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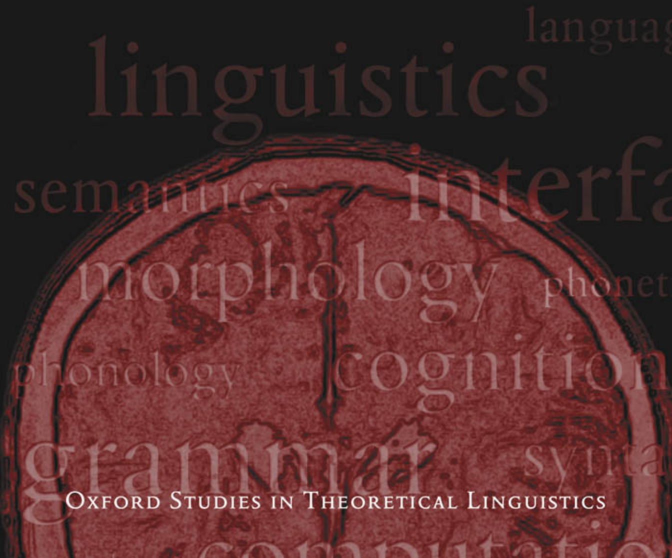
Canonical Forms in Prosodic Morphology

LAURA J. DOWNING



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General Preface

The theoretical focus of this series is on the interfaces between subcomponents of the human grammatical system and the closely related area of the interfaces between the different subdisciplines of linguistics. The notion of 'interface' has become central in grammatical theory (for instance, in Chomsky's recent Minimalist Programme) and in linguistic practice: work on the interfaces between syntax and semantics, syntax and morphology, phonology and phonetics, etc. has led to a deeper understanding of particular linguistic phenomena and of the architecture of the linguistic component of the mind/brain.

The series covers interfaces between core components of grammar, including syntax/morphology, syntax/semantics, syntax/phonology, syntax/pragmatics, morphology/phonology, phonology/phonetics, phonetics/speech processing, semantics/pragmatics, intonation/discourse structure as well as issues in the way that the systems of grammar involving these interface areas are acquired and deployed in use (including language acquisition, language dysfunction, and language processing). It demonstrates, we hope, that proper understanding of particular linguistic phenomena, languages, language groups, or inter-language variations all require reference to interfaces.

The series is open to work by linguists of all theoretical persuasions and schools of thought. A main requirement is that authors should write so as to be understood by colleagues in related subfields of linguistics and by scholars in cognate disciplines.

In this volume, Laura Downing tackles the question of what constrains the sizes and shapes of those morphemes which are the output of prosodically sensitive processes, such as reduplication, truncation, or minimal size effects. Rather than deriving these constraints from the prosodic hierarchy, she develops a more general approach which appeals to an interaction between morphological and phonological complexity. She provides a new way of looking at the interface between morphology and prosodic phonology which derives broad empirical coverage from a minimum of independently motivated categories and principles.

David Adger
Hagit Borer

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Introduction

Prosodic morphology is defined, in this work, as the study of morphological processes that are crucially characterized in terms of a (relatively) constant output prosodic shape rather than (relatively) constant output segments.[1] Prosodic morphology has been an important research area in phonological theory since work like McCarthy (1979), McCarthy and Prince (1986), Marantz (1982), and Levin (1985) showed that many aspects of the constant shape of prosodic morphemes follow from independently motivated principles of phonological theory. Recently, in work like Downing (1997, 1999*c*, 1999*d*, 2000, 2003, 2004, to appear *b*), McCarthy and Prince (1999), Urbanczyk (1996, 2000), attention has turned to the role of morphology, in particular the concept of canonical morpheme shape, in defining the constant form of prosodic morphemes. This work aims to present a new theoretical approach, developed within Optimality Theory (OT), to coordinating the morphological and prosodic factors conditioning the form of prosodic morphemes. This chapter provides essential background to the analyses developed in subsequent chapters. Section 1.1 defines the scope of this work, introducing the types of prosodic morphemes to be discussed. Sections 1.2 and 1.3 sketch why defining the canonical shape of prosodic morphemes is of relevance to phonological and

[1] Since the focus of this work is the constant syllabic shape characteristic of prosodic morphemes, other aspects of prosodic morpheme realization, like infixation or prosodic circumscription or fixed segmentism, which are treated in other works on Prosodic Morphology, are not discussed here. See e.g. Alderete et al. (1999), McCarthy and Prince (1986, 1993), Lombardi and McCarthy (1991), Stonham (1994), Urbanczyk (to appear), and Yu (2003) for discussion of these topics.

morphological theory, respectively. Section 1.4 presents a brief critical overview of recent work, especially within OT, arguing that canonical morpheme shape plays a key role in defining the constant form of prosodic morphemes. Section 1.5 outlines the goals and organization of the present work.

1.1. What is Prosodic Morphology?

A common textbook definition of the morpheme is that it is a linguistic unit with a more or less constant pronunciation correlating with a more or less constant meaning or grammatical function (Bauer 1988: 11).[2] The 'more or less constant pronunciation' is generally understood to refer to a string of segmental phonemes. For example, the English word, 'unexpected' may be divided into three morphemes—*un*, *expect*, *ed*—consisting of segment strings that occur with similar meaning or function in other English words: *__un__forgiven*, *__un__justifiable*, *__expect__ation*, *__expect__s*, *paint__ed__*, *decid__ed__*, etc.

However, there are several types of morphemes which are recognized as problems for this definition, because they cannot be characterized solely in terms of a constant string of segments. Rather, what characterizes these morphemes is having a constant shape. For example, if we compare the plain and repetitive ('X here and there; now and again') forms of the Swati verb stems in (1), we can see that the repetitive stem is formed by repeating part of the Base verb stem. As a result, the segmental content of the repetitive morpheme (underlined) is different with every Base. However, we can see that it does have a constant size and relation to the Base:

[2] This is the Structuralist definition, developed in work like Bloomfield (1984), Harris (1966), and Hockett (1966*a*), and still commonly cited in textbooks. It should be pointed out that most Structuralists and current textbooks acknowledge this definition is best viewed as a useful working hypothesis, as morphological constructions like those discussed in this work clearly do not fit it.

it reduplicates just the first two syllables, no matter how long the Base stem is:

(1) Swati verbal reduplication (Downing 1994, 1997; stems are preceded by *si-ya-*'we are')

Verb stem	*Gloss of stem*	*Repetitive stem*
si-ya-tfú:tsa	move house	si-ya-tfutsá-tfu:tsa
si-ya-bó:na	see	si-ya-boná-bo:na
si-ya-kalé:la	weigh for	si-ya-kale-kalé:la
si-ya-khulú:ma	talk	si-ya-khulu-khulú:ma
si-ya-tfutsé:la	move for	si-ya-tfutse-tfutsé:la
si-ya-khulumísa:na	talk to each other	si-ya-khulu-khulumísa:na
si-ya-bonísa:na	show each other	si-ya-boni-bonísa:na

As we shall see in the next section, cross-linguistically, it is typical for reduplicative morphemes to be exactly either one syllable or two syllables in size.

Another morphological construction in Swati which is subject to a shape condition is the imperative verb stem paradigm. As shown in (2*a*), the imperative consists of the bare verb stem if the verb is multisyllabic (*ku-* is the infinitive prefix). Monosyllabic verb stems, in (2*b*), must be made disyllabic by including the suffix, *-ni*:

(2) Swati imperative stems (Downing 1999*b*: 76, fig. (3))

	Infinitive	*Imperative singular*	*Gloss*
(*a*) Polysyllabic stems			
	kú-bóna	bóna (*bona-ni)	'see'
	kú-vala	valá	'close'
	kú-khulúma	khulúma	'talk'
(*b*) Monosyllabic stems			
	kû-dlá	dlá-ni (*dla)	'eat'
	kû-phá	phá-ni (*pha)	'give'

The process of Swati imperative formation, then, includes the requirement that these words have a consistent minimal size of two syllables. As we shall see, it is quite common for languages to require lexical Words to have a particular minimal size.

