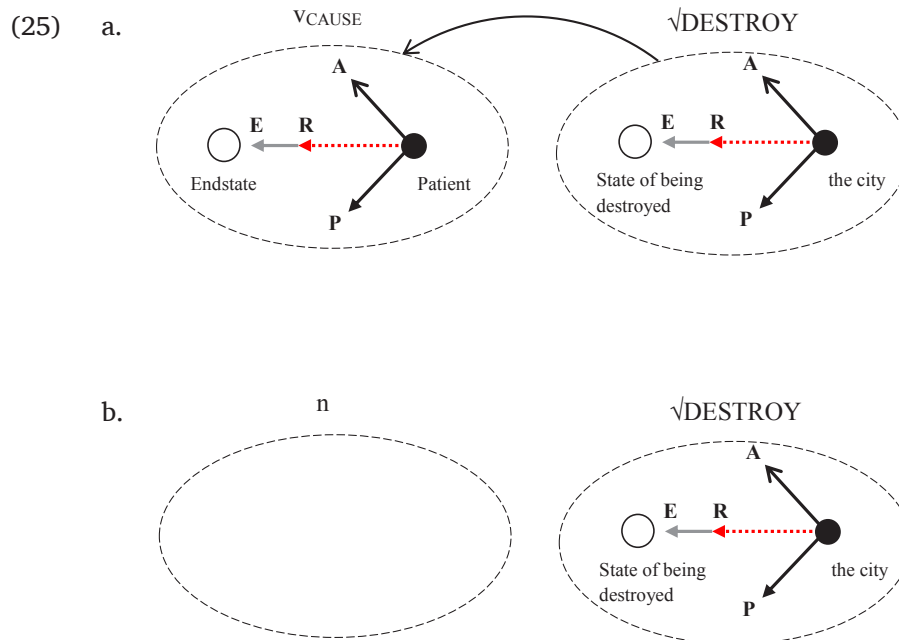
The current analysis has another advantage over Copley & Harley's, allowing us to explain the force-theoretic causal distinction between  $v$  and  $n$ . Copley & Harley's (2015) force-based treatment of predicates is a great leap forward in our understanding of the mapping between linguistic semantics and the cognitive system; however, it is limited to the verbal domain. Two issues arise here: first, dealing with schema (i.e., non-sortal) nouns, following Copley & Harley, one finds identical conceptual "net" force and situation in (14a) and (14c), repeated here in (24). Similar event and argument structures are observed in these examples, thus, one expects similar force analyses for the  $vP$  in (24a) and the  $nP$  in (24b). This is not tenable; from the discussion in previous sections, we know that due to the causal nature of  $v$  (and the non-causal nature of  $n$ ), (24a) and (24b) must have different force-based analyses.

- (24) a. The enemy destroyed the city.  
 b. the enemy's destruction of the city

Second, in Copley & Harley (2015: § 4.3) roots are treated as predicates of forces that add information about the nature of the forces introduced by  $v$ . Based on this account,  $\sqrt{\text{DESTROY}}$  in *The enemy destroyed the city* (14a) and  $\sqrt{\text{BREAK}}$  in *The glass broke* (16b) are both predicates of forces (type  $\langle f, t \rangle$ ) that modify  $v_{CAUSE}$  and  $v_{BECOME}$  respectively. If roots are predicates of forces that modify other predicates of forces (i.e., any node of type  $\langle f, t \rangle$ ), then we should accept that roots modify some predicate of forces in nominals, namely little  $n$ . This is not true; as argued above,  $n$  does not provide any configuration of forces and hence cannot be considered to be a predicate of forces.

The analysis in this paper addresses these two issues. The idea is that not only  $v$ , but also roots encode some causal apparatus (unlike  $n$ ). Different root classes, as in (13), provide different patterns of force and/or position vectors. Roots of "destroy" class show a full causal apparatus where  $\|\mathbf{A}\|$  and  $\|\mathbf{P}\|$  are greater than zero, but  $\|\mathbf{O}\|$  can equal zero. Roots of "grow" class encode a configuration of forces where  $\mathbf{A}$  is not defined,  $\|\mathbf{P}\|$  is greater than zero, but  $\|\mathbf{O}\|$  can equal zero. Remember from (13) that  $\sqrt{\text{GROW}}$  is internally caused. For roots of "break" class only the endstate vector  $\mathbf{E}$  is relevant. This model serves to explain the external/internal causal pattern of the noun phrase as well as the semantic licensing of the arguments in the nominal domain.

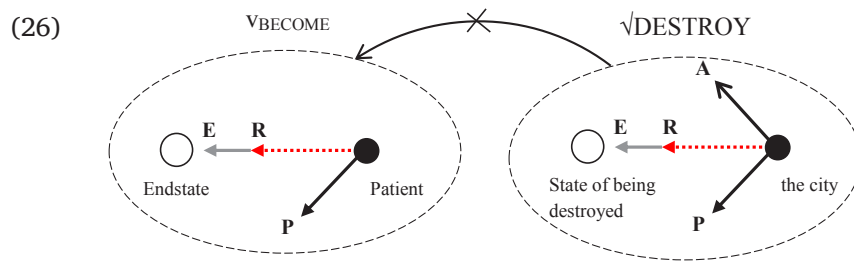
Based on this proposal, the force analyses of the vP in (24a) and the nP in (24b) can be schematized as in (25a) and (25b), respectively. Other forces (vector **O**) is disregarded here for the sake of ease. As shown in (25a), the causal apparatus of  $\sqrt{\text{DESTROY}}$  is mapped onto that of  $v_{\text{CAUSE}}$  in the verbal domain. Thus, the patient is identified as the city and the endstate is identified as the state of being destroyed. In the nominal domain, as shown in (25b), this mapping does not take place since  $n$  does not provide any causal apparatus. Thus, the causal reading of the noun phrase is merely rooted in the root's force configuration. Note that the empty space for  $n$  in (25b) does not mean that  $n$  is meaningless, but that it lacks causal meaning.



