

## The Quantitative Trochee in Latin

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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 of this foot is thus  $\sigma[\mathbf{F}(\mathbf{F})]$ : a syllable of any weight followed by an optional light

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syllable. This admits all the structures in (1) as licit quantitative trochees. (**1**<sub>F</sub> = [ : : ]<sub>F</sub> = heavy syllable, **1**<sub>F</sub> = [ : ]<sub>F</sub> = light syllable, **F** = syllable of any weight).

- (1) a. [**1**<sub>F</sub>**1**<sub>F</sub>]      b. [**1**<sub>F</sub>**1**<sub>F</sub>]      c. [**1**<sub>F</sub>]      d. [**1**<sub>F</sub>]

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): [**1**<sub>F</sub>**1**<sub>F</sub>] stands for [**1**<sub>F</sub>**1**<sub>F</sub>], [**1**<sub>F</sub>] for [**1**<sub>F</sub>], etc.<sup>1</sup>

Partially building on insights in earlier studies (Allen 1973, McCarthy 1979), a different conception of the quantitative trochee has emerged in recent work (Hayes 1987, 1991, Kager 1991, McCarthy and Prince 1986, 1990). In these approaches, the foot is characterized by a constant moraic substance, invariably present in all of its manifestations: It is strictly bimoraic ([ : : ]), 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 "moraic trochee theory" (Hayes 1987); trimoraic (1a) and monomoraic (1d) sequences are ruled out as feet.

Much of the discussion in the literature dealing with moraic trochee theory (e.g. McCarthy and Prince 1986, Hayes 1987, Prince 1990, Kager 1992a) has taken place in the context of proposed universal foot inventories designed to accommodate broad rhythmic patterns governing iambic and trochaic parsing (Hayes 1985). Building on the insights gained in these works, the present investigation approaches the topic from a slightly different angle and attempts to make a case for moraic trochee theory not by crosslinguistic and typological arguments, but by a detailed case study of one well explored and unquestionably trochaic system, Latin.

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 rhythmic organization of the language. Besides 'Classical' Latin (the canonized variety attested in the literary works of the late 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.

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

a.	F	b.	F	c.	*	d.	
	/\		/\				
	s w		o \		(* *)		(x .)
	<b>F F</b>		<b>F F</b>		<b>F F</b>		<b>F F</b>
Liberman & Prince 1977		Hammond 1984	Halle &	Hayes 1987, 1991			
				Vergnaud 1987			

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 Nespov 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 are unable to decide between the two conceptions of the quantitative trochee outlined above: the standard trochee [**F(F)**] and the moraic trochee [ : : ]. 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 *inimīcūs* '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 [**F(F)**]-parsing and moraic-trochaic [ : : ]-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.)

- |     |                          |                    |                 |
|-----|--------------------------|--------------------|-----------------|
| (2) |                          | <i>sá pi ēns</i>   | 'wise', nom.sg. |
| a.  | [ <b>F(F)</b> ]-parsing: | [ <b>F(F)</b> <F>  |                 |
| b.  | [ : : ]-parsing:         | [ <b>F(F)</b> <F>  |                 |
|     |                          |                    |                 |
| (3) |                          | <i>sapi én tēs</i> | 'wise', nom.pl. |
| a.  | [ <b>F(F)</b> ]-parsing: | [ <b>B</b> <F>     |                 |
| b.  | [ : : ]-parsing:         | [ <b>B</b> <F>     |                 |

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

- |     |                          |                      |                  |
|-----|--------------------------|----------------------|------------------|
| (4) |                          | <i>sapi én ti or</i> | 'wiser', nom.sg. |
| a.  | [ <b>F(F)</b> ]-parsing: | [ <b>B(F)</b> <F>    |                  |
| b.  | [ : : ]-parsing:         | [ <b>B</b> F<F>      |                  |

In standard-trochaic parsing (4a), the medial syllable *ti* is the second member of a trimoraic trochee [**B(F)**], using the maximal expansion of the foot; in moraic-trochaic parsing (4b), it

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<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 *ks*; long vowels are distinguished by a macron ( $\bar{a}$  = [a:], etc.), short vowels are unmarked (*a*) or indicated by a breve (*ă*).

<sup>3</sup> Except for monosyllabic words like *árs* '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. the 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.



In LR<sup>6</sup> 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<sup>6</sup> footing of **[BFF7]**

a. [ : : ]-parsing:  $\begin{array}{c} x \quad x \\ \mathbf{[B [FF7] F7} \end{array}$

b. [**F(F7)**]-parsing:  $\begin{array}{c} x \quad x \\ \mathbf{[BF7] [FF7]} \end{array}$

The empirical upshot is that the moraic trochee is superior LR<sup>6</sup> since it alone can successfully account for the Cairene Arabic pattern (5); the LR<sup>6</sup> parsing pattern (7b) predicted by the standard-trochaic foot has so far remained uninstantiated (see Hayes 1991, pp. 63-66). The two types of trochees are equally successful RL<sup>7</sup> (6) (see Prince 1990 for detailed discussion). It might be argued that this establishes the moraic trochee only in one direction (LR<sup>6</sup>), and leaves the door open for theoretical attempts to preserve the standard trochee in the other direction (RL<sup>7</sup>). This paper attempts to show that trochaic footing has directional symmetry and exhibits moraic-trochaic character in both directions. In particular, once we look beyond the facts of word stress, there is considerable evidence within at least one RL<sup>7</sup> system, namely Latin, which is compatible only with the moraic trochee.<sup>7</sup>

Broadening the area of investigation beyond stress is imperative in 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.

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<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.

<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.

## 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 that do not necessarily go hand-in-hand, that is, the standard theory and moraic trochee theory do not exhaust the theoretical alternatives. 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?

It will be convenient for our discussion and argumentation to have a simple way of referring to the theoretical alternatives. 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 second maximal size). Moraic trochee theory is then  $QT_{\langle 2,2 \rangle}$ , standard trochee theory is  $QT_{\langle 1,3 \rangle}$ , the alternative theory alluded to above (with trimoraic, but not monomoraic, feet) is  $QT_{\langle 2,3 \rangle}$ , 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  $QT_{\langle 1,3 \rangle}$ ,  $QT_{\langle 1,2 \rangle}$ ,  $QT_{\langle 2,3 \rangle}$ , and  $QT_{\langle 2,2 \rangle}$ . The richest conception of the quantitative trochee, the standard  $QT_{\langle 1,3 \rangle}$ , always succeeds in exhaustively parsing the whole string into feet, including light syllables in all positions.  $QT_{\langle 1,2 \rangle}$  lacks trimoraic expansions, but does not differ from  $QT_{\langle 1,3 \rangle}$  in degree of parsing, as will be seen immediately. The situation is quite different for  $QT_{\langle 2,3 \rangle}$  and  $QT_{\langle 2,2 \rangle}$ , which in certain contexts cannot incorporate light syllables into feet and must leave them unparsed. I will refer to this phenomenon as "prosodic trapping".

Consider first the context illustrated in (8), where an initial light syllable is followed by a heavy syllable. Letting the notation " $QT_{\langle \rangle}(s)$ " denote the parsing imposed on a given string  $s$  by some version of quantitative trochee theory  $QT_{\langle \rangle}$ , the results are as follows (where  $f$ , encloses prosodic words and  $[ ]$  indicates footing):

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<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  $QT_{\langle 1,3 \rangle}$  (see section 4.1), and Jacobs (1990) argues for  $QT_{\langle 2,3 \rangle}$  (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  $QT_{\langle 1,3 \rangle}$ ; but at the same time it preserves the central insight of moraic trochee theory in ranking the bimoraic trochee above all other expansions ( $[ : : ]^{TM} [ : : ]^{TM} [ : ]$ ); most of the evidence to be presented below is also compatible with this approach, see section 4.2 for discussion.

- (8)  $s = f \mathbf{F} \mathbf{B} \dots$
- a.  $QT_{\langle 1,3 \rangle}(s) = f[\mathbf{F}][\mathbf{B}] \dots$
  - b.  $QT_{\langle 1,2 \rangle}(s) = f[\mathbf{F}][\mathbf{B}] \dots$
  - c.  $QT_{\langle 2,3 \rangle}(s) = f \mathbf{F}[\mathbf{B}] \dots$
  - d.  $QT_{\langle 2,2 \rangle}(s) = f \mathbf{F}[\mathbf{B}] \dots$  @initial trapping

Since they allow monomoraic feet, both the standard  $QT_{\langle 1,3 \rangle}$  and  $QT_{\langle 1,2 \rangle}$  yield complete and exhaustive parses (8a,b). The  $QT_{\langle \min:2 \rangle}$  theories (8c,d), i.e. those that respect the bimoraic minimum and disallow monomoraic feet, show initial trapping of light syllables in this context (in either direction of parsing).

