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# Latin verbal morphology and the diachronic development of its thematic and athematic constructions

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**Abstract:** This paper investigates the verbal morphology of Latin in terms of the theoretical framework of Distributed Morphology (DM). In addition to providing a synchronic analysis of the verbal system of Latin, this paper discusses the development of the thematic vowel system and of athematic perfect forms in this language from their reconstructed Proto-Indo-European (PIE) antecedents and demonstrates the role of morpho-syntactic structure in constraining the historic analyses, and specifically the role that morpho-syntactic locality played in this historical development. It will be shown that despite radical changes in the exponence, the morpho-syntax and the semantics, of the verbal forms, the (local) structural relation between roots as the repositories of idiosyncratic morphological information and aspectual morphemes displaying special (irregular) exponents was consistently preserved across the millennia.

**Keywords:** Latin; Indo-European; verbal morphology; Distributed Morphology; thematic vowels; athematic perfect

Distributed Morphology (DM) was born out of the convergence of research interests between Morris Halle and Alec Marantz in the early 1990s. Both at that time were stressing the importance of post-syntactic phonological and morphological operations. On one side, Halle (1990) proposed that functional morphemes, which he then called abstract morphemes, were assigned phonological realization by applying post-syntactic vocabulary insertion rules. On the other, Marantz (1988) proposed the existence of post-syntactic morphological operations such as m-merge between morphemes. The meeting of these two research projects led to the writing of Halle and Marantz (1993), the foundational work of DM. The key feature of the model was the presence of a post-syntactic morphological component where syntactic

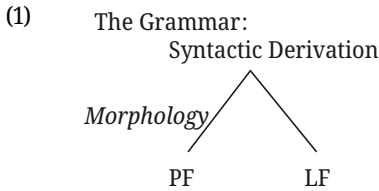
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representations—thought of as a hierarchical organization of morpho-syntactic feature bundles—may be manipulated by operations such as head-raising/lowering, feature deletion/insertion, morpheme addition, etc. Then, the feature bundles are spelled out phonologically through vocabulary insertion and other morpho-phonological and phonological operations. Hence, the derivation of all morphological forms takes place in accordance with the architecture given in (1).



DM, in aiming to be a valid and successful general theory of the morphological component, must define the conditions that constrain possible linguistic changes and must be able to provide adequate accounts of them. Historical concerns, however, were not important in the early development of DM, although Calabrese (1994, 1998), following seminal ideas of Noyer (1992), attempted to use DM to account for historical syncretic processes in Romance clitic systems and in Case systems (see also Calabrese 2008, 2011, Calabrese and Pescarini 2014). Notable exceptions include David Embick’s investigation of Latin deponents and Passive morpho-syntax (Embick 2000), Laura Grestenberger’s work on verbal morphology in Sanskrit and Ancient Greek (Grestenberger 2016, 2017, 2018, 2019, 2022), David Embick and Morris Halle’s and Eva Remberger’s work on Latin verbs and participles (Embick and Halle 2004, 2005; Remberger 2012 (see also Calabrese (2020)), and the excellent chapter on historical morphology in Ringe and Eska (2013). Such historical concerns remained relatively peripheral in DM. In fact, I do not know other works that deal with historical issues in this framework. In this article, I will work out a single case study to demonstrate the importance of a DM analytical framework in understanding diachronic processes. Morris Halle used to tell me that any successful morphological theory must be able to provide an adequate account for the complex verbal morphology of Latin, something he did in synchronic terms in his collaboration with David Embick (Embick and Halle 2004, 2005, Halle 2018, and see also Embick (2000)). Here I will follow his advice and investigate aspects of the Latin verbal systems from a historical perspective building on his work with Embick, albeit with some theoretical innovations of mine.

The key DM features that will be relevant in the analysis are the following:

- i. Roots and morphemes, as complex bundles of morpho-syntactic and semantic features, are combined—by head movement—into larger syntactic structures, complex heads, which may then be moved if necessary (Embick and Noyer 2001; Halle and Marantz 1993; Harizanov and Gribanova 2018, a.o.).

- ii. Morphological and Morpho-Phonological operations are governed by locality principles sensitive to these structures (Bobaljik 2012, a.o.; Embick 2010, 2013).
- iii. There is a set of morphological operations that precede Phonological Spell Out. These operations modify the structures generated by the syntax. Crucial operations of this type that will be used in this paper are the addition of ornamental<sup>1</sup> morphemes and the cyclic pruning of null exponents (with upward docking of their features (see below)) (Arregi and Nevins 2012, a.o.; Embick and Noyer 2001; Halle and Marantz 1993).
- iv. Phonological Spell out applies cyclically morpheme-by-morpheme bottom up. It includes 1. cyclic Vocabulary Insertion that assigns exponents, i.e., phonological indices, to the terminal nodes of the complex heads, and 2. Morpho-Phonological (MP),<sup>2</sup> and Phonological processes that modify the phonological shape of these exponents (Halle and Marantz 1993).

Finally, the DM model adopted here requires a derivational approach to morpho-phonology in which surface morpho-phonological representations are built cyclically step-by-step, starting from abstract underlying representations and given well-grounded morpho-syntactic structures.

In addition to providing a brief synchronic analysis of the verbal system of Latin, this paper discusses the development of the thematic vowel system and athematic Perfect forms in this language from their reconstructed Proto-Indo-European (PIE) antecedents. This discussion serves to demonstrate the role of morpho-syntactic structure in constraining historical analyses, and specifically the role that morpho-syntactic locality played in this historical development. It will be shown that, despite radical changes in the exponence, the morpho-syntax, and the semantics, of verbal forms, the (local) structural relation between roots (as the repositories of idiosyncratic morphological information) and aspectual morphemes displaying special (irregular) exponents was consistently preserved across the millennia.

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<sup>1</sup> As pointed out by Embick and Noyer (2007: 305), “while all morphemes and interpretable features are present at PF, not all morphemes that are found at PF are necessarily present in the syntactic derivation. Specifically, depending on language-specific well-formedness requirements, certain morphemes are added at PF. Such morphemes are never essential to semantic interpretation since the derivation diverges onto PF and LF branches prior to the insertion of these morphemes. Thus, we speak of the reflexes of any morphemes inserted at PF as being ‘ornamental’: they merely introduce syntactico-semantically unmotivated structure and features which ‘ornament’ the syntactic representation.” In other words, ornamental means that they do not have syntactico-semantic functions or content.

<sup>2</sup> I will refer to morpho-syntactically conditioned phonological processes with the term MP processes instead of readjustments rules, the term usually used in Distributed Morphology.

In the approach to historical changes outlined here, the reconstruction of plausible and adequate morpho-syntactic structures, related morpho-syntactic reanalysis, and the associated postulation of abstract underlying representations play a crucial explanatory role. The changes I will consider do not affect forms but properties of abstract morpho-syntactic structures. Thus, the structure constrains the analytical choices that can be made; the nature of each morphological piece in the surface string must be assessed in terms of the independently motivated morpho-syntactic structure of the word. An issue of this type will be faced not only when I analyze the so-called “thematic” /-e-/ of PIE (Sanskrit /-a-/, Greek /-e-/) but also in the analysis of the verbal TV of the III conjugation in Latin.

In the same way, the insertion of ornamental pieces that do not have functional syntactico-semantic functions cannot be syntactically random and can occur only in definite positions; for example, the Latin ornamental Thematic vowels are added to syntactic heads. It follows that the diachronic reanalyses that lead to their development must be well-motivated from the structural point of view.

Furthermore, contextual allomorphy involving exponents or morpho-phonological changes must be strictly governed by locality principles. This establishes strong constraints on possible diachronic changes. In the case of this paper, it specifically accounts for why the appearance of root-conditioned exponence in Asp can occur only if the root and the latter node are morpho-syntactically adjacent.

I will end this introduction by mentioning Morris Halle. He always stressed the importance of re-examining linguistic history in light of linguistic theory and proposing new explanations for historical facts using recent theoretical models like DM in this article. As in all sciences, the validity of these explanations is demonstrated by their ability to reduce the phenomena under analysis to other known phenomena and extend the proposed explanations to other independent facts. As he emphasized, these re-examinations can not only lead to new explanations for old historical facts but also to the discovery of new connections between them while also testing the adequacy of the theoretical framework. Note that a theoretical analysis of this type is more naturally rooted in an internal reconstruction of the historical facts; this may lead to analyses that may be different or in contrast to the assumptions made by historical linguists on comparative grounds. This article tries to do this with aspects of the development of the Latin verbal system.

The paper develops as follows. Section 1 provides the basic machinery required for a detailed synchronic analysis of Latin verbal forms starting from their basic segmentation (§ 1.1). It will first show how their surface strings are derived from abstract syntactic structures in DM (§ 1.2). As we will see, the derivation of Latin’s surface morphosyntactic strings crucially requires cyclic pruning of the null exponent nodes and up-ward floating of features, leading to node fusion, specifically the

creation of spans involving adjacent fused nodes (§1.3). I argue for replacing Impoverishment with what I call Freezing in the operation of vocabulary insertion in §1.4. In §1.5, I introduce the crucial distinction in exponence between vocalic and consonantal pieces: consonants are exponents of functional pieces, vowels of ornamental ones.

Latin regular and irregular verbal forms are then derived in detail in Section 2 from independently motivated syntactic structures. The derivation proceeds through the cyclic application of ornamental TV-insertion rules and vocabulary insertion, followed by the pruning and upward floating of features. Section 2.2 deals with irregular Perfect forms.

In Section 3, I will deal with the development of Latin's thematic vowel system and of the athematic Perfect constructions. I will begin with a basic outline of the PIE verbal system (§ 3.1). An important issue is that of the morphological status of what is traditionally called the “thematic” vocalic piece /-e-/ (Sanskrit /-a-/, Greek /-ε-/). I will argue that it is a default exponent of the  $\text{Asp}^0$  node as it cannot co-occur with other clear  $\text{Asp}^0$  exponents (§ 3.2). Section 3.3 deals with the development of the Latin ornamental vocalic pieces added to  $v^0$ , which I will call verbal TVs, from PIE  $v^0$ -derivatives such as causative and denominative morphemes. This leads to the discussion of the development of athematic constructions in the *perfectum*, which involved a reanalysis: the verbal TV was deleted after certain roots in this aspectual system; otherwise, ornamental verbal TVs are inserted freely. This led to a situation where all verbal structures were systematically thematic in the *inflectum*. Since the insertion of irregular—root-conditioned—exponents is only possible in athematic structures which allow the local application of root-conditioned  $\text{Asp}^0$  VIs, such exponents became characteristic of the *perfectum* system. Section 3.4 discusses the exponence of the  $\text{Asp}^0$  node in Latin and relates it to the PIE etymological counterparts. A brief conclusion closes the paper.

## 1 Theoretical preliminaries

### 1.1 A morpho-syntactic analysis of the Latin verbal system

An analysis of the Latin verbal system will illustrate the basic machinery used in the DM model adopted in this paper. It builds on the analysis proposed by Embick and Halle (2004, 2005), Halle (2018), but it deviates from it in several ways, as explained later.

Latin is traditionally described as having four conjugations characterized by different thematic vowels, as shown in (2). The thematic vowel may be absent in specific morphological categories such as irregular perfects or Past participles as well as in specific verbs (e.g., *su-mus/es-se*):<sup>3</sup>

(2)	Traditional Label	Theme Vowel	Example 1 <sup>st</sup> Pl	Infinitive
	Conj. I	-ā-	<i>laud-ā-mus</i>	<i>laud-ā-re</i>
	Conj. II	-ē-	<i>mon-ē-mus</i>	<i>mon-ē-re</i>
	Conj. III	-I-	<i>dūc-i-mus</i>	<i>duc-e-re</i>
	Conj. III(i)	-ĭ <sup>4</sup>	<i>cap-ĭ-mus</i>	<i>cap-e-re</i>
	Conj. IV -	-ī-	<i>aud-ī-mus</i>	<i>aud-ī-re</i>

With /-I/, I will be referring to the short thematic vowel of the III conjugation. Here I assume Halle's (2018) synchronic analysis of this vowel, according to which it is an underlying [+high, +back, -round] vowel (see Section 3.3 for discussion of its diachrony). This vowel, like /-ā/, is deleted by (3) below, before vowel-initial suffixes (*am-ā-ō* → *amō*, cf. *dūc-I-ō* → *dūcō*, vs. *mon-ē-ō* → *moneō*, *aud-ī-ō* → *audiō*, *cap-i-ō* → *capiō*).

(3) [-cons, +back] → ∅ / [ \_\_ ]<sub>TV</sub> -V (i.e., *I, ā* → ∅ / [ \_\_ ]<sub>TV</sub> -V)

When this vowel appears before a consonant, and therefore is not deleted, it is fronted by the rule in (ii) (cf. *dūcimus, dūcite*; otherwise, the /e/ in *dūceremus, dūcere* is accounted for by an independently needed rule lowering short [i] before rhotics (*cap-ĭ-mus* vs. *cap-e-re*) (see (5) below):

(4) [-round] → [-back] / [ \_\_, -low] (i.e., *I* → *i*)

(5)

	X	
	[ -back ] → [ -high ] / [ __ [ +cons, +son, -nas, -lat ]	(i.e., <i>i</i> → <i>e</i> / [ __ r ])

The properties of the thematic vowels in (2) will be discussed in Section 1.5; their development will be addressed in Section 3.2.

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<sup>3</sup> To be consistent with the Latin orthography I will use the macron  $\bar{\quad}$  to indicate long vowels. The symbol  $\check{\quad}$  is also used to indicate short vowels. Since its use is redundant with respect to the simple absence of the macron, I will use it only when I want to emphasize the shortness of the vowel (cf. the short TV /-ĭ-/ vs. the long TV /-ī-/), or in penultimate syllables to help computation of stress position.

<sup>4</sup> I follow Embick and Halle (2004: 18) in treating *capiō* verbs as belonging to a fifth conjugation with respect to the traditional four ones, which they refer to as III(i). The short /-ĭ-/ of this conjugation could be underlying or derived from an /-ī-/ which was shortened after roots with a certain prosodic shape, an issue that will not be addressed here.

I will now provide a basic segmentation of the Latin verbal forms. The Latin verbal system is characterized by a basic aspectual opposition between imperfective and perfective forms (*Īnfectum* vs. *Perfectum*). Tense distinctions are found in each of these aspectual categories, as shown in (6), although no Future forms are present in the Subjunctive. The features I use in (6) are tentative but, I hope, can characterize the basic morphological contrasts of the system (for discussion of the semantic properties of the forms, see Haverling (2011)):<sup>5, 6</sup>

(6)	<i>Īnfectum</i>		vs.	<i>Perfectum</i>			
	[-Perfect]			[+Perfect]			
	[-Past]	[+Past]	[+Future]	[-Past]	[+Past]	[+Future]	
	Present	Imperfect	Future	Perfect	Pluperfect	Future Perfect	
Ind.	<i>laudāmus</i>	<i>laudābāmus</i>	<i>laudābīmus</i>	<i>laudāvīmus</i>	<i>laudāverāmus</i>	<i>laudāverīmus</i>	[-Irrealis]
Subj.	<i>laudēmus</i>	<i>laudārēmus</i>	—	<i>laudāverīmus</i>	<i>laudāvissēmus</i>	—	[+Irrealis]

A possible basic segmentation of Latin verbal forms is given in (7)–(8) (Halle Class Notes, Fall 2004). Some of the functional nodes are treated as having a null exponent. The issue of representational zeros is dealt with later. The analysis assumes, as developed more fully later, that the vocalic pieces found after the root and inflectional elements are ornamental thematic vowels. Inflectional elements below include consonants and  $\emptyset$ s.

(7)	Root-	Asp <sup>0</sup>	T <sup>0</sup>	Mood <sup>0</sup>	AGR <sub>1pl</sub>	
a.	<i>laud</i> - $\bar{a}$ + v <sup>7</sup>	-i	+ r	- $\bar{a}$ + $\emptyset$	+ <i>mus</i>	Indicative Pluperfect
b.	<i>laud</i> - $\bar{a}$ + v	-i	+ r	-I + $\emptyset$	+ <i>mus</i>	Future Perf.
c.	<i>laud</i> - $\bar{a}$ + v	-i	+ $\emptyset$	+ $\emptyset$	+ <i>mus</i>	Perfect
d.	<i>laud</i> - $\bar{a}$ +	$\emptyset$	+ b	-I <sup>8</sup> + $\emptyset$	+ <i>mus</i>	Future
e.	<i>laud</i> - $\bar{a}$ +	$\emptyset$	+ b	- $\bar{a}$ + $\emptyset$	+ <i>mus</i>	Imperfect
f.	<i>laud</i> - $\bar{a}$ +	$\emptyset$	+ $\emptyset$	+ $\emptyset$	+ <i>mus</i>	Present

5 For the sake of expository simplicity, I will use only forms of the 1 Person Plural and neglect in the analysis all other persons (although there will be some discussion of the distribution of ending *-ō/-m* of the 1Sing.).

6 For the Latin verb paradigms, see Gildersleeve and Lodge (2000), or any other standard Latin grammar. I have also drawn on Sommer (1914) and Leumann (1977), in addition to specialized works such as Ernout (1953/1989), Sihler (1995), Meiser (1998) and Weiss (2009).

7 Note that this exponent alternates between consonantal [v] and vocalic [u] depending of syllable structure: it is [u] after consonants, otherwise [v], as in these cases.

8 Later it will be argued that the Indicative Imperfect/Future exponent *-b-* (and the relevant TVs) are to be inserted in the higher Mood<sup>0</sup> node. The issue is not relevant at this point; thus I will insert under T<sup>0</sup> for the sake of the exposition.

(8)	Root-	Asp <sup>0</sup>	T <sup>0</sup>	Mood <sup>0</sup>	AGR <sub>1pl</sub>		
a.	<i>laud</i> - <i>ā</i> +	<i>v</i> - <i>I</i> +	<i>s</i> - $\emptyset$ +	<i>s</i> - <i>ē</i> +	<i>mus</i>	Subjunctive	Pluperfect
b.	<i>laud</i> - <i>ā</i> +	<i>v</i> - <i>I</i> +	$\emptyset$ +	<i>r</i> - <i>i</i> <sup>9</sup> +	<i>mus</i>		Perfect
c.	<i>laud</i> - <i>ā</i> +	$\emptyset$ +	$\emptyset$ +	<i>r</i> - <i>ē</i> +	<i>mus</i>		Imperfect
d.	<i>laud</i> - +	$\emptyset$ +	$\emptyset$ +	$\emptyset$ - <i>ē</i> +	<i>mus</i>		Present

Given the segmentations in (7)–(8), a synchronic simplification of the exponence of the Latin verbal inflectional elements is possible if one assumes that there is a correlation between the intervocalic [r]s found in the case of the [+Past]<sub>T0</sub> and [+Irrealis]<sub>Mood0</sub> in lines (7)a-b) and (8)b-c), respectively, and [s]s found for the same nodes in Subjunctive Pluperfect in line (8)a). Alternations between [s] and intervocalic [r], in fact, are a characteristic feature of Latin morpho-phonology and are due to the independently motivated so-called rhotacism process, given in (9):

(9) [+cons, +cont, -nas, -lat] → [+son] / V \_\_ V (i.e., *s* → *r* / V \_\_ V)

Given its importance in the synchronic analysis of the verbal forms, a brief discussion of the synchronic status of this rule is needed. The issue of the synchronic status of the rhotacism is, in fact, debated (Wetzels 1981; Baldi 1994).

Alternations between *s* and *r* in an intervocalic context are common in Latin.<sup>10</sup>

- (10) *aes/aeris* ‘copper-N/G’  
*flōs/floris* ‘flower’  
*opus/operis* ‘work-N/G’  
*mōs/mōris* ‘custom-N/G’  
*rōs/rōris* ‘moisture-N/G’  
*mās/maris* ‘male-N/G’  
*est* ‘is’ vs. *erit* ‘it will be’, *erat* ‘it was’  
*gestus/gerō* ‘carry about-PRTC/PRS.1SG.’  
*haustus/hauriō* ‘draw up PRTC/PRS.1SG.’  
*questus/queror* ‘complain PRTC/PRS.1SG.’  
*hesternus* ‘yesterday’ (adjective), *herī* ‘yesterday’ (adverb)

<sup>9</sup> This vowel was long in early stages of Latin (cf. Ernout 1953/1989: 218–9). It was, however, shortened in classical times. I adopt the classical time pronunciation in this paper.

<sup>10</sup> Old Latin also shows *arbos/arboreis* ‘tree-N/G’; *honōs/honōris* ‘honor-N/G’; *labōs/labōris* ‘work-N/G’; *odōs/odōris* ‘smell-N/G’; *lepōs/lepōris* ‘pleasantness-N/G’. As well known, polysyllabic nominal roots, like the preceding forms, restructured their underlying representations to a paradigmatically consistent -r in Classical time: *arbor*, *honor*, *labor*, *odor*, and *lepor* (Bermudez-Otero 2018; Kiparsky 1997; Wetzels 1981). Monosyllables, however, were not affected by this restructuring, so we have, as shown in (10), only *mōs/mōris* ‘custom’, etc.

On the other hand, there are also many exceptions. Loanwords show intervocalic [s], e.g. *basis* ‘pedestal’, *Mūsa* ‘Muse’ *nausea* ‘sea-sickness’ (from Greek), *cisium* ‘cabriolet’ (from Gaulish), *asinus* ‘donkey’, *casa* ‘hut’ (from Etruscan?) (Leumann 1977: §180). Additionally, rhotacism appears not to have applied when the [s] is followed by an [r] in an adjacent syllable: for example, in *miser* ‘wretched’ (for which we might expect \**merer*, cf. the verb *maereō/ maestus* ‘lament’), and in *caesariēs* ‘luxuriant hair’ (cf. Sanskrit *kēsara-* ‘mane’) (but *soror* ‘sister’ < \**swesōr* (cf. German *Schwester*).

However, Touratier (1975) proposes that rhotacism applied regularly across morpheme boundaries (see Wetzels (1981) for detailed discussion). Following his lead, one could assume that that it is a cyclic morpho-phonological rule sensitive to root-based information (diacritics), which would explain exceptions such as *Mus-a*, *cas-a*, etc. (See Roberts (2012) for a proposal along the same lines). Crucially under this account, rhotacism would apply regularly in the verbal inflectional morphology as assumed here.<sup>11</sup>

I will thus assume the synchronic activity of the rhotacism rule in (9). Therefore, the underlying representations (UR) for vocalic exponents as in (11)–(12) can also be postulated (see below for discussion, cf. Halle Class Notes, Fall 2004, Embick and Halle (2004), Embick (2010)). If one assumes that rhotacism as in (9) is still active as a synchronic (morpho-phonological) rule in the verbal inflectional system, we can hypothesize the URs for the consonantal exponents in (11)–(12).<sup>12</sup> As already noticed above, there is also an alternation between short [i] and [e] with [e] appearing only before [r] (etymological or derived by (9)). Ordering the rule in (5a) after (9) accounts for these alternations. Additionally, the rule (3) is also needed to account for the absence of the thematic vowels *ā* before *ē* in (12)d) (cf. also *laud-* *ā-ō* → *laudō* ‘I praise’).

<sup>11</sup> Failure of rhotacism across prefixal boundaries (e.g. *dē-siliō* ‘jump.down-PRS.1SG’ (cf. *saliō* ‘jump PRS.1SG’), *nī-sī* ‘unless’ (cf. *sī* ‘if’) could be accounted for if one assumes that Latin prefixes are non-cyclic (cf. Halle and Vergnaud’s (1987) analysis of yer-vocalization in Russian perfective forms).

Non-application of rhotacism to the intervocalic [s] which is the output the simplification of clusters of coronal stops [t/d] before [s] (e.g., *suāsī* (<*suād-s-ī*) ‘urge-PRF.1SG’, *rīsī* (<*rid-s-ī*) ‘laugh-PRF.1SG’, *divīsī* (<*divid-s-ī*) ‘divide- PRF1SG’, *cāsu-* (*cad-s-u-*) ‘fall-PRTP’, *vīsu-* (<*vid-s-u-* ‘I see’), *ūs-* (*ūt-s-u-* ‘use PRTP’) could be accounted for by ordering rhotacism after cluster simplification, or better after the degemination of the [ss].

<sup>12</sup> The underlying exponents /s/ in (11)–(12) are also independently required for diachronic reasons, see Ernout (1953/1989), Sihler (1995), Meiser (1998) and Weiss (2009) (see Section 3.4 for further discussion).

(11)	Root-	Asp <sup>0</sup>	T <sup>0</sup>	Mood <sup>0</sup>	AGR <sub>1pl</sub>		
a.	<i>laud</i> - $\bar{a}$ + <i>v</i> - <i>i</i> + <i>s</i> - $\bar{a}$ + $\emptyset$				+ <i>mus</i>	Indicative	Pluperfect
b.	<i>laud</i> - $\bar{a}$ + <i>v</i> - <i>i</i> + <i>s</i> - $\check{i}$ + $\emptyset$				+ <i>mus</i>		Future Perf.
c.	<i>laud</i> - $\bar{a}$ + <i>v</i> - <i>i</i> + $\emptyset$				+ <i>mus</i>		Perfect
d.	<i>laud</i> - $\bar{a}$ + $\emptyset$ + <i>b</i> - $\check{i}$ + $\emptyset$				+ <i>mus</i>		Future
e.	<i>laud</i> - $\bar{a}$ + $\emptyset$ + <i>b</i> - $\bar{a}$ + $\emptyset$				+ <i>mus</i>		Imperfect
f.	<i>laud</i> - $\bar{a}$ + $\emptyset$ + $\emptyset$				+ <i>mus</i>		Present

(12)	a.	<i>laud</i> - $\bar{a}$ + <i>v</i> - <i>i</i> + <i>s</i> - $\emptyset$ + <i>s</i> - $\bar{e}$ + <i>mus</i>	Subjunctive	Pluperfect
	b.	<i>laud</i> - $\bar{a}$ + <i>v</i> - <i>i</i> + $\emptyset$ + <i>s</i> - $\check{i}$ + <i>mus</i>		Perfect
	c.	<i>laud</i> - $\bar{a}$ + $\emptyset$ + $\emptyset$ + <i>s</i> - $\bar{e}$ + <i>mus</i>		Imperfect
	d.	<i>laud</i> - $\bar{a}$ + $\emptyset$ + $\emptyset$ + $\emptyset$ - $\bar{e}$ + <i>mus</i>		Present

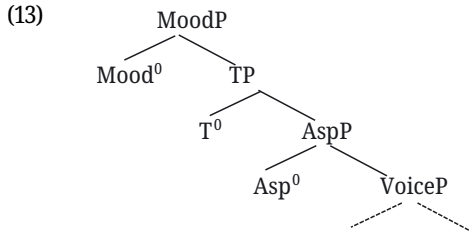
In this paper, I will assume the underlying representations for the Latin verbal inflectional elements in (11)–(12). As discussed below, they will eventually allow a fully parsimonious account of the Latin verbal exponence.

## 1.2 From syntax to verbal forms. Theoretical background

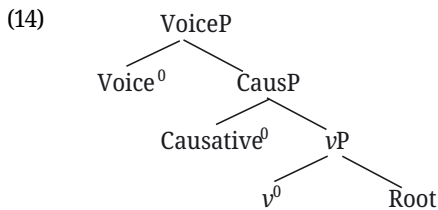
In this section I derive the morpho-syntactic structure of the Latin verbal forms in terms of the morphological model adopted here *Distributed Morphology* (DM). Doing this will also allow us to illustrate the basic aspects of this model. DM (Embick 2010; Halle and Marantz 1993) is a theory of morphology claiming that the distribution of morphological pieces in word formation is syntactically driven. As already mentioned, the framework rests upon three main tenets. First, morphemes (roots and affixes), as complex feature bundles, are combined—by head movement—into larger syntactic structures, complex heads, which may then be moved if necessary (Embick and Noyer 2001; Halle and Marantz 1993; Harizanov and Gribanova 2018, a.o.). Second, phonological spell-out applies cyclically morpheme-by-morpheme, bottom up, and includes both cyclic *Vocabulary Insertion* that assigns exponents, i.e., phonological indices, to the terminal nodes of the complex heads, and also morpho-phonological and phonological processes that modify the phonological shape of these exponents (Halle and Marantz 1993). Third, such morphological and morpho-phonological operations are governed by locality principles sensitive to these structures (Bobaljik 2012, a.o.; Embick 2010, 2013).