Other types of morphological construction are also subject to the requirement that the output have a constant shape. It is characteristic of Semitic languages like Arabic and Modern Hebrew for verb stems in many conjugations to be required to be exactly two syllables long (McCarthy 1979, 1993; McCarthy and Prince 1986; Ussishkin 2000, etc.). This is illustrated for Classical Arabic verb Measures (McCarthy 1979, 1993; McCarthy and Prince 1986, 1995*b*, 1998) by the paradigm for *katab*:

(3) Classical Arabic verb Measures (McCarthy 1979: 240)

Measure	*Arabic verb*	*Gloss of stem*
I	katab	'write'
II	kattab	'cause to write'
III	kaatab	'correspond'
IV	ʔaktab	'cause to write'
VI	ta-kaatab	'write to each other'
VII	n-katab	'subscribe'
VIII	k-tatab	'write, be registered'
X	s-taktab	'write, make write'

Nicknames and abbreviations are also commonly subject to size restrictions. For example, German 'Spitznamen' are exactly two syllables long (and end in '*i*'), even though the full names on which they are based are variable in length:

(4) German 'Spitznamen' (Itô and Mester 1997: 119; Féry 1997: 6)

Full name or word	*Abbreviated form*	
Gabriele	Gabi	
Waldemar	Waldi	
Gorbatschow	Gorbi	
Alkoholiker	Alki	'alcoholic'
Amerikaner	Ami	'American'
Trabant	Trabi	(type of DDR car)

'Prosodic Morphology' is used in this work, then, to refer just to these morphological constructions—reduplicative morphemes, words and stems, nicknames, and other abbreviated words—which are required to have a constant minimal and/or maximal shape. An important goal of recent research on Prosodic Morphology, including this work, is to determine which general phonological and morphological principles predict the cross-linguistic repertoire of constant morpheme shapes. The next section discusses how well generalizations about constant morpheme shape fit a general theory of possible prosodic constituent types. Section 1.3 discusses how morphemes characterized by a constant shape fit into a general theory of word formation and possible morphological constituent types.

1.2. The phonology of Prosodic Morphology

1.2.1. *Prosodic constituents and markedness*

Even though one could easily imagine that prosodic morphemes might be of any shape and that the shape could vary unpredictably from form to form, previous cross-linguistic studies of Prosodic Morphology have shown that actually only a very limited number of possible shapes are employed by prosodic morphemes. Moravcsik's (1978) comprehensive survey of reduplication, for example, makes the striking observation that the string copied in partial reduplication is never composed of an arbitrary number of segments. When partial reduplication does not respect morphological constituency, she found that the reduplicated string can 'invariably be defined in reference to [a fixed number of] consonant-vowel sequences and absolute linear position' (p. 307).[3] Further, in her large sample, 'the reduplicated partial string [never] involves more than two vowels' (p. 310). As she shows, trying to define the reduplicative string in terms of number of segments is untenable. This would incorrectly predict that the first CVC of a consonant-initial CVCCV stem should reduplicate, and the first VCC of a vowel-initial VCCV stem should reduplicate, as this would lead to a constant length of three segments. Instead, what you find is that only the first VC of vowel-initial stems reduplicates, so that in both vowel-initial and consonant-initial stems, the reduplicated string is equivalent to a single syllable, the first syllable of the Base. This is illustrated by the Agta data in (5):

[3] An exception to this generalization is provided by single segment reduplication, discussed in more detail in Chapter 5, below.

(5) Agta (Moravcsik 1978: 311 citing Healey (1960))

		Unreduplicated		*Reduplicated*	
(*a*)	takki	'leg'	tak-takki	'legs'	
(*b*)	uffu	'thigh'	uf-uffu	'thighs'	(*uff-uffu)

McCarthy and Prince (1986) surveys not only reduplicative systems in a number of languages, but also other types of Prosodic Morphology, like minimality conditions on words (as in Swati imperatives in (2), above), nicknames (as in (4)), and root-and-pattern morphology (as in (3)). This study confirms that the invariant shapes characteristic of all of these constructions typically consists of a fixed number of CV sequences, with at least one and no more than two vowels.

Work on Prosodic Morphology beginning with McCarthy (1979) characterized these fixed sequences in terms of an autosegmental CV template. For example, Measure I verb stems in Arabic (see (3)) would have the fixed shape, CVCVC; the prosodic morphemes in (1), (2), and (4) would have the fixed shape, CV(C)CV. McCarthy and Prince (1986) argue that there are two important problems with using CV templates like these to define invariant morpheme shape. First, they note that CV templates miss the generalization that the segmental sequences are always prosodically well-formed syllables or disyllables, not arbitrary strings of segments. Second, phonological processes in general cannot refer to arbitrary strings of segments, because they must respect the Locality Principle:

(6) Locality Principle (McCarthy and Prince 1986: 1)
A rule may fix on one specified element and examine a structurally adjacent element and no other.

In other words, phonological processes can only count up to two. Since more than two segments are involved in all of the examples of prosodic morphemes illustrated so far, their shape must be characterized in terms of some other level of structure. As McCarthy and Prince (1986) show, the constant shapes just described for prosodic morphemes correspond exactly to the familiar prosodic entities, syllable and Foot. CV sequences are fairly straightforwardly equivalent to sequences of syllables. The disyllabic (two-vowel) maximality requirement illustrated in (1)–(4), above, is equivalent to the maximal size of stress feet. They propose, therefore, that prosodic morphemes can be redefined as ones having a prosodic constituent (syllable or stress foot) in their lexical representation. That is, what makes prosodic morphemes distinctive is that their constant form is not defined by a string of segments (or an autosegmental CV template), but rather by a single prosodic constituent. The morphemes acquire segmental content by associating segments—typically those of the morphological Base—with the prosodic constituent.

McCarthy and Prince's (1986) approach is illustrated in (7) for Swati verbal reduplication. As shown in (1), above, the partial reduplicative string is exactly two syllables long: exactly one Foot. The input form of the reduplicative morpheme would, then, consist of just a Foot, as shown in (7*a*). The Foot is given segmental content by copying the entire Base stem, associating the copied segments with the Foot (and, if necessary, deleting unassociated copied segments). The resulting output is the structure in (7*b*).

(7) Swati verbal reduplication, following McCarthy and Prince (1986)

(*a*) Input
FOOT—tfutsela

(*b*) Output
FOOT
△
tfutse—tfutse:la

Beginning with McCarthy and Prince (1986), Prosodic Morphology became an important source of evidence for the Prosodic Hierarchy (8):

(8) Prosodic Hierarchy (McCarthy and Prince 1986, 1993; Inkelas 1989; Nespor and Vogel 1986; Selkirk 1978/81, 1984, 1995)

Prosodic Word
|
Foot
|
σ
|
μ

A well-formed parse into constituents in the Prosodic Hierarchy must conform to the Strict Layer Hypothesis (Selkirk 1978/81, 1984, 1995; Nespor and Vogel 1986). For our purposes, the most important clause of this hypothesis is the Headedness requirement (Itô and Mester 1992, Orie 1997, Selkirk 1995). Each constituent must be (properly) headed by containing at least one of the units at the next level: Prosodic Words consist of Feet, Feet of syllables, and syllables of moras. Further, each constituent must contain at most two of the units at the next level due to the Locality Principle (6). According to the Prosodic Morpheme Hypothesis (McCarthy and Prince 1986, 1993), all and only the constituents in (8) are possible prosodic morpheme shapes.

As work like Inkelas (1989) and McCarthy and Prince (1986) makes clear, however, the category Prosodic Word is not the same sort of entity as the ones it dominates. For one thing, it is not a purely phonological category like the others, but instead denotes a correlation between phonological and morphological structure. (It is a phonological domain roughly equivalent to the morphological category, Word.) For another, the Locality Principle (6) predicts that Prosodic Words should contain at most two Feet as it allows prosodic constituents to consist of no more than two adjacent elements, each adjacent to a constituent edge as well as to each other. In fact, it is not widely attested for all words of a language to have a maximal size.[4] It is also not widely attested for prosodic morphemes to be exactly two Feet in size. Recall, both Moravcsik's (1978) and McCarthy and Prince's (1986) studies show that a single Foot is the usual maximal size of reduplicative morphemes. McCarthy and Prince (1986) address this problem by proposing that the Minimal Prosodic Word (consisting of a single Foot) should be recognized as a prosodic category. Support for this comes from work like McCarthy and Prince (1994*a*, 1994*b*, 1995*a*, 1995*b*) and McCarthy (2000), which shows that unmarked Prosodic Words in some languages contain a single Foot. As we shall see beginning in section 1.4, how best to formalize correlations between prosodic constituents (like Foot) and morpheme categories (like Word) is

[4] We will, though, see examples of languages where words or truncations have a maximal length restriction of four syllables (potentially two Feet) in Chapter 5.

a matter of current theoretical debate. Indeed, it is the theme of this work.

