

## THE QUANTITATIVE TROCHEE IN LATIN\*

As a paradigm case of syllable weight controlling the place of prosodic prominence within the phonological word, the (ante)penultimate stress pattern of Latin and other languages (e.g., English) has played an important role in the development of modern phonology (Chomsky and Halle 1968, Prince 1976, Halle and Vergnaud 1978, McCarthy 1979, Hayes 1980, etc.). Within Metrical Theory, it has provided one of the prime examples of a foot which is left-prominent (trochaic) and responsive to syllable-internal structure (quantity-sensitive). A number of basic questions regarding the structure of this type of foot are still under discussion (Hayes 1987, 1991, Kager 1989, 1992a, McCarthy and Prince 1986, Halle and Vergnaud 1987, Prince 1990, among others). This paper attempts to advance our understanding of trochaic quantity by focussing on the multiple roles of the foot within the phonological and morphological system of the Latin language. In addressing the central issues of foot minimality and maximality, the paper substantiates a distinction between primary and subsidiary foot formation, develops a notion of structure-changing footing, explores the preference order among quantitative repair strategies, and motivates the need for prosodically-driven lexical selection devices.

### 1. INTRODUCTION

#### 1.1. *Issues*

In the standard theory of metrical phonology (e.g., Hayes 1980), the quantity-sensitive trochaic foot (or “quantitative trochee”) is constrained by boundedness (no more than two syllables) and quantity-sensitivity (barring heavy syllables from metrically weak positions). The general form

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of this foot is thus  $_F[\sigma(\check{\sigma})]$ : a syllable of any weight followed by an optional light syllable. This admits all the structures in (1) as licit quantitative trochees. ( $\bar{\sigma} = [\mu\mu]_{\sigma}$  = heavy syllable,  $\check{\sigma} = [\mu]_{\sigma}$  = light syllable,  $\sigma$  = syllable of any weight).

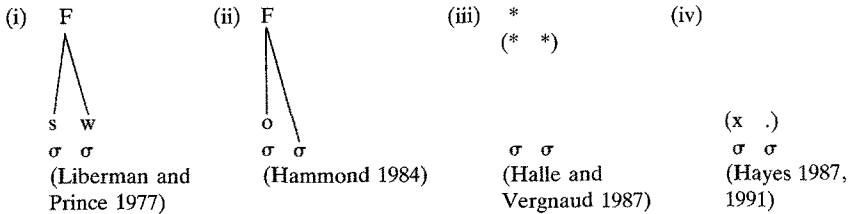
- (1) a.  $[\check{\sigma}\check{\sigma}]_F$     b.  $[\check{\sigma}\bar{\sigma}]_F$     c.  $[\bar{\sigma}]_F$     d.  $[\check{\sigma}]_F$

Since this paper is exclusively concerned with the nature of quantitative-trochaic footing, I will often make use of simplified bracketed representations without prominence marking (leftheadedness is assumed throughout):  $[\check{\sigma}\check{\sigma}]$  stands for  $[\check{\sigma}\check{\sigma}]_F$ ,  $[\bar{\sigma}]$  for  $[\bar{\sigma}]_F$ , etc.<sup>1</sup>

A different conception of the quantitative trochee has emerged in recent work (Hayes 1987, 1991, Kager 1991, McCarthy and Prince 1986, 1990; see also Allen 1973, McCarthy 1979). In these approaches, the foot is characterized by a constant moraic substance, invariably present in all of its manifestations: It is strictly bimoraic ( $[\mu\mu]$ ), instantiated either by a sequence of two light syllables (1b) or by a single heavy syllable (1c). Whereas the standard theory admits all four structures in (1), only the two bimoraic structures constitute licit feet in this ‘‘moraaic trochee theory’’ (Hayes 1987); trimoraic (1a) and monomoraic (1d) sequences are ruled out as feet.

The present investigation attempts to make a case for moraic trochee theory by a detailed case study of one well explored and unquestionably trochaic system, Latin (supplementing the typological arguments for proposed foot inventories from such works as McCarthy and Prince 1986, Hayes, 1985, 1987, Prince 1990, and Kager 1990). Even though no longer spoken and no longer accessible through the judgments and intuitions of native users, Latin is in fact eminently suitable for such an enterprise because many decades of close investigation have left us a rich legacy of linguistic observations and generalizations regarding the quantitative and

<sup>1</sup> By definition, a quantitative trochee is a left-headed (left-prominent) constituent, as expressed in different ways in (i) *sw*-notation, (ii) arboreal grid notation, and (iii and iv) bracketted grid notations.



rhythmic organization of the language. Besides “Classical” Latin (the canonized variety attested in the literary works of the late Roman Republic and early Empire), the present study will be concerned with the preclassical form of the language. Preclassical Latin (also called “Republican” or “Early Latin”) is known from the writings of the 2nd century BC (in particular, the comedies of Plautus (254–184 BC) – hence the term “Plautinian Latin”). It is widely agreed that the Latin encountered in these works was much closer to the spoken language than the later strictly regulated classical idiom.

The starting point of our investigation is one of the principal tenets of prosodic phonology: As a central component of phonological constituency, the foot is an abstract element of linguistic structure responsible for a wide variety of effects, “stress” being only one out of many (see Nespor and Vogel 1986, Selkirk 1986, Prince 1990, and references cited there); equally important manifestations range from the contextual conditions governing phonological processes to the typology of templates in shape-invariant morphology (McCarthy and Prince 1986, 1990, Archangeli 1991, etc.). Such non-stress evidence is of critical importance for the case of Latin because the accentual facts alone cannot decide between the two conceptions of the quantitative trochee outlined above: the standard trochee [ $\sigma(\check{\sigma})$ ] and the moraic trochee [ $\mu\mu$ ]. As is well known, stress in Classical Latin is computed from the right word edge and falls on heavy penults, otherwise on antepenultimate syllables, as illustrated by forms like *inimīcus* ‘enemy’ and *inimīcītia* ‘hostility’.<sup>2</sup> The final syllable is extrametrical and never carries the word accent.<sup>3</sup>

As shown below, standard-trochaic [ $\sigma(\check{\sigma})$ ]-parsing and moraic-trochaic [ $\mu\mu$ ]-parsing yield identical results when both penult and antepenult are light (2) or when the penult is heavy (3). (Here and throughout, “[ ]” encloses feet and “⟨ ⟩” extrametrical syllables.)

<sup>2</sup> Latin forms are cited in the standard orthography (note that  $c=[k]$ ), except for a few minor changes in the interest of clarity: Thus the glides [j] and [w] are transcribed as *j* and *v* (instead of *i* and *u*), and the symbol *x* is replaced by the sequence *kx*; long vowels are distinguished by a macron ( $\bar{a}=[a:]$ , etc.), short vowels are unmarked (*a*) or indicated by a breve ( $\breve{a}$ ).

<sup>3</sup> Except for monosyllabic words like *ars* ‘art’ and in a few special cases mentioned in section 4.1. Here and throughout, I am using the terms ‘stress’ and ‘accent’ interchangeably for Latin. There is little agreement concerning the actual phonetic nature of the Latin word accent (for the wide range of opinions, see, e.g., survey of the literature in Leumann (1977, pp. 248–254)). A number of researchers have defended the view (consistent with much of the Roman grammarians’ direct testimony) that the accent was mainly realized as high pitch.

- (2) *sá pi ēns* ‘wise’, nom.sg.  
 a. [σ(ǝ)]-parsing: [ǝ ǝ]⟨σ⟩  
 b. [μμ]-parsing: [ǝ ǝ]⟨σ⟩
- (3) *sapi én tēs* ‘wise’, nom.pl.  
 a. [σ(ǝ)]-parsing: [ǝ]⟨σ⟩  
 b. [μμ]-parsing: [ǝ]⟨σ⟩

A structural difference emerges in examples like (4), with a heavy antepenult and a light penult.

- (4) *sapi én ti or* ‘wiser’, nom.sg.  
 a. [σ(ǝ)]-parsing: [ǝ ǝ]⟨σ⟩  
 b. [μμ]-parsing: [ǝ] ǝ⟨σ⟩

In standard-trochaic parsing (4a), the medial syllable *ti* is the second member of a trimoraic trochee [ǝ ǝ], using the maximal expansion of the foot; in moraic-trochaic parsing (4b), it remains unfooted.<sup>4</sup> This is a clear structural distinction – but a distinction without a difference, as long as foot-building is used exclusively as a means to assign stresses: (4a) and (4b) single out exactly the same syllable as prominent, namely *en*; footed or unfooted, the penult *ti* is predicted to be stressless.

The two theories are not always stress-wise equivalent, however; different predictions arise in the case of Cairene Arabic (McCarthy 1979), which has played a crucial role in the argumentation for the moraic trochee (Hayes 1987, 1991; Prince 1990). The correct computation of word stress here depends on parsing the word into maximally bimoraic feet from left to right; the most prominent syllable of the last foot carries the word stress.<sup>5</sup> As the example in (5) illustrates, only bimoraic parsing (5a) assigns stress correctly.<sup>6</sup>

- (5) ?adwiyatúhumaa ‘their-two drug’  
 a. [μμ]-parsing: [ǝ] [ǝ ǝ] [ǝ ǝ] ǝ  
 ?ad wi ya tú hu ma⟨a⟩

<sup>4</sup> Hayes (1987) suggests instead that a stressless (or headless) foot is built over such monomoraic syllables.

<sup>5</sup> Secondary stresses are not consistently reported, see Blevins (to appear) for recent discussion of this issue.

<sup>6</sup> Slight complications, irrelevant in the present context, arise in the treatment of final syllables, see Hayes (1991, pp. 57–58) and Prince (1990) for recent discussion. (5) follows these authors in regarding the second mora of final long vowels as extrametrical.

- (5)b.  $[\sigma(\check{\sigma})]$ -parsing: \*  $[\bar{\sigma} \check{\sigma}][\check{\sigma} \check{\sigma}][\check{\sigma} \check{\sigma}]$   
 ?ad wi ya tu hú ma(a)

Compare the Latin case (4) (different structures, but identical stress predictions) with the Cairene Arabic case (5) (different structures and different stress predictions): As pointed out by Prince (1990), the crucial factor here is the direction of parsing. The two theories impose different foot structures in both directions, but only in left-to-right parsing ( $LR^{\rightarrow}$ ), as in Cairene Arabic, do they make divergent stress predictions.

The stress-wise equivalence in right-to-left footing ( $RL^{\leftarrow}$ ) is schematically illustrated for the syllable sequence  $|\bar{\sigma}\check{\sigma}\check{\sigma}\check{\sigma}|$  in (6). Both parsings pick out the first and third syllable as foot heads (potential locations of stress are indicated by the grid mark ‘\*’).

- (6)  $RL^{\leftarrow}$  footing of  $|\bar{\sigma}\check{\sigma}\check{\sigma}\check{\sigma}|$
- |   |                                 |                                   |
|---|---------------------------------|-----------------------------------|
|   | *                               | *                                 |
| a. $[\mu\mu]$ -parsing:                 | $[\bar{\sigma}]$                | $[\check{\sigma} \check{\sigma}]$ |
|   | *                               | *                                 |
| b. $[\sigma(\check{\sigma})]$ -parsing: | $[\bar{\sigma} \check{\sigma}]$ | $[\check{\sigma} \check{\sigma}]$ |

In  $LR^{\rightarrow}$  foot construction (7), the two parsings diverge in head assignment (to the first and second syllable in (7a), to the first and third syllable in (7b)).

- (7)  $LR^{\rightarrow}$  footing of  $|\bar{\sigma}\check{\sigma}\check{\sigma}\check{\sigma}|$
- |   |                                 |  |
|---|---------------------------------|--|
|   | *                               | *  |
| a. $[\mu\mu]$ -parsing:                 | $[\bar{\sigma}]$                | $[\check{\sigma} \check{\sigma}] \check{\sigma}$ |
|   | *                               | *  |
| b. $[\sigma(\check{\sigma})]$ -parsing: | $[\bar{\sigma} \check{\sigma}]$ | $[\check{\sigma} \check{\sigma}]$                |

The empirical upshot is that the moraic trochee is superior  $LR^{\rightarrow}$  since it alone can successfully account for the Cairene Arabic pattern (5); the  $LR^{\rightarrow}$  parsing pattern (7b) predicted by the standard-trochaic foot has so far remained uninstantiated (see Hayes 1991, pp. 63–66). This paper attempts to show that once we look beyond the facts of word stress, there is considerable evidence within at least one  $RL^{\leftarrow}$  system, namely Latin, which is compatible only with the moraic trochee.<sup>7</sup>

Broadening the area of investigation beyond stress is imperative in

<sup>7</sup> The argumentation becomes more intricate when harmony-theoretic refinements of the parsing algorithm are taken into account (Prince 1990); see section 4.2 for a discussion of the issues involved.

another respect. Given that there is no consistent report of phonetic secondary stresses in Latin,<sup>8</sup> an analysis based exclusively on stress facts will be led to posit sparsely footed representations, with only a single foot per word (see, e.g., Halle 1990, pp. 160–161, (11.b.vi.)). On the other hand, a more broadly conceived prosodic approach promises to reveal a richer and more pervasive prosodic organization. Given that the category “foot”, as an abstract element of linguistic organization, has been shown to play a crucial role even in languages where it manifestly does not serve as a stressing device (e.g., in Japanese, see in particular Poser 1984, 1990; cf. also Itô 1990, Mester 1990, Weeda 1992), foot structure should indeed be expected to play a comparable organizational role in stress languages, giving rise to various hitherto unnoticed or unexplained empirical effects, without always being flagged by audible secondary stresses.

### 1.2. *Minimality and Maximality*

The moraic trochee differs from the standard trochee in two respects: It does not allow monomoraic feet (bimoraic minimum), and it also does not allow trimoraic feet (bimoraic maximum). Bimoraic minimality and bimoraic maximality are clearly independent aspects; for example, there is the intermediate possibility of a trochee which lacks a monomoraic option but possesses a trimoraic expansion. Posing the question in this way invites a critical examination of the evidence available in the literature for strictly bimoraic trochees: Are both the minimality and the maximality aspect of the moraic trochee equally supported?

In order to distinguish the different conceptions of the quantitative trochee (QT), we will use the notation  $QT_{\langle \min:2 \rangle}$  to refer to the class of theories respecting bimoraic minimality, irrespective of the size of their maximal foot. Similarly,  $QT_{\langle \max:2 \rangle}$  refers to all theories respecting the bimoraic maximum, irrespective of their minimality requirements. These notations are instantiations of the general scheme  $QT_{\langle \min:i, \max:j \rangle}$  (abbreviated as  $QT_{\langle i,j \rangle}$ , where the first argument expresses minimal size, the se-

<sup>8</sup> A reviewer has drawn my attention to claims sometimes found in the literature to the effect that initial syllables carried secondary stress when not immediately pretonic (see, e.g., Allen 1973, pp. 190–191, Jacobs 1989, p. 7, and references cited there; we will return to certain aspects of this question in section 2.2). The assumption itself is quite plausible and certainly suggested by the fact that the evolution of vowels in initial syllables in the Romance languages was in many ways parallel to that of vowels under (Latin) main stress. On the other hand, there are also significant differences (see, e.g., Bourciez 1967, pp. 101–117 for French), and there is no universal agreement that stress was indeed the factor responsible for the special behavior of initial vowels (cf. again Bourciez 1967, pp. 42–43). The evidence must therefore be considered as ambiguous with regard to this question.

cond, maximal size). Moraic trochee theory is then  $QT_{(2,2)}$ , standard trochee theory is  $QT_{(1,3)}$ , and the alternative theory alluded to above (with trimoraic, but not monomoraic, feet) is  $QT_{(2,3)}$ , etc.<sup>9</sup>

### 1.3. *Strict Bimoraicity and Incomplete Footing*

There is a rough correlation between the range of foot expansions that a theory admits and its parsing results: the more flexible the foot, the more exhaustive and continuous the parse. For example, consider the context illustrated in (8), where an initial light syllable is followed by a heavy syllable. Letting the notation “ $QT_{(\alpha)}(s)$ ” denote the parsing imposed on a given string  $s$  by some version of quantitative trochee theory  $QT_{(\alpha)}$  the results are as follows (where  $\llbracket \ ]$  encloses prosodic words and  $[ \ ]$  indicates footing):

- (8)  $s = \llbracket \check{\sigma} \bar{\sigma} \dots \rrbracket$
- a.  $QT_{(1,3)}(s) = \llbracket \llbracket \check{\sigma} \rrbracket [ \bar{\sigma} ] \dots \rrbracket$
  - b.  $QT_{(1,2)}(s) = \llbracket \llbracket \check{\sigma} \rrbracket [ \bar{\sigma} ] \dots \rrbracket$
  - c.  $QT_{(2,3)}(s) = \llbracket \check{\sigma} [ \bar{\sigma} ] \dots \rrbracket$
  - d.  $QT_{(2,2)}(s) = \llbracket \check{\sigma} [ \bar{\sigma} ] \dots \rrbracket$
- } initial trapping

Since they allow monomoraic feet, both the standard  $QT_{(1,3)}$  and  $QT_{(1,2)}$  yield complete and exhaustive parses ((8a, b)). The  $QT_{(\min:2)}$  theories ((8c, d)), i.e., those that respect the bimoraic minimum, cannot incorporate light syllables into feet in this context and therefore must leave them unparsed (in either direction of parsing). I will refer to this phenomenon as “prosodic trapping”.