The ultimate goal of this framework is to define the grammatical conditions that constrain morphological exponence under the assumption that morphemes are structure-dependent, syntactic entities. This results in two main corollaries. First, given an independently motivated morpho-syntactic structure, changes in word exponence can only involve changes in the exponents of the terminal nodes of this structure. Second, the structure constrains the analytical choices that can be made: each morphological piece in the surface string must be assessed in terms of the word's independently motivated morpho-syntactic structure. This approach to analytical choices will be crucial in this paper.

The morpho-syntactic structure of the verbal systems of the languages considered in the paper is derived by assuming, along the lines of Wurmbrand (2015; but see also Cinque 1999), the verbal functional structure in (13), which expresses the basic core temporal, aspectual, and modal structure of eventualities.<sup>13</sup>



As standard in DM, the split-verb phrase hypothesis (Borer 1994, 2005; Chomsky 1995; Hale and Keyser 1993; Harley 2017; Kratzer 1994, 1996; Larson 1988; Marantz 1997; Pylkkänen 2008; Travis 2000, 2010), is also adopted and with it a complex structural organization of the VP-shell. It includes (i) *vP*, which assigns verbal category to the category-unspecified root head of its complement and that may mediate between the inner syntactico-semantic properties of the root and the higher functional projection; it also has the function of verbalizing nominal and adjectival constituents in its complement—namely, it can be a denominative/deadjectival verbalizer; (ii) *CausP*, which introduces causative syntax and semantics; and (iii) *VoiceP*, which controls the presence/absence of the external argument (and consequently assignment of accusative case, given Marantz (1991)). The VP-shell structure is given (14).<sup>14</sup>



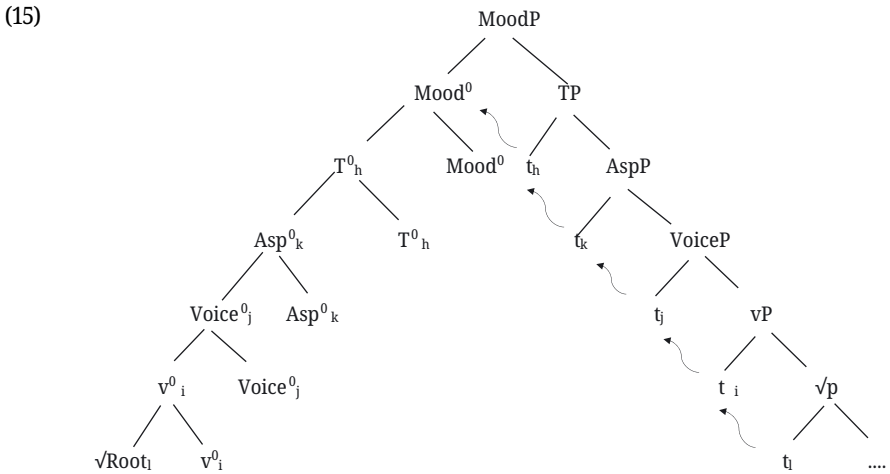
I will refer to the head nodes in (14), and to their exponents, as the VP-shell functional nodes and the VP-shell exponents, respectively.<sup>15</sup>

<sup>13</sup> Along the lines of Wurmbrand (2015), additional functional heads may be provided by bleached lexical roots (that is, restructuring verbs). These functional heads express additional “nuances” of eventualities (see also Calabrese (Forthcoming a) for discussion). The matter is not of relevance here and will not be pursued further.

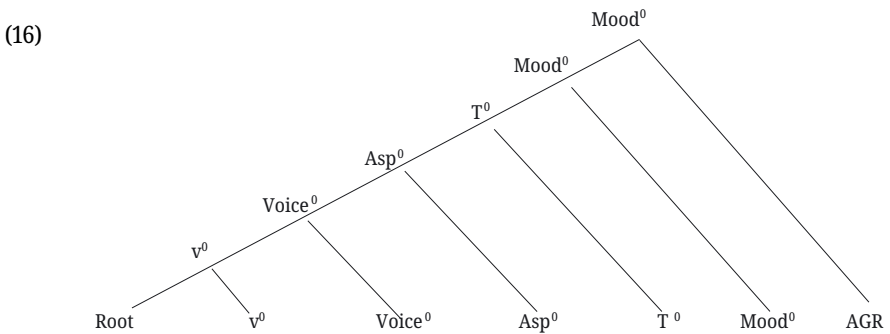
<sup>14</sup> The structure reported in (3) is simplified with respect to the one proposed by Harley (2017) in not having the inner Appl(ictive)P and the outer CausP, which are not relevant in our analysis here.

<sup>15</sup> It is important to observe that Pylkkänen (1999) introduced a “bundling” parameter, allowing for the bundling of the nodes in (14) to occur in a language, depending on the setting of the parameter. A

The universal hierarchical structure formed by the combination of (13) and (14) is then mapped onto surface morphological units (i.e.,  $X^0$ -complexes; Embick and Noyer 2001) via cyclic, iterated head-rollup movement of Root through  $v$ , Asp, T, M. I will not linger over the technical aspects of head-movement and their justification here (see Calabrese 2019 for my implementation of this procedure). Such a procedure will create the structure in (15) (For graphic simplicity, I will omit the CausP until it is relevant for the analysis further below):



Following Halle and Marantz (1993) and Bobaljik (2000), the node AGR is adjoined to the highest  $X^0$  in the complex verbal  $X^0$  head. The resulting structure is reported below; as opposed to (15), all terminal nodes are on the same horizontal line for reasons of graphic simplicity:



morphological version of this parameter will be proposed below; it will also allow further bundling of the nodes in (14) with higher nodes like  $Asp^0$  (see Section 1.3).

The structure in (16) undergoes Vocabulary Insertion, i.e. the procedure of association between (a bundle of) morpho-syntactic features (i.e., functional nodes) and phonological content (exponence). It is assumed to occur cyclically from the inside out (Bobaljik 2000).

Putting aside the Voice node,<sup>16</sup> the structure in (16) nicely accounts for the morpheme orders we see in (11)–(12), as for example in the Pluperfect Subjunctive form *laud-a-vi-s-se-mus*, i.e., [[ [ [ [ [ [ *laud-* ]<sub>Root</sub> [-*a*] ]<sub>TV</sub> ]<sub>v<sup>0</sup>-v</sub> [-*i*] ]<sub>TV</sub> ]<sub>[+perfl]-Asp<sup>0</sup></sub> ] -*s* ]<sub>[+Past]-T<sup>0</sup></sub> -*s* ] [-*e*] ]<sub>TV</sub> ]<sub>[+irr]-Mood<sup>0</sup></sub> ] -*mus* ]<sub>[1pl]-AGR</sub> ] ‘praise.PLUPRF.SUBJ1PL’ (see below for a full derivation of this form).

If one considers the segmentations in (11)–(12), it is apparent that a few of the nodes in (16) are not realized overtly in the Latin morphemic string. It is natural to assume that node silence results from their being marked with the null exponent  $\emptyset$ . However, adoption of zero-exponence leads to problems pointed out by many authors (among others, Anderson 1992; Halle and Marantz 1993; Marantz 1997; Trommer 2012; Dahl and Fabregas 2021). Zero-exponence may allow for a proliferation of theories, none of which are testable. To exemplify, consider the Latin form *laud-ā-b-ā-mus* ‘praise.IMPERF.IND.1PL’. In this form, many of the terminal nodes are silent, and only one of them is realized as *-b-* (the vocalic piece *-ā-* appearing next to it will be discussed below in Section 1.5). In principle, DM currently allows for the practitioner to analyze *-b-* as any of the existing nodes above the root. Consider the possible solutions in (17); there is no independent way to motivate one over the others (Pullum and Zwicky 1992).

- (17) a. ... [Mood<sup>0</sup> [T<sup>0</sup> [Asp<sup>0</sup> [Voice<sup>0</sup> [v<sup>0</sup> *laud -ā-* ]<sub>v<sup>0</sup></sub> *b-ā-* ]<sub>Voice<sup>0</sup> - $\emptyset$ -</sub> ]<sub>Asp<sup>0</sup> - $\emptyset$ -</sub> ]<sub>T<sup>0</sup> - $\emptyset$ -</sub> ]<sub>Mood<sup>0</sup></sub> ...  
 b. ... [Mood<sup>0</sup> [T<sup>0</sup> [Asp<sup>0</sup> [Voice<sup>0</sup> [v<sup>0</sup> *laud -ā-* ]<sub>v<sup>0</sup></sub> - $\emptyset$ - ]<sub>Voice<sup>0</sup> -*b-ā-*</sub> ]<sub>Asp<sup>0</sup> - $\emptyset$ -</sub> ]<sub>T<sup>0</sup> - $\emptyset$ -</sub> ]<sub>Mood<sup>0</sup></sub> ...  
 c. ... [Mood<sup>0</sup> [T<sup>0</sup> [Asp<sup>0</sup> [Voice<sup>0</sup> [v<sup>0</sup> *laud -ā-* ]<sub>v<sup>0</sup></sub> - $\emptyset$ - ]<sub>Voice<sup>0</sup> - $\emptyset$ -</sub> ]<sub>Asp<sup>0</sup> - *b-ā-*</sub> ]<sub>T<sup>0</sup> - $\emptyset$ -</sub> ]<sub>Mood<sup>0</sup></sub> ...  
 d. ... [Mood<sup>0</sup> [T<sup>0</sup> [Asp<sup>0</sup> [Voice<sup>0</sup> [v<sup>0</sup> *laud -ā-* ]<sub>v<sup>0</sup></sub> - $\emptyset$ - ]<sub>Voice<sup>0</sup> - $\emptyset$ -</sub> ]<sub>Asp<sup>0</sup> -  $\emptyset$ -</sub> ]<sub>T<sup>0</sup> - *b-ā-*</sub> ]<sub>Mood<sup>0</sup></sub> ...

**16** The inner Voice node is systematically absent (never marked with an inner exponent) in Latin verbal morphology. If the periphrastic Perfect Passive is put aside, Latin synthetic Passive forms display a suffixal *-r/* that is apparently added to the AGR endings as a comparison of the Passive forms with their active counterparts in the case of the Present 1 and 3 singular readily indicates (*am-o-r/mon-e-o-r/aud-i-o-r* vs. *am-o/mon-e-o/aud-i-o*; *am-a-t-[u]-r/mon-e-t-[u]-r/aud-i-t-[u]-r*—where [u] is epenthetic— vs. *am-a-t/mon-e-t/aud-i-t* ‘love/warn/hear’). In fact, the idea that the morphology of the Latin Passive should be analyzed as containing a morpheme */r/* that is added to the personal desinences is standard in the traditional analyses of these forms (cf. Meillet 1964; Ernout and Thomas 1951/1972; Embick 2000). The Passive, and Voice morphology, in Latin will not be addressed further in this article. I will keep mentioning the inner Voice node in the morphosyntactic structures for expository simplicity but it will be eventually systematically removed by assigning it zero exponence, which will lead to pruning of this node, as discussed below (see Kastner and Zu (2017), Zyman and Kalivoda (2020), Bertocci and Pinzin (2021) for further discussion. See also Calabrese (Forthcoming b) for my own analysis).

## 1.3 On silence in morphology

### 1.3.1 Against silence as morpho-syntactic absence

Note at this point that  $\emptyset$  in the structures in (11)–(12) could also be analyzed as involving the absence of a node before vocabulary insertion. For example, one could assume that nodes with unmarked features are not syntactically projected (see Embick and Halle (2004) and also Halle (2018) with regard to Latin).<sup>17</sup> This move would be welcome insofar as it would simplify syntactic structures *ab origine*, a matter of representational parsimony. Unfortunately, the evidence is that the distribution of morphological zeros does not follow from syntactic activity/inactivity but is simply a property of the node exponence. First, note that [+]marked, and therefore syntactically active, nodes such as Mood<sup>0</sup> in the Subjunctive Present and Imperfect, T<sup>0</sup> in the irregular futures of the III and IV conjugations, and also Asp<sup>0</sup>, as mentioned before, are phonologically null. These marked, active nodes must be syntactically projected; null nodes must be assumed to explain their silence. With their existence independently established, null nodes are available for the treatment of all other cases of silence. It follows that phonological silence is not due to syntactic inactivity/unmarkedness.

The existence of null exponents is also motivated by the patterns of certain exponents. Specifically, the features of unmarked phonologically silent nodes are needed by rules of vocabulary insertion and other rules of exponence. A striking case is that of the exponent of the 1<sup>st</sup> Sg AGR node, which, putting aside the Perfect where we find /-ī/ (cf. *laudāvī*), is /-ō/ in Present and Future Indicative forms (*laud-ō*, *laudāb-ō*, *laudāver-ō*), otherwise -m (*laudāba-m*, *laudāvera-m*, *laude-m*, *laudāre-m* *laudāverim*, *laudāviss-em*). The only way to characterize the distribution of /-ō/ is to refer to the feature specifications [-Past, -Irrealis]. These are clearly unmarked, yet they must be present when Agreement exponence is inserted. This could not be accounted for if the relevant nodes were not syntactically projected.

If we assume the segmentations in (11) and (12), we have other similar cases. For example, as already observed, the exponent /-b-/ appears to have a much more restricted distribution with respect to the exponent /-s-/, which occurs in a larger variety of contexts as the exponent of a node with marked features. The exponent /-b-/ occurs as the exponent of a [+Past] or [+Future] node only in a context featurally characterized as [-Perfect, -Irrealis]. Both feature specifications are unmarked but must be representationally available to determine the insertion of /-b-/. This is not expected if the relevant dominating nodes are not syntactically projected. A similar

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<sup>17</sup> Or otherwise fully removed from the morphosyntactic representations before vocabulary insertion.

situation is found in the Subjunctive Imperfect and in the Subjunctive Present. If /-s-/ is the exponent of nodes with marked features, we should expect to find it as the exponent of the [+Past]<sub>T0</sub> node of the Imperfect and as the exponent of the [+Irrealis]<sub>Mood</sub> node of the Present. This is not borne out in the data; (11) and (12) show that both have  $\emptyset$ s. To account for this, we need to refer to unmarked features: in the case of the Imperfect Subjunctive, we need to say that the [+Past]<sub>T0</sub> is realized as  $\emptyset$  in the context [-Perfect, +Irrealis], and in the other case that [+Irrealis]<sub>Mood</sub> is realized as  $\emptyset$  in the context of [-Perfect, -Past] (see below for an account). The distribution of these exponents cannot be accounted for if nodes with unmarked features are not projected syntactically. The most adequate way to formally deal with such a situation is to assume that these features are associated with a  $\emptyset$ .

Thus, it can be proposed that once it is determined what nodes, or better what features, receive overt exponents, all other nodes and features are automatically assigned zeros. The nodes, or features, receiving zeros are obviously constrained. Some zeros will be inserted in positions that have overt counterparts. For example, an overt exponent for [+Past]<sub>T0</sub> motivates a  $\emptyset$  for [-Past]<sub>T0</sub> if there is no overtly marked exponence for this configuration.<sup>18</sup> However, a zero can also be assigned to silent positions containing features triggering morpho-phonological rules. This is the case of the number terminal node in many southern Italian dialects where one finds alternations such as *péjff/píjff* ‘fish-SG/PL. [+plural] triggers systematic metaphonic alternations such as. A zero is also assigned to silent nodes containing features intervening in morphosyntactic processes such as the node Voice in the Romance languages where the feature [+Passive] blocks verb head movement as in the analysis proposed by Embick (2000), Bjorkman (2011), Calabrese (2019, forthcoming a), a.o., thus resulting in a periphrastic structure. It follows that zeros are automatically assigned to otherwise non-overt nodes containing contrastive morphological features, therefore, to features that are morphologically active in a language. As discussed in the next section, however, all these nodes will be pruned, and their features will be docked and bundled with immediately higher up nodes if present.

### 1.3.2 Zeros, fusion and null node pruning

Null exponents,  $\emptyset$ s, are also needed for another reason. The Subjunctive Pluperfect form *laud-ā-v-i-s-s-ē-mus* ‘Praise-Subj.Pluperfect’, is an agglutinative structure, i.e., an accumulation of morphological nodes; however, in the case of the form *laud-ā-r-ē-mus* ‘Praise-Subj.Imperfect’, a single morpheme seems to appear instead of the

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<sup>18</sup> This would be a way of formalizing the structuralist Block’s constraint on the use of zeros: “One of the alternants of a given morpheme may be zero; but no morpheme has zero as its only alternant” (Bloch 1947: 402).

string of exponents for the  $\text{Asp}^0 + \text{T}^0 + \text{Mood}^0$  nodes. Zeros were used to account for this in the representation in (11)–(12), as mentioned above. Now, alternatively, fusion could be used in the DM model of Halle and Marantz (1993) to account for the merging of some of these nodes. Since the beginning of DM, both the use of surface zeros and fusion have been considered problematic. On the one hand, Zwicky and Pullum (1990) have argued that the use of surface zeros leads to insufficiently restrictive analyses. On the other, fusion has a look ahead problem insofar as nodes must be fused pre-vocabulary insertion to allow the insertion of the relevant port-manteaux exponent (Chung 2007, 2009). But use of both fusion and zero exponents can be used to accomplish the same surface outcome.

An operation that can directly connect fusion and zero exponents is null node pruning. This procedure consists of delinking nodes with non-overt exponence, where  $\emptyset$ s are inserted when independently motivated terminal nodes fail to have phonological realization. This is followed by the upward docking of features that had become floating due to pruning. The procedure was independently proposed by Calabrese (2019) for the following reasons: (a) to simplify the phonological realization of morphosyntactic structures, (b) to account for the convergence of complex morphosyntactic structures and their simpler PF surface shape, and also crucially (c) to explain why phonologically null exponents—regardless of their marked/unmarked status—appear not to act as interveners for morphological locality (cf. Embick (2010); Calabrese (2019)).<sup>19</sup>

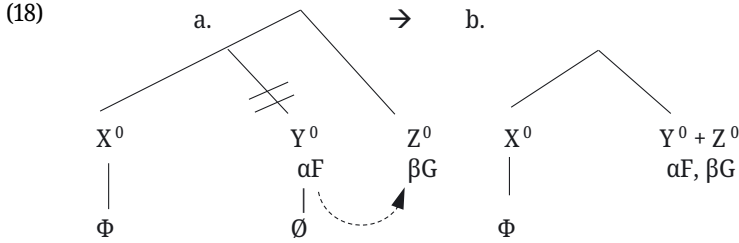
Pruning applies as in (18), where the terminal node  $Y^0$  is assigned a null exponent during cyclic vocabulary insertion in phonological spell out.<sup>20</sup> Pruning detaches  $Y^0$  from its immediately dominating node. However,  $Y^0$  is not deleted; its features become floating and are merged with an adjacent higher terminal node, if there is one. The lower adjacent node has already undergone VI— $\Phi$  is an overt exponent, and therefore can no longer be assigned morphological features. This results in the fusion of the two terminal nodes where fusion is always triggered by this pruning operation. A further application of cyclic vocabulary insertion applies to this fused node at this point.<sup>21</sup>

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<sup>19</sup> Pruning was originally proposed by Embick (2010) only for non-overt category defining nodes. Following Christopolous & Petrosino (2017) and Christopoulos (2018), Calabrese (2019) extended it to all types of non-overt category nodes and reformulated it as in (36).

<sup>20</sup> The features of nodes with  $\emptyset$  exponents can always be included in the structural description of morpho-phonological rules, which will apply cyclically and locally when the relevant nodes are reached. See below for examples in the case of Latin irregular perfects.

<sup>21</sup> Unattached floating features are eventually deleted but only at the end of phonological spell out, so they can play a role in triggering morpho-phonological rules such as ablaut processes.



Thus, what matters is the pattern of overt exponence. Given an independently motivated morpho-syntactic structure such as the hierarchy in (16) and the distribution of overt exponents, zero exponent insertion and bottom-up cyclic pruning can generate the relevant simplified morpho-syntactic structures. Once null exponents are identified,  $\emptyset$ s can be considered as devices triggering pruning and subsequent fusion and I will be using them with this function. The resulting bundles will include features of nodes that do not have overt exponence despite being morpho-syntactically active.<sup>22</sup> Pruning could be thought of as triggered by the UG filter in (19) which disallows a terminal node exhaustively dominating a null exponent, i.e. phonologically realized as  $\emptyset$  (see Arregi and Nevins 2012; Calabrese 2019 for a theory of morphology including morphological filters and repairs):



The constraint target morpho-syntactic configurations. Null exponents are independently needed as argued earlier to account for the silence associated with certain morphosyntactic features. Null exponents can be cyclically inserted during Vocabulary Insertion as motivated earlier. Once these null exponents are inserted in terminal nodes, they violate (19). But then they are immediately removed by pruning as a repair. This theory has consequences on the structure of the VIs and on the feature specification to be used in them. In fact, due to (19), the use of  $\emptyset$  is costly. The following principle governing VI composition can then be proposed:

<sup>22</sup> Note that the fused terminal nodes generated in this way derive the lexical spans of Nano Syntax (Starke (2009, 2014); Merchant 2015) in a principled way insofar as each span will have a single terminal node and a relevant VI. This is done in a DM model in which vocabulary insertion operates on terminal nodes and not on arbitrary phrasal chunks. An in-depth comparison between what proposed here and Nano Syntax spans is not possible here.

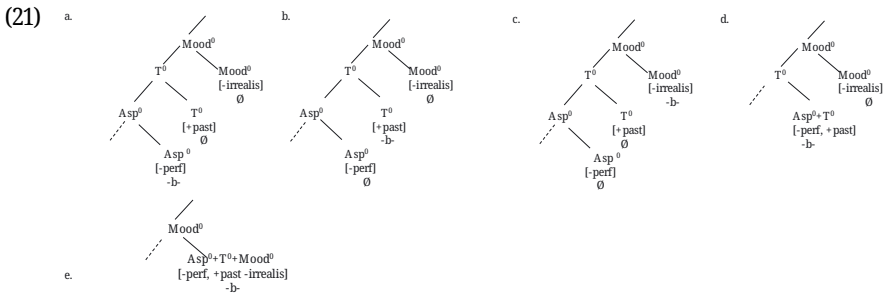
## (20) Vocabulary Items can only assign overt exponence.

It follows that, given an overt exponent whose distribution involves the features of more nodes, it must be postulated in such a way that it maximally expones the entire sequence of nodes and must therefore be inserted in the highest node. At the same time,  $\emptyset$ s are assigned by default and not by VIs.

For example, consider the Imperfect Indicative form *laudābāmus*. Once it is compared with the other forms of the Latin verbal paradigm, it can be decomposed as *laud-ā-b-ā-mus*. The focus here is on the piece *-b-*. Given the analysis proposed in (11)–(12), it competes with the other exponents *-Ø-*, *-v-* and *-s-* and, as already mentioned, its distribution is characterized by the features [+F, -Perfect, -Irrealis] where [+F] can be [+Future] as in *laudābimus*, or [+Past] as in this case.<sup>23</sup>

Once the featural distribution of an item such as *-b-* is established, one must determine its structural distribution: the insertion site of the exponent. If the specification(s) belong(s) to a single terminal node, there is no issue: the exponent is inserted into this terminal node. The situation is more complicated if the Vocabulary Item includes specifications belonging to multiple terminal nodes. This is the case of Latin *-b-*.

Consider the possible structures in (21) with the relevant exponent assignments and the related VIs in (22) where the feature specifications in the square brackets must match those contained in the VI insertion site:



<sup>23</sup> The featural distribution of an exponent is determined by looking at the paradigm including that exponent. Assuming that a paradigm is the set of the morphological realizations of the feature combinations of a given terminal node of the morpho-syntax, the principle that governs feature assignments to an exponent, i.e., the relevant vocabulary item, is given in (i) (Calabrese (2008)):

- (i) For each vocabulary item *I* in a paradigm *P*, the minimal set of feature specifications able to account for the maximal distribution of *I* in *P* is assigned to *I*.

- (22) /-b-/ <->
- a. [-Perfect] / [ \_\_\_ +Past, -Irrealis]
  - b. [+Past] / [ \_\_\_, -Perfect, -Irrealis]
  - c. [-Irrealis] / [ \_\_\_ +Past, -Perfect]
  - d. [-Perfect, +Past] / [ \_\_\_ -Irrealis]
  - e. [+Past, -Perfect, -Irrealis]

The two following well-established requirements restrict analytic possibilities: (i) Once feature specifications of the morphosyntactic structures are used up in their relevant insertion cycle, they are no longer available (Bobaljik 2000) (Feature Obsolescence). (ii) Vocabulary insertion requires morphological Locality, specifically structural adjacency between the elements in the structural description of the VI (Bobaljik 2012; Embick 2010) (Locality).

Consider first cases where pruning, and subsequent fusion, are disallowed. In this case,  $\emptyset$  must be assigned, and preserved, to nodes in violation of (19). These is the case of the structures in (21)a, b) and c). The structure in (21)a), and the related VI in (22)a) are excluded by Locality: when the VI applies to insert /-b-/ in the Asp node, the feature [-Irrealis] is too far away. Let us consider (21)b) now. In this case, /-b-/ is inserted in the T node, which contains only the feature [+Past]. Feature Obsolescence forbids this option because once the vocabulary insertion inserts  $\emptyset$  in the Asp node, the feature [-Perfect] becomes unavailable for higher insertion cycles. Therefore, it is inaccessible for the VI (22)b). Therefore, this structure and the related VI in (22)b) can be rejected. We now turn to (21)c) and the related VI in (22)c), which are excluded by both Locality and Obsolescence: when /-b-/ is inserted in the Mood node, it requires access to the feature [-Perfect], which is too far away up and rendered inaccessible by vocabulary insertion cycle in Asp<sup>0</sup>.

If we assume feature Obsolescence and Locality, we must assume that features of nodes with zero exponents can be made available to the c-commanding adjacent node. I represented this availability in (21) by including the relevant features in the insertion site of the VI, i.e. by using pruning, and subsequent fusion. The option in (21) d) with the related VI in (22)d) postulates the presence of a null exponent terminal node. This option then requires the further application of a pruning operation in comparison to the option in (21)e) with the related VI in (22)e), where all the relevant features are maximally used in the vocabulary insertion process. Derivational parsimony selects the latter more economical option. This is the option implemented by (19) and (20).

Hence, the VIs in (23) can be proposed for the functional nodes of Latin verbal structures. Remember the distribution of the exponent / $\emptyset$ / and /s/ in (11)–(12): with the exception of some cases discussed below, / $\emptyset$ / occurs as the exponent of functional nodes characterized by unmarked (–) features and /s/ as the exponent of functional nodes with marked (+) features. At the same time, /s/ competes with two other

exponents: with /b/ in the Imperfect and Future Indicative, and with /v/ in the regular forms of the Perfect (where also /-s-/ and /-Ø/ can appear after athematic roots, as discussed below). The VIs for the functional nodes are then the following. Note that +F can be any marked feature specification; Ø is assigned automatically to any node not satisfying (23)a,b) and c). The Ø assigned in this way then triggers pruning:<sup>24</sup>

- (23) a. /-b-/ <—> [-Perfect, +F, -Irrealis]<sub>Mood</sub><sup>25</sup>  
 b. /-v-/<sup>26</sup> <—> [+Perfect] (Provisional. See below)  
 c. /-s-/ <—> [+F]  
 d. Otherwise: Ø

Thus, as mentioned already, what matters is the pattern of overt exponence. All follows from that.

## 1.4 Freezing

Before going on further with the analysis of the Latin verbal forms, I will introduce an independently needed modification of the DM theoretical machinery. It was originally proposed in Calabrese (2002), where I called it feature freezing.