It is especially surprising that the Prosodic Word requirement should commonly be satisfied by the minimal expansion of the constituent (a single Foot), as the other prosodic constituents are generally required to be maximal in size. For example, in the Swati analysis sketched in (7), the reduplicative Foot is not considered filled if it contains one syllable (a degenerate Foot); it must have the maximal two-syllable or two-mora size allowed by the LOCALITY PRINCIPLE (6). The requirement that prosodic constituents minimally be as large as possible falls out from a general prosodic principle that work like Halle and Vergnaud (1987) and Itô (1989) calls the MAXIMALITY CONDITION (9*a*).[5] The MAXIMALITY CONDITION and the LOCALITY PRINCIPLE (6) together motivate the familiar BINARITY constraint in (9*b*), which defines the maximal and minimal size for all prosodic constituents as consisting of two of the units dominated by the constituent:

(9) (*a*) MAXIMALITY CONDITION (Itô 1989, p. 219; citing Prince (1985))
Units are of maximal size, within the other constraints on their form.

(*b*) BINARITY (McCarthy and Prince 1993, Prince and Smolensky 2004, Orie 1997)
A prosodic constituent contains minimally and maximally two of the units dominated by the constituent (i.e. Prosodic Word contains minimally and maximally 2 Feet; Foot contains minimally and maximally two syllables or moras; syllable contains minimally and maximally two moras).

As Halle and Vergnaud (1987) and Itô (1989) argue, without the MAXIMALITY CONDITION, maximal structures would never have a chance to surface. This can be seen in the Swati example in (7): if the

[5] Confusingly, the MAXIMALITY CONDITION (9*a*) motivates constituent minimality, as a subminimal constituent does not satisfy it. The LOCALITY PRINCIPLE (6) motivates the requirement that constituents contain maximally two of the units they dominate in the Prosodic Hierarchy (8). See Harris (1994) for detailed discussion in the Government Phonology framework of the role of LOCALITY in optimizing maximally binary branching prosodic constituents. We shall return to the formulation of minimality and maximality constraints in section 3.1.1, below.

Foot size requirement could be satisfied by a submaximal Foot (a single syllable), there would be no principle requiring the reduplicative string to consistently contain a two-syllable Foot instead. Most recent theories of metrical structure, like Hayes (1995), McCarthy and Prince (1993), Prince and Smolensky (2004), in fact, assume that BINARITY (9*b*) is an inviolable principle, eliminating submaximal (degenerate) Feet as a possible Foot type.[6] And while non-binary (monomoraic) syllables are widely attested, many languages (see e.g. Kenstowicz (1980) on Cairene Arabic syncope) have productive processes eliminating monomoraic syllables, especially if they are unstressed, showing this is a dispreferred syllable type.

The preference for maximal prosodic structure helps account for one traditional problem with defining reduplication in terms of syllable copy. As noted by Moravcsik (1978), in many cases where the reduplicative string is one syllable in size, it does not match the corresponding syllable of the Base. This is why she characterizes reduplicative strings as CV sequences rather than syllables, even though her discussion clearly implies that the CV sequences are to be understood as syllables. There are two ways that the reduplicative syllable can fail to match the Base: by containing more material than the corresponding Base syllable or by containing less material. Both of these possibilities are illustrated in Ilokano. Hayes and Abad (1989) show that Ilokano has two types of reduplication, referred to as 'heavy' and 'light', correlating with different morphological constructions. As illustrated in (10*a*), the requirement that the heavy reduplicative string be a C_1VC_2 syllable can be satisfied by copying a segment that is an onset in the Base into C_2 position. And as shown in (10*b*), the requirement that the light reduplicative string be a CV syllable can be satisfied by not copying the coda of the corresponding Base syllable (the reduplicative morpheme is underlined):

[6] Hayes (1995) does allow, though, for degenerate feet under a very limited set of conditions. See, too, work like Crowhurst (1992), Downing (1998*b*), Everett (1995), Goedemans (1996), Halle and Vergnaud (1987), Orie (1997), and Ussishkin (2000) for analyses arguing for degenerate feet, both in stress systems and in Prosodic Morphology.

(10) Ilokano (Hayes and Abad 1989: 357, figs. (26), (27))

(*a*) *Heavy reduplication*

kaldíŋ	'goat'	kal-kaldíŋ	'goats'
púsa	'cat'	pus-púsa	'cats'
na-ʔalsém	'sour'	naka-ʔal-ʔalsém	'very sour'
sáŋit	'to cry'	ʔag-saŋ-sáŋit	'is crying'
trabáho	'to work'	ʔag-trab-trabáho	'is working'

(*b*) *Light reduplication*

liŋʔét	'perspiration'	si-li-liŋʔét	'covered with perspiration'
bunéŋ	'kind of knife'	si-bu-bunéŋ	'carrying a *bunéŋ*'
pandilíŋ	'skirt'	si-pa-pandilíŋ	'wearing a skirt'
sáŋit	'to cry'	ʔagin-sa-sáŋit	'pretend to cry'
trabáho	'to work'	ʔagin-tra-trabáho	'pretend to work'

Heavy reduplication follows straightforwardly from the Maximality Condition (9*a*). The reduplicative string, like the rest of the word that contains it, preferentially contains maximal syllables, defined by the Binarity principle (9*b*) as bimoraic.

However, if a light (monomoraic) syllable is a dispreferred syllable type, how can it be chosen as the target shape for reduplication in (10*b*)? Work since Steriade (1988) shows there is a strong tendency for reduplicative strings to contain less marked syllable structure than the Base string. Since closed syllables are more marked than open ones (and long vowels more marked than short), light reduplication can be accounted for by proposing that this morphological construction imposes syllable markedness conditions on the reduplicative string while heavy reduplication does not.

In sum, work on Prosodic Morphology has been important in phonological theory in providing further evidence for independently motivated prosodic principles. The constant shapes of prosodic morphemes match the prosodic constituents independently necessary to account for phonotactics and prominence systems. The generalization that prosodic morphemes are often of the maximal size of the relevant constituent also falls out from independent principles on constituent size and prosodic parsing. The opposing tendency towards the submaximal prosodic targets and other forms of reduction found in Ilokano reduplication (10*b*) or nickname truncation (4), for example, provide evidence for independently motivated markedness conditions on phonological structure.

1.2.2. *Prosodic Morphology in Optimality Theory*

One of the most important original arguments in favour of Optimality Theory (OT), the theory adopted in this book, is that it provides a way of resolving opposing cross-linguistic tendencies like those illustrated by the two types of Ilokano reduplication in (10). In this theory, phonological processes are accounted for in terms of ranked constraints. There are two main types of constraints. Markedness constraints define unmarked phonological structure. Morpheme-specific Faithfulness constraints require identity between morphologically related forms, like the input and output of the same string or a Base and its Reduplicant or other prosodic morpheme. Phonological alternation (or mismatch between some prosodic morpheme and its Base) is possible if some Markedness constraint violated by the input or the Base outranks other constraints, including some Faithfulness constraint.[7]

To return to the Ilokano example, Heavy reduplication is explained by the tendency for prosodic constituents to be of maximal size, while Light reduplication is explained by the opposing tendency for some prosodic morphemes to have unmarked (reduced) structure. In an OT analysis, these opposing tendencies can be accounted for as follows. The Maximality Condition (9), optimizing the largest reduplicative syllable possible, is formalized

[7] It is assumed that the reader has a grasp of the basics of Optimality Theory (OT), so that the formalism adopted for the analyses can be followed from the discussion provided. Readers wishing more of an introduction to OT can consult McCarthy and Prince (1993) and Prince and Smolensky (2004), or one of the several good introductory textbooks available, notably Archangeli and Langendoen (1997), Kager (1999), and McCarthy (2002). See Urbanczyk (1996) for thoughtful comparison of reduplication in OT with previous approaches, and see Ussishkin (2000, 2005) for a brief introduction to root and pattern morphology in pre-OT frameworks.

by the FAITHFULNESS constraint MAX-BR (11*a*), optimizing segmental identity of the Base and reduplicative string (RED), and the MARKEDNESS constraint BINARITY (11*b*), requiring unmarked syllables to be minimally and maximally bimoraic. The other syllable markedness constraints (11*c*, *d*) optimize the opposing tendency for syllables to be open and monomoraic. The shape constraint RED = σ (11*e*) is satisfied if the reduplicative string is coextensive with a single syllable.[8]

(11) Constraints accounting for Ilokano Heavy and Light Reduplication
Faithfulness Constraint
(*a*) MAX-BR: All the segments of the Base are contained in the RED.
Markedness Constraints
(*b*) BINARITY(σ): Syllables are minimally and maximally bimoraic.
(*c*) NOCODA: Syllables do not have codas.
(*d*) *VV: Long vowels are marked. (Rosenthall 1994)
Morpheme shape constraint
(*e*) RED = σ: The reduplicative string is coextensive with a syllable.