The parsings imposed by the two  $QT_{(\min:2)}$  theories are not always the same – they diverge in context (9), where a light syllable is flanked by

<sup>9</sup> Various analyses of Latin, to be taken up at appropriate points in the following sections, can be classified in these terms. Thus the treatment of Latin enclitic stress in Steriade (1988) and Halle and Kenstowicz (1991) presupposes  $QT_{(1,3)}$  (see section 4.1), and Jacobs (1990) argues for  $QT_{(2,3)}$  (see section 3.2). The proposal in Prince (1990) differs from the others in incorporating an explicit markedness theory. Since both trimoraic and monomoraic trochees are in principle allowed, it falls under  $QT_{(1,3)}$ . But at the same time it preserves the central insight of moraic trochee theory in ranking the bimoraic trochee above all other expansions ( $[\mu\mu] > [\mu\mu \mu] > [\mu]$ ). Most of the evidence to be presented below is also compatible with this approach; see section 4.2 for discussion.

heavy syllables on both sides. As shown in (9d), only  $QT_{(2,2)}$  exhibits medial trapping in this situation.<sup>10</sup>

- (9)  $s = [ \dots \bar{\sigma} \check{\sigma} \bar{\sigma} \dots ]$
- a.  $QT_{(1,3)}(s) = [ \dots [ \bar{\sigma} \check{\sigma} ] [ \bar{\sigma} ] \dots ]$
- b.  $QT_{(1,2)}(s) = [ \dots [ \bar{\sigma} ] [ \check{\sigma} ] [ \bar{\sigma} ] \dots ]$
- c.  $QT_{(2,3)}(s) = [ \dots [ \bar{\sigma} \check{\sigma} ] [ \bar{\sigma} ] \dots ]$
- d.  $QT_{(2,2)}(s) = [ \dots [ \bar{\sigma} ] \check{\sigma} [ \bar{\sigma} ] \dots ]$  medial trapping

In (9),  $QT_{(1,3)}$  and  $QT_{(2,3)}$  behave alike: The substring in (9a, c) is exhaustively parsed into two feet since the medial light syllable can join the preceding heavy syllable in a trimoraic foot.  $QT_{(1,2)}$  ((9b)) also produces an exhaustive parse – but consisting of three feet, the medial one monomoraic. The strictly bimoraic  $QT_{(2,2)}$  lacks both of these options; diverging from the other theories at this point, it results in a medially trapped syllable (9c) (in either direction of parsing).<sup>11</sup>

In the following sections, this notion of prosodic trapping will permit an empirical comparison of the different theories and their footing patterns. For Latin, there is considerable evidence that complete parsing makes the wrong predictions: Light syllables in word-initial and word-medial contexts show special behavior in many cases, ranging from prosodic quantity adjustments to segmental deletion effects, with far-reaching consequences for the Latin lexicon, from minimal word effects to allomorphy selection. What makes these divergent surface reflexes relevant is the one property they all share: They are cases where the strictly bimoraic  $QT_{(2,2)}$  predicts prosodic trapping. And what unifies them is the result that they all achieve: representations without prosodically trapped syllables.<sup>12</sup>

Previewing some of the results of this paper, we encounter the following typology of anti-trapping effects in the prosodic phonology and morphology of Latin. A prosodically trapped syllable (i) can be directly affected by lengthening, so that it can itself project a well-formed foot (section

<sup>10</sup> Strictly speaking, “non-initial trapping” would be more accurate here than “medial trapping”, since the same parsing contrast also arises for final light syllables after heavy syllables, i.e., in the context  $[ \dots \bar{\sigma} \check{\sigma} ]$ . I am here anticipating a situation with final syllable extrametricality, as in Latin. Word-final trapping in the relevant sense cannot arise in such a system (extrametricality in fact amounts to the requirement that final syllables remain unparsed, cf. section 2.1 and Prince and Smolensky 1992).

<sup>11</sup> As a reviewer points out, directionality effects arise in  $QT_{(2,2)}$  for odd-numbered sequences of light syllables flanked by heavies, e.g., in  $\bar{\sigma} \check{\sigma}_1 \check{\sigma}_2 \check{\sigma}_3 \bar{\sigma}$ :  $LR^{\rightarrow}$  footing traps  $\check{\sigma}_3$  (i),  $RL^{\leftarrow}$  footing traps  $\check{\sigma}_1$  (ii).

(i)  $[ \bar{\sigma} ] [ \check{\sigma}_1 \check{\sigma}_2 ] \check{\sigma}_3 [ \bar{\sigma} ]$   
 (ii)  $[ \bar{\sigma} ] \check{\sigma}_1 [ \check{\sigma}_2 \check{\sigma}_3 ] [ \bar{\sigma} ]$

<sup>12</sup> See Hayes (1991, pp. 128–132) and Prince (1990) for arguments along similar lines.



2.2); (ii) alternatively, it can undergo outright deletion (section 3.2); (iii) somewhat more indirectly, we find cases where trapping is resolved by shortening the following heavy syllable, so that the prosodically trapped syllable can form a foot together with it (sections 2.1, 3.1).

Besides such mechanisms repairing configurations with prosodic trapping after they have arisen, there are further devices at work in the grammar that prevent such configurations from arising in the first place: (iv) Prosodic trapping can guide lexical selection in the sense that allomorphs are chosen so as to avoid the dispreferred configuration (sections 2.3, 3.3); (v) similar to the antigemination effect of the OCP (McCarthy 1986), we find rule blocking effects where a rule R fails to apply if its application would result in prosodic trapping (section 2.1).

In this way, the various effects of prosodic trapping reveal the underlying metrical parse of the word, and when taken in their totality, they constitute a strong empirical argument in favor of the strictly bimoraic quantitative trochee  $QT_{(2,2)}$ .

Before turning to the details of the analyses, a few general remarks are in order regarding trapping configurations. The fact that they are disfavored, and in many cases repaired in various ways, does not entail that they are impossible. In fact, many cases of trapping in Latin words remain unresolved, and the trapped syllable is not part of any bimoraic foot on the surface. If the evidence was such that only a SINGLE mechanism were at work, eliminating ALL prosodic trapping configurations in Latin, our investigation would be a simple one. What we find instead is a more complex picture, with MULTIPLE mechanisms at work, and affecting only SOME of the disfavored configurations. Precisely this type of situation is the expected state of affairs in the recently emerging framework of Harmony-Theoretic Phonology, an approach to phonological theory that builds on insights in connectionist Harmony Theory (Smolensky 1986) and is developed in Prince and Smolensky (1991, 1992) and Smolensky et al. (1992), and somewhat differently in Goldsmith (1990, 1991, 1992).

Although harmony-theoretic approaches per se are not the focus of this paper, we will have several occasions to refer to some of their tenets in the ensuing discussion. One of the central concepts which will prove useful in a number of contexts is the notion of “preference”, which receives a precise formalization in Harmony-Theoretic Phonology as a ranked hierarchy of principles and mechanisms governing well-formedness, against which representations are optimized. Languages typically do not choose one mechanism (e.g., shortening) to the total exclusion of another (e.g., lengthening) – rather, both mechanisms form part of the grammar, but with a preference relation defined on them. For example, as we will see

in section 2.1, shortening is usually preferred in Latin over lengthening, the latter only applying when the former is inapplicable. Crucially, however, both must be available in the grammar. For phonological representations, it is also not the case that a certain configuration is categorically ill-formed or well-formed – we are instead dealing with degrees of well-formedness (or “better-formedness”): Optimization means that representations must attain the best state available, not that they must always reach absolute perfection.

Viewed from this perspective, it is not surprising that some prosodic trapping configurations remain on the surface: Even a less-than-perfect configuration will be tolerated if nothing better is accessible through the interplay of the principles and mechanisms that constitute the overall grammar. The ultimate fate of such surviving trapping configurations depends to a large extent on the details of the theory of Prosodic Licensing and on whether the prosodic hierarchy is strictly layered in the sense of Selkirk (1984, p. 26). If strict layering is inviolable, then a default mechanism of stray adjunction can be invoked to adjoin trapped syllables to adjacent feet, thereby creating constituents that are not part of the underlying foot inventory (see Hayes 1991 for discussion). But if, as seems likely, strict layering is an optimization target and not an absolute imperative (see Itô and Mester 1992 for discussion), the trapped syllable might in fact remain unfooted within the prosodic word. What is clear, and what the following sections will attempt to demonstrate, is that in many instances trapping configurations in fact get resolved by various mechanisms which all target bimoraic feet. This is the core of the argument to be developed below.

## 2. THE MINIMAL TROCHEE

In this section, we will present initial trapping phenomena in Latin (cf. (8) above) as characteristic effects of bimoraic minimality. We will see evidence that a monomoraic syllable in a trapping configuration is unable to constitute a foot on its own: When an initial light syllable remains unfooted, it triggers one of several quantitative adjustments. Such facts establish the minimality aspect of the trochee, supporting  $QT_{\langle \text{min}:2 \rangle}$ .<sup>13</sup>

<sup>13</sup> While at odds with the standard trochee  $QT_{\langle 1,3 \rangle}$ , and  $QT_{\langle 1,2 \rangle}$  the phenomena to be discussed are compatible both with the moraic trochee  $QT_{\langle 2,2 \rangle}$  and the trochee  $QT_{\langle 2,3 \rangle}$ . But when taken together with the evidence for bimoraic maximality ( $QT_{\langle \text{max}:2 \rangle}$ ) in section 3, the strictly bimoraic foot  $QT_{\langle 2,2 \rangle}$  emerges as the only trochee that is able to offer a coherent and unified account for a significant portion of Latin prosodic phonology and prosodically driven morphology.

2.1. *Brevis Brevians* (Iambic Shortening)

The strongest piece of evidence for bimoraic minimality is found in a pervasive process operating in Early Latin known as “Brevis Brevians” (*brevis syllaba brevians sequentem syllabam* ‘a short syllable shortening the following syllable’) or “Iambic Shortening”. A traditional topic in Latin metrics, it has received linguistic attention both in Allen (1973) and in more recent work (e.g., Hayes 1989, Prince 1990).

The typical effect of Iambic Shortening is indicated in (10): In disyllabic words of the form light syllable + heavy syllable (“iambic words”), the final heavy syllable is made light (“shortened”).

$$(10) \quad [[\acute{\sigma} \bar{\sigma}]]_{\text{wd}} \rightarrow [[\acute{\sigma} \acute{\sigma}]]_{\text{wd}}$$

“Shortening” here refers strictly to syllable weight and means monomoraic scansion of long vowels and nonmoraic scansion of coda consonants in closed syllables. The process, generally viewed as an optional but productive rule of the spoken language of the 2nd century BC, is accessible to us through the poetic texts of early Latin literature. We are dealing with quantitative verse which rigidly respects syllable quantity, with one major exception: Heavy syllables in iambic words are routinely encountered in positions where the metrical scansion requires a light syllable. Ever since the systematic character of these exceptions was recognized by 19th-century philologists, the pattern in (10) has been interpreted not as some arbitrary violation of quantity in verse, but rather as the result of a systematic shortening process operative in the common language. The comedies of the early dramatists Plautus and Terence show a widespread pattern of such shortenings. (11) gives some typical examples.

$$(11) \quad [[\acute{\sigma} \sigma]]_{\text{wd}} \rightarrow [[\acute{\sigma} \acute{\sigma}]]_{\text{wd}}$$

putā	→ pută	‘believe’, 2sg.imp.
voló	→ volǒ	‘want’, 1sg.
virī	→ virĭ	‘man’, gen.sg., nom.pl.
homō	→ homǒ	‘human being’, nom.sg.
amā	→ amă	‘love’, 2sg.imp.

Such shortenings are not motivated by the fact that words of the quantitative pattern  $[[\acute{\sigma} \bar{\sigma}]]$  would otherwise not fit into the metrical line: The iambic senarius, the main spoken dramatic meter, is in fact very flexible and can easily accommodate quantitatively perfect iambs like *putā* (see Halporn et al. 1980, pp. 72–79).

In the iambic environment, word-final syllables heavy by position (i.e., closed syllables) undergo Iambic Shortening parallel to syllables with long

vowels, but in this case no segmental effects are visible. The prosodic result is again that an iambic word can be scanned as a pyrrich, i.e., as two light syllables [ǒǒ] (see (12)).<sup>14</sup>

(12)	$[[\acute{\sigma} \bar{\sigma}]]_{\text{w}d} \rightarrow [[\acute{\sigma} \acute{\sigma}]]_{\text{w}d}$	
	putat → putăt	'believe', 3sg.pres.
	canis → canĭs	'dog'
	enim → enĭm	'for', conjunction
	simul → simŭl	'at the same time'
	tamen → tamĕn	'nevertheless'
	adest → adĕst	'be present', 3sg.pres.
	legunt → legŭnt	'read', 3pl.pres.
	velint → velĭnt	'want', 3pl.pres.subjunctive

A comparison of (11) and (12) with (13) shows that the iambic syllable sequence  $[[\acute{\sigma} \bar{\sigma}]]$  is indeed the determining factor for shortening. Spondaic words like *mandā* ( $[[\acute{\sigma} \bar{\sigma}]]_{\text{w}d}$ ) and anapestic trisyllables like *simulā* ( $[[\acute{\sigma} \acute{\sigma} \bar{\sigma}]]_{\text{w}d}$ ) are not encountered in verse positions where their final syllable would have to be measured light; in other words, their final syllables were immune to shortening.

(13)	$[[\acute{\sigma} \bar{\sigma}]]_{\text{w}d} \not\rightarrow [[\acute{\sigma} \acute{\sigma}]]_{\text{w}d}$	
	mandā → *mandă	'entrust', 2sg.imper.
	laudō → *laudŏ	'praise', 1sg.pres.
	laudant → *laudănt	'praise', 3pl.pres.
	$[[\acute{\sigma} \acute{\sigma} \bar{\sigma}]]_{\text{w}d} \not\rightarrow [[\acute{\sigma} \acute{\sigma} \acute{\sigma}]]_{\text{w}d}$	
	simulā → *simulă	'simulate', 2sg.imper.
	habitō → *habitŏ	'inhabit', 1sg.pres.
	habitant → *habitănt	'inhabit', 3pl.pres.

The metrical evidence indicates that Iambic Shortening was always an optional rule: There are many examples in Plautinian Latin of unshortened final syllables in iambic words.<sup>15</sup> While Iambic Shortening was lost as a

<sup>14</sup> Here and in other examples below, I am following Allen (1965, p. 86) and other authors in indicating the light quantity of the final closed syllable by a diacritic on the vowel symbol (*ă*, etc.).

<sup>15</sup> Besides text frequency (with frequent words being more prone to shortening), the main linguistic factors controlling the application and non-application of Iambic Shortening are (i) the segmental makeup of the final syllable and (ii) the overall position of the word within the sentence. Regarding the first point, it has been noted, for example, that superheavy finals with a long vowel plus a consonant cluster are rarely affected, like *amāns* 'loving', *egēns* 'lacking', or *ferōks* 'wild' (see Allen 1973, p. 183, who refers to Drexler and Soubiran for these findings). And regarding the second point, the primary targets of Iambic Shortening are words forming a close syntactic (and arguably also prosodic) unit with what follows, as

productive process in the later classical language (it is in any case not visible in the metrical texts of the late Republic and the following Empire),<sup>16</sup> its effects have become lexicalized in Classical Latin in a number of original  $[[\check{\sigma}\bar{\sigma}]]$  words (of high textual frequency), as exemplified by the forms in (14a).

(14)a.	lexicalized shortenings:	b.	cf. unshortened:
	citō      ‘fast’    (<cito)		sērō      ‘late’
	modō      ‘only’    (<modo)		modicē    ‘moderate’
	benē      ‘good’    (<bene)		longē      ‘long’
	malē      ‘bad’     (<male)		timidē    ‘timid’
	duō      ‘two’     (<duo)		ambō      ‘both’

The adverbial suffix  $-\bar{e}/-\bar{o}$  appears with a short vowel in (14a) after an initial light syllable; in other contexts (14b), there is no shortening. A similar contrast is exhibited by the dual ending, which is realized as short  $-ō$  in *duō* ‘two’ after a light syllable, but as long  $-ō$  in *ambō* ‘both’ after a heavy syllable. Other classical forms that have lexicalized the effects of Iambic Shortening include *egō* ‘I’, *mihī* ‘me, dat.’, *tibī* ‘you (2sg), dat.’, *sibī* ‘reflex. dat.’, *ibī* ‘there’, *ubī* ‘where’, *herī* ‘yesterday’, and *nisī* ‘unless’ (cf. *sī* ‘if’), but poets continue to make use of the older unshortened forms like *egō* when they are metrically convenient.

Concerning the linguistic analysis of Iambic Shortening, a number of authors (see in particular Hayes 1989 and Prince 1990) have recognized, following Allen (1973),<sup>17</sup> that this process provides crucial insight into the structure of the Latin foot and supports a minimally bimoraic trochee ( $QT_{(\min:2)}$ ). Given final syllable extrametricality (we will return to the proper understanding of this notion below and argue that the standard version is in need of emendation), iambic-shaped words provide initial trapping configurations par excellence, with a prosodically stranded light syllable ( $[[\check{\sigma}\bar{\sigma}]]_{wd}$ ). Even if the final syllable is included in the foot,

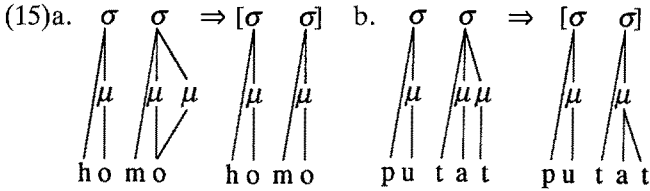
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has been documented in detail in a series of studies by Drexler (1967, 1969, and works cited there; see Soubiran 1971 for a critical summary).

<sup>16</sup> There are, however, strong indications that Iambic Shortening remained a characteristic feature of colloquial speech throughout the classical period. Thus Lindsay (1900, p. 31) points out that “[...] Cicero’s story (*Div.ii.40.84*) of Crassus mistaking the cry of a figseller *Cauneas! Cauneas!* (sc. *ficus vendo*) for the warning *cave ne eas*, shews that *cāvē* must have been pronounced *cāvē*, or rather *cau* (cf. *neu* and *neve*), and that the whole phrase must have been uttered in some such way as *cāu(ē)-n(e)-eas*”. And Devine and Stephens (1980, p. 145) draw attention to an inscription from Pompeii “[...] where the phrase *in manū* occurs in two consecutive lines both times with BB [Brevis Brevis, A.M.] in what are (both in language and in subject matter) vulgar septenarii”.

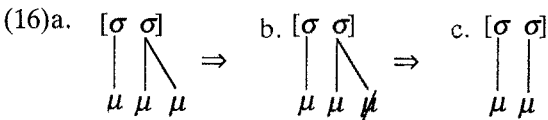
<sup>17</sup> See Devine and Stephens (1980, pp. 147–148) for references regarding earlier related proposals.

suspending extrametricality, no proper quantitative trochee emerges ( $*[[\acute{\sigma} \bar{\sigma}]]_{\text{wd}}$ ). Iambic Shortening resolves the problem by removing the (foot-wise) excessive second mora of the last syllable, allowing a proper bimoraic trochee to be established (15a).