The parsings imposed by the two  $QT_{\langle \min:2 \rangle}$  theories are not always the same — they diverge in context (9), where a light syllable is flanked by heavy syllables on both sides. As shown in (9d), only  $QT_{\langle 2,2 \rangle}$  exhibits medial trapping in this situation.<sup>10</sup>

- (9)  $s = f \dots \mathbf{B} \mathbf{F} \mathbf{B} \dots$
- a.  $QT_{\langle 1,3 \rangle}(s) = f \dots [\mathbf{B} \mathbf{F}][\mathbf{B}] \dots$
  - b.  $QT_{\langle 1,2 \rangle}(s) = f \dots [\mathbf{B}][\mathbf{F}][\mathbf{B}] \dots$
  - c.  $QT_{\langle 2,3 \rangle}(s) = f \dots [\mathbf{B} \mathbf{F}][\mathbf{B}] \dots$
  - d.  $QT_{\langle 2,2 \rangle}(s) = f \dots [\mathbf{B} \mathbf{F}][\mathbf{B}] \dots$  } medial trapping

In (9),  $QT_{\langle 1,3 \rangle}$  and  $QT_{\langle 2,3 \rangle}$  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.  $QT_{\langle 1,2 \rangle}$  (9b) also produces an exhaustive parse — but consisting of three feet, the medial one monomoraic. The strictly bimoraic  $QT_{\langle 2,2 \rangle}$  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. A decision between the alternatives is only possible on strictly empirical grounds. Everything else being equal, the standard theory  $QT_{\langle 1,3 \rangle}$ , which guarantees exhaustive parsing in all imaginable situations, might appear preferable. But these are a priori considerations, and I will argue that empirically

<sup>10</sup> Strictly speaking, "noninitial 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  $f \dots \mathbf{B} \mathbf{F}$ . 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  $QT_{\langle 2,2 \rangle}$  for odd-numbered sequences of light syllables flanked by heavies, e.g. in  $\mathbf{B} \mathbf{F} \mathbf{F} \mathbf{F} \mathbf{B}$  LR<sup>6</sup> footing traps  $\mathbf{F}$ <sub>3</sub>(a), RL<sup>7</sup> footing traps  $\mathbf{F}$ <sub>4</sub>(b).

- a.  $[\mathbf{B} [\mathbf{F} \mathbf{F}] \mathbf{F}] [\mathbf{B}]$
- b.  $[\mathbf{B} \mathbf{F} [\mathbf{F} \mathbf{F}]] [\mathbf{B}]$

everything else is not equal in this case. 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>

A schematic illustration of the ways in which prosodically trapped syllables are eliminated from surface representations is given below (using the notation "...] **F**..." as shorthand for all kinds of trapping situations). The offending syllable can be directly affected (i) by lengthening, so that it can itself project a well-formed foot, or (ii) by outright deletion.

- (i) Lengthening (section 2.2)

...] **F**[...  
 9  
 ...] [**B**[...

- (ii) Deletion (section 3.2)

...] **F**[...  
 9  
 ...] Ø [...

Somewhat more indirectly, we find cases where trapping is resolved by shortening the following heavy syllable (iii), so that the prosodically trapped syllable can form a foot together with it.

- (iii) Shortening (section 2.1 and section 3.1)

...] **F** **B**...  
 9  
 ...] [**F** **F**...

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. Thus prosodic trapping can guide lexical selection (iv) in the sense that allomorphs are chosen so as to avoid the dispreferred configuration. And similar to the antigemination effect of the OCP (McCarthy 1986), we find anti-trapping effects (v), where a rule R fails to apply if its application would result in prosodic trapping.

- (iv) Allomorphy selection (section 3.3)

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

Avoid the allomorph resulting in the configuration  
 "...]F̄..."

- (v) Anti-trapping (section 2.1)  
 Rule R is blocked if its output shows the  
 configuration "...]F̄..."

In this way, the various effects of prosodic trapping reveal the underlying metrical parse of the word, and when taken as a whole, they constitute an empirical argument in favor of the strictly bimoraic quantitative trochee  $QT_{\langle 2,2 \rangle}$ .

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. This is not a cause for concern, however, nor does it diminish the force of our argument, which focusses on the convergence towards strictly bimoraic feet through a number of repair mechanisms. What is perhaps more significant is the fact that precisely this type of situation is the expected state of affairs in the recently emerging framework of Harmonic 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), see Goldsmith (1990, 1991, 1992) for a different but related proposal.

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 Harmonic Phonology as a ranked hierarchy of principles and mechanisms governing wellformedness, 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 illformed or wellformed — we are instead dealing with degrees of wellformedness (or "betterformedness"): Optimization means that representations must attain the best state available, and 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, 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  $QT_{\langle \min:2 \rangle}$ .<sup>13</sup>

### 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)  $\text{f} \overline{\text{f}} \text{f}$ <sub>wd</sub> 6  $\text{f} \overline{\text{f}} \overline{\text{f}}$ <sub>wd</sub>

"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

<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 ( $QT_{\langle \max:2 \rangle}$ ) 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.

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)	$f\overline{F}\overline{F}$ <sub>wd</sub>	ó	$f\overline{F}\overline{F}$ <sub>wd</sub>	
	putā	ó	pută	'believe', 2sg.imp.
	volō	ó	volō	'want', 1sg.
	virfī	ó	virfī	'man', gen.sg., nom.pl.
	homō	ó	homō	'human being', nom.sg.
	amā	ó	amă	'love', 2sg.imp.

Such shortenings are not motivated by the fact that words of the quantitative pattern  $f\overline{F}\overline{F}$  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, Ostwald, and Rosenmeyer 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 [ $\overline{F}\overline{F}$ ] (see (12)).<sup>14</sup>

(12)	$f\overline{F}\overline{F}$ <sub>wd</sub>	ó	$f\overline{F}\overline{F}$ <sub>wd</sub>	
	putat	ó	putăt	'believe', 3sg. pres.
	canis	ó	canĭs	'dog'
	enim	ó	enĭm	'for', conjunction
	simul	ó	simŭl	'at the same time'
	tamen	ó	tamĕn	'nevertheless'
	adest	ó	adĕst	'be present', 3sg.pres.
	legunt	ó	legŭnt	'read', 3pl.pres.
	velint	ó	velfĭnt	'want', 3pl. pres. subjunctive

A comparison of (11) and (12) with (13) shows that the iambic syllable sequence  $f\overline{F}\overline{F}$  is indeed the determining factor for shortening. Spondaic words like *mandā* ( $f\overline{F}\overline{F}$ <sub>wd</sub>) and anapestic trisyllables like *simulā* ( $f\overline{F}\overline{F}$ <sub>wd</sub>) 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.

<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.).

(13)	<b>𐀀𐀁</b> <sub>w</sub>	𐀀	<b>𐀀𐀁</b> <sub>w</sub>
	mandā	𐀀	* mandā 'entrust', 2sg.imp.
	laudō	𐀀	* laudō 'praise', 1sg.pres.
	laudant	𐀀	* laudānt 'praise', 3pl.pres.
	<b>𐀀𐀁𐀂</b> <sub>w</sub>	𐀀	<b>𐀀𐀁𐀂</b> <sub>w</sub>
	simulā	𐀀	* simulā 'simulate', 2sg.imp.
	habitō	𐀀	* habitō 'inhabit', 1sg.pres.
	habitant	𐀀	* habitānt '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 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 **𐀀𐀁** words (of high textual frequency), as exemplified by the forms in (14a).

(14)a. lexicalized shortenings:                      b. cf. unshortened:

citō	'fast'	(<citō)	sērō	'late'
modō	'only'	(<modō)	modicē	'moderate'
benē	'good'	(<benē)	longē	'long'
malē	'bad'	(<malē)	timidē	'timid'
duō	'two'	(<duō)	ambō	'both'

<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 has been documented in detail in a series of studies by Drexler (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

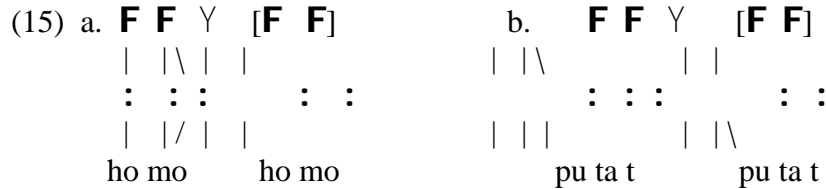
"[...] Cicero's story (*Div.ii.40.84*) of Crassus mistaking the cry of a figseller *Cauneas! Cauneas!* (sc. *ficus vendo*) for the warning *cave ne eas*, shews that *cāvē* must have been pronounced *cāvē*, or rather *cau* (cf. *neu* and *neve*), and that the whole phrase must have been uttered in some such way as *cāu(cān(e)-eas*."

And Devine and Stephens (1980, p. 145) draw attention to an inscription from Pompeii:

"[...] where the phrase *in manu* occurs in two consecutive lines both times with BB [Brevis Brevians, A.M.] in what are (both in language and in subject matter) vulgar septenarii."

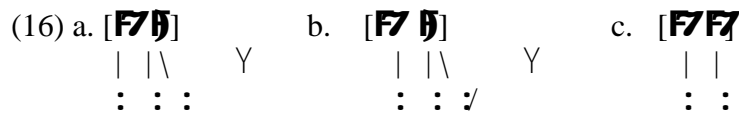
The adverbial suffix *-ē/-ō* appears with a short vowel in (14a) after an initial light syllable; in other contexts (14b), there is no shortening. A similar contrast is exhibited by the dual ending, which is realized as short *-ō* in *duō* 'two' after a light syllable, but as long *-ō* in *ambō* 'both' 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<sub><min:2></sub>). 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 are initial trapping configuration par excellence, with a prosodically stranded light syllable (~~f~~**F**~~B~~<sub>w</sub>d). Even if the final syllable is included in the foot, suspending extrametricality, no proper quantitative trochee emerges (~~\*f~~**F**~~B~~<sub>w</sub>d). 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 [~~F~~**F**~~B~~] is formed (16a), and subsequently a foot-domain rule (16b) having precisely this configuration as its environment fixes the illformed representation by removing a mora from the second syllable, resulting in a bimoraic foot (16c).