Both Heavy and Light reduplicative strings are always coextensive with a syllable, so constraint (11*e*) must be highly ranked. The syllable markedness constraints (11*c*, *d*) are satisfied by the Light reduplication pattern (10*b*) but not by the Heavy reduplication pattern (10*a*). However, the reverse is true of BINARITY(σ) (11*b*): it is satisfied by the Heavy reduplication pattern not by the Light reduplication pattern. This can be accounted for by proposing that the Heavy and Light reduplication patterns are associated with distinct, construction-specific constraint rankings, or co-phonologies.[9] Crucially, MAX-BR and BINARITY(σ) outrank NOCODA and

[8] The formulation in (11*e*) follows McCarthy and Prince (1993) for the sake of concreteness. Alternative formalisms are developed in the remainder of the book.

[9] In this analysis, I follow work like Inkelas (1998), Inkelas and Orgun (1998), Inkelas and Zoll (2000, 2005), and Orgun (1996, 1998) in proposing that different (prosodic) morphemes in the same language can have different optimal output structures because each morphological construction is potentially associated with a different co-phonology: a construction-specific constraint ranking. It is beyond the scope of this work to justify this approach. The interested reader can consult the works cited for detailed motivation, exemplification, and comparison with other approaches.

*VV for the Heavy reduplication pattern, while the opposite ranking holds for the Light reduplication pattern:

(12) (*a*) Co-phonology accounting for Heavy reduplication
RED = σ, BINARITY(σ) ≫ MAX-BR ≫ NOCODA, *VV

(*b*) Co-phonology accounting for Light reduplication
RED = σ, NOCODA, *VV ≫ BINARITY (σ), MAX-BR

The analysis of Heavy reduplication is exemplified in (13) and Light reduplication in (14):[10]

(13) Ilokano Heavy reduplication

Heavy RED-trabaho	RED=σ	BINARITY (σ)	MAX-BR	NOCODA	*VV
☞ *a.* trab-trabaho			***	*	
b. tra:-trabaho			****!		*
c. trabaho-trabaho	*!	***			
d. tra-trabaho		*!	****		

(14) Ilokano Light reduplication

Light RED-trabaho	RED=σ	NOCODA	*VV	BINARITY (σ)	MAX-BR
a. trab-trabaho		*!			***
b. tra:-trabaho			*!		****
c. trabaho-trabaho	*!			***	
☞ *d.* tra-trabaho				*	****

Candidate (13*a*) is optimal for Heavy reduplication, as it best satisfies the constraints MAX-BR and BINARITY(σ) which optimize copying as many Base segments as possible while still not exceeding a single bimoraic syllable. Candidate (14*d*) is optimal for Light reduplication. The reduplicative string violates none of the highest

[10] In tableaux (13) and (14), violations of BINARITY (σ) (11*b*) are only counted in the reduplicative morpheme. Since the Base syllables remain identical in all candidates, Base violations of BINARITY (σ) (11*b*) also are identical and so cannot determine the choice of optimal reduplicative morpheme.

ranked constraints on reduplicant size or syllable markedness, while the competing candidates each violate one.

Recent work on reduplication (e.g. Alderete et al. 1999) confirms that both the prosodic (and segmental) structure of reduplicative strings is often less marked than that of the Base. Work like Weeda (1992) proposes that it is also typical of nicknames to have less marked syllable structure. For example, in the German data in (4) we see that the nicknames have only a single consonant in the medial onset while the full names can have complex onsets (compare 'Ga.briele' with its nickname 'Ga.bi' (*Ga.bri)).[11] Markedness principles, then, are a factor explaining common mismatches between various types of prosodic morphemes and their Bases. The role of phonological markedness in defining the constant shape of prosodic morphemes will be discussed further in the next chapters.

Notice, too, in this analysis that the constant shape of the reduplicative strings is not accounted for by having a segmentally empty syllable in the input of the reduplicative morphemes. This can be clearly seen by comparing (13) and (14) with the analysis in (7), above, where a segmentally empty Foot is part of the input. Instead, the constant shape is defined through constraint interaction: Markedness constraints optimizing a single syllable in the reduplicative string (11*b*-*e*) outrank the Faithfulness constraint (11*a*) optimizing total reduplication.[12] The input for prosodic morphemes like reduplications (and truncations), then, includes no constant input form—either segment(s) or prosodic constituent—in OT. The input contains only a morphological label (e.g. HeavyRED, LightRED, Truncation) linking the morphological construction to a co-phonology. That is, in OT, the constant shape characteristic of

[11] As Harris (1997: 363) argues, the markedness constraint involved in explaining Onset simplification in the second syllable of German truncations is one banning complex structure Foot-medially. More detailed discussion of the German truncations is provided in section 3.2.1.3, below.

[12] See Steriade (1988) and Stonham (1994) for pre-OT models of reduplication which define the constant shape of reduplicative morphemes in terms of output-oriented well-formedness constraints rather than by an input template.

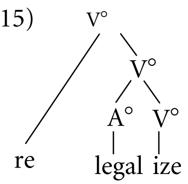
all the constructions discussed in section 1.1, like other predictable aspects of output realization, is accounted for through constraint interaction rather than input specification.

1.3. The morphology of Prosodic Morphology

As we have just seen, Prosodic Morphology has been a topic of intense investigation within phonology (see McCarthy and Prince 1986, 1993 for extensive references), as the constant forms that characterize these morphemes have provided additional evidence for independently motivated phonological principles defining prosodic constituents and markedness. This is not the case for morphological theory. On the contrary, as the particular problems posed by Prosodic Morphology do not easily fit into current models of word formation, they have received little formal attention from morphologists.

Prosodic Morphology lies outside the scope of many morphological theories, as they adopt what Hockett (1966*b*) terms the Item-and-Arrangement approach to word and sentence structure. In this sort of approach, morphemes are defined as Items identified by applying the technique implied by the traditional definition of the morpheme given in section 1, above: isolating more or less constant forms that have a more or less constant meaning or grammatical function in a set of data. Words are formed by adding affixes to a Base in a concatenative fashion, and, like syntactic units, words have a hierarchical constituent structure. For example, the word *relegalize* would have the following structure, defined as well formed by rules of morpheme concatenation (Lieber (1992): 36, fig. (16) is adopted here for the sake of concreteness):

(15)



This conception of word formation is the foundation of many current syntax-based theories of morphology like DiSciullo and Williams (1987), Selkirk (1982), Lieber (1992), etc.[13]

As work since at least Hockett (1966*b*) notes, several types of morphological construction do not neatly fit this model, with prosodic morphemes presenting an obvious problem. For example, as shown in (7), above, while some theories define the reduplicative morpheme as an Item—in this case, a Foot—it is clear that reduplication involves more than concatenating the segmentally empty Foot to its Base. Some additional process—which we might term 'COPY'—must give segmental content to the foot by duplicating Base material.[14] Minimality satisfaction (2), nickname truncation (4), and root-and-pattern morphology (3) also clearly do not easily fit into a concatenative model of word formation. The segmental material included to satisfy minimality has no morphological significance; truncation involves deleting, rather than adding segments to modify the Base meaning; and the stem shape and vocalism characterizing root-and-pattern morphology are realized over the entire stem, not as a concatenative affix.

Early work in the generative tradition formalized constructions like reduplication and root-and-pattern stem formation as transform-

[13] See Anderson (1992), Spencer (1998), and Stonham (1994) for thoughtful critiques of the continuing influence of the Item-and-Arrangement model on North American morphology.

It should also be pointed out that not all current syntactic models of morphology which adopt the concatenative, hierarchical model of word formation retain the assumption that syntax manipulates morphemes that have a phonological realization. Non-isomorphic models manipulate, instead, morpho-syntactic feature bundles, and the phonological realization of the derived hierarchical word structure is left to another component of the grammar. Since the essential analytical problem for prosodic morphemes is to explain their phonological realization, non-isomorphic theories of word formation obviously have nothing to say about these types of morphological constructions. See Borer (1998) for a recent overview of syntactic models of word formation.