The shortening of word-final closed syllables (cf. (12)) can be understood in an entirely parallel fashion, as in (15b), following Hayes (1989) and Kager (1989, p. 109). No changes at the segmental level are evident here – but in terms of prosodic form the same loss of a mora is at work. Just as the second mora of previously long vowels disappears in (15a), previously moraic coda consonants are deweighted in (15b) and reattach to the remaining vowel mora (or directly to the syllable node).

How exactly is the change in (15) to be understood? One way of looking at the chain of events is the one suggested in Hayes (1989, p. 3): As shown in (16), first a foot of the form  $[\acute{\sigma} \bar{\sigma}]$  is formed (16a), and subsequently a foot-domain rule (16b) having precisely this configuration as its environment fixes the ill-formed representation by removing a mora from the second syllable, resulting in a bimoraic foot (16c).



This way of proceeding has two drawbacks: It requires us, first, to build an ill-formed prosodic constituent which is subsequently repaired. Second, the statement of the rule (16) is redundant in that it repeats in its structural description the diagnosis of what is wrong with  $[\text{h} \acute{\sigma} \text{m} \bar{\sigma}]$  etc. as a quantitative trochee in the first place: namely, a gross violation of the quantity-prominence relations that are characterized in universal foot theory (see Prince 1990, Hayes 1991, and Kager 1992a for different proposals).

A better way of understanding the shortening in (15), I would like to propose, taking up a suggestion by A. Prince, is as a by-product of the imposition of the bimoraic foot itself. Let us assume that feet can be imposed in a structure-changing way, in case basic well-formedness prin-

ciples would otherwise be violated. Of course, not just any conceivable structural change will do – the change must be licensed by a valid repair strategy in the language in question (cf. recent proposals regarding the role of repair strategies in phonology in Calabrese 1988, Paradis 1988, Yip 1988, McCarthy 1991, Prince and Smolensky 1991, 1992, and others; see Myers 1991 for a different but related approach). For the case at hand, the most obvious candidates are (i) lengthening the first syllable and (ii) shortening the second syllable. These can be stated in a more general way, as in (17).

- (17) Prosodic Repair Strategies:  
 a. SHORTEN: REMOVE- $\mu$   
 b. LENGTHEN: ADD- $\mu$

These options might be conceived of as instantiations of more general schemata like “remove/add  $\alpha$ ”, where  $\alpha$  could also include nonprosodic units and other elements of phonological representation like association lines. But for present purposes, (17) is sufficient. As repair strategies, (17a, b) have no environment, or better, their environment is “violation of well-formedness”. This solves the redundancy problem noted above: Universal foot theory already localizes the points where well-formedness is violated. A second and related point is that as repair strategies (17a, b) do not operate to remove or add moras indiscriminately; they operate ONLY to increase well-formedness. In all other situations, the default is inertia: Moraic quantity remains unchanged (see in particular Prince and Smolensky 1992).

Of the two options in (17), Latin chooses REMOVE- $\mu$  (17a) as its designated repair strategy.<sup>18</sup> We are here dealing with a high-level choice made by an individual language. For the case of Latin, this has the significant advantage that other cases can be subsumed under the same generalization: We do not have to repeat in case after case that shortening is the method chosen to resolve quantity conflicts.

The proposal is, then, that Iambic Shortening as in (15a, b) is a structure-changing imposition of a foot ( $QT_{(\min:2)}$ ) on otherwise unfootable words. A structure-changing imposition of a foot is one which, simultaneous with constituent formation, invokes the designated repair strategy

<sup>18</sup> We will see in section 2.2. that it is not appropriate to view this as a parameter choice, with REMOVE- $\mu$  being admitted in Latin to the exclusion of ADD- $\mu$ . It is far more accurate to say that Latin prefers REMOVE- $\mu$  over ADD- $\mu$ , in the sense of Harmony-Theoretic Phonology (see section 1.3). We will encounter a situation where REMOVE- $\mu$  leads to no improvement, and ADD- $\mu$  is chosen instead.

of the language (for Latin, REMOVE- $\mu$  (17a)) to achieve a well-formed result.<sup>19</sup>

Our exposition has so far not addressed the important question of how Iambic Shortening interacts with the general requirement of final syllable extrametricality in Latin. Extrametricality must have somehow been suspended since the final syllable ends up being included in a foot (cf. (15)). But if so, it is unclear why the bimoraic foot is not erected on this final syllable in the first place. This would result in final stress, as in (18a), instead of the desired outcome (18b).<sup>20</sup>

(18)a. \*ho[mō]      b. [hómō]

The solution must lie in a more finely-grained analysis of the notion “extrametricality” along the lines proposed in Prince and Smolensky (1992) (for a number of cases, including Latin) in the context of Harmony-Theoretic Phonology. The standard conception of final syllable extrametricality is an all-or-nothing affair that keeps the last syllable outside of all feet; it comes with an exception clause for monosyllabic words which, as Prince (1983, p. 80) has pointed out, has the status of an empirical necessity not entailed by the theory itself. The harmony-theoretic alternative, elevating to the level of principle the implicit preference structure revealed by such ‘exception clauses’, conceives of extrametricality instead as an ordered set of preferences: Under extrametricality, it is best for a final syllable to remain completely unfooted; if footing cannot be avoided (due to a dominant constraint insisting on prosodic word status), the next best option is to be the non-head of a foot; the worst option is for such a final syllable to end up as a foot-head (which happens only when entirely unavoidable, namely in monosyllabic words). Final extrametricality, then, can be seen as an explication of the traditional idea that ends of words tend to constitute “prosodically weak” positions. Simplifying and restating Prince and Smolensky’s (1992) proposal for our purposes, we can formulate the two related constraints in (19), ranked as indicated.

<sup>19</sup> J. Itô (personal communication) observes that this kind of structure-changing imposition of a foot template might have an analogue in syllabification, namely in the common process of vowel shortening in closed syllables. Rather than first building an ill-formed superheavy syllable and subsequently shrinking it to the appropriate size, a parallel structure-changing syllabification should be able to immediately build well-formed syllables. See Broselow (1992) for a treatment along these lines of superheavy syllables in Arabic dialects.

<sup>20</sup> Note that the initially trapped first syllable in (18a) is not the source of ill-formedness, cf. the related adjective *hu[mā]⟨nus⟩*. Such trapping of an initial light syllable in words which already possess a well-formed foot has a different status from cases where the issue is rather whether any foot can be built at all (cf. below and section 3.1. for discussion).



- (19) Final syllable extrametricality:  $\langle \sigma \rangle_{\text{wd}}$   
 For  $\sigma_{\text{wd}}$ : (a) avoid foot-head,  
 (b) avoid footing.

In other words, the notation “. . .  $\langle \sigma \rangle_{\text{wd}}$ ” means “ $\sigma$  is prosodically weak word-finally”, explicated in terms of (19).<sup>21</sup> The most important aspect of (19) is the subdivision of extrametricality into two separate constraints, with the ban on foot-head status being superordinate to the ban on foot inclusion: A violation of (19a) is costlier than a violation of (19b). Returning to ((18a) vs. (18b)), we see that (19) resolves the issue. Bimoraic minimality ( $QT_{(\text{min}:2)}$ ) implies that the light penult alone, without the final syllable, cannot constitute a foot. This forces the inclusion of the final syllable in the foot, in violation of (19b); it is still preferable to obey (19a) and keep the foot-head off the final syllable, resulting in [hómo] (by the concomitant operation of REMOVE- $\mu$ ) instead of \*ho[mó].

A comprehensive treatment of Iambic Shortening in Early Latin would have to deal with a number of further issues that cannot be fully addressed in the present context. For example, Iambic Shortening is encountered not only word-finally in bisyllables but also in medial position preceding the accent in longer words. This results in Plautinian scansion like *gubĕr-nābunt* ‘they will reign’ as [ǒ ǒ ó̄]. More examples of this kind appear in (20).

- (20) scanned as:  
 [ǒ ǒ ó . . .
- |    |               |                         |  |
|----|---------------|-------------------------|--|
| a. | vo.lŭp.tātēs  | ‘desires’, nom.pl.      |  |
|    | ju.vĕn.tūte   | ‘youth’, abl.           |  |
|    | mi.nīs.tĕrium | ‘service’, nom./acc.sg. |  |
|    | a.dŏp.tātus   | ‘adopted’, nom.sg.      |  |
| b. | pu.dī.citiam  | ‘chastity’, acc.sg.     | (cf. <i>pudīcus</i><br>‘chaste’)       |
|    | a.mī.citiam   | ‘friendship’, acc.sg.   | (cf. <i>amīcus</i><br>‘friend’)        |
|    | ve.rĕ.bāminī  | ‘you (pl.) were afraid’ | (cf. <i>verĕbar</i><br>‘I was afraid’) |

There is no doubt that the iambic word-initial syllable sequence is a

<sup>21</sup> It remains to be seen how other kinds of extrametricality fit into this picture. Thus E. Broselow points out (personal communication) that it is not clear whether final consonant extrametricality is always amenable to a relative and not absolute interpretation. It is possible that such melody-sensitive extrametricality effects have a different status from melodically unrestricted extrametricality of prosodic constituents.

precondition for such shortenings: *mo.lēs.tōrum* ‘troublesome’ is admissible in Plautine verse with its second syllable measured short, but not \**fū.nēs.tōrum* ‘mournful’, etc. Allen (1973), followed by Hayes (1989) and Prince (1990), proposes to assimilate the word-internal shortenings in (20) to the standard case in (11) and (12) by assuming the presence of a secondary stress in initial position. Whether or not a phonetic secondary stress was actually present in initial position – if we hypothesize that Latin words are characterized by foot structure beyond the single foot necessary to establish the word accent (see sections 1.1 and 3.1 for further development and motivation), we can understand this phenomenon as initial trapping: The initial syllable cannot be part of a bimoraic trochee in a form like *gu.ber.nābunt*, scanned as [[ $\check{\sigma}$  . . .]]. If an additional foot is erected at the beginning of the word, the concomitant REMOVE- $\mu$  (17a) will lead to the observed shortening of the second syllable, by structure-changing footing. Such cases of Iambic Shortening thus have structural characteristics similar to the standard word-final cases, the difference being that they do not involve the main accentual foot of the word.<sup>22</sup>

Iambic Shortening resolves initial trapping situations by reducing the heavy syllable in second position (21). Footing is here accompanied by

<sup>22</sup> But various problems remain in this area (see Devine and Stephens 1980 for discussion). Displays like (20) are in one respect misleading. The overwhelming majority of word-medial instances of Iambic Shortening involve closed syllables (20a); it is very rare for long vowels (20b) to be shortened in this position, see Allen (1973, p. 182) and in particular Lindsay (1900, p. 34). Examples like *amicitiā* and *verēbāmini* thus constitute the exception and not the rule (common cases of shortening like *calē-facere* ‘warm, heat’ involve a compound word boundary and are irrelevant for the issue, see Lindsay (1900, p. 34)). This is quite different in word-final Iambic Shortening, where long vowels are affected just as often as closed syllables. It has been speculated (see in particular Burger 1928, p. 3) that this is so because in word-final position the shortening of long vowels is aided by a phonetic tendency to weaken final vowels. This tendency, visible in some diachronic developments, is usually counteracted by the necessity to preserve quantity contrasts, which often have morphological import (*mensa* vs. *mensā* ‘table’ (nom. vs. abl.), etc.). Faced with this clear difference between consonant deweighting and vowel shortening, our designated repair strategy REMOVE- $\mu$  (17a) stands in need of further differentiation. Some distinction must be made between the removal of consonantal moras (deweighting of coda consonants, always available) and removal of vocalic moras (highly marginal, freely available only word-finally, probably because final weakening enters here as an additional favorable factor and because of the primary status of the accentual foot). One attractive possibility would be to appeal to an overriding principle of distinctive quantity preservation, which would counteract any shortening of long vowels, but would leave the predictable positional weight of coda consonants unprotected. This in turn raises questions about cases of Iambic Shortening involving geminates like *supēllēctilis* ‘utensils’, which are not at all unusual and whose proper representation is an interesting issue in itself, requiring perhaps a formal distinction between gemination and ambisyllabicity. I will leave these issues unresolved in the present context, anticipating that some of the interactions between the various factors at work here can be illuminated in terms of Harmony-Theoretic Phonology.

the designated repair strategy REMOVE- $\mu$  (17a), which turns a bimoraic syllable into a monomoraic syllable.

$$(21) \quad \llbracket \check{\sigma} \bar{\sigma} \dots \rrbracket \\ \downarrow \\ \llbracket [\check{\sigma} \check{\sigma}] \dots \rrbracket$$

A conceivable alternative mode of resolution would be to focus on the trapped syllable itself: Instead of shortening the following heavy syllable so that it fits into the foot, the trapped light syllable could be lengthened, as in (22), and constitute a foot on its own.

$$(22) \quad \llbracket \check{\sigma} \bar{\sigma} \dots \rrbracket \\ \downarrow \\ \llbracket [\check{\sigma} \check{\sigma}] \dots \rrbracket$$

A possible case of this kind is indeed found in Latin polysyllabic words in one special instance, as a lexical idiosyncrasy in root vowel quantity (i.e., not as an instance of the alternative strategy ADD- $\mu$  (17b)). The paradigm of the verb *fieri* ‘become, happen’ shows quantity vacillation between short *ĭ* and long *ī*, as illustrated in (23).

(23)a.	short <i>ĭ</i> :		b.	long <i>ī</i> :	
	<i>fierī</i>	inf.		<i>fīō</i>	1sg.pres.
	<i>fierem</i>	1sg.past subjunctive		<i>fīunt</i>	3pl.pres.
	<i>fierent</i>	3pl.past subjunctive		<i>fīent</i>	3pl.fut.

The contrast in (23) is remarkable in view of the existence of a general rule of Latin phonology that shortens all long vowels in prevocalic position (24).

(24)	Prevocalic Shortening ( $\bar{v} \rightarrow \check{v} / \_ v$ )		
	<i>fidē-ī</i>	<i>fidē-s</i>	‘trust’, gen./nom.sg.
	<i>fīnī -ō</i>	<i>fīnī-re</i>	‘end’, 1sg./inf.

The prevocalic shortening rule predicts short *ĭ* in both (23a) and (23b). The preservation of long *ī* in the latter case is therefore unexpected. Noting that the root vowel is long preceding a heavy syllable (e.g., *fī.ō* in (23b)) and short preceding a light syllable (e.g., *fī.e.rī* in (23a)), Safarewicz (1974, pp. 232–233) draws attention to the rhythmic factor that is at work here. If the first syllable of *fī.ō* (23b) were to contain short *ĭ* instead of long *ī*, as prevocalic shortening (24) would lead us to expect, an initial trapping configuration would have arisen ( $\llbracket \check{\sigma} \bar{\sigma} \rrbracket$ ). Different from Iambic Shortening, the resolution in this special case consists in blocking the otherwise general rule of prevocalic vowel shortening, thus preserving the heaviness

of the first syllable, and allowing a proper initial foot to be erected. In *fī.e.rī* (23a), on the other hand, it is precisely the short quantity of the root vowel, in conformity with prevocalic shortening, that allows a bimoraic foot to be erected (and avoids medial trapping of *e*, in terms of section 3 below). The fact that in the classical language the (partially irregular) paradigm of this particular verb contains some forms that violate (23) is a lexical idiosyncrasy and of no particular interest, at least from a synchronic point of view.<sup>23</sup> What is significant is the resulting distribution of long and short variants, which is not synchronically arbitrary, but instead follows a clear rhythmic pattern striving towards optimal footing (Safarewicz 1974 made essentially this point).

## 2.2. *The Minimal Word and Foot Minimality*

Foot minimality is intimately connected with word minimality. The recent literature is rich in examples of minimal word requirements (McCarthy and Prince 1986) which impose a lower limit on the prosodic size of lexical words in a given language.<sup>24</sup> The crucial distributional finding in Latin (stated e.g., in Kurylowicz 1968 and Allen 1973, p. 51) is that monosyllabic words never consist of an open syllable with a short vowel, as illustrated by the representative forms in (25). Words like *\*re*, *\*spe* etc. are completely excluded.<sup>25</sup>

<sup>23</sup> A reviewer makes the interesting observation that at earlier stages of Latin the verb *fieri* showed prevocalic long *ī* in a still larger class of contexts (as evidenced by attested forms like *fīerī*, *fīerem*, *fīeres*, etc.), suggesting that the classical distribution was established at a late date, when the rule of prevocalic shortening had acquired prosodic restrictions. This is a very plausible scenario. However, even in Plautinian Latin, the earliest reasonably well attested stage of the language, the short-vowelled variant *fīerī* is already the norm. Thus the *Thesaurus Linguae Latinae* (vol.6.1, 1913, pp. 84–85) earmarks practically all occurrences of long-vowelled *fīerī* etc. as metrical licenses restricted to particular verse positions (mainly to the ends of iambic and trochaic lines: “productitur [. . .] in fine versuum iambicorum et trochaicorum catalectorum [. . .]”), whereas the short variants (*fīerī*, etc.) are found everywhere else (“corripitur ceteris locis omnibus”).

<sup>24</sup> See, e.g., McCarthy and Prince (1990) for a detailed demonstration that the minimal word in Classical Arabic is bimoraic. Similar minimal word requirements have turned up in numerous languages: Estonian (Prince 1980), Iraqi Arabic and Mohawk (Broselow 1982), Lardil (Wilkinson 1988), Diyari (Poser 1989, McCarthy and Prince 1986), Japanese (Poser 1990, Itō 1990), Kama and Bawana (Everett 1990), Sesotho (McNally 1990), Asheninca (Spring 1990, Black 1991), Cantonese (Yip 1991), and many others.

<sup>25</sup> There is no independent phonological rule of final vowel lengthening that could account for this distributional generalization: Final short vowels are stable in polysyllables (cf. *legĕ* ‘read’, imper., *pōnĕ* ‘put’, imper., *animă* ‘soul’, etc.), and vowel quantity contrasts in final syllables play a central part in the morphological system (cf. note 22).