As already discussed, insertion of phonological exponents is governed by the Subset Principle (Halle 1997). The phonological exponent of a Vocabulary item is inserted in the terminal string if the item matches all or a subset of the grammatical features specified. Now, there are cases where insertion of the more specific vocabulary item does not occur and instead a less specific one is inserted. Since Bonet (1991), feature impoverishment has been used to account for these cases (see also Bobaljik 2003; Halle and Marantz 1993; Noyer 1992, 1998, a.o.). Impoverishment deletes or removes features from the morpheme in a terminal node. By doing so, it blocks the insertion of a more specific Vocabulary item and allows the insertion of a less specified one.<sup>27</sup> A problem noticed by Calabrese (2002), however, was that impoverished features are often used by other rules applying after the relevant VI. This should not be possible if they are actually deleted as

<sup>24</sup> Remember as already mentioned in footnote 16 that Voice is always assigned Ø regardless of its specification.

<sup>25</sup> By exclusion, here, [+F] can be either [+Past] or [+Future].

<sup>26</sup> Remember that this exponent alternates between vocalic [u] and consonantal [v] depending on syllable structure: it is [u] after consonants, otherwise [v]. The other exponents of the Perfect will be discussed below in Section 3.6.

<sup>27</sup> Most Distributed Morphology works see impoverishment as involving the permanent deletion of a feature in a morpho-syntactic representation. In Calabrese (2008) (see also Calabrese 1994), I argued that morpho-syntactic representations must be always fully specified, and propose that when a feature is deleted, an insertion of the opposite feature value immediately follows (which leads to a syncretic change). I also proposed that cases of impoverishment that cannot be analyzed in terms of feature deletion + insertion actually involve feature freezing as proposed above.

in impoverishment. For example, in the case of the Present Subjunctive *laudēmus* the mood node [+Irrealis] is assigned a null exponent  $\emptyset$  instead of the expected [-s-]. Impoverishment of the [+Irrealis] feature would account for what happens in this case as the removal of this feature would prevent the application of the VI inserting [-s-]; the elsewhere  $\emptyset$  can be inserted instead. The problem is that the feature [+Irrealis] also plays a role in the insertion of the TV /-ē-/ (cf. (43)–(44)) in the higher up insertion site. If it is assumed that this feature is deleted by impoverishment during the earlier insertion cycle, we have a problem here. Due to similar cases in Italian dialects, Calabrese (2002) proposed to use an alternative strategy: feature freezing during Vocabulary Insertion. Feature freezing prevents the use of a feature by a VI at a given insertion site; the same feature, though, can then be used by another rule (since it was not deleted as in impoverishment).

So, to account for what happens in *laudēmus*, one can say that there is freezing of the marked [+Irrealis] when Vocabulary Insertion reaches the Mood<sup>0</sup> terminal node. Therefore, not /-s-/ but /- $\emptyset$ -/ is inserted in the Present Subjunctive (cf. (52)). Freezing, being temporary, allows the feature [+Irrealis] to be available later for the insertion of the TV /-ē-/.

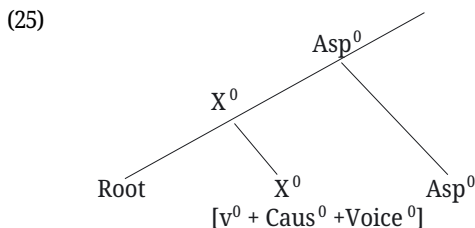
- (24) Freeze [+Irrealis] for the Mood<sup>0</sup> VI insertion rule in the context [-Perfect, -Past, \_ ]

I will consistently use Freezing instead of Impoverishment in this paper.

The final step of this theoretical introduction concerns the possibility of inserting ornamental morphology.

## 1.5 Exponents I: vocalic pieces

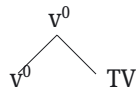
A simple glance at the structure of segmentations in (11)–(12) shows that at least two of the nodes of the VP-shell below Asp<sup>0</sup> have null exponence, so that after pruning the structure in (25) is generated. At first sight, it would be possible to assume that the root-adjacent vocalic piece /-ā-/ , as well as the other root adjacent vocalic pieces: /-ē-, -I-, ĭ-/ and /-ī-/ , are exponents of this bundled node.



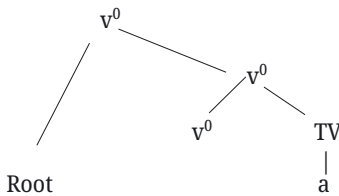
In his analysis of Latin morphology, Aronoff (1994) stresses the double nature of these vocalic pieces. On the one hand, these vocalic pieces are legitimate morphemes, separate from the nearby root and/or derivational suffix (on the left side),

and the further inflectional suffixes (on the right side). These pieces (a) are in complimentary distribution with one another, and (b) consistently occur within the same verb paradigm. On the other hand, they seem to carry no consistent syntactico-semantic meaning to the word. According to Aronoff, the most adequate analysis is one in which the Latin TVs are considered purely structural (“ornamental”) elements inserted in stem-final position. In the theory adopted here, following Ultra-Massuet and Arregi 2005, they are analyzed as ornamental elements which are devoid of syntactico-semantic functions or content. They are adjoined to the verbalizers ( $v^0$  heads which carry consistent functional meaning) as in (27) by the rule in (26).

(26)  $v^0 \rightarrow$



(27)



The Latin root-adjacent vocalic pieces have been carefully investigated by Bertocci (2017) and Bertocci and Pinzin (2021) with the precise goal of identifying their morpho-syntactic status and their semantic properties. They distinguish between the formatives  $/\bar{a}-, -\bar{i}/$ , which are found both in the *infectum* and the *perfectum*, and the formatives  $/\bar{e}-, -\bar{i}, -\bar{i}/$ , which are found only in the *infectum*.<sup>28</sup> I will discuss their analysis of  $/\bar{a}-/$  and  $/\bar{i}-/$  first, then deal with the other formatives.

I begin with the verbs of the 1st conjugation, i.e., the verbs that include the vocalic piece  $/\bar{a}-/$ . As shown by Bertocci (2017), Bertocci and Pinzin (2021) (see also De Vaan 2012), most  $/\bar{a}-/$ -verbs display one important property: they can be thought of as secondary formations. The lexical element which selects for  $/\bar{a}-/$  is a noun or an adjective (*armāre* ‘to arm’ (cf. *arm-a* ‘weapons, arms’), *novāre* ‘to make new’ (cf. *nov-o* ‘new’), *congregāre* ‘to collect into a flock/herd’ (cf. *greg-e-* ‘flock/herd’), or an existing verb (*cantāre* ‘to sing’ (cf. *can-e-* ‘sing’). In particular, they assume that the piece  $/\bar{a}-/$  is a productive verbalizer due to the causative/agentive semantic aktionsart these verbs have. This nature is shown by the residual causativizing function in couples like stative *liqu-ē-re* ‘to be liquid’ versus causative *liqu-ā-re* ‘to

<sup>28</sup> However, I will be claiming the  $/\bar{i}-/$  can be found also in the participle, hence in the *perfectum* (see below).

make liquid'; *placēre* 'to please' versus *placāre* 'to appease' and *sedēre* 'to sit' versus *sedāre* 'to settle'.<sup>29</sup> Crucially, as also noticed by Bertocci and Pinzin, there is an important subset that cannot be characterized in this way. These are verbs that seem the direct output of ancient primary verbs, i.e., they cannot be derived from attested nouns, adjectives or verbs (De Vaan 2012).<sup>30</sup> They are verbs like *amāre*, *arāre*, *putāre*, *volāre*, etc. In addition to transitive activity verbs like *amāre* 'to love', *arāre* 'to plough', *dolāre* 'to hew', this third group also contains intransitive verbs like *fārī* 'to speak' and *volāre* 'to fly'. These verbs mostly have animate subjects which can be considered initiators of processes. However, this is not true for verbs like *cubāre* 'lie down', *flagrāre* 'to glow', which are unaccusative and obviously non-agentive.<sup>31</sup>

The same holds for the /-ī-/verbs: some of them are indeed clearly related to a nominal/adjectival basis (e.g. *finio* 'I limit' - *finis* 'limit'). However, many others are not such as *dormio* 'I sleep', *venio* 'I come'. As before, finding a common semantic feature or structural property is not possible in this case.

Despite the wealth of data and the soundness of the analyses, their arguments appear unconvincing to me. Identifying common semantic properties in the case of the /-ā-/ and /-ī-/ vocalic pieces is truly elusive. The /-ā-/ and /-ī-/ verbs are a rather composite class where no clear common features can be established, both in terms of morpho-syntactic and semantic properties.

A further problem is that, whatever their etymological or derivational bases, all of the /-ā-/ and /-ī-/ verbs can undergo suppression or demotion of agentivity in Passive or impersonal constructions: *am-ā-tur*, *liqu-ā-tur*; *plac-ā-tur*, *sed-ā-tur*, *congreg-ā-tur*, *cant-ā-tur*, *fin-ī-tur*, etc. Despite this, they preserve the /-ā-/ and /-ī-/ markers. This shows that these markers cannot be associated with "agentivity". In this sense, Aronoff is right in proposing that root-adjacent pieces such /-ā-/ or /-ī-/ do not carry any syntactico-semantic meaning to the word. Furthermore, as shown by Aronoff, vocalic pieces such as /-ā-/ and /-ī-/ can cooccur with intensive verbalizers and causative markers as in the forms in (28). If /-ā-/ and /-ī-/ carried a causative/agentive meaning, they should be incompatible with the markers below. Again, in these forms, they appear to be semantically empty, redundant morphological elements (cf. especially the case of *ex-carn-ific-ā-re*):

<sup>29</sup> The presence of sporadic word pairs does not imply the presence of a systematic word-formation process.

<sup>30</sup> Out of the more than 1100 verbs taking -ā (this number does not take into consideration the prefixed variants), there are around 150 verbs of this type, whose bases do not have other uses as a noun/adjective/etc.

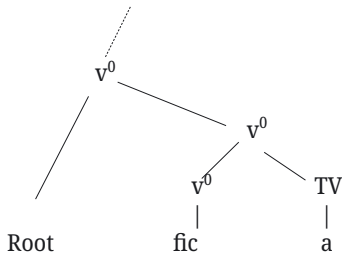
<sup>31</sup> This is also shown by a verb like *flagrāre* as in *flagrābānt ignes* Ov. F.6, 439 'the fires were glowing' is clearly unaccusative so not agentive.

## (28) Derivational verb suffixes

Suffixes	Thematic vowel	Meaning	Example	Gloss
-it-	<i>ā</i>	iterative	<i>vīs-it-ā-re</i>	‘see often’
-fic-	<i>ā</i>	causative	<i>ex-carn-ific-ā-re</i>	‘flesh out’
-ic-	<i>ā</i>	iterative	<i>mors-ic-ā-re</i>	‘bite continually’
-ur-	<i>ī</i>	desiderative	<i>ēs-ur-ī-re</i>	‘be hungry’

To account for cases like those in (28), Bertocci and Pinzin propose that a derivative like */-fic-/* “lexicalizes *v* only when it is related to complex actional semantics, whereas */-ā-/* closes the derivation enhancing the agentive function properly”. It is unclear to me what this really entails from the syntactic and semantic point of view. The point is that the derivative like */-fic-/* includes agentive semantics, and the agentive piece */-ā-/* is simply redundant. The most adequate analysis of the constructions in (28) is thus Aronoff’s original proposal, reanalyzed in DM as involving the complex structure in (29). It consists of a  $v^0$  head with a clear functional meaning, followed by the “thematic vowel”, another  $v^0$ -head but without a functional meaning. The theme vowel in this case is essentially a “redundant”  $v^0$  head devoid of syntactico-semantic functions or content.<sup>32</sup>

## (29)



32 Working in a Nano-Syntax framework (Starke 2009, 2014), Fabregas (2017) proposes that the thematic vowels in the Spanish counterparts of the Latin forms in (28) are the actual verbalizers, whereas what are considered the verbalizers in (6) are instead “allomorphs” of them. Proposing this for these Latin constructions is quite implausible. Putting aside the fact it is quite unclear in what sense elements such as */-ficā* *-/, /-esse/, /-urī-*, etc. could be considered allomorphs of the verbalizing TVs—Fabregas does not provide any formal analysis of what happens in this case in Spanish—, this hypothesis is untenable in the terms of most basic morphological analysis of these formatives insofar as it would entail that some allomorph—*/-ificā*, *urī*, *-esse*, *itā*-, etc.—end in either */-ā-/*, */-ī-/* or */-I-/* which happen to be three of the four basic thematic vowels (cf. Oltra Massuet 2021 for a similar argument for Spanish). Any adequate morphological analysis should recognize this generalization and extract these morphological elements and recognize their syntactico-semantic vacuity. It is in fact obvious, as observed by Aronoff, and as is standard in traditional grammars, that the meaning differences in the verbalizations we see in (28) are carried out by pieces such as */-fic*-, *-ess-*, *-ur-*; pieces such as */-ā-/*, */-ī-/*, */-I-/*, which can co-occur with many of the former pieces (see the distribution of */-ā-/*, for example), can in no way do that; they are simply morphologically redundant.

- (30) a. [[[[vīs]<sub>Root</sub> [-it-]<sub>v<sup>0</sup></sub> [-ā]<sub>TV</sub>]<sub>v<sup>0</sup></sub> -re]<sub>T<sup>0</sup>+AGR</sub>] ‘see often-infinitive’  
 b. [[[[ex-carn-]<sub>Root</sub> [-ific-]<sub>v<sup>0</sup></sub> [-ā]<sub>TV</sub>]<sub>v<sup>0</sup></sub> -re]<sub>T<sup>0</sup>+AGR</sub>] ‘flesh out-Infinitive’  
 c. [[[[ēs-]<sub>Root</sub> [-ur-]<sub>v<sup>0</sup></sub> [-ī-]<sub>TV</sub>]<sub>v<sup>0</sup></sub> -re]<sub>T<sup>0</sup>+AGR</sub>] ‘be hungry-Infinitive’

Let us turn to the other root-adjacent vocalic pieces /-ē-, -ī-/ and /-I-/. Bertocci and Pinzin propose that they are higher elements, that is, they realize functional features related to the actional-aspectual domain insofar as they are consistently absent with perfective aspect.<sup>33</sup>

(31)		Present	Perfect		Infinitive
a.	II	<i>ten-ē-mus</i>	<i>ten-u-ī-mus</i>	‘hold’	Athematic + -v- <i>ten-ē-re</i>
b.	II	<i>aug-ē-mus</i>	<i>aug-s-ī-mus</i>	‘increase’	Athematic + -s- <i>aug-ē-re</i>
c.	II	<i>sed-ē-mus</i>	<i>sēd-ī-mus</i>	‘hold’	Athematic + -∅ <i>ten-ē-re</i>
d.	III(i)	<i>rap-ī-mus</i>	<i>rap-u-ī-mus</i>	‘pillage’	Athematic + -v- <i>rap-ē-re</i>
e.	III(i)	<i>-spec-ī-mus</i>	<i>spec-s-ī-mus</i>	‘look at’	Athematic + -s- <i>-spec-ē-re</i>
f.	III(i)	<i>cap-ī-mus</i>	<i>cēp-ī-mus</i>	‘seize’	Athematic + -∅ <i>cap-ē-re</i>
g.	III	<i>vom-ī-mus</i>	<i>vom-u-ī-mus</i>	‘vomit’	Athematic + -v- <i>vom-ē-re</i>
h.	III	<i>dūc-ī-mus</i>	<i>dūc-s-ī-mus</i>	‘lead’	Athematic + -s- <i>dū-ē-re</i>
i.	III	<i>vert-ī-mus</i>	<i>vert-ī-mus</i>	‘turn’	Athematic + -∅ <i>vert-ē-re</i>

However, also in this case, as for /-ā-/ and /-ī-/, it is difficult to find common morpho-syntactic or semantic properties. First, /-ē-/, /-ī-/ and /-I-/-verbs cannot be characterized in terms of common special aktionsart properties. As a matter of fact, the same aktionsart properties can be found across Latin verbal conjugations, and it has never been possible to classify Latin conjugation classes in semantic terms. Second, the aktionsart properties of the verbs in question do not change with the change of aspectual features as Bertocci and Pinzin observe. If the root adjacent vocalic pieces are markers of these properties, it is unclear why they disappear

<sup>33</sup> Bertocci and Pinzin (2020) argue that Latin root nouns like *rēx/rēgis* ‘the one who rules’, *dux/ducis* ‘the one who leads’, *vōx/vōcis* ‘voice’, and Latin synthetic compounds, or Root compounds, e.g. *pontifex* ‘pontiff’, *auspex* ‘auspex’, *iudex* ‘judge’, *princeps*, *artifex* ‘master in an art’, provide evidence for a morpho-syntactic distinction between the III conjugation and the other conjugations. All of them are possible only with verbs belonging to the former conjugation and not to the other. There are no root nouns such as *\*clam-s/\*clama-s* ‘the one who calls’ from *clam-ā-re*, or root compounds such *\*agri-ar-s* or *\*agri-ar-ā-s* from *ager* ‘field’ and *ar-ā-re* ‘to plow’. Discussion of these constructions would take too much space and is not possible in this article. It is to note though that they are unproductive and belong to a very ancient stratum of the Latin lexicon. They are considered remnants of a far common option in the PIE language. Therefore, they plausibly predate the development of the /-ā-/,-ē-/, /-ī-/ and /-ī-/-conjugations (discussed below in Section 3.2. This immediately explains why they are restricted to the III conjugation which includes old primary verbs. Furthermore, according to Bertocci and Pinzin the /-ē-/ and /-ī-/-conjugations should pattern with the III conjugation synchronically. This common patterning is not shown by these constructions.

when these properties are still preserved. Furthermore, and most importantly, these formatives cannot be characterized as aspectual markers. In Bertocci and Pinzin's analysis, they would realize [-Perfect] Asp<sup>0</sup>. Thus, we would have the following VI for [-Perf] Asp<sup>0</sup>:

- (32) a. /-ē-/ <-> [-Perfect]<sub>Asp<sup>0</sup></sub> /Root<sup>e</sup> \_\_\_\_\_  
 b. /-ī-/ <-> [-Perfect]<sub>Asp<sup>0</sup></sub> /Root<sup>i</sup> \_\_\_\_\_  
 c. /-I-/ <-> [-Perfect]<sub>Asp<sup>0</sup></sub> /Root<sup>I</sup> \_\_\_\_\_

Consideration of the Imperfect Indicative forms, cf. *monēbāmus*, clearly shows the problem of this analysis. As argued above, the distribution of the exponent /-b-/ in forms such as *laudābāmus* requires the feature [-perf] to appear in the /-b-/ insertion site together with the Tense feature [+Past], therefore Asp<sup>0</sup> must be fused with T<sup>0</sup>. This is impossible if we assume that /-ē-/ is the exponent of the [-perf] Asp<sup>0</sup>. In this case, /-b-/ can only appear in T<sup>0</sup>, and this is not consistent with the preceding requirement. Therefore, /-ē-/ cannot be an aspectual exponent. The same holds for forms such as *legēbāmus capiēbāmus*, which display the insertion of a the long vocalic /-ē-/ piece before /-b-/ (</leg-I-ē-b-ā-mus/, /cap-i-ē-b-ā-mus/ (see Footnote 42). Therefore, the hypothesis that vocalic pieces such as /-I-/, /-ē-/ and /-ī-/ are exponents of [-perf]<sub>Asp<sup>0</sup></sub> is difficult to maintain.<sup>34</sup>

Furthermore, root-adjacent, distributionally indistinguishable, vocalic pieces end up being analyzed as having two different statuses: as verbalizers (or as ornamental pieces related to verbalizers) in the case of /-ā-/ or /-ī-/ and as aspectual elements in the case of /-ē-/, /-ī-/, and /-I-/. But this violates the analytic criterion of pattern congruity: an identical distribution should entail the same structural position provided that there is no other evidence, which in this case is missing. In other words, the hypothetical structures where /-I-/, /-ē-/ and /-ī-/ are exponents of [-perf]<sub>Asp<sup>0</sup></sub> are simply inconsistent with the general patterning we see in the other conjugations. In fact, the identical morphological patterning of these vocalic pieces has been recognized since early Latin Grammarians such as Varro, Sacerdos and Priscian (Ernout 1953/1989). This has led to

34 All the etymologically related vocalic pieces of the Romance languages are clearly ornamental TVs, not aspectual elements, as the fact that can appear with both [+perf] and [-perf] Asp pieces shows, as in the following Italian verbal forms:

	Infinitive	Imperfect-1sg	Perfect-1sg	
(i)	<i>am-a-re</i>	<i>am-a-v-o</i>	<i>am-a-i</i>	'love'
	<i>batt-e-re</i>	<i>batt-e-vo</i>	<i>batt-e-i</i>	'beat'
	<i>tem-e-re</i>	<i>tem-e-v-o</i>	<i>tem-e-i</i>	'fear'
	<i>part-i-re</i>	<i>part-i-v-i</i>	<i>part-i-i</i>	'leave'

In lack of contrary evidence, one can assume that the same analysis holds for Latin.

the traditional systematization of the Latin verbal conjugations based precisely on these vocalic elements. An analysis that morphological pieces with the same distribution have the same morphological identity is preferred over one that assumes that they are different. As noted by Aronoff, the other root-adjacent vocalic pieces have the same distribution as *-ā-* and *-ī-*.

There is additional evidence against Bertocci and Pinzin's analysis of the vocalic pieces. Many verbs with the short thematic vowels */-ī-/* and */-I-/* may have a root adjacent vocalic piece in the Perfect under certain conditions. Thus, verbs like *petō* 'seek', *quaerō* 'search', *sapiō* (cf. *sapĕre*) 'taste', *cupiō* (cf. *cupĕre*) 'desire' and all the verbs formed with the suffix */-ess-/* (cf. *cap-ess-ō* 'seize eagerly') change their thematic vowel to */-ī-/* in the *perfectum* (cf. *petīvī*, *quaesīvī*, *sapīvī*, *cupīvī*, *capessīvī*).

Consider *cap-ess-e-re* 'seize eagerly'. One can exclude that */-I-/* (>surface [ē]) is the exponent of  $v^0$  since this position is occupied by */-ess-/*. If */-I-/* is not an ornamental TV, it must belong to  $[-\text{perf}]_{\text{Asp}^0}$ , as assumed by Bertocci and Pinzin as shown in (33). But then this exponent should be replaced by a  $[+\text{Perfect}]$  exponent in the *perfectum* and the form should be athematic (see (33)ii) as expected in Bertocci and Pinzin's approach:

- (33) i. Present vs. ii. Perfect
- $$\begin{array}{l} \text{[[[cap]_{Root} \text{ess-}]_{v^0} -I]_{[-\text{perf}]_{\text{Asp}^0} -]_{T^0+\text{AGR}}} \end{array} \quad \begin{array}{l} \text{[[[[[cap]_{Root} \text{ess-}]_{v^0} - ?X?]_{[+\text{perf}]_{\text{Asp}^0} ]_{T^0+\text{AGR}}} \text{'seize'} \end{array}$$

The presence of the long */-ī-/* of *capessīvī* is therefore totally unexpected. It can belong neither to  $v^0$ , which is occupied by */-ess/*, nor to  $\text{Asp}^0$ , which is realized by */-v-/*. Its presence cannot be motivated in semantic, morpho-syntactic, or phonological terms. Bertocci and Pinzin must stipulate the insertion of an Ornamental-like position special to the *perfectum* of these verbs. The most parsimonious analysis for these forms is instead one that assumes there is an ornamental TV for both the *infectum* and the *perfectum*. This position can be realized as */-I-/* in *cap-ess-e-re*, *petō* 'seek', *quaerō*, etc. or as */-ī-/* in the case of *sapiō* (cf. *sapere*) 'taste', *cupiō* (cf. *cupere*) 'desire'. The process of lengthening in (34) (followed by rule (4), which fronts back */-I-/*) accounts for what happens in the Perfect with these verbs:

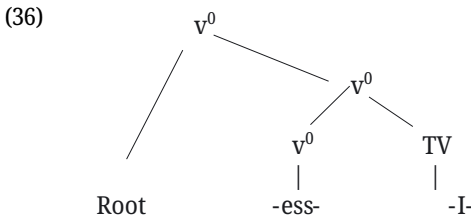
- (34) N N  
| /\  
X → X X / Head<sup>L</sup> [ \_ ]<sub>TV</sub> [+perf], head<sup>L</sup> = *pet-, quaer-, cup-, -ess-, etc.*

Similar evidence against root-adjacent vocalic pieces being  $\text{Asp}^0$  realizations is provided by */-ē-/* and */-I-/* verbs. These display a root adjacent [i] in the participle (see below in Section 2.2 for further discussion of these forms). As argued in Calabrese (2020) (see also Embick and Halle (2004); Remberger (2012)), the piece */-t-/* is an exponent of  $[+\text{perf}]_{\text{Asp}^0}$  in participle forms:

- (35) *monēre monitum monuimus* ‘warn’  
*gignere genitum genuimus* ‘beget’  
*molere molitum moluimus* ‘grind’  
*cubāre cubitum cubuimus* ‘recline’

As before, the most adequate analysis preserves the morpho-syntactic structure across forms. As discussed later, in these forms, the TV is reduced to /-I-. This accounts for the appearance of the Perfect exponent /v-/, which as proposed later occurs only after vowels. The thematic element /-I-/ is deleted by a phonological rule before /v-/ but is preserved before /-t/, thus accounting for the pre-aspectual vocalic element of the participles in (35) (see Section 2.2 for details). It follows that the pre-vocalic element cannot have an aspectual meaning.

If this analysis is on the right track, one must conclude that all root-adjacent vocalic pieces are the same: they are devoid of syntactic and semantic properties and are, therefore, ornamental. Thus, the pieces /-I-, -ē-/ and /-ī-/ are inserted by the rule in (26), as shown in (36) for the form *cap-ess-e-re*.