[14] Although Lieber (1992: 172–96) argues that Prosodic Morphology can be considered a form of affixation, her argument concentrates on the representation of the prosodic constituent defining the shape of the morpheme which can, indeed, be considered a type of affix. (See (7), above.) It is the segmental realization of the affixed prosodic constituent which clearly requires processes, either phonological or morphological, not found in other types of morphology.

ational operations on phonemic strings, implicitly acknowledging they involve non-concatenative operations. For example, Chomsky (1951; cited in McCarthy (1979)) defines the disyllabic shape of Modern Hebrew roots by the following transformational rule: $C_1C_2C_3 + Q_1$—{: } Q_2[:] → $C_1Q_1C_2$ (:)Q_2C_3 {: }. This rule (actually somewhat simplified here) takes an input of three consonants (a triliteral root) and two vowels (Q, also with morphemic value) and derives an output where the vowels and the consonants are intercalated in such a way as to yield two syllables. Similarly, Carrier (1979) and Carrier-Duncan (1984) propose that Tagalog R1 reduplication (16*a*)—essentially identical to Ilokano light reduplication in (10*b*), above—is defined by the transformational rule in (16*b*):

(16) Tagalog R1 Reduplication (Carrier-Duncan 1984: 262, figs. (5), (8))

(*a*)	k a ndilah 'candle'	→	mag +	k a–	k a *ndilah* 'candle vendor'		
(*b*)	X[-seg] C V Y	→	1	2 3	2 3 4		
	1 2 3 4						

As McCarthy (1979) and Marantz (1982) argue, transformational rules like these are undesirable, as they are too unconstrained, allowing any manipulation of an arbitrary string of phonemes to define a possible morphological operation. As McCarthy (1979) argues in his analysis of Semitic root-and-pattern morphology, the autosegmental approach to Prosodic Morphology exemplified in (7), above, allows the invariant shape defining these morphemes to be reified as an input entity—a CV template in McCarthy (1979) or an independently motivated prosodic constituent in work beginning with McCarthy and Prince (1986)—with regular phonological operations accounting for the association of segments with the template defining the invariant shape.[15] (As noted above, though, other operations, like COPY, are also necessary, which do not so clearly fall out from the phonological or morphological theories in which the

[15] See, too, Lieber (1992), McCarthy and Prince (1986), Spencer (1991) for further discussion of how the autosegmental approach to Prosodic Morphology makes it more compatible with the affixation approach to word formation. However, Carrier-Duncan (1984) shows Tagalog reduplication poses important problems for the autosegmental approach which were only solved with the advent of OT (McCarthy and Prince 1995*a*).

analyses are cast. See Stonham (1994) for recent discussion of such morphological operations.)

Interestingly, work on Prosodic Morphology in Optimality Theory (OT) has moved away from the item-affixation model of word formation implicit in McCarthy and Prince (1986).[16] In discussing (13) and (14), above, it was pointed out that prosodic morphemes do not have an input prosodic constituent defining their constant shape in this theory. In the case of reduplicative morphemes, the input is, in fact, phonologically null. Characterizing the constant shape of prosodic morphemes in terms of constraint interaction in effect defines both the shapes and their segmental realization as the output of processes rather than as items, as Spencer (1998) points out. This reconception of Prosodic Morphology has largely gone unnoticed for a couple of reasons. First, as noted above, many current syntactic theories of word formation assume the phonological realization of morphological structures is handled in a separate component, while syntax manipulates non-phonological entities. As a result, whether the phonological shape of a morpheme is itself an item or results from a process is not an issue in these theories. Further, in OT the same sorts of constraints accounting for prosodic morpheme realization account for all phonological (and morphological) operations. This is in contrast to earlier theories, where the transformational rules proposed for reduplication in work like Carrier (1979) stood out as an exceptional mechanism not motivated for other areas of the grammar.[17] It can be considered an advantage of the OT approach, in fact, that the constant shape of prosodic morphemes is analysed using the same formal mechanisms independently needed to account for other aspects of phonological and morphological well-formedness.

OT is not the only model of morphology which takes the Word (the output of phonological and morphological operations) as primary and views word formation in terms of processes rather

[16] See Kim (2003), Pulleyblank (to appear), however, for OT analyses of reduplication that assume prosodic constituents like Foot are in the input of some reduplicative morphemes.

[17] An exception to the current trend away from reduplication-specific rule types is Raimy (2000), who develops a procedural approach to reduplication in the Distributed Morphology framework, arguing against the OT approach. See Downing (2001*b*) for a review of this work; it would take the discussion too far astray to critique it here.

than rules of concatenative arrangement. There is, in fact, a tradition of work, like that of Aronoff (1976, 1994), Matthews (1991), and Anderson (1992), arguing against morphemes as Items and for morphemes as processes relating words. While this work often mentions Prosodic Morphology as the sort of morphological construction which does not yield to an Item-and-Arrangement approach, rather surprisingly, none of this work has developed a (constrained) formalism accounting for either the constant shapes or the operations (like COPY) which are characteristic of Prosodic Morphology. Instead, inflectional morphology has been the focus of most of these theories. One reason OT is adopted in this book is that it is the theory where prosodic morphological processes have been analysed in the most formal detail.

Equally surprising is how little attention has typically been paid in the morphological literature to the morphological category (word, stem, root, or affix) of prosodic morphemes and their formal resemblance to other morphemes of the language. (Botha (1988) is a striking exception.) Reduplicative morphemes, for example, tend to be labelled as affixes, apparently based on their meaning or function, even when their form clearly distinguishes them from other affixes. For example, Keenan and Polinsky (1998) describe Malagasy reduplication as a type of suffixation, even though, as shown in (17), reduplicative strings are generally disyllabic and are stressed like the Base even when this results in stress clash (17*d*, *e*):

(17) Malagasy reduplication (Keenan and Polinsky 1998: 571, 578)

	Unreduplicated		*Reduplicated*	
(*a*)	máimbo	'stinky'	màimbo-máimbo	'somewhat stinky'
(*b*)	hadíno	'forget'	hadìno-díno	'forget a bit'
(*c*)	saláma	'healthy'	salàma-láma	'fairly healthy'
(*d*)	bé	'big, numerous'	bè-bé	'fairly big, numerous'
(*e*)	ló	'rotten'	lò-ló	'somewhat rotten'

(*f*) cf. tránoko 'my house', trànonáo 'your (sg) house', trànontsíka 'our (incl.) house', trànonáy 'our (excl) house'

As shown in (17*f*), non-reduplicative affixes tend to be monosyllabic, and are stressed by the general stress principles of the language (main stress on the penult, usually, and secondary stress on every other syllable before the main stress).

Similarly, Myers and Carleton (1996) propose that the reduplicative morpheme in CiYao, a Bantu language spoken in Malawi, is an affix, as tone is not reduplicated. However, as shown in (18), since the entire Base verb stem is reduplicated in this language, reduplicative strings are typically polysyllabic, in contrast to other affixes, like the infinitive prefix *ku*-, which are monosyllabic:

(18) CiYao verb reduplication (Myers and Carleton 1996: 64, fig. (56))

	Unreduplicated		*Reduplicated*	
(*a*)	ku-téléka	'to cook'	ku-téléka-teleka	'to cook repeatedly'
(*b*)	ku-wómbóka	'to save'	ku-wómbóka-womboka	'to save repeatedly'
(*c*)	ku-súlúmunda	'to sift (flour)'	ku-súlúmunda-sulumunda	'to sift (flour) repeatedly'

To account for problems like these, work like Downing (2000, 2003, 2005*a*), Eulenberg (1971), Fabb (1998), Inkelas and Zoll (2000, 2005), McCarthy and Prince (1994*a*, 1999) and Niepokuj (1991) argues that reduplication is often best considered a type of compounding rather than affixation.[18] In CiYao (18), for example, the reduplicative string is segmentally identical to its Base verb stem, so that the reduplicative complex resembles a verb stem compound. The stress pattern and length of the partial reduplication morpheme in the Malagasy data in (17) is also more consistent with a root compound analysis of reduplication than with an affixation analysis. Indeed, recent work in Prosodic Morphology argues that the constant shape of partial reduplicative strings often matches the canonical form of some lexical morpheme (Stem or Root), rather than that of an Affix. The constant shape of other prosodic morphemes, like nicknames and abbreviations or the verb stems of root-and-pattern

[18] Numerous examples of languages where both total and partial reduplication are best analysed as compounding are discussed in Chapters 2 and 3.

morphology, matches that of minimal (derived) words. As the next section shows, determining how well the constant shapes of prosodic morphemes correlate with the canonical forms of particular morphological categories has become an important research topic.