- (25)a. nominal forms: *rē* 'thing', *spē* 'hope', *vī* 'force' (all abl.)  
 b. verbal forms: *dō* 'I give', *stā* 'stand!'  
 c. pronouns: *mē* 'me', *sē* refl., *tū* 'you' sg. *is* 'he', *id* 'it'  
 d. conjunctions: *nē* 'lest', *sī* 'if', *cum* 'when'  
 e. prepositions: *ā*, *ab* 'from', *ē* 'out of', *prō* 'in front of'

The observed ban against monomoraic words is formulated in (26) in a preliminary way.

- (26) \*[[σ]]<sub>wd</sub>

Latin adheres to this minimal word requirement with remarkable strictness: There are literally no exceptions.<sup>26</sup> We can view minimal word effects as limit cases of trapping: Different from the polysyllabic environments, where the initial light syllable is trapped by the following heavy syllable ((27a)), the minimal word environment shows trapping in isolation ((27b)).

- (27) Trapped σ:  
 ↓  
 a. [[σ̄ σ . . .]  
 b. [[σ̄]]

Word minimality effects like (26) are intrinsically connected to foot minimality in the standard conception of the prosodic hierarchy (see Selkirk 1980, Nespor and Vogel 1986, Zec 1988, Inkelas 1989, and others), whose organization is taken to entail that every phonological phrase must contain at least one prosodic word, every prosodic word at least one foot, every foot at least one syllable (a consequence of proper headedness and not of Strict Layering, in the conception of Itô and Mester 1992). If the foot is minimally bimoraic, prosodic hierarchy theory automatically projects this minimality requirement upwards, onto the prosodic word (and beyond), as was first recognized in Prince (1980, p. 535): If (i) prosodic words must contain at least one foot and (ii) feet are minimally bimoraic, then it follows that the language cannot have monomoraic prosodic words;

<sup>26</sup> As is apparent from their treatment in verse, even names of letters like *p t k* always show long vowels when used as independent words. Kurylowicz (1968, p. 191) cites the example in (i) (from the early satirist Lucilius (2nd century BC)), where the meter (which demands a heavy syllable at the beginning of the dactyl *p sequi*) indicates that the pronunciation must have been [pe:].

(i) scansion:     - | - ~ ~ | - ~ ~ | - - |  
                   nam *p*    sequitur    simul    et    *t*

that is, (26) above is a consequence of foot minimality and requires no separate statement.<sup>27</sup>

Beyond such static facts of lexical distribution, there is one morphological context which sheds further light on the minimal word requirement by exhibiting an overt alternation. The relevant category is the imperative singular. As shown in (28), this verbal category (unique in being formed without an overt ending) consists of the bare present stem.

(28)	Infinitive	Imperative	
	<i>flā-re</i>	<i>flā</i>	'blow'
	<i>laudā-re</i>	<i>laudā</i>	'praise'
	<i>flē-re</i>	<i>flē</i>	'weep'
	<i>monē-re</i>	<i>monē</i>	'warn'
	<i>lege-re</i>	<i>lege</i>	'read'
	<i>pōne-re</i>	<i>pōne</i>	'put'
	<i>scī-re</i>	<i>scī</i>	'know'
	<i>audī-re</i>	<i>audī</i>	'hear'

The crucial case is the verb *dā-re* 'give' (29), which has short *ā* as its stem vowel (in contrast to the long *ā* of all other first conjugation verbs).

(29)	<i>dā-te</i>	(imp.pl.)	<i>dā-bō</i>	(1sg.fut.)
	<i>dā-mus</i>	(1pl.pres.)	<i>dā-tur</i>	(3sg.pres.pass.)
	<i>dā-bam</i>	(1sg.past)	<i>dā-tus</i>	(perf.part.)

As the imperative singular form, the morphology predicts monomoraic *dā*. But instead an otherwise unexpected process of lengthening takes place, yielding *dā* (30), enforcing the bimoraic minimality requirement of Latin.

<sup>27</sup> A note of caution is in order here: Not all word size requirements are consequences of foot minimality, and foot minimality need not always automatically project into word minimality. First, nothing in the theory prevents the imposition of additional constraints on prosodic words, like word binarity (see Itô and Mester 1992 for Japanese), over and above foot-induced minimality. Second, the automatic upward projection of prosodic minimality is contingent on proper headedness (in the sense that every prosodic constituent must have a head of the next lower prosodic rank, see the above reference for details). The minimality-related work over the past years has clearly demonstrated that this is the unmarked case. If proper headedness could be violated in marked cases (with the category "prosodic word" anchoring directly in syllables, without an intervening foot node), sub-minimal words would receive a coherent prosodic structure (perhaps along lines suggested in Kager 1989). Another mechanism giving rise to apparent violations of foot-induced minimality is catalexis in the sense of Kiparsky (1992) (see also section 4.1). Finally, obligatory cliticization (adjunction to another prosodic word) might be another option for sub-minimal content words which requires further exploration.

(30) *dā* (\**dǎ*) (imper. sg.)

The contrasting plural imperative *dǎ-te* in (29), where the presence of the suffix is sufficient to insure bimoraicity, shows that the vowel length is not morphologically conditioned by the imperative.

In terms of the approach to such quantitative adjustments developed in the preceding section, we are here encountering a structure-changing imposition of a foot accompanied by the alternative repair strategy ADD- $\mu$  (see section 2.1, (17b)).<sup>28</sup> This is illustrated in (31a), in comparison with an Iambic Shortening example exhibiting the opposite quantitative effect (31b).

(31)	Foot assignment:	Quantitative adjustment:
a. / <i>dǎ</i> /	[ <i>dǎ</i> ]	ADD- $\mu$ (lengthening)
b. / <i>putā</i> /	[ <i>pútǎ</i> ]	REMOVE- $\mu$ (shortening)

In both cases, syllable quantity is adjusted so that the output is a well-formed bimoraic structure. Such ‘conspiracy’ effects naturally follow from a theory driven by well-formedness and a ranked series of available repair strategies.<sup>29</sup> Given that the designated repair strategy of Latin is REMOVE- $\mu$ , this usually results in bimoraic syllables becoming monomoraic (31b). But in cases where REMOVE- $\mu$  achieves no improvement, the secondary repair strategy ADD- $\mu$  comes into play, and a monomoraic syllable becomes bimoraic (31a).

### 2.3. *Quantity Selection in io-verbs*

The final piece of evidence for bimoraic minimality in Latin is a case where this prosodic factor plays a more indirect but nevertheless quite prominent role. It is found in the verbal morphology and concerns an

<sup>28</sup> Similar evidence is found in lengthened reflexes of inherited monomoraic forms. From a comparative perspective, light monosyllables would be expected in cases like *prō* ‘in front of’, where cognate forms in related languages are short-vowelled (cf. Skr. *prā*, Gr. *prō*, Goth. *frā*). In Latin, such cases show long vowels, providing evidence for a ‘compensatory’ lengthening process (see Kurylowicz 1949, who cites work by Havet).

<sup>29</sup> See Prince and Smolensky 1992 for a systematic development of this kind of approach and Itō (1986, 1989) for a similar well-formedness-driven approach to syllabification.

alternation governing the quantity of the theme vowel *-i-* in so-called *io*-verbs.<sup>30</sup>

In the standard system of Latin verb conjugations, the *io*-verbs are distributed over the third and fourth conjugations: The *ī*-verbs (e.g., *cap-ī-(mus)* ‘(we) take’) form a subgroup of the 3rd conjugation, whereas the *ī*-verbs (e.g., *aud-ī-(mus)* ‘(we) hear’) constitute the 4th conjugation. The underlying unity of the two groups emerges once we realize that for primary verbs the quantity of the theme vowel is to a large extent predictable from the prosodic pattern of the root. This is illustrated in (32) (after Leumann 1977, pp. 567–570): The theme vowel is short when preceded by a single light root syllable (*capīmus*, etc.);<sup>31</sup> it is long when preceded by a heavy root syllable ((32a) *audīmus*, etc.) or by two light root syllables ((32b) *aperīmus*, etc.).

(32)a.	[[ō ō . . .		b. [[ǒ ǒ ō . . .		c. [[ǒ ǒ . . .	
	-ī-		-ī-		-ī-	
<i>audīmus</i>	‘hear’		<i>aperīmus</i>	‘open’	<i>capīmus</i>	‘catch’
<i>prūrīmus</i>	‘itch’		<i>operīmus</i>	‘cover’	<i>sapīmus</i>	‘taste’
<i>saepīmus</i>	‘enclose’		<i>sepelīmus</i>	‘bury’	<i>jacīmus</i>	‘throw’
<i>sāgīmus</i>	‘scent’		<i>amicīmus</i>	‘cover’	<i>fugīmus</i>	‘flee’
<i>haurīmus</i>	‘draw’		<i>reperīmus</i>	‘find’	<i>cupīmus</i>	‘desire’
<i>farcīmus</i>	‘plug’		<i>resipīmus</i>	‘taste of’	<i>facīmus</i>	‘do’
<i>sentīmus</i>	‘feel’				<i>fodīmus</i>	‘dig’
<i>dormīmus</i>	‘sleep’				<i>rapīmus</i>	‘rob’
<i>sancīmus</i>	‘consecrate’				<i>parīmus</i>	‘bring forth’
<i>vincīmus</i>	‘fetter’					

The *ī* ~ *ī* alternation is a characteristic of primary verbs;<sup>32</sup> secondary (mostly denominal) verbs uniformly take *-ī-*, irrespective of all prosodic

<sup>30</sup> The name refers to their usual citation form, the first person singular (*cap-ī-ō* ‘I take’, *aud-ī-ō* ‘I hear’, etc.), where the length contrast is neutralized by a general rule of prevocalic vowel shortening (see (24) above). I am avoiding the ambiguous term “stem vowel” in favor of “theme vowel”, which is here meant in a strictly synchronic sense (see, e.g., Meillet (1912, pp. 163–164), and Leumann (1977, pp. 507, 519) for a diachronic perspective). While the main distributional facts presented below are listed in most standard handbooks (see, e.g., Buck 1933, pp. 272–273, or Meillet and Vendryès 1966, pp. 282–284), it was W. S. Allen (1973, pp. 164–165) who first articulated their relevance for a modern conception of the Latin stress foot as a prosodic constituent, drawing on important earlier work on ‘binary rhythm’ in Latin (Niedermann 1908, Burger 1928).

<sup>31</sup> The theme vowel is also short after a sequence consisting of a heavy syllable followed by a light syllable; see the discussion below. A general rule lowering *ī* to *ē* before *r* is responsible for the infinitive *capĕre* ‘catch’ (from *!capīrel*), etc. In order to abstract away from such additional changes, all examples below appear in their 1pl. form (with the ending *-mus*), which clearly shows both the quantity and the quality of the theme vowel.

<sup>32</sup> An exception to the generalization in (32) is found in resonant-final roots, which in general show *-ī-* even after a light syllable (e.g., *venīmus*, \**venīmus* ‘come’). But even within this class, *ī-* appears after *r*-final roots with a light root syllable (cf. *parīmus* in (32c)).



factors. Thus the secondary verb *sit-ī-mus* ‘be thirsty’ (from *sitis* ‘thirst’) has *-ī-* in spite of its light first syllable. Many polysyllables are denominal and take *-ī-* for this reason alone, like *custōdīmus* ‘guard’ (cf. *custōs* ‘guardian’) and a host of other examples listed in the standard handbooks. This includes secondary verbs like *fulgurīmus* ‘hit by lightning’ and *impedīmus* ‘hinder’ mentioned in Allen (1973, p. 164), whose theme vowel quantity is not prosodically determined (see Leumann 1977, p. 556), but rather the default *-ī-* assigned to all denominal verbs.<sup>33</sup> As a result, *ī-*verbs are much more frequent than *ī-*verbs, and length emerges as the default quantity of the theme vowel, paralleling long *-ā-* in the first conjugation (e.g., *laud-ā-mus* ‘praise’) and long *-ē-* in the second conjugation (e.g., *mon-ē-mus* ‘admonish’).

It has long been hypothesized (since Thurneysen’s 1879 work on the topic, see Niedermann 1908) that the ultimate historical source for the Latin *ī* ~ *ī* alternation is to be sought in Sievers’ Law, a process reconstructed for Proto-Indo-European (PIE) which is responsible for syllabicity alternations of semivowels (including /y/), depending on the weight of the preceding syllable (syllabic after a heavy syllable, nonsyllabic after a light syllable; see Seebold 1972 for a comprehensive treatment). Sievers’ Law has reflections in a number of distinct daughter languages (e.g., in Gothic; see Murray 1988 and Drescher and Lahiri 1991 for two recent approaches). As one reviewer has pointed out, the connection to Sievers’ Law makes sense of the fact that the Latin alternation under discussion is restricted to the theme vowel *-i-* (which goes back to a reconstructed suffix *\*-y<sup>h</sup>/o-* with an initial semivowel (see Meillet and Vendryès 1966, pp. 282–284)), and never affects the theme vowels *-ā-* and *-ē-*. Within Latin, we are thus dealing not with a general phonological rule, but with two variants of one particular theme vowel whose distribution is prosodically governed.

On the other hand, a careful consideration of the Latin facts immediately reveals that the details of the *ī* ~ *ī* alternation are quite specific to Latin and cannot be directly reduced to patterns inherited from PIE. Thus Lindsay (1894, p. 475), among others, notes that variants with *-ī-* instead of *-ī-* were quite frequent in Early Latin, citing Plautinian forms like *capīs* ‘desire, 2sg’ (instead of classical *capīs*), *facīs* ‘do, 2sg’ (instead of *facīs*), or

<sup>33</sup> Cf. *fulgur* ‘lightning’; for *impedīmus* (lit. ‘tie with foot shackles’), cf. *expedīmus* ‘make free, develop’ (lit. ‘untie’), *compedīmus* ‘shackle s.o.’s feet together’, *compēs* ‘foot shackle’, and *pēs*, *pēdis* ‘foot’. Such secondary verbs with the quantitative pattern [ōō...] do not bear on the prosodic factors governing the *ī* ~ *ī* alternation in primary verbs; in particular, they do not call for trimoraic feet [ōō] (*pace* Kenstowicz 1991). Primary verb forms with the quantitative pattern [ōō...] in fact show short *ī*, see (35c) *dēsīpīmus* and the subsequent discussion.

*facīt* ‘do, 3sg’ (instead of *facit*); and the archaizing Latin of Lucretius has *cupīrent* ‘desire’ (3pl. imperf. subj.) for classical *cuperent*, etc. Such forms are probably due to the default status of long  $\bar{i}$  (found, e.g., with all secondary verbs, see above) and the productivity of the 4th conjugation. Given this historical scenario, the full establishment (or reestablishment) of the short theme vowel in all of these cases by the time of the classical language is a fact about the internal history of Latin. As such, it cannot be directly subsumed under a sound law operating in PIE, but demands an account based on language-internal factors.<sup>34</sup>

With these preliminary considerations out of the way, we can turn to the synchronic analysis of the  $\bar{i} \sim \check{i}$  alternation. Given its lexically restricted nature, there is no motivation for positing a general phonological rule. The alternation is also not simply a case of Iambic Shortening (as assumed in Kenstowicz 1991): Besides chronological problems (Iambic Shortening was not operative in the classical language, see section 2.1), this is not compatible with the fact that the other theme vowels never alternate (see above).

Our analysis thus has to come to terms with the lexical, morphologized character of the  $\bar{i} \sim \check{i}$  alternation; at the same time, it should recognize that the same prosodic factor is at work here that was involved in Iambic Shortening (section 2.1) and Word Minimality (section 2.2), namely, the minimally bimoraic foot (QT<sub>(min:2)</sub>). This was essentially Allen’s (1973, pp. 164–165) suggestion, stated in terms of his notion ‘accentual matrix’: The basic idea is that \**capīmus*, for example, is avoided in favor of *cápīmus* because the first leads to initial trapping of a light syllable.

In order to make this idea more precise, we hypothesize that the theme vowel /i/ constitutes a separate morpheme, with the two allomorphs in (33).

- (33) Theme vowel /i/:
- a. primary allomorph:  $-\bar{i}-$
  - b. secondary allomorph:  $-\check{i}-$

The primary allomorph  $-\bar{i}-$  is the default realization of the morpheme; for example, it is the only one available for secondary (e.g., denominal) verbs (see the earlier discussion). But for primary verbs, the secondary allomorph  $-\check{i}-$  is accessible and is chosen under a prosodic selection criterion

<sup>34</sup> Cf. Buck (1933, p. 273), Seebold (1972, p. 118), and Allen (1973, pp. 164–165, note 4); see in particular Collinge (1985, pp. 283–286) for a summary of the arguments in favor of a Latin-internal rhythmic account of the  $\bar{i} \sim \check{i}$  alternation.

in situations where short quantity results in a more optimal prosodic organization (informally, the directive is “pick the best collocation”).

The operation of prosodic selection is illustrated in (34) by comparing the possibilities that arise when *-ĭ-* and *-ī-* are freely combined with representative roots from (32) above. The correct forms are enclosed in boxes.

- |        |   |     |  |     |   |
|--------|---|-----|--|-----|---|
| (34)a. | $[\bar{\sigma}][\acute{\sigma}]$<br>a u d ī ⟨mus⟩<br>audīmus  | b.  | $[\acute{\sigma}\acute{\sigma}][\acute{\sigma}]$<br>a p e r ī ⟨mus⟩<br>aperīmus  | c.  | $\acute{\sigma}[\bar{\sigma}]$<br>c a p ī ⟨mus⟩<br>(*capīmus) |
| a'.    | $[\bar{\sigma}]\acute{\sigma}$<br>a u d ī ⟨mus⟩<br>(*audīmus) | b'. | $\acute{\sigma}[\acute{\sigma}\acute{\sigma}]$<br>a p e r ī ⟨mus⟩<br>(*aperīmus) | c'. | $[\acute{\sigma}\acute{\sigma}]$<br>c a p ī ⟨mus⟩<br>capīmus  |

In the case of the light root *cap-*, the primary allomorph *-ī-* leads to initial trapping of the root syllable (34c); the secondary allomorph *-ĭ-* avoids initial trapping by allowing the root syllable to be footed together with the theme vowel into a bimoraic trochee. For this reason, prosodic selection picks *-ĭ-*. In (34a, b), on the other hand, choosing the primary allomorph *-ī-* results in the optimal prosodic structure, whereas the secondary allomorph *-ĭ-* would result in trapping.