- (37)  $[[[cap]_{Root} [-ess]_{V^0} [-I]_{TV}]_{V^0} -re]_{T^0+AGR}$  ‘seize eagerly-infinitive’

We can now turn to the different exponents we see in the strings in (11)–(12) and consider the status of the vocalic pieces appearing within. Specifically, the vowels that appear in the inflections in (11)–(12) must be considered. Putting aside the /u/ of /-mus/, which is part of the 1pl plural ending, what is the role of the vowel /ā/ of *-bāmus-*, *-verāmus* or the /i/ of *-bimus-*, *-vimus-*, *-verāmus-* (>/e\_r), and *-verimus*? Consider the different phonological pieces that can be associated with each of the functional nodes in (11)–(12) as shown in (38):

- |      |    |    |     |  |                        |                      |
|------|----|----|-----|--|------------------------|----------------------|
| (38) | -u | -i | <-> | [+perf] <sub>Asp<sup>0</sup></sub>   | laud-ā+v-i+∅+∅+mus     | <i>laudāvimus</i>    |
|      | -s | -i | <-> | [+fut] <sub>T<sup>0</sup></sub> / [+perf] <sub>Asp<sup>0</sup></sub> ___                                     | laud-ā+v-i+s-i+∅+mus   | <i>laudāverimus</i>  |
|      | -b | -i | <-> | [+fut] <sub>T<sup>0</sup></sub> / ___ [-irr] <sub>Mood<sup>0</sup></sub>                                     | laud-ā+∅+b-i+∅+mus     | <i>laudābimus</i>    |
|      | -b | -ā | <-> | [+Past] <sub>T<sup>0</sup></sub> / [-perf] <sub>Asp<sup>0</sup></sub> ___                                    | laud-ā+∅+b-ā+∅+mus     | <i>laudābāmus</i>    |
|      | -s | -ā | <-> | [+Past] <sub>T<sup>0</sup></sub> / [+perf] <sub>Asp<sup>0</sup></sub> ___                                    | laud-ā+v-i+s-ā+∅+mus   | <i>laudāverāmus</i>  |
|      | -s | -ē | <-> | [-perf, +Past, +irr] <sub>Mood<sup>0</sup></sub>   | laud-ā+∅+∅+s-ē+mus     | <i>laudārēmus</i>    |
|      | -s | -∅ | <-> | [+Past] <sub>T<sup>0</sup></sub> / [+perf] <sub>Asp<sup>0</sup></sub> ___ [+irr] <sub>Mood<sup>0</sup></sub> | laud-ā+v-i+s-∅+s-ē+mus | <i>laudāvissemus</i> |
|      | -∅ | -ē | <-> | [-Past] <sub>T<sup>0</sup></sub> / [-perf] <sub>Asp<sup>0</sup></sub> ___ [+irr] <sub>Mood<sup>0</sup></sub> | laud-ā+∅+∅+∅-ē+mus     | <i>laudēmus</i>      |

A system that considers all the pieces in (38) as possible exponents of the different functional nodes is not very parsimonious. A simpler system can be achieved if we segment away vowels and consonants as independent pieces.<sup>35</sup> A first possibility was put forward by Halle (2018), who assumes that the exponents of the nodes are the vowels. Consonants, meanwhile, are considered ornamental “augments”. Corresponding rules are given in (39) for vowels and in (40) for consonants (where +F indicates a marked feature (e.g. +Perfect, +Future), and obviously [-F] an unmarked feature (-Perfect, -Past, etc.):

- (39) a.  $\bar{a}$   $\leftrightarrow$  [+Past]<sub>T0</sub>  
 a.  $\bar{e}$   $\leftrightarrow$  [+irreal]<sub>Mood0</sub>  
 b.  $I$   $\leftrightarrow$  [+F]<sub>X0</sub>
- (40) a.  $\emptyset \rightarrow /-b-/ / [-\text{perf}]_{\text{Asp}0} \text{ \_\_ } [+F]_{\text{T}0} \text{ \_\_ } [-\text{irreal}]_{\text{Mood}0} (+F=+\text{Past or } +\text{Fut})$   
 b.  $\emptyset \rightarrow /-v-/ / \text{ \_\_ } [+perf]_{\text{Asp}0}$   
 c.  $\emptyset \rightarrow /-s-/ / \text{ \_\_ } [+F]_{\text{T}0} (+F=+\text{Past or } +\text{Fut})$

The problem of the system in (39)–(40) is that it fails to account for the striking overlap between the functional vowels in (39) and the verbal thematic vowels, which must be introduced by another set of rules as in (41):

- (41) a.  $\emptyset \rightarrow /-\bar{e}-/ \text{ Root}^e [ \text{ \_\_ } ]_{\text{TV}}$   
 b.  $\quad \quad \quad /-\bar{i}-/ \text{ Root}^i [ \text{ \_\_ } ]_{\text{TV}}$   
 c.  $\quad \quad \quad /-\bar{\imath}-/ \text{ Root}^i [ \text{ \_\_ } ]_{\text{TV}}$   
 d.  $\quad \quad \quad /-I-/ \text{ Root}^i [ \text{ \_\_ } ]_{\text{TV}}$   
 e.  $\quad \quad \quad /-\bar{a}-/ \text{ Root}^{\bar{a}} [ \text{ \_\_ } ]_{\text{TV}}$

Notably, the functional vowels of (39) and the thematic vowels of (41) belong to the same set of phonemes [ $\bar{a}$ ,  $\bar{e}$ ,  $\bar{i}$ ,  $\bar{\imath}$  / and  $/I/$ ]. There are seven other contrastive Latin vowels; such an overlap can only be accounted for if it is the same set of vowels occurring in both functional and thematic positions. This follows if the exponents of the functional nodes are the consonants (see (23)) and the vowels are ornamental “thematic” elements. These thematic vowels are simply those in (41). An overarching generalization of Latin morpho-phonology, therefore, appears to be that the exponents of the verbal functional nodes are consonantal pieces and that vowels have just an ornamental function.

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<sup>35</sup> This functional distinction between consonants and vowels in Latin verbal morphology may be perhaps connected to the overarching functional distinction between consonants and vowels that according to Nespor et al. (2003), Mehler et al. (2006) governs speech processing and language acquisition.

Thus, along the lines of Oltra-Massuet 1999, Oltra-Massuet and Arregi (2005), I assume that vowels are ornamental TVs inserted by the rule in (42), a generalization of (26) to all functional nodes (but see below for some exceptions).

$$(42) \quad X^0 \rightarrow \begin{array}{c} X^0 \\ / \quad \backslash \\ X^0 \quad \text{TV} \end{array}$$

Thematic vowels are inserted by the rules in (43). They are sensitive to a special diacritic assigned to the head. For  $v^0$ , the diacritic is inherited or copied from the root; it is assigned by the rules in (44) for other functional nodes (provisional, see (74)–(75) for a revision). The diacritics  $\bar{e}$ ,  $\bar{i}$ ,  $\bar{i}$ , and  $\bar{i}$  are idiosyncratically specified as root information, and from there transmitted to  $v^0$ . The diacritic  $\bar{a}$  is instead inserted as the default diacritic for  $v^0$  by (44)c) when an idiosyncratic root diacritic is missing. This accounts for the default status of the  $\bar{a}$ -conjugation. On the other hand, the fact that I is the most common inflectional vowel is accounted for by (44)d).

- (43) a.  $\emptyset \rightarrow /-\bar{e}-/ \quad / \text{Head}^{\bar{e}} [ \_ ]_{\text{TV}}$   
 b.  $\emptyset \rightarrow /-\bar{i}-/ \quad / \text{Head}^{\bar{i}} [ \_ ]_{\text{TV}}$   
 c.  $\emptyset \rightarrow /-\bar{i}-/ \quad / \text{Head}^{\bar{i}} [ \_ ]_{\text{TV}}$   
 d.  $\emptyset \rightarrow /-I-/ \quad / \text{Head}^I [ \_ ]_{\text{TV}}$   
 e.  $\emptyset \rightarrow /-\bar{a}-/ \quad / \text{Head}^{\bar{a}} [ \_ ]_{\text{TV}}$
- (44) a.  $\emptyset \rightarrow \bar{e} \quad / [+Irrealis]_{\text{Mood}}^0 -$   
 b.  $\emptyset \rightarrow \bar{a} \quad / [+Past]_{\text{Mood}}^0 -$   
 c.  $\emptyset \rightarrow \bar{a} \quad / v^0 -$   
 d.  $\emptyset \rightarrow \bar{i} \quad / X^0 -$

Still some refinements are needed. Note that the thematic vowels are not present in all functional nodes. The following generalization can be postulated: thematic vowels always occur after  $v^0$ ,<sup>36</sup> after a [+Perfect]  $\text{Asp}^0$ , and after the highest node that contains a [+F] feature in the verbal complex  $X^0$ , where F could be [Irrealis], [Past] or [Future]. Thus, there can be a maximum of three TVs per verbal form.<sup>37</sup> So, we have a form like that in (45a) instead of a form like that in (45b) where each functional head has the expected TV.

36 The issue of athematic verbs where the expected TV after  $v^0$  is missing will be discussed later.

37 In all these cases, the Thematic Vowel is present even if the relevant  $X^0$  head is null: *iact-Ø-ā-re* ‘throw hard’ (cf. *ex-carn-ific-ā-re* ‘flesh out’), *laud-ē-mus* < /*laud- ā -Ø-ē-mus*/ ‘Praise-Ind.Pluperfect’, *cēp-Ø-ī-mus* ‘take-Ind.Perf’.

- (45) a. *laud-ā-v-i-s-s-ē-mus* ‘praise.pluprf.sbjv.1pl’  
 [[[[*laud-*]<sub>Root</sub> [*-a*]<sub>TV</sub>]<sub>v<sup>0</sup></sub>-*v*-[*-i*]<sub>TV</sub>]<sub>[+perf]-Asp<sup>0</sup></sub>]-*s*]<sub>[+Past]-T<sup>0</sup></sub>-*s*-[*-ē*]<sub>TV</sub>]<sub>[+irr]-Mood<sup>0</sup></sub>]-*mus*]<sub>[1pl]-AGR</sub>  
 b. †<sup>38</sup>*laud-a-v-i-r-ā-r-ē-mus* /UR: *laud-a-v-i-s-ā*<sup>39</sup>-*s-ē-mus*/.

In order to account for this fact, I propose that a TV is adjoined only to X<sup>0</sup> containing marked feature specifications (see (46)) with the proviso that above Asp<sup>0</sup> only the highest marked functional node receives it: the output constraint in (47) accounts for this restriction. It blocks the insertion of a TV in T<sup>0</sup> if there is a marked mood feature:

- (46)  $X^0 \rightarrow X^0$   
 $\begin{array}{c} X^0 \\ \alpha \end{array} \quad \text{TV}$  (α=marked feature, V<sup>0</sup> is always marked)

- (47) \*[TV]<sub>T<sup>0</sup></sub> / \_ [+F]<sub>X<sup>0</sup></sub>

This section has introduced the theoretical framework which the analysis in the following section is built on. Additionally, it has provided a DM account for some basic aspects of the Latin verbal system. I will now derive the basic Latin verbal forms beginning with regular verbal forms.

## 2 The derivation of Latin verbal forms

### 2.1 Regular verbal forms

As observed in Calabrese (2015), when we talk of irregular morphology, we are dealing with morpheme-specific morphology, i.e., situations in which morphological operations are dependent on lexical diacritics, root specific information.<sup>40</sup> A clear contrast between a case of irregular morphology and a case of regular morphology is provided by the Imperfect and the Perfect in the Italian verbal system. The Imperfect is regular in always having the same exponent across verbs and conjugations. The Perfect, on the other hand, is irregular in having different exponents according to verbs and

<sup>38</sup> Given that the asterisk \* in historical linguistic is used to indicate reconstructed forms, I will use the symbol † to indicate ungrammaticality/morphological impossibility of forms.

<sup>39</sup> Here I am assuming that the TV of [+Past]<sub>T<sup>0</sup></sub> is *ā* as in the Indicative Pluperfect.

<sup>40</sup> In the model I adopt, lexically restricted generalizations require diacritics identifying the forms characterized by a certain property (see Calabrese (2019)). Any theory must state something similar: thus, for example, even if listing is used, a lexically restricted set of forms is nothing else than a set of forms identified by a special property (a diacritic).

conjugations. To account for these different exponents, the Perfect must have special vocabulary item that reference root information—represented by diacritics—in their structural description.<sup>41</sup> No such contextual restrictions are needed for regular morphology, i.e., for the Imperfect -v- or for the  $\emptyset$  which otherwise characterizes regular Italian Perfect (see Calabrese (2015) for detailed discussion).

(48)	Italian regular morphology			Italian irregular morphology	
	Infinitive	Imperfect-1sg	Perfect-1sg	Infinitive	Perfect-1sg
	<i>amare</i> ‘love’	<i>ama-v-o</i>	<i>ama-<math>\emptyset</math>-i</i>	<i>perdere</i> ‘lose’	<i>perd-s-i</i> [ <i>persi</i> ]
	<i>battere</i> ‘beat’	<i>batte-v-o</i>	<i>batte-<math>\emptyset</math>-i</i>	<i>venire</i> ‘come’	<i>ven-X-i</i> [ <i>venni</i> ]
	<i>partire</i> ‘leave’	<i>parti-v-o</i>	<i>parti-<math>\emptyset</math>-i</i>		

- (49) a. /-v-/  $\leftrightarrow$  [-Perfect, +Past] a. /-s-/  $\leftrightarrow$  [+Perfect]/ root<sup>s</sup> \_\_ (root<sup>s</sup> =perd, etc.)  
 b. /-X-/  $\leftrightarrow$  [+Perfect]/ root<sup>X</sup> \_\_ (root<sup>X</sup> =perd, etc.)  
 c. /otherwise - $\emptyset$ -

Latin verbal morphology is regular in the analysis developed in this article in the sense that I do not posit special VIs referring to root specific information in the Latin verbal system. Instead, Section 2.2 attributes root-contextual irregular allomorphy in Latin exclusively to the action of root-triggered morphophonological and freezing operations. In this section, I will deal only with verbal forms that do not require access to these root-triggered operations.

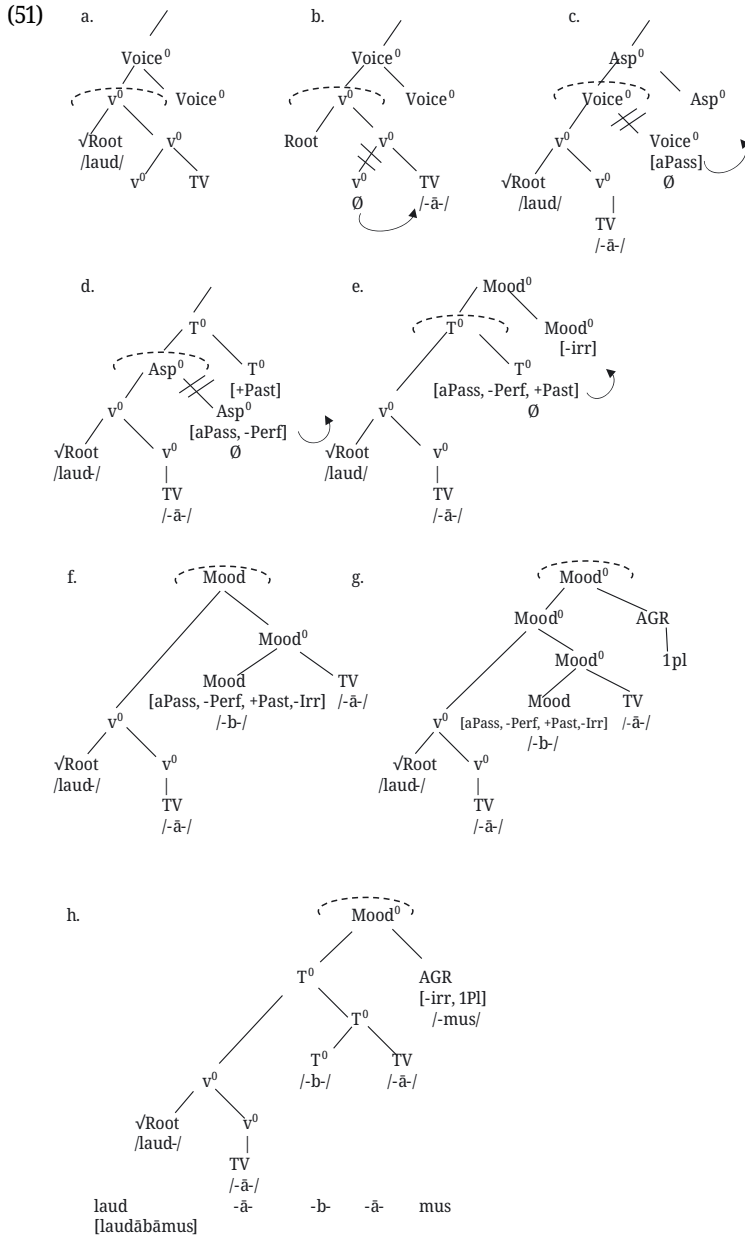
Let us start with the Indicative Imperfect *laudābāmus* ‘we were praising’. The complex  $X^0$  for this form is derived as in (51). Phonological spell out operates cyclically node-by-node bottom up (the cyclic stages are represented by the curved stashed lines). Thus, the cyclic derivation in (51) is generated with the relevant application of Vocabulary Insertion, TV insertion and AGR insertion. In addition to overt exponents,  $\emptyset$ s are cyclically inserted when independently motivated terminal nodes fail to have phonological realization, followed by pruning of these  $\emptyset$ s and feature docking; thus, some verbal functional nodes become fused together.<sup>42</sup>

All the VIs needed for this form were introduced earlier, with the exception of (50) spelling out AGR. Since I am considering only 1pl forms, this VI can phonologically spell out AGR in all forms under discussion:

<sup>41</sup> As discussed below, the transmission of information necessary for morphological operation application, and more generally any morpheme-to-morpheme interaction, can occur only in a local configuration, where locality involves adjacency (Bobaljik 2012; Calabrese 2019; Embick 2010, 2013).  
<sup>42</sup> I follow Halle (2018) in assuming that the rule in (i) accounts for the insertion of an ornamental piece /-ē-/ in the Imperfect Indicative of verbal forms with [+high] TVs (including *I*) (i.e., (*aud-i-ē-bam* → *audiēbam*, *cap-i-ē-bam* → *capiēbam*, *dūc-I-ē-bam* → *dūcēbam* (after *I* deletion), versus *am-ā-bam*, versus *mon-ē-bam*):

(i)  $\emptyset \rightarrow \bar{e} / [+high]_{TV} \_ [-perf., +Past, -irr.]$

(50) /-mus/ <-> [+participant, +author, +plural]<sub>AGR</sub>

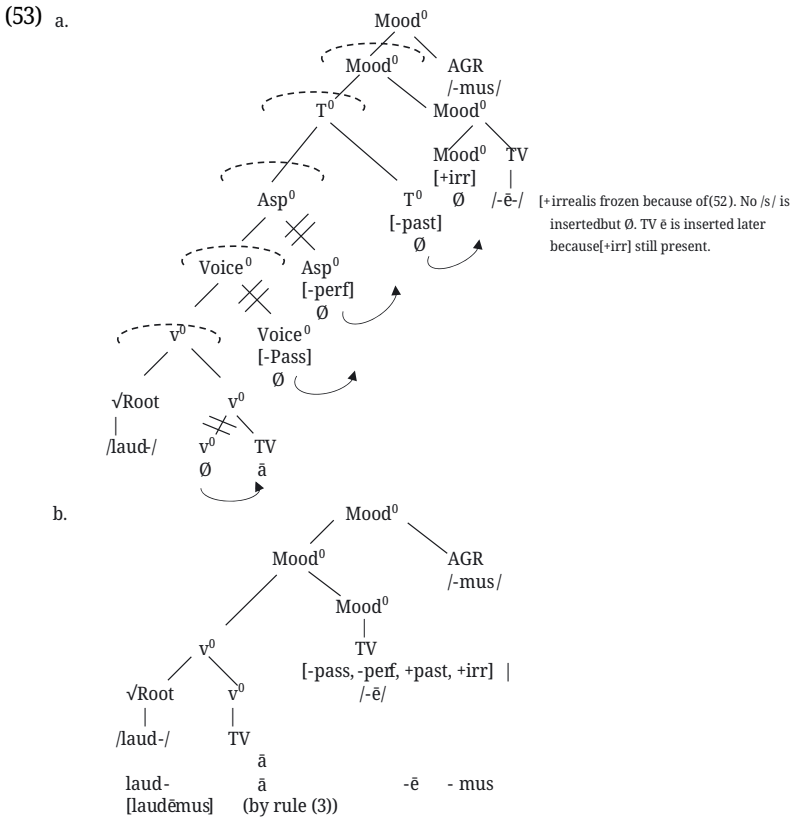


Not all cases of  $\emptyset$  are predictable according to the VIs in (23) and (43), however. For example, in the case of the Present Subjunctive *laudēmus*, the mood node [+Irrealis] is assigned a  $\emptyset$  instead of the expected [-s-]. As discussed in Section 1.4, feature freezing during Vocabulary Insertion accounts for this case. Feature freezing prevents the use of

a feature by a VI at a given insertion site; the same feature, though, can be used by another rule (since it was not deleted as in impoverishment). Thus, the marked [+Irrealis] is realized as /-Ø-/ through feature freezing in the Present Subjunctive (cf. (52)).

- (52) Freeze [+Irrealis] for the Mood<sup>0</sup> VI insertion rule in the context [-Perfect, -Past, \_ ]

The feature [+Irrealis] can still play a role in the insertion of the TV /-ē-/ because the relevant VI applies in the higher up insertion site. I represent the derivation of this form as in (53)a) where all the different cyclic steps are compacted together. The final output is given in (53)b):

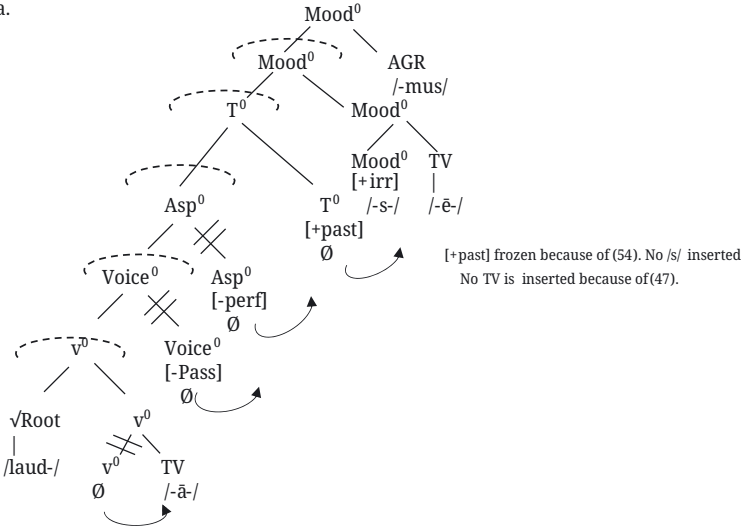


Feature freezing occurs also in the case of the Subjunctive Imperfect *laudārēmus* ‘we would be praising’ where the marked Tense [+Past] node is unexpectedly assigned the null exponent Ø. In this case the freezing operation in (54) occurs:

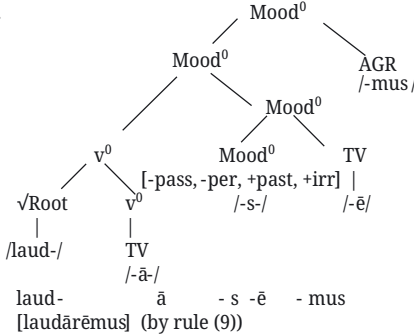
- (54) Freeze [+Past] for the T<sup>0</sup> VI insertion rule in the context [-Perfect, \_\_\_\_ ] [+Irrealis]

The derivation is given in (55)a) and the eventual output is that in (55)b):<sup>43</sup>

(55) a.



b.

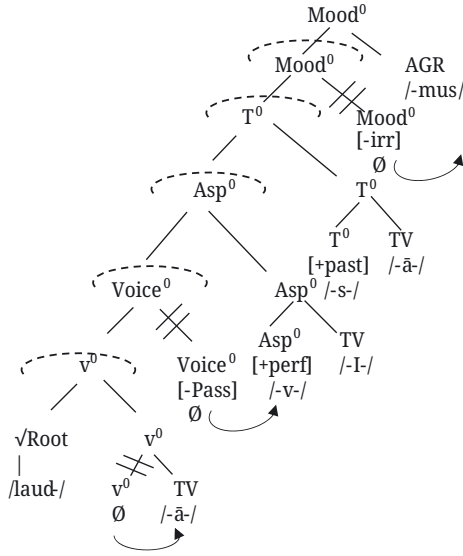


The Indicative Pluperfect form *laudāverāmus* can be cyclically derived as in (56)a).<sup>44</sup> The output is given in (56)b):

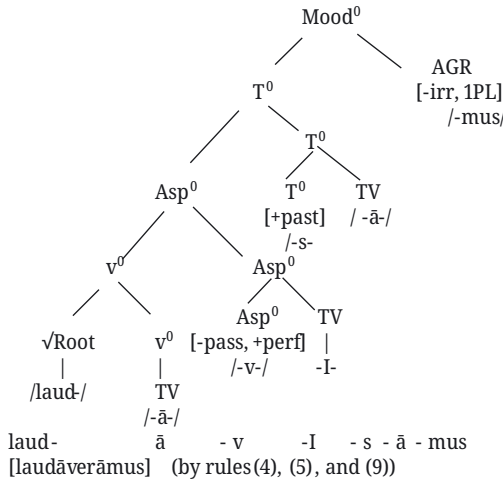
43 Bobaljik’s (2000) cyclic feature Obsolescence excludes the possibility of assigning /-s-/ to the [+Past] T<sup>0</sup> with ∅ assigned in the [+Irrealis] Mood<sup>0</sup>. In this case we would need to freeze the use of the feature [+Irrealis] in the context [+Past] \_\_. However, the feature [+Past] has been already used in the insertion of the /-s-/ at T<sup>0</sup> and therefore could no longer be available as an environment for this freezing operation in the Mood<sup>0</sup> cycle.

44 Note that I follow Embick (2000: 213–214) in rejecting Giorgi and Pianesi’s (1997) proposal that forms of the Pluperfect Indicative (*laudāverāmus*) and Future Perfect (*laudāverimus*) are accounted for by assuming incorporation of the Indicative Imperfect (*eramus*) and Future (*erimus*) of the verb *sum* onto a Perfect base (*laudavi*) (See footnote 62) on Future forms.).

(56) a.



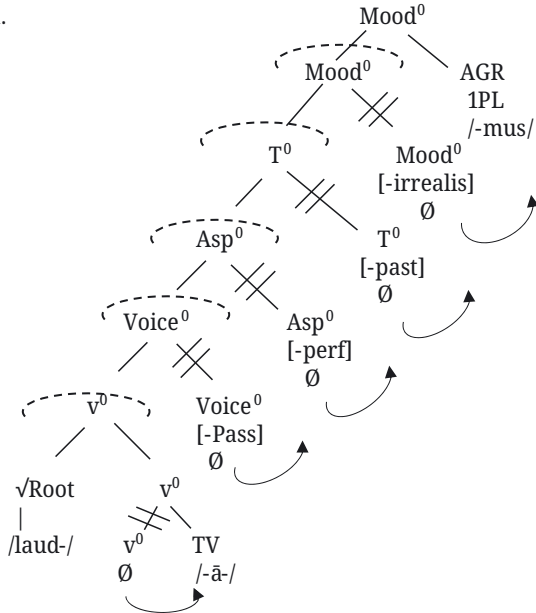
b.



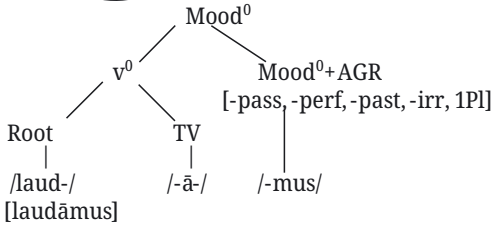
On the other hand, the Subjunctive Pluperfect form *laudāvissēmus* can be cyclically derived as in (57)a). The output is given in (57)b):



(58) a.



b.



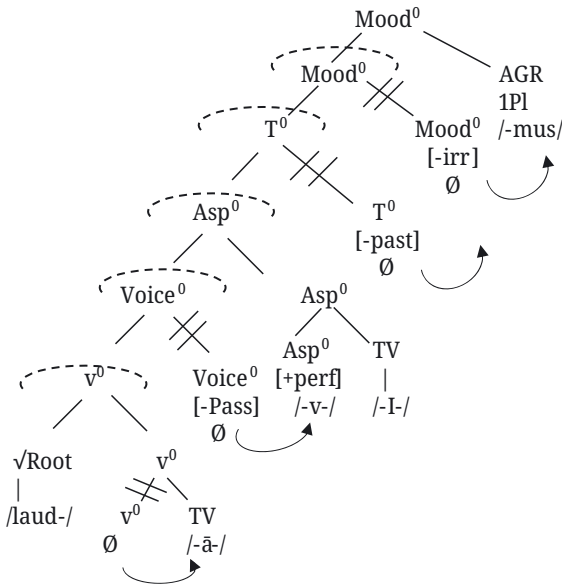
## 2.2 Irregular Perfect forms

The cases we discussed up to this point involve the regular allomorphs of the different functional heads. Irregularities, however, are found in the Perfect (see Footnote 42 and Footnote 62 on the conjugation-based irregularities found in the Imperfect forms and in the Future forms of the III and IV conjugations).<sup>45</sup>

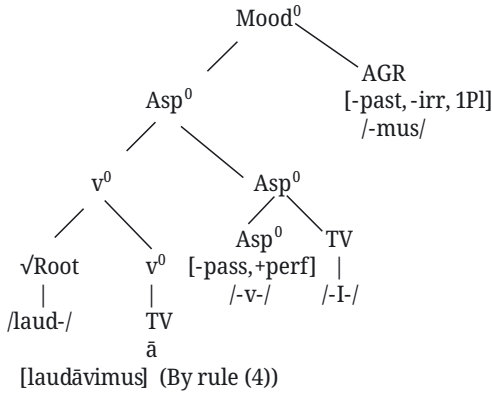
<sup>45</sup> For reasons of space, I will be unable to discuss the irregular morphology of the few verbs that are athematic in the inflectum such as *esse* ‘be’, *ferre* ‘bring’, *ire* ‘go’, *velle* ‘want’.