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

This way of proceeding has two drawbacks: It requires us to first build an illformed prosodic constituent which is subsequently repaired. Secondly, the statement of the rule (16) is redundant in that it repeats in its structural description the diagnosis of what is wrong with [hómC 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 suggest, 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 wellformedness principles 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 1987, 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-:
- b.     LENGTHEN:   ADD-:

These options might be conceived of as instantiations of more general schemata like "remove/add  $\square$ ", where  $\square$  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 wellformedness". This solves the redundancy problem noted above: Universal foot theory already localizes the points where wellformedness is violated. A second and related point is that as repair strategies, (17a,b) do not operate to indiscriminately remove or add moras; they operate ONLY to increase wellformedness. 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-: (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<sub><min:2></sub>) on otherwise unfootable words. A structure-changing

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

imposition of a foot is one which, simultaneous with constituent formation, invokes the designated repair strategy of the language (for Latin, REMOVE-: (17a)) to achieve a wellformed 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[mó]
- b. [hómǒ]

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 Harmonic Phonology. I will restrict myself here to a sketch of the main idea (see the cited reference for further development). The intuitive idea is the following: Final syllable extrametricality is in effect not a single constraint keeping the final syllable unfooted, but rather a set of several closely related constraints all having to do with the 'weak' prosodic status of word-final syllables.

The standard conception of final syllable extrametricality is an all-or-nothing affair and keeps the last syllable outside of all feet. The harmony-theoretic alternative sees in extrametricality instead an ordered set of preferences: For final syllables, it is best to remain completely unfooted; if footed, it is best to be the non-head of a foot; the worst option is for final syllables to be foot-heads (which happens only when entirely unavoidable, as in monosyllabic words). Final extrametricality, then, can be seen as an explication of the traditional notion that ends of words are 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.

- (19) Final syllable extrametricality:  $\langle \mathbf{F} \rangle_{*wd}$   
 For  $\mathbf{F}_{*wd}$ : (i) avoid foot-head,

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<sup>19</sup> J. Itô 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 illformed superheavy syllable, and subsequently shrinking it to the appropriate size, a parallel structure-changing syllabification should be able to immediately build wellformed syllables. The repair strategy might take the form of adjoining a consonant to a vowel mora, or of freeing one mora position by removing one of the links of the vowel melody. See Broselow (1991) for a treatment of superheavies in Arabic dialects along these lines.

<sup>20</sup> Note that the initially trapped first syllable in (18a) is not the source of illformedness, cf. the related adjective *hu[má]* <nus>. Such trapping of an initial light syllable in words which already possess a wellformed 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).

- (ii) avoid footing.

In other words, the notation "...<F><sub>wd</sub>" means "F 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 (19i) is costlier than a violation of (19ii). Returning to the case under discussion, namely (18a vs. b), we see that (19) resolves the issue. Bimoraic minimality (QT<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 (19ii); it is still preferable to obey (19i) and keep the foot-head off the final syllable, resulting in [*hómo*] (by the concomitant operation of REMOVE-: ) 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 *gubĕrnābunt* 'they will reign' as *fF766*. More examples of this kind appear in (20).

- (20) scanned as:  
*fF77F*... ,
- |    |                |                         |                       |
|----|----------------|-------------------------|-----------------------|
| a. | vo.lŭp.tātēs   | 'desires', nom.pl.      |                       |
|    | ju.vĕn.tūte    | 'youth', abl.           |                       |
|    | mi.nfĭs.tĕrium | 'service'               |                       |
|    | a.dŏp.tātus    | 'adopted'               |                       |
| b. | pu.dĭ.cĭtiam   | 'chastity', acc.sg.     | (cf. <i>pudĭcus</i> ) |
|    | a.mfĭ.cĭtiam   | 'friendship', acc.sg.   | (cf. <i>amĭcus</i> )  |
|    | ve.rĕ.bāminĭ   | 'you (pl.) were afraid' | (cf. <i>verĕbar</i> ) |

There is no doubt that the iambic word-initial syllable sequence is a precondition for such shortenings: *mo.lĕs.tōrum* 'troublesome, gen.pl.masc.' is admissible in Plautine verse with its second syllable measured short, but not \**fū.nĕs.tōrum* 'mournful, gen.pl.masc.', 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 *fF6*... . If an additional foot is erected at the beginning of the word, the concomitant REMOVE-

<sup>21</sup> It remains to be seen how other kinds of extrametricality fit into this picture. Thus E. Broselow point out (personal communication) that it is not clear whether final consonant extrametricality is readily 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.

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

(21)  $f\mathbf{F7B} \dots$  ,  
           9  
 $f\mathbf{F77} \dots$  ,

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)  $f\mathbf{7B} \dots$  ,  
           9  
 $f\mathbf{B B} \dots$  ,

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 of the

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<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 *amfícítiam* and *verēbáminfi* thus constitute the exception and not the rule (common cases of shortening like *calē-facere* 'warm, heat' involve a compound word boundary and are therefore 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-: (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 *supēlléctilis* '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 Harmonic Phonology.

alternative strategy ADD-: (17b)). The paradigm of the verb *fieri* 'become, happen' shows quantity vacillation between short *ī* and long *ī̄*, as illustrated in (23).

(23) a. short <i>ī</i> :		b. long <i>ī̄</i> :	
<i>fieri</i>	inf.	<i>ffīō</i>	1sg.pres.
<i>fierem</i>	1sg.past subj.	<i>ffīunt</i>	3pl.pres.
<i>fierent</i>	3pl.past subj.	<i>ffīent</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 ( $\bar{v} \acute{ } \check{ } / \_ \_ v$ )	
<i>fidē-fī</i>	<i>fidē-s</i> 'trust', gen./nom.sg.
<i>ffīnī-ō</i>	<i>ffīnī-re</i> 'end', 1sg./inf.

The prevocalic shortening rule predicts short *ī* in both (23a) and (23b), the preservation of long *ī̄* in the latter case is therefore unexpected. Noting that the root vowel is long preceding a heavy syllable (e.g. *ffī.ō* in (23b)) and short preceding a light syllable (e.g. *ffī.e.fī* in (23a)), Safarewicz (1954, pp. 232-233) draws attention to the rhythmic factor that is at work here. If the first syllable of *ffī.ō* (23b) were to contain short *ī* instead of long *ī̄*, as prevocalic shortening (24) would lead us to expect, an initial trapping configuration would have arisen (***fīō***). 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 *ffī.e.fī̄* (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 1954 made essentially this point).

## 2.2 The Minimal Word and Foot Minimality

<sup>23</sup> A reviewer makes the interesting observation that at earlier stages of Latin the verb *fieri* showed prevocalic long *ī̄* in a still larger class of contexts (as evidenced by attested forms like *ffīeri*, *ffīerem*, *ffīeres*, 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; even in Plautinian Latin, however, the earliest reasonably well attested stage of the language, the short-vowelled variant *ffīerfī* is already the norm. Thus the *Thesaurus Linguae Latinae* (vol.6.1, 1913, pp. 84-85) earmarks practically all occurrences of long-vowelled *ffīerfī* 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 (*fierfī*, etc.) are found everywhere else ("corripitur ceteris locis omnibus").

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, 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>

- (25) a. nominal forms: *rē* 'thing', *spē* 'hope', *vfī* 'force' (all abl.)  
 b. verbal forms: *dō* 'I give', *stā* 'stand!'  
 c. pronouns: *mē* 'me', *sē* refl., *tū* 'you', *is* 'he', *id* 'it'  
 d. conjunctions: *nē* 'lest', *sfī* '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) \*  $f_{wd}$

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).

<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: Kama, Bawana (Everett 1990), Diyari (Poser 1989, McCarthy and Prince 1986), Japanese (Poser 1990, Itō 1990), Estonian (Prince 1980), Lardil (Wilkinson 1988), 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. *legē* 'read, imp.', *pōnē* 'put, imp.', *animā* 'soul', etc.), and vowel quantity contrasts in final syllables play a central part in the morphological system (cf. note 22).

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

(i) scansion:            - ] [ -    - ] [ -    - ] [ -    - ]  
                               nam *p* sequitur simul et *t*

- (27) Trapped  
syllable
- 9
- a. *f***F7***..*
- 9
- b. *f***F7***,*

Size requirements 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 phonological word, every prosodic word at least one foot, every foot at least one syllable, etc.

- (28)
- |          |                       |
|----------|-----------------------|
| !        | (phonological phrase) |
|          |                       |
| W        | (prosodic word)       |
|          |                       |
| F        | (foot)                |
|          |                       |
| <b>F</b> | (syllable)            |
|          |                       |
| :        | (mora)                |

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 (28) and (ii) feet are minimally bimoraic, then it follows that the language cannot have monomoraic prosodic words; that is, (26) above is a consequence of foot minimality and requires no separate statement.<sup>27</sup>

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<sup>27</sup> A note of caution is in order here: Not all word size requirements are necessarily consequences of foot minimality, and foot minimality need not always automatically project into word minimality. First, nothing in the theory prevents the imposition of still more stringent additional constraints on prosodic words, over and above foot-induced minimality (for example, word bisyllabicity in addition to bimoraic foot minimality, as argued in Itô 1990 for Japanese). Furthermore, the automatic upward projection of prosodic minimality holds only as long as strict layering of the Prosodic Hierarchy is adhered to. The minimality-related work over the past years has demonstrated that this must be the unmarked case. But if strict layering can be violated in marked cases (e.g. if the category "prosodic word" can anchor directly in syllables, without an intervening foot node), subminimal words will receive a coherent prosodic structure, as suggested in Kager 1989 (see e.g. Hayes 1980, Prince 1983, 1985, Halle and Vergnaud 1987 for related proposals in earlier versions of Metrical Theory). In terms of Prosodic Licensing (Itô 1986, 1989, Goldsmith 1990), they fail at the level of foot-licensing, but are redeemed by being directly licensed 'from above', by the prosodic word. Obligatory cliticization (adjunction to another prosodic word) might be another option for subminimal content words which requires further exploration.

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 (29), this verbal category (unique in being formed without an overt ending) consists of the bare present stem.