The proposed analysis receives additional support from overt alternations between unprefixated light verb roots taking the theme vowel *-ĭ-* (35a) and their prefixed counterparts taking *-ī-* (35b). In this case, the addition of the light-syllable prefix *re-* changes the prosodic environment: Prosodic selection chooses the long theme vowel in (35b), contrasting with the short theme vowel in (35a). But when the prefix consists of a heavy syllable (35c), the short theme vowel emerges again.<sup>35</sup>

- |        |   |    |   |
|--------|---|----|---|
| (35)a. | $[\acute{\sigma}\acute{\sigma}]$<br>-ĭ-<br>parīmus ‘bring forth’<br>sapīmus ‘taste’ | b. | $[\bar{\sigma}\acute{\sigma}][\acute{\sigma}]$<br>-ī-<br>re-perīmus ‘find’<br>re-sipīmus ‘taste of’ |
|--------|---|----|---|

<sup>35</sup> A less transparent case of a similar kind is *amicī(-mus)* ‘cover’ with *-ī-* (literally ‘throw around’), which is based on the preverb *am(b)-* ‘around’ and *jaci(-mus)* ‘throw’ with *-ĭ-*. There are good reasons to doubt the existence of a synchronic relation in this case, but the example is still telling as a minimal contrast illustrating the prosodic generalization. In general, compound verbs follow the base verb in theme vowel quantity. This follows if theme vowel selection is a property of verbal roots, which will also correctly make it unavailable for denominal verbs (see McCarthy and Prince 1990 for similar observations in Arabic and English).

- (35)c.  $[\bar{\sigma}][\check{\sigma}\check{\sigma}]$   
 -ĭ-  
 dē-sipĭmus ‘be out of one’s mind’

The contrast between *resipī-mus* (35b) and *dēsipĭ-mus* (35c) emphasized by Niedermann (1908, p. 51) is particularly telling since both are derived from the same root, the only difference lying in the quantity of the prefix. Anticipating the discussion of foot maximality in section 3 below, note that this contrast would remain unexplained if trimoraic sequences  $[\bar{\sigma}\check{\sigma}]$  constituted licit trochees:  $*[d\bar{e}si][p\bar{i}]$ - shows no trapping but is footwise isomorphic to  $[resi][p\bar{i}]$ -, and we would expect long  $-i-$  in both forms (rather than the actually observed short  $-ĭ-$  in the first case).<sup>36</sup>

The analysis presented in this section is tentative to the extent that the status of prosodic selection criteria governing allomorphy remains to be further explored (other cases of a similar nature will be presented and analyzed in section 3.3). Since they are crucially output-oriented and involve a comparison of the relative prosodic well-formedness of several candidate collocations, such selection and optimization mechanisms find a natural place in Harmony-Theoretic Phonology; in the standard strictly derivational model, they remain at a purely observational level. If the analysis outlined above is on the right track, we have interesting independent evidence for bimoraic minimality from inside the morphological system.

In conclusion, let us assess what the evidence presented so far has revealed about the structure of the quantitative trochee. Various arguments, based on different types of empirical phenomena (Iambic Shortening, minimal word requirement, theme vowel selection), converge on bimoraic minimality as a property of the Latin trochee; only  $QT_{(\min:2)}$  is compatible with the data. The evidence presented in this section speaks directly only to the minimality aspect; bimoraic maximality constitutes the topic of the following section.

<sup>36</sup> Alongside *dēsipĭmus*, Niedermann lists, as further examples with the rhythmic pattern  $[\bar{\sigma}\check{\sigma}\dots]$ , *conspicĭmus* ‘sight’, *illicĭmus* ‘attract’, and *porricĭmus* ‘sacrifice’, arguing that the short theme vowel here cannot plausibly be regarded as simply inherited from the root – either because the relationship is entirely obscure and perhaps even etymologically dubious, as in the last case (*jacĭmus?*), or because the roots themselves had almost completely fallen out of use (*specĭmus*, *lacĭmus*). Similar observations hold for *dēsipĭmus* (cf. Niedermann 1908, p. 51: “*dēsĭpis* could in principle have been remade on the basis of *sapĭs*, but this hypothesis must be discarded because of the existence of *resipĭs* [. . .] [trans. A.M.]”)

## 3. THE MAXIMAL TROCHEE

In word-internal position, a light syllable is prosodically trapped when it cannot form a foot with either of the adjacent syllables. Medial trapping arises under right-to-left moraic-trochaic parsing in the context (36): after a heavy syllable, if simultaneously followed by another heavy syllable or by a sequence of two light syllables which are already grouped into a foot.

$$(36) \quad \text{unfooted}$$

$$\downarrow$$

$$\dots [\bar{\sigma}]_F \check{\sigma} \left\{ \begin{array}{l} [ [\bar{\sigma}]_F ] \dots \\ [ [\check{\sigma} \check{\sigma}]_F ] \end{array} \right.$$

Strict bimoraic parsing ( $QT_{\langle \min:2, \max:2 \rangle}$ ) is the crucial factor that leads to medial trapping. Bimoraic minimality makes it impossible to build a separate monomoraic foot on the unparsed syllable. Bimoraic maximality (which could not play a role in the initial trapping environments discussed in section 2) prevents it from joining the first foot.

If bimoraic maximality does not hold (i.e., if trimoraic trochees  $[\bar{\sigma}\check{\sigma}]$  are fully admitted), medial trapping cannot arise under right-to-left parsing since light syllables can always form a well-formed foot with their lefthand neighbors, as illustrated in (37).<sup>37</sup>

$$(37) \quad \text{footed}$$

$$\downarrow$$

$$\dots [\bar{\sigma} \check{\sigma}]_F \left[ \begin{array}{l} \bar{\sigma} \\ \check{\sigma} \check{\sigma} \end{array} \right]_F \dots$$

The structural contrast between the non-contiguous footing in (36) and the contiguous footing in (37) makes it possible for us to bring empirical evidence to bear on the question of the maximal trochee.<sup>38</sup> The argumen-

<sup>37</sup> Note that there is one situation in which not only  $QT_{(2,2)}$ , but also  $QT_{(2,3)}$  gives rise to medial trapping. It occurs under left-to-right footing in the partial mirror-image context of (36) in (i):

$$(i) \quad \text{unfooted}$$

$$\downarrow$$

$$\dots [\check{\sigma} \check{\sigma}]_F \check{\sigma} [\bar{\sigma}]_F \dots$$

When two light syllables are already grouped into a foot on the left, the medial syllable will be unparsable by both  $QT_{(2,2)}$  and  $QT_{(2,3)}$ . All the cases analyzed in this section have the structure  $[\bar{\sigma}]\check{\sigma}[\bar{\sigma}]$ , where medial trapping arises only in  $QT_{(2,2)}$  and is independent of directionality.

<sup>38</sup> Building on the results of the preceding section, the ensuing discussion presupposes bimoraic minimality and abstracts away from the initial trapping cases of section 2.

tation will involve the assumption that non-contiguous footing of a string is prosodically non-optimal and can trigger processes that resolve trapping situations.

The overall predictions are clear: The standard theory  $QT_{(1,3)}$  has the power to fully parse any sequence of heavy and light syllables into feet. All sequences of syllable quantities are prosodically equally well-formed, as far as contiguous footing is concerned. In particular, since the configuration (37) is just as good as any other, there is no reason to expect the existence of specific processes transforming it into something else.<sup>39</sup>

A theory with bimoraic maximality, on the other hand, which does not yield a continuous parse for all sequences of syllables, predicts a sharp distinction between different quantitative configurations: Those that give rise to medial trapping (36) are disfavored, and processes establishing contiguous footing have a prosodic rationale. In this section, I will present analyses of three different cases from the prosodic phonology and morphology of Latin where the predictions of bimoraic maximality are borne out.

### 3.1. Resolution by Quantity Adjustment: Cretic Shortening

The first case to be discussed is known as “Cretic Shortening”, a name derived from a metron that occurs as a rhythmic element (a long-short-long sequence) in classical meters. Similar to Iambic Shortening, but hardly discussed in the recent linguistic literature, this process concerns the (optional) weight reduction of heavy finals following light (trapped) penults. While the quantitative effects observed in the two cases are identical, the overall prosodic context is different: Cretic Shortening is the monomoraic scansion of heavy syllables at the end of words of the form [ $\dots \bar{\sigma}\check{\sigma}\bar{\sigma}$ ]<sub>wd</sub>, as illustrated in (38a).

- |  |  |
|--|--|
| (38)a. Cretic Shortening:  | b. cf. Iambic Shortening:  |
| $[[\check{\sigma} \check{\sigma} \bar{\sigma}] \rightarrow [[\check{\sigma} \check{\sigma} \check{\sigma}]]$ | $[[\check{\sigma} \bar{\sigma}] \rightarrow [[\check{\sigma} \check{\sigma}]]$ |
| dīcitō      dīcitō   | putō      putō   |
| ‘say’, imp.fut.  | ‘believe’, 1sg.  |

Like its iambic counterpart, Cretic Shortening is an optional process well attested in the texts of the early Roman dramatists (see, e.g., Lindsay (1900, p. 37) for Plautinian Latin). Both types of shortening are accessible to us only in the form of metrical options observed in regulated verse, but it is widely agreed that the metrical facts are firmly grounded in

<sup>39</sup> The situation is different once markedness considerations are brought into play, as in Harmonic Parsing (Prince 1990); see section 4.2 for discussion.

general linguistic rules governing the spoken language of the time (see Devine and Stephens 1980, who emphasize the unity of the two shortening processes). In other words, 2nd century BC Latin regularly showed cretically shortened forms as in (39).

(39)	[[ $\acute{\sigma}$ $\check{\sigma}$ $\bar{\sigma}$ ]]	→	[[ $\acute{\sigma}$ $\check{\sigma}$ $\check{\sigma}$ ]]	
	dīcitō		dīcitō	‘say’, imp.fut.
	dīk.serō		dīkserō	‘say’, 1sg.fut.perf.
	im.perā		imperā	‘rule’, imp.
	mak.sumē		mak.sumē	‘most’, adv.
	Hēgiō		Hēgiō	(name)
	men.tiō		mentiō	‘mention’
	Pol.liō		Polliō	(name)
	har.pagō		harpagō	‘grappling-iron’
	nes.ciō		nes.ciō	‘not know’, 1sg.
	dēs.inō		dēs.inō	‘cease’, 1sg.
	comm.modā		commodā	‘adjust’, imp.
	quōmodō		quōmodō	‘in what way?’

In an analogous way, final closed syllables, whether with long vowels (40a) or simply heavy by position (by the presence of one or more coda consonants) (40b), can be measured short in cretic contexts.

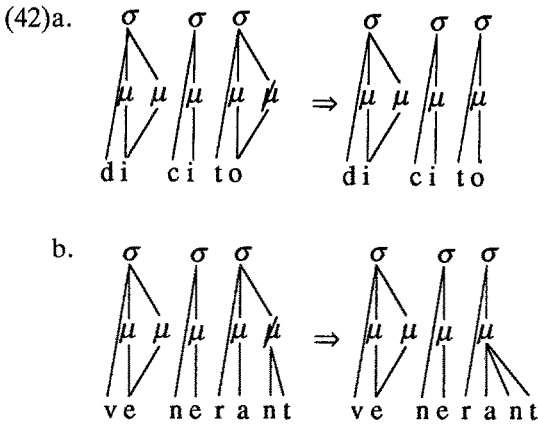
(40)	[[ $\acute{\sigma}$ $\check{\sigma}$ $\bar{\sigma}$ ]]	→	[[ $\acute{\sigma}$ $\check{\sigma}$ $\check{\sigma}$ ]]	
a.	ēnicās		ēnicās	‘murder’, 2sg.
	līberās		līberās	‘free’, acc.pl.fem.
	virginēs		virginēs	‘virgins’, nom/ac.pl.
	grātiās		grātiās	‘thanks’, acc.pl.
	turbinēs		turbinēs	‘whirl’, nom/acc.pl.
b.	dīkserint		dīkserīnt	‘say’, 3pl.perf.subjunct.
	vēnerant		vēnerānt	‘come’, 3pl.fut.perf.

Final syllables shorten only after light syllables (i.e., there is no final vowel shortening in words with heavy penults like *compellō* ‘compel, 1sg.’ or *repellō* ‘repel, 1sg.’). And the crucial control cases in (41) demonstrate

that the heaviness of the antepenultimate syllable is indeed a necessary condition.<sup>40</sup>

(41)	[[ $\acute{\sigma}$ $\check{\sigma}$ $\bar{\sigma}$ ]]		
	facitō	*facitō	'do', imp.fut.
	studeō	*studeō	'strive', 1sg.
	simulā	*simulā	'simulate', imp.

The phonological effects of Cretic Shortening can be formally understood in a similar way as in the iambic case: The final syllable loses one mora, resulting in short vowel quantity in *dīcitō* (42a) and in deweighting of coda consonants in *vēnerānt* (42b).



The crucial difference between Iambic Shortening and Cretic Shortening lies in the relation of the shortened syllable to the word accent. In iambically shortened disyllables, the accent falls on the syllable that immediately precedes the final. But in cretically shortened trisyllables (or longer words with a cretic ending), the accent falls on the antepenult and is therefore not adjacent to the final (shortened) syllable. As a quasi-minimal contrast, consider the shortening form *dīcītō* ( $\rightarrow$  *dīcītō*) and the non-shortening form *fācītō* (\**fācītō*) (cf. (39) and (41)). In both cases the penult is light; as (43) illustrates, whether or not the final syllable undergoes shor-

<sup>40</sup> This holds for Preclassical Latin. The language of the later classical texts, in which both Iambic and Cretic Shortening are suppressed, shows a very restricted reflex of the process limited to the single vowel  $\bar{o}$  in final position, which is often measured short in the later Republican and Augustan poets (see e.g., Lindsay 1896, pp. 212–213). This special shortening of final  $\bar{o}$  in Classical Latin (by the 4th century AD virtually exceptionless in many morphological contexts) does not share the crucial prosodic context of Iambic and Cretic Shortening and is in fact largely independent of the internal foot structure of the word (cf. Ovidian scansions like *ergō* for *ergō* 'therefore' and *Sulmō* for *Sulmō*).



tening is determined by the quantity of the non-adjacent accented antepenult.

$$(43) \quad \dots \sigma \quad \check{\sigma} \quad \bar{\sigma} \parallel$$

It is hard to see how a heavy antepenultimate syllable could directly trigger a shortening of the final syllable. This non-local relation to the accented syllable makes Cretic Shortening a major embarrassment for traditional accounts which lack a conception of the foot as a prosodic constituent and interpret all shortening as a direct effect of the word accent (e.g., Sommer 1914, Sommer and Pfister 1914/1977). Interestingly, the problem does not immediately disappear in a metrical approach, but persists as long as only the single trochaic foot is taken into account that is necessary to establish the word accent. This is sufficient for Iambic Shortening (*pu<itō>* → [*pūtō*]), properly understood as a structure-changing imposition of a bimoraic trochee (i.e., accompanied by the designated repair strategy REMOVE-μ (17a)).

But this mode of explanation does not carry over to the cretic case. In words of the form  $[[\bar{\sigma} \check{\sigma} \bar{\sigma}]]$ , a well-formed foot has already been successfully established (*[ím]pe<rā>* by QT<sub>(2,2)</sub>, *[ímpe]<rā>* by QT<sub>(max:3)</sub>); and it is not obvious how this accentual foot could be held responsible for the observed shortening of the (extrametrical) final syllable (except by direct stipulation).

Cretic Shortening, then, appears as an unconnected prosodic idiosyncrasy. But Iambic and Cretic Shortening are historically entirely parallel and intimately related (see in particular Lindsay (1900, pp. 30–40); cf. also Burger (1928, pp. 53–57), and Devine and Stephens 1980).<sup>41</sup> They should not be separated into a pair of accidentally co-occurring processes, but should have a unified account. This goal is attainable once the category “foot” is granted a role beyond the task of stress placement. As in earlier sections 2.1 and 2.3, we again encounter a situation where it is crucial to recognize non-primary foot-structural organization in Latin words. The central idea is that the quantity adjustments known as Iambic and Cretic Shortening arise through one and the same prosodic optimization process; their differences are a function of the different roles of the foot that is being optimized. Iambic Shortening is the optimization of the trochee

<sup>41</sup> It has been observed that there are some statistical differences between the two (mainly, a lower frequency of Cretic Shortening in certain meters). Upon closer scrutiny, they turn out to be artifacts due to meter-specific bridge rules which happen to severely restrict the positions where cretically-shortened (i.e., rhythmically dactylic) words can licitly appear within the line (for details, see the references cited in the text).

assigned by primary foot formation, which is instrumental in building well-formed higher prosodic structure on iambic words. Cretic Shortening, on the other hand, is a more subtle instantiation of the same foot optimization process, in this case operating on the post-accentual material.

The proposal is best explained on the basis of a concrete example. Assuming strict bimoraicity ( $QT_{(2,2)}$ ), a cretic word like  $[d\acute{i}]ci\langle t\bar{o}\rangle$  comes out with a footed antepenult  $[d\acute{i}]$  (which receives the word accent by End Rule (Final)) and an extrametrical final syllable  $\langle t\bar{o}\rangle$  (44a-c); trapped in between is the loose post-accentual syllable *ci*. This representation is optimized by building further foot structure on the (light) penult. This is referred to in (44d) as “subsidiary foot formation”, which is related to the idea of “persistent footing” in Hayes (1991). Bimoraic minimality requires the final (extrametrical) syllable to join this subsidiary foot. The heavy final undergoes shortening, again by means of the designated repair strategy REMOVE- $\mu$  (17a) as the trochaic foot is imposed:  $[d\acute{i}]ci\langle t\bar{o}\rangle \rightarrow [d\acute{i}][ci\check{o}]$  ‘say, imper. fut.’ (44d). In this account, Cretic Shortening is nothing but Iambic Shortening applying to a subsidiary (and unaccented) word-final foot.<sup>42</sup>

- |   |                    |                   |                                |
|---|--------------------|-------------------|--------------------------------|
| (44)a. Extrametricality:                            | $\bar{\sigma}$     | $\check{\sigma}$  | $\langle \bar{\sigma} \rangle$ |
|   | $d\acute{i}$       | $ci$              | $t\bar{o}$                     |
| b. Primary foot formation:                          | $[\bar{\sigma}]$   | $\check{\sigma}$  | $\langle \bar{\sigma} \rangle$ |
|   | $d\acute{i}$       | $ci$              | $t\bar{o}$                     |
| c. End Rule (Final):                                | $[\bar{\sigma}^*]$ | $\check{\sigma}$  | $\langle \bar{\sigma} \rangle$ |
|   | $d\acute{i}$       | $ci$              | $t\bar{o}$                     |
| d. Subsidiary foot formation<br>and REMOVE- $\mu$ : | $[\bar{\sigma}^*]$ | $[\check{\sigma}$ | $\check{\sigma}]$              |
|   | $d\acute{i}$       | $ci$              | $t\check{o}$                   |

When the final syllable is already light, as in  $[d\acute{i}]ci\langle te \rangle \rightarrow [d\acute{i}][cite]$  ‘say, imper. pl.’, the derivation follows the same steps, except that the additional foot can be imposed without any quantity adjustments.