Consider first the Latin Perfect form *laudāvīmus*. It is derived as in (59)a) assuming the VI in (23). The output is in (59)b):

(59) a.



b.

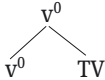


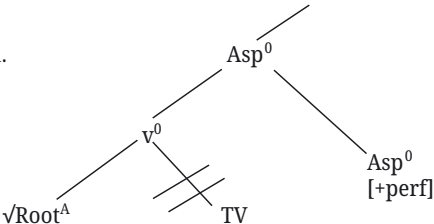
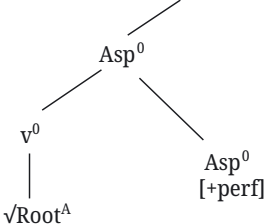
Consider now the III conjugations forms in (60):

- (60) a. *vom* – *v* -*i* +  $\emptyset$  +  $\emptyset$  +*mus* [*vomuimus*] (cf. *vom-i-mus* ‘vomit-Pres’)  
 b. *scrib* – *s* -*i* +  $\emptyset$  +  $\emptyset$  +*mus* [*scripsimus*]<sup>46</sup> (cf. *scrib<sup>1</sup>-s-i-mus* ‘write-Pres’)  
 c. *vert* –  $\emptyset$  -*i* +  $\emptyset$  +  $\emptyset$  +*mus* (cf. *vert-i-mus* ‘turn-Pres’)

They are athematic.

Assuming that the general rule (46)—repeated here as (61)—applies to the  $v^0$  of all verbs, one can propose that athematicity is due to a rule pruning the TV of certain roots before [+Perfect]  $Asp^0$ . This is triggered by roots with the diacritic A, for Athematic, as in (62a) (see Embick and Halle (2004) for a similar proposal). The use of this diacritic is temporary and employed for now just for the sake of the exposition. Once the analysis of the underlying TVs is revised (2.2), I will propose that no diacritics are needed. The rule applies cyclically once the [+Perfect]  $Asp^0$  is reached. The unlinked TV is then phonologically deleted. Removal of this TV thus results in the structure in (62b) (see Section 3.3 for a discussion of the diachronic development of athematicity in Latin).<sup>47</sup>

- (61)  $v^0 \rightarrow$
- 
- A tree diagram showing a root node  $v^0$  branching into two child nodes:  $v^0$  on the left and TV on the right.

- (62)
- a.
- 
- A tree diagram for (62a). The root node is  $Asp^0$ . It branches into two children:  $v^0$  on the left and  $Asp^0$  [+perf] on the right. The  $v^0$  node further branches into  $\sqrt{Root^A}$  on the left and TV on the right. The TV node is crossed out with three diagonal lines, indicating its deletion.
- b.
- 
- A tree diagram for (62b). The root node is  $Asp^0$ . It branches into two children:  $v^0$  on the left and  $Asp^0$  [+perf] on the right. The  $v^0$  node further branches into  $\sqrt{Root^A}$  on the left and an empty space on the right, representing the absence of the TV.

We can then assume the derivation in (63)a) with the output in (63)b) for the verb form *scrib-s-i-mus* ‘write-Pres’ from (60)b) (see below on /-s-/ as a Perfect exponent):

<sup>46</sup> Voiced /b/ becomes [p] before /-s-/.

<sup>47</sup> I have proposed different ways to account for *perfectum* athematicity in past works (Calabrese 2015, 2019). I now believe that the account proposed here is the more adequate insofar as it satisfies locality restrictions once it is assumed that (62)a) applies once the  $Asp^0$  node is reached. The other accounts in one way or another all required violations of locality.



- (64) a. Lengthening (e.g., *sedēmus/sēdimus* ‘sit-pres/perf’, *legimus/lēgimus* ‘readpres/perf’, *capimus/cēpimus* ‘seize-pres/perf’, *agimus/ēgimus* ‘drive pres/perf’):

$$\begin{array}{c} \text{N} \qquad \qquad \qquad \text{N} \\ | \qquad \qquad \qquad / \quad \backslash \\ \text{X} \quad \rightarrow \quad \text{X} \quad \text{X} \quad / \quad [ \_ ]_{\text{Root}^{\text{L}}} \quad [+Perf], \text{Root}^{\text{L}} = \textit{sed, leg, cap, etc.} \end{array}$$

- b. Ablaut (e.g., *capimus/cēpimus* ‘seize-pres/perf’ *agimus/ēgimus* ‘drive-pres/perf’):

$$[-\text{cons}, +\text{low}] \rightarrow [-\text{low}, -\text{back}] / \_ \text{C}]_{\text{Root}^{\text{A}}} [+Perf], \text{Root}^{\text{A}} = \textit{cap, ag, etc.}$$

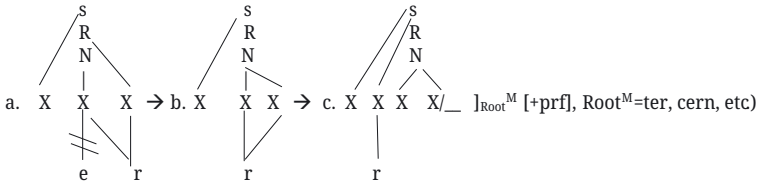
- c. Nasal deletion (e.g., *vincimus/vīcimus* ‘win-pres/perf’, *fundimus/fūdimus* ‘pour-pres/perf’, *rumpimus/rūpimus* ‘break-pres/perf’)<sup>50</sup>

$$\begin{array}{c} \text{X} \quad \rightarrow \quad \emptyset / \_ \text{C}]_{\text{Root}^{\text{ND}}} [+perf], \text{Root}^{\text{ND}} = \textit{vinc-, fund-, frang-, etc.} \\ | \\ \left[ \begin{array}{l} +\text{consonantal} \\ +\text{nasal} \end{array} \right] \end{array}$$

- d. Rhotic Metathesis (e.g. *terimus/trīvimus* ‘rub-pres/perf’; after *n*-deletion: *cernimus/crēvimus* ‘distinguish-pres/perf’, *spernimus/sprēvimus* ‘despise-pres/perf’, *sternimus/strāvimus* ‘stretch-pres/perf’). It involves re-syllabification of /r/ as the root syllable nucleus as in (a) below. Then, fission repairs the illicit syllabic rhotic (\*r̥) resulting in the structure in (c) below. The unspecified nucleus is then filled in with vocalic features ( $\emptyset \rightarrow \bar{e}$ ); further ablaut operation lead to  $\bar{i}$  or  $\bar{a}$ .) (see Calabrese (2009: 269–277) on fission as the repair of syllabic sonorants. The historical roots of this alternations will not be dealt with in this article)

conditioned consonant assimilation (e.g., *iubēmus/iūssimus* ‘order-pres/perf’, cf. *scrībimus/scrīpsimus* above).

<sup>50</sup> Note that the deleted [n] was an original exponent of the exponent of [-perf] Asp<sup>0</sup> (<\*/-ne/) characterizing the *īnfectum*, and therefore originally missing in the *perfectum*. As discussed in Section 3.5.3, this morpho-syntactic alternation was eventually reanalyzed in terms of the morpho-phonological operation given above. A similar process deletes the piece [sk]—another original *īnfectum* marker (see § 3)—in roots such as *nōscō* ‘know’, *pāscō* ‘feed’ *quiēscō* ‘rest’ which have the Perfect forms *nōvi*, *pāvi*, *quiēvi*, respectively.



- e. Reduplication (e.g., *discimus/didicimus* ‘learn-pres/perf’, *mordēmus/momordi* ‘bite-pres/perf’, *currimus/cucurrimus* ‘run-pres/perf’ *spondēmus/spopondimus* ‘promise-pres/perf’ *scindimus/scicidimus* ‘cut-pres/perf’ *cadimus/cecidimus* ‘fall-pres/perf’, *fallimus/fefellimus* ‘fail-pres/perf’, *parcimus/pepercimus* ‘spare-pres/perf’, *tangimus/tetigimus* ‘touch-pres/perf’)

RED<sup>51</sup> / [ \_\_\_ ]<sub>Root<sup>R</sup></sub> [+Perf], Root<sup>R</sup>=*mord, curr, spond*, etc.

Note that structures which appear to be athematic can be found in all conjugations, not only in the III conjugation forms (at least in the surface string, see below for discussion). So, in addition to the III conjugation athematic Perfect forms in (110), we also have athematic Perfect forms in other conjugations as in (65) (from Embick and Halle (2004)):

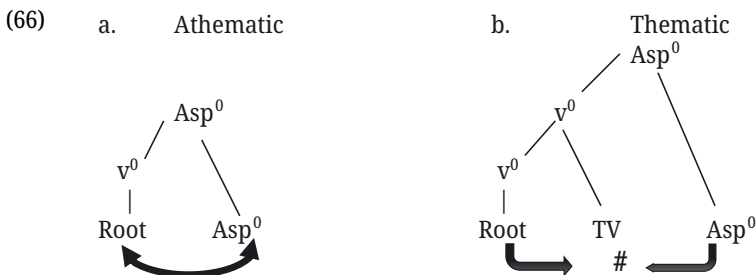
(65)	Conj.	Verb	Perfect	Gloss.	Type
	a. I	<i>dom-ā-mus</i>	<i>dom-u-i-mus</i>	‘tame’	Athematic + -v-
	b. I	<i>sec-ā-mus</i>	<i>sec-u-i-mus</i>	‘cut’	Athematic + -v-
	c. II	<i>mon-ē- mus</i>	<i>mon-u-i-mus</i>	‘warn’	Athematic + -v-
	d. II	<i>sed-ē- mus</i>	<i>sēd-i-mus</i>	‘sit’	Athematic + -∅-, +lengthening
	e. II	<i>man-ē- mus</i>	<i>man-s-i-mus</i>	‘remain’	Athematic + -s-
	f. II	<i>mord-ē-mus</i>	<i>mo-mord-i-mus</i>	‘bite’	Athematic + -∅-, +Reduplication

51 Space restrictions prevent me from giving a full formal discussion of the reduplication rule. It is given informally in (i), simplified derivations focusing only on the reduplicated parts are given in (ii); square brackets [] indicate the copied syllable:

- (i) RED= Copy root syllable, skipping appendix /s/. Insert Copy to the left of root. Remove coda in Copy. Apply ablaut rule (64)b) to /a/ in Copy. Further ablaut rules may apply to Root base vowel.
- (ii) a. *mord-* → Copy → [*mord*]-*mord* → Coda reduction → [*mo*]-*mord-*  
 b. *spond-* → Copy → s [*pond*]-*pond* → Coda reduction → s [*po*]-*pond-*  
 c. *cad-* → Copy → [*cad*]-*cad* → Coda reduction → [*ca*]-*cad-* → Copy Ablaut → [*ce*]-*cad* → Root Ablaut → [*ce*]-*cid-*  
 d. *tang-* → Copy → [*tang*]-*tang* → Coda reduction → [*ta*]-*tang-* → Copy Ablaut → [*te*]-*tang* → Root Ablaut → [*te*]-*ting-* → (64)c) → [*te*]-*tig-*

- |   |                                       |
|---|---------------------------------------|
| g. III(i) <i>rap-ĭ-mus rap-u-i-mus</i> ‘seize’        | Athematic + -v-                       |
| h. III(i) <i>cap-ĭ-mus cēp-i-mus</i> ‘take’           | Athematic + -∅-, +lengthening, ablaut |
| i. III(i) <i>-spic-ĭ-mus spec-s-i-mus</i> ‘peer’      | Athematic + -s-, +ablaut              |
| j. III(i) <i>par-ĭ-mus pe-per-i-mus</i> ‘bring forth’ | Athematic + -∅-, +Reduplication       |
| k. IV <i>aper-ĭ-mus aper-u-i-mus</i> ‘open’           | Athematic + -v-                       |
| l. IV <i>ven-ĭ-mus vĕn-i-mus</i> ‘come’               | Athematic + -∅-, -lengthening         |
| m. IV <i>farc-ĭ-mus far-s-i-mus</i> ‘stuff’           | Athematic + -s-                       |

Root-  $\text{Asp}^0$  interaction is observed only in athematic morphology. Following Embick (2010, 2013), see also Embick and Shwayder (2018), I account for this basic fact by assuming, that any morpheme-to-morpheme interaction, can only occur locally, where locality involves adjacency<sup>52</sup> (see Calabrese (2019) for refinements of this idea). Root-conditioned [+Perfect]  $\text{Asp}^0$  exponents, as well as aspect-conditioned root morpho-phonological changes such as vowel-lengthening, ablaut and reduplication—accounted for by the rules in (64)—can only appear in athematic contexts. As shown diagrammatically in the configurations in (66), morpheme-to-morpheme interactions are only possible where root and  $\text{Asp}^0$  node are adjacent; therefore, only in (66)a) but not in (66)b). Given that root information cannot be transmitted across the thematic vowel, only regular morphology can appear in this case (see previous pages for the derivation of these structures) (where the bolded hashsign # indicates impossibility of morphological interaction):



The operation deleting the TV is thus a prerequisite for the application of the root -  $\text{Asp}^0$  interactions in Latin. TV deletion—whose historical development is discussed below—allows a root - conditioned allomorphic interactions between the root and the resulting  $\text{Asp}^0$  adjacent node.<sup>53</sup>

<sup>52</sup> Two nodes may be adjacent due to how the morpho-syntactic operations of head-movement apply. Node adjacency, however, can also be crucially created by node pruning, as in all the cases under discussion here.

<sup>53</sup> TV-deletion is a root-conditioned operation that is independent of the root-conditioned irregular properties of VIs. Simply, it cannot be the case that it is the aspectual exponent to require this deletion

Before moving on to the exponence of [+perf] Asp<sup>0</sup>, note that there is a crucial difference between athematic forms. Specifically, there is no [+perf] Asp<sup>0</sup> conditioned root-allomorphy when the Asp<sup>0</sup> exponent is syllabic [u] (from /-v-/). There is such allomorphy when the exponent is /-Ø-/ (the most common situation (e.g. (67)a), /-s-/ (e.g. (67)b)) or /-v-/ (e.g. (67)c)). But there are no cases when Asp<sup>0</sup> exponent is [u], such as †CeC-ē-mus/ CēC-u-imus (with lengthening), †CaC-ē-mus/ CēC-u-imus (with ablaut, and lengthening), †CaC-ē-mus/ CeCiC-u-imus (with reduplication), etc. This is a striking fact that needs an explanation. It will be provided below.

- (67) a. i. Lengthening: *sed-ē-mus/sēd-Ø-imus* ‘sit-pres/perf’, *leg-i-mus/lēg-Ø-imus* ‘read-pres/perf’;  
 ii. Ablaut (and lengthening): *cap-i-mus/cēp-Ø-imus* ‘seize-pres/perf’;  
 iii. [n]-deletion: *vinc-i-mus/vīc-Ø-imus* ‘win-pres/perf’, *fund-i-mus/fūd-Ø-imus* ‘pour-pres/perf’;  
 iv. Reduplication: *disc-i-mus/didic-Ø-imus* ‘learn-pres/perf’, *mord-ē-mus/momord-Ø-imus* ‘bite-pres/perf’, *currimus/cucurrimus* ‘run-pres/perf’;  
 b. i. Lengthening: *divid-i-mus/ dīvid-Ø-s-imus* [dīvisimus] ‘divide-pres/perf’, *iub-ē-mus/iūb-s-simus* [iūssimus] ‘order-pres/perf’ cf. also Ernout 1953/1989: 199: *reg-i-mus/rēg-s-imus* [rēximus] ‘rule-pres/perf’, *trah-i-mus/trāg-s-imus* [trāximus] ‘drag-pres/perf’;  
 c. i. Rhotic metathesis: *ter-i-mus/trī-v-imus* ‘rub-pres/perf’; with *n*-deletion: *cern-i-mus/crē-v-imus* ‘distinguish-pres/perf’).

Let us turn to the exponent of the Perfect forms introduced above: they are /-s-/, /-v-/ and /-Ø-/ (see (23)). As discussed earlier in this section, the insertion of Ø in a node containing a marked feature, requires a freezing operation; in this case, a root-conditioned operation freezes the feature [+Perfect], as in (68) (where <sup>0</sup> is the relevant root diacritic):

- (68) Freeze [+Perfect] for the Asp<sup>0</sup> VI in the context of the root<sup>0</sup>

Remember that freezing does not impact application of other rules so [+Perfect] can be active for the application of the morpho-phonological rules in (64).

The exponent /-v-/ is the only one that is found in thematic structure. Let us postulate that it occurs only after a syllabic nucleus (=always a vowel in Latin), as in the VI in (69):

---

(see Halle 2018 for a similar analysis). Consider *vert-Ø-imus* and assume that it is a property of the exponent /-Ø-/ to require TV-deletion. In this case, the operation in (62) would be driven by the Asp<sup>0</sup> exponent and not driven by the root and Asp<sup>0</sup> feature as stated above. This means that this exponent must be inserted before TV-deletion. However, the insertion of this exponent requires access to root-information. It follows that the insertion of this exponent must access this information across the TV; this is a clear violation of morphological locality, which otherwise seem to strictly govern the distribution of exponents in Latin verbal morphology.

- (69)
- |      |                            |
|------|----------------------------|
|      | N                          |
|      |                            |
| /-v/ | <—> [+Perfect] / X ] _____ |

However, this exponent can also appear in forms that seem to be athematic such as *monuimus* ‘warn-Perfect’, *cubuimus* ‘recline-Perfect’, etc. Interestingly, many of the verbs that display /-v-/ in an athematic context have a participial form with a surface short thematic vowel [i]. Several of these verbs are from the /-ē-/ conjugation but they are also found in the other ones (Ernout 1953/1989: 206):

(70)	Present	Perfect	Perf. Participle	
	<i>monēmus</i>	<i>monuimus</i>	<i>monitum</i>	‘warn’
	<i>gignimus</i>	<i>genuimus</i>	<i>genitum</i>	‘beget’
	<i>molimus</i>	<i>moluimus</i>	<i>molitum</i>	‘grind’
	<i>cubāmus</i>	<i>cubuimus</i>	<i>cubitum</i>	‘recline’
	<i>domāmus</i>	<i>domuimus</i>	<i>domitum</i>	‘tame’
	<i>sonāmus</i>	<i>sonuimus</i>	<i>sonitum</i>	‘sound’
	<i>vomāmus</i>	<i>vomuimus</i>	<i>vomitum</i>	‘vomit’

This can be accounted for nicely by postulating that the *perfectum* and participial forms above contain the thematic vowel /-I-/ (see below for an account). Insofar as all these verbs are thematic in the *perfectum*, the Asp<sup>0</sup> VI in (69), i.e., /-v-/ is inserted. The thematic /-I-/ could be then deleted before the [-consonantal] [v] by the rule in (71).<sup>54,55</sup>

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<sup>54</sup> According to Aronoff (1994: 43), this pattern is followed by the 75 % of these verbs. There is, however, another group of verbs, which like those in (70), display a /-v-/ in an athematic context but appear as athematic in participial forms:

(i)	Present	Perfect	Perf. Part.	Infinitive	
	<i>docēmus</i>	<i>docuimus</i>	<i>doctum</i>	<i>docere</i>	‘teach’
	<i>cēnsēmus</i>	<i>cēnsuimus</i>	<i>cēnsum</i>	<i>cēnsere</i>	‘assess’
	<i>secāmus</i>	<i>secuimus</i>	<i>sectum</i>	<i>secare</i>	‘cut’
	<i>salimus</i>	<i>saluimus</i>	<i>saltum</i>	<i>salire</i>	‘jump’
	<i>aperimus</i>	<i>aperuimus</i>	<i>apertum</i>	<i>aperire</i>	‘open’
	<i>rapimus</i>	<i>rapuimus</i>	<i>raptum</i>	<i>rapere</i>	‘seize’

I would like to extend the same account for the appearance of /-v-/ proposed for the verbs in (70) in the text also to these verbs. Therefore, I assume that they have a TV /-I-/ in the *perfectum* and undergo the rule in (71). An additional rule must be postulated to delete the TV in the Past participle.

<sup>55</sup> Athematic roots that display a final vowel in the Perfect as the outcomes of morphological readjustment (cf. *stern-o* → *strā-*, *cern-o* → *crē-* (cf. rule (64)d) always display the exponent /-v-/ (see below for further discussion of verbs such as *stā-re* ‘stand’, *de-lē-re* ‘destroy’, *plē-re* ‘fill’, etc.)).

(71) X  
|  
[-cons] → ∅ / [ \_ ]<sub>TV</sub> [-consonantal]

(72) [[[mon]<sub>Root</sub> I]<sub>V0</sub>+perf]<sub>Asp0</sub> ... → VI → [[[mon]<sub>Root</sub> I]<sub>V0</sub>-v-]<sub>Asp0</sub>... → (71) →  
[[[mon]<sub>Root</sub> I]<sub>V0</sub>-v-]<sub>Asp0</sub>... → [resyllabification] → (71) → [[[mon]<sub>Root</sub> I]<sub>V0</sub>-u-]<sub>Asp0</sub>...

Once we assume the VI in (69) and the analysis in (72) for the verbs in (70), one can generalize the VI inserting /-s-/ in the Perfect as /-s-/ <—> [+Perfect], but this is nothing more than an instance of the more general rule in (23)c). The VI in (69) (cf. the derivation in (72)) and the special freezing operation in (68) account for the [u] exponents and for the occurrence of /-∅-/ , respectively. Thus, it follows that /-s-/ is the default exponent of [+perf] Asp<sup>0</sup> in thematic structures. This conclusion is possible because Latin roots end in consonants, thus excluding the application of (69). The VI rules accounting for the phonological spell out of functional nodes in Latin verbal forms are, therefore, those in (73), which is a decidedly parsimonious system given the surface complexity of Latin verbal morphology (where [+F] is a marked feature):

(73) a. /-b-/ <—> [-Perfect, +F, -Irrealis]<sub>Mood0</sub>  
N  
|  
c. /-v-/ <—> [+Perfect] ] / X ] \_\_\_\_\_  
d. /-s-/ <—> [+F]  
e. /-∅-/ <—> [ ]

Observe that the generalizations leading to (73) can be captured only if the underlying morphosyntactic configuration is accessed. In surface representations, the exponent /-v-/ is found both after vowels and consonants, e.g. *strāvī*, *monuī*, and the exponent /-s-/ is found both after vowels and consonants: *divīsī*, *scrīpsī*. If the underlying morphosyntactic configurations are accessed, one can observe that /-s-/ and

(i) *strā-v-imus* ‘stretch-Perf, *crē-v-i-mus* ‘distinguish-perf’, *plē-v-i-mus* ‘fill-perf’, etc.

A possible way to account for this is to assume that the rule inserting /-v-/ is sensitive to the phonological properties of the preceding string—i.e., a preceding vowel— as cyclically constructed up to that point due to the application of the morpho-phonological adjustments in (64). Thus, forms such as *strā-v-imus* or *crē-v-i-mus* require a derivation in which the morpho-phonological adjustments precede the VI-insertion of the Asp<sup>0</sup>-exponent, as shown below for *strā-v-imus* (at the cyclic point where Asp<sup>0</sup> is reached).

(ii) [[[stern-]<sub>Root</sub> I]<sub>TV</sub>]<sub>V0</sub> [+perf]<sub>Asp0</sub> ... → TV-Del → [[[stern-]<sub>Root</sub> I]<sub>V0</sub> [+perf]<sub>Asp0</sub> ... → (64)c) →  
[[[stern-]<sub>Root</sub> I]<sub>V0</sub> [+perf]<sub>Asp0</sub> ... → (64)d) → [[[strā-]<sub>Root</sub> I]<sub>V0</sub> [+perf]<sub>Asp0</sub> ... → VI → [[[strā-]<sub>Root</sub> I]<sub>V0</sub> [-v-]<sub>Asp0</sub>...

/-Ø-/ are found only after consonants, which means that these exponents are directly attached to a root, i.e., they can occur only in an athematic construction. The exponent /v-/ is found only after vowels, which could be either TVs—the clear majority of cases, or root-final segments in an athematic context, either underlying as in *de-lē-v-i* ‘destroyed’ or the result of the morpho-phonological adjustment in (64d) as discussed in footnote 55.

A further simplification of the Latin verbal morpho-phonological system is now possible. Earlier, I postulated that the *perfectum* forms of the verbs in (70) (and of the verbs in (i) in Footnote 54) contain the thematic vowel /-I-/. A way to account for this is to generalize the status of /-I-/ as the default inflectional TV also to  $v^0$ , i.e., /-I-/ is the general default TV as in in (74)–(75).<sup>56</sup>

- (74) a.  $\emptyset \rightarrow$  /-ē-/ / Head<sup>ē</sup> [ \_ ]<sub>TV</sub>  
 b. /-ī-/ / Head<sup>ī</sup> [ \_ ]<sub>TV</sub>  
 c. /-ĩ-/ / Head<sup>ĩ</sup> [ \_ ]<sub>TV</sub>  
 e. /-ā-/ / Head<sup>ā</sup> [ \_ ]<sub>TV</sub>  
 d. /-I-/ / [ \_ ]<sub>TV</sub>

- (75) a.  $\emptyset \rightarrow$  <sup>ē</sup> / [+Irrealis]<sub>Mood<sup>0</sup></sub> <sup>-</sup>  
 b.  $\emptyset \rightarrow$  <sup>ā</sup> / [+Past]<sub>Mood<sup>0</sup></sub> <sup>-</sup>  
 c.  $\emptyset \rightarrow$  <sup>ā</sup> /  $v^0$  <sup>-</sup>

The appearance of /-I-/ as the verbal TV of all II conjugation verbs, and of some verbs of the other conjugations, can be accounted for by a rule of TV neutralization in (76). Rule (76) deletes the vocalic content of the TV inserted in the preceding  $v^0$  cycle.

- (76)  $X^0$  / Root<sup>X</sup> [ +perf ]<sub>Asp<sup>0</sup></sub> Root<sup>X</sup> = *cub-, son- sec-, aper, sal, etc.*  
 |  
 TV  
 ✗  
 -cons

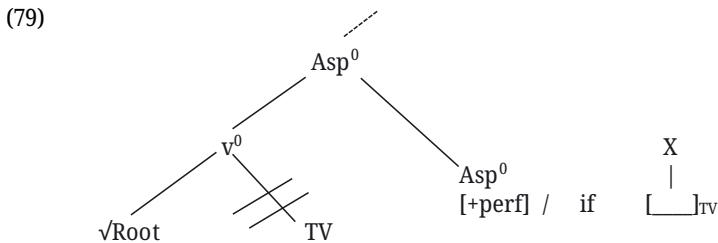
56 Evidence for the fact that /-I-/ is the default TV may be provided by the following instances of nominalizations in which the root does not refer to an eventuality, but a concrete referent, such as those in (i) (Steriade 2016: 130). Since roots such as these cannot carry diacritics, the default TV should be inserted. It is a short [i] like those we see in the participle forms in (70) which indicates TV /-I-, if the analysis developed above is correct.

- | (i) Non-eventuality root        | Nominalization    |                        |
|---------------------------------|-------------------|------------------------|
| <i>ianua</i> ‘door’             | <i>ianitor</i>    | ‘doorkeeper’           |
| <i>oliva</i> ‘olive’            | <i>olivitor</i>   | ‘olive tree planter’   |
| <i>vindemia</i> ‘grape harvest’ | <i>vindemitor</i> | ‘harginger of vintage’ |

Note that the rule preserves that TV position which must then be filled in. Root diacritics are not available at this point, and therefore the default rule in (74) d) applies inserting /-I-/. This vowel is deleted in the Perfect by the rule (71), after the insertion of /-v-/ (see (77) below). The vowel is instead preserved in the participle, as shown by the derivation in (78) (see Calabrese (2020) for discussion of the feature [+Perfect] in participles; see also Embick (2004), Alexiadou (2001)).