(29)	INFINITIVE	IMPERATIVE	
	flā-re	flā	'blow'
	laudā-re	laudā	'praise'
	flē-re	flē	'weep'
	monē-re	monē	'warn'
	lege-re	lege	'read'
	pōne-re	pōne	'put'
	scī-re	scī	'know'
	audī-re	audī	'hear'

The crucial case is the verb *dā-re* 'give' (30), which has short *ā* as its stem vowel (unlike all other 1st conjugation verbs with long *ā*).

(30)	dā-te (imp.pl.)	dā-bō (1sg. fut.)
	dā-mus (1pl. pres.)	dā-tur (3sg. pres.pass.)
	dā-bam (1sg. past)	dā-tus (perf.part.)

As the imperative singular form, the morphology predicts monomoraic *dā*. But instead an otherwise unexpected process of lengthening takes place, yielding *dā* (31), enforcing the bimoraic minimality requirement of Latin.<sup>28</sup>

(31)	dā (*dā) (imp. sg.)
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The contrasting plural imperative *dā-te* in (30), 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-: (see section 2.1, (17b)).<sup>29</sup> This is illustrated in (32a), in comparison with an Iambic Shortening example exhibiting the opposite quantitative effect (32b).

<sup>28</sup> E. Broselow points out that in a similar situation different dialects of Arabic use different means (epenthesis vs. lengthening) to rescue subminimal imperative forms (cf. Broselow 1982).

<sup>29</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).

(32)	Foot assignment:	Quantitative adjustment:	
a. /dā/	[dā́]	ADD-:	(lengthening)
b. /putā/	[pútǎ]	REMOVE-:	(shortening)

In both cases, syllable quantity is adjusted so that the output is a wellformed bimoraic structure. Such 'conspiracy' effects naturally follow from a theory driven by wellformedness and a ranked series of available repair strategies.<sup>30</sup> Given that the designated repair strategy of Latin is REMOVE-:, this usually results in bimoraic syllables becoming monomoraic (32b). But in cases where REMOVE-: achieves no improvement, the secondary repair strategy ADD-: comes into play, and a monomoraic syllable becomes bimoraic (32a).

We have here confirmation for the preference-ranking of the repair strategies (17) mentioned earlier in section 2.1: It is not the case that the choice of one option in a given language implies that the other option is unavailable. Dispreferred mechanisms are still present in the grammar, but have few chances to assert themselves.

### 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 alternation governing the quantity of the theme vowel *-i-* in so-called *io*-verbs.<sup>31</sup>

In the standard system of Latin verb conjugations, the *io*-verbs are distributed over the third and fourth conjugations: The *ǎ*-verbs (e.g. *cap-ǎ-(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 (33) (after Leumann 1977, pp. 567-570): The theme vowel is short when

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<sup>30</sup> See Prince and Smolensky 1992 for a systematic development of this kind of approach; see also Itô (1986, 1989) for a similar wellformedness-driven approach to syllabification.

<sup>31</sup> The name refers to their usual citation form, the first person singular (*cap-ǎ-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, p. 507, p. 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).

preceded by a single light root syllable (*capfimus* etc.);<sup>32</sup> it is long when preceded by a heavy root syllable ((33a), *audfimus* etc.) or by two light root syllables ((33b) *aperfimus*, etc.).

(33)a.	<b>f66..</b>	b.	<b>f776..</b>	c.	<b>f777..</b>	
	<b>-ĭ</b>		<b>-ĭ</b>		<b>-ĭ</b>	
	audfimus	'hear'	aperfimus	'open'	capfimus	'catch'
	prūrfimus	'itch'	operfimus	'cover'	sapfimus	'taste'
	saepfimus	'enclose'	sepelfimus	'bury'	jactfimus	'throw'
sāgfimus	'scent'	amicfimus	'cover'	fugfimus	'flee'	
haurfimus	'draw'	reperfimus	'find'	cupfimus	'desire'	
farcfimus	'plug'	resipfimus	'taste of'	factfimus	'do'	
sentfimus	'feel'			fodfimus	'dig'	
dormfimus		'sleep'			rapfimus	'rob'
sanctfimus	'consecrate'			parfimus	'bring	
vincimus	'fetter'				forth'	

The  $\bar{i}$ - $\check{i}$  alternation is a characteristic of primary verbs;<sup>33</sup> secondary (mostly denominal) verbs uniformly take  $\bar{i}$ , irrespective of all prosodic factors. Thus the secondary verb *sit-ī-mus* 'be thirsty' (from *sitis* 'thirst') has  $\bar{i}$  in spite of its light first syllable. Many polysyllables are denominal and take  $\bar{i}$  for this reason alone, like *custōdfimus* 'guard' (cf. *custōs* 'guardian') and a host of other examples listed in the standard handbooks. This includes secondary verbs like *fulgurfimus* 'hit by lightning' and *impedfimus* 'hinder' mentioned in Allen (1973, p. 164), whose theme vowel quantity is not prosodically determined (see Leumann 1977, p. 556), but rather the default  $\bar{i}$  assigned to all denominal verbs.<sup>34</sup> As a result,  $\bar{i}$ -verbs are much more frequent than  $\check{i}$ -verbs, and length emerges as the default quantity of the theme vowel, paralleling long  $\bar{a}$  in the first conjugation (e.g. *laud-ā-mus* 'praise') and long  $\bar{e}$  in the second conjugation (e.g. *mon-ē-mus* 'admonish').

<sup>32</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  $\check{i}$  to  $\check{e}$  before  $r$  is responsible for the infinitive *capĕre* 'catch' (from *capfire*), 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>33</sup> An exception to the generalization in (33) is found in resonant-final roots, which in general show  $\bar{i}$  even after a light syllable (e.g. *venfimus*, \**venfimus* 'come'). But even within this class,  $\check{i}$  appears after  $r$ -final roots with a light root syllable (cf. *parfimus* in (33c)).

<sup>34</sup> Cf. *fulgur* 'lightning'; for *impedfimus* (lit. 'tie with foot shackles'), cf. *expedfimus* 'make free, develop' (lit. 'untie'), *compedfimus* 'shackle s.o.'s feet together', *compēs* 'foot shackle', and *pēs*, *pēdis* 'foot'. Such secondary verbs with the quantitative pattern **f67..**, do not bear on the prosodic factors governing the  $\bar{i}$ - $\check{i}$  alternation in primary verbs; in particular, they do not call for trimoraic feet [**67**] (pace Kenstowicz (1991)). Primary verb forms with the quantitative pattern **f67..**, in fact show short  $\check{i}$ , see (36c) *dēsipimus* and the subsequent discussion.

It has long been hypothesized (since Thurneysen's (1879) work on the topic, see Niedermann 1908) that the ultimate historical source for the Latin  $\bar{i}$ - $\check{i}$  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  $*-y^e/o-$  with an initial semivowel, see Meillet and Vendryès (1966, pp. 282-284)), and never affects the theme vowels  $-\bar{a}-$  and  $-\bar{e}-$ . 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  $\bar{i}$ - $\check{i}$  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  $-\bar{i}$  instead of  $-\check{i}$  were quite frequent in Early Latin, citing Plautinian forms like *cap̄tis* 'desire, 2sg' (instead of classical *cap̄tis*), *fac̄tis* 'do, 2sg' (instead of *fac̄tis*), or *fac̄tit* 'do, 3sg' (instead of *fac̄tit*); and the archaizing Latin of Lucretius has *cup̄f̄irent* 'desire' (3pl. imperf. subj.) for classical *cup̄erent*, 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>35</sup>

With these preliminary considerations out of the way, we can turn to the synchronic analysis of the  $\bar{i}$ - $\check{i}$  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  $\bar{i}$ - $\check{i}$  alternation; at the same time, it should recognize that the same prosodic factor is at work here that was involved in Iambic Shortening (2.1) and Word Minimality (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  $*cap̄f̄imus$ , for example, is avoided in favor of *cápf̄imus* because the first leads to initial trapping of a light syllable.

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<sup>35</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  $\bar{i}$ - $\check{i}$  alternation.

In order to make this idea more precise, we hypothesize that the theme vowel /i/ constitutes a separate morpheme, with the two allomorphs listed in (34).

- (34) 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 in situations where short quantity results in a more optimal prosodic organization (in a slogan, "pick the best collocation").

The operation of prosodic selection is illustrated in (35) by comparing the possibilities that arise when  $-\check{i}$  and  $-\bar{i}$  are freely combined with representative roots from (33) above. The correct forms are enclosed in boxes.

- (35)
- |  |  |  |
|--|--|--|
| <p>a. <math>\boxed{[B [B]}</math><br/> <math>/   /  </math><br/>                 a u d <math>\mathcal{P}</math>&lt;mus&gt;<br/>                 aud <math>\mathcal{P}</math>mus</p>    | <p>b. <math>[F7F7 [B]</math><br/> <math>  /   /  </math><br/>                 a p e r <math>\mathcal{P}</math>&lt;mus&gt;<br/>                 aper <math>\mathcal{P}</math>mus</p>      | <p>c. <math>F7 [B]</math><br/> <math>/   /  </math><br/>                 c a p <math>\mathcal{P}</math>&lt;mus&gt;<br/>                 (*cap <math>\mathcal{P}</math>mus)</p> |
| <p>a'. <math>\boxed{[B F7}</math><br/> <math>/   /  </math><br/>                 a u d <math>\mathcal{Z}</math>&lt;mus&gt;<br/>                 (*aud <math>\mathcal{Z}</math>mus)</p> | <p>b'. <math>F7 [F7 F7]</math><br/> <math>  /   /  </math><br/>                 a p e r <math>\mathcal{Z}</math>&lt;mus&gt;<br/>                 (*aper <math>\mathcal{Z}</math>mus)</p> | <p>c'. <math>[F7 F7]</math><br/> <math>/   /  </math><br/>                 c a p <math>\mathcal{Z}</math>&lt;mus&gt;<br/>                 cap <math>\mathcal{Z}</math>mus</p>  |

If choice of allomorph is guided by a prosodic selection criterion favoring optimal collocations, we can make sense of this distribution. As in section 2.1 for cases of word-internal Iambic Shortening, the analysis here assumes that, driven by Prosodic Licensing (Itô 1986, 1989, Goldsmith 1990), the prosodic representation of Latin words is organized in terms of foot structure beyond the main stress foot (see section 3.1 below for further discussion and motivation).