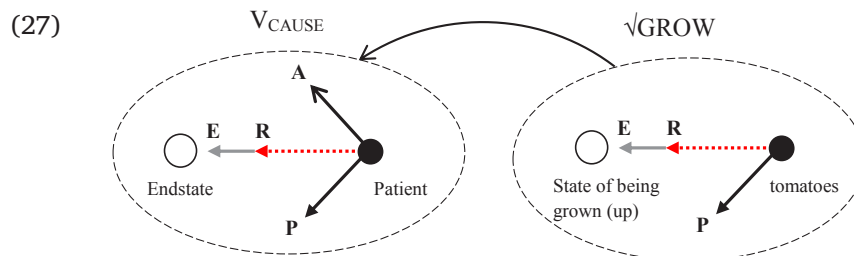
The mapping in the verbal domain (25a) is not trivial; below, it is shown that the proper mapping of these causal apparatuses is crucial to have well-formed verbal constructions.

An interesting consequence of the view proposed here is that matching the causal apparatus encoded in  $v$  with the causal apparatus encoded in the root turns out why not all flavors of  $v$  can select all types of roots (e.g.,  $v_{\text{BE}}$  does not select a root of “destroy” class): all flavors of  $v$  select roots with weaker or at most similar causal apparatus compared with theirs.  $v_{\text{CAUSE}}$  can select roots of different classes as it has a full causal apparatus itself, whereas  $v_{\text{BECOME}}$  selects roots of “grow” or “break” class, but not roots of “destroy” class since the causal apparatus in the latter involves vector **A** that is not defined in the causal apparatus of  $v_{\text{BECOME}}$ . This is schematized in (26).





On the other hand, when a flavor of  $v$  selects a root with a weaker causal apparatus (e.g., when  $v_{\text{CAUSE}}$  selects  $\sqrt{\text{GROW}}$ , as shown in (27)), the causal capacity of the phrase is augmented (e.g., an external cause can be expressed when  $v_{\text{CAUSE}}$  selects  $\sqrt{\text{GROW}}$ ). This is not the case with nominals, as seen in (15a) and (15c) above. I leave details of this final issue for further research.<sup>12</sup>



## 5 Conclusions

As causality is a research field with roots in philosophy, psychology, physics and application domains in medicine and knowledge engineering, this study attempted to offer some insight into the expression of causal relations in natural language and to set the stage for a new chapter in the field.

Concerning the objectives listed in the introduction, this article argued that we need to consider some temporal perspective for the interpretation of noun phrases and that Nominal Tense provides an opportunity to account for several issues, including adjectival syntax and the possible orderings of adjectives. Different semantic and syntactic behaviors of the clausal

<sup>12</sup> Related to this issue, in a paper, Goldschmidt & Zwarts (2016) discuss that force vectors are the necessary components of force verbs that bring about their aspectual and directional meanings and lead us to their lexical definitions (cf. my idea on force vectors as encoded in the roots). They also note that not all prepositions can be used with force verbs in German (e.g., *schlagen* ‘to hit’ requires *auf* ‘on’, whereas *ziehen* ‘to pull’ requires *an* ‘on’) and attribute this restriction to “the need to match the direction of the force vectors of the path assigned to the event with those of the set of paths denoted by the PP to arrive at a non-empty set-intersection” (Goldschmidt & Zwarts 2016: 447) (cf. my idea on the selectional restrictions of different flavors of  $v$ ).

Tense and Nominal Tense remain to be investigated; Musan's (1997; 1999) "life-time effect", "presuppositional conditions" and "information-status" as observed in noun phrases would provide clear avenues for further research. The crucial conclusion in section 2 was that the categorial feature [V] on  $\nu$  is not responsible for an extending-into-time perspective at LF.

It was then suggested that causation is the necessary interpretive perspective encoded in  $\nu$ , but not in  $n$  nor in Voice. In order to be precise in our understanding of the causal nature of  $\nu$ , the force theory of causation was applied to define causation not as change-of-state/location, but in terms of an atemporal arrangement of four types of forces and a position vector. In the light of the force-theoretic approach to  $\nu$ , the finer distinction of the different flavors of  $\nu$  was delineated with reference to different patterns of forces in the causal apparatus provided by [V] on  $\nu$ . Follow-up questions are: How does this force-theoretic framework account for the expression of external and internal cause as provided by, for instance, roots of the "destroy" class? And if a similar force configuration can be detected in roots, how does it interact with the causal apparatus of  $\nu$  in the verbal domain? Could there be, apart from syntactic reasons (e.g., Case checking), a mechanism of "force identification" that blocks, for example, the co-occurrence of  $\nu$ DESTROY and  $\nu_{BE}$ ?

The temptation to cast doubt on the causal nature of  $\nu$  by viewing causal relations as temporal relations opens up another avenue for further research. This is not truly problematic, as, though related, causal structure and temporal structure are distinct. Wolff (2007) notes that "from a force dynamic perspective, temporal priority is not a requirement of causation; rather, it is an artifact of the way forces often converge" (see also Copley & Harley 2015 and reference therein). This, however, requires careful investigation.

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## Competing interests

The author declares that she has no competing interests.

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