Subsidiary foot formation is motivated by a basic well-formedness requirement of prosodic phonology: At the end of the phonological derivation, every element of the phonological string must be prosodically

<sup>42</sup> As a formal element of prosodic constituent structure that manifests itself through its effect on syllable quantity, the subsidiary foot in (44d) does not imply a secondary stress in this position: There is no ‘stress clash’ (a notion which is in any case inappropriate if Classical Latin was indeed a pitch accent system, cf. note 3 in section 1.1).



two cases *dīcitō* and *facitō* (cf. (39) and (41)) foot-structurally equivalent, as  $[dīci]⟨tō⟩$  and  $[faci]⟨tō⟩$ ; and there is no explanation why the final vowel should be shortened in the former, but not in the latter case.

The distinctive mark of trochees with trimoraic expansions is their superior parsing ability: Medial syllables do not get trapped in contexts like (45). As long as our only concern is the determination of main word accent, this might appear as a virtue, when compared to incomplete parsers like the maximally bimoraic  $QT_{⟨2,2⟩}$ . But the very flexibility of the trimoraic trochee turns into a liability when confronted with the empirical evidence for medial trapping effects, as in Cretic Shortening (and in other cases to be considered below; see Kager 1992a for related discussion). The trimoraic trochee approach is motivated by the right insight, namely that representations are optimal to the extent that the whole word, and in particular the post-accentual material, is fully parsed into feet; but the direct implementation of this insight in terms of an exhaustive footing algorithm makes it impossible to provide a unified analysis for the two shortening processes in terms of prosodic trapping.

To complete the argument, let us consider the possibility of invoking subsidiary foot formation in the trimoraic analysis (45). Since everything besides the extrametrical syllable is already fully parsed, only the final (extrametrical) syllable is available for footing ( $[dīci]⟨tō⟩ \rightarrow [dīci][tō]$ ). This line of attack offers little promise since it makes Cretic Shortening still harder to explain: Now a bimoraic foot would have to shrink to a monomoraic foot ( $[dīci][tō] \rightarrow [dīci][tō̄]$ ), a perplexing event in any theory that regards monomoraic quantitative trochees as at least to some degree marked. We might rather expect the opposite scenario: Lengthening of final light syllables in forms like  $[dīci]⟨te⟩$  'say' (imp.pl.). But such lengthening, which would result in *\*dīcitē*, etc., is unheard of at all stages of the Latin language. More generally, such an analysis misses the most fundamental property of all the shortening processes under discussion: They apply exclusively to heavy finals in words of very specific prosodic shapes ( $[[\check{\sigma}\bar{\sigma}]]$ ,  $[[\bar{\sigma}\check{\sigma}\bar{\sigma}]]$ ) and are by no means applicable to final heavy syllables across-the-board (cf. the stable final long vowels in *simulā*, *laudā*, etc.).

Instead of building a subsidiary foot on the final syllable, the trimoraic analysis might resort to a restructuring of the entire string, as shown in (46).

$$(46) \quad \text{Restructuring:} \quad [\bar{\sigma} \check{\sigma}] \langle \bar{\sigma} \rangle \rightarrow [\bar{\sigma}] [\check{\sigma} \check{\sigma}] \\ dī \quad ci \quad tō \quad \quad \quad dī \quad ci \quad tō̄$$

A first point to note here is that (46), as it stands, does not illuminate the

motivation behind Cretic Shortening and fails to connect the process to other facts about Latin phonology. In addition, as J. McCarthy points out, such wholesale restructuring of the prosodic representation violates the Free Element Condition (Prince 1985, Steriade 1988, Halle and Kenstowicz 1991), which maintains that newly built prosodic structure respects existing prosodic structure and does not overwrite it. In this case, the foot establishing the main prominence in the word would have to be partially destroyed. Note the crucial difference in the bimoraic analysis (44): Here subsidiary foot building is motivated by the trapped penult, and the new foot is built exclusively on previously unparsed material.

We might finally consider the possibility of refining the restructuring analysis ((46)) by including an intermediate step: First the penult is detached from the trimoraic foot ( $[\bar{\sigma}\check{\sigma}]\langle\bar{\sigma}\rangle \rightarrow [\bar{\sigma}]\check{\sigma}\langle\bar{\sigma}\rangle$ ) and is turned into a stray syllable; this triggers the subsequent construction of the subsidiary foot ( $[\bar{\sigma}]\check{\sigma}\langle\bar{\sigma}\rangle \rightarrow [\bar{\sigma}][\check{\sigma}\check{\sigma}]$ ) (assuming monomoraic feet are unavailable). But this amounts to a roundabout version of the strictly bimoraic analysis: The first step destroys the trimoraic foot after it has been constructed and reduces it to a bimoraic trochee, and from then on the derivation proceeds exactly as in the strictly bimoraic analysis.

I conclude from this discussion that the subsidiary foot formation observed in Cretic Shortening provides an argument that Latin words of the quantitative form  $[[\bar{\sigma}\check{\sigma}\bar{\sigma}]$  are prosodically structured not as in (47b), with a trimoraic trochee, but as in (47a), with a bimoraic trochee followed by an unfooted syllable triggering further foot building.

(47)a.  $[\bar{\sigma}]\check{\sigma}\langle\bar{\sigma}\rangle$       b.  $[\bar{\sigma}\check{\sigma}]\langle\bar{\sigma}\rangle$

When the various shortening processes of Latin are confronted in their totality, a successful prosodic explanation must simultaneously account for shortening in iambic words (*putō* → *putō*, etc.); shortening in cretic words (*dīcitō* → *dīcitō*, etc.); and lack of shortening in other cases (*laudō*/*\*laudō*, *simulō*/*\*simulō*), etc.). The core of the argument is that a unified and explanatory account is only attainable if bimoraic maximality holds as a constraint governing the quantitative trochee in Latin.

### 3.2. Resolution by Syncope

Besides quantitative adjustments that optimize foot structure by shortening or lengthening the relevant syllable, a number of further strategies are potentially available to natural languages in situations of prosodic trapping. In this section and in the subsequent one, I will briefly discuss two cases which cast additional light on the issue of bimoraic maximality.

Instead of incorporating a trapped syllable into foot structure, a more drastic alternative would be to remove it from the representation, as in (48).

$$(48) \quad \dots [\bar{\sigma}] \check{\sigma} [\bar{\sigma}] \dots$$

$$\quad \quad \quad \downarrow$$

$$\quad \quad \quad \emptyset$$

In terms of its segmental consequences, such a deletion process will affect the vowel of the medial syllable; the remaining consonants will either resyllabify into the surrounding syllables or else delete. Burger (1928, pp. 37–52), who argues for a (moraiically) binary rhythmic organization in Latin within a framework very different from the present one, claims that a scenario as in (48) is borne out by a certain syncope process in Latin that I will refer to as “Early Syncope”: vowel loss during the period of the language that is the subject of this paper (Preclassical and Classical Latin). Typical cases of Early Syncope in post-tonic position appear in (49); these examples all share the property of having a light penult trapped between a heavy antepenult and a heavy final.<sup>44</sup>

(49)	[ $\acute{\sigma}$ ] $\check{\sigma}$ ( $\bar{\sigma}$ )	[ $\acute{\sigma}$ ] ( $\bar{\sigma}$ )	
	lāridī	lardī	‘bacon’, gen.sg.
	perregō	pergō	‘continue’ (cf. perrēxī)
	porrigō	porgō	‘stretch out’, 1st.sg.pres.
	surrigō	surgō	‘raise’ (cf. surrēxī), 1st.sg.pres.
	pūrigō	purgō	‘clean’, 1st.sg.pres.
	jūrigō	jurgō	‘quarrel’, 1st.sg.pres.
	aevitās	aetās	‘age’, nom.sg.
	ūvidōs	ūdōs	‘wet’, acc.pl.

Various scholars have noted an interesting restriction on Early Syncope. Lindsay (1894, p. 173) states that post-tonic syncope under the penultimate accent law “[. . .] seems, during the Republic and early Empire, to occur only when the accented vowel is long”, citing examples of syncope like *jurgō* ‘quarrel’ (in Plautus still *jūrigō*) in (49). And Vendryès (1902, p. 242ff.) determines the canonical context of Early Syncope still more narrowly as a light syllable between heavies (cf. (48)). Burger (1928), building

<sup>44</sup> For many examples the unscopated forms are actually attested in early sources (e.g., in Plautinian Latin), showing that syncope here took place under the classical (ante)penultimate accent (see Burger 1928 and Meillet and Vendryès 1966, pp. 114–115).

on Vendryès' generalization, presents a significant amount of evidence, giving careful consideration to a number of possible counterexamples.<sup>45</sup>

Early Syncope, then, is a lexically restricted operation, which in addition depends on specific syllabic conditions (the preceding consonant must be a sonorant). It is not the case that vowel loss never occurred after a light syllable during the preclassical and classical periods: We encounter cases of this kind in frequently occurring words like the degree adverb *valdē* 'very' (in Plautus still *validē*), which is related to *validus* 'strong'. This kind of syncope began in Vulgar Latin and became fully general in Late Latin (see below). The crucial observation is that such examples constitute a small minority in the literary language, contrasting with the large majority of the cases where post-tonic syncope took place in the trapping environment after a heavy syllable (48). The point of the argument, then, is not that syncope in the classical language was entirely restricted to trapping configurations, a claim that is difficult to reconcile with the evidence (see, e.g., Leumann's 1931 review of Burger 1928); the point is rather that syncope is preferentially encountered in medial trapping configurations.<sup>46</sup> This kind of distributional skewing in favor of vowel deletion between heavy syllables calls for an explanation (which is unlikely to be forthcoming, e.g., on the basis of strictly syllable-oriented considerations).

The contrast to be captured is the following: Words of the form  $[[\bar{\sigma}\check{\sigma}\bar{\sigma}]]$  like *lāridī* in (49) were in a significant number of cases subject to Early Syncope. On the other hand, words of the form  $[[\check{\sigma}\check{\sigma}\bar{\sigma}]]$  like *calidī* 'warm, gen.' remained largely unaffected and retained their post-tonic vowels in the classical language. Burger (1928) makes the important observation that not only the preceding but also the following context is important. In particular, vowel loss is not encountered before a final light syllable; the mere presence of a preceding heavy syllable is not sufficient. Thus forms like *dēnique* 'finally' were not syncope to *\*denque*.

The interesting point about Vendryès' (1902) and Burger's (1928) syncope generalization is the fact that the context (49) amounts to a trapping configuration, as illustrated in (50a). Strictly bimoraic parsing leaves the medial syllable *ri* unfooted: the overall prosodic configuration is in fact

<sup>45</sup> Burger (1928) actually extends the righthand context of Early Syncope to one other environment, namely cases where the light syllable precedes two light syllables grouped into a foot (in modern terminology), i.e.  $[\bar{\sigma}]\check{\sigma}[\check{\sigma}\check{\sigma}]$ . The overwhelming majority of his examples, however, instantiate the heavy-syllable context  $[\bar{\sigma}]\check{\sigma}[\bar{\sigma}]$ . I will furthermore restrict the discussion to post-tonic syncope following the antepenultimate accent, see Burger (1928) for pretonic cases (which mostly also occur in trapping configurations).

<sup>46</sup> I am grateful to a reviewer and to Ellen Broselow for clarification of the logic of the argument.

identical to that of Cretic Shortening (cf. (44b)). In (49), trapping is resolved by a lexically restricted syncope process, taking precedence over the more general shortening process.

- (50) *jūrigō* → *jurgō* 'quarrel'
- a.  $QT_{(2,2)}$ :  $\begin{array}{ccc} j\bar{u} & ri & g\bar{o} \\ [\bar{\sigma}] & \check{\sigma} & \langle \bar{\sigma} \rangle \end{array}$       b.  $QT_{(max:3)}$ :  $\begin{array}{ccc} j\bar{u} & ri & g\bar{o} \\ [\bar{\sigma} & \check{\sigma}] & \langle \bar{\sigma} \rangle \end{array}$
- ↓
- ∅

The trapping environment, and hence the foot-structural motivation for syncope, hinges on bimoraic maximality: As shown in (50b), under  $QT_{(max:3)}$  the medial syllable would already be fully integrated into foot structure as part of a trimoraic trochee, and no preferential vowel deletion is predicted for this context.

The strictly bimoraic analysis in (50a) also provides a motivation for the fact that other environments characteristically resisted Early Syncope. Again, subsidiary footing plays an important role: Given that the last two syllables of *dēnique* (51a) are grouped into a subsidiary foot, there is no trapping and hence no foot-structural motivation for syncope. Similarly, words in which both antepenult and penult are light, like *calidī* (51b), also show no trapping since they are already fully footed. Note again that  $QT_{(max:3)}$  misses the prosodic distinction between the non-syncope (51b) and the syncope cases exemplified in (50b).

- (51)a. [dē][nique] 'finally'      b. [cāli]⟨dī⟩ 'warm', gen.sg.

In the output of syncope, long vowels in the preceding syllable are usually shortened, in conformity with the generally marked character of superheavy CVVC syllables in Latin (see Allen 1973, pp. 66–67, p. 141). Thus the syncope form of *jūrigō* is *jurgō*, with a shortened vowel in the newly closed first syllable. The derivation in (52) makes this explicit by focussing on the moraic level of representation and shows the consonant *r* usurping the second mora of the preceding vowel.

- (52)  $\begin{array}{ccccc} ju & ri & go & \rightarrow & ju & r & go & \rightarrow & ju & r & go \\ \diagdown & | & \diagdown & & \diagdown & | & \diagdown & & \diagdown & / & \diagdown \\ [\mu\mu] & \mu & [\mu\mu] & & [\mu\mu] & [\mu\mu] & [\mu\mu] & & [\mu\mu] & [\mu\mu] \\ & \downarrow & & & & & & & & & \\ & \emptyset & & & & & & & & & \end{array}$

There are a number of further segmental and syllabic restrictions on



syncope that are interesting in their own right but are beyond the scope of this paper. The overall generalization is that syncope is contingent on syllabically favorable conditions (in particular, the preceding consonant must be a sonorant, see Burger (1928, pp. 45–46)).<sup>47</sup>

Since the medial trapping environment is two-sided and hence sensitive to the prosody on its right, it might be expected that different derivational and inflectional suffixes should give rise to alternations, depending on their syllable weight. In the overwhelming number of cases, this is not what we find: Uniformity is imposed within paradigms, with either the syncopated or the full forms winning out (see Burger 1928, pp. 46–51 for details).

To conclude this section, let us compare Early Syncope, operative in Preclassical and Classical Latin, with the much more pervasive syncopation process that began in Vulgar Latin and became fully general in Late Latin and Romance, deleting all vowels in post-tonic penultimate open syllables (see Jacobs 1989, 1990; see also Rice 1992, p. 56). Crucially, Late Latin Syncope is routinely found after light antepenults (*cálidus* → *cáldus* ‘warm’, *sólidus* → *sóldus* ‘solid’, etc.).<sup>48</sup> Jacobs (1990) argues that this across-the-board syncopation of post-tonic penultimate vowels, applying after heavy and light syllables alike, can be analyzed as deletion in the weak position of a foot – but only if trochees with trimoraic expansions are allowed. In other words, if both [ǒǒ] and [ǒǒ̄] constitute licit quantitative trochees, the syncope rule can target non-head positions of feet.

This is an interesting argument for trimoraic quantitative trochees. The central question that arises with respect to Syncope in Late Latin concerns the degree to which the stress system was still quantity-sensitive at the period in question. After all, this is precisely the stage when all vowel quantity distinctions were lost from the language (cf. Jacobs 1990, p. 97). The result was that in all words with open penults the stress could fall either on the penult or the antepenult and was no longer predictable

<sup>47</sup> As L. Selkirk points out, this seems to indicate that the output must be more than just fully syllabifiable – the resultant syllable must rank relatively high on the scale of syllable well-formedness (sonorous coda). In terms of Harmony-Theoretic Phonology, we are faced with a case where two different optimization domains (foot and syllable) compete with each other, posing interesting questions for further research.

<sup>48</sup> Forms resulting from Late Syncope are distinct from those of Early Syncope in many respects: They never undergo phonological rules of Early Latin like *o*-Raising before coda resonants (*soldus*, *\*suldus*), and they are entirely absent from the texts of the early dramatists. It is also noteworthy that forms like *calda*, with syncope after a light syllable, were still branded as unacceptable by late grammarians, as in the Appendix Probi (3rd century A.D.): “*calida non calda, viridis non viridis, oculus non oclus, vetulus non veclus*”, etc. (‘warm’, ‘green’, ‘eye’, ‘oldish’).

within the synchronic grammar (I am assuming that familiar abstractness considerations rule out analyses attempting to reconstruct the full system of classical quantities in a language without any overt length contrasts). I conclude from the data and analysis presented in Jacobs (1990) that the only true remnant of the classical system of syllable weights is the fact that closed penults continue to count as heavy and attract stress. All other syllables count as light.

Suppose we turn this generalization into the cornerstone of our analysis: Closed syllables count as heavy only in penultimate position (i.e., finally, with extrametricality of the last syllable).<sup>49</sup> In addition, a number of (formally long-vowelled) open penults are now marked for stress by means of lexical foot structure. The main points of Jacobs' (1990) analysis can then be fully reconstructed within moraic trochee theory. In a language with few and positionally restricted heavy syllables, moraic trochees act largely like syllabic trochees (see Hayes 1991, Kager 1992b). In the case under discussion, quantitative effects are limited to the penultimate position in the word. As far as I can see, this makes the same predictions as Jacobs' (1990, p. 101) analysis, which regards all feet except for the last foot in the word as quantity-insensitive.