In the case of the light root *cap-*, the primary allomorph  $-\bar{i}$  leads to initial trapping of the root syllable (35c); the secondary allomorph  $-\check{i}$  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  $-\check{i}$ . In (35a,b), on the other hand, choosing the primary allomorph  $-\bar{i}$  results in the optimal prosodic structure, whereas the secondary allomorph  $-\check{i}$  would result in trapping.

The proposed analysis receives additional support from overt alternations between unprefixed light verb roots taking the theme vowel  $-\check{i}$  (36a) and their prefixed counterparts

taking  $-\bar{i}$  (36b). In this case, the addition of a light-syllable prefix<sup>36</sup> changes the prosodic environment: Prosodic selection chooses the long theme vowel in (36b), contrasting with the short theme vowel in (36a). But when the prefix consists of a heavy syllable (36c), the short theme vowel emerges again.<sup>37</sup>

- (36) a.  $[F\bar{F}F]$   
 |  
 $-i$   
 par̄imus 'bring forth'  
 sap̄imus 'taste'
- b.  $[F\bar{F}F][B]$   
 |  
 $-i$   
 re-per̄imus 'find'  
 re-sip̄imus 'taste of'
- c.  $[B][F\bar{F}F]$   
 |  
 $-i$   
 dē-sip̄imus 'be out of one's mind'

The contrast between *resip̄i-mus* (36b) and *dēsip̄i-mus* (36c) emphasized by Niedermann (1908, p. 51) is particularly telling since both are derived from the same root, the only difference lies 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  $[BF]$  constituted licit trochees:  $*[dēs̄i][p̄i]-$  shows no trapping but is footwise isomorphic to  $[res̄i][p̄i]-$ , and we would expect long  $-\bar{i}$  in both forms (rather than the actually observed short  $-i$  in the first case).<sup>38</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 wellformedness of several candidate collocations, such selection and optimization mechanisms find a natural place in non-

<sup>36</sup> Note that the preverb *rĕ-* has a short vowel in Latin (Leumann 1977, pp. 559-560).

<sup>37</sup> A less transparent case of a similar kind is *amic̄i(-mus)* 'cover' with  $-\bar{i}$  (literally 'throw around'), which is based on the preverb *am(b)-* 'around' and *jac̄i(-mus)* 'throw' with  $-i$ . 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).

<sup>38</sup> Alongside *d̄'sipimus*, Niedermann lists, as further examples with the rhythmic pattern  $[BF]$ ..., *conspicimus* 'sight', *illicimus* 'attract', and *porricimus* '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 (*jacimus?*), or because the roots themselves had almost completely fallen out of use (*specimus*, *lacimus*). Similar observations hold for *d̄'sipimus* (cf. Niedermann 1908, p.51: "*d̄'sipis* enfin pourrait, en principe, être refait sur *sapis*, mais cette hypothèse doit être écartée en raison de l'existence de *resip̄is* [...]. L'alternance *sapis sapere : resip̄is resip̄ire : dēsip̄is dēsip̄ere* est particulièrement caractéristique et l'importance de cet argument en faveur de ma théorie n'échappera à personne.")



(38)                   footed  
                           9  
                   ... [ **B****F**<sub>F</sub> **B** ...  
                                   **F****F**<sub>F</sub>

The structural contrast between the noncontiguous footing in (37) and the contiguous footing in (38) makes it possible for us to bring empirical evidence to bear on the question of the maximal trochee.<sup>40</sup> The argumentation will involve the assumption that noncontiguous footing of a string is prosodically nonoptimal 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 wellformed, as far as contiguous footing is concerned. In particular, since the configuration (38) is just as good as any other, there is no reason to expect the existence of specific processes transforming it into something else.<sup>41</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 (37) 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" in traditional Latin metrics. 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 word-final "cretic" syllables sequences of the form *f*... **B****F**<sub>wd</sub>, as illustrated in (39a).<sup>42</sup>

9  
 ... [ **F****F**<sub>F</sub> **F** [ **B** ...

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 [ **B****F****B** ], where medial trapping arises only in QT<2,2> and is independent of directionality.

<sup>40</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.

<sup>41</sup> The situation is different once markedness considerations are brought into play, as in Harmonic Parsing (Prince 1990), see section 4.2 for discussion.

<sup>42</sup> The name derives from the *creticus* (—<sup>-</sup>—), a metron that occurs as a rhythmic element in classical meters.

- (39) a. Cretic Shortening:                      b. cf. Iambic Shortening:  
 $f \overline{B} \overline{F} \overline{7} \overline{6}$ , 6  $f \overline{B} \overline{F} \overline{7} \overline{7}$ ,                       $f \overline{7} \overline{6}$ , 6  $f \overline{7} \overline{7}$ ,  
 d̄f̄icitō                      d̄f̄icitō                      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 based on 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 (40).

- (40)
- |   |   |   |                      |
|---|---|---|----------------------|
| $f \overline{B} \overline{F} \overline{7} \overline{6}$ | 6 | $f \overline{B} \overline{F} \overline{7} \overline{7}$ |                      |
| d̄f̄icitō   |   | d̄f̄icitō   | 'say', imp.fut.      |
| d̄f̄ikserō  |   | d̄f̄ikserō  | 'say', 1sg.fut.perf. |
| imperā  |   | imperā  | 'rule', imp.         |
| mak.sumē  |   | mak.sumē  | 'most', adv.         |
| Hēgiō   |   | Hēgiō   | (name)               |
| mentiō  |   | mentiō  | 'mention'            |
| Polliō  |   | Polliō  | (name)               |
| harpagō   |   | harpagō   | 'grappling-iron'     |
| nes.ciō   |   | nes.ciō   | 'not know', 1sg.     |
| dēsiniō   |   | dēsiniō   | 'cease', 1sg.        |
| commodā   |   | commodā   | 'adjust', imp.       |
| quōmodō   | ☞ | quōmodō   | 'in what way?'       |

In an analogous way, final closed syllables, whether with long vowels (41a) or simply heavy by position (by the presence of one or more coda consonants) (41b), can be measured short in cretic contexts.

- (41)
- |    |   |   |   |                           |
|----|---|---|---|---------------------------|
|    | $f \overline{B} \overline{F} \overline{7} \overline{6}$ | 6 | $f \overline{B} \overline{F} \overline{7} \overline{7}$ |                           |
| a. | ēnicās  |   | ēnicās  | 'murder', 2sg.            |
|    | l̄f̄iberās  |   | l̄f̄iberās  | 'free', acc.pl.fem.       |
|    | virginēs  |   | virginēs  | 'virgins', nom/acc.pl.    |
|    | grātiās   |   | grātiās   | 'thanks', acc.pl.         |
|    | turbinēs  |   | turbinēs  | 'whirl', nom/acc.pl.      |
| b. | d̄f̄ikserint  |   | d̄f̄ikserf̄int  | 'say', 3pl.perf.subjunct. |
|    | vēnerant  |   | vēnerānt  | 'come', 3pl.fut.perf.     |

Final syllables only shorten 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 (42) demonstrate that the heaviness of the antepenultimate syllable is indeed a necessary condition.<sup>43</sup>

(42)	<b>f7776</b>		
	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 *dficitō* (43a) and in deweighting of coda consonants in *vēnerānt* (43b).

(43)a.	<b>6 7 6</b>	Y	<b>6 7 7</b>
	\     \		\
	: : : : /		: : : :
	/     /		/
	d i c i t o		d i c i t o
b.	<b>6 7 6</b>	Y	<b>6 7 7</b>
	\     \		\
	: : : : /		: : : :
	/     \		/     \
	v e n e r a n t		v e n e r a n t

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 *dficitō* (6 *dficitō*) and the non-shortening form *fācitō* (\**fācitō*) (cf. (40) and (42)). In both cases the penult is light; as (41) illustrates, whether or not the final syllable undergoes shortening is determined by the quantity of the non-adjacent accented antepenult.

<sup>43</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. It is limited to the single vowel *ō* 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 *ō* 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 scansiones like *ergō* for *ergō* 'therefore' and *Sulmō* for *Sulmō*).

(44)           ... **F** **F** **B**<sub>i</sub>  
                   8       8

It is hard to see how a heavy antepenultimate syllable could directly trigger a shortening of the final syllable. This nonlocal 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). 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*<*tō*> *ó* [*pútō*]), properly understood as a structure-changing imposition of a bimoraic trochee (i.e. accompanied by the designated repair strategy REMOVE-: (17a)).

But this mode of explanation does not carry over to the cretic case. In words of the form ~~**f****7****B**~~, a wellformed foot has already been successfully established ([*fím*]*pe*<*rā*> by QT<2,2>, [*fímpe*]<*rā*> by QT<max:3>); 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 this is an unfortunate result: 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>44</sup> They should not be separated into a pair of accidentally cooccurring 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 assigned by primary foot formation, which is instrumental in building wellformed 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 postaccentual material.

