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Directionality in cross-categorial derivations

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What exactly is the relationship between the verb *hammer* and the noun *hammer*? Is one derived from the other, are both derived from a common source, and how can we tell? This article provides an overview of recent generative approaches to derivational directionality and reviews the different kinds of answers given to such questions, considering the diachrony and synchrony of deverbal nouns, deadjectival and denominal verbs, and similar forms. We critically survey the main empirical points argued for in different languages and evaluate the different analyses that have been proposed. We highlight where progress has been made and what open questions still remain, proposing that formal accounts can be seen as implementing one of two concrete processes, which we term Affix Imposition and Root Augmentation.

1 Introduction

Recent research in linguistics has seen renewed interest in the study of cross-categorial or category-changing derivation, by which we mean the derivation of denominal verbs, deverbal nouns, "mixed categories" with both verbal and nominal features, and similar constructions. The goals of this article are to survey the most important empirical points that have played a role in contemporary theorizing and to outline and critically review the main analyses. For reasons of space, we focus on piece-based generative approaches to cross-categorial derivation, in particular those in Distributed Morphology (DM, Halle & Marantz 1993 and much subsequent literature). Taking a typical example like English *hammer*, which can be used as either a noun or a verb, two questions arise in these approaches:

(1) a. Is one of the forms derived from the other, or are both derived from one common ROOT?
     b. If one is derived from the other, then which is the BASE and which is the DERIVATIVE?

Schematically, these questions can be presented as follows: how can we tell whether a given verb is derived from a noun (2a), the noun from the verb (2b), or both from an uncategorized root (2c-d)?

(2) a.
```
            V
         hammer
          /\
        N     V
     hammer   Ø
```

b.
```
            N
         hammer
          /\
        V     N
     hammer   Ø
```

c.
```
            V
         hammer
          /\
    √HAMMER    V
               Ø
```

d.
```
            N
         hammer
          /\
    √HAMMER    N
               Ø
```

Importantly, while the structures in (2a-b) imply that there is a *directionality of derivation* from $n \rightarrow v$ or from $v \rightarrow n$, no such directionality is implied by those in (2c–d), which illustrate two independent derivatives from one and the same root. Therefore much of the discussion in the first part of this article is devoted to the diagnostics for directionality that have been proposed in the literature to distinguish between "root-derived" and "stem-derived" lexemes. Because the distinction between these two word formation strategies is rarely clear-cut, as we will see, we introduce two further terms for word-formation mechanisms that have played a role in the literature (borrowing terminology from specific accounts of Hebrew discussed in section 2.3):

- AFFIX IMPOSITION adds a (potentially semantically vacuous) affix as input for further derivation, resulting in stem-derived words. This term is broader than "stem-derived word" because it includes cases in which a word is derived from a base that does not exist by itself and in which the affix seems to be required by lexical/morphosemantic context (section 3.1).
- ROOT AUGMENTATION creates a new root through reanalysis of the base, resulting in root-derived words. Section 4 discusses the diachronic contexts for this type of reanalysis (see also sections 3.2.1 and 3.1).

The different predictions that these analyses make will be fleshed out where relevant. Moreover, depending on whether or not one's analysis allows for phonologically empty ("zero") categorizers as in (2), Root Augmentation may be reduced to Affix Imposition with a zero categorizer. This problem is addressed in sections 2.2.5, 3.4, and 4.3.

The paper is structured as follows: In section 2 we evaluate the different arguments for and against directionality proposed in the literature. Section 3 discusses different formal approaches and their limitations, section 4 turns to the diachrony of these derivations, and section 5 concludes. We will set aside most of the literature on nominalizations, especially those with an overt nominalizing affix, given that these have already received a fair amount of attention (Chomsky 1970; Grimshaw 1990; Marantz 1997). See Wood (2021), Ahdout (2021) and the chapters in Alexiadou & Borer (2020) for recent overviews and contributions. We will not discuss deadjectival "degree achievements" for the same reason (e.g. Hay et al. 1999), and cannot do justice to any of the literature on sign languages (e.g. Abner et al. 2019) in the current paper either.

2 Arguments for directionality

2.1 Background

A core problem in cross-categorial derivation is the question of DIRECTIONALITY: in English examples like noun *hammer* and verb *hammer,* how do we decide if one is derived from the other

(or if they are two independent derivatives from the same root)? Several criteria have been proposed in the literature in order to discern the directionality of the derivation:

- **Historical**: Where the appropriate diachronic resources exist, it is often possible to find out which form was attested first in a given corpus. The usual caveats apply when considering linguistic theory: a language user does not necessarily have access to this information. Moreover, depending on the corpus and the attestation history, the lack of any form in a written record may be accidental.

- **Frequency**: The derived form is often less frequent than the base. This type of argument is useful together with historical arguments in establishing *diachronic* directionality, but it's less helpful for establishing a synchronic formal analysis.

- **Morphological/phonological**: The form of the base is expected to be preserved in the derivative; or the form of the derivative is transparently derivable from the form of the base.

- **Semantic**: The lexical-semantic meaning of the base (including idiosyncratic, idiomatic or otherwise "lexicalized" meaning) is expected to be compositionally preserved in the derivative. The extent to which this is true has been hotly debated, primarily with respect to English (section 2.2) and Hebrew (section 2.3).

- **Syntactic/semantic**: Related to the previous point, it has been argued that the event and argument structure properties of the derivative should also systematically reflect the syntactico-semantic properties of the base. Specifically, the Aktionsart of derived denominal verbs is predicted to follow directly from certain properties of their base, such as mass vs. count. Again, these arguments have primarily been tested with respect to English data.

In what follows we review how these criteria have been applied to a number of different languages.

2.2 English

2.2.1 Introduction

A longstanding question in many treatments of the English lexicon is the problem of derivational directionality in English noun—verb pairs such as *a hammer/to hammer* and *a tape/to tape*, which are at the center of a vast literature on *conversion* or zero derivation in English and beyond (Don 1993; Štekauer 1996; Balteiro 2007; Nagano 2008; Lundquist 2009; Velasco 2009; Martsa 2013; Bauer 2018; among many others; see, e.g., Dahl & Fábregas 2018; Martsa 2020; Werner Forthcoming for recent surveys of different approaches to conversion and zero morphemes). In the approaches discussed here, these forms can be treated in two different ways: as two independent synchronic derivations from one and the same root, regardless of which came first

historically, or equivalently a lexical item with variable category membership (Chomsky 1970; Lieber 1981; 1992; Farrell 2001; Borer 2013); or as a directional relationship in which one is derived from the other, in which case we would also need to identify which is the base and which is the derivative (Marchand 1964; Kiparsky 1982c; 1997; Plag 2002). We survey arguments based on morphophonological form first, followed by semantic considerations.

2.2.2 Form and stress

Kiparsky (1982a; b; c) adduces two morphophonological arguments in favor of the analysis that some verbs are root-derived, while others are derived from nominal bases.

The first argument is that true denominal verbs and true deverbal nouns preserve the stress of the base, which is assigned at the first cycle of derivation and "inherited" by the next cycle (Hayes 1980; Kiparsky 1982a; c, a.m.o). This is illustrated in column a. of **Table 1** for denominal verbs, which inherit the initial stress of the base, and in column b. of **Table 1** for deverbal nouns, which inherit the oxytone stress of the base. In Kiparsky (1982c), the generalization seems to be that "primary" (root-derived) verbs are accented word-finally and "primary" (root-derived) nouns are accented word-initially. Primary verbs without a corresponding noun also show this stress pattern, e.g., *discérn, assért, adópt,* etc.

a.	$n_{óσ} → v_{óσ}$, no shift		b.	$v_{σó} → n_{σó}$, no shift	
	a páttern	to páttern		to exháust	an exháust
	an índex	to índex		to debáte	a debáte
	an ínput	to ínput		to retúrn	a retúrn

Table 1: English $n → v$ and $v → n$ without stress shift.

In addition to these two classes, there is a third class of noun-verb pairs, illustrated in **Table 2**, in which stress shift seems to take place, in that the verb is accented on the final syllable (like in column b. of **Table 1**), while the noun is accented on the initial syllable, like in column a. These not only differ in their stress pattern, they are also argued to be semantically less transparently related to each other compared to the forms in **Table 1**. Kiparsky (1982c; 1997) therefore argues that these pairs are independent formations which receive their stress separately, rather than one being derived from the other.

a.	to permít	a pérmit
b.	to constrúct	a cónstruct
c.	to protést	a prótest

Table 2: v & n, stress shift.

Similarly, Lohmann (2017) argues based on the patterns summarized in (3) that the form of a word may signal the direction of derivation.

(3) a. Polysyllabic words with initial stress are most probably derived from nouns (cf. **Table 1**): *bóttle, hámmer, nétwork, óutline, páckage, quéstion, sílence, chállenge, chísel, cómbat, hárvest, párrot*

   b. Words that are trisyllabic or longer are most likely derived from nouns: *torpedo, barricade, interface, barbecue, camouflage, prostitute, experiment*

   c. Disyllabic words with final stress are probably derived from verbs (cf. **Table 1**, column b.): *desígn, attémpt, appróach, escápe, awárd, regrét, resólve, requést, neglect*

Some additional listing is then necessary for exceptions like *paráde, tattóo* and *canóe*, all denominal.

Another paradigm of sorts that has been pointed out is that of "triplets" such as those in **Table 3**. These triplets consist of a *v/n* pair as in **Table 2** plus a denominal verb that preserves the stress of the nominal base, as in column a. of **Table 1**.

	$V_{\sigma\acute{\sigma}}$	$N_{\acute{\sigma}\sigma} \rightarrow$	$V_{\acute{\sigma}\sigma}$
a.	to compóund	a cómpound	to cómpound
b.	to permít	a pérmit	to pérmit
c.	to protést	a prótest	to prótest

Table 3: English stress shift "triplets" (Borer 2013: 353).

In the original analysis in Lexical Phonology, these patterns arise because the (zero) affixes involved attach at different *levels of attachment*, with (possibly irregular) "level I" affixes being closer to the root than regular affixes, which attach at "level II" (e.g. Siegel 1974 and Kiparsky 1982; but cf. Borer 2013; 2014; Newell 2021 and Pöchtrager 2021). This is also meant to account for the regular past tense inflection of the denominal verbs in the last column of **Table 3**: since a level II affix (the assumed zero verbalizer) intervenes, the irregular level I inflection cannot attach to it (see also section 2.2.3 on the inflection of denominal verbs). However, in order to capture the pattern in **Table 3**, Kiparsky has to operate with both zero nominalizers and zero verbalizers at both level I and level II, as schematized in **Table 4**.

level I	*protést*$_{v\text{-}\emptyset}$	*prótest*$_{n\text{-}\emptyset}$	*permít*$_{v\text{-}\emptyset}$	*pérmit*$_{n\text{-}\emptyset}$
		↓	↓	
level II		*prótest*$_{v\text{-}\emptyset}$	*permít*$_{n\text{-}\emptyset}$	

Table 4: Zero categorizers at levels I & II (based on Kiparsky 1982c: 11).

Criticism of this argument has mostly focused on whether there is a derivational "stress shift" in verb-noun pairs with differing stress placement, such as *to protést* vs. *a prótest,* which Kiparsky treats as underived from each other. For example, Plag (2019) argues that the supposedly underived pairs with alternating stress such as the ones in the a. rows of **Table 5** actually show verb-to-noun conversion, parallel to the pairs in the b. rows in which result/event nouns are derived from phrasal verbs, descriptively by shifting the stress to the beginning of the word (comparable to stress in English compounds). If the same stress shift derives nouns from verbs in the a. rows, then these pairs cannot be used as an argument for distinguishing between root- vs. noun-derived verbs in English—rather, they would show that some deverbal (result?) nouns are derived by shifting the stress to the left, while others such as *an exháust, a retúrn, a debáte* in **Table 1** preserve the stress of the base (see Rasin et al. Forthcoming: 8–9 for similar arguments).[1]

a.	to tormént	a tórment
	to permít	a pérmit
	to constrúct	a cónstruct
b.	to gèt awáy	a gét-awày
	to lèt dówn	a lét-dòwn
	to pùsh úp	a púsh-ùp

Table 5: English noun/verb pairs with stress shift (Plag 2019: 108).

In a historical perspective, Minkova & Stockwell (2009: 9) point out that the stress shift in V $\Rightarrow$ N items appears to be a relatively recent phenomenon, with only *rebel* and *record* showing such stress shift before 1570 (which is when many Latinate borrowings took hold). To sum up, while stress shift has often been appealed to as a diagnostic for distinguishing root-derived from deverbal and denominal forms, the many (lexical, language-specific) idiosyncrasies of English compound and derivational stress have made it difficult to assess its usefulness as a diagnostic tool for derivational directionality (or lack thereof).

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[1] Lowenstamm (2014: 247ff.) does not treat the above forms directly, but points out an interesting parallel in the stress shift variation of adjectives in *-able*, (i).

(i) a. cómparable, réparable, réfutable, préferable, dísputable
b. compárable, repá(i)rable, refútable, preférable, dispútable

This alternation corresponds to the root-derived vs. deverbal distinction also in that root-derived forms, with initial stress, may differ in meaning from word-derived forms with antepenultimate stress (Oltra-Massuet 2014; Alexiadou 2018):

(ii) a. This is the cómparable model in our line
b. *This is the compárable model in our line

2.2.3 Form and irregular inflection

The second argument comes from the distribution of irregular verb inflection: Kiparsky argues that only root-derived verbs can take irregular inflectional endings and undergo ablaut, as in (4a), while true denominal verbs do not ablaut, (4b). These claims will line up with claims about the semantics of these verbs, which we put aside until section 2.2.4.

(4)   Claim about irregular vs. regular inflection
        a.   Root-derived, irregular: *string/strung, sting/stung*
        b.   Denominal, regular: *ink/inked, ring/ringed* ('provide with a ring; to band')

This distinction would also be expected under approaches in which frequency, productivity, or transparency of derivation would motivate the regular past tense inflection of denominal verbs. The question is whether any of the ablauting verbs in the root-derived class (4a) could reasonably be analyzed as synchronically denominal independently of this diagnostic—if yes, these would then constitute counterexamples to this generalization.

Of the two examples of Kiparsky (1997), *string* (*strung*) and *sting* (*stang–stung*), the latter is an inherited strong verb (OE *stingan*, Go. *us-stiggan*, ON *stinga*, OHG *stingan*, etc.) and therefore historically not a denominal verb—but there is a synchronically transparent denominal variant *to sting* that means 'provide(d) with a sting' (as in "a stinged insect") which takes regular past tense inflection, in line with Kiparsky's argument. For the second case, *to string*, a denominal analysis is diachronically established (OE *streng* 'string, rope, cord' < PGmc. *strangiz*, cf. Kroonen 2013: 483); the derived verb 'to provide with string(s)' is attested from 1400 onwards and synchronically plausible as well. As would be expected for a denominal, this verb originally inflected as a regular verb, but switched to irregular inflection fairly early on (*strung* ca. 1570+). However, it does also occur with regular past tense inflection in the synchronically transparent denominal verb meaning "provide with strings", as in *to string a guitar*. Assuming the older denominal *to string* was reanalyzed as a root-derived or "primary" verb fairly early on and acquired irregular inflection parallel to morphophonologically similar verbs like *sing, sting*, etc., this verb pair, too, behaves as predicted by Kiparsky's distinction. In other words, in those cases in which a synchronic denominal analysis seems likely on semantic grounds, we usually find a regular variant besides the (inherited) irregular past/participle. See also Plag (2002: 108) and Marantz (2013: 102) for related discussion.