Notice that in this alternative approach, Late Latin Syncope is fully compatible with moraic-trochaic parsing, even if formulated as the deletion of the weak member of a foot. The parsing results in Late Latin will in essential respects be different from Classical Latin, in response to the impoverished system of syllable weight contrasts. (53) illustrates this by contrasting the classical form *tābulam* 'board' (53a) (which did not fulfill the syllabic conditions of Early Syncope – the preceding consonant is not a sonorant – and in any case did not undergo it) and its Late Latin counterpart *tabulam* (53b) (the latter turned into French *table* by way of syncope of the penultimate vowel).

(53)a.	Classical Latin:	[tá]bu⟨lam⟩ 'board'	[cáli]⟨dus⟩ 'warm'
b.	Late Latin:	[tábu]⟨lam⟩	[cáli]⟨du⟩
c.	French:	<i>table</i>	<i>chaud</i>

The crucial point is that at the Late Latin stage, the foot in (53b) includes the penultimate syllable in *tábulam* just as in *cálidu* which resulted in French *chaud* by way of syncope coupled with further segmental changes, and different from the classical footing of *tābulam* in (53a) (compare also (51) and (50) above): The old foot-structural contrast between

<sup>49</sup> See Hayes (1991, p. 205) for a similar proposal regarding initial syllables in the Norton Sound Dialect of Central Alaskan Yupik.

[[ $\bar{\sigma}$ ] $\check{\sigma}$ ⟨ $\sigma$ ⟩] and [[ $\check{\sigma}$ ] $\check{\sigma}$ ⟨ $\sigma$ ⟩] has been neutralized by the collapse of the old system of quantities. We are thus free to adopt Jacobs' (1990) proposal and state Late Latin Syncope as targeting weak positions of feet. In this analysis, the operation of such a rule is entirely compatible with moraic-trochaic footing.

Returning again to the contrasting case of Early Syncope in Latin, we note in conclusion that as a process predominantly affecting post-tonic light syllables stranded between heavy syllables, it receives a natural interpretation in a strictly bimoraic theory as a way of resolving trapping situations.

### 3.3. *Lexical Selection: The Morphology of the Perfect Stem*

In many areas of Latin morphology, we find cases of allomorphy that cannot be directly accounted for by phonological rules, but are still clearly governed by genuine prosodic factors. In section 2.2, we already encountered one well-known case of this kind, namely the distribution of long  $\bar{i}$ - and short  $\check{i}$ - as theme vowels in Latin. As suggested there, such cases of allomorphy selection can be viewed as instances of a prosodic selection criterion ("pick the best collocation").

Most interesting in the present context are morphological variants whose distribution is organized in terms of a negative prosodic target: the avoidance of medial trapping configurations. The many examples of this kind of prosodic selection that can be found in the standard grammars and in particular in Niedermann (1908) and Burger (1928), two studies devoted to rhythmic effects in Latin derivational morphology, include the distribution of the suffixes  $-ia$  and  $-i\bar{e}s$ , which form abstract nouns of the 1st and 5th declensions, respectively. The two suffixes are entirely synonymous, and doublets like *māter-ia*, *māter-iēs* 'matter' are routinely encountered. But in a large class of cases, only one of the variants is attested, as illustrated for the variant  $-ia$  in (54).

(54)	<b>-i.a</b> $\bar{\sigma}$ $\check{\sigma}$ $\bar{\sigma}$ <i>grā.ti.a</i> 'grace' <i>au.dā.ci.a</i> 'audacity' <i>clē.men.ti.a</i> 'clemency'	<b>-i.ēs</b> $\bar{\sigma}$ $\check{\sigma}$ $\bar{\sigma}$ <i>*grā.ti.ēs</i> <i>*au.dā.ci.ēs</i> <i>*clē.men.ti.ēs</i>
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The skewing of the lexical distribution observed here makes sense under prosodic selection: The  $-i\bar{e}s$  variant is avoided after heavy syllables because of its 'built-in' medial trapping structure (e.g.,  $*[grā]ti\langle\bar{e}s\rangle$ ,  $*[au][dā]ci\langle\bar{e}s\rangle$ ), which arises under strict bimoraic parsing.

This contrasts with free variation in cases like *māteria* ~ *māteriēs*, where neither variant yields trapping. In the midst of all the oscillations between competing suffixes characteristic of this area of Latin derivational morphology (where doublets abound and in fact form mixed paradigms, according to Burger (1928, p. 12)), the systematic avoidance of *-iēs* after heavy syllables is surprising.

Such examples illustrate a different route towards prosodic optimization within the overall grammatical system: Instead of optimizing representations after morpheme concatenation, prosodically disfavored configurations are prevented from arising in the first place, by means of prosodically governed lexical selection. In a broad sense, this kind of allomorphy falls in the domain of Prosodic Morphology (McCarthy and Prince 1986, 1990, 1991). Its most important characteristic is that the relative well-formedness of the whole output form is the determining factor: After all, there is nothing about *grāt-* and *-ia* in (54), considered in lexical isolation, that would attract them to each other.<sup>50</sup>

The clearest and most extensive case of such lexical selection in Latin is the formation of the perfect stem in the 2nd (*ē*) conjugation. The overall generalization governing the distribution of the canonical *u*-perfect and various non-canonical formations that emerges from Burger's (1928) study is that non-canonical formations are selected only in situations where the *u*-perfect would result in prosodic trapping.

The standard (and predominant) mode of perfect formation in the 2nd conjugation is the *u*-perfect (historically an innovation within Latin, see Meillet and Vendryès 1966, pp. 272–275) illustrated for *monēre* in (55a), with a perfect stem consisting of the verb root followed by short *-ŭ-*.<sup>51</sup>

(55)a.	<i>monēre</i>	'warn', pres.inf.
	root:	<i>mon-</i>
	present stem:	<i>mon-ē</i>
	perfect stem:	<i>mon-ŭ-</i>
	1sg perfect:	<i>mon-ŭ-ī</i>

<sup>50</sup> A similar case is the output-controlled allomorphy selection of the Dyirbal ergative suffix discussed in McCarthy and Prince (1990, p. 237, note 17).

<sup>51</sup> The following overview is based on Burger (1928, pp. 22–31). In accordance with standard practice, the 1sg. (*-uī*) is used as the citation form. The perfect stem in *-u-* is the basis for the whole perfect system, including all finite forms (*mon-u-istī*, *mon-u-ii*, etc.) and the perfect infinitive (*mon-u-isse*). Vowel-final roots take a variant in *-v-* (e.g., *flē-re flē-v-ī* 'weep', *dēlē-re dēlē-v-ī* 'destroy'). Historically *u* is a contraction of *li + v/* (*monuī* < <sup>†</sup>*monivai*, cf. *monitus* perf.part.), see Leumann (1977, p. 594).

## b. Other examples:

decēre	decuī	‘be seemly’	rigēre	riguī	‘be stiff’
docēre	docuī	‘teach’	rubēre	rubuī	‘be red’
egēre	eguī	‘be in need’	silēre	siluī	‘be silent’
habēre	habuī	‘have’	studēre	studuī	‘strive’
jacēre	jacuī	‘lie’	stupēre	stupuī	‘be stunned’
latēre	latuī	‘be hidden’	tacēre	tacuī	‘be silent’
madēre	maduī	‘be wet’	tepēre	tepuī	‘be warm’
merēre	meruī	‘deserve’	timēre	timuī	‘be afraid’
nitēre	nituī	‘be shiny’	tumēre	tumuī	‘be swollen’
nocēre	nocuī	‘harm’	valēre	valuī	‘be strong’
olēre	oluī	‘smell’	vigēre	viguī	‘be vigorous’
patēre	patuī	‘be open’	virēre	viruī	‘be green’
placēre	placuī	‘please’			

Among the noncanonical perfect formations in the 2nd conjugation, the most important is the sigmatic perfect or *s*-perfect illustrated in (56a) (perfect stem: root + /s/, with segmental adjustments).

(56)a.	augēre	‘enlarge’, pres.inf.
	root:	aug-
	present stem:	aug-ē-
	perfect stem:	auk-s-
	1sg perfect:	auk-s-ī

## b. Other examples:

algēre	alsī	‘be cold’	rīdēre	rīsī	‘laugh’
haerēre	haesī	‘hand’	suādēre	suāsī	‘advise’
indulgēre	indulsī	‘be indulgent’	tergēre	tersī	‘wipe clean’
lūgēre	lūksī	‘mourn’	tugēre	tursī	‘be swollen’
mulcēre	mulsi	‘stroke	urgēre	ursī	‘urge’

The other noncanonical perfect formation in the 2nd conjugation is the archaic reduplicating perfect found with a few verbs (57).<sup>52</sup>

(57)	spondēre	spopardī	‘vow’
	mordēre	momordī	‘bite’
	tondēre	totondī	‘shear’

The contrast between canonical and non-canonical formations seen for

<sup>52</sup> A. Prince draws attention to the “hypersimilarity effects” among the members of this class (see Pinker and Prince (1988, pp. 116–117)), which all share the root vowel *o* followed by a sonorant-obstruent cluster (*spond-*, *mord-*, *tond-*).

the finite perfect forms in (55)–(57) has further ramifications and parallels in other morphological categories (the supine and the perfect participle).<sup>53</sup>

The remarkable fact about this distribution is its organization in terms of a prosodic principle. The canonical *u*-perfect is the default representative of the perfect and fully productive. Non-canonical formations appear where the *u*-perfect would result in a medial trapping configuration [... $\bar{\sigma}\check{\sigma}\bar{\sigma}$ ...].

Such a configuration arises after roots ending in heavy syllables,<sup>54</sup> which is exactly what the *augēre*-type verbs ((56)) and the reduplicating verbs ((57)) have in common (contrasting with the *monēre*-type verbs with light root syllables in (55)). The crucial factor is that in a significant part of the paradigm<sup>55</sup> of verbs with heavy root syllables the *u*-perfect give rises to non-optimal collocations with medial trapping, whereas the *s*-perfect<sup>56</sup> does not ((58a)). Verb roots ending in a light syllable ((58b)), on the other hand, combine with the short *u* of the perfect in a prosodically optimal manner. (Note again here the output-orientation of the selection mechanism.)

(58)		<i>u</i> -perfect						
a.		$\bar{\sigma}$	$\check{\sigma}$	$\bar{\sigma}$	$\bar{\sigma}$	$\bar{\sigma}$		
	<i>augēre</i>	*au	gŭ	ī		auk	sī	‘enlarge’
	<i>algēre</i>	*al	gŭ	ī		al	sī	‘be cold’
	<i>suādēre</i>	*suā	dŭ	ī		suā	sī	‘advise’
	<i>mordēre</i>	*mor	dŭ	ī		momor	dī	‘bite’

<sup>53</sup> *u*-perfect formations correspond to perfect participles in *-itus* (e.g., *monuī*, *monitus*), whereas *s*-perfect formations correspond to perfect participle in *-itus*, without connecting vowel (e.g., *auksiī*, *auctus*), as do reduplicating perfects (e.g., *momordī*, *morsus*). One of the very few exceptions to this correlation is the verb *docēre* ‘teach’, with the *u*-perfect *docuī* but with a perfect participle directly built on the root (*doctus*, \**docitus*). Even in this case, however, the expected stem ending in *i* shows up in the related forms *doci-lis* ‘docile’ and *docu-mentum* ‘document’ (with labialization).

<sup>54</sup> Note that “heavy syllable” here effectively means “closed syllable”, since all vowel-final roots take *-v-* to form the perfect stem, see note 51.

<sup>55</sup> Only the 1sg. forms are illustrated in (58), but similar considerations hold for many other forms of the paradigm (e.g., 2sg. *auk.sis.tī* [̄σ̄ σ̄ σ̄] vs. \**au.gu.is.tī* [̄σ̄ σ̄ σ̄ σ̄], perf.inf. *auk.sis.se* [̄σ̄ σ̄ σ̄] vs. \**au.gu.is.se* [̄σ̄ σ̄ σ̄ σ̄], etc.).

<sup>56</sup> Furthermore, there is no independent historical reason for *s*-perfects (which are characteristic of the 3rd conjugation) to appear in the 2nd conjugation, see Burger (1928, pp. 22–31).

(58)b.		ǒ	ǒ	ō	
	monēre	mo	nŭ	ī	'admonish'
	tacēre	ta	cŭ	ī	'be silent'
	stupēre	stu	pŭ	ī	'be stunned'
	abolēre	abo	lŭ	ī	'abolish'

The lexical selection of perfect formations is schematically illustrated in (59).

(59)a.	monēre 'warn'	b.	augēre 'enlarge'	
	canonical perfect: [ǒ ǒ] <ō> <i>mo nu ī</i>		noncanonical perfect: [ō] <ō> <i>auk sī</i>	canonical perfect: [ō] ǒ <ō> * <i>au gu ī</i>
			↙ ↘	
			Lexical Selection	

I am assuming here, as in the analysis of *io*-verbs in section 2.3, a lexical selection process that is driven by a prosodic criterion choosing the best among several alternatives. Within this system, the *u*-perfect is the default formation, taking over whenever selection is out of force, as in denominal verbs.<sup>57</sup>

The mechanism of prosodic lexical selection invites further exploration in the framework of Harmony-Theoretic Phonology, where strategies like 'pick the best among several alternatives' are formally integrated in the overall theory. The optimization criterion that underlies the selection process is, as we have seen, avoidance of the disfavored trapping configuration. This provides a further argument for strict bimoraicity: If trimoraic and/or monomoraic trochees were available, there would be no corre-

<sup>57</sup> The cases not in line with the prosodic generalization are all examples where the default *u*-perfect formation appears after a heavy root syllable. For example, the perfect of *frīgēre* 'be cold' is *frīksī* in Old Latin, but was later remodeled as *frīguī* (after the adjective *frīgidus*), see Burger (1928, pp. 28–31) for discussion. More importantly, the prosodic selection criterion is out of force among all derived (denominal) verbs. Here we find *u*-perfects in all contexts, including after heavy syllables (e.g., *albēre albuī* 'be white', from *albus* 'white'). Such 'regularization' in favor of the default formation is characteristic of derived members of a category. Prosodic selection is a property of verbal roots; denominal verbs by definition lack verbal roots and are therefore predicted to take the productive *u*-perfect (see Kiparsky 1973, Itô 1990, and McCarthy and Prince 1990 for related observations on derived formations).

sponding pressure towards the selection of the non-canonical form since a perfect like \**auguī* would be fully footed as [augu]⟨ī̄⟩ (or [au][gu]⟨ī̄⟩).

#### 4. FURTHER IMPLICATIONS

The approach to the Latin stress foot developed in this paper raises a number of further issues which remain to be addressed. Section 4.1 takes up questions related to enclitic accent and sketches a new analysis of the facts in this area. The final section (4.2) concludes the paper by relating the results obtained here to the theory of Harmonic Parsing proposed in Prince (1990).

##### 4.1. Latin Enclitic Accent

Both bimoraic minimality and bimoraic maximality raise some interesting questions in connection with a recent treatment of enclitic accent in Latin proposed by Steriade (1988), and further developed in Halle (1990) and Halle and Kenstowicz (1991). According to the testimonies of a number of Roman grammarians,<sup>58</sup> whose reliability has remained controversial, enclitics like the monosyllabic conjunction *-que* uniformly attract the word accent onto the final syllable of the host word, irrespective of syllable quantity. Alongside forms like *virúmque* ‘and the man’ or *mūsáeque* ‘and the Muses’, which are unremarkable in having the accent on a heavy penult, this implies accentuations like *vōtáque* ‘and the vows’, *mūsáque* ‘and the Muse’, and *līmináque* ‘and the thresholds’, which do not conform to the (ante)penultimate accent pattern.<sup>59</sup> Similar preaccenting behavior

<sup>58</sup> Collected in Schoell (1876); see Leumann (1977, pp. 238–242) for a critical summary.

<sup>59</sup> With respect to examples like *līmináque* ‘and the thresholds’ or *sceleráque* ‘and the crimes’, Leumann (1977, p. 240) cautions that they cannot be supported by occurrences in hexameter verse (e.g., Virgil’s, the chief authority for later Roman commentators): Given their quantitative form (⟨[ō̄-ō̄-ō̄-ō̄]⟩ and ⟨[ō̄-ō̄-ō̄-ō̄]⟩, respectively), such words simply cannot fit anywhere into the line. I am aware of one occurrence of the form *līminaque* in the Aeneid (V. Aen. 3.91): *līminaque laurusque deī* ‘both the gateways and the laurels of the god’, scanned as |<sup>1</sup>- - - |<sup>2</sup>- - |<sup>3</sup>- - - |<sup>4</sup>-. As can be seen, *līminaque* must here be scanned as ⟨[ō̄-ō̄-ō̄-ō̄]⟩, with the enclitic *-que* measured as a heavy syllable (in imitation of a Homeric model (see Williams 1962, p. 74), but in this case anomalously before a single consonant). Accentuations like *līmináque* find no support from such lines – on the contrary, based on Virgilian ‘lengthenings’ of *-que* (a total of 16 instances, without exception in the arsis of the foot, according to Williams 1962), some modern metricists have even postulated a secondary stress on the enclitic, in addition to the normal word stress (i.e., *līminaquè*); see Allen (1973, p. 159) for references and discussion. Such considerations illustrate the empirical difficulties in this area, and many researchers have expressed grave doubts concerning the factual accuracy of the Roman grammarians’ statements – among other things, because of the suspiciously close parallelism between the claimed behavior of clitics in Latin and the facts of Greek enclitic



is reported for bisyllabic clitics in words like *súb-inde* ‘immediately thereafter’, *íd-circō* ‘for this reason’, or *eá-propter* ‘therefore’ (note the heaviness of the penultimate syllable in these examples). The basic idea of the approach developed by the authors cited above is that two rounds of accent assignment are involved, first on the domain of the host word and subsequently on the clitic domain. On the word domain, the foot is the quantity-sensitive trochee  $QT_{(1,3)}$ , and consequently only the final (extrametrical) syllable of the host word remains unmetrified:  $[mū]\langle sa \rangle$ ,  $[e]\langle ā \rangle$ ,  $[līmi]\langle na \rangle$ . On the clitic domain, where footing switches to quantity-insensitive trochees, the unmetrified (previously extrametrical) final syllable of the host word becomes the head of a new foot:  $[mū][sa]\langle que \rangle$ ,  $[e][āprop]\langle ter \rangle$ , and  $[līmi][na]\langle que \rangle$ . The final foot receives main stress, deriving  $[mū][sá]\langle que \rangle$ ,  $[e][āprop]\langle ter \rangle$ , and  $[līmi][ná]\langle que \rangle$ , and secondary feet are eliminated (see Steriade 1988, pp. 296–298 and Halle and Kenstowicz 1991, pp. 262–264 for further details and illustrations). The Free Element Condition (FEC; see also, section 3.1 above) is instrumental in these derivations: In the version of the principle proposed by Halle and Kenstowicz (1991, p. 464) (see below for the slightly different approach taken in Steriade 1988), it rules out both (i) the removal of a footed syllable from one foot and its reassignment to another foot, thus preventing  $*[lī][mína]\langle que \rangle$  (‘opacity effect’) and (ii) the extension of the boundaries of an existing foot to include unfooted material, thus preventing  $*[mūsa]\langle que \rangle$  (‘closure effect’). This is an ingenious analysis. Since it involves, besides a combination of quantity-sensitive and quantity-insensitive footing, the construction of both monomoraic trochees and trimoraic trochees (for cases like  $[līmi][ná]\langle que \rangle$  ‘and the thresholds’), it demands our attention in the present context.