The proposal is best explained on the basis of a concrete example. Assuming strict bimoraicity (QT<2,2>), a cretic word like [*dfí*]*ci*<*tō*> comes out with a footed antepenult [*dfí*] (which receives the word accent by End Rule (Final)) and an extrametrical final syllable <*tō*> (45a-c); trapped in between is the loose postaccentual syllable *ci*. This representation is optimized by building further foot structure on the (light) penult. This is referred to in (45d) 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

<sup>44</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).

heavy final undergoes shortening, again by means of the designated repair strategy REMOVE-: (17a) as the trochaic foot is imposed: [*dfī*]ci<tō> ́ [*dfī*][*ci*tō] 'say, imp.fut.' (45d). In this way, Cretic Shortening is nothing but Iambic Shortening applying to a subsidiary (and unaccented) word-final foot.

- (45) a. Extrametricality:                    **ĥ F7<ĥ>**  
   dfī ci tō
- b. Primary foot formation:                **[ĥ] F7<ĥ>**  
   dfī ci tō
- c. End Rule (Final):                        \*  
   **[ĥ] F7<ĥ>**  
   dfī ci tō
- d. Subsidiary foot formation **[ĥ] [F7F7]**  
     & REMOVE-: :                            dfī ci tō

When the final syllable is already light, as in [*dfī*]ci<te> ́ [*dfī*][*ci*te] 'say, imp.pl.', the derivation follows the same steps, except that the additional foot can be imposed without any quantity adjustments.

The subsidiary foot in (45d) is a formal element of prosodic constituent structure, in this case empirically tangible through its effects on syllable quantity. Its presence does not imply a secondary stress in this position, there is no "stress clash".<sup>45</sup>

Subsidiary foot formation is motivated by a basic wellformedness requirement of prosodic phonology: At the end of the phonological derivation, every element of the phonological string must be prosodically licensed (Itô 1986, 1989, Goldsmith 1990). The optimal representation (in terms of the prosodic hierarchy) is one in which all syllables are grouped into feet, to the extent possible. In the abstract, any kind of foot in the universal typology could be recruited for this purpose — but the Uniformity Principle (McCarthy and Prince 1986) requires subsidiary foot formation to make use of the canonical foot of the language (for Latin, the quantitative trochee).<sup>46</sup>

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<sup>45</sup> Note in this context also the possibility that the Latin accent was in effect a pitch accent, cf. note 3 in section 1.1.

<sup>46</sup> The principle of Prosodic Licensing must be sharply distinguished from conditions on rule application like the Exhaustivity Condition of Halle & Vergnaud (1987, p. 15) (which governs the application of constituent construction rules), see Kager (1992a). It is in fact immaterial for purposes of the present discussion whether primary foot formation is viewed as noniterative (the usual view) or as exhaustive, followed by line conflation, as proposed in Halle 1990 (see Blevins (to appear) for arguments against exhaustivity in this sense). Either way, what I am calling subsidiary footing must take place in a second round of foot formation, after the primary accent foot has

Let us now return to the central theoretical issue of this section, foot maximality. As we have just seen, bimoraic maximality (QT<2,2>) makes it possible to give an analysis which not only accounts for both Cretic and Iambic Shortening in a motivated way, but also establishes the unity of the two processes at a higher level.

If bimoraic maximality does not hold and the trimoraic quantitative trochee [67] is systematically admitted, this result is not attainable. The crucial difference lies in the structure assigned by primary foot formation. As (46b) shows, the penultimate syllable of cretic words is parsed into a single foot with the antepenult. Since in this case the result of primary foot formation is already optimal in all relevant respects, with the medial syllable *ci* fully footed, there is no explanation for the observed shortening of the final syllable *tō*.

- (46) a. Extrametricality:  $\text{F F7<F>}$   
           *dfi ci tō*
- b. Primary foot formation:  $[\text{F F7<F>}]$   
           *dfi ci tō*

Cretic Shortening, then, is unwelcome news for trimoraic trochee theory: Recall from the introduction (cf. (4) in section 1.1) that it is precisely words with light penults and heavy antepenults that constitute the main empirical reason for admitting such feet in the first place; this, if anywhere, is where they should prove robust. Trimoraic trochee theory renders the two cases *dficitō* and *facitō* (cf. (40) and (42)) foot-structurally equivalent, as [*dfici*]*<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 (46). 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 correct insight, namely that representations are optimal to the extent that the whole word, and in particular the postaccentual material, is fully parsed into feet. But this insight is implemented by a single pass of an exhaustive footing algorithm that never skips a syllable. Trapping configurations do not arise in this approach, and this makes it impossible to provide a unified analysis for the two shortening processes.

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already been established. As (45) indicates, I am assuming that main stress (i.e. End Rule (Right), in the sense of Prince 1983, Kager 1989, and Hayes 1991) applies after Primary Foot Formation (45b) but before Subsidiary Foot Formation (45c): In other words, main stress is assigned as soon as a foot is available that can serve as the prosodic head of the word. (45b) and (45d) might in effect be widely separated in the derivation.

To complete the argument, let us consider the possibility of invoking subsidiary foot formation in the trimoraic analysis (46). Since everything besides the extrametrical syllable is already fully parsed, only the final (extrametrical) syllable is available for footing ( $[df̄ici] < t̄ō > \acute{[df̄ici][t̄o]}$ ). 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 ( $[df̄ici][t̄o] \acute{[df̄ici][t̄o]}$ ), 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  $[df̄ici] < te >$  'say' (imp.pl.). But such lengthening, which would result in  $*df̄icitē$ , 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 ( $f\mathbf{F}\mathbf{B}$ ,  $f\mathbf{B}\mathbf{F}\mathbf{B}$ ) 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 (47).

(47) Restructuring:  $\begin{array}{c} [\mathbf{f}] \mathbf{F}\mathbf{7} < \mathbf{f} > \acute{[ \mathbf{f} ]} [\mathbf{F}\mathbf{F}\mathbf{7}] \\ d\mathbf{f}ci \ t\mathbf{C} \quad d\mathbf{f}ci \ t\mathbf{O} \end{array}$

A first point to note here is that (47), 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 (45): 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 (47) by including an intermediate step: First the penult is detached from the trimoraic foot ( $[\mathbf{f}\mathbf{F}\mathbf{7}] < \mathbf{f} > \acute{[ \mathbf{f} ]} \mathbf{F}\mathbf{7}\mathbf{B}$ ) and is turned into a stray syllable; this triggers the subsequent construction of the subsidiary foot ( $[\mathbf{f}\mathbf{F}\mathbf{7}\mathbf{B}] \acute{[ \mathbf{f} ]} [\mathbf{F}\mathbf{F}\mathbf{7}]$ ) (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  $f\mathbf{B}\mathbf{F}\mathbf{B}$  are prosodically structured not as in (48b), with a trimoraic trochee, but as in (48a), with a bimoraic trochee followed by an unfooted syllable triggering further foot building.

(48) a.  $[\mathbf{B}\mathbf{F}\mathbf{7}] < \mathbf{B} >$       b.  $[\mathbf{B}\mathbf{F}\mathbf{7}] < \mathbf{B} >$

When the various shortening processes of Latin are confronted in their totality, a successful prosodic explanation must simultaneously account for all of (i)-(iii).

- (i) Shortening in iambic words: *putō* 6 *putō̄*, etc.
- (ii) Shortening in cretic words: *dficitō* 6 *dficitō̄*, etc.
- (iii) No Shortening in other cases: *laudō* (\**laudō̄*), *simulō* (\**simulō̄*), 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 (49).

- (49)           ... [**6** **7**[**6** ...  
                           9  
                           Ø

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. Latin syllable structure significantly limits the role that such a syncope process can play. Consonant loss is generally avoided, and the superheavies (CVVC, CVCC) resulting from resyllabifying consonants into already heavy syllables have a marked status in Latin syllabification (see Allen 1973, pp. 66-67, p. 141).

Burger (1928, pp. 37-52), who argues for a (morally) binary rhythmic organization in Latin within a framework very different from the present one (see the review in Leumann 1931), claims that a scenario as in (49) is borne out by a certain syncope process in Latin that I will refer to as "Early Syncope" (to be contrasted with other syncopation processes found in the history of the language, see the discussion below). Typical cases of Early Syncope in posttonic position appear in (50); these examples all share the property of having a light penult trapped between a heavy antepenult and a heavy final.<sup>47</sup>

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<sup>47</sup> For many examples the unsyncopated 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).

(50)	[ <del>BF7</del> ]	[ <del>B</del> < <del>B</del> ]	
	lāridfī	lardfī	'bacon', gen.sg.
	perregō	pergō	'continue' (cf. perrēxfī)
	porrigō	porgō	'stretch out'
	surrigō	surgō	'raise' (cf. surrēxfī)
	pūrigō	purgō	'clean'
	jūrigō	jurgō	'quarrel'
	aevitās	aetās	'age'
	ūvidōs	ūdōs	'wet', acc.pl.m.

Syncope is perhaps the most complex chapter of Latin historical phonology (see e.g. Sommer & Pfister 1914/1977, pp. 108-111); the following analysis is largely based on Burger's findings and generalizations. Given the complexity of the facts, conclusions in this area must remain tentative. The main analytical difficulty regarding Latin syncope is the task of disentangling the historical situation. At various stages in the development of the language, different syncope processes were at work, which operated under partially different conditions (see Burger (1928, pp. 37-52) for a detailed examination of these questions). For present purposes, the most important result of Burger's work is the distinction between (i) Prehistoric Syncope, (ii) Early Syncope (in Early and Classical Latin), and (iii) Late Syncope (in Late and Vulgar Latin, with pervasive reflexes in the Romance languages).<sup>48</sup>

We are here concerned with Early Syncope: vowel loss during the period of the language that is the subject of this paper (Preclassical and Classical Latin), under the (ante)penultimate accent law. For this period, various scholars have noted an interesting restriction on 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 (50). And Vendryès (1902) determines the canonical context of Early Syncope still more narrowly as a light syllable between heavies (cf. (49)).<sup>49</sup> Burger (1928), building on Vendryès' generalization, presents a significant amount of evidence, giving careful consideration to a number of possible counterexamples.<sup>50</sup>

<sup>48</sup> The distinction between the latter two is particularly important: Besides chronological and sociolinguistic differences, they are disparate in scope and in prosodic conditioning. For example, different from Early Syncope, characteristic examples of Late Syncope (like *solidus* < *soldus* 'solid') do not undergo phonological rules of Early Latin like *o*-Raising before coda resonants (*soldus*, \**suldus*) and are entirely absent from the texts of the early dramatists. For further discussion, see the end of this section.