2.2.4 Meaning

If there is a derivational relationship between the verb *hammer* and the noun *hammer*, then the direction of that derivation becomes relevant. On the semantic side, this means that we expect there to be a transparent and regular relationship between the meaning of the base (noun) and that of the derivative (verb). If both are root-derived, on the other hand, the meaning of

both should be determined by the root without any sort of semantic directionality between the root-derived verb and the root-derived noun. Exactly this sort of difference has been claimed for root- vs. noun-derived manner-of-motion/instrument verbs in English. In his discussion of cross-categorial derivations, Kiparsky distinguished between "true denominal instrumental verbs" which incorporate (the meaning of) the base noun (*tape, chain, button, bicycle, screw, padlock*), and "pseudo-instrumental verbs" which are underived (*hammer, brush, paddle, string, whistle, saw*). According to him, the first class is incompatible with modification by an instrument that differs from the base noun, (5), while the latter can be modified with various types of instrumental adjuncts because these verbs "do not semantically incorporate the meaning of the noun" (Kiparsky 1997: 488), (6).

(5)   "True denominal"
        a. #She taped the picture to the wall <u>with pushpins</u>.
        b. #They chained the prisoner <u>with a rope</u>.
        c. #Jim buttoned up his pants <u>with a zipper</u>.

(6)   "Pseudo-instrumental"
        a.   He hammered the desk <u>with his shoe</u>.
        b.   They brushed their coat <u>with their hand</u>.
        c.   She paddled the canoe <u>with a board</u>.

The infelicity of examples like those in (5) is argued to follow from a semantic principle of "canonical use", formulated in (7).

(7)   Canonical Use Principle (CUP, Kiparsky 1997: 482, cf. Green 1974)
        If an action is named after a thing, it involves a canonical use of the thing.

Kiparsky argues that the infelicity of (5) follows from the fact that *to tape* means 'the action of canonically using tape', thus excluding other instruments as modifiers: you cannot use pushpins to tape something to a wall. However, (7) does not apply to manner-of-motion-verbs like *hammer*, because these are not derived from nouns, hence *to hammer* describes a type of action that is carried out in a particular manner, compatible with different kinds of instruments (e.g., a shoe as in (6)a).

Moreover, Kiparsky argues that this distinction also explains the difference in grammaticality between (8a) and (8b):

(8)   Intended meaning: *I put some fertilizer on the bush/I gave the bush some fertilizer*
        a.   I fertilized the bush
        b.   *I bushed some/the fertilizer

In three-place predicates with a theme and a location argument (location and locatum verbs), there seem to be semantic rather than syntactic restrictions on which argument can incorporate:

while (8a) describes a canonical use of fertilizer, (8b) does *not* describe a canonical use of bushes (that is, it is not a canonical use of bushes to put fertilizer on them). Kiparsky notes that there are a number of verbs in which either the place or the theme argument can incorporate, such as *shelve, ice, index, string*, cf. (9), which again suggests that the restriction is semantic rather than syntactic.

(9)　　a.　John papered the shelves.
　　　　b.　John shelved the papers.

These two classes of "instrument verbs" have become known as the *tape*-class and the *hammer*-class. Kiparsky proposes that the *tape*-class is derived from the corresponding nouns, while the *hammer*-class is not—verbs of this class merely share the root of their corresponding nouns. The pseudo-instrumental *hammer*-class moreover corresponds to the apparently denominal verbs with irregular inflection discussed in section 2.2.3, which also allow various types of instrumental modifiers, (10a), while true denominals with regular inflection pattern with the *tape*-class and are incompatible with instruments that differ from the base noun, (10b). This suggests that Kiparsky's morphosemantic and morphophonological criteria do indeed pick out the same two classes.

(10)　　a.　strung up someone <u>with a rope</u>; stung <u>with a needle</u>
　　　　b. #inked a drawing <u>with crayons</u>; #ringed pigeons <u>with dye marks</u>

Criticism of the *tape/hammer* distinction (in English) has scrutinized the semantic intuition. Harley & Haugen (2007), for example, argue that *tape*-verbs are in fact compatible with instrumental modifiers, (11).

(11)　　Lola taped the poster to the wall with band-aids / mailing-labels. (Harley & Haugen 2007: 9)

This finding suggests that manner of motion or manner of use is what is relevant for this class, just like it is for the *hammer*-class: you cannot tape with pushpins, but you can with band-aids. The same goes for (12), which is infelicitous according to Kiparsky (1982c):

(12)　　?Screw the fixture on the wall with nails. (Kiparsky 1982c:12 [16])

Harley & Haugen (2007: 9) argue that (12) is fine provided that the nails are twisted into the wall, in the way screws are driven in. So both classes are compatible with instrumental modification, provided they are compatible with the canonical manner of use/motion described by the action—the CUP still applies. Moreover, both classes require *cognate* instrumental modifiers to be additionally modified or specified, (13) (from Harley & Haugen 2007: 10):

(13)　　a.　Lola hammered the metal with a ball-peen hammer / ?with a hammer.
　　　　b.　Lola taped pictures to the wall with duct-tape / ?with tape.

This, too, suggests that there is no structural/derivational distinction between the *tape* and the *hammer* class (see also Borer 2013: 351ff.). Harley (2008) develops this argument further and claims that the CUP (or CUC, Canonical Use Constraint) applies to bare nouns in general, not just in derived denominal verbs, based on Stvan (1998; cf. also Stvan 2007). Thus, bare singular nouns like *school* and *church* in (14a) and (15a) refer to generic or "institutional" uses of a location, while the use with a determiner refers to a specific location or institution at which a specific action is performed.

(14) a. John is going to school   (for education)
      b. John is going to the school   (for a specific purpose/activity)

(15) a. The pastor wants everyone to come to church once   (for service)
          a week
      b. The pastor wants everyone to come to the church   (for a specific purpose/activity)
          once a week

If denominal verb formation is the result of some form of incorporation of a bare noun (cf. section 3.3), the CUP/CUC naturally becomes relevant in these constructions—but this is a property of the bare noun, not a requirement on denominal derivation as suggested by Kiparsky's definition in (7).

Results from a series of experiments by Bleotu & Bloem (2019; 2020; 2021) also cast doubt on the original claim. In the first study (Bleotu & Bloem 2020), participants were asked to rate the acceptability of sentences following the original claim:

(16) a. He crowned her ??with a hat/with a rose garland.   (presumably nominal *crown*)
      b. Tom paddled the canoe with a board/??with a spoon.   (presumably root $\sqrt{\text{paddle}}$)

The findings indicated that what mattered for acceptability ratings was the similarity of the modifying PP to the predicate, rather than the presumed derivational history of the predicate.

Whereas the first study classified similarity of PP to verb according to the authors' intuitions, the second study asked participants to rate the similarity themselves (Bleotu & Bloem 2021). Continuing with the materials from the previous experiment, participants chose which of the two nouns was more similar to the predicate noun along three criteria (drawing on Pustejovsky 1995). Exemplifying with (16b), the following questions were presented in order to establish the similarity of *board* and *spoon* to *paddle*:

(17) a. **Form:** Which is more similar to paddle in terms of shape? i. board ii. spoon
      b. **Composition:** Which is more similar to paddle in terms of material? i. board ii. spoon
      c. **Function:** Which is more similar to paddle in terms of use? i. board ii. spoon

All three criteria predicted the results of the first experiment better than the binary classification of Kiparsky (1982c; 1997). Combining criteria improved the model fit even more, although since the criteria are correlated with one another, additional work is required in order to better understand their interplay. In sum, these studies provide further evidence that the *hammer/tape* distinction is not structural, reflecting instead a number of different semantic factors.

A similar conclusion was reached in work by Rimell (2012). In her discussion of the Canonical Use Principle, she shows that linguistic and extra-linguistic contexts are able to override the "canonical use" of a noun.

(18)　a. #I've been necktie-ing. (intended reading: wearing a necktie)

　　　b. You and your colleague work in a garment factory. On any given day you may be making gloves, socks, or neckties. At the end of the day, your colleague asks: What have you been doing today?
　　　　Answer: I've been necktie-ing.

The *tape* debate aside, Rimell (2012) uncovered a number of additional generalizations on denominal verbs in English; for Rimell (2012: 113), the decision on whether a verb is denominal, or whether the noun is deverbal, was based on assumptions in previous work as well as historical precedence.

First, the base noun cannot be interpreted as the Patient, Theme, or Holder of a result event (Rimell 2012: 40):

(19)　a. #Mary was appling at lunch today.
　　　　　(int. 'eating apples', theme)

　　　b. #Beth was hatting when I saw her.
　　　　　(int. 'wearing a hat', theme)

　　　c. #It was stuffy inside, so Lee went around windowing.
　　　　　(int. 'opening windows', result state holder)

Once the construction goes beyond a simple intransitive, the examples improve (Rimell 2012: 49):

(20)　a. #Mary was appling at lunch today.
　　　b. Mary appled Betty.
　　　c. Mary appled into the room.
　　　d. Mary has been appling (it) up all week.

Second, denominal verbs tend to be transitive (Rimell 2012: 52).

(21)　a. *juice* 'to get juice from something' (not #'to drink juice')
　　　b. *bag* 'to put something in a bag' (not #'to carry a bag')

On her account, "denominal" verbs are still actually root-derived. Affixed nouns cannot be zero-converted into verbs (cf. section 2.2.5), so she concludes that only roots can get "converted" in this sense (adapted from Rimell 2012: 43):

(22) a. The employee was typically happy during off-work hours.
     b. #The employee frequently happinessed away during the off-work hours.

To sum up the *tape/hammer* debate, we have seen phonological, morphological, and semantic arguments that have been adduced and critiqued in an attempt to distinguish two classes of denominal verbs in English. While much of this debate has focused on the question of diagnostics for derivational directionality and for determining the direction of the derivation, a related line of work argues against any directionality in *tape/hammer* noun/verb pairs at all, as we will see next.

2.2.5 Zero categorizers and zero directionality

Borer (2013; 2014) provides a detailed discussion of zero-derived noun–verb pairs like the ones discussed so far, arguing against derivational directionality of any kind in these pairs. This discussion is part of a longer argument against zero categorizers, or covert categorizing morphology. On conceptual grounds, Borer (2013: 322) argues that accepting zero categorizers means essentially abandoning the idea that morphophonological complexity correlates with or reflects morphosyntactic complexity, opening the door to circular or unfalsifiable arguments. She also adduces several empirical arguments, in particular the absence of pairs such as those in **Table 6**, where an affixed form is converted. This observation suggests that zero derivation is only available for underived noun–verb pairs (Myers' Generalization: Zero-derived words do not permit the affixation of further derivational morphemes, Myers 1984; Pesetsky 1995).

	$n \rightarrow *v$				$*n \leftarrow v$		
a.	a salut-ation	b.	*to salutation	c.	*a crystallize	d.	to crystal-lize
	an arriv-al		*to arrival		*an instantiate		to instant-iate
	a writ-er		*to writer		*a fatten		to fatt-en

Table 6: Illicit Ø-derived verbs and nouns (Borer 2013: 325).

Borer argues that if *salut-ation* is a deverbal noun from *salute* (hence $v \rightarrow n$), in the same way that $walk_n$ is from $walk_v$, and if moreover $-Ø_n$ and $-ation_n$ are allomorphs of the same categorizing head, then it is difficult to see why derivation with $-Ø_n$ should only be possible for verbs like *walk, talk* and *run,* but not for the verbs in column d. of **Table 6**. The same holds, *mutatis mutandis,* for the illicit zero verbalizers in column b.

Moreover, the existence of verbs derived from compounds whose second member contains a zero-derived noun (e.g., *wardrobe—to wardrobe, blackboard—to blackboard, chicken wire—to chicken wire*, etc.) suggests that the issue is not just derivational complexity, but the presence vs. absence of overt derivational morphology (compare the ungrammaticality of **to city neighborhood,* **to student fellowship,* **to law enforcement*; Borer 2013: 326).

An alternative way of understanding this distribution is in terms of contextual allomorphy, in which Ø and the various other nominalizing morphemes (*-(a)tion, -ment, -al*) as well as *-ing* compete for insertion at different levels of structure. Borer and others have noted that zero-derived nouns in English are generally not compatible with verbal argument structure, that is they tend to be simple event nominals or result nouns, rather than argument structure (AS) nominals, as shown by their inability to take arguments:

(23)   a. *the walk of the dog for three hours
       b. *the dance of the fairy for a whole evening
       c. *the (gradual) fall of the trees for two hours/in two minutes

On the other hand, nominalizers like *-ation* in (24c) are compatible with arguments (contrast the zero-derived noun in (24a)), while gerund-/participle-forming *-ing* can even take accusative case objects, (24d), in addition to genitive case objects, (24b).

(24)   a. *the salute of the officers by the subordinates
       b. the saluting of the officers by the subordinates
       c. the salutation of the officers by their subordinates
       d. the subordinates' saluting the officers (was upsetting)

This could be taken to suggest that there are structural differences in the *height of attachment*, or selectional properties of these different affixes (Anagnostopoulou 2003; Harley 2009; Alexiadou et al. 2015; Alexiadou 2017; Grestenberger 2020; Iordăchioaia 2020; Ahdout 2021). Assuming that the zero nominalizer attaches to the root or a low verbalizing projection (*v*, Res) predicts that it will never compete with "higher" nominalizers like *-ation* and *-ing* which select a larger amount of functional structure, and hence that it will also not be compatible with verbal argument structure. This still leaves the question to be answered why zero derivation in English is restricted to "first phase" nominalization and verbalization, or to categorization in the strict sense, rather than derivation. We will return to this problem from a diachronic perspective in section 4. Note, however, that there are exceptions to this generalization even in English, such as the the zero-derived AS nominals in (25) (Harley 2009: 341).

(25)   a. the frequent *murder* of journalists
       b. the frequent *capture* of American privateers by the king's cruisers
       c. the more frequent *defeat* of moderate candidates

See also Lieber (2018) for evidence that zero-derived "conversion nouns" in English are compatible with different types of argument structure.

2.2.6 Neurolinguistic and experimental approaches

As discussed in section 2.2.4, Bleotu and Bloem (2019; 2020; 2021) provide experimental evidence against the *tape/hammer* distinction in English denominal verbs. A different type of neurolinguistic approach to the issue of derivational directionality is offered by King et al. (2016), who asked whether it is more likely that one of the forms is derived from the other, or that both are derived directly from an abstract root like $\sqrt{\text{HAMMER}}$ (Vigliocco et al. 2011). Their intuition is that if there were two distinct lexical primitives *hammer*$_N$ and *hammer*$_V$, then the situation is tantamount to homophony, which has a recognizable neural signature. Yet if they are both the result of a categorizing affix attaching to a root—as in DM and related approaches—then the neural signature should resemble that of affixation. The findings lend support to this latter view, according to which both forms are derived from a single source, the root.[2]

Sharpe & Marantz (2017) show that nouns and verbs in English do have certain formal characteristics that can be uncovered in a large enough dataset. A range of phonological and lexical variables were used to predict the noun/verb ratio for ambiguous words like *tape*. The more a word diverged from the "typical" form for its lexical category (verb or noun), the slower response latencies were. Distributional factors were also investigated in work by Plag (2002), who observed a tendency for bases to be more frequent than derivatives. Out of 92 English adjectives ending in *-able*, only 7 derivatives were more frequent than the base. Similarly for verbs ending in *-ize*, only in 11 out of 102 forms was the derivative more frequent. Plag suggested that derivatives have a narrower range of meaning, which makes them appropriate for fewer contexts.

2.3 Hebrew and other Semitic languages

2.3.1 Cluster preservation

The discussion of cross-categorial derivation need not center on zero derivation. In Semitic languages like Hebrew, morphological marking can be used to decide which form in a pair is the base and which is the derivative.

In her important work on denominal verbs in Hebrew, Bat-El (1994) provided morphophonological evidence that certain verbs are derived from underlying nouns. In this context, it's important to remember that a typical Semitic word is made up of a root— usually containing three consonants—and a prosodic and segmental pattern. For many pairings of noun

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[2] See also Ševčíková (2021) for a study of directionality in Czech nouns and Li et al. (2020) for a crosslinguistic study using vector-space representations in natural language processing.

and verb, there is no obvious way to tell whether one is derived from the other or whether both are derived from the abstract consonantal root, (26); here we are again speaking in descriptive terms, leaving the formal analysis to section 3.2.