- (77) a.  $[[[mon]_{Root} \text{-}\bar{e}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (76)+(74)d] \rightarrow [[[[mon]_{Root} \text{-}I\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow VI \rightarrow$   
 $[[[mon]_{Root} I]_{V^0} \text{-}v\text{-}J_{Asp^0} \dots \rightarrow (71) \rightarrow [[[[mon]_{Root} J_{V^0} \text{-}v\text{-}J_{Asp^0} \dots \rightarrow [resyllabification]$   
 $\rightarrow [[[mon]_{Root} J_{V^0} \text{-}u\text{-}J_{Asp^0} \dots \rightarrow \dots \rightarrow monuimus$
- b.  $[[[cub]_{Root} \text{-}\bar{a}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (76)+(74)d] \rightarrow [[[[cub]_{Root} \text{-}I\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow VI \rightarrow$   
 $[[[cub]_{Root} I]_{V^0} \text{-}v\text{-}J_{Asp^0} \dots \rightarrow (71) \rightarrow [[[[cub]_{Root} J_{V^0} \text{-}v\text{-}J_{Asp^0} \dots \rightarrow [resyllabification]$   
 $\rightarrow [[[cub]_{Root} J_{V^0} \text{-}u\text{-}J_{Asp^0} \dots \rightarrow \dots \rightarrow cubuimus$
- (78) a.  $[[[mon]_{Root} \text{-}\bar{e}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (76)+(74)d] \rightarrow [[[[mon]_{Root} \text{-}I\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow VI \rightarrow$   
 $[[[mon]_{Root} \text{-}I\text{-}J_{V^0} \text{-}t\text{-}J_{Asp^0} \dots \rightarrow (4) \rightarrow [[[[mon]_{Root} \text{-}i\text{-}J_{V^0} \text{-}t\text{-}J_{Asp^0} \dots \rightarrow monitum$
- b.  $[[[cub]_{Root} \text{-}\bar{a}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (76)+(74)d] \rightarrow [[[[cub]_{Root} \text{-}I\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow VI \rightarrow$   
 $[[[cub]_{Root} I]_{V^0} \text{-}t\text{-}J_{Asp^0} \dots \rightarrow (4) \rightarrow [[[[cub]_{Root} \text{-}i\text{-}J_{V^0} \text{-}t\text{-}J_{Asp^0} \dots \rightarrow \dots \rightarrow cubitum$

Notice that a consequence of all of this is that the only TVs that undergo systematic deletion are short /-ĭ-/ and /-I-/. No diacritics are needed. These vowels are inserted at the v<sup>0</sup> cycle or result from the TV neutralization process in (76). However, they are deleted by two different rules: a) (71) and b) (79) which replaces (62) in no longer referring to lexical diacritics:



The rules (71) and (79) account for the presence of two types of athematic structures in the Perfect. The first type consists of the structures of the III and III(i) conjugations, which undergo the rule in (79), and are therefore athematic during cyclic spell out. The second type includes the structures of the II and other conjugations, which undergo rule (71) and therefore become athematic only after VI insertion. Root-Asp<sup>0</sup> morpho-phonological interactions are possible only under structural adjacency. It

follows that these interactions are not found in the latter forms where athematicity is due to phonology. This explains why no such interaction occurs in Perfect forms displaying syllabic /-u-/, which as discussed above are phonologically athematic due to rule (71).<sup>57</sup>

Given that the rule in (79), differently from (62), is no longer sensitive to diacritics and applies only to short vowels, some adjustments are needed. For example, one can no longer account for the athematic structure found in the *perfectum* of the /-ē-/ and /-ī-/verbs that take /-s-/ or Ø + reduplication. Assuming just the rule of neutralization in (76), one would find only /-v-/ with these verbs. To account for these cases, an additional process is needed. I hypothesize the rule of TV shortening in (82). This rule applies before (79), and feeds it. The shortened vowels that result from this rule are then deleted by (79). The need for a process independent from (79) is evidenced by the fact that the /-ē-/verbs display /-s-/ or reduplication especially when the root is prosodically heavy (Meiser (1998); Weiss (2009)). The rule could then be made sensitive to the prosodic structure of the root. The same generalization seems to hold for /-ī-/verbs.<sup>58</sup> No such prosodic conditioning is needed for the application of (79) to verbs of the III and II(i) conjugations:

---

57 Rule (79) is associated with athematic structures both in the Perfect and the participle. The Perfect, in this case, has the exponent /-s-/ or Ø in addition to morpho-phonological processes such as lengthening or reduplication. TV-neutralization (76) with subsequent (71), is associated with /-u-/ Perfect in an athematic structure and a thematic /-i-/ in the participle although a small set of participles are athematic in this case. It follows that the presence of a thematic participial form always predicts the presence of a /-v-/Perfect.

58 There are a few exceptions to these generalizations. First, root that are heavy because of final liquids are systematically treated as light. This could be simply accounted for by assuming that root final liquids are extrametrical.

(i) *horr-ē/horr-u-i-mus* ‘we bristled’, *pall-ē/pall-u-i-mus* ‘I was pale’, *torr-ē/torr-u-i-mus* ‘we were hot’

However, there is also a number of roots that take /-s-/ or /Ø/ despite being light and roots that display /-u-/ despite being heavy:

(ii) light roots with /Ø/ and /s/:

ē-verbs: *mov-ē/mōv-Ø-i-mus* ‘we moved’, *sed-ē/sēd-Ø-i-mus* ‘we sat’, *vid-ē/vīd-Ø-i-mus* ‘we saw’;  
*man-ē/man-s-i-mus* ‘we remained’

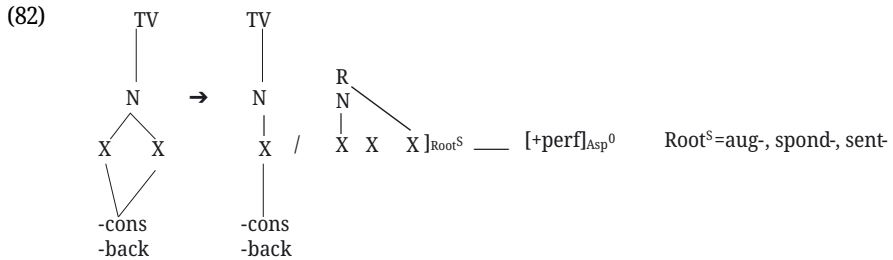
ī-verbs: *ven-ē/vēn-Ø-i-mus* ‘we came’

(iii) heavy roots with u-: *arc-ē/arc-u-i-mus* ‘we kept off’, *cens-ē/cens-u-i-mus* ‘we reckoned’

*splend-ē/splend-u-i-mus* ‘we shone’, *torp-ē/torp-u-i-mus* ‘we were numb’

This indicates that rule (82) may have eventually lost the prosodic conditioning and have simply become sensitive to root diacritic.

- (80) (i) Light roots: *doc-ē/doc-u-i-mus* ‘we taught’, *eg-ē/ eg-u-i-mus* ‘we lacked’, *hab-ē/hab-u-i-mus* ‘we had’, *mon-ē/ mon-u-i-mus* ‘we warned’, *tac-ē/ tac-u-i-mus* ‘we were silent’.  
 (ii) Heavy roots: i. *alg-ē/al[k]-s-i-mus* ‘we were cold’ *aug-ē/au[k]-s-i-mus* ‘we increased’ *rīd-ē/rīd-s-i-mus* ‘we laughed’ *suad-ē/ suad-s-i-mus* ‘we persuaded’  
 ii. *mord-ē/momord- i-mus* ‘we bit’, *spond-ē/ spond-i-mus* ‘we promised’
- (81) (i) Light roots: *aper-ī/aper-u- i-mus* ‘we opened’, *oper-ī/ oper-i-mus* ‘we covered’, *dē-sil-ī/ dē-sil-u-i-mus* ‘we leaped down’  
 (ii) Heavy roots: *haur-ī/haur-s-i-mus* ‘we drank’, *saep-ī/ saep-s-i-mus* ‘we surrounded’, *sanc-ī/sank-s-i-mus* ‘we ordained’ *vinc-ī/ vink-s-i-mus* ‘we fettered’.



The derivations in (83) illustrate what happens in these cases:

- (83) a.  $[[[alg]_{Root} \tilde{e}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (82) \rightarrow [[[alg]_{Root} \tilde{e}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (79) \rightarrow$   
 $[[[alg]_{Root} + perf]_{Asp^0} \dots \rightarrow VI \rightarrow [[[alg]_{Root} \text{-}s]_{Asp^0} \dots \rightarrow \dots \rightarrow alksimus$   
 b.  $[[[mord]_{Root} \tilde{e}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (82) \rightarrow [[[mord]_{Root} \tilde{e}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (79) \rightarrow$   
 $[[[mord]_{Root} + perf]_{Asp^0} \dots \rightarrow VI \rightarrow [[[mord]_{Root} \text{-}\emptyset]_{Asp^0} \dots \rightarrow \dots \rightarrow momordimus$   
 c.  $[[[saep]_{Root} \tilde{i}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (82) \rightarrow [[[saep]_{Root} \tilde{e}\text{-}J_{V^0} + perf]_{Asp^0} \dots \rightarrow (79) \rightarrow$   
 $[[[saep]_{Root} + perf]_{Asp^0} \dots \rightarrow VI \rightarrow [[[saep]_{Root} \text{-}\emptyset]_{Asp^0} \dots \rightarrow \dots \rightarrow saepsimus$

Another set of cases that are still needed to be accounted are those of the /-I-/ and /-ī-/ conjugations where /-v-/ is found in the Perfect, as in (84). They must be treated as exception to rule (79). Therefore, in these forms, a TV is present when [+perf] Asp<sup>0</sup> undergo Vocabulary Insertion; so, /-v-/ is inserted (by (73)c). The TV is then deleted by (71).



### 3 Historical development of the Latin thematic vowel system and of athematic Perfect forms

I will now consider the historical development of Latin verb structure starting from Proto-Indo-European (PIE). Notably, the Latin III consonantal conjugation developed from the so-called primary verbs—verbs including roots without additional derivatives. On the other hand, the remaining conjugations developed from secondary verbs—verbs including roots with additional derivatives such as denominals and causatives. As we will see such a distinction is fundamental to understand the special behavior of the III conjugation TV both in the *infectum* and in the *perfectum*. The investigation of this development will lead to a better understanding of other properties of the Latin verbal system.

There is some controversy concerning the early PIE verbal system because of Hittite, the oldest documented Indo-European language. Hittite has a rather simple verbal structure with no clear traces of the aspectual contrasts found in Sanskrit and Greek (cf. Watkins (1997: 56–62); Beekes (1995: 225–227, 252–254); Szemerényi (1990: 230–232, 245–247); Lehmann (2002), a.o.). Therefore, many historical linguists believe that the early Proto-Indo-European verbal system had a relatively simple structure, which was considerably different from that later found in Sanskrit and Greek. It is currently assumed, though, that the Latin verbal system developed from that of Late PIE, as found in Greek and Sanskrit (Meiser 2003; Sihler 1995; Weiss 2009).

I will thus begin with a basic outline of the late PIE verbal system. In doing this I will focus on the Sanskrit and Classical Greek verbal systems whose complexities can help us the most in the analysis of Latin.

We will see that also in these languages, and plausibly in PIE, root-conditioned allomorphy in the  $\text{Asp}^0$  node can occur only under adjacency between the root and this node (§3.1). An important issue is that of the morphological status of what is traditionally called the “thematic” vocalic piece /-e-/ (Sanskrit /-a-/, Greek /-ε-/). I will argue that it is a default exponent of the  $\text{Asp}^0$  node as the fact that it cannot co-occur with other clear  $\text{Asp}^0$  exponents shows (§ 3.2.1). Section 3.2.2 deals with the development of the Latin TVs, ornamental vocalic pieces added to  $v^0$ , from PIE  $v^0$ -derivatives such as causative and denominative morphemes. Section 3.3 deals with the development of verbal athematic constructions. It first investigates the morphological status of the root-adjacent vocalic pieces /-I-/, /-ē-/ and /-i-/, which, as opposed to /-ā-/ and /-ī-/, were restricted only to the *infectum* system and did not spread to the *perfectum*. I will propose that this led to a reanalysis where a rule deleted the verbal TV after certain roots in the *perfectum*. Section 3.4 discusses the exponence of the  $\text{Asp}^0$  node in Latin and relates it to its PIE etymological counterparts. It also shows how root- $\text{Asp}^0$  interactions required a local configuration, i.e., node adjacency. Allomorphic complexity, i.e., the possibility of multiple root conditioned exponents for  $\text{Asp}^0$  was restricted to cases in which  $\text{Asp}^0$  is adjacent to the root node, i.e. in athematic contexts.

### 3.1 A sketch of the PIE verbal system

The PIE basic stem systems are the so-called Present, the Perfect and the Aorist, which are distinguished in terms of aspectual features. These systems are given in (87) (where the features I use are again tentative but I hope can characterize the basic morphological contrasts of the system):

(87)	Present	Aorist	Perfect
	Perfective	–	+ +
	Stative	–	– +

Other stem systems are the Future, the Passive, the Causative, the Desiderative, the Denominative and the Intensive/Frequentatives (cf. Rix 1986, 2001 for more in-depth discussion of these systems). Some of them will be considered later.

Each system includes mood distinctions: Indicative, Subjunctive, Optative, imperative.

(88)	Aspect	Present				Aorist				Perfect			
	Perfective (PFV)	–				+				+			
	Stative (STAT)					–				+			
	Mood	Ind	Subj	Opt	Imp	Ind	Subj	Opt	Imp	Ind	Subj	Opt	Imp
	Irrealis (IRR)	–	+	+	–	–	+	+	–	–	+	+	–
	Desiderative (DES)	–	–	+	+	–	–	+	+	–	–	+	+

The Indicative mood has Tense distinctions between a Present and a Past ([+/-Past]). There are also Voice [+/-Active] and Subject Agreement Person/Number distinctions.<sup>64</sup>

A major step in the development of Latin Verbal System was the conflation of the PIE Aorist and Perfect. In this article, I cannot deal with the reasons for this change or with its syntactico-semantic consequences. I only address its implications for the verbal morphology of Latin. It gave rise to the important morphological distinction between the Latin *infectum*, which developed from the PIE Present system, and the Latin *perfectum*, which developed from the PIE Aorist and Perfect systems.

The basic verbal morpho-syntactic structure of PIE verbs in the Present system can be observed in the following Subjunctive and Optative forms from Sanskrit and Classical Greek (see calabrese and Petrosino (2023) for further discussion; see also Calabrese (Forthcoming b) for some discussion of the realization of Voice in Sanskrit; cf. also Grestenberger (2016, 2018)). In addition, [+Past] T<sup>0</sup> is marked by a prefixal vowel, the so called augment (i.e., Sanskrit: *á-kṛṇu-ta* ‘make-Imperf-2pl’, root: kar, Greek: *ἔ-δείκνυ-τε* ‘point-Imperfect-2pl’, root: δείκ). It may involve an antitropical

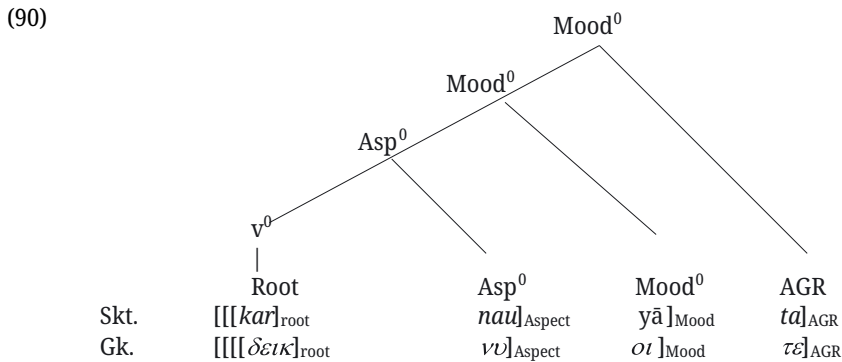
<sup>64</sup> Some possible feature combinations are excluded by morphological conditions, for example, the Aorist always implies a Past tense:

(i) [+Perfective, -Stative] → [+Past]

realization of the  $T^0$  exponent as a prefix.<sup>65</sup> I will not be able to discuss this issue here.<sup>66</sup>

- (89) a.  $kṛṇuyāta$  ‘make-Imperfective-Optative-Active-2PL Root:  $kar$  (Skt.)  
 [[[ $kar$ ]<sub>root</sub>  $nau$ ]<sub>Aspect</sub>  $yā$ ]<sub>Mood</sub>  $ta$ ]<sub>Tense+Voice+AGR</sub>  
 $\delta\epsilon\kappa\nu\acute{o}\iota\tau\epsilon$  ‘point-Imperfective-Optative-Active-2PL Root:  $\delta\epsilon\kappa$  (Gr.)  
 [[[ $\delta\epsilon\kappa$ ]<sub>root</sub>  $\nu\upsilon$ ]<sub>Aspect</sub>  $οι$ ]<sub>Mood</sub>  $\tau\epsilon$ ]<sub>Tense+Voice+AGR</sub>
- b.  $kṛṇāvadhve$  ‘make-Imperfective-Subjunctive-Middle-2PL (Skt.)  
 [[[ $kar$ ]<sub>root</sub>  $nau$ ]<sub>Aspect</sub>  $a$ ]<sub>Mood</sub>  $dhve$ ]<sub>Tense+Voice+AGR</sub>  
 $\delta\epsilon\kappa\nu\acute{\eta}\sigma\theta\epsilon$  ‘point-Imperfective-Subjunctive-Middle-2PL (Gr.)  
 [[[ $\delta\epsilon\kappa$ ]<sub>root</sub>  $\nu\upsilon$ ]<sub>Aspect</sub>  $\eta$ ]<sub>Mood</sub>  $\sigma\theta\epsilon$ ]<sub>Tense+Voice+AGR</sub>

The basic morphosyntactic structure of the forms in (89) is that in (90). It is derived as discussed earlier for Latin (see below). Given the structural convergence between Sanskrit and Greek, one can plausibly hypothesize that this structure can be reconstructed for PIE.<sup>67</sup>



Taking into consideration the Sanskrit forms in (89) (but the same point holds for the Greek forms once the relevant VIs are changed), one observes that only  $Asp^0$  and  $Mood$  have overt exponence as in (91); the other nodes, then, are assigned zero exponence by default. By cyclic pruning,  $v^0$  and  $Voice^0$  are delinked and fused with the higher

65 When lexically marked as antitropical, the exponent of an affix is phonologically inserted in the side opposite to that expected by the morpho-syntax (e.g., the affix is prefixal instead of being suffixal as regularly expected (see Bye and Svenonius (2012) for further discussion).

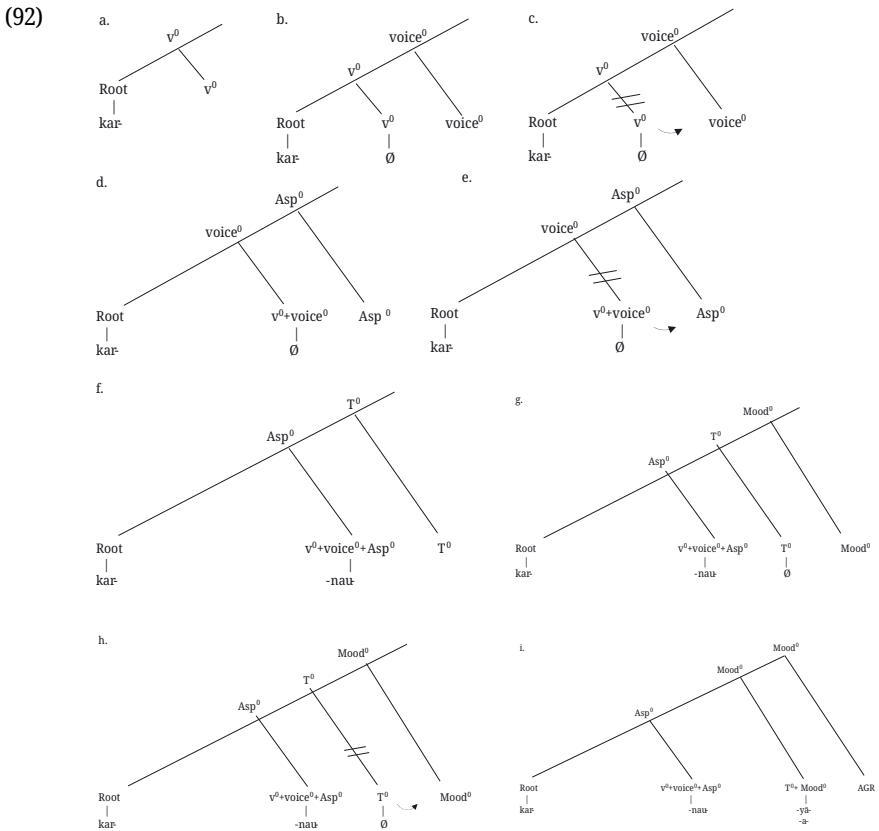
66 See MacDonnell (1916), Whitney (1889) as standard references on Sanskrit; Smyth and Messing (1956), Schwyzler (1939) on Greek.

67 See Grestenberger (2022) for independent work on Ancient Greek assuming the same structure in (90) for this language. She, however, assumes that affixes such as  $-ne-$ ,  $-nū-$ ,  $-ye-$ , etc. in (93) are associated with  $v^0$ . This hypothesis, though, fails to recognize their tight connection with [-perf]  $Asp^0$ , which is the basis of my analysis here (see below for more discussion).

local Asp<sup>0</sup> node. Further, T<sup>0</sup> is pruned and fused with Mood<sup>0</sup>. The cyclic derivation is illustrated in (92) (where the outcomes of cyclic accent and zero grade are not considered; see Calabrese and Grestenberger (2023) for discussion):

- (91) a. -nau- <--> [-PFV]<sub>Aspect<sup>0</sup></sub>/ Root<sup>V, VIII</sup> \_\_\_\_  
 b. -a- <-->  $\begin{pmatrix} +IRR \\ -DES \end{pmatrix}_{Mood^0}$   
 c. -yaH <-->  $\begin{pmatrix} +IRR \\ +DES \end{pmatrix}_{Mood^0}$

Otherwise ∅.



The resulting structure after insertion of an overt exponent in AGR is that in (90). I assume that the same structure can be reconstructed for PIE.

In PIE, as in ancient IE languages such as Sanskrit and Greek, the Present (Imperfect) system displays a wide variety of affixes (cf. Ringe (2006), Rix (1986, 2001), Szemerényi (1990)), which traditionally form the different classes of the Present and involve root dependent realizations of [-Perfect] aspect.<sup>68,69</sup>

(93)	Sanskrit		PIE		cf. Greek
	[[ <i>bhav</i> ] <sub>Root</sub>	- <i>a</i> ] <sub>Aspect</sub>	*- <i>e</i> ] <sub>Aspect</sub>		- <i>e</i> ] <sub>Aspect</sub>
	[[ <i>raudh</i> ] <sub>Root</sub>	- <i>na</i> ] <sub>Aspect</sub>	*- <i>ne</i> ] <sub>Aspect</sub>		- <i>ne</i> ] <sub>Aspect</sub>
	[[ <i>pas</i> ] <sub>Root</sub>	- <i>ya</i> ] <sub>Aspect</sub>	*- <i>ye</i> ] <sub>Aspect</sub>		- <i>ye</i> ] <sub>Aspect</sub>
	[[ <i>star</i> ] <sub>Root</sub>	- <i>nau</i> ] <sub>Aspect</sub>	*- <i>new</i> <sup>70</sup> ] <sub>Aspect</sub>		- <i>nū</i> ] <sub>Aspect</sub>
	[[ <i>ad</i> ] <sub>Root</sub>	- $\emptyset$ ] <sub>Aspect</sub>	*- $\emptyset$ ] <sub>Aspect</sub>		- $\emptyset$ ] <sub>Aspect</sub>
			*- <i>sk'ē</i> ] <sub>Aspect</sub>		- <i>ske</i> ] <sub>Aspect</sub>

Note that as argued by Rix (1986), affixes such as /\*-*ne*-/, /\*-*ye*-/, /\*-*sk'ē*-/ may have had original aktionsart properties in early stages of Proto-Indo-European, and traces of these properties may still be found in the daughter languages (cf. Eska & Ringe 2013 chapter 8, Haverling 2010 on \*-*sk'ē*-, Meiser 1993, Bertocci 2010, 2013 on /\*-*ne*-/, Lazzeroni 2002, Kulikov 2012 on /\*-*ye*-/, a.o.). The fact is that, by the late stages of PIE, these affixes acquired aspectual properties and appear to have had the distribution of aspectual markers. That these affixes may have had aktionsart features associated with  $v^0$  or  $caus^0$  is nicely expressed in this system. These affixes are inserted in a node that results from the bundling of  $v^0$  or  $caus^0$  with the  $Asp^0$ . The actional properties of the former nodes may play a role in the selection of these suffixes in some forms. However, clear systematic generalizations cannot be found (Burrow 1955: 302) So,

<sup>68</sup> I will not deal with accent and zero-grade alternations that are fundamental to understand the complex morpho-phonology of the ancient IE language (see for an analysis of these alternations Calabrese and Grestenberger (2023)). I will also put aside the so-called *o*-grade by which vowel \**e*- became *-o*- in certain morpho-phonological environments. For the sake of simplicity, I will refer to this vowel as just */e/* in the examples.

<sup>69</sup> The pieces \**-ye/o-*, \**-ne/o-*, \**-ske/o-*, etc. are sometimes segmented as involving two suffixal elements: a consonantal suffix *-y-*, *-n-*, *-sk-*, and a vocalic suffix *-e/o-* (cf. Grestenberger 2022). In DM, the presence of a suffixes entails the presence of a terminal node. Thus, in this case, the presence of the two suffixes should correspond to the presence of two terminal nodes; for example in the case of these root-adjacent elements, a VP-shell node and an  $Asp^0$  node. However, as discussed in Calabrese and Petrosino (2023), there is no evidence in support of such distinct terminal nodes, therefore I reject this segmentation and argue for a single bundled VP-shell +  $Asp^0$  node.

<sup>70</sup> According to Rix (1992: 210), \**-new* could have developed from the infix \**-ne-* within roots ending in *-w*. However, at a late stage of PIE, as it developed into Sanskrit, Greek and Latin, there is no evidence for such a segmentation and this suffix must be analyzed as involving a single exponent.

they are analyzed here as aspectual elements (see Calabrese and Petrosino (2023) for further discussion).

There is an important morphophonological distinction between affixes that needs to be mentioned at this point: affixes such as */\*-e-*, */\*-ye-*, */\*-sk'ē-* are called “thematic” (see below Section 3.2.1 for the origin of this terminology); the others, i.e., */\*-ne-*, */\*-neu-* are called non-thematic. The vowel of the thematic suffixes has special morpho-phonological properties: it specifically never undergoes zero grade (syncope), whereas aspectual suffixes such as */\*-new-*, */\*-ne-*, may undergo zero grade. A discussion of these properties is not possible here. See Calabrese and Grestenberger (2023). As argued in this work but also briefly below, the exceptional property of the thematic suffixes does not follow from their morpho-syntactic position, which they share with */\*-ne-* and */\*-new-*; it is an idiosyncratic property of these exponents.