<sup>49</sup> Burger (1928, p. 45) notes that Vendryès (1902) "[...] constate que, dans la grande majorité des cas, la syncope se produit là où la voyelle brève était placée entre deux syllabes longues (voir *Intensité initiale*, p.242 et suiv.) [...]."

<sup>50</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. [~~BF7F7~~]. The overwhelming majority of his examples, however, instantiate the heavy-syllable context [~~BF7B~~]. I will furthermore restrict the discussion to posttonic syncope following the antepenultimate accent, see Burger (1928) for pretonic cases (which mostly also occur in trapping configurations).

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. The crucial observation is that such examples constitute a small minority in the literary language, contrasting with the large majority of the cases where posttonic syncope took place in the trapping environment after a heavy syllable (49). 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 defend against 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 (I am grateful to a reviewer and to Ellen Broselow for clarification of the logic of the argument). 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  $f\mathbf{F}\mathbf{F}\mathbf{B}$  like *lāridfī* in (50) were in a significant number of cases subject to Early Syncope. On the other hands, words of the form  $f\mathbf{F}\mathbf{B}$  like *calidfī* 'warm, gen.' remained largely unaffected and retained their posttonic 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 syncopated to *\*denque*.

The interesting point about Vendryès' and Burger's (1928) syncope generalization is the fact that the context (50) amounts to a trapping configuration, as illustrated in (51a). Strictly bimoraic parsing leaves the medial syllable *ri* unfooted, the overall prosodic configuration is in fact identical to that of Cretic Shortening (cf. (45b)). In (50), trapping is resolved by a lexically restricted syncope process, taking precedence over the more general shortening process.

- (51) jūrigō ó jurgō 'quarrel'
- |             |  |               |  |
|-------------|--|---------------|--|
| a. QT<2,2>: | jū ri gō                               | b. QT<max:3>: | jū ri gō                               |
|             | $[\mathbf{B} \mathbf{F} < \mathbf{B}]$ |               | $[\mathbf{B} \mathbf{F} < \mathbf{B}]$ |
|             | 9                                      |               |  |
|             | ∅                                      |               |  |

The trapping environment, and hence the foot-structural motivation for syncope, hinges on bimoraic maximality: As shown in (51b), 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 (51a) 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* (52a) 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 *calidfī* (52b), also show no trapping since they



deletion in the weak position of a foot, but only if trochees with trimoraic expansions are allowed. In other words, if both [~~GF~~] and [~~FF~~] constitute licit quantitative trochees, the syncope rule can target nonhead 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 an open penult the stress could fall either on the penult or the antepenult and was no longer predictable within the synchronic grammar (I am assuming that familiar abstractness considerations rule out analyses attempting to reconstruct the 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.<sup>53</sup>

Suppose we turn this generalization into the cornerstone of our analysis: Closed syllables count as heavy only in penultimate position (i.e. word-finally, with extrametricality of the last syllable);<sup>54</sup> and as a lexical idiosyncrasy, a number of (historically long-vowelled) open penults carry 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) analysis (which defines all feet except for the last one 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. (54) illustrates this by contrasting the classical form *tābulam* 'board' (54a) (which did not fullfill 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* (54b). The latter turned into French *table* by way of syncope of the penultimate vowel.

- |         |                  |                     |                    |
|---------|------------------|---------------------|--------------------|
| (54) a. | Classical Latin: | [tá]bu<lam> 'board' | [cáli]<dus> 'warm' |
| b.      | Late Latin:      | [tábu]<lam>         | [cáli]<du>         |
| c.      | French:          | (table)             | (chaud)            |

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<sup>53</sup> In Jacobs' (1990, p.101) analysis, this is reflected by the fact that all feet except for the last foot in the word are quantity-insensitive.

<sup>54</sup> See Hayes (1991, p.205) for a similar proposal regarding initial syllables in the Norton Sound Dialect of Central Alaskan Yupik.

The crucial point is that at the stage of Late Latin, the foot in (54b) includes the penultimate syllable in *tábulam* just as in *cálidu* (French *chaud*), and different from the classical footing of *tábulam* in (54a) (compare also (52) and (51) above): The old foot-structural contrast between  $f[\mathbf{BFZF}]<_r$  and  $f[\mathbf{FFZ}F]<_r$ , 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 posttonic light syllables stranded between heavies, 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 wellknown 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. Among the many examples of this kind of prosodic selection that can be found in the standard grammars and in particular in Niedermann (1928) and Burger (1928), two studies devoted to rhythmic effects in Latin derivational morphology, consider the distribution of the suffixes *-ia* and *-iēs*, which form abstract nouns of the 1st and 5th declinations, 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 (55).

(55)	<b>-i.a</b>	<b>-i.ēs</b>
	<b>BFZF</b>	<b>BFZF</b>
	grā.ti.a 'grace'	*grā.ti.ēs
	au.dā.ci.a 'audacity'	*au.dā.ci.ēs
	clē.men.ti.a 'clemency'	*clē.men.ti.ēs

The skewing of the lexical distribution observed here makes sense under prosodic selection: The *-iēs* variant is avoided after heavy syllables because of its 'built-in' medial trapping structure (e.g.  $*[grā]ti<ēs>$ ,  $*[au][dā]ci<ēs>$ ), 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 wellformedness of the whole output form is the determining factor: After all, there is nothing about *grāt-* and *-ia* in (55), considered in lexical isolation, that would attract them to each other.<sup>55</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 noncanonical formations that emerges from Burger's (1928) study is that noncanonical 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 (56a), with a perfect stem consisting of the verb root followed by short *-ū*.<sup>56</sup>

- (56) a.      mon<sup>6</sup>re      'warn', pres.inf.  
               root:            mon-  
               present stem: mon-<sup>6</sup>-  
               perfect stem: mon-ū<sup>7</sup>  
               1sg perfect: mon-ū<sup>7</sup>

b.      Other examples:

decēre	decufi	'be seemly'	rigēre	rigufi	'be stiff'
docēre	docufi	'teach'	rubēre	rubufi	'be red'
egēre	egufi	'be in need'	silēre	silufi	'be silent'
habēre	habufi	'have'	studēre	studufi	'strive'
jacēre	jacufi	'lie'	stupēre	stupufi	'be stunned'
latēre	latufi	'be hidden'	tacēre	tacufi	'be silent'
madēre	madufi	'be wet'	tepēre	tepu <sup>8</sup> fi	'be warm'
merēre	merufi	'deserve'	timēre	timufi	'be afraid'
nitēre	nitufi	'be shiny'	tumēre	tumufi	'be swollen'
nocēre	nocufi	'harm'	valēre	valufi	'be strong'

<sup>55</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>56</sup> The following overview is based on Burger (1928, pp. 22-31). In accordance with standard practice, the 1sg. (*-ufi*) 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-istfi*, *mon-u-it*, etc.) and the perfect infinitive (*mon-u-isse*). Vowel-final roots take a variant in *-v-* (e.g. *flē-re flē-v-fi* 'weep', *dēlē-re dēlē-v-ī* 'destroy'). Historically *u* is a contraction of /i+v/ (*monufi* < *monivai*, cf. *monitus* perf.part.), see Leumann (1977, p. 594).

olēre	olufi	‘smell’	vigēre	vigufi	‘be vigorous’
patēre	patufi	‘be open’	virēre	virufi	‘be green’
placēre	placufi	‘please’			

Among the noncanonical perfect formations in the 2nd conjugation, the most important is the sigmatic perfect or *s*-perfect (57a) (perfect stem: root+/s/, with segmental adjustments).

- (57) a.      augēre                      'enlarge', pres.inf.  
               root:                        aug-  
               present stem:            aug-ē-  
               perfect stem:        auk-s-  
               1sg perfect:            auk-s-fi

b.      Other examples:

algēre	alsfi	‘be cold’	rfdēre	rfisfi	‘laugh’
haerēre	haesfi	‘hang’	suādēre	suāsfī	‘advise’
indulgēre	indulsfi	‘be indulgent’	tergēre	tersfi	‘wipe clean’
lūgēre	lūksfi	‘mourn’	turgēre	tursfi	‘be swollen’
mulcēre	mulsfī	‘stroke’	urgēre	ursfi	‘urge’

The other noncanonical perfect formation in the 2nd conjugation is the archaic reduplicating perfect found with a few verbs (58).<sup>57</sup>

- (58)    spondēre    spondfi    ‘vow’  
               mordēre    momordfi    ‘bite’  
               tondēre    totondfi    ‘shear’

The contrast between canonical and noncanonical formations seen for the finite perfect forms in (56)-(58) has further ramifications and parallels in other morphological categories (the supine and the perfect participle).<sup>58</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

<sup>57</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-*).