(26) Some forms in $\sqrt{\text{ʃmn}}$ (Arad 2003: 743); verb forms are given in 3SG.M past:
    a. *ʃemen* 'oil' (N)
    b. *ʃuman* 'fat' (N)
    c. *ʃamen* 'fat' (A)
    d. *ʃimen* 'greased' (V)
    e. *hiʃmin* 'grew fat' (V)

What Bat-El (1994) showed is that sometimes, the base has phonological characteristics that are preserved by the derivative in a way that would be unexpected were the derivative to be derived directly from the root. The core insight relates to the preservation of consonant clusters.

In (26e) we saw an example of a verb in the template *hiXYiZ*, where X-Y-Z are placeholders for the root consonants. Let's now examine another verb in that template, *hiʃprits* 'gushed, splashed'. The first "slot" is occupied by /ʃ/, the second by /pr/, and the third by /ts/. But why was this template chosen, rather than the one in (26d)? That choice would have led to the non-existent **ʃiprets* or **ʃpirets*. The answer is that *hiʃprits* contains the most optimal preservation of the cluster /ʃpr/ from the base noun *ʃprits* 'gush, splash'. The forms in the other verbal template are less faithful, in that sense, as summarized in (27).

		Base			ʃpr	i	ts
(27)	✓	Derivative		hi	✓ʃpr	i	✓ts
	✗						
		Derivative	✗ʃ	i	✗pr	e	✓ts
	✗	Derivative	✗ʃp	i	✗r	e	✓ts

Some more examples from Bat-El (1994: 578) are reproduced in (28), where the non-existent verbal forms either do not preserve the cluster, (28a) or are phonotactically illicit, (28 b–c). See additional examples in Laks (To appear).

(28)   a. *flik* 'slap' → *hiflik* 'slapped' (**filek*)
       b. *praklit* 'lawyer' → *priklet* 'practiced law' (**hipriklt*)
       c. *guʃpanka* 'approval, seal' → *giʃpenk* 'approved' (**higʃpink*)

Another kind of segmental transfer occurs in forms such as those in (29), also from Bat-El (1994: 580). Here the vowel of the monosyllabic base persists in the derived verb, even though it's not a typical vowel for that verbal template; see Ussishkin (1999; 2005) for further discussion of this kind of data, including the well-formedness considerations that lead to the final segment being doubled.

(29)   a.   *boks* 'box (blow)' → *hitbokses* 'boxed (fought)' (*hitbakses*)
       b.   *xok* 'law' → *xokek* 'legislated' (*xikek*)
       c.   *ʔot* 'sign' → *ʔotet* 'signaled' (but also *ʔitet*)

Many of these cases are loanwords. This is where the diachronic consideration kicks in: since we know for a fact that the borrowed noun existed before the native verb, we know not only that the verb is the derivative, but also that the phonological reasoning is consistent with the history of these words. What this all means is that we have phonological evidence for the noun being the base and the verb being derived from it, at least in these cases. Nevertheless, we will see in section 3.2 that there is no knock-down argument for Affix Imposition (or rather Template Imposition) over Root Augmentation here.

2.3.2 Word-derived and root-derived words

What we have seen so far are cases in Modern Hebrew where a form has certain consonant clusters, or certain vowels, which only make sense if they refer to an earlier stage of the derivation: to the base. A different kind of evidence is adduced by Arad (2003), who drew attention to cases of *affix* preservation. Here, a consonant which is part of the nominal pattern persists in a verb, even though it would not have been part of the original root or verbal template. A typical example is the noun *misgeret* 'frame', originally from the root $\sqrt{sgr}$:

(30)   Forms derived from $\sqrt{sgr}$ (after Arad 2003: 746):
       a.   *seger* 'closure' (N)
       b.   *sograim* 'parentheses' (N)
       c.   *sgira* 'closing' (N)
       d.   *sagur* 'closed' (A)
       e.   *misgeret* 'frame' (N)
       f.   *sagar* 'closed' (V)
       g.   *histager* 'cocooned himself' (V)

Arad draws our attention to the verb *misger* 'framed', which has one consonant "too many". Her claim is that the /m/ persists since the verb is derived from the noun *misgeret*, rather than from the root $\sqrt{sgr}$. This denominal derivation takes the consonants from the base noun, turning it into a derived verb; the vowels are of the verbal template, not the nominal pattern, as in (31).

(31)   a.   ✓ $\sqrt{sgr}$ → *misgeret*$_N$ → *misger*$_V$
       b.   ✗ $\sqrt{sgr}$ → *misger*$_V$

Additional examples are given in (32). We can call these *miXYeZ* verbs, where the initial *m-* is carried over from the nominal prefix.

(32) *miXYeZ* verbs (Arad 2003: 749fn8):

	Derived verb		Base noun		Root
a.	*mixzer*	'recycled'	*maxzor*	'cycle'	$\sqrt{\text{xzr}}$
b.	*misxer*	'commercialized'	*misxar*	'commerce'	$\sqrt{\text{sxr}}$
c.	*mixʃev*	'computerized'	*maxʃev*	'computer'	$\sqrt{\text{xʃb}}$

Similar cases involve *tiXYZ*, *hitXaYZen* and *iXYeZ*, exemplified in turn in (33)–(35). The choice of template follows from the quadrilateral nature of the base.

(33) *tiXYeZ* verbs (Arad 2003: 749–750fn):

	Derived verb		Base noun		Root
a.	*tixzek*	'maintained'	*taxzuka*	'maintainance'	$\sqrt{\text{xzk}}$
b.	*tikʃer*	'communicated'	*tikʃoret*	'communication'	$\sqrt{\text{kʃr}}$
c.	*tifked*	'functioned'	*tafkid*	'function'	$\sqrt{\text{pkd}}$

(34) *hitXaYZen* verbs (Arad 2003: 752fn):

	Derived verb		Base noun		Root
a.	*hitxaʃben*	'settled accounts'	*xeʃbon*	'account'	$\sqrt{\text{xʃb}}$
b.	*hitkamtsen*	'acted miserly'	*kamtsan*	'miser'	$\sqrt{\text{kmts}}$
c.	*hitbaxjen*	'complained'	*baxyan*	'one who often cries'	$\sqrt{\text{bkj}}$

(35) *iXYeZ* verbs (Kastner 2020b: 194–195fn):

	Derived verb		Base noun		Root
a.	*izker*	'commemorated'	*azkara*	'memorial service'	$\sqrt{\text{zkr}}$
b.	*ixles*	'populated'	*uxlusija*	'population'	$\sqrt{\text{kls}}$
c.	*irgen*	'organized'	*irgun*	'organization'	$\sqrt{\text{rgn}}$

How strong is this type of evidence? The answer depends on one's assumptions about the Hebrew verbal system. Some authors have proposed that Modern Hebrew is witnessing the innovation of new verbal templates; see Schwarzwald (2016) for discussion. Under that view, there are simply new templates *miXYeZ*, *tiXYeZ* and so on, which the triconsonantal root is slotted into as usual. Another idea is that a new quadrilateral root like $\sqrt{\text{msgr}}$ is "extracted" and slotted into an existing verbal template as usual; this is Root Augmentation.

The last relevant case discussed by Arad (2003) is the idea that verbs derived directly from a root might have phonological idiosyncrasies, whereas denominal derivatives don't (Arad 2003; Kastner 2019). For example, roots beginning in /n/ often drop their first segment in certain templates, but nouns do not. If a verb in the relevant template does have this /n/, that might be because this verb is derived from a base noun. The verb *hitsil* 'rescued' is coined from the root $\sqrt{\text{ntsl}}$, which does showcase the initial /n/ in other words, so the verb is derived from the root:

(36) a. *nitsol* 'survivor' (N)
      b. *nitsel* 'exploited' (V)
      c. *hitsil* 'rescued' (*hintsil) (V)

But the verb *hingid* 'juxtaposed' should be seen as derived from the noun *neged* 'against', since the /n/ is preserved (#*higid* is attested but as a different word, from a different root with a different meaning, $\sqrt{\text{jgd}}$ 'told'). Additional examples include those in (37), and see Ouhalla (2016) for a similar case study in Moroccan Arabic.

(37) Phonological regularization in denominal verbs (Arad 2003: 772):

	Derived verb		Base form		Root
a.	*hingid*	'juxtaposed'	*neged*	'against'	$\sqrt{\text{ngd}}$
b.	*hintsiax*	'commemorated'	*netsax*	'eternity'	$\sqrt{\text{ntsx}}$

While the thrust of the argument is fairly clear, each individual case does open up opportunities to debate how convincing it is, and whether the verb might be derived from the root after all. Arad (2003) actually makes a more nuanced claim: the semantics also reflects the meaning of the base, in parallel with the phonology.

2.3.3 Derived semantics

Arad (2003) is well-known for the claim that the semantics of the derivative reflects that of the base. Not only is the phonology of Hebrew *misger* 'framed' derived from that of its base *misgeret* 'frame', but also its semantics: the meaning 'is to put something in a frame', and not anything having to do with closure, parentheses, or any of the other meanings which words derived directly from $\sqrt{\text{sgr}}$ might have, (30).

The original claim centered around what Arad (2003; 2005) called Multiple Contextualized Meaning: When we look at the range of meanings a root has in different verbal templates and nominal patterns, we find that the only one available for a denominal verb is that of the noun it's derived from. For example, $\sqrt{\text{sgr}}$ might have one meaning in *sagar* 'closed', another in *hisgir* 'extradited' and yet another in *misgeret* 'frame', but once one of these forms is taken as a base for further derivation, the other meanings are no longer accessible. Accordingly, *misger* 'framed' cannot possibly mean 'closed' or 'extradited'. We could see this generalization as an operational definition of semantic relatedness.

The immediate problem is that we don't have a robust metric for semantic similarity or relatedness. Nevertheless, it's possible to use Hebrew in order to estimate how closely related a base and its derivative are in general.

Some authors have critiqued a stronger version of the original claim, focusing on semantic *predictability* even though Arad (2003) did not center on predictability as such (but rather on the

attested meanings that can be found in different instantiations of the root). For example, Rasin et al. (Forthcoming) argue against a strong version of predictability by focusing on examples such as *mixzer* 'recycled'. The issue is that while the root $\sqrt{\text{xzr}}$ has a number of meanings related to "returning" like those in (38), the verb in question ought to have been derived from (38d) according to the morphophonology (given that the prefix *m-* is carried over to the novel verb). But the meaning of (38e) is not immediately predictable from that of (38d).

(38) a. *xazar* 'returned somewhere'
      b. *hexzir* 'returned something to someone'
      c. *xizer* 'courted someone'
      d. *maxzor* 'cycle', 'period'
      e. *mixzer* 'recycled'

Let's pause for a moment to remind ourselves of the original claim. The exercise we need to perform for the recycling example is to look for another verb with that original root. We have a few in (38a–c). Those meanings are not the meaning of the verb *mixzer*, so by that metric Arad's generalization holds.[3]

Setting that misunderstanding aside, the broader question in the context of the current paper remains: is 'recycling' predictable from 'cycle', in Hebrew or any other language? Are the two meanings as closely related as the noun 'frame' is to the verb 'framed'? As we noted, the field lacks an established battery of diagnostics (though see Harley 2014 on evaluating the relatedness of suppletive pairs). The extreme cases identified by Aronoff (2007) and revisited by Harley (2014) are useful: his argument was that there is no common meaning to the words in (39), even though all share the same root $\sqrt{\text{kb}\int}$. Historically all share some particular kind of pressing, but the gap standing between the explicit morphological analysis and an explicit semantic analysis is still as wide in Hebrew as it is in any other language.[4]

(39) a. *kvi∫* 'road'
      b. *kibu∫* 'occupation'
      c. (*melafefon*) *kavu∫* 'pickle'

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[3] The same holds for the 'childish' example discussed by Rasin et al. (Forthcoming). This misinterpretation of Arad (2003) also obviates the phonological objections raised by them. They claim that the verb *hintsiax* 'commemorated' does not have the same meaning as *netsax* 'eternity', so there's no reason to think the verb is denominal, in which case the fact that the initial /n/ is attested in both forms is irrelevant to their morphological relatedness. But according to Arad's metric, the verb is denominal: looking at other verbal templates, *nitseax* means 'defeated' and *hitnatseax* means 'argued publicly (with)'. "Commemoration" has to do with "eternity" and not with either of those other meanings. The verb is denominal after all.

[4] Kastner (2020a) attempted to use quantitative tools from Natural Language Processing in order to gauge semantic relatedness, only to conclude that they are not yet able to handle the intricacies of Hebrew morphology.

2.4 Greek

The distinction between root- and category-derived words was also introduced into the discussion of *deverbal* formations, for example in Modern Greek (MG). MG has two different suffixes that form passive participles/verbal adjectives, *-men(os)* and *-t(os)*, which are described as verb- vs. root-derived in Anagnostopoulou (2003), Alexiadou & Anagnostopoulou (2008), and Alexiadou et al. (2015). Some examples are given in **Table 7**.

Verb	*-menos*	*-tos*	
vrazo	*vras-**menos***	*vras-**tos***	'boiled'
anigo	*anig-**menos***	*anih-**tos***	'opened; open'
klino	*klis-**menos***	*klis-**tos***	'closed'

Table 7: *-men(os)* vs. *-t(os)* participles (Anagnostopoulou 2003: 11).

The structural difference (*v-* vs. root-derived) between these two suffixes is posited based on the syntactic and semantic differences between them: 1) *-menos* has event implications, *-tos* does not (though see below), 2) *-menos* is compatible with manner adverbs, *-tos* is not, 3) *menos*-participles can occur with agent *by*-phrases, *-tos* cannot, 4) *-menos* is part of periphrastic verbal constructions such as the periphrastic passive, while *-tos* is not, and 5) only *-tos* can be negated with the adjectival negative prefix *a-*. These diagnostics are discussed at length in Anagnostopoulou (2003) and Alexiadou et al. (2015) and suggest that *-menos* and *-tos* are "outer" and "inner" suffixes, respectively, with the former attaching to an existing verb (outside of a categorizing head, Marantz 2007), while the latter attach to the root or before the first categorizing head.

At first glance, this picture is confirmed by the morphology of *menos-* vs. *tos*-participles: The former co-occur with morphology that is generally analyzed as verbalizing/*v*-related, namely suffixes and "theme vowels" such as *-iz-, -o(n)-, a/i-, -ev-, -az-, -en-*. The latter are generally not compatible with these markers, as shown in **Table 8**.

a.	aspr-**iz**-men-os	ler-**o**-men-os
	white-V-PTCP-NOM.SG.M	dirty-V-PTCP-NOM.SG.M
	'whitened'	'dirtied'
b.	*aspr-**is**-t-os	*ler-**o**-t-os
	white-V-PTCP-NOM.SG.M	dirty-V-PTCP-NOM.SG.M

Table 8: *v*-attachment of *–menos* (a.); no *v*-attachment of *–tos* (b.; examples adapted from Anagnostopoulou & Samioti 2014: 85).

In a perfect world, the MG participial suffixes would therefore show how form and meaning are directly correlated with the amount of functional structure of the base of derived word forms. Unfortunately, these generalizations do not hold exceptionlessly. Anagnostopoulou and Samioti (2013; 2014) show that three different types of *tos*-participles can be distinguished in MG, among them a class that forms ability/possibility participles that are compatible with agent *by*-phrases, (40), instrument phrases, and adverbial modification, suggesting that they contain more verbal structure than just the root after all.