1.4. Canonical form and prosodic morpheme shape

Morphemes in many languages tend to have a 'canonical form' or 'general phonemic shape' (Hockett 1966*a*, Nida 1949). In Fijian, for example, lexical morphemes are generally two moras in size (none is shorter and few are longer), while most affixes and function words are monomoraic (Hockett 1966*a*, Dixon 1988). Notice that the canonical morpheme shapes for Fijian are identical to the prosodic constituents, syllable and Foot, which were shown in section 2, above, to define the characteristic shape of prosodic morphemes. Indeed, there is a body of recent work showing that, cross-linguistically lexical morphemes, like Stems, tend to be canonically Foot-sized, while Roots and Affixes tend to be monosyllabic (see e.g. Downing (2005*b*), Gordon (1999), McCarthy and Prince (1994*b*), Urbanczyk (1996, 2000)). Work like Downing (1999*d*, 2000, 2003, 2005*b*), McCarthy and Prince (1994*a*, 1994*b*, 1995*a*, 1995*b*, 1999), McCarthy (2000), Niepokuj (1991), and Urbanczyk (1996, 2000)) argues that these similarities between canonical forms and prosodic morpheme shapes are best accounted for by assigning the appropriate morphological category (Stem, Root, or Affix) to the prosodic morpheme. The constant form of the prosodic morpheme would then follow from the canonical form holding in general for morphemes of that category. The following overview of these proposals is intended both to introduce some of the most important arguments for correlating canonical form with prosodic morpheme shapes and to identify some of the problems with previous approaches which the theory defended in this work aims to solve.

Niepokuj's (1991) study of the diachronic development of reduplication makes a number of important observations about the correlation between the phonological realization of reduplicative forms and their morphological status. She argues that total reduplication is the historically primary form and is always to be considered a form of self-compounding.[19] By this is meant that the reduplicative string copies both the morpho-syntactic structure and the phonological structure of its Base. Deviations from total reduplication are best analysed as reductions towards structures that are phonologically or morphologically less marked. The first stage of this process is for the reduplicative morpheme to be reduced phonologically, either in size or in phonological complexity. At this stage, the reduplicative morpheme and its Base continue to match morpho-syntactically, so the reduplicative complex is arguably still a compound. For example, in the CiYao data in (18), while tonally the reduplicative string has undergone reduction, Downing (2003) argues that segmentally the reduplicative string is still identical to a verb stem, and the reduplicative complex is a Stem compound. Niepokuj (1991) suggests that the Foot is a common size delimiter for partial reduplicative strings, as this is the canonical size of lexical morphemes like Stem and Word. Reduction to the canonical size of the morphological category of the Base would continue to be consistent with a compound analysis of the reduplicative complex, as the Base and reduplicative string would still have the same morpho-syntactic category. Reduction to a size shorter than the canonical length of Stems or Roots would motivate analysing the morpho-syntactic category of the

[19] Other work, like Eulenberg (1971), Inkelas and Zoll (2000, 2005), Kiparsky (1986), McCarthy and Prince (1995*a*), Niepokuj (1991), Pulleyblank (to appear), and Yip (1998), has also proposed that reduplication—especially total reduplication—is often a form of compounding. Since this work does not discuss the role of canonical morpheme form in predicting partial reduplication shape, it is not discussed here.

Note further that Pulleyblank (to appear) proposes that only total reduplication represents a kind of compounding. Partial reduplication is apparently affixal and accounted for by proposing the relevant prosodic constituent is part of the input of the reduplicative morpheme. As mentioned in the discussion following (14), above, other OT approaches to reduplication define the shape of prosodic morphemes through constraint interaction.

reduplicative string as an Affix. Reductions (typically markedness neutralizations) in phonological structure, like those discussed in connection with the Ilokano data in (10), above, are also predicted to be more likely with affixal reduplicative strings than with reduplicative compounds, as morpho-syntactic similarity between the Base and Reduplicant is proposed to correlate with phonological similarity. As we shall see, some of Niepokuj's observations find an echo in recent OT literature on reduplication discussed below.[20] Unfortunately, Niepokuj herself does not formalize her proposals. Another limitation of the study is that its focus is on reduplication. The role of canonical morpheme shapes in other areas of Prosodic Morphology is left unexplored.

A recent approach developed within OT, called Generalized Template Theory (GTT) formalizes many of the points raised by Niepokuj (1991). The leading idea behind GTT is that the size requirements typical of prosodic morphemes should fall out from their morphological category, rather from construction-specific size constraints like RED = σ (11*e*). The constraints deriving this result are given in (19), taken from work like Crowhurst (2004); McCarthy and Prince (1994*a*, 1994*b*, 1995*a*, 1995*b*, 1999); McCarthy (2000); and Urbanczyk (1996, 2000). The first principle of this theory (constraint (19*a*)) is that a prosodic morpheme, like other morphemes, must be assigned a morphological category: Stem or Affix. As noted above, cross-linguistically it is typical for affixes to be monosyllabic (or

[20] See, too, Inkelas and Zoll (2000, 2005) for further discussion of Niepokuj's (1991) proposals and for arguments that reduplication is essentially a form of compounding. In their approach, the reduplicative morpheme is semantically identical to its Base. Morphological and, to a lesser extent, phonological identity, follow from this. While Inkelas and Zoll (2005) observe that the target shapes for reduplicative truncation match the shapes found for other processes of truncation, they do not formalize a theory of possible output shapes. The concern of their theory is rather to account for matches and mismatches in the respective phonologies of the reduplicative morpheme and its Base. For this reason, it is not discussed in more detail here.

See, too, Faraclas and Williamson (1984) for arguments that in Benue-Congo languages, total reduplication is historically primary, and the fixed length and (high) vowels found in many modern reduplicative morphemes are the result of reduction processes.

monomoraic), while Stems are larger, typically Foot-sized. These correlations are formalized in (19*b–d*):

(19) Generalized template constraints

(*a*) Prosodic Morpheme (e.g. RED) = MCat (Stem, Root, Affix)

(*b*) Affix ≤σ—The phonological exponent of an affix is no larger than a syllable.

(*c*) Stem=PrWd—Stems (and Roots) are mapped to Prosodic Words.

(*d*) Headedness
Every Prosodic Word must contain a Foot (and every Foot a syllable and every syllable a mora).

(*e*) Root(Faith) ≫ Affix(Faith):
Roots (and Stems) contain more marked structure than Affixes.

The Stem–Foot correlation follows from the Prosodic Hierarchy (8), if one adopts the proposal in (19*c*) that Stems are universally mapped to Prosodic Words. As Prosodic Word dominates stress Foot, all Prosodic Words must contain an optimal stress Foot to satisfy Headedness (19*d*).[21] Constraints (19*a–d*) together, then, formalize the claim that monosyllabic prosodic morphemes are Affixes, while Foot-sized prosodic morphemes are Stems. Note, however, that the Affix-monosyllable correlation constraint in (19*b*) is simply a stipulation. While it is empirically well motivated, it does not follow from an independent theoretical principle like the Stem–Foot correlation does. The tendency that Niepokuj (1991) observes for reductions in phonological markedness to be more common with reduplicative Affixes than with reduplicative compound Stems, is accounted for in this framework by formalizing in (19*e*) the general cross-linguistic tendency for Roots (and Stems) to contain more marked structure than Affixes (see e.g. Beckman (1997, 1998), Kenstowicz and Kisseberth (1977), McCarthy and Prince (1995*a*), Steriade (1995)).

[21] This proposal incorporates the well-attested cross-linguistic generalizations (see e.g. Nespor and Vogel 1986) that Prosodic Word is the domain for stress assignment and that in stress languages all lexical words must be stressed (and so must contain at least one Foot).

An important advantage of GTT is that it expresses formally the relation between the canonical form of particular morphological categories and prosodic morpheme shape. This allows the restrictions on prosodic morpheme size to follow from independent principles of the grammar, rather than from construction-specific templates like RED = σ (11*e*). It also predicts that all prosodic morphemes of the same morphological category should be subject to the same size restrictions. Defining the constant shape of prosodic morphemes indirectly by general constraints on canonical Stem and Affix form has the important further advantage of explaining other phonological properties of prosodic morphemes besides their constant shape.