(94)		Sanskrit	Greek <sup>71</sup>	PIE	
	Thematic:				
		<i>-a</i> ] <sub>Asp<sup>0</sup></sub>	<i>-e</i> ] <sub>Asp<sup>0</sup></sub>	* <i>-e</i> ] <sub>Asp<sup>0</sup></sub>	
		<i>-ya</i> ] <sub>Asp<sup>0</sup></sub>	<i>-ie</i> ] <sub>Asp<sup>0</sup></sub>	* <i>-ye</i> ] <sub>Asp<sup>0</sup></sub>	
		<i>-cha</i> ] <sub>Asp<sup>0</sup></sub>	<i>-ske</i> ] <sub>Asp<sup>0</sup></sub>	* <i>-sk'ē</i> ] <sub>Asp<sup>0</sup></sub>	
	Non-thematic:				
		<i>-na</i> ] <sub>Asp<sup>0</sup></sub>	<i>-ne</i> ] <sub>Asp<sup>0</sup></sub>	* <i>-ne</i> ] <sub>Asp<sup>0</sup></sub>	(infix)
		<i>-nau</i> ] <sub>Asp<sup>0</sup></sub>	<i>-nü</i> ] <sub>Asp<sup>0</sup></sub>	* <i>-new</i> ] <sub>Asp<sup>0</sup></sub>	
		<i>-∅</i> ] <sub>Asp<sup>0</sup></sub>	<i>-∅</i> ] <sub>Asp<sup>0</sup></sub>	* <i>-∅</i> ] <sub>Asp<sup>0</sup></sub>	

Therefore, the root-adjacent exponence consists of the overt suffixes: */\*-e-*, */\*-ye-*, */\*-neu-*, */\*-ne-*, to which *-∅-* can be added. Strikingly, these suffixes never co-occur together. Thus, the Sanskrit thematic vocalic suffix */-a-/* patterns together with the thematic suffix */-ya-/*, the athematic suffix */-nau-*, the infix */-na-* and the null *-∅-*, in being in complementary distribution: thus, they all appear to compete for the same structural position.

The Perfect and Aorist system are also characterized by the same complex root-dependent realization of Asp<sup>0</sup> one observes in the Present system. There are two types of Perfect: root Perfects and reduplicated Perfects (both with non-overt suffixal exponents). They are given in (95). The Aorist system stem has four types. The simple Aorist (the root Aorist) does not have an overt aspectual exponent. The s-Aorist has the aspectual exponent */-s-*. The “thematic” Aorist is formed with suffixal */-e-*. The

71 Note that in Greek the thematic suffixes are associated with special desinential AGR endings so that two conjugations are recognized: the thematic (e.g. PRS1SG: *lú-ō*) and the athematic (PRS1SG: *tí-t'ē:-mi*).

reduplicating Aorist involves reduplication and suffixal /-e-/. They are given in (96) (Ringe 2006: 29).<sup>72</sup>

- (95) a. Root perfects:  
           \*woyd-Ø- ~ \*wid-Ø-           ‘know’  
 b. Reduplicated perfects:  
           \*me-món-Ø- ~ \*me-mn-Ø-       ‘remember’
- (96) a. The root Aorist with no overt suffixal element:  
           \*gwém-Ø- ~ \*gwm̄-Ø-           ‘step’  
           \*bhuh<sub>2</sub>-Ø-                   ‘become’  
 b. The /-s-/ Aorist.  
           \*déyk'-s-                   ‘point out’  
           \*wég'h-s-                   ‘transport’  
 c. The /-é-/ Aorist (traditionally called the thematic Aorist)  
           \*h<sub>2</sub>ludh-é-                   ‘arrive’  
 d. Reduplicating Aorist  
           \*wé-wk-e-                   ‘say’ (root *wek*)

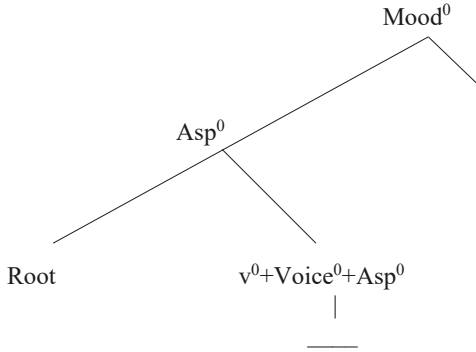
Perfect and Aorist formatives may never co-occur with different Present system exponents, *within the same conjugation*. Table (97) below is from Sanskrit, while also generalizable to PIE (cf. Ringe 2006; Szemerényi 1990). (97) shows that, at the paradigmatic level, none of the affixes occurring in the Present stem occurs in the Aorist stem of the same verb.

(97)	Present stem	Aorist stem	
	ján-a-	jan-	‘generate’
	bháv-a-	bhu-	‘be’
	sr̥j-á-	sr̥j/sraj-	‘emit’
	vṛh-á-	vṛk-śa-	‘tear’
	ruh-á-	rauh-/ruh-/rauk-sa/	‘ascend’
	bhi-n-d-/bhi-na-d-	bhid-/bhaid-	‘split’
	ru-n-dh-/ru-na-dh-	rudh-/raudh-	‘obstruct’
	kar-nau-/kar-nu-	kar-/kr̥-	‘make’
	su-nau-/nu-	sau-/su-	‘press’

It follows that the Present, Aorist, and Perfect suffixes appear to compete for the same morpho-syntactic position. Given their semantics, one can propose that all of them are exponents inserted under the Asp<sup>0</sup> node in (98):

<sup>72</sup> As already mentioned above, some Indo-European languages such as Sanskrit and Greek display a prefixal vowel, the so-called augment (Gr. *ε-/Skt. a-*), in [+Past] forms such as the Aorist and the Imperfect (as well as the Pluperfect). Since it is irrelevant in the analysis presented here, it is not considered here.

(98)



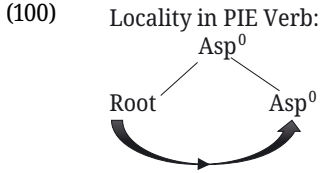
One can therefore propose that Aspect is realized through the different root dependent VIs listed below. Note that */\*-e-/\** can be treated as an elsewhere aspectual exponent insofar as it also appears as the exponent of the Aorist. Otherwise,  $\emptyset$  is inserted.<sup>73</sup>

- (99)
- |    |                   |     |   |
|----|-------------------|-----|---|
| a. | <i>/*-s-/*</i>    | <-> | [+pfv, -STAT] <sub>Asp⁰</sub> / Root <sup>-s-</sup> ___ |
| b. | <i>/*-ye-/*</i>   | <-> | [-PFV] <sub>Asp⁰</sub> / Root <sup>-ya-</sup> ___       |
| c. | <i>/*-ne-/*</i>   | <-> | [-PFV] <sub>Asp⁰</sub> / Root <sup>-na-</sup> ___       |
| d. | <i>/*-new-/*</i>  | <-> | [-PFV] <sub>Asp⁰</sub> / Root <sup>-neu-</sup> ___      |
| e. | <i>/*-sk'ē-/*</i> | <-> | [-PFV] <sub>Asp⁰</sub> / Root <sup>-sk'ē-</sup> ___     |
| f. | <i>/*-e-/*</i>    | <-> | [ ] <sub>Asp⁰</sub>                                     |
- Otherwise */\*-∅-/\**

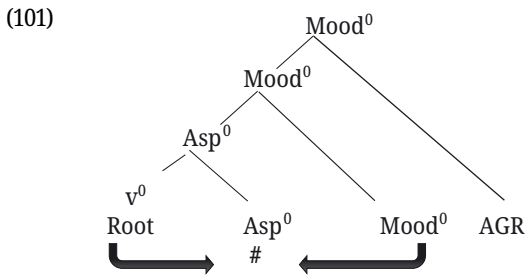
As it happens, the basic structure in (98) for the root adjacent node and the VIs in (99) are perfectly consistent with the Rix and Cowgil's reconstruction of the structure of the PIE verbal forms (Ringe 2006): there is a single root-adjacent functional position including original actional elements that have become aspectual markers. This position may have null exponence both in the Present and in the Aorist system, so that root-based forms appear in both systems. Otherwise, this position is filled in by competing overt exponents: */\*-e-/\**, */\*-ne-/\**, */\*-ye-/\**, */\*-new-/\**, */\*-sk'ē-/\** for the imperfective Present system and */\*-s-/\**, */\*-e-/\** for the perfective and Aorist system.

All the systems—the Present, the Perfect, and the Aorist—display a complex system of root-conditioned contextual allomorphy. Observe that the different VIs in (99) require access to root-based information (root-diacritics). Therefore, as already discussed in the case of Italian and Latin in Section 2.1, they can apply only when the root and the aspect node are adjacent, i.e., in a local configuration that allows morphemic interactions. This is allowed in the structure in (98) as shown below:

<sup>73</sup> The occurrence of  $\emptyset$  as the exponent of the Perfect and in the Aorist is accounted for by a freezing operation targeting the feature Asp<sup>0</sup>, so that the default  $\emptyset$  is inserted. Reduplication is due to special morphophonological rules which are not discussed here.



In contrast, mood and AGR suffixes never show complex root-conditioned allomorphy: they only show a single exponent, i.e., Subjunctive */\*-e-/*; Optative */\*-yeh<sub>1</sub>-/*, as expected since they are not in a local configuration with the root. Exponent variation in this case can only be conditioned by Aspect.



### 3.1.1 PIE “thematic” vowels as parts of functional exponents

As already mentioned, the analytical choices made in the framework developed here are constrained insofar as the nature of each morphological piece in the surface string must be assessed in terms of the overall—independently motivated—morpho-syntactic structure of the word. In this section, I will deal with the nature of the PIE “thematic” vowels. They need to be assigned a proper morpho-syntactic position.

In Latin, a morphological segmentation of inflectional Consonant-Vowel strings led to an analysis in which different morphological roles are assigned to Consonant (functional) and Vowels (ornamental). This is not the case for exponents such as those we see in (93), which are better analyzed as involving simply a syllable.<sup>74</sup> This is clear in the case of the Present system exponent */\*-new-/* (Sanskrit */-nau-/*, Greek */-nü-/*), which cannot be morphologically segmented into any plausible way at least at this stage of PIE (see footnote 69). Therefore, there is no reason to postulate ornamental vocalic elements for Sanskrit or Greek, or for PIE.

A crucial issue to deal with at this point, especially concerning the development of the Latin conjugational system, is the status of what is traditionally called “thematic”

74 The nuclear vowel of these syllables is always \*e.

*/\*-e-/\** which is assumed to be an exponent of  $\text{Asp}^0$  in (94). In Latin (and the Romance languages), thematic vowels appear to be purely structural elements, ornamental morphology, inserted in the morphological component (as discussed in § 2.3). If the analysis in (94) is correct, this is not the case for the aspectual *-e-* we see there.

In fact, its descendant, Sanskrit *-a-* and Greek *-e-*, appear to pattern together with suffixes such as *-nau-/-neu-*, and the infix *-na-/-ne-* (in addition to the */-Ø-*) in the Present system, and with the suffix */s/* (and */Ø/*) in the Aorist system. Specifically, they never co-occur with these suffixes (see Footnote 75 for some exceptions). They all appear to compete for the same structural position, which appears to be the  $\text{Asp}^0$  node. Thus, given their distribution, it is plausible to assume that they are all exponents of this node.<sup>75</sup> PIE */\*-e-*, and the Sanskrit and Greek descendants, are not to be considered ornamental thematic vowels; rather, they are exponents of [-Perfect] aspect, much like others such as */nau, neu/*, etc. (see Villanueva Svensson (2021 for further discussion of PIE */\*-e-*).

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75 Both Sanskrit and Greek display sporadic forms where a morphological element that appears to be the zero grade of */nau/* and */na/* co-occur with the suffix */a/*.

(i)	Sanskrit:					
	a.	Present		Aorist	Root	
		í-nv-a-ti	vs.	i-nó-ti	<i>ai</i>	‘send’
		hí-nv-a-ti	vs.	hi-nó-ti	<i>hai</i>	‘impel’
	b.	ḱṛ-n-t-á-ti			kart	‘cut’
		vi-n-d-á-ti			vaid	‘find’
	c.	Greek:				
		<i>κυνέω</i> ‘kiss’ (<* <i>ku-ne-s-e-</i> ) Hom. <i>ἔκυσσα</i> aor., <i>κύσω</i> ‘fut.’ Root: <i>kus</i>				

Burrow (1955: 290–1), discussing the Sanskrit forms, states that they must be considered innovations. Sihler (1995) refers to Greek form as an instance of sporadic “Thematization”. These “thematization” structures appear to be restricted to the “Present system”. This indicates that both affixes *-nv-* and *-n-* and the vowel *-a-* in Sanskrit, and *-ne-* and *-e-* in Greek, are associated with the feature [-perf]. The forms in (i) appear to be similar to Latin forms such as Present *fi-n-d-i-mus*/ Perfect: *fid-ī-mus* ‘split’, Present: *fu-n-d-i-mus* Perfect: *ffūd-ī-mus* ‘pour (metal)’—which will be discussed in Section 3.5.3—insofar as they display a co-occurrence between thematic vowel */-I-* and a piece *-n-*, which is missing in the Perfect system. A crucial difference is to be noticed, though: the co-occurrence of these two elements in Latin is systematic; there are no cases displaying root-internal *-n-* without the TV */-I-* in this language; in Sanskrit and Greek, instead, it is sporadic: it in fact occurs only for the cases listed above, whereas there plenty of cases where an infixal */n/* appears as the single marker of [-perf]  $\text{Asp}^0$ . In Calabrese (2019), I propose that the “thematization” we see in the Sanskrit forms in (i) involves the insertion of an “ornamental” extra-position in  $\text{Asp}^0$ . This position is filled with by default  $\text{Asp}^0$  *-a-*. This change is indeed sporadic in Sanskrit and Greek. It is, however, part of a clear Indo-European tendency for vocalic pieces to become ornamental. This tendency as argued below will become full-blown in Latin and will account for the development of the thematic vowels of the Latin verbal system.

It is then clear that the Latin TV and the PIE aspectual /e-/ in (94) actually have different behaviors. In order not to create confusion in dealing with these facts, I will distinguish them terminologically. As mentioned, the aspectual /\*-e-/ in (94) is also traditionally referred to as being thematic, insofar as it is usually the last element of the stem (=thema).<sup>76</sup> However, the stem final (and inflectional) vocalic pieces of Latin are pure structural (ornamental) elements. I will use the term Ornamental Thematic Vowel (OTV) to refer to the Latin ornamental entities inserted by rule as in the DM tradition. I will refer to the PIE aspectual /\*-e-/ and its descendants /-a-/-ε-/ of Sanskrit and Greek as Functional Thematic Vowels (FTV) in the sense that they are not ornamental elements but exponents of a functional node (Asp<sup>0</sup> in the case of (94)).

### 3.1.2 The development of Latin ornamental thematic vowels

To understand the development of the Latin conjugation system, one must consider PIE secondary derived stems. As discussed below, these stems played a major role in the development of Latin verbal system and formed the bases for the regular verbal conjugations. In contrast, the original underived PIE verb forms became a closed, relic class and gave rise to the third irregular conjugation.

We have derived verbs such as the following (De Vaan 2012; Ringe 2006: 26; Szemerényi 1996):

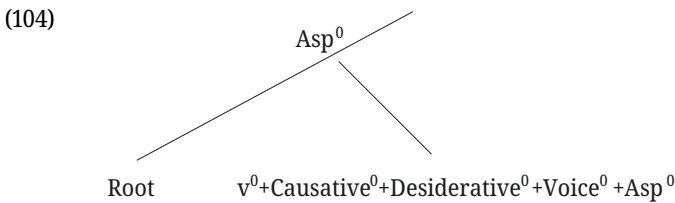
- (102) Statives in *-eh<sub>1</sub>-*  
*\*h<sub>1</sub>rudh-éh<sub>1</sub>-* ‘be red’ < *\*h<sub>1</sub>rewdh-* ‘red’  
 Factitives in *-eh<sub>2</sub>-*  
*\*nêwe-h<sub>2</sub>-* ‘renew’ < *\*newo* ‘new’  
 Causatives and iteratives in *\*-éye-* (with *o*-grade root) from basic roots:  
*\*sod-éye-* ‘seat (someone)’ < *\*sed* ‘sit down’  
*\*bhor-éye-* ‘be carrying around’ < *\*bher* ‘carry’  
 Desideratives in *\*-sé*, with and without reduplication from basic roots,  
*\*wéid-se-* ‘want to see’ < *\*weyd* ‘catch sight of’  
*\*k<sup>h</sup>i-k<sup>h</sup>l<sup>h</sup>-se-* ‘try to conceal’ < *\*k<sup>h</sup>el* ‘hide’  
 Denominatives in *-yé-* formed from nominals:  
*\*h<sub>2</sub>k<sup>h</sup>h<sub>2</sub>ows-yé-* ‘be sharp-heard’ < *\*h<sub>2</sub>ek* ‘sharp’ and *\*k<sup>h</sup>h<sub>2</sub>éw-es* ‘hear’  
 Factitives in *\*-yé-* formed from adjectives:  
*\*prkto-yé-* ‘frighten’ < *\*prkto-* ‘afraid’

In the proto-language, these suffixes seem to be associated with the Present system and were morphologically incompatible with other aspectual markers (Ringe 2006:

<sup>76</sup> As mentioned in the previous section (§3.2), the term ‘thematic’ is also used to refer to all stem-final suffixes ending in a fixed (i.e., non-alternating with  $\emptyset$ ) vowel (e.g., *-ye-*).

27–35; Sihler 1995: 494). This also appears to be true for Ancient Greek (see Calabrese and Petrosino (2023)). In the model developed here, this follows if we assume that the VP-shell nodes also had zero exponence, so they underwent the pruning and docking operations discussed above. Thus, they were bundled with the  $\text{Asp}^0$ -node, and their exponents were inserted there. This node included  $v^0 + \text{Causative}^0 + \text{Desiderative}^0 + \text{Voice}^0 + \text{Asp}^0$  features, particularly the aspectual feature specification [-Perfect].<sup>77</sup> Thus, the VI in (103) can be postulated for the proto-language:

- (103) \**-ye-* <-> [ $v^0$ , -Perf]<sub>Asp<sup>0</sup></sub>  
 \**-eye*<sup>78</sup> <-> [Causative<sup>0</sup>, -Perf]<sub>Asp<sup>0</sup></sub>  
 \**-se-* <-> [Desiderative<sup>0</sup>, -Perf]<sub>Asp<sup>0</sup></sub>  
 \**-ye-* <-> [+Passive, -Perf]<sub>Asp<sup>0</sup></sub>



This accounts for why different exponents or morphological constructions were required for Aorist or Perfect [+perf]  $\text{Asp}^0$  of secondary derived stems. For example,  $\emptyset$  was used in Aorist denominative forms, or Perfect causative forms were periphrastic.

There is evidence, however, that VP-shell exponents began to co-occur with aspectual exponents at some point in the history of Vedic Sanskrit. The cases are few but clearly show a trend:

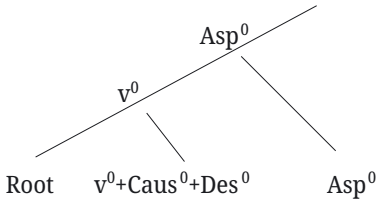
- (105) Aorist Denominative/Causative
- |                     |                           |                       |                                  |
|---------------------|---------------------------|-----------------------|----------------------------------|
| <i>pāpa-y-iṣ-</i>   | Aorist of <i>pāpa-yá-</i> | (Denominative /-ya-/) | ‘lead into evil ( <i>pāpa</i> )’ |
| <i>vyath-áy-iṣ-</i> | <i>vyath-áya-</i>         | (Causative /-aya-/)   | ‘disturb’                        |
| <i>dhvan-áy-iṣ-</i> | <i>dhvan-áya-</i>         | “                     | ‘envelope’                       |

Forms like those in (105) must have been reanalyzed as involving a dedicated VP-shell node, so that VP-shell features were inserted in this position. Therefore, there was no longer bundling with  $\text{Asp}^0$ ; hence this node could get its own exponent. The derived verbs in (105) then had the morpho-syntactic structure in (106):

<sup>77</sup> This a bundling also included  $\text{Voice}^0$  insofar as the Passive suffixal \**-ye-* also appears to be restricted to the Present system. I am omitting it.

<sup>78</sup> But see Calabrese and Petrosino (2023) on the composition of this suffix where final /-e-/ is  $\text{Asp}^0$ .

(106)



I assume that this is the structure for Proto-Italic.<sup>79</sup> Thus, in this IE variety, VP-shell nodes were no longer bundled with  $ASP^0$ , and could be inserted under a lower node independent from  $ASP^0$ . This is the situation that must be reconstructed, at least for the  $/\bar{a}-/$  and  $/\bar{i}-/$  derivatives whose occurrence was independent of that of aspectual features, cf.  $[[[[[laud]-\bar{a}]_{v^0b-\bar{a}}]_{Asp^0} \text{ mus}]_{AGR}$  ‘praise-Imperfect’ /  $[[[[[laud]-\bar{a}]_{v^0-v-i}]_{Asp^0} \text{ mus}]_{AGR}$  ‘praise-Perfect’,  $[[[[[aud]-\bar{i}]_{v^0} -\bar{e}-b-\bar{a}]_{Asp^0} \text{ mus}]_{AGR}$  ‘hear-Imperfect’ /  $[[[[[aud]-\bar{i}]_{v^0-v-i}]_{Asp^0} \text{ mus}]_{AGR}$  ‘hear-Perfect’.

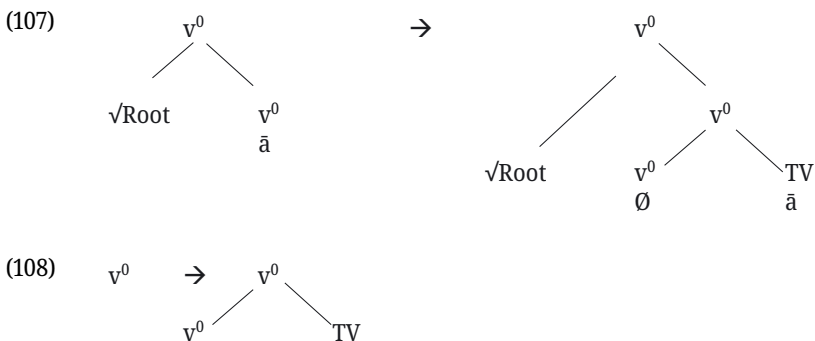
One can then hypothesize that in this variety, verb-forming derivatives were inserted under the  $v^0$ -node independently of  $ASP^0$  suffixes as in (106). Therefore, there could be an overt suffixal piece, such as the  $/*-eye-/$  characteristic of causatives in PIE, the  $/*-ye-/$  of denominatives, the  $/*-eh_1-/$  characteristic of statives, etc., between root and  $ASP^0$ . A crucial development of Latin is that these overt pieces were re-analyzed as thematic vowels, i.e., ornamental morphological pieces that can cooccur with other  $v^0$ -forming derivatives, as argued in section §1.5 (e.g. forms such as iterative  $[[[[[v\bar{i}s]_{Root} -it]_{v^0} -\bar{a}]_{TV}]]_{v^0-re}]_{T^0+AGR}$  ‘see often-infinitive’, causative  $[[[[[ex-carn]_{Root} ific-]_{v^0} -\bar{a}]_{TV}]]_{v^0-re}]_{T^0+AGR}$  ‘flesh out-Infinitive’, desiderative  $[[[[[es-]_{Root} -ur-]_{v^0} -\bar{i}]_{TV}]]_{v^0-re}]_{T^0+AGR}$  ‘be hungry-Infinitive’). Specifically, the  $/\bar{a}-/$  of the I conjugation developed mostly from denominatives in  $/*-ye-/$  whose bases were the nominal stems of the  $/\bar{a}-/$  ( $<*-eh_2-$ ) declension (Bertocci 2017; De Vaan 2012):  $/\bar{a}-/ < /*-eh_2-ye-/$ :<sup>80</sup> e.g. *curāmus* ‘cure’ (cf. *curā* ‘cure’). The  $/\bar{e}-/$  of the II conjugation developed mostly from the stative suffix  $/\bar{e}-/$  ( $<*-eh_1-$ ), or from causatives in  $/*-eye-/$  (with  $o$ -grade of root):  $/\bar{e}-/ < /*-eh_1-$ : e.g., *sedēmus* ‘I am sitting’ ( $< *sed-eh_1-$ ; cf. *sīdo*,  $*si-sd-$  ‘I sit down’),  $/\bar{e}-/ < /*-eye-/$  e.g. *monēmus* ‘I warn’ ( $< *mon-eye-$ ). The  $/\bar{i}-/$  of the IV conjugation developed mostly from denominatives in  $/*-ye-/$ ,  $/\bar{i}-/ < *denominative /*-ye-/$  e.g. *fnīmus* ‘limit’ (cf. *fnis*

79 Other Italic languages such as Oscan and Umbrian display a fully formed system of Thematic Vowels similar to that of Latin (Buck 1928; Levi 1934; Pisani 1964; Rix 2003). So, one can assume that the changes occurred in the common stage of these languages. Unfortunately, an in-depth analysis of the verbal morphology of the other Italic variety is impossible here, and from now on I will keep referring just to Latin.

80 The following phonological steps led to the outcome  $\bar{a}$ : 1. Loss of laryngeal  $h_2$  2. loss of the intervocalic glide, 3. subsequent merging of the vowel sequence. Finally, there was reanalysis of the resulting piece as a  $v^0$ -derivative, as discussed further below.

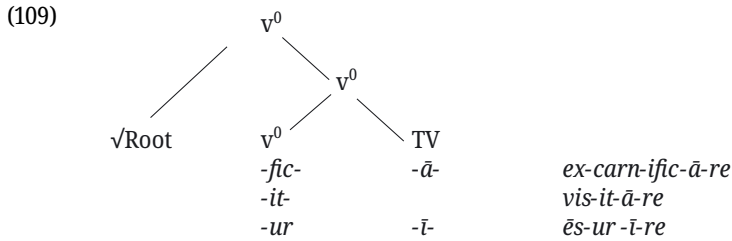
‘end’), but also from original stems in */\*-ye-/: venīmus* ‘come’ (<*\*g<sup>w</sup>en-ye-*>) (see Ernout (1953/1989), Sihler (1995), Meiser (1998), Weiss (2009) for further illustration of the relevant developments).

So, the exponents of these PIE derivatives were reanalyzed in the history of Latin as realizing purely structural elements. These pieces are “ornamental” and were added to all instances of  $v^0$  by a general rule. One can assume that this change was first caused by a loss of semantic specificity; these derivatives were bleached in meaning due to their disparate etymological sources. For example, */-ā-/* did not develop only from the Denominative sequence */\*-eh<sub>2</sub>-ye-/* but also from de-adjectival factitive with the suffix */\*-h<sub>2</sub>-/: novare* ‘to renew’ from *novus, nova, novum* ‘new’. It may have even developed from a root-final laryngeal in the case of primary verbs in */-ā-/*, which have unclear etymology: *amāre* ‘to (make) love’, *arāre* ‘to plow’, *volāre* ‘to fly’, *cubāre* ‘lie down’, *flagrāre* ‘to glow’ (Note the semantic heterogeneity of these verbs, which can be transitive, intransitive and also unaccusative). Similarly, the */-ī-/* of the IV conjugation developed from the Denominatives in */\*-ye-/,* but also from deverbal actional/aspectual */\*-ye-/. Learners could no longer assign a clear semantic or morpho-syntactic function to derivatives like */-ā-/* and */-ī-/* and, thus, they became devoid of syntactic or semantic features. The same happened with the other root-adjacent vocalic pieces. I propose that it is this bleaching that led to the overarching generalization that appears to characterize Latin verbal morphophonology: whereas only consonants could be the exponents of functional nodes; vocalic pieces could only be the exponents of non-functional nodes, i.e., ornamental morphology. This generalization could have been helped by a more principled morphological difference between vowels and consonants (cf. footnote 35). Given this generalization, these derivatives were reanalyzed as ornamental nodes inserted by the rule in (108):*



As a summary, I assume that this historical development involved the following steps: at first,  $v^0$  and  $Asp^0$  appeared to be bundled into a single node in the proto-language. Eventually they were reanalyzed as involving different independent

nodes; the verbalizers were positioned under  $v^0$ , as expected, and therefore could co-occur with (regular) aspectual markers. Finally, in Latin, verbalizers were re-analyzed as ornamental TV. Once this happened, new verbalizers (e.g., *-fic-*) developed and were able to cooccur with the newly formed ornamental TVs. In this way, vocalic pieces such as */-ā-/* and */-ī-/* were able to spread across formatives and be found in structures where they were neither etymologically nor functionally expected, as in the case of the causatives and iterative verbs:



Let us consider the fact that the II and III conjugations TVs are systematically absent in the perfectum.