(40)   I   istoria   tou   ine   pist<u>ef</u>-**t**-i   *apo olous.*
       the story.F   his   is   believe-PTCP-NOM.SG.F   by   everyone
       "His story can be believed by everyone." (Anagnostopoulou & Samioti 2014: 92, ex. 28a)

Moreover, some *tos*-forms are compatible with verbalizing morphology, such as *-ef-*(*-ev-*), underlined in (40), and the ones illustrated in Table 9.

a.	axn-**is**-t-os	axn-**iz**-o
	steam-V-PTCP-NOM.SG.M	steam-V-1SG.NONPAST
	'steaming hot'	'steam'
b.	vathoul-**o**-t-os	vathoul-**on**-o
	hollow-V-PTCP-NOM.SG.M	hollow-V-1SG.NONPAST
	'hollow'	'hollow out'

Table 9: *v*-attachment of *-tos* (adapted from Anagnostopoulou & Samioti 2014: 97).

However, despite the presence of this verbalizing morphology, *tos*-participles like those in **Table 9** are not eventive, but denote characteristic *states*. They are also not compatible with adverbial modification, instrumental phrases or agent *by*-phrases (the diagnostics that were used to distinguish between "inner" *-tos* and "outer" *-menos* above). Finally, the *-tos/-menos* distinction does not correlate with the availability of idiomatic meaning, another diagnostic for distinguishing between "inner" (root-derived) and "outer" (categorized stem-derived) affixation in this approach: both *tos-* and *menos*-forms *can* have idiomatic meanings (though they do not always inherit the idiomatic meaning of their base), with or without an overt verbalizer.

To explain this conundrum, Anagnostopoulou & Samioti (2014: 99) propose that "*-tos* selects expressions naming events" and adopt the root ontology of Harley 2005 (see section 3.3), in which roots denote events, things, or states. Event-denoting roots like those of *klino* 'close', *dino* 'give', etc., can combine with *-tos* directly, while roots that denote things need to first combine with a verbalizer in order to be compatible with *-tos*, essentially a type of Affix Imposition: the base is categorized as an event to make it compatible with the selectional requirements of *-tos*.

This is the case for instrument verbs and other denominal-looking verbs that resemble those at the heart of the *tape* debate, e.g., *afrizo* 'foam', *axnizo* 'steam', *vidono* 'screw', *koumbono* 'button', etc., which Anagnostopoulou and Samioti argue to be root- rather than *n*-derived based on the diagnostics of Kiparsky (1982c).

Importantly, adding verbalizing morphology to these roots does not make the resulting *tos*-forms "eventive" in the way the passive participles in -*menos* are, since the exceptional *tos*-forms are incompatible with eventive interpretation, event-modifying adverbs, and instrument/agent phrases. Anagnostopoulou and Samioti are thus forced to dissociate verbalizing morphology from the event- and argument-introducing projections *v* and Voice, effectively reducing the MG verbalizing suffixes to a morphophonological rescue operation for defective roots (see Bertocci 2017 for a similar analysis of Latin 1st conjugation verbs).

The important (if frustrating) lesson is that morphology alone cannot be used to distinguish between root- and category-derived participles in MG, and neither can meaning: Idiomatic meaning is found both in *tos*- and in *menos*-participles (though Marantz 2013 suggests a solution for this conundrum; see the discussion in section 3.1 below). This case study is therefore an important reminder that even in languages with relatively rich categorizing and derivational morphology (compared to English), we are faced with essentially the same problems in identifying derivational directionality and structural complexity that we encountered in the *tape* debate.

2.5 Interim summary

In this section, we have gone over the empirical evidence that has been adduced in favor of (and against) the notion of derivational directionality. We have reviewed morphophonological, semantic, and psycholinguistic arguments and diagnostics for determining directionality, with a focus on the overall empirical picture. In the next section, we focus on theoretical issues raised by the notion of derivational directionality and the formal analysis of the different classes of derived verbs that have been proposed in the literature.

3 Analyses in generative morphology
3.1 Introduction: Types of word-formation processes

As we turn to the formal treatment of the patterns described above, it's important to once again tease apart two sets of issues that overlap throughout the literature. We have described the arguments which guide us in deciding which form is the base and which is the derivative. In this section, we segue into discussion of whether a form is the result of Root Augmentation, derived from an abstract root (cf. Farrell 2001), or of Affix Imposition, derived from an (existing) categorized word.

Transferring the insights of Arad (2003; 2005) back into English within DM, the structures of the two verb classes from the *tape* debate can now be understood as in (41), assuming for the moment a Kiparsky-style approach.

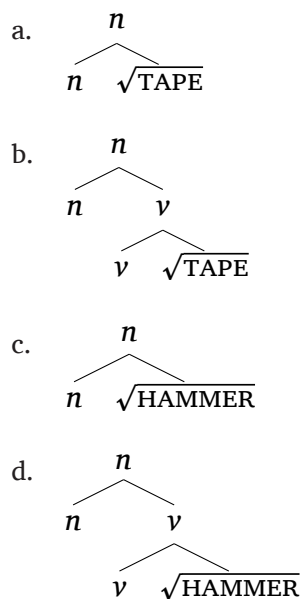(41)   Kiparsky/Arad analysis of the verbs *tape* and *hammer*.

a.
```
        v
       / \
      v   n
         / \
        n  √TAPE
```

b.
```
        v
       / \
      v  √HAMMER
```
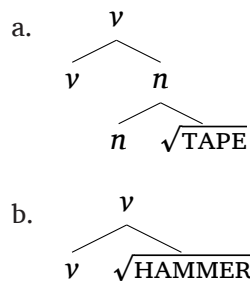
Yet each analytical choice needs to be argued for. The following options are also possible:

(42)   Alternative structures for the verbs *tape* and *hammer*.

a.
```
        v
       / \
      v  √TAPE
```

b.
```
        v
       / \
      v   n
         / \
        n  √HAMMER
```
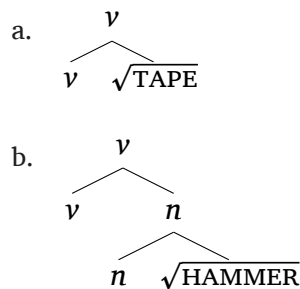
(43)   Possible structures for the nouns *tape* and *hammer*.

a.
```
        n
       / \
      n  √TAPE
```

b.
```
        n
       / \
      n   v
         / \
        v  √TAPE
```

c.
```
        n
       / \
      n  √HAMMER
```

d.
```
        n
       / \
      n   v
         / \
        v  √HAMMER
```
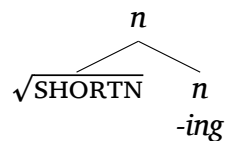
But the problem runs deeper: consider the English noun *shortening* /ˈʃɔrtnɪŋ/, a fat used in baking (this useful example is due to Alec Marantz, p.c). How can we be sure whether it's synchronically derived from the verb *shorten* (plus a phonological rule that deletes the medial syllable nucleus; contrast regular trisyllabic /ˈʃɔrtənɪŋ/, participle of 'to shorten', and cf. *lightning* in McCarthy 2005) or from an innovated root we might call $\sqrt{\text{SHORTN}}$ /ˈʃɔrtn/? The former is a case of what we call Affix Imposition (44a), and while it might seem intuitive, it cannot always be easily distinguished from Root Augmentation, (44b).

(44) a. **Affix Imposition**

```
              n
           ┌──┴──┐
           v      n
        ┌──┴──┐  -ing
        a      v
     ┌──┴──┐  -en
  √SHORT   a
           Ø
```
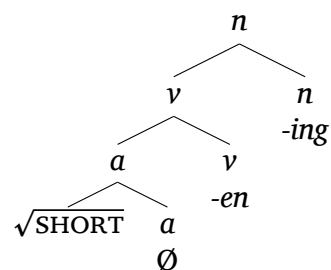
  b. **Root Augmentation**

```
           n
        ┌──┴──┐
    √SHORTN   n
             -ing
```

Since morphological arguments such as the presence vs. absence of overt nominalizers or verbalizers are not always decisive (sections 2.3–2.4 and coming up in 3.2), researchers have turned to the semantic content of roots and the context of their interpretation (for example, the adjectival and verbal heads in (44a) would be semantically vacuous in the "baking fat" interpretation). Moreover, if semantic primitives such as boundedness, mass/count, or event/thing/state can be properties of roots, for example (e.g., Harley 2005; Anagnostopoulou & Samioti 2014), or if roots can be "nominal" or "adjectival" (Levinson 2014; Coon 2019; Henderson 2019), it follows that at least some apparently cross-categorial derivation could really be de-radical derivation (section 2.2).

But even if not, it's been proposed that some component of lexical meaning may survive only certain cycles in the derivation. Idiomatic interpretation ("special meaning") and polysemy resolution have played an important role in distinguishing between de-radical and category-based derivation. In generative approaches, the "Marantz/Arad Hypothesis" (e.g., Marantz 1997; Arad 2003), (45), is a common starting point and basically states that root meaning is determined in the first phase, that is, via merger with a category-forming head (inspired by Arad's work as summarized in section 2.3.3).

(45)　The Marantz/Arad Hypothesis (Anagnostopoulou & Samioti 2014: 81)
　　　Roots are assigned an interpretation in the context of the first category assigning head/ phase head merged with them, which is then fixed throughout the derivation.

Marantz (2013) further elaborates on this by distinguishing between idiomatic meaning—which can be assigned to complex words, phrases and even full sentences—and contextual allosemy of roots and functional heads (Levinson 2010; Wood 2021), which is determined strictly locally. With respect to derivation, this rules out "semantic flip-flopping" (Marantz 2013: 105): a change in root meaning in the context of one category head, and a switch to another root meaning at the next category head. In other words, derivation based on something that is already categorized is expected to display compositional meaning that builds on the meaning of the base and cannot "skip" an intermediate categorizing head. This idea is captured by the "(non-)compositionality generalization", (46).

(46)　The (non-)compositionality generalization (Anagnostopoulou & Samioti 2014: 85)
　　　When affixes attach directly to the root, idiosyncratic meanings may arise. When affixes attach outside category defining heads, the result is a meaning predictable from the meaning of the stem.

As we've seen in sections 2.3–2.4, (46) does not always result in a clear-cut picture: the Hebrew data don't implicate strong predictability, while Greek *-tos* sometimes attaches directly to the root and sometimes to a stem consisting of root + verbalizer, not necessarily in correlation with a corresponding difference in idiosyncratic meaning or "predictability". Marantz (2013) essentially argues that (46) is only true for cases in which the categorizing morphology is semantically contentful — "semantically vacuous" categorizers can be skipped for the purpose of meaning computation (much like phonologically empty intervening nodes are skipped for purposes of contextual allomorphy, cf. Embick 2010 among many others).

Determining the contextual conditions on polysemy and idiomatic meaning of roots and stems is thus an important preliminary for formal approaches to cross-categorial derivation because the answer restricts the types of derivations that are compositionally possible in these approaches. With this background in mind, in section 3.2 we draw once again on Hebrew, which has been argued to exemplify these issues most clearly. We then discuss different ways of transferring these insights into languages like English beyond the attempts in (41)–(43), approaching it through the syntactic work by Hale and Keyser (section 3.3) and translating it into a Spanning account (section 3.4).

3.2 DM lessons from Semitic

3.2.1 Morphophonology

Recall from section 2.3 that there are good morphophonological reasons to believe that a recent Hebrew coinage like the verb *misger* 'framed' is derived, at least diachronically, from the nominal

base *misgeret* 'frame'. Researchers have had to contend with the morphophonological processes that create derivatives from bases, leading them to construct general hypotheses on word formation. Taking denominal verbs as a case in point, we identify four families of hypotheses.

(47) **H1: Consonant-to-Verb**: Take only the consonants from the base noun, treat them as a string, and slot the vowels where they need to go. There is no reference to a "root". From *misgeret*, take *msgr*, and then insert vowels according to prosodic well-formedness conditions: *misger*. The phonology needs to know that it is only looking for consonants.

This approach is a non-starter, because as we saw earlier, denominal derivations must know which consonants form clusters: the verb 'to troll someone' is *hitril* and not **tirel* because the grammar wants to preserve the cluster /tr/ from *trol* 'troll'. As Bat-El (1994: 572) notes, an ordered string of consonants is not enough, so Consonant-to-Verb is ruled out. Her own proposal is as in (48).

(48) **H2: Melodic Overwriting** (Bat-El 1994): Take the base noun in its entirety and rewrite only the vowels, in whichever way makes the most phonological sense. This is Stem Modification/Melodic Overwriting, which relies on syllabification to get the right outcomes. The morphology needs to know that the consonants it's extracting from the noun are clustered in certain ways, without making explicit reference to a "root", but this knowledge is indirect. Cluster preservation is a side effect of Stem Modification, not an explicit principle (e.g. Bat-El 1994: 579).

This approach has been critiqued on several grounds. Faust & Hever (2010) explain that some notion of a root is still implied, while also providing empirical arguments against this kind of analysis. To take one concrete argument, Faust & Hever (2010) and Faust (To appear) ask why the noun *fokus* 'focus'—which has no clusters that need preserving—gives us the verb *fikes* 'focused (something)' and not **hifkis*. Their answer is that the grammar knows first which template it is going to select, based in part on cluster preservation, and then inserts the noun. On a pure Stem Modification approach, the clusters would have dictated the choice of template.

Discussions of this hypothesis often end up arguing "for" or "against" the root as a theoretical and empirical construct in Semitic, whereby in our view the evidence weighs heavily towards the root (Kramer 2006; Faust & Hever 2010; Kastner 2019). See also Kastner & Tucker (submitted), who point out that within DM at least, the question of whether the "root" exists is irrelevant given that the theoretical object is available by assumption. The final two hypotheses rely on the notion of the root.

(49) **H3: Template Imposition** (Arad 2003; Faust & Hever 2010): Take only the consonants from the base noun, treat them as a complex phonological object with internal structure (a "noun"), and insert them into their slots in a template. From the noun *trol* 'troll', the tuple *tr-l* is extracted, and then placed into the verbal template *hiXYiZ*.

The term "Template Imposition" is from Faust & Hever (2010); we believe that Arad (2003) subscribes to the same view, although she did not make it explicit. Our generalization beyond Semitic is therefore Affix Imposition. For discussion of the exact point in the morphophonological derivation in which the phonological content of the abstract root gets invoked in Semitic (and consequently whether it undergoes "early insertion"), see Faust (2016).

(50)　　**H4: Root Augmentation** (Goldenberg 1994): Take the consonants from the base noun, treat them as a novel morphological object (a novel root), and insert them into their slots in a template accordingly. This means creating $\sqrt{trl}$, $\sqrt{\int prts}$ or $\sqrt{msgr}$ and deriving a new verb in the appropriate template.

This view essentially assumes that there are two types of roots: primary roots and augmented roots. Augmentation of the root can take various shapes, including clustering of two segments.[5]

On all four views, the original syllabification of the base is discarded at some point.[6] The two approaches that best account for the data are Template Imposition and Root Augmentation. But how can we tell whether the input is the string *trl* or the root $\sqrt{trl}$, the string *msgr* or the root $\sqrt{msgr}$, when in all cases the clustering is taken care of by the choice of template?

One avenue to consider is nominalizations whose base is "wrong" in some sense. The Hebrew nominalization *kibuʃ* 'occupation' should be derived from a verb in the template *XiYeZ*, but there is no verb *kibeʃ 'occupied' (Kastner 2019; Ahdout 2021). The only reasonable base is the verb *kavaʃ* 'occupied' in the template *XaYaZ*. Another example is *haxtala* 'changing a baby's diaper', which is not derived from a morphologically related *hixtil but is related to the verb *xitel* 'changed a baby's diaper'.[7] Even more striking is a noun like *hadata* 'religionization', which does not have any verb associated with it as a possible base but nonetheless has the form of a nominalization derived from a verb in the template *hiXYiZ*. Regardless of how these derivations are analyzed—and the nominalizations do pass the tests for Complex Event Nominals (Grimshaw 1990 et seq), except perhaps in the case of *hadata* 'religionization'—there seems to be another derivational step between the root and the nominalization. Perhaps this step is the extraction of an Augmented root, and perhaps it's a process of Template Imposition; both approaches would need to be developed further before we can tell what their predictions are.