These points are illustrated by McCarthy and Prince's (1994*a*, 1994*b*, 1995*a*, 1995*b*, 1999) analysis of the Diyari reduplication pattern in (20). In this data, we see that the reduplicated string (bolded) always contains exactly two syllables no matter how long the Base is:

(20) Diyari reduplication (McCarthy and Prince 1994*a*: 350, fig. (29))

	Base	*Reduplicated*	*Gloss of Base*
(*a*)	wíl̪a	**wíl̪a**-wíl̪a	'woman'
(*b*)	kánku	**kánku**-kánku	'boy'
(*c*)	kúɭkuŋa	**kúɭku**-kúɭkuŋa	'to jump'
(*d*)	tʲílparku	**tʲílpa**-tʲílparku	'bird sp.'
(*e*)	ŋánkan̪t̪i	**ŋánka**-ŋánkan̪t̪i	'catfish'

Labelling the reduplicant a Stem in Diyari correctly predicts not only its disyllabic minimal size, but also accounts for the fact that it has main stress. Both fall out from the requirements that Stems map to Prosodic Words (19*c*) and that Prosodic Words contain at least one stress Foot (19*d*).[22] (The alternating stress pattern in words like *ŋándawàlka* 'to close' shows that stress Feet in Diyari are disyllabic.) Further, it accounts for why the reduplicated string is vowel final. Consonant-final syllables can only occur word-medially in Diyari; all words must end with vowels. In contrast, accounting for the

[22] The constraints presented here do not account for why the Diyari reduplicant is maximally a disyllabic Foot. This point is taken up in the discussion of McCarthy and Prince's (1994*a*, 1994*b*, 1995*a*, 1995*b*, 1999) analysis of Diyari found in Chapter 2.

disyllabic condition on the reduplicative string with a morpheme-specific templatic constraint (e.g. RED=Foot) could not account for why the reduplicative Foot cannot end with a consonant to match the corresponding stress Foot of the Base. A morpheme-specific templatic constraint also would miss the generalization that not just the reduplicative Stem but also all lexical words of Diyari are minimally disyllabic (Poser 1989). In GTT, the word minimality condition is straightforwardly accounted for by the same constraints, Stem = PrWord (19*c*) and Headedness (19*d*), that account for the disyllabic minimality condition on the reduplicative morpheme.

However, proposing that a disyllabic/bimoraic size requirement on prosodic morphemes universally follows from the Stem-Prosodic Word correlation in (19*b*) also faces important problems. For example, Poser (1990) and Itô (1990) show that a minimal Foot size condition holds for nicknames and abbreviations in Japanese, even though this language has no lexical stress. Even in stress languages, numerous mismatches are found between the Foot relevant for assessing (prosodic) morpheme minimality and the stress Foot, as work like Crowhurst (1992), Garrett (1999), Gordon (1999), Hayes (1995), Kager (1992), and Spring (1990) demonstrates. These problems will be discussed in detail in the following chapters.

Even though the GTT constraints in (19) cannot be maintained as the only general principles determining the prosodic shape of Stems and Affixes, they have the important advantage of being explicitly formalized. Further, the Stem–Foot correlation (19*c*, *d*) follows from independent prosodic principles. Other work proposing correlations between the canonical form of sublexical morphemes (Stem, Root, and Affix) and constant prosodic morpheme shapes has not been so successful in devising an explicit, independently motivated formalism. For ease of comparison with Diyari, the examples which follow also illustrate analyses of reduplication. Examples of problems found in extending the GTT approach outlined in (19) to other constructions are taken up in detail in the next chapter.

Downing (1997, 1999*c*, 1999*d*, 2000, 2001*a*, to appear *b*) shows that in several Bantu languages verb stems are required to be minimally disyllabic in some morphological constructions. For example, as we saw in (1), above, verb stem reduplicants are minimally disyllabic in Swati. Downing (1999*d*) argues that the disyllabicity requirement falls out if the reduplicative string is also a verb stem. A strong argument in support of analysing the reduplicative string as a verb stem is that it provides the most plausible explanation for why the final vowel of the verbal reduplicative morpheme is 'a' in many of these languages, no matter what vowel occurs in the corresponding syllable of the Base verb stem. As traditional scholars like Doke (1954) and Meeussen (1967) show, the canonical Bantu verb stem consists of a (disyllabic) verb Root-Final Vowel complex, and the most common Final Vowel morpheme is 'a'. The Swati data in (21) exemplifies this pattern:[23]

(21) Swati /-a/-final verbal reduplication (Downing 1997: 25, fig. (17); Downing field notes; *bá-ya-*'they are')

Verb stem	*Gloss*	*Repetitive stem*
ba-ya-líindz-eel-a	wait for	ba-ya-lindz-a-líndz-eel-a
ba-ya-líndz-iis-a	cause to wait	ba-ya-lindz-a-líndz-iis-a
ba-ya-hámb-eel-a	travel for/to	ba-ya-hamb-a-hámb-eel-a
ba-ya-hlány-eel-a	be unreasonable	ba-ya-hlany-a-hlány-eel-a
ba-ya-fúndz-iis-a	teach	ba-ya-fundz-a-fúndz-iis-a

If the reduplicative string, like its Base, is a verb stem, then the disyllabic size restriction appears to be consistent with the GTT constraints in (19): a Stem reduplicative morpheme should be parsed as a Prosodic Word, disyllabic because it parses an optimal stress Foot. However, as we can see in (21), only the Base string has a lengthened penult vowel that is characteristic of stress. The reduplicative string is unstressed. The reduplicative string also cannot be a Prosodic Word, as the High tone of the subject prefix *bá-* surfaces on the antepenult of the entire reduplicated form, even though High tones normally do not cross Prosodic Word boundaries in Swati.[24] In short, the Stem-Prosodic Word-Foot correlation formal-

[23] The data in (21) is an optional variant form of reduplication for most of the verbs in (1). See Downing (1997, 1999*c*) for detailed discussion.

[24] See Downing (1999*b*, 2000, 2001*a*, 2003) for detailed discussion of the arguments that the reduplicative Stem is not a Prosodic Word in Bantu languages.

ized in (19*c*, *d*) does not provide an explanation for the disyllabic size restriction on this reduplicative prefix, as Stems are not Prosodic Words.

Downing (1999*d*) proposes instead that Bantu *a*-final partial reduplicative patterns like the one illustrated in (21) are disyllabic because this is a defining property of the Canonical Verb Stem. The claim formalized in (22) is that a Canonical Stem is characterized by a correlation between a disyllabic prosodic constituent and a bimorphemic morphological constituent:

(22) CANONICAL STEM (Downing 1999*d*: 72)
  (*a*) Prosodic shape: syllabic trochee.
  (*b*) Morphological form: verb stem [Root+Final Vowel].

However, the CANONICAL STEM=FOOT correlation (22*a*) shares with AFFIX ≤ σ (19*b*) the failing that it is not motivated by an independent theoretical principle like the Prosodic Hierarchy (8). In later work, Downing (2000, 2001*a*) formalizes the size restriction with the reduplication-specific constraint, RED = FOOT. This alternative is problematic as, first, it leaves unexplained why the reduplicative Foot is not assigned stress but merely serves as a size restrictor. Further, a morpheme-specific constraint like RED = FOOT misses the generalization that the size of the reduplicative string is related to its canonical verb stem status. As a result, this alternative cannot account for the fact that verb stems in other morphological constructions (like the imperatives in (2)) are also constrained to be minimally disyllabic.

Urbanczyk's (1996, 2000) analyses of reduplication in Lushootseed (a Salishan language spoken in the Puget Sound area of North America) suffer from similar weaknesses. Lushootseed has two prefixal reduplication patterns, diminutive and distributive. The distinction between them is reminiscent of the two Ilokano patterns illustrated in (10), above: the diminutive is CV in form, while the distributive is CVC:[25]

[25] The realization of the diminutive reduplicative morpheme in Lushootseed involves some variation that is not presented here as it does not affect the canonical CV shape of the morpheme. See Urbanczyk (1996) and Alderete et al. (1999) for discussion.