<sup>58</sup> *u*-perfect formations correspond to perfect participles in *-itus* (e.g. *monufi*, *monitus*), whereas *s*-perfect formations correspond to perfect participle in *-tus*, without connecting vowel (e.g. *auksfi*, *auctus*), as do reduplicating perfects (e.g. *momordfi*, *morsus*). One of the very few exceptions to this correlation is the verb *docēre* 'teach', with the *u*-perfect *docufi* 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).

productive. Noncanonical formations appear where the *u*-perfect would result in a medial trapping configuration *f...**FB**...*.

Such a configuration arises after root ending in heavy syllables,<sup>59</sup> which is exactly what the *augēre*-type verbs (57) and the reduplicating verbs (58) have in common (contrasting with the *monēre*-type verbs with light root syllables in (56)). The crucial factor is that in a significant part of the paradigm<sup>60</sup> of verbs with heavy root syllables the *u*-perfect give rises to nonoptimal collocations with medial trapping, whereas the *s*-perfect<sup>61</sup> does not (59a). Verb roots ending in a light syllable (59b), 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.)

(59)		<i>u</i> -perfect				
a.	<b>B</b>	<b>F7</b>	<b>B</b>	<b>B</b>	<b>B</b>	
<i>augēre</i>	*au	gŭ	fī	auk	sŕī	'enlarge'
<i>algēre</i>	*al	gŭ	fī	al	sŕī	'be cold'
<i>suādēre</i>	*suā	dŭ	fī	suā	sŕī	'advise'
<i>mordēre</i>	*mor	dŭ	fī	momor	dfī	'bite'
b.	<b>F7</b>	<b>F7</b>	<b>B</b>			
<i>monēre</i>	mo	nŭ	fī			'admonish'
<i>tacēre</i>	ta	cŭ	fī			'be silent'
<i>stupēre</i>	stu	pŭ	fī			'be stunned'
<i>abolēre</i>	abo	lŭ	fī			'abolish'

The lexical selection of perfect formations is schematically illustrated in (60).

(60)	a. <i>monēre</i> 'warn'	b. <i>augēre</i> 'enlarge'	
	canonical	noncanonical	canonical
	perfect:	perfect:	perfect:
	[ <b>F7</b> < <b>B</b> ]	[ <b>B</b> < <b>B</b> ]	[ <b>B</b> ] <b>F7</b> < <b>B</b> >
	<i>mo nu fī</i>	<i>auk sŕī</i>	<i>*au gu fī</i>
	a	—	
	Lexical Selection		

<sup>59</sup> Note that "heavy syllable" here effectively means "closed syllable", since all vowel-final roots take *-v-* to form the perfect stem, see note 52.

<sup>60</sup> Only the 1sg. forms are illustrated in (59), but similar considerations hold for many other forms of the paradigm (e.g. 2sg. *auk.sis.tŕī* **fBB** vs. *\*au.gu.is.tŕī* **fBFB**, perf.inf. *auk.sis.se* **fBB7** vs. *\*au.gu.is.se* **fB7B7**, etc.).

<sup>61</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).

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>62</sup>

The mechanism of prosodic lexical selection invites further exploration in the framework of Harmonic 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 corresponding pressure towards the selection of the noncanonical form since a perfect like *\*auguŕi* would be fully footed as [augu]<ŕi> (or [au][gu]<ŕi>).

#### 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>63</sup>, whose reliability has remained controversial, enclitics like the 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 *lfimináque* 'and

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<sup>62</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 *frīksŕi* in Old Latin, but was later remodeled as *frīguŕi* (after the adjective *frīgīdus*), 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 albuŕi*, 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).

<sup>63</sup> Collected in Schoell 1876, see Leumann (1977, pp. 238-242) for a critical summary.

the thresholds' which do not conform to the (ante)penultimate accent pattern.<sup>64</sup> Similar preaccenting behavior is reported for bisyllabic clitics in words like *súb-inde* 'immediately thereafter', *íd-circō* 'for this reason', or *eā-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*]<*sa*>, [*e*]<*ā*>, [*lfimi*]<*na*>. 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*]<*que*>, [*e*][*āprop*]<*ter*>, and [*lfimi*][*na*]<*que*>. The final foot receives main stress, deriving [*mū*][*sá*]<*que*>, [*e*][*áprop*]<*ter*>, and [*lfimi*][*ná*]<*que*>, 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 \*[*lfī*][*mína*]<*que*> ('opacity effect') and (ii) the extension of the boundaries of an existing foot to include unfooted material, thus preventing \*[*mūsa*]<*que*> ('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 [*lfimi*][*ná*]<*que*> '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

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<sup>64</sup> With respect to examples like *lfimináque* '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 patterns (*f*~~**FFFF**~~ and *f*~~**FFFF**~~, respectively), such words simply cannot fit anywhere into the line ("[...] die von Modernen als Beispiele verwendeten *lfimináque sceleráque* können sich nach ihrer Wortstruktur nicht auf Vergil stützen"). I am aware of one occurrence of the form *lfiminaque* in the Aeneid (V. Aen. 3.91): *lfiminaque laurusque defī* "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, *lfiminaque* must here be scanned as *f*~~**FFFF**~~, 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. No support for accentuations like *lfimináque* can be derived from this occurrence — in fact, based on such Virgilian 'lengthenings' of *-que* (a total of 16 instances, all in the arsis of the foot, according to Williams 1962, p. 74), some modern metricists have postulated a secondary stress on the enclitic, in addition to the normal word stress (i.e.: *lfimínáquèf*), see Allen (1973, p. 159) for references and discussion. It is in general rather difficult to reach a firm conclusion regarding Latin enclitic accent since many researchers have expressed grave doubts concerning the factual accuracy of the Roman grammarians' statements in this area — among other things, because of the suspiciously close parallelism between the claimed behavior of clitics in Latin and the rules of Greek enclitic accent (Latin *mūsá-que* after Greek *muusá-te* etc., as another instance of the well-known tendency 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).

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][*ǎprop*]*<ter>* could be avoided in a language as thoroughly quantity-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, e.g., by 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 (61), where a bisyllabic host word *é.ā* combined with a bisyllabic clitic in *e.ǎ-prop.ter* 'therefore' (61a) is contrasted with a monosyllabic host word *íd* combined with a bisyllabic clitic in *íd-cir.cō* 'for this reason' (61b). The problem arises in the second case: (61b) 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). (61b) should be compared with the parallel derivation of *mūsáque* in (61c), where a shift of the accent to the second syllable is indeed the desired outcome.

(61)	a. <i>ffFF, F F ,</i> <i>ffeā, propter,</i>	b. <i>ffF, F F ,</i> <i>ffid, circō,</i>	c. <i>ffFF, F ,</i> <i>ffmūsa, que,</i>
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 (QI):	[è][ǎ prop]<ter>	[íd][cír]<cō>	[mù][sá]<que>
Output:	<i>eǎpropter</i> 'therefore'	<i>*ídcircō</i> 'for this reason'	<i>mūsáque</i> 'and the Muse'

(61) assumes a 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 (62) illustrates, the monosyllabic-host problem disappears: *ídcirco* receives the desired preclitic stress (62b), 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 *mūsáque* in (62c) (the very 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>65</sup>

(62)	a. <i>ffFF, F F ,</i> <i>ffeā, propter,</i>	b. <i>ffF, F F ,</i> <i>ffid, circō,</i>	c. <i>ffFF, F ,</i> <i>ffmūsa, que,</i>
Word Domain			
EM:	e <ā>	id	mū <sa>
Footing (QS):	[é]<ā>	[íd]	[mú]<sa>
Clitic Domain			
EM:	[é] ā prop <ter>	[íd] cir <cō>	[mú] sa <que>
Footing (QI):	[è][á prop]<ter>	[ídcir] <cō>	[músa] <que>
Output:	eápropter 'therefore'	ídcircō 'for this reason'	*músaque '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 (61a,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 suggests 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 *e ~* with a monosyllabic clitics like *que* 'and': Instead of [*e][á]<que>*, with the desired preclitic stress, we would end up with \**[éā]<que>* (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. (61b) above). In order to account for this, let us assume that the clitic

<sup>65</sup> It is interesting that the contrast between the foot extension in [*íd+cir*]cō and the lack of foot extension in [*mū*][*sá*]+*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.

itself (and not merely the 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 (61) proceed correctly: (61a) [e]ā<propter> now resembles (61c) [mū]sa<que> in making only a single syllable available on the second round of footing, namely the last (previously extrametrical) syllable of the host; and in (61b) [id]<circō>, no further foot building can take place, since the host is already fully footed and the rest of the form 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 to allow 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 (45c) in section 3.1); the suggestion is preclitic 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>66</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.

In this analysis, then, the facts of preclitic accent, as reported by Roman commentators and grammarians, do not call for any loosening of foot theory so as to include monomoraic quantitative trochees; and taken together with other proposals to capture the special metrical behavior of peripheral syllables, such as catalexis (Kiparsky 1992, see above), a theory upholding a categorical ban on degenerate feet becomes a realistic project.

Given the many empirical unclaritys in this area of Latin accentology, all conclusions must remain tentative.<sup>67</sup> But it can be noted that no significant problem has emerged for our approach to the structure of the Latin trochee. On the positive side, the End-Rule-based 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.

#### 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 Harmonic Phonology (Prince & Smolensky 1991, 1992; see Goldsmith (1991, 1992) for related ideas). 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:

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<sup>66</sup> This analysis is formally similar to preaccentuation 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).

<sup>67</sup> There is possibly independent support for the view that End Rule (Final), applying at the syllable level, is responsible for preclitic accent in Latin. 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.





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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the advantage of such a notion is that it recognizes as a legitimate kind of minimal word not only the bisyllabic sequence *f~~FF~~*, but also the trisyllabic sequence *f~~FFF~~* (see Itô 1990 and Itô, Kitagawa and Mester 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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