Brice (2017) conducted a visual masked priming experiment to test whether a denominal verb like *letaxker* 'to debrief', from the noun *taxkir* 'debriefing, inquest', is more directly related to the base noun or to the underlying root $\sqrt{xkr}$. He found that the base noun primed the derived form whereas a verb derived from the underlying root, *laxkor* 'to investigate', did not. This result

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[5]　Faust & Hever (2010) point out that Rosén (1977: 120) makes a similar distinction, claiming that the augmented root (which he calls the *radical*) has replaced the root "in all living derivation processes" in contemporary Hebrew. See also Faust (2015) and Berman (2003) for related insights from developmental studies.

[6]　We set aside the possibility that new templates are created, as mentioned in section 2.3.2.

[7]　The verb might be back-formed from the noun in this case. Thanks to Odelia Ahdout (p.c.) for discussion.

speaks for a theoretical model like Template Imposition and against both Melodic Overwriting and Root Augmentation, assuming that the entire noun is the input to the final verbalizing step.

For the time being, then, we do not know of formal ways to tease the two analyses apart. The answer might depend on what we think the semantic properties of the derived form should be, a question we turn to next.
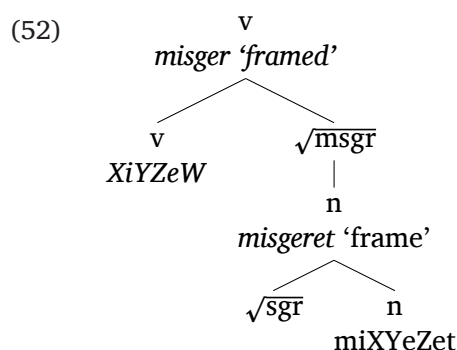
3.2.2 Morphosemantics

A recurring theme in our overview has been the idea that a derived form should share the semantics of its base to some extent, with the semantic relationship mediated by the derivational process. Keeping in mind the analytical options discussed above, we can again disentangle Template Imposition from Root Augmentation.

Under Template Imposition—which is what we believe Arad (2003) had in mind—the base noun is taken as a string, its consonants are preserved, and that string is inserted into a verbal template. This is the familiar structure in (51).[8] Note that the suffixed -*et* in the original noun, a SG.F marker, would need to be excluded from the derived form somehow; cf. the discussion of *destruct-ion* in Borer (2013).

(51)

v
misger 'framed'

    v   n
XiYZeW   *misgeret* 'frame'

        $\sqrt{\text{sgr}}$ n
                miXYeZet
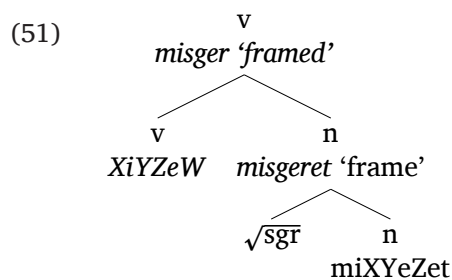
Under Root Augmentation, a novel quadrilateral root $\sqrt{\text{mXYZ}}$ (in this case $\sqrt{\text{msgr}}$) would be "extracted" or derived, as in (52):

(52)

v
misger 'framed'

    v $\sqrt{\text{msgr}}$
XiYZeW

            n
        misgeret 'frame'

        $\sqrt{\text{sgr}}$ n
            miXYeZet

---

[8] The verbalizer is simply given as v in these trees, abstracting away from the possibility that additional structure such as Voice heads might be involved in the Semitic templates.

How is the semantic generalization accounted for in each case? Under Template Imposition, the by-now familiar idea is that the base noun transfers its semantics and only its own semantics to the derived verb, regardless of other meanings its own underlying root might have; for generalized Affix Imposition, other intervening functional heads might be semantically null (say with *-en-* in *short-en-ing*). Root Augmentation would need to say that the extracted root has only the semantics of the noun, in which case that is the only meaning the augmented root can give the derived verb.

Again, it's difficult to tease these two accounts apart without committing to specific notions of predictability. One might ask why, if we extract a novel root like $\sqrt{\text{msgr}}$, we don't see it used in other templates. A reasonable answer is that these coinages are fairly recent, and not all templates are equally productive, so it's common for a new root to only be instantiated in *XiYeZ* (and in templates derived from it by valency-altering operations such as passive *XuYaZ* and anticausative *hitXaYeZ*). Better tests are still lacking.

3.3 L-syntax

3.3.1 Conflation and its benefits

Another influential approach to denominal verb formation is based on work by Hale & Keyser (1993; 1998; 2002; 2005), who argue that unergative intransitive verbs in noun–verb conversion pairs in English are denominals formed via *conflation*. This is illustrated in (53), in which the (nominal) complement *dance* moves to and "conflates" with a selecting verbal projection to form the unergative verb *dance*.[9]

(53)
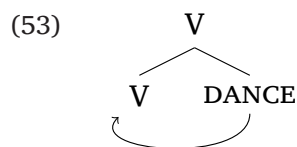
Hale and Keyser's definition of conflation is given in (54).

(54)   Conflation (Hale & Keyser 2005: 16):
        a head X^0 may enter into the Conflation relation with the head of its complement C if X^0 selects C.

Conflation is essentially a "stricter" version of incorporation in the sense of Baker (1988). Both obey the Head Movement Constraint (Travis 1984), but canonical incorporation can target anything

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[9] We refrain from assigning a label to the element DANCE in (53) because Hale and Keyser remained equivocal as to the exact category of the complement—they refer to it as "nominal complement" and "nominal root" in Hale & Keyser (2005), and use "NP" in, e.g., Hale & Keyser (1993). Cf. the discussion of Harley's work below and in section 2.2.4 and of Bleotu 2019 in section 3.3.4, in which "nominal root" and "bare noun" are also used more or less interchangeably.

in the complementation domain of the selecting head X^0 (including elements in the specifier of a selected projection), while conflation obeys "strict complementation" (Hale & Keyser 2002: 59) between the selecting head and the head of its complement (defined via mutual c-command between the selecting head and the maximal projection of its complement). Whether conflation is actually a subtype of incorporation/head movement or a purely phonological operation is still a matter of debate (Hale & Keyser 2002: chap. 3, Bleotu 2019: 52ff.).

Hale and Keyser thus argue that argument structure can be reduced to syntactic structure and that the observed cross-linguistic uniformity of thematic roles derives from structural restrictions on argument selection in the VP (for example, whether an argument is merged as a complement or as a specifier of V) and whether conflation takes place.

Harley (1999; 2005; 2011) expands on this approach and argues that different argument structure classes arise from the combination of a small set of light verbs (or verbalizers) with the meaning of the complements they select. In this approach, unergative verbs like English *walk, dance*, etc. structurally consist of an agent-selecting verbal projection DO which conflates with its internal argument (a bare noun).

The thematic uniformity of these verbs then follows from the fact that the functional projection that introduces (or s-selects) the external argument is always the same (v_{DO}). In the same vein, unaccusative verbs of the causative alternation (e.g., English *clear, redden, blacken*) are structurally deadjectival; they consist of a verbal projection BECOME which conflates with a selected adjective. Location and locatum verbs (discussed in more detail in Kiparsky 1997; Harley 2005; Acedo-Matellán & Real-Puigdollers 2015; Bleotu 2019: ch. 6) consist of a light verb *put/cause* which conflates with a location/ground argument of a selected PP (location verbs, e.g., English *bag, bottle, pocket, shelve*) or with a locatum/figure argument of a selected PP (locatum verbs, e.g., English *bandage, butter, dress, house, paint, saddle, shoe*).

In these approaches, analytic unergatives/unergative light verb constructions in languages like Basque are structurally identical to synthetic unergatives in languages like English: Both consists of a light verb and its complement, but they differ in that the selected noun moves into/ *conflates with* the selecting verbal projection in languages like English—and if this projection happens to be phonologically zero (e.g., for diachronic reasons, cf. section 4.3), this conflation will create the effect of conversion.

Importantly for our purposes, the morphological and semantic properties of the incorporated base noun should be reflected in the derived verb. Work by Harley (1999; 2005; 2011) argues that the boundedness of the incorporated element and its ability to take a complement determines the Aktionsart of the derived verb. Harley thus explicitly links telicity in denominal verbs to the incorporation of a [+bounded] complement, drawing a parallel to the "measuring out" of unincorporated theme-like arguments. **Table 10** summarizes the basic root properties according

to Harley (2005). In combination with a limited number of verbalizers (light verb projections or "flavors of *v*"), this root typology is able to derive the attested varieties of Aktionsart types under this approach.

Referent of √	no complement		complement	
	bounded	**unbounded**	**bounded**	**unbounded**
Event	*hop*	*sleep*	*kick*	*push*
Thing	*foal*	*drool*	N/A?	N/A?
State	*flat*	*rough*	*clear*	??

Table 10: Basic root properties (Harley 2005: 56).

Incorporation of [+bounded] "things" (e.g., *foal*) gives rise to intransitive telic predicates, as shown by their compatibility with adverbial phrases that are standardly used to diagnose boundedness/telicity ("in x hours/minutes"), (55a), while incorporation of [–bounded] "things" (e.g., mass nouns like *drool*) gives rise to intransitive atelic predicates, as shown by their compatibility with adverbial phrases that are standardly used to diagnose unboundedness ("for x hours/minutes"), (55b).

(55) Unergative accomplishments (Harley 2005: 47)
    a. The mare foaled   in two hours/#for two hours. (+bounded, telic, no complement)
    b. The baby drooled for two hours/#in two hours. (–bounded, atelic, no complement)

The same holds for semelfactives and unergative activities, which according to Harley form minimal pairs with (55), the difference being that the referent of the incorporating root is a [±bounded] "event" rather than a "thing". Like the predicates in (55), these also take no complements. Thus, semelfactives as in (56) (in the "instantaneous event" reading) incorporate bounded events (*hop, flash*), whereas unergative activities as in (57) incorporate unbounded events (*dance, whistle*).
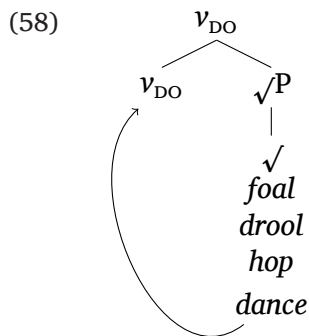
(56) Semelfactives (Harley 2005: 49)
    a. Sue hopped   #for five minutes/#in five minutes. (+bounded, no complement)
    b. The light flashed #for five minutes/#in five minutes. (+bounded, no complement)

(57) Unergative activities (Harley 2005: 49)
    a. Sue danced   for five minutes/#in five minutes. (–bounded, atelic, no complement)
   b. Sue whistled for five minutes/#in five minutes. (–bounded, atelic, no complement)

In other words, (55)–(57) all have the same basic structure (or "L-syntax", in Hale/Keyser/Harley terminology), (58); the Aktionsart differences follow from the type of incorporating element.

(58)
v_{DO}

v_{DO} $\sqrt{}$P

$\sqrt{}$
foal
drool
hop
dance

Roots whose referent is an "event" can take non-incremental themes as complements, resulting in transitive atelic semelfactives/activities (Harley 2005; 2014), (59).

(59)   Transitive atelic/semelfactive (referent of $\sqrt{}$ = "event") ($\pm$ bounded, $+$ complement) (Harley 2005: 51–52):

     a.   John pushed the cart   for five minutes/#in five minutes. (–bounded, $+$ complement)

     b.   Sue kicked the wall   #for five minutes/#in five minutes. ($+$ bounded, $+$ complement)

The structure for these is given in (60).

(60)
v_{DO}

v_{DO} $\sqrt{}$P

$\sqrt{}$ DP
*push*   *the cart*
kick   *the wall*
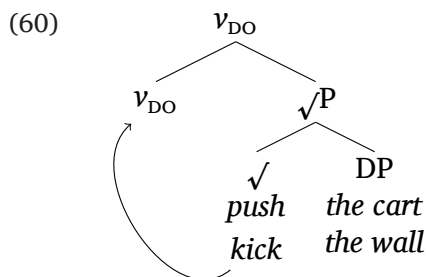
The last row in **Table 10** illustrates verbs based on roots whose referent is a state. Harley (following Hale and Keyser) argues that these give rise to deadjectival inchoatives/causative alternation verbs. For these verbs, "the Aktionsart of the verb is determined by the degree to which some state is true of the theme of the verb" (Harley 2005: 53). As in the case of "event" and "thing" roots, the referent of "state" roots can be [$\pm$ bounded], (61).

(61)   Deadjectival change-of-state verbs (Harley 2005: 53; 55)

     a.   Sue cleared the table   #for five minutes/in five minutes. ($+$ bounded, telic)

     b.   Bill lengthened the rope   for five minutes (–bounded, atelic)

Compositionally, these verbs again consist of a selecting verbalizer (v_{CAUSE}/v_{BECOME}) plus an adjectival STATE embedded in a small clause. Moreover, some "state" roots can take complements, (62).

(62) Complement-taking state-denoting roots (Harley 2005: 54–55)

    a.   Jill cleared the table (of dishes).   (+bounded, +complement)

    b.   Jill swept the table clear (of dishes).

    c.   Jill flattened the metal (#of bumps).   (+bounded, –complement)

    d.   Jill hammered the metal flat (#of bumps).

Harley argues that in these cases, the state root projects and takes a complement, parallel to the transitive event roots in (60). The structure for verbs derived from [±bounded] states without complements is given in (63). The incorporating adjective/adjectival root is the predicate of a Small Clause (SC) containing the (surface) object of the verbs in (61)–(62).

(63)
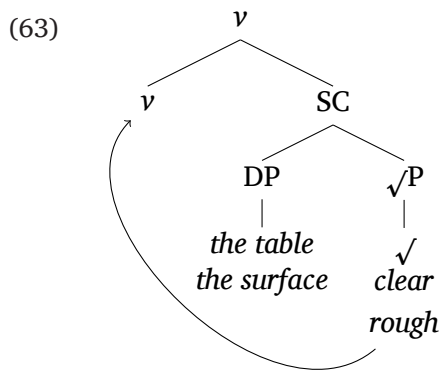
To summarize, the L-syntactic approach derives the semantic and syntactic properties of (different classes of) unergative and unaccusative verbs from their structural composition (light verb + complement noun/adjective), effectively treating these verb classes as underlyingly denominal and deadjectival. In English, the light verb is zero in the conversion verb classes discussed in this section, but this is not necessarily the case in all languages and contexts. Analyzing these verbs as underlyingly denominal and deadjectival leads to specific predictions concerning the argument and event structure properties of their different subclasses, which are connected to the [±bounded] feature of their base according to this approach. This prediction holds regardless of how one interprets what "nominal root" stands for—that is, this prediction is not sensitive to the distinction between derivation from roots and derivation from categorized stems in which the categorizer happens to be phonologically zero.

3.3.2 Quantitative validation

Bleotu (2019: 30) presents a case study of how to test this prediction, using a corpus of over 200 denominal verbs in Romanian which she classifies according to: 1) whether the nominal root is concrete (C) or abstract (A), 2) whether the nominal root is count (N) or mass (not N), 3) whether the denominal verb is telic, atelic or both, 4) what theta-role the nominal root bears (for concrete nominal roots). Bleotu assumes that denominal verbs are formed from nominal roots or bare

nouns that are specified as [+count] (count nouns), [-count] (mass nouns), or underspecified for the feature [count]. **Table 11** summarizes her findings.

	count nominal √	**mass nominal √**	**underspecified √**
telic	54.4% (93)	40.9% (18)	30.76% (8)
atelic	28.1% (48)	47.7% (21)	30.76% (8)
both	17.5% (30)	11.4% (5)	38.46% (10)
Total	171	44	26

Table 11: Telicity of denominal verbs in Romanian, Bleotu 2019: 32ff.