(110)

		Present	Perfect		
a.	III	<i>vom-ī-mus</i>	<i>vom-v-i-mus</i>	‘vomit’	Athematic + <i>-v-</i>
b.	III	<i>dūc-ī-mus</i>	<i>dūc-s-i-mus</i>	‘lead’	Athematic + <i>-s-</i>
c.	III	<i>vert-ī-mus</i>	<i>vert-i-mus</i>	‘turn’	Athematic + $\emptyset$

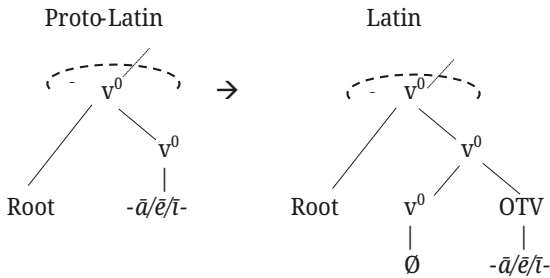
(111)

a.	II	<i>mon-ē- mus</i>	<i>mon-u-i-mus</i>	‘warn’	Athematic + <i>-v-</i>
b.	II	<i>sed-ē- mus</i>	<i>sēd-i-mus</i>	‘sit’	Athematic + $\emptyset$
c.	II	<i>man-ē- mus</i>	<i>man-s-i-mus</i>	‘remain’	Athematic + <i>-s-</i>
d.	II	<i>mord-ē-mus</i>	<i>mo-mord-i-mus</i>	‘bite’	Athematic + $\emptyset$ + Reduplication
e.	III(i)	<i>rap-ī-mus</i>	<i>rap-u-i-mus</i>	‘seize’	Athematic + <i>-v-</i>
f.	III(i)	<i>cap-ī-mus</i>	<i>cēp-i-mus</i>	‘take’	Athematic + $\emptyset$
g.	III(i)	<i>-spic-ī-mus</i>	<i>-spec-s-i-mus</i>	‘peer’	Athematic + <i>-s-</i>
h.	III(i)	<i>par-ī-mus</i>	<i>pe-per-i-mus</i>	‘bring forth’	Athematic + $\emptyset$ + Reduplication

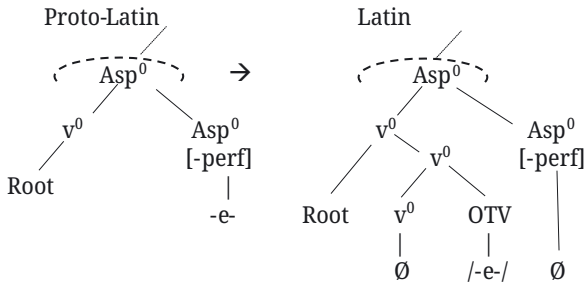
In Sect 1.5, I rejected the analysis that hypothesizes that the vocalic pieces */-I-/*, */-ē-/* and */-ī-/* of the *infectum* forms of these conjugations are exponents of [-perf] Asp<sup>0</sup> and therefore accounts for their absence in the *perfectum* simply because of feature incompatibility. All root adjacent vocalic pieces can be shown to be ornamental TV associated with  $v^0$  (cf. §1.5). This includes not only */-ā-/* and */-ī-/*, and */-ē-/* which developed from a VP-shell element but also */-I-/* from */\*-e-/* (see §3.4 for discussion of the development from */\*-e-/* to */-I-/*), and */-ī-/* from */\*-ye-/*, which were both true aspectual

[-perf] markers. It follows that, when  $v^0$  derivatives were reanalyzed as OTV as in (112), the [-Perfect]  $\text{Asp}^0$  FTV /-e-/ of the proto-language—the counterpart of the Sanskrit and Greek /-a-/ and /-ε -/ respectively—was also reanalyzed as an OTV as in (113). Specifically, one can assume that all root adjacent vocalic pieces, regardless of their functional status, were analyzed in this way in their relevant insertion cycle (after pruning) (for Proto-Latin I am assuming a PIE-consistent structure of the verbal forms; note that the newly postulated  $\emptyset$ s are assumed to be pruned after the reanalysis. Given Note 79, we can assume that these changes occurred at the common Italic stage.).

(112)



(113)



I assume that the same generalization was extended to the other vowels appearing in the inflections. They were re-analyzed as ornamental TVs inserted by the rule in (42). As assumed earlier, this re-analysis was motivated by a morphological generalization: an ornamental role was assigned to vocalic pieces and a functional one to consonantal pieces. Thus, as proposed in (44), the Imperfect Indicative /-ā-/ and the Subjunctive /-ē-/ were re-analyzed as ornamental TVs. Importantly, these are etymologically based on original vocalic exponents of the relevant functional nodes (cf. Ernout (1953/1989), Meiser (1998), Sihler (1995) and Weiss (2009)). This led to the development of alternative consonantal functional exponents such as /-b-/ and /-s-/ in these cases. This eventually developed into the Romance situation investigated by Oltra-Massuet and Arregi (2005), where all verbal inflectional vowels (both those associated with  $v^0$  as well those associated with other functional nodes) behave as a single class of ornamental elements in terms of stress and other phenomena.

### 3.2 The development of athematicity

Recall that the PIE formatives that developed into the Latin OTVs were originally restricted to the Present system, i.e., to what became the Latin *īnfectum*. So, when they are found in the *perfectum*, one must assume that these formatives were generalized across forms in the same paradigm. However, this extension was not consistent. As a matter of fact, paradigmatic TV spreading occurred only with the verbal forms characterized by TVs */-ā-/* and */-ī-/*. In this case, these TVs spread from the form of the *īnfectum* to those of the *perfectum* (see below). In this way, thematic forms such Present, Imperfect, and Perfect ones such as those in (114) developed:

(114)	<i>am-ā-mus</i>	<i>am-ā-bāmus</i>	<i>am-ā-bimus</i>	<i>am-ā-vimus</i>	<i>am-ā-verāmus</i>
	<i>aud-ī-mus</i>	<i>aud-ī-ēbāmus</i>	<i>aud-ī-ēmus</i>	<i>aud-ī-vimus</i>	<i>aud-ī-verāmus</i>
	Pres. Ind.	Imperf. Ind.	Fut. Ind.	Perf. Ind.	Pluperf.Ind.
	<i>am-ā-verimus</i>	'love'			
	<i>aud-ī-verimus</i>	'hear'			
	Fut.Perf. Ind.				

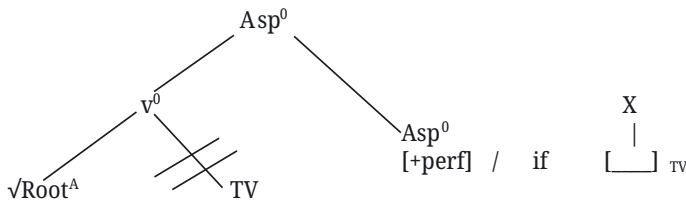
As already observed, verbal OTVs such as */-I-/*, */-ī-/* and */-ē-/* show up only in the *īnfectum* and not in the *perfectum*. Given the analysis proposed in Section 2.2, we can assume that this is just a surface property of forms in the *perfectum*. As a matter of fact, a structural  $v^0$ -TV position was systematically introduced across verbal forms and aspectual contexts: the structural presence of a verbal OTV became the characteristic feature of the *īnfectum* and of the *perfectum* regardless of the root. If it was missing in the *perfectum*, this was due to a short vowel (either */-I-/* or */-ī-/*) being deleted either by (79) or (71). The most parsimonious and adequate account for this situation is then the one, already proposed in Section 2.2, where a rule like (46) applies in a general fashion to all verbs, and where athematicity is, instead, analyzed as being due to rules pruning or deleting short TVs.<sup>81</sup>

I identified three situations that leads to athematicity. Two are accounted for by the application of (79) repeated here as (115). As already discussed, (115) applies before Vocabulary Insertion at the  $Asp^0$  node and therefore leads to the appearance of the exponents */-s-/* and */-Ø-/* (and to the application of morpho-phonological rules like reduplication and lengthening). (115) applies to the short TV vowels inserted by the rules in (74), i.e., */-I-/* or */-ī-/*, or to the short vowels generated when (82), repeated here as (116), applies to */-ē-/* and */-ī-/*. I assume that the rules in both cases developed through the reanalysis of the surface situation that was found in Latin after rule (46) was introduced. Specifically, */-I-/* (from */\*-e-/* or */-ī-/* (from */\*-ye/*) were missing in

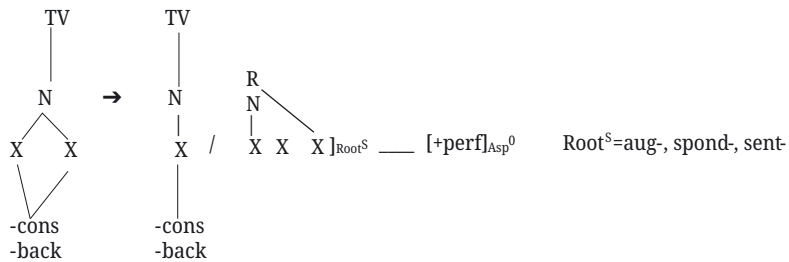
<sup>81</sup> This operation is implemented cyclically when the [+Perfect]  $Asp^0$  node is reached.

Perfect primary verbs, and the derivatives /-ē-/ and /-ī-/ had not spread to the *perfectum* (possibly due to the prosodic effect of heavy roots).

(115)



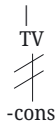
(116)



In contrast, the TV-neutralization rule in (76), repeated here as (117)a), and the subsequent TV deletion rule in (71), repeated here as (117)b) are morpho-phonological rules which explain the remaining cases of surface athematicity in the *perfectum*. They account for the appearance of the exponent /-v-/ in *perfectum* athematic constructions and, at the same time, for the appearance of thematic [i] in the participle (*monuimus/monitum* ‘warn’, *domui/domitum* ‘tame’). Rule (117)a) may have originated in cases that displayed short vowels in the participle in the case of /-ē-/verbs, i.e. \**mone-to* instead of \**monēto* (see Weiss 2009: 439 for a possible explanation). This reanalysis was systematically extended to all /-ē-/verbs where (116) did not apply.

(117)

a. i.  $X^0 / \text{Root}^X \_ [+perf]_{\text{Asp}^0} \text{Root}^X = \text{cub-,son- sec-, aper, sal, etc}$  ii. (74) d).



b.



I assume that all these processes are due to reanalyses that took place after the changes in (112)–(113) were introduced in Latin morpho-phonology. In particular, the reanalyses were triggered by the absence of the original aspectual markers /-I-/ and /-ī-/ and by the fact that /-ē-/ and instances of /-ā-/ and /-ī-/ had not spread to the

*perfectum*.<sup>82</sup> Since rules (115), (116), and (117) were restricted to apply only in the *perfectum*, TVs were free to appear in the *infectum*. Therefore, all verbal structures are systematically thematic in the *infectum* even in the case of the primary verbs, i.e., the III conjugation, which originally lacked a vocalic secondary derivative after the root.

This led to a restructuring in irregular exponence: root-conditioned exponents became characteristic of the *perfectum* system (cf. the III conjugation forms below) since their insertion was possible only in athematic structures, where root-Asp<sup>0</sup> interactions could occur:

## (118) Athematic Perfects

<i>dūc-s-īmus</i>	<i>dūc-s-erāmus</i>	<i>dūc-s-erimus</i>	<i>dūc-s-erīmus</i>
( <i>dūximus</i> )	( <i>dūxerāmus</i> )	( <i>dūxerimus</i> )	( <i>dūxerīmus</i> )
<i>lēg-Ø-i</i>	<i>lēg-Ø-erāmus</i>	<i>lēg-Ø-erimus</i>	<i>lēg-Ø-erīmus</i>
<i>crē-v-īmus</i>	<i>crē-v-erāmus</i>	<i>crē-v-erimus</i>	<i>crē-v-erīmus</i>
<i>momord-Ø-īmus</i>	<i>momord-Ø-erāmus</i>	<i>momord-Ø-erimus</i>	<i>momord-Ø-erīmus</i>
Perf. Ind.	Pluperf. Ind.	Fut. Perf. Ind.	Perf. Subj.
<i>dūc-s-issemus</i>			
( <i>dūxissemus</i> )			
<i>lēg-Ø-issemus</i>			
<i>crē-v-issemus</i>			
<i>momord-Ø-issemus</i>			
Pluperf. Subj.			

Meanwhile, irregular allomorphy due to root-Asp<sup>0</sup> interactions disappeared from the *infectum* system where only thematic structures were possible. So, even in the case of the III conjugation, Asp<sup>0</sup> allomorphy was no longer possible in this system; the forms below are perfectly regular from that point of view.

- (119) *dūc-i-mus dūc-ē-bāmus dūc-ē-mus dūc-ā-mus dūc-e-remus dūc-e-re*  
*leg-Ø-īmus etc.*  
 Pres. Ind. Imperf. Ind. Fut. Ind. Pres. Subj. Imperf. Subj. Infinitive

Aspect exponence does show irregularities in the *infectum* but they are conjugation-based, i.e., conditioned by the TV properties, and not by the root properties (as in the Imperfect and Future Indicative cases discussed in note 42 and note 62). It follows that Latin stand in contrast to Sanskrit and Greek, where root-conditioned irregular aspectual exponents can be found in all aspectual systems. In these languages, Asp<sup>0</sup> is always adjacent to the root, and therefore irregular exponence is present not only in the Aorist and the Perfect (equivalent to the Latin *perfectum*)

<sup>82</sup> Special instances of reanalysis are needed for the cases discussed in footnote 58.

but also in the Present (equivalent to the Latin *īfectum*). In Latin, however, irregular aspectual exponents became a characteristic feature of the *perfectum* system.<sup>83</sup>

### 3.3 Generalization of the OTV in the *īfectum* of primary verbs

It is now important to discuss a crucial difference between the distribution of the PIE FTV /\*-e-/ (/ -a-/, / -e-/) of Sanskrit and Greek, respectively) and that of the Latin short OTV /-I-/, which may be etymologically related with this /\*-e-/ (see below for an analysis of the development of /-I-/ from /\*-e-/). In fact, the Latin OTV /-I-/ can co-occur with the other pieces that represented [-perf] aspect in the other languages (cf. (93)).

Since the OTV insertion rule applied systematically across verbs, restricted only by the rules (115), (116), and (117) in the *perfectum*, the primary verbs display it regularly in the *īfectum*. Therefore, they display an OTV /-I-/ associated with  $v^0$ , together with a [-perf] Asp<sup>0</sup> with  $\emptyset$  exponence, as postulated in (113). It follows that original Asp<sup>0</sup> exponence, mostly *ne*-infixation, but also more sporadically /-nu-/ and /-sk-/ suffixation, had to be reanalyzed as being part of the root. This includes undergoing morpho-phonological readjustments in the *perfectum*, i.e., a rule deleting a nasal coda (cf. (64)c) in cases such *sper-n-ō/sprēvi*, *findō/fidī*, but not in *iungo*, /*iunxi*/ *iunctus*. A radical restructuring of the aspectual exponence was thus achieved.

(120)	<i>īfectum</i>	<i>Perfectum</i>	
Nasal suffix:	<i>cer-n-i-mus</i>	<i>crē-v-ī</i>	‘see’sight’
	<i>sper-n-i-mus</i>	<i>sprē-v-ī</i>	‘spurn’
	<i>ster-n-i-mus</i>	<i>strā-v-ī</i>	‘spread, strew’
Nasal infix <sup>84</sup>	<i>fi-n-d-i-mus</i>	<i>fid-ī</i>	‘split’
	<i>fu-n-d-i-mus</i>	<i>fūd-ī</i>	‘pour (metal)’
	<i>sci-n-d-i-mus</i>	<i>scid-ī</i>	‘tear, split’
Suffix /sk-/	<i>crē-sc-i-mus</i>	<i>crē-v-ī</i>	‘grow larger, increase’
	<i>nō-sc-i-mus</i>	<i>nō-v-ī</i>	‘examine’
	<i>adolē-sc-i-mus</i>	<i>adolē-v-ī</i>	‘grow up’

<sup>83</sup> It is to observe that a similar development, although under quite different morphosyntactic structural conditions occurred in Germanic: root conditioned irregular morphology became a feature of the Past/Perfect system and was lost in the Present system (as in the Latin *īfectum*). At this moment, I do not have an explanation for these parallel developments. A possibility that comes to mind is that some sort of Jakobsonian markedness principle is playing a role here: marked irregular exponence is associated with marked features, [+Perfect], for example; unmarked regular exponence appears otherwise. Further research is needed on this point.

<sup>84</sup> In the case of the following verbs the original aspectual element became fully part of the root and was no longer removed in *perfectum* forms:

Note at this point that the exponent of the III conjugation TV—what I assume is */-I-/* cannot be directly developed from the PIE FTV */\*-e-/*. It must really be a new morphological entity. One can indeed assume that in primary verbs that originally had an F-thematic */-e-/*, */-I-/* developed directly from this element by reanalysis as an OTV (cf. (113)). This, however, cannot be the case for the primary non-F-thematic verbs, in particular for those with suffixal or in infixal */-n-/* as in (120). In this case, the TV exponent cannot be the original */\*-e-/* and must be a new entity. We know that this vowel is normally [+high] [i] in surface representations unless it is before a rhotic, where it is [-high] [e] (or it is before other vowels where it is deleted). This distribution readily indicates that this vowel is underlying [+high]. It is, therefore, different from the vowel that is etymologically expected from PIE: the mid vowel [e]. A plausible account for what happened is to postulate that a short high vowel—indeed a short high back as argued by Halle 2018— was inserted as the OTV for the *inflectum* of III conjugation verbs (the primary verbs) in all cases where there was no OTV from PIE */\*-e-/*. We can assume that eventually this OTV was phonologically reanalyzed as being an underlyingly [+high] and [+back] vocalic segment.

### 3.4 Perfect exponence and locality from PIE to Latin

These innovations from PIE to Latin led to a situation in which there was irregularity in the athematic forms, therefore in the *perfectum*, and regularity in the thematic forms. The presence of TVs involved regular morphology. The thematic vowel appears in all cases where there is no root-conditioned contextual allomorphy. If there is root-conditioned contextual allomorphy, then there is no TV. Again, we can assume that this follows from the fact that this is the only case where the aspectual node can access the root diacritics needed for the application of the specific VIs.

As already mentioned, a major development in the history of the Latin Verbal System was the conflation of the PIE Aorist and Perfect.

The Perfect exponents of Latin are */-s-/* and */-v-/*, and */-Ø-/* as the default. Their VIs are given again in (121), together with that of */-b-/*.

(121) a. */-b-/* <—> [-Perfect, +F]/\_\_ [-Irrealis]<sub>Mood<sup>0</sup></sub>

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(i) <i>Inflectum</i>	<i>Perfectum</i>	
iung- <i>i-mus</i> ,	iung-s-ī [iunxi], iung-t-us [iunctus]	‘join’
sternu- <i>i-Ø-mus</i> (with /nu-/)	sternu-ī	‘sneeze’
po-sc- <i>i-mus</i>	poposc-ī	‘demand’

- b. N  
|  
 /-v-/ <—> [+Perfect] ] / X ] \_\_\_\_\_
- c. /-s/ <-> [+F]  
 Otherwise /-Ø-/

The exponent /-v-/ cannot be traced back to PIE and can be characterized as a development peculiar to Italic, or most properly to Latin (see Sihler (1995), Meiser (2003), Rix (1992), Weiss (2009), a.o., for discussion of its possible development). Whatever its origin, it is found in thematic structures. As mentioned by Sihler (1995: 585), this exponent may have become a hiatus breaker between the thematic vowel and a following suffixal vowel, which may have also been the TV /-i-/ in some verbs. One can assume that the hiatus breaking /-w-/ (i.e., the /-v-/ used in this text) was eventually reanalyzed as an exponent of Asp<sup>0</sup>.<sup>85,86</sup>

The exponent /-s-/ can meanwhile be traced back to PIE. It is, in fact, etymologically related to the PIE VIs in (122) (see (99a)).

- (122) /\*-s-/ <-> [+Perfect, -stative] / Root<sup>s</sup> \_\_\_\_\_

Also, Latin /-Ø-/ is inherited from both default Perfect and Aorist /-Ø-/. So, we have Perfect forms with reduplication that underwent changes such as the following *sēd-Ø-ī* < \**se-sd-Ø-* ‘sit’ (Sihler (1995: 582)). At the same time, we have Aorist forms that were preserved in Latin: *fid-Ø-ī* < \**bheid-Ø-*, Inflectum Present *findō* ‘split’ (cf. Skt. *bhinātti* 3sg pres. vs. *bhēt* /*bhāit-Ø-t* 3sg. aor.), *liqu-Ø-ī* < *leik<sup>w</sup>*, Inflectum Present *linquō* ‘leave’ (cf. Skt. *rinakti* 3sg pres. vs. *riktām* /*rik-Ø-tam*/ 2du Aor.) (see Sihler (1995: 581–2) for more examples and detailed discussion). Once /-v-/ was introduced in the Latin system, /-Ø-/, whose use was more general, became the option for Asp<sup>0</sup> in athematic roots not taking /-s-/ or /-v-/. The distribution of Ø thus became root-conditioned in Latin as expressed by the freezing rule in (68), which is locally governed by root-information.

This is not the case for /-s-/ which was originally conditioned by root diacritic as stated in (122). As argued in Section 2.6.2., its distribution in Latin is actually context-free, as in (121d). One can assume that what happened was a generalization of the originally Aorist exponent [s] to be the exponent of all marked inflectional nodes. This change is also hinted in historical grammars (cf. Sihler (1995: 590), Ernout (1953/1989: 212)).<sup>87</sup>

<sup>85</sup> See Sihler (1995: *ibid.*) for discussion of other accounts of the development of this exponent [develop].

<sup>86</sup> Note that if this reconstruction is correct, the exponent of Asp<sup>0</sup> must have been /-Ø-/.

<sup>87</sup> Both Sihler, Ernout, Meiser and Weiss (a.o.) assume a piece /\*-(i)s-/ in the formation of a wide variety of verbal forms. I analyze this piece as involving the exponent /-s-/ of marked functional nodes plus the vocalic element /i/ (actually /I/) as the TV of the preceding functional node, e.g. *laud-ā-v-i-s-s-ē-mus*, *laud-ā-v-i-s-ā-mus* [*laudāverāmus*].

Note that all generalizations require mention of the cyclic stage where  $\text{Asp}^0$  is reached and where access to root information is still possible (albeit only in athematic structures). Once this stage is reached, there are three possibilities depending on the absence versus presence of the TV, which results from the root-conditioned rule (79):

- (123) a. /-v-/ is inserted either when there is a TV, or, if there is no TV, when the root undergoes the locally triggered morpho-phonological adjustment in (64)d) that generates a root-final vowel (e.g. *cer-n-i-mus* vs perf. *crē-v-i-mus*).
- b. /-∅-/ is inserted if there is no TV but the root-conditioned freezing in (68) applies.
- c. Default /-s-/ is inserted if there is not a TV, and if neither a) or b) occur.

It follows that the appearance of both /-∅-/ and /-s-/ requires athematic structures as determined at the  $\text{Asp}^0$  cyclic stage.<sup>88</sup> It also follows that, although the exponent /-s-/ was no longer conditioned by root diacritics, its distribution still requires access to root information. It must be locally established at the  $\text{Asp}^0$  cyclic stage with no immediately preceding vowel present, so that the alternative /-v-/ cannot be inserted. Its distribution is therefore still determined locally once that cyclic stage is reached.<sup>89</sup>

Despite all the restructuring, irregular allomorphy still occurred under the required local configurations. So, reduplication, ablaut and vowel lengthening were

<sup>88</sup> The same obviously holds for the morpho-phonological rules in (64).

<sup>89</sup> Note that forms were not simply preserved in the passage from PIE to Latin. Insofar as the exponent /-s-/ was the default exponent in athematic forms, there was a major redistribution of exponents so that the use of /-s-/ was extended to new verbs. For example, this is what we find in the following cases where the ∅-allomorph of the Perfect aspect is replaced by the /-s-/, especially when there is a prefixal element. We can simply say that the freezing rule in (68) stopped applying in these contexts.

(i) Redistribution of the exponents in athematic contexts:

- a. *iungō* ‘join’ *iunxī* (<*iug-*, cf. *vincō/vicī*, *frango/frēgi*, *rumpo/rūpī*)  
*pingō* ‘paint’ *pinxī* (<*pig-*)  
*figō* ‘shape’ *finxī* (<*fig-*)  
*pangō* ‘fasten’ *panxī/pepigī*

If there was a prefixal element:

- b. *momordī* ‘die’ *praemorsī* (<*prae-mord-*) ‘bite feraciously’  
*pepercī* ‘spare’ *compersī* (<*con-perc-*) ‘save’  
*pupugī* ‘prick’ *compunxī* (<*con-pung-*) ‘puncture severely’  
*pepulī* ‘drive’ *expulsī* (<*ex-pulg-*) ‘drive out’
- c. *ēmī* ‘buy’ *dempsi* (<*de-em-*) ‘take away’  
*iēcī* ‘throw’ *amixī* (<*ami-ic-*) ‘throw around’  
*lēgī* ‘read’ *intellexī* (<*inter-leg-*) ‘see into, perceive’

never extended to thematic configurations. Thus, it also follows that allomorphic complexity—the possibility of multiple root conditioned exponents for  $\text{Asp}^0$ —is restricted to cases in which  $\text{Asp}^0$  is adjacent to the root node, i.e. in athematic contexts.

Note that in all these diachronic developments, the actual forms changed; they were not preserved. There was no preservation of actual forms. What was preserved, however, was a structural property: complex root-conditioned allomorphy was possible only under adjacency with the root.

## 4 Conclusions

As discussed by Kiparsky (1982: 16), historical changes in grammatical structures provide the best “window” to the actual composition of these structure insofar as we expect that the components of the structures play a role in the changes.

I looked at the development of the Latin verbal ornamental TVs. They developed from PIE  $v^0$ -derivatives such as causative and denominative morphemes. The crucial change occurred when these derivatives were re-analyzed as exponents of “ornamental” nodes added to  $v^0$  by a general rule. This change may have been motivated by an overarching generalization characterizing Latin verbal morphophonology: only consonants could be exponents of functional nodes and vocalic pieces could only be exponents of non-functional nodes, i.e., ornamental morphology. Verbal athematic constructions in the *perfectum* developed because derivatives like /-ē-/ and short /-i-/ and the vocalic piece /-I-/ did not spread to the *perfectum* system. This led to reanalyses where rules deleted the verbal TV under certain conditions in the *perfectum*. Otherwise, ornamental verbal TVs are inserted freely. This led to a situation where all verbal structures were systematically thematic in the *infectum*, even in the case of the primary verbs, i.e., in the case of the III conjugation, which lacked vocalic derivatives after the root. Insertion of irregular—root-conditioned—exponents is possible only in athematic structures which allow the local application of root-conditioned  $\text{Asp}^0$  VIs. Therefore, such exponents became characteristic of the *perfectum* system. Allomorphic complexity, the possibility of multiple root conditioned exponents for  $\text{Asp}^0$ , was restricted to cases in which  $\text{Asp}^0$  is adjacent to the root node, i.e. in athematic contexts.

The morphological developments in the verbal system of Latin are most adequately accounted for in an analysis where morphological components such as roots, thematic vowels, and Asp are hierarchically organized in morpho-syntactic structures. Specifically, morphological locality can govern their interactions, as expected in DM. These changes crucially show the effect of morpho-syntactic structure, a syntactic structure that is enriched by the application of morphological operations

like the addition of ornamental pieces. This structure appears to be constructed syntactically. This follows naturally in frameworks like DM where the input to morphology is syntax, but not in lexical models where words, or stems, are built prior and independently of the syntax.

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