Quite independent of questions regarding bimoraic minimality and maximality, the mixture of quantity-sensitive and quantity-insensitive trochees that characterizes this approach should incite us to look for an alternative. The quantity-mixing account largely succeeds in locating the accent on the syllable preceding the clitic (though there is one important empirical problem, discussed below), but it succeeds only at a considerable cost in terms of the prosodic coherence of the overall system: Everything else being equal, it would be preferable if quantity-insensitive footings like  $[e][āprop]\langle ter \rangle$  could be avoided in a language as thoroughly quantity-

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accent (Latin *mūsá-que* after Greek *muúsá-te* etc., as another instance of the well-known habit of Roman grammarians to directly imitate Greek authorities, cf. Allen (1965, pp. 83–84); see Leumann (1977, pp. 238–240) for philological details and a summary of the Latinist literature, and Allen 1973, p. 159, and Halle 1990 for linguistic discussion).

sensitive as Latin (cf. Sauzet 1989 and Golston 1990 for similar criticisms regarding Attic Greek).

The empirical problem with the quantity-mixing analysis is the following: The crucial interaction of the FEC with extrametricality predicts that, when combined with bisyllabic enclitics, monosyllabic host words should behave differently from polysyllabic host words. This is so because the final (and only) syllable of a monosyllabic word enjoys a special status on the first round of foot assignment: It is not subject to syllable extrametricality, by virtue of the “whole form exemption” (an assumption shared by, e.g., Halle and Vergnaud (1987, p. 50)). Consequently, this syllable is already metrified upon entering the second round of foot assignment. This makes a crucial difference, as illustrated in (60), where a bisyllabic host word *é.ā* combined with a bisyllabic clitic in *e.ā-prop-ter* ‘therefore’ ((60a)) is contrasted with a monosyllabic host word *íd* combined with a bisyllabic clitic in *íd-cir.cō* ‘for this reason’ ((60b)). The problem arises in the second case: (60b) does not derive the intended stress on the last (here, only) syllable of the host word (*íd-circō*). Instead the accent lands on the clitic (*\*ídcircō*), since [*íd*] is already footed (FEC: closure effect). (60b) should be compared with the parallel derivation of *mūsáque* in (60c), where a shift of the accent to the second syllable is indeed the desired outcome.

(60)a.    [[[[σσ]] σ σ]] [[[eā]] propter]]	b.        [[[[σ]] σ σ]] [[[íd]] circō]]	c.        [[[[σ σ]] σ]] [[[mūsa]] que]]
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Word Domain

EM:        e ⟨ā⟩	id	mū ⟨sa⟩
Footing: [é]⟨ā⟩	[íd]	[mú]⟨sa⟩

Clitic Domain

EM:        [é] ā prop ⟨ter⟩	[íd] cir ⟨cō⟩	[mú] sa ⟨que⟩
Footing [è][á prop]⟨ter⟩	[íd][cír]⟨cō⟩	[mù][sá]⟨que⟩

(QI):

<u>Output:</u> eápropter	*ídcircō	mūsáque
‘therefore’	‘for this reason’	‘and the Muse’

(60) assumes a strong version of the FEC which prohibits not only changes in constituent membership (opacity effect), but also extensions of constituent boundaries (closure effect), as proposed in Halle and Kenstowicz (1991). A different but equally serious empirical problem arises if the principle is construed more narrowly. Steriade (1988, pp. 309–310) proposes a version of the FEC with opacity but without closure, arguing that constituents must be allowed to expand and incorporate stray material, if

the principle is to be compatible with the facts of syllabification. The quantity-mixing analysis of Latin enclitic stress fares no better under this opacity-only version of the FEC. As (61) illustrates, the monosyllabic-host problem disappears: *ídcirco* receives the desired preclitic stress ((61b)) since the monosyllabic foot [*íd*] can extend on the second round of foot formation to incorporate the syllable *cir*. But instead the analysis now breaks down for *músaque* in (61c) (the form that appears in several sources as a paradigmatic example of preclitic stress, see Leumann 1977, p. 240): By entirely parallel reasoning, the extension of the monosyllabic foot on [*mú*](*sa*) here derives the unwanted result \*[*músa*](*que*).<sup>60</sup>

(61)a.    [[[[σσ]] σ σ]] [[[eā]] propter]]	b.        [[[[σ]] σ σ]] [[[íd]] circō]]	c.        [[[[σ σ]] σ]] [[[músa]] que]]
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Word Domain

EM:        e ⟨ā⟩	id	mū ⟨sa⟩
Footing    [é]⟨ā⟩	[íd]	[mú]⟨sa⟩
(QS):		

Clitic Domain

EM:        [é] ā prop ⟨ter⟩	[íd] cir ⟨cō⟩	[mú] sa ⟨que⟩
Footing    [è][á] prop ⟨ter⟩	[íd cir]⟨cō⟩	[músa]⟨que⟩
(QI):		

<u>Output:</u> eápropter	ídcircō	*músaque
‘therefore’	‘for this reason’	‘and the Muse’

It appears, then, that the quantity-mixing analysis cannot derive all cases of preclitic stress, whichever version of the FEC is adopted (opacity-cum-closure, or opacity-only). It is not obvious how these problems could be overcome, given the assumptions on which the analysis rests. Returning to (60a,b), we might consider stipulating that the two hosts are exempt from foot formation on the word domain (say, because of their pronominal nature). Under this assumption, the correct accent position would be derived on the Clitic Domain in both cases: *e[áprop]⟨ter⟩*, [*ídcir]⟨cō⟩*. But the stipulation would be ad hoc and would create problems elsewhere. Both *id* and *eā* belong to the paradigm of the personal pronoun *is* (nom/acc.sg. neuter and adverbial form, respectively), and nothing sug-

<sup>60</sup> It is interesting to note that the contrast between the foot extension in [*íd* + *cir*]cō and the lack of foot extension in [*mú*][*sa*] + *que* is in some ways reminiscent of Strict Cycle effects. See Steriade (1988) for a discussion of the significant overlap between the Strict Cycle Condition and the FEC, and their crucial differences regarding the derivational preservation of prosodic constituent structure.

gests that such forms are prosodically in any way special (every form of the paradigm fulfills the minimal word requirement, see section 2.3). More importantly, the problem would not disappear, but resurface in a different area, namely, in combinations of the bisyllable *eā* with a monosyllabic clitics like *que* ‘and’: Instead of  $[e][\acute{a}]\langle que \rangle$ , with the desired preclitic stress, we would end up with  $*[\acute{e}\bar{a}]\langle que \rangle$ . (Recall that footing on the clitic domain is quantity-insensitive, by hypothesis.)

To conclude this section, I will briefly sketch an alternative approach to the facts reported for enclitic accent in Latin. The foremost observation to be captured is that the accent never lodges on the clitic (cf. (60b) above). In order to account for this, let us assume that the clitic itself (and not merely its final syllable) is extrametrical. Clitic extrametricality makes immediate sense of part of the surprising ‘quantity-insensitivity’ effect in enclitic accent, where the weight of penultimate syllables in clitics has no influence on accent position. Extrametricality provides a superior account here than quantity-insensitive feet since it is fully compatible with the otherwise thoroughly quantitative nature of Latin prosody.

Equipped with clitic extrametricality, the derivations in (60) proceed correctly: (60a)  $[e]\bar{a}\langle propter \rangle$  now resembles (60c)  $[m\bar{u}]sa\langle que \rangle$  in making only a single syllable available on the second round of footing, namely the last (previously extrametrical) syllable of the host; and in (60b)  $[id]\langle circō \rangle$ , no further foot building can take place, since the host is already fully footed and the rest of the form is extrametrical. In this way, the correct preclitic accent can be derived in all cases without ever invoking quantity-insensitive trochees.

But once we have taken the crucial step of making the clitic extrametrical, a very different kind of approach suggests itself. Consider again the basic generalization to be captured: Enclitic accent always appears at the rightmost edge of the host word, irrespective of the weight of its last syllable. Theories with restricted foot inventories, like the one defended in this paper, are by their very nature ill-equipped to assign strictly edge-bound accents in situations like the one under discussion. If monomoraic quantitative trochees count as subminimal (‘degenerate’) and are not admitted, a final light syllable can never be the head of a trochaic foot. One possible reaction would be a slight enrichment of the foot inventory. Thus Hayes (1991, pp. 75–89) suggests allowing degenerate feet as ‘last resort’ devices, to be admitted only under specific conditions and on a parametrized basis. We could opt for a slightly weaker theory along such lines; but in the case of Latin, where the evidence for bimoraic minimality is particularly strong (see section 2), even a limited admission of degenerate (monomoraic) feet is not attractive. Another option would be to make

use of the idea of catalexis, proposed in Kiparsky (1992) as a device complementary to extrametricality which, among other things, allows light syllables in peripheral positions to count as honorarily heavy. This is an intriguing idea, but the case of preclitic accent in Latin is not easily amenable to this kind of treatment since the peripheral position within the whole form is already taken up by the extrametrical clitic.

The situation appears in a rather different light if we confront the basic generalization more directly: Preclitic accent is final accent, *modulo* clitic extrametricality. This invites a reconsideration of one assumption tacitly adopted until now, namely that such accents are necessarily due to foot building. As Prince (1990) reminds us, feet do not have a monopoly as stressing devices. Just as the presence of a foot does not always imply a stress, likewise a stress in a certain position does not always signal the presence of a foot. Phonological Theory has other devices that give rise to prosodic prominence; in particular, it contains a mechanism that directly seeks out edges of domains, namely the End Rule (Prince 1983; this alternative account arose out of a discussion with R. Kager). Suppose, then, we analyze preclitic accent as an effect of End Rule (Final), an operation that assigns prominence to the rightmost element within a domain, at a given level of scansion. In the usual case the Latin End Rule assigns prominence to the last foot (see (44c) in section 3.1); pre-clitic accent can be accommodated if viewed as a direct application of the rule at the syllable level (and not the foot level), assigning an additional accent to the final syllable within its domain. Given clitic extrametricality, the domain-final syllable is the last syllable of the host word, preceding the enclitic.<sup>61</sup> And since the End Rule is not sensitive to syllable weight, it is unsurprising that heavy and light syllables alike end up accented in pre-clitic position.

As for the role of enclitic accent within the overall system of Latin accentology, I see little reason to dismiss it as a mere fiction created by Roman commentators and grammarians. But it remains true that the reported facts are tantalizingly close to those found in Greek (without being identical, see Steriade 1988, pp. 283–299). Given the indisputable authoritative influence of the Greek language on educated Latin speakers (many of whom were fully bilingual), a rather different conclusion suggests itself: Preclitic accent was indeed a genuine, but ‘borrowed’, feature of the speech of educated Romans. As such, it was not an organic element

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<sup>61</sup> This analysis is formally similar to pre-accentuation cases typically found in pitch accent systems like Japanese, adding further support to the view that the accent of Classical Latin was of a tonal nature (see note 3 above).

of the Latin accentual system, but rather the result of an imposition of Greek tonal patterns, in terms of a simple End-rule generalization, on the native language.<sup>62</sup>

Given the many empirical unclaritys in this area of Latin accentology, all conclusions must remain tentative. On the positive side, the End-rule analysis, coupled with clitic extrametricality, is free of the descriptive problems connected with other alternatives, avoids inconsistencies in the quantitative character of the foot, and is consistent with a restricted foot inventory in which the quantitative trochee is strictly bimoraic. And taken together with other proposals to capture the special metrical behavior of peripheral syllables (such as catalexis (Kiparsky 1992)), a theory upholding a categorical ban on degenerate feet becomes a realistic project.

#### 4.2. *Harmonic Parsing and Maximality*

The main results of this paper are compatible with the conclusion that both bimoraic minimality and bimoraic maximality hold in quantitative trochaic parsing. This is moraic trochee theory in its pure form, where monomoraic and trimoraic expansions are categorically excluded and do not exist. But our results are also compatible with a weaker form of the theory, in which monomoraic and trimoraic feet still exist, but only as highly marked expansions of the trochaic foot, whose canonical form remains strictly bimoraic. This is a markedness version of moraic trochee theory in which bimoraic minimality and bimoraic maximality are not inviolable principles, but rather markedness criteria determining the direction of optimization.

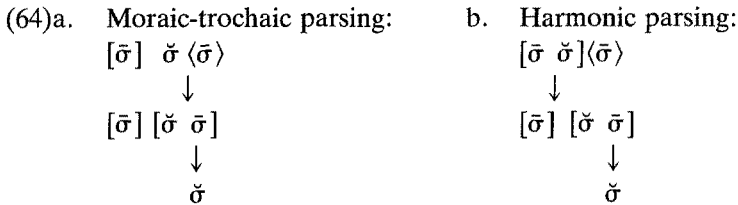
I will conclude with a few remarks comparing these two approaches. The markedness approach is interesting in light of recent developments within Harmony-Theoretic Phonology. Prince (1990) has made an interesting case for a theory which in principle allows trimoraic trochees but can also account for moraic trochee patterns. In the present context, the crucial assumptions are the following: (i) Bimoraic trochees, [ $\bar{\sigma}$ ] and [ $\check{\sigma}\check{\sigma}$ ],

<sup>62</sup> There is possibly some independent support for the view that End Rule (Final), applying at the syllable level, is responsible for pre-clitic accent. It is found in cases where overt word-final accent is in fact reported for certain function words. Thus Lindsay (1896, p. 168) quotes Priscian's (ii.p.27.4H.) observation that "Latin prepositions, like Greek, had by themselves the acute accent on the last syllable (*supér, hypér*), but in the sentence lost the accent (accentum habent praepositiones acutum in fine, tam apud Graecos quam apud nos, qui tamen cum aliis legendo, in gravem convertitur)". The facts are not very clear, and a number of alternative interpretations are possible (see Leumann 1977, pp. 238–240 for a recent summary); this property, however, is shared by most of what is reported about Latin enclitic accent.



The comparison of the two theories then reduces to the question of whether the syncope trigger is unfooted material or the undesirable trimoraic structure. In the case of syncope, both strictly bimoraic footing and optimally bimoraic footing succeed in deriving the facts. But the analysis also shows that in Latin, where trimoraic trochees routinely arise under harmonic parsing (62b), they still do not constitute stable prosodic units.

Cretic Shortening (section 3.1) reveals a more significant difference between the two approaches, as schematically illustrated in (64).



In the strictly bimoraic analysis ((64a)), shortening (REMOVE- $\mu$ ) is an adjustment that makes contiguous footing possible. Here the subsidiary foot is exclusively built on previously unfooted ('free') material.

As in the case of syncope, the harmonic parse ((64b)) yields a trimoraic foot adjacent to the extrametrical syllable. Here optimization must mean that this structure is transformed into a sequence of two optimal bimoraic feet. This restructuring of the form must partially overwrite existing metrical structure, which is problematic in view of the Free Element Condition (see section 4.1). This remains a disadvantage of theories admitting trimoraic trochees, as long as they are embedded within an overall derivational model of phonology: Even in a markedness version of the theory, the derivation will first take a wrong step, which is subsequently corrected by restructuring the representation, in violation of the Free Element Condition.

The problem disappears in the strictly non-derivational harmony-theoretic approach of Prince and Smolensky (1991, 1992), whose basic mode of operation is not a sequential step-by-step optimization procedure, but consists in the simultaneous comparison of different possible outputs, leading to the selection of the most well-formed candidate representation.

Where the strictly bimoraic theory appeals to unparsed structures as a motivation for prosodic change, the harmonic parsing theory appeals to the non-optimality of trimoraic structures. Future research must assess to what extent such non-optimality can be empirically distinguished from a simple ban on trimoraic trochees. Besides the central issue of foot typology (Hayes 1991, van der Hulst 1991, Kager 1992a), another important question is whether trimoraic trochees find independent support in Prosodic



Morphology.<sup>63</sup> The Latin evidence considered in this paper suggests that the optimal bimoraic foot is in effect the only ultimately acceptable trochee. No phonological evidence has emerged for intermediate stages with trimoraic feet, and whenever there is a chance for non-bimoraic trochees to assert themselves, they are conspicuously absent. As far as empirical probing in terms of prosodic effects is concerned, everything works as if bimoraicity is strictly obeyed in the quantitative trochaic system of Latin.

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<sup>63</sup> This is empirically somewhat unclear (cf. Prince 1990). The potential role such a foot could play in Prosodic Morphology has been undermined by the recently proposed notion of a "loose minimal word" (McCarthy and Prince 1991), defined as a minimal word that contains one foot and anything else smaller than a foot. For the trochaic case, the advantage of such a notion is that it recognizes as a legitimate kind of minimal word not only the bisyllabic sequence [̄σ̄σ̄], but also the trisyllabic sequence [̄σ̄σ̄σ̄] (see Itô 1990 and Itô et al. 1992 for arguments that these two types of sequences form a natural class, a generalization beyond the reach of trimoraic trochees).

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