While the majority of verbs based on count nouns are indeed telic, and most of the verbs based on mass nouns are atelic (as predicted by Harley), it is clear from **Table 11** that this is not a particularly clear-cut generalization, as there is a large percentage of atelic and "both" verbs in the first group, and the majority of verbs in the second group is actually either telic or "both". In other words, verbs derived from mass nouns in particular seem to contradict Harley's prediction. Bleotu therefore concludes that there is no connection between telicity and the boundedness of the incorporated nominal root.

However, there are a number of methodological caveats that weaken the validity of this conclusion. First, the role of diachronic evidence for determining directionality and excluding verbs from the corpus is not defined. Bleotu states that sometimes "it is the nouns that are derived from the verb through backformation, and not the verbs that are formed from the nominal root" (p. 30) and excludes 42 verbs in which the direction of derivation appears to be $v \rightarrow n$. Some of these are apparently loanwords in which the verb is a loan which gave rise to a nominal derivative in Romanian (a "backformation"), such as *anunţa* 'announce', *boicota* 'boycott', but it is not clear from the discussion that this applies to all of the excluded cases. Moreover, a number of the excluded "backformations" are atelic/stative "A, not N" verbs (*a cugeta* 'to meditate', *a deranja* 'to disturb, bother', *a jindui* 'to yearn (for)', *a se odihni* 'to rest', *a păzi* 'to guard', etc.), so the question of diagnostics for *synchronic* directionality directly impacts the reported distribution of telic/atelic/"both" verbs in this (relatively) small corpus.

Second, if the primacy of diachronic evidence for distinguishing between denominal verbs and "backformations" is accepted, then the etymological information must be more detailed than what is discussed in her Appendix. For example, Bleotu does not systematically distinguish between inherited words and words that were borrowed from other Romance languages. Thus the "origin" of *a respecta* 'to respect' is given as "Fr. *respect*, Lat. *respectus*", presumably meant to indicate that it is either inherited or a loanword—but why exclude the Latin verb *respectāre* as a potential basis? Similar concerns hold for *a (se) ruşina* 'to abash//shame', whose basis is given as "Lat. *roseus*",

a derived adjective meaning 'rose-colored, rosy' rather than the (likewise derived) adjective *rosīnus* 'red(ish), rose-like', which is morphophonologically more closely related and whose substantivization is found in the Romanian (f.) noun *ruşine* 'shame' (Puşcariu 1905: 133)—which is *not* given as potential nominal basis of the verb *a (se) ruşina*. These morphological and semantic discrepancies between the putative base *roseus* and its alleged derivative are not discussed.

Finally, there is the problem of the semantic classification of the Aktionsart of the individual verbs and the category of their base. For example, *a exila* 'to exile' is classified as "A" (abstract) and "not N". Since it is telic, it therefore should count among the 40.9% of mass nominals in **Table 11** which constitute counterexamples to Harley's generalization (the diagnostic for establishing telicity is the *for/in*-test). But "exile" can refer to a specific location as well as to the abstract concept and can be pluralized (in Romanian as well). It is therefore not immediately clear why this should be classified as "not N" and be grouped in the same category as *a respecta* 'to respect' (A, not N, atelic/state) and *a duşmăni* 'to hate' (A?, not N), which are classified as atelic and are therefore not counterexamples.

In sum, these methodological problems weaken the conclusions concerning the connection between boundedness and telicity in denominal verbs that one might draw based on **Table 11** in assessing the predictions that the H&K/Harley framework makes in this respect. But they are useful insofar as they show the importance of establishing *synchronic* a priori criteria for treating verbs as "denominal" and nouns as "deverbal", as well as deciding in advance on the role that etymological arguments are going to play in this classification (not to mention the importance of crosslinguistic comparisons). Further studies investigating the connection between telicity/Aktionsart and the type of incorporated nominal in derived verbs from a broad empirical perspective are an urgent desideratum.

3.4 Zero verbalizers vs. spans

Bleotu (2019) compares DM accounts of denominal verbs in English and Romanian to different Spanning and Nanosyntax accounts. She argues that unergatives consist of a noun N, a ProcP (introducing a process-denoting subevent), and an InitP (introducing a causing/initation subevent), in the framework of Ramchand (2008). The structure is given in (64), where 'x' indicates the surface subject (moving from Proc to Init).

(64)
```
          Init
         /    \
      'x'     Proc
             /    \
          'x'      N
                   |
                 dance
```
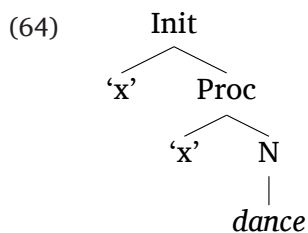
Bleotu (2019: 140ff.) argues that this sequence is linearized as [N Proc Init] and discusses various ways of spelling out this sequence. For example, one could now assume that the lexicon contains two different lexical items *dance,* one for spelling out the noun [N], and one for spelling out the verb, i.e., the sequence of functional heads [N Proc Init]. The latter is a *span* (a complement sequence of terminal nodes within an extended projection, Svenonius 2012; 2016; Merchant 2015) spelled out as *dance-Ø-Ø*. Such an approach might make sense for cases in which the noun and the derived verb differ phonologically, e.g., English *a shelf/to shelve*. However, Bleotu argues that assuming a single lexical item for both contexts is more economical.

Despite the notation, Bleotu argues against "silent items" such as zero categorizers: Spanning (together with Nanosyntax' Superset Principle) lets one and the same vocabulary item realize different "sizes" of syntactic structure, e.g., both [N] and [N Proc Init]. Moreover, in languages in which there is morphology available that marks the additional verbal structure in the denominal verb, such as Romanian *dans* 'dance' vs. *dans-a-* 'to dance', the difference can be modelled as a mapping difference rather than as a structural difference, with theme vowels such as *-a-* spelling out verbal functional projections such as Proc or Init (though Bleotu proposes a designated Thematic Vowel Projection to account for "complex thematic suffixes" which can be segmented into categorizer + theme, e.g., Romanian *-iz-a-* in *fosil-iz-a-* 'to fossilize'). Variants like *shelve/shelf* need to be accounted for with (lexical) phonological rules, as in other frameworks.

However, if further projections in the extended domain are added, as in optionally telic verbs with a GoalP and PlaceP (*dance across/into the room*), or verbs which can optionally take hyponymous objects (see section 3.5.2), additional assumptions are necessary to explain why the span cannot extend to lexicalize Goal and Place, and why it can seemingly lexicalize twice in cases like *to dance a dance.* Special assumptions are also needed for verbs like *fossil-ize* and *solid-ify* in English, which seem to have overt morphology for Proc/Init (or *v*, in DM)—it is not clear from Bleotu's brief discussion of these how to exclude potentially expected **to fossil* as Spell Out of the span [N Proc Init], since this should be preferred by the "Biggest Wins" principle ("The lexical item corresponding to the biggest subtree wins", Bleotu 2019: 88). As in other approaches, lexically specific rules are also needed to exclude **to danc-ize,* etc.

While theme vowels and other verbalizing morphology in languages like Romanian and Greek (see section 2.4) can be explained as spelling out *v* in DM-based accounts, in denominal verbs without overt verbalizing morphology, like *dance,* etc., DM is forced to assume morphologically empty categorizing morphology and the host of problems associated with it (see section 2.2.5). Finally, in Borer's exoskeletal framework, there is also only one lexical item/root √*dance,* but this crucially always spells out the same amount of structure (i.e., only the root), independent of whether it is embedded under nominal or verbal "functors".

To conclude, once one commits to a view in which noun-verb pairs like *dance* in English (and their equivalents in other languages) share structure, the question invariably arises how much of that structure is spelled out by the same phonological form. The various mechanisms that have been proposed all have to deal with a certain amount of redundancy and lexical idiosyncrasy.

In the next section, we discuss some denominal verb classes that have not played a crucial role in the formal analyses discussed so far, but that could be relevant in deciding between the different approaches and analytical options (cf. also the discussion of Rimell 2012 in section 2.2.4).

3.5 Open issues

3.5.1 Instrument and agent incorporation

"Instrument verbs" expressing manner of motion or manner of action (*hammer, brush, rake*) have played a crucial role in assessing the morphosemantic and morphophonological arguments in the *tape* debate (section 2.2), but their formal analysis remains a problem, especially in the L-Syntax approach discussed in section 3.3. As noted by Harley (2005: 60), the telicity of these verbs is not derivable from the boundedness of the base. Her examples in (65) are compatible both with telic and with atelic adverbs, even though the nominal bases (the instruments) in question are all [+bounded].
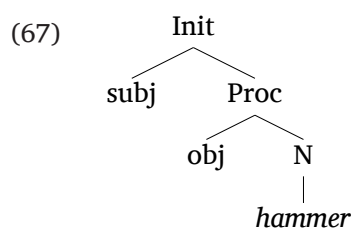
(65)   Denominal instrument verbs (Harley 2005: 60)
    a.   John hammered the metal   for five minutes/in five minutes.
    b.   Sue brushed the dog   for five minutes/in five minutes.
    c.   Jill raked the leaves   for an hour/in an hour.

This could suggest that these verbs do not incorporate their underlying direct object/internal argument, but rather the instrument with which the action is performed. Harley therefore proposes that these show incorporation of a manner adjunct ("manner incorporation"), illustrated by the structure in (66).

(66)   Preliminary structure for "Sue hammered the metal" (from Harley 2005: 61)
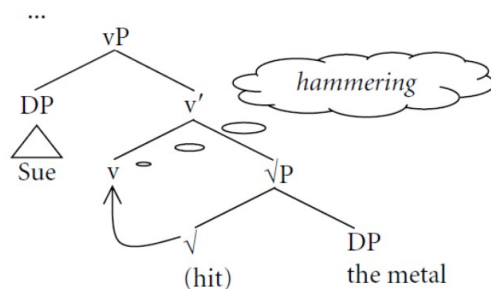
Harley emphasizes the preliminary nature of this analysis. Moreover, this type of structure is not predicted by the H&K framework's definition of conflation (the adjunct is by definition not the complement of the selecting head), nor is it incorporation in the technical sense (because the manner adjunct is not part of the complementation domain of the selecting head). Extending the conflation or incorporation domain to include adjuncts is moreover undesirable and would significantly overgenerate - clearly not all types of (manner) adjuncts can form the basis of such derived verbs, certainly not manner adverbs such as *carefully* or *quickly*. Bleotu (2019: 230ff.) proposes that the instrument nouns are generated as complements (rather than adjuncts) of ProcP; her (simplified) structure is given in (67).
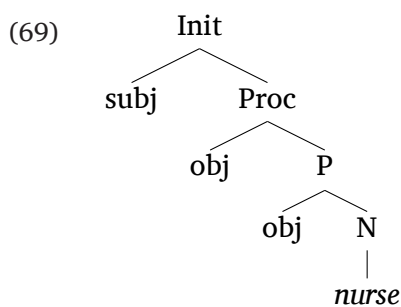
(67)

```
            Init
           /    \
        subj     Proc
                /    \
             obj      N
                      |
                   hammer
```

In this account, instrument verbs essentially have the same structure as unergatives like *laugh, dance*, etc. in section 3.4 and spell out the same amount of material ('span'). But the difference in the status of the instrument, which is an adjunct in the quasi-paraphase "hit y *with a hammer*" but a complement in (67), is difficult to justify, as Bleotu herself acknowledges. She tentatively proposes that the two constructions could simply differ in their underlying syntax and that "use a hammer" might be a more accurate way of paraphrasing instrument verbs like *hammer* and hence provide motivation for the structure in (67). Acedo-Matellán & Mateu (2014), on the other hand, propose a neoconstructivist approach in which the interpretation of a given root (i.e., manner vs. result) is derived from its position in the syntactic structure. Roots naming instruments such as *hammer* can be merged either as complements of a preposition of terminal coincidence which is itself the complement of the selecting verbalizer, in which case they resulting verb is a telic change-of-state-verb compatible with *in five minutes*, or as complements of a preposition of central coincidence, in which case the resulting verb is an atelic transitive activity verb compatible with *for five minutes* (see also Oltra-Massuet & Castroviejo 2014 for a similar approach). This approach dissolves the apparent ambiguity of *hammer*-verbs with respect to telicity by positing a distinct structure for each reading.

Apparent agent incorporation/conflation is likewise problematic for the formal accounts discussed above, and for similar reasons: Agents are assumed to merge in the specifier of *v*/Voice (Kratzer 1996) rather than as its complement or in its complementation domain and are thus not expected to form the basis of denominal verbs in the H&K framework. Agent incorporation is also excluded by Baker (1988) and subsequent literature. Nevertheless, verbs that are apparently

built on agent nouns or nouns of profession are surprisingly common in many of the languages that usually feature in the discussion of denominal verbs. Bleotu (2019: 163ff.) refers to these as "pseudo-agent verbs", Xu et al. (2007) call them "to act like *y*"-verbs (where *y* is an animate noun). In Ancient Greek and Latin, some of these verbs are ambiguous between a stative ('be X') and an activity ('act as/like X') reading.

(68)   a.   English: *to butcher, to nurse, to proctor, to author, to referee, to monitor*, etc.

      b.   Latin: *arbitror* 'to act as/be a witness' (*arbiter* 'witness'), *fūror* 'to steal, rob' (*fūr* 'thief'), *ancillor* 'act like a handmaid' (*ancilla* 'handmaid'), *interpretor* 'explain, interpret' (*interpres, -pret-*) 'intermediary'), *philosophor* 'act like a philosopher, be philosophical' (*philosophus* 'philosopher'), etc.

      c.   Ancient Greek: *basileúō* 'be king; rule' (*basileús* 'king'); *hippeúō* 'be a horserider' (*hippeús* 'horserider'), *khalkeúō* 'be a coppersmith' (*khalkeús* 'coppersmith', *hiereúō* 'act as priest, sacrifice' (*hiereús* 'priest'), *pompeúō* 'conduct, escort' (*pompeús* 'attendant, escort'), etc.

      d.   Hebrew (Arad 2003: 752, Faust To appear): *hitkamtsen* 'was stingy' (*kamts-an* 'stingy person'), *hitbaxjen* 'complained' (*baxj-an* 'crybaby'), *hiʃtaxtsen* 'acted arrogantly' (*ʃaxts-an* 'arrogant person'), *hitril* 'trolled' (*trol* 'troll'), etc.

      e.   Romanian (Bleotu 2019: 165): *a măcelari* 'to butcher', *a pilota* 'to pilot', *a păzi* 'to guard', *a păstori* 'to shepherd', *a arbitra* 'to referee', etc.

Bleotu (2019: 166ff.) argues that the putative agent is actually base-generated in the "complement domain" of the verbal functional element that selects it, rather than as its external argument or specifier (parallel to her analysis of instrument verbs). She capitalizes on the "act like" semantics of these verbs and argues that verbs like *butcher* spell out a span that consists of [N P Proc Init], that is, a PP *like/as* + N as complement of Proc. This is illustrated in (69) for *to nurse* (adapted from Bleotu 2019: 169).

(69)

```
            Init
          /      \
       subj      Proc
               /      \
             obj       P
                     /    \
                   obj     N
                           |
                         nurse
```

Semantically this works well for verbs like *to butcher* and *to nurse*, which do not require identity between the incorporated agent noun and the surface subject. Thus, in *John butchered the cow*, John "acts like" a butcher independent of what his actual profession is (though, as Bleotu points out, this is not the case with *to author*, for example). An analysis in which the supposed agent is actually base-generated in a comparative PP or Small Clause (as proposed by Oltra-Massuet

& Castroviejo 2014 for Spanish; cf. the Small Clause structure for deadjectival verbs in (63)) would also be compatible with the H&K framework. In that case both the surface subject and the incorporating "agent" would be base-generated in a complex predicate as the complement of *v*, or only the agent acts as the predicate while the surface subject is introduced by *v* or Voice, cf. (70).

(70)

vP$_{\text{ACT}}$
(*John*) v_{ACT}
         v_{ACT} PredP
                 (*John*) … *butcher*
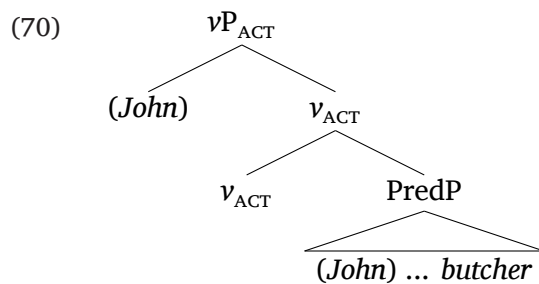
This analysis is essentially already implied by Flobert (1975: 66), who refers to Latin denominal deponents like in (68) b. as "predicative", in that the base noun appears to act as the predicate of the subject. The "flavor" v_{ACT} in (70) indicates that the thematic role assigned by v is that of an actor rather than an agent (see Doron 2003 and Kastner 2020b: 51 on the difference between AGENT and ACTOR, or Massam 2009 and Tollan & Oxford 2018 on AGENT vs. DOER). Pseudo-agent verbs with stative readings like Greek *basileúō* 'am king' could then have a structure similar to the deadjectival change-of-state verbs in (63) (cf. section 3.3), with a selecting verbalizer BE rather than ACT.

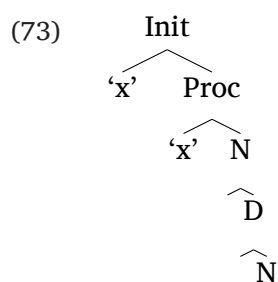### 3.5.2 Denominal verbs and hyponymous objects

Denominal verbs with direct objects (hyponymous or cognate objects) are a problem for approaches in which a denominal verb consists of a (possibly silent) light verb v and its incorporated complement, since these approaches predict such verbs to be syntactically intransitive. While Harley (2005)'s account includes complement-taking eventive roots (e.g., *push, kick*), this is excluded for nominal roots (roots denoting things; more precisely, it is marked as "N/A?"). Therefore the fact that unergative verbs like *laugh* and *dance* can occur with cognate objects as in (71) and hyponymous objects as in (72) could be considered a problem for this type of account.

(71)   Cognate objects (ex. from Haugen & Siddiqi 2013: 506)
   a.   He **laughed** a false **laugh** that held genuine bitterness.
        (Michael Chabon, *Gentlemen of the Road*, p. 187)
   b.   Hortense is **dancing** a happy **dance**.

(72)   Hyponymous objects (ex. from Hale & Keyser 2002: 88)
   a.   They are **dancing** a Sligo jig.
   b.   He **shelved** the books on the windowsill.

Hale & Keyser (2002) argue based on syntactic diagnostics like the ability to passivize, undergo A'-movement and become pronominalized (all of which are grammatical for hyponymous objects, but excluded for cognate objects in English) that hyponymous objects and cognate objects actually belong to two different types of unergative denominal verbs in English: Cognate objects undergo *noun incorporation* into (rather than conflation with) the selecting verbalizing projection, which involves copying of the noun into the incorporating position (*v*) with Spell-Out of both the lower and the higher copy (though note that cognate objects like in (71) also require adjectival or other modifiers to be well-formed). Hyponymous objects arise in *conflation contexts* and are semantically in a subset or "kind of"-relation to the conflated noun. Hale and Keyser argue that this is achieved through binding of the hyponymous object by the (conflated) verb.

Haugen (2008; 2009) and Haugen & Siddiqi (2013) propose a similar analysis based on noun incorporation in the Uto-Aztecan languages, in which a noun in object position incorporates into the selecting verb via movement. Since movement involves copying, they argue, both copies can be spelled out either with the same material/root (cognate objects) or with differing material (hyponymous objects), and the "kind of" or "instance of" (hyponymous) reading of the lower copy arises through pragmatic coercion. According to them, this also explains why cognate objects require some kind of modification in order to be semantically well-formed: Otherwise there would be no reason to insert the same root twice. However, the syntactic differences between cognate and hyponymous objects discussed by Hale & Keyser (2002) are not addressed in this approach.

Bleotu (2019) mentions cognate objects only briefly. Her proposed structure for *dance a dance* (simplified in (73) from Bleotu 2019: 148), in which 'x' is the subject and *dance* spells out both the higher span N-Proc-Init and the lower span N, suggests that cognate objects are associated with the noun that forms the basis of denominal verbs (via spanning rather than incorporation, in her account):

(73)

```
        Init
       /    \
     'x'    Proc
           /    \
         'x'     N
                 |
                 D
                 |
                 N
```

It is unclear under which circumstances nouns can select such cognate objects as complements (or be modified by them) or what constrains this process.

Gallego (2012) proposes a "doubling account" of cognate objects, parallel to clitic doubling. In this account, cognate objects are merged with the nominal roots that incorporate into/conflate with a selecting *v*, illustrated in (74) (adapted from Gallego 2012: 101, ex. 12b).

(74)

vP
v √DANCE
D √DANCE
a jig
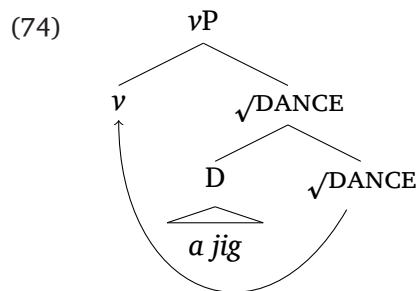
The merged object forms a Small Clause with the root and therefore cannot incorporate itself (only complements incorporate, and roots don't take complements in this approach, cf. Gallego 2012: 103–4). This account, too, treats cognate and hyponymous objects as essentially alike, though Gallego does acknowledge that the modification requirement as well as other properties of these constructions need further elucidation. In sum, while the formal accounts of denominal verbs discussed in this section all have (sometimes even non-*ad hoc*) tools for dealing with the problem of cognate and hyponymous objects to denominal verbs, the details are far from settled.

3.6 Summary

In this section we summarized the formal analyses that have been proposed for derived verbs, again focussing on Hebrew and English. Specifically, we compared how Affix Imposition, Root Augmentation, Spanning and Conflation handle various classes of denominal and deadjectival verbs, and the morphosemantic and morphophonological relationship between base and derivative in these classes. We also briefly discussed various classes that have not been at the center of the discussion so far and whose properties need further elucidation. In the next section we turn to derivational directionality in diachrony.

4 Diachrony
4.1 Morphophonological change and derivational morphology

Even though discussions of derivational directionality in formal analyses often appeal to diachrony, this is rarely done systematically, focusing rather on the history of specific lexical items rather than diachrony of particular word-formation rules. This topic is also somewhat understudied within historical linguistics and descriptive approaches to the typology of language change. In particular, there is little work on the diachronic development of verbalizers (and other categorizers) and their interaction with argument structure changes in languages which

have historically relied primarily on synthetic derivational morphology in building deadjectival and denominal verbs.[10] Cases of "backformation" like *to edit* which was backformed from *editor*, and *to peddle* which was backformed from *peddler*, have received some attention in the literature (see Štekauer 2015 for an overview), but are more pertinent to understanding the diachrony of word-formation rules that are already productive in a language (cf. also the discussion of Bleotu's Romanian data in section 3.3) rather than the development of new means of cross-categorial derivation, especially argument and event structure-changing morphology.

In this section, we look at directionality from a diachronic perspective. Although this area is understudied from a formal perspective (though see van Gelderen 2018; 2019; Grestenberger Forthcoming), we identify some case studies from Old English and Greek which allow us to delineate the role of morphological and phonological change and semantic "bleaching" in the development of nominal and verbal derivational morphology.

4.2 Directionality in diachrony

From the H&K framework discussed in section 3.3, we identify a prediction for diachronic directionality in denominal and deadjectival verbs: If such verbs are built on nominal and adjectival stems, we expect to see nominal and adjectival morphology as part of their structure, at least historically (in the same way that we expect to see verbalizing morphology in deverbal nouns and adjectives, section 2.4); cf. Grestenberger Forthcoming for further discussion of this diachronic prediction.

There are indeed some cases in which a synchronic verbalizer historically goes back to a noun- or adjective-forming suffix that seem to confirm this prediction with respect to diachronic directionality. One such case is the productive Modern Greek (MG) verbalizer *-ev-*, which verbalizes nouns, adjectives, adverbs and loanwords. Its Ancient Greek (AG) ancestor originally formed agent nouns/nouns of professions in Nom.sg. *-eu-s*, which could become the derivational basis for denominal "agent incorporation verbs" (section 3.5.1) using the inherited and productive verbal stem-forming suffix **-je/o-* (the glide was subsequently lost with varying palatalization effects). This is illustrated in the a. examples in **Table 12** (the citation form is the 1Sg. *-eú-ō* from **-eu-jō*). That this suffix was reanalyzed as part of the verbal domain already at some point in AG is suggested by AG verbs in *-eú-ō* that were derived from bases which do not contain the agent noun-forming suffix *-eú-s*, as in the b. examples, leading to the MG use of the suffix illustrated in d. (ex. from Panagiotidis et al. 2017). The MG verbs in c. are reflexes of the corresponding AG

---

[10] Haspelmath (1995: 21) discusses cases of affixal reanalysis and resegmentation and argues that these are driven by the need for morphophonological clarity or "compensation of phonological reduction", but does not touch on the issue of derivational directionality or concomitant argument structure changes.

verbs, but there is no synchronically transparent derivational relationship to an agent noun any more (*-eu-* no longer forms agent nouns in MG).

AG verb in *–eúō*			MG verb in *-ev-o*		
	Verb	**Base**		**Verb**	**Base**
a.	*basil-**eú**-ō*	*basil-**eú**-s*	c.	*vasil-**év**-ō*	(√/*vasiliás*)
	'am king; rule'	'king'		'govern'	(√/'king')
	*khalk-**eú**-ō*	*khalk-**eú**-s*		—	
	'am a coppersmith'	'coppersmith'			
	*hipp-**eú**-ō*	*hipp-**eú**-s*		*ipp-**év**-ō*	(√/*ippéas*)
	'am a horserider'	'horserider'		'ride'	(√/'horserider')
b.	*arkh-**eú**-ō*	*arkhós*	d.	*stox-**év**-o*	*stóx-os*
	'command'	'commander, leader'		'aim at'	'target'
	*aethl-**eú**-ō*	*aethlós*		*kont-**év**-o*	*kontá*
	'contend for a prize'	'contest for a prize'		'approach'	'near'
	*hēgemon-**eú**-ō*	*hēgemṓn*		*xak-**év**-o*	Engl. *hack*
	'lead the way'	'leader'		'hack'	

Table 12: AG verbs in *-eú-ō* vs. MG verbs in *-ev-*.

The (historical) directionality is undisputed: No verbal suffix *-eu-* is known from other Indo-European (IE) languages, while there are clear analogues to *-(ē)u-* in the nominal and adjectival domain, and the derivational history of the nouns in *-eu-s* (themselves denominal) is also well-established (Schindler 1976). The "additive" behavior of the nominal + verbal suffix is likewise decisive in frameworks that insist on monotonicity, like DM. The proposed reanalysis of the suffix from nominal to verbal (a. → b./c. → d. in **Table 12**) is illustrated in (75).

(75)   "Upwards reanalysis" of AG nominal *-eu-* (Grestenberger Forthcoming)
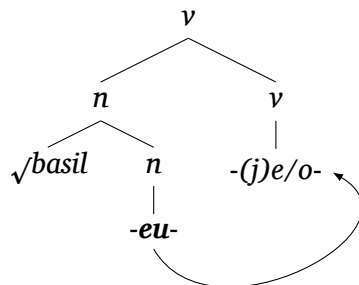
This type of reanalysis not only gave rise to MG *-ev-*, but also to a variety of other MG verbalizers that consisted historically of a nominal suffix plus the verbalizer *-je/o-*. It is also attested with

adjectival morphology, for example in the AG factitive verbs in *-óō* and *-únō*. The latter originally formed factitives ("make x", where x = adj.) from adjectives in *-u-*, as in the examples in rows a. of **Table 13**. Subsequently, the *-ū-* that originally belonged to the adjectival stem was reanalyzed as part of the verbalizing suffix and extended to deadjectival factitive formation from adjectives that did not contain an *u*-suffix, as in the b. rows (see Tucker 1981 on this class).

a.	*bar-**ú**-s*	'heavy'	*bar-**ǘ**-n-ō*	'make heavy'
	*bath-**ú**-s*	'deep'	*bath-**ǘ**-n-ō*	'deepen'
b.	*lept-**ó**-s*	'thin'	*lept-**ǘn**-ō*	'make thin'
	mégas, megál-	'great, big'	*megal-**ǘn**-ō*	'make great'

Table 13: AG deadjectival factitives in *-ūnō* (Tucker 1981: 22f., Rau 2009: 115ff.)

The deadjectival factitives in *-ó-ō* (< *-o-je/o-* + inflectional endings) also show adjectival stem-forming morphology (*-ó-*) plus verbalizing morphology (*-je/o-* in the present stem, *-s(a)-* in the aorist; see Tucker 1981; 1990 on the development of these verbs). The arguments for directionality in these classes are the same as above: The adjectival suffixes *-u-* and *-ó-* are also found in related languages and established as inherited by comparative reconstruction, whereas the derived verbal stems are only known from Greek and consist of the adjectival morphemes plus "stacked" verbalizing morphology, and this additive behavior is mirrored by the semantic compositionality of this type ("make adj.", and, with middle morphology, "become adj.").

While the diachrony of these verb classes is relatively well understood, it must be emphasized that the synchronic problem of derivational directionality remains, even in languages with relatively rich derivational morphology. Thus, while the verbs in *-óō* and the related class in *-áō* in AG (see **Table 14**) are diachronically denominal (the former from adjectives and nouns in *-o-*, the latter from nouns in *-ā/*Att.-Ion. *-ē* (> MG *-i-*), once their vocalic formants are reanalyzed as verbalizers (Spyropoulos et al. 2015; Panagiotidis et al. 2017), this opens up the possibility for reanalysis of the nominal (and adjectival) diachronic bases in *-ā-* and *-o-* as deverbal nouns and adjectives, or even for a Borer-style analysis in which both the adjective/noun and the formerly deadjectival/denominal verb are reanalyzed as root-derived (i.e., a diachronically motivated type of Root Augmentation, cf. section 4.3).

	Base	**Meaning**	**1Sg. Pres.**	**Meaning**
a.	*nī́kē, nī́kā*	'victory'	*nīk-**á**-ō*	'be victorious'
	tīmḗ, tīmā́	'respect, esteem'	*tīm-**á**-ō*	'to treat with respect'
b.	*stéphanos*	'crown'	*stephan-**ó**-ō*	'to crown'
	orthós	'straight'	*orth-**ó**-ō*	'to straighten'

Table 14: AG verbs in *-áō* and *-óō*.

While there is evidence that the vocalic stems *-a-/-ā-* and *-o-/-ō-* of these classes were still interpreted as nominal/adjectival morphemes at this stage of the language (for example, from the formation of *-tos*-adjectives, which is restricted to root- and noun-derived formations in AG), these are also exactly the contexts in which the verbalizing Affix Imposition occurs in MG according to Anagnostopoulou & Samioti 2014. This suggests once again that a reanalysis from $n \rightarrow v$ has taken place. If and when exactly this reanalysis occurred is a matter of debate (cf. the discussion of new verbal templates and Root Augmentation in sections 2.3 and 3.2).

These examples show that overt categorizing and derivational morphology is no guarantee for an unambiguous *synchronic* morphological analysis of directionality (though it certainly helps). The next section looks at the problem of zero categorizers from a diachronic perspective.

4.3 Diachronic arguments for zero categorizers

4.3.1 Background

The case studies in the previous section show diachronic reanalysis in derivational morphology in the absence of sound change (with the exception of the loss of the palatalizing glide in Greek examples). In this section, we look at case studies in which sound change, in particular the loss of verbalizing and nominalizing morphology, results in apparent changes in derivational directionality and possibly in zero categorizers.

(Morpho)phonological change as driver of syntactic change has long been a staple of the diachronic literature since the Neogrammarians (especially Paul 1880). However, the link between phonological change and the development of new categorizers remains underexplored, especially where the diachronic development of category-changing morphology and its connection to argument structure change is concerned. This becomes an especially urgent question in the context of the debate surrounding the content of roots discussed in section 3.1 and the problem of zero categorizers (section 2.2.5). If phonological change can indeed act as a "cue" for morphosyntactic change then the question of the existence and distribution of zero categorizers become once again valid and relevant: under what circumstances can category- and argument structure-changing morphology be phonologically zero? A valid diachronic reanalysis path presupposes that the endpoint of the reanalysis (in this case, a zero morpheme) is a valid synchronic option of a grammatical system. We consider the English labile alternation and noun-verb conversion in what follows.

4.3.2 English causatives

There are some examples in the historical record that seem to show exactly this type of development, in that an overt categorizing or (verbal) derivational affix is lost via sound change, leading to an apparently "zero-derived" form. One such case is found in the history of English

"labile" causative alternation verbs, in which the loss of overt causativizing morphology coincided with the rise of the "labile" type of causative alternation verbs. In the following, we will illustrate this with the development of the inherited Proto-Germanic causativizer *-j(a)-* (though note the parallel development of labile *-en* verbs like *redden, blacken*, etc.), which derived deverbal causatives, illustrated in **Table 15** with Gothic examples.

anticausative		causative	
ur-reisan	'arise'	*ur-raisjan*	'make arise'
drigkan	'drink'	*drakjan*	'make drink'
ligan	'lie'	*lagjan*	'lay'

Table 15: Gothic causatives (cit. after van Gelderen 2018: 86).

This suffix was lost in Old English, together with the palatalization and/or gemination of the preceding consonant. Its erstwhile presence is still visible in the ablaut alternation between the anticausative and the causative alternants (cf. the English pairs *rise/raise, sit/set, drink/drench*, etc.), where the ablaut grade of the latter is due to umlaut triggered by the glide; cf. **Table 16** for examples.
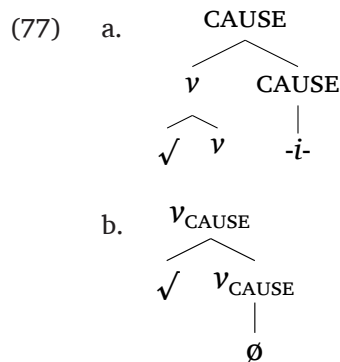
anticausative		causative	
sittan	'sit'	*settan*	'set'
liċġan	'lie'	*leċġan*	'lay'
scrincan	'shrink/wither'	*screncan*	'cause to shrink'

Table 16: Old English causatives

However, already in Old English the differentiation breaks down and both variants begin to occur in anticausative/unaccusative and in causative/transitive frames, eventually leading to the "labile" behavior of Modern English causative alternation verbs. The following examples illustrate this with originally causative *byrnan* 'to burn sth.', which already in Old English occurs both in causative, (76a), and anticausative, (76b), contexts.

(76) a. *swa ... fyr   wudu   byrneð*
          as   fire   wood   burns
          "As the fire burns the wood." (DOE, *Paris Psalter*, Ps 82.10, cit. after van Gelderen 2018: 88)

      b. *cwædon   þæt he on þam beorge   byrnan sceolde*
          say.3PL.PST that he on that mountain burn   should
          "They said that he was going to burn on that hill." (DOE, *Exeter Book*, Guthlac 191, van Gelderen 2018: 88)

The extent of this phenomenon and its subsequent spread is still a matter of debate (see van Gelderen 2018: 80ff. for a summary of previous literature). It suggests, however, that the loss of the original causativizer in (77a) resulted in a phonologically null causative *v* as indicated in (77b), in which *v* adds a causation event which does (causative) or does not (anticausative) specify a theta role for the external cause of the event (cf. van Gelderen 2018: 89, 96).

(77) a.

```
              CAUSE
             /     \
          v        CAUSE
        /   \         |
       √     v       -i-
```

b.

```
          v_CAUSE
         /      \
        √      v_CAUSE
                  |
                  ∅
```

Crucially, if the projection that introduces the cause event and/or the external causer (the causativizing projection spelled out as *-j-* in **Table 15**) is part of the representation of Modern English causative alternation verbs like *break, bend, melt, shrink*, etc., then its reanalysis as zero-marked must have constituted a valid analysis from the point of view of the language acquirer at the point when there was no sufficient evidence for the glide anymore.[11]

A skeptic might argue that this case is not quite pertinent to the discussion because it illustrates the loss of a (verbal) *derivational* (i.e., "outer") suffix rather than a categorizer (or "inner" suffix). But if the phonological content of "higher" functional projections can be lost by regular sound change, then surely the same should be possible for "lower", categorizing morphology (assuming this distinction is valid; see section 2.4 for arguments in favor of distinguishing between *v* as a mere categorizer and higher event- and argument-introducing projections), as phonological change is not expected to be sensitive to postulated morphosyntactic distinctions such as these.

4.3.3 Verb → noun conversion revisited

To give another example, consider the English "zero-derived" noun-verb pairs like *walk* and *run* again, in which the noun is usually argued to be deverbal. As discussed in section 2.2.5, Borer points out that it is odd that these nouns for the most part are not AS nominals ("complex event nominals"), even though they are semantically closely related to their putative basis, and that

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[11] Reanalysis is defined here as a change event during L1 acquisition in which "a hearer successfully analyses an incoming sentence using a grammar different from the one that the speaker used to generate it" (Walkden 2021: 19), rather than as a mechanism, cause, or result of change. See Hale (1998; 2007), Roberts & Roussou (2003), Roberts (2007), Walkden (2014: 39) on the role of reanalysis in formal theories of syntactic change, and note that the same definition applies of course to reanalysis of complex words rather than sentences as in the quote above.

genuine AS nominals to the same verbs are invariably formed via affixation (*-ing*, *-(a)tion*, etc.). Borer takes this as evidence that both the verb and the noun in "zero-derived" pairs are derived directly from the root.

If we consider this class from a diachronic perspective, we find that for the vast majority of the noun/verb pairs listed by Borer, the verb is older in the sense that it is attested earlier in the historical record, or has cognates in other Germanic languages and can thus be reconstructed for Proto- (North-West-)Germanic.[12] Excluding the particle verb nominals *a follow-up, a lie-down, a sit-in* (on which see section 2.2.2), Borer (2013: 331–2, ex. 40) lists 47 noun/verb pairs, which can be divided into three groups, depending on whether the verb is attested first (29 pairs), the noun is attested first (4 pairs), or both are attested at the same time (either because both are inherited or because both were loaned around the same time; 14 pairs). A table that summarizes these three groups with the approximate dates of attestation of each noun/verb pair can be found in the Supplementary Materials.

This distribution suggests that at least from a diachronic perspective, the pairs in the first and largest group consist of a verb and its derived noun, hence deverbal nouns (18 of which are not attested before the Early Modern Period), e.g., *to/a break, to/a climb, to/an export, to/a fall, to/a frown*. In the third group, in those cases in which both the verb and the noun are inherited (e.g., *to/a bite, to/a float, to/a grip, (to) hate, to/a kiss*), the inherited nouns go back to verbal nouns in *-i-* or *-a* (PGmc.*bit-i-* 'bite', *hat-i(z)-* 'hate', *grip-i-* 'grip', *flut-a-/fleut-a-* 'float', *kuss-a-* 'kiss', etc.), whose inflectional endings began to merge already in OE, with the stem distinction eventually collapsing; see Ringe & Taylor (2014: 374ff.) for a discussion of the chronology of the sound changes affecting OE noun inflection and Kastovsky (1985; 2005) for a more detailed discussion of the function of the different OE noun classes and their diachronic development.

Diachronically, then, we effectively lose the phonological realizations of the nominal stem-forming suffixes of the inherited nouns in this class (these changes of course affected the verbal system as well, cf. (77)). Assuming that these stem-forming suffixes were categorizers, this change resulted in zero categorizers and the establishment of a morphological rule of $v \to n$ conversion that led to the pairs in the first group, in which the nouns are attested later than the corresponding verbs. The directionality is moreover confirmed by the fact that the nouns in the third, inherited group have adopted the vocalism of the corresponding verbs in those cases in which there was originally a difference: E.g., *kiss* has the vocalism of the verb OE *cyssan* rather than its OE nominal predecessor *coss*; *bite* has a diphthong from a long vowel, namely that of OE *bītan* 'to bite' (the expected short vowel is preserved in *bit*), and *stand* contains the nasal of

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[12] Note that this is a relatively small sample; for a detailed study of English conversion pairs in diachrony see Balteiro (2007), who argues that diachronic criteria establish 145 $n \to v$ pairs in which the noun is historically older and 77 $v \to n$ pairs in which the verb is older in her corpus of 231 conversion pairs (the rest is inconclusive). Borer's sample is skewed towards inherited verbs.

the present stem OE *standan* (cf. also *a break* in group a., which replaces *breach* < OE *bryce* < **bruk-i-* in its older meaning 'act of breaking; break').

Having established the diachronic directionality of this class, the question remains if these nouns were ever AS nominals, rather than simple event or result nouns, as they overwhelmingly are in Modern English (though there are exceptions, e.g., *change, release, use, murder*, that seem to be AS nominals). The comparative evidence suggests that the answer is no. The equivalents of the OE and Proto-Germanic verbal (and adjectival) noun-forming suffixes **-i-*, **-a-* and **-ti-* (e.g., English *might, deed*; not productive) form root-derived simple event and result nouns that differ from verbal stems with respect to their ablaut grade and for the most part do not take arguments. However, both properties can change in the course of time (as in the Engl. *kiss/cyssan* vs. *coss* example above), and some of these suffixes develop into AS nominals in related Indo-European languages and take genitive or (less often) accusative objects. For example, the reflexes of verbal abstracts in **-ti-* can take genitive objects in Vedic Sanskrit, (78a), but also occur with accusative objects, (78b). The latter use is only attested when the verbal abstract is in the dative and is generally analyzed as an infinitival construction (Keydana 2013; cf. Lowe 2017: 118ff.).[13]

(78) a. mah-ānāṃ   dev-ānāṃ   vī-**tí**-m
          great-GEN.PL gods-GEN.PL pursue-VN-ACC
          "to the pursuit of the great gods" (RV 9.1.4ab)

      b. ū-**táy**-e   nṛ́n
          help-VN-DAT men.ACC.PL
          "for the help of the men/to help the men" (RV 7.26.5a)

But this is not a reconstructable property of these stems, as other languages that have inherited this suffix (such as Ancient Greek and the older Germanic languages, including Old English) do not have it. This suggests that verbal noun-forming suffixes like Proto-Germanic **-ti-*, **-a-* (< **-o-*), and **-i-* selected a fairly minimal amount of verbal structure, e.g., a non-eventive *v*/Res (as proposed for result nouns by Sleeman & Brito 2010), or even just the root (cf. Alexiadou 2001 on result nouns).

To conclude, this case study shows that categorizers (if defined as "low-" or "root-attaching" *v, n*, etc.) can diachronically turn into zero categorizers, given sufficient time (and sound changes), but also that the selectional properties of these categorizers can change over time, independent of whether or not they are zero, as in the Vedic *ti*-stems in (78), the rise of deverbal noun formation by conversion in English (Kastovsky 1985), the development of the deverbal noun-forming suffixes *-ing/-ung* in English and German (Iordăchioaia & Werner 2019), and the development of the participial suffixes in Greek (Grestenberger 2020). Finally, establishing that

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[13] This suffix also independently developed into an infinitival suffix in Balto-Slavic, cf. OCS *-ti*, OLith. *-ti*, etc.

a category is *historically* deverbal (e.g., the zero-derived nouns in the noun/verb pairs discussed above) does not necessarily mean that this is also the best *synchronic* analysis, or that it holds for each member of the class (recall the four "exceptions" in English noun/verb pairs mentioned above in which the noun historically precedes the verb).

4.4 Summary

In this section we have seen examples of clear instances of diachronic directionality, in which denominal and deadjectival verbs gave rise to new verbalizing morphology. We have also seen examples of loss of categorizing/derivational morphology due to sound change and the way in which these changes interact with the problem of zero categorization diachronically. In light of these diachronic developments, it might make sense to return to the problem of root content discussed throughout section 3. Alexiadou & Lohndal (2017) propose to parametrize the content of roots cross-linguistically, essentially arguing that roots carry more content in some languages than in others, (79).

(79)   A scale from 'empty' roots to 'contentful' roots (Alexiadou & Lohndal 2017: 99)
        Hebrew > Greek > Old English > English

They argue that this scale predicts three classes of languages: 1) languages in which the root is practically contentless and the basic unit of interpretation is the word (Hebrew), 2) languages where the root is strongly contentful and determines the meaning of a word (English) and 3) languages in between in which the basic unit of meaning is the stem (root + categorizer; Modern Greek). This move allows them to reconcile Borer's view (roots have no content at all) with Harley (2005)'s view (roots are minimally structured into events, things, and states): Both are right, but in different languages. It does, however, mean giving up on the idea that possible root meanings are universals. An alternative way of understanding the proposed scale in (79) is as a diachronic segmentation problem, rather than a cross-linguistic generalization about root content. That is, whether language acquirers posit a single root, a root + zero verbalizer, or a span to cover the content ascribed to the root in (79) seems to be an artifact of the particular theoretical approach chosen rather than of the data itself. As long as we lack meaningful diagnostics for distinguishing between these analyses *synchronically*, even fairly unambiguous diachronic evidence may prove uninformative.

5 Conclusion

In this article we have summarized and evaluated arguments for and against derivational directionality, with a focus on denominal verbs. We started out by discussing semantic and morphonological arguments in English and Hebrew, the languages at the center of the debate from a theoretical (specifically generative) perspective. The core arguments insist on morphonological

and semantic "inheritance" of *some* properties of the base by the derivative, though the extent of this inheritance is disputed (see especially section 2.3.3 on "predictability"). In general, a clear, *a priori* definition of synchronic criteria for derived vs. primary status should be the starting point for any analysis (or description) of derivational directionality.

Open issues and further research questions center around the problem of deriving the semantic properties of the derivative from those of the base, most clearly seen in the discussion of whether the telicity/Aktionsart properties of denominal verbs reflect the boundedness of the nominal base (section 3.3). The diachrony of the different denominal verb classes is also understudied, especially with respect to the question of when and how derived verbs are reanalyzed as primary verbs or roots (sections 2.3.2 and 4.2). Additionally, some generalizations have emerged concerning the difference of height of attachment (or "inner" vs. "outer" morphology, or cycles/phases) which suggest that category-changing derivation is only available up to a certain "height". Like many of the claims surveyed here, this one, too, needs to be confirmed with a larger sample of typologically diverse languages, and motivated from a theoretical perspective.

Abbreviations

1 = first person, 3 = third person, A = adjective/adjectivizer, ACC = accusative, AG = Ancient Greek, AS = argument structure, DAT = dative, DM = Distributed Morphology, F = feminine, Fr. = French, GEN = genitive, Go. = Gothic, IE = Indo-European, Init = Initiation, Lat. = Latin, M = masculine, MG = Modern Greek, N = noun/nominalizer, NOM = nominative, OCS = Old Church Slavonic, OE = Old English, OHG = Old High German, OLith. = Old Lithuanian, ON = Old Norse, PGmc. = Proto-Germanic, PL = plural, Pred = predicate, Proc = process, PRS = present, PST = past, PTCP = participle, RV = Rig Veda, SC = small clause, SG = singular, V = verb/verbalizer, VN = verbal noun.

Additional file

The additional file for this article can be found as follows:

- **Supplementary Materials.** Attestation of selected noun-verb conversion pairs in English. DOI: https://doi.org/10.16995/glossa.8710.s1

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Competing interests

The authors have no competing interests to declare.

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