(23) Lushootseed reduplicative patterns (Urbanczyk 2000, fig. (24))

(*a*) *Diminutive*

ʔálʔal	'house'	ʔá-ʔalʔal	'hut'
ʔúqʷ'ud	'pull out'	ʔú-ʔuqʷ'ud	'pull part way out'
híw-il	'go ahead'	hí-hiw-il	'go on ahead a bit'
q'íxʷ	'upstream'	q'í-q'ixʷ	'a little upstream'

(*b*) *Distributive*

sáqʷ'	'fly'	sáqʷ'-saqʷ'	'fly here and there'
gə́lk'	'entangle'	ʔəs-gə́l-gəlk'	'all tangled up'
tʃəgʷás	'wife'	tʃəgʷ-tʃəgʷás	'seeking a woman to marry'
pástəd	'Caucasian'	pás-pastəd	'many white folks'

Urbanczyk (1996, 2000) argues convincingly that the size distinction between the diminutive and distributive reduplicative morphemes falls out from their morphological category. The canonical prefix form in Lushootseed is CV, and the canonical root form is CVC. And, as Urbanczyk (1996) argues, the GTT constraints in (19) seem to predict that prosodic morphemes in these morphological categories will have these shapes. Affixes are defined as unmarked, (open, light) syllables by constraints (19*b*, *e*). Roots, like Stems, should be mapped to Prosodic Words and contain a stress Foot by constraints (19*c*, *d*). However, there are problems with this analysis. As noted above, the Affix-monosyllable correlation does not follow from any independent theoretical principles. A more serious problem is that the Root-reduplicant, the Distributive, is not a separate Prosodic Word from the Base. Further, as Urbanczyk (1996, 2000) shows, there is no evidence from stress that CVC syllables are bimoraic stress Feet.[26]

Urbanczyk (2000) avoids these problems by proposing an alternative means of formalizing the distinction between Root vs. Affix reduplicative morphemes. Instead of constraints correlating morphological categories with particular prosodic constituents, like (19*b*, *c*, *d*), the size restriction on the two types of

[26] The data in (23) illustrates the regular stress pattern of Lushootseed. The leftmost full vowel in the Stem is stressed. If there are no full vowels, then the leftmost stem vowel is stressed even if it is a schwa. That is, while stress is sensitive to vowel quality, it is insensitive to syllable shape, so there is no evidence from stress that CVC syllables are bimoraic.

reduplicative morphemes is defined through ranking the constraints in (24):

(24) Lushootseed Diminutive and Distributive reduplication (Urbanczyk 2000)
Faithfulness Constraints
(*a*) MAX-BR-ROOT: All the segments of the Base are contained in the Root RED.
(*b*) MAX-BR: All the segments of the Base are contained in the RED.
Markedness Constraints
(*c*) NOCODA: Syllables do not have codas.
(*d*) *STRUCσ: Minimize the number of syllables.[27]

This analysis, consistent with GTT, does not account for the constant shape of the reduplicative morphemes through a templatic constraint such as RED = σ. Instead, the reduplicative morphemes are defined as maximally monosyllabic by ranking *STRUCσ (24*d*) above MAX-BR-ROOT (24*a*) and MAX-BR (24*b*). Root reduplicative morphemes are defined as CVC monosyllables and Affixal ones as CV by ranking MAX-BR-ROOT (24*a*) above NOCODA (24*c*), which in turn outranks MAX-BR (24*b*).

The analysis is exemplified in (25):

(25) Lushootseed (adapted Urbanczyk 2000: figs. (39), (43)

	*STRUCσ	MAX-BR-ROOT	NOCODA	MAX-BR
/DIM(Afx)-hiw-il/				
☞ *a.* hi-hiwil	*		*	***
b. hiw-hiwil	*		**!	**
c. hiwil-hiwil	**!		**	
/DIST(Root)-pastəd/				
☞ *d.* pas-pastəd	*	***	***	***
e. pa-pastəd	*	****!	**	****
f. pastəd-pastəd	**!		****	

[27] See work like Walker (2000) for more detailed justification of a constraint like *STRUCσ to optimize a syllable-sized maximality condition on reduplicative morphemes. This approach is critiqued in Chapter 2, and an alternative analysis of Lushootseed reduplication is developed in Chapter 3.

Candidate (25*a*) is optimal for diminutive (Affixal) reduplication, as it best satisfies the markedness constraints—NoCoda (24*c*) and *Strucσ (24*d*)—which optimize copying as much of the Base as possible while not exceeding a single open syllable. (Violations of *Strucσ are only assessed for the reduplicative string in this tableau, as the Base string contains the same number of syllables in all candidates in each set.) Candidate (25*c*) is optimal for distributive (Root) reduplication. Since the distributive reduplicant is a Root, it is optimal for the reduplicative syllable to contain a coda. (Notice that Max-BR-Root violations are only incurred if the reduplicant is specified Root; all reduplicants incur Max-BR violations.)

This analysis provides an elegant account of the two reduplication patterns and meets the GTT goal of accounting for prosodic morpheme size restrictions in terms of general markedness constraints. However, notice that the Root vs. Affix shape distinction in the reduplicative prefixes (CVC vs. CV) is derived through a constraint ranking that crucially contains reduplication-specific Faithfulness constraints: Max-BR and Max-BR-Root. As a result, the analysis in (25) fails the GTT goal of avoiding construction-specific definitions of the size restrictions. For this reason, it cannot generalize to account for why words in Lushootseed, which are morphologically minimally Roots, are minimally CVC in size just like Root reduplicative morphemes are.[28]

In sum, while a range of work convincingly argues there is a correlation between canonical morpheme form and prosodic morpheme shape, none of the previous proposals provides a complete theory of the correlation. All face the problem that the Prosodic Hierarchy (8) only makes predictions about the minimal (or maximal) size of Stems, and then only for languages where Stems map to Prosodic Words and dominate a stress Foot. It is not clear in these approaches how to account formally for disyllabic prosodic mor-

[28] It is, in fact, not clear how to formalize this minimality constraint in GTT. Since there is no evidence from stress that CVC syllables are bimoraic, they are not optimal Feet. Yet, in GTT, word minimality should fall out from Headedness (19*d*): a Prosodic Word must contain an optimal stress Foot. We shall return to this problem in Chapters 2 and 3.

phemes which are not stress Feet, as the Foot is the only disyllabic constituent motivated by the theory. As we saw, there is also no independent theoretic motivation for size restrictions on Affixes and monosyllabic Roots, as these morphological categories do not map to constituents in the Prosodic Hierarchy.

1.5. Goals and outline

The book has, first, a descriptive goal, namely, to present a wide range of prosodic morphological constructions from a wide variety of languages, emphasizing data illustrating the role of morphology in determining prosodic morpheme shape. As this topic has not received much attention in previous surveys (like those mentioned above), it is hoped the empirical base of Prosodic Morphology will be expanded by including data that has not been widely cited and analysed elsewhere. The prosodic morpheme types analysed are those illustrated in section 1.1, above: reduplication, word minimality, nicknames and abbreviations, and root-and-pattern morphology.

The theoretical goal of this book is to develop within OT a coherent formal theory of canonical morphological shapes and its role in defining the constant shape of prosodic morphemes. This theory adopts the Generalized Template Theory (GTT) proposal, developed in work like McCarthy and Prince (1994*a*, 1994*b*, 1995*a*, 1995*b*, 1999), McCarthy (2000), and Urbanczyk (1996, 2000), that prosodic morpheme shapes fall out from assigning them a particular morphological category—Stem, Root, Affix—rather than from construction-specific constraints (like RED = Foot). The size restrictions should then be identical to the canonical shapes of these morphological categories. Chapter 2 presents in more detail the version of the Prosodic Hierarchy-based version of the GTT summarized in (19), above. The aim of this chapter is both to show the successes of this theory in accounting for a variety of prosodic morpheme shape restrictions and also to discuss more explicitly the limitations of this version of the GTT as a cross-linguistically valid general theory of canonical forms. As sketched in the preceding section, the Prosodic Hierarchy provides no motivation for the frequently attested correlation between Affixes and monosyllables or between Roots and CVC syllables, and only posits a correlation between Stems and disyllables in languages with word-level stress. These and other problems will be discussed in more detail in Chapter 2.

Chapter 3 develops an alternative version of the GTT which divorces the motivation for canonical shapes from the Prosodic Hierarchy. This alternative builds on the proposal by Dresher and van der Hulst (1998) that the minimality constraints defining canonical forms fall out from a correlation between morphological complexity and phonological complexity. Lexical Heads (Roots and Stems) meet minimality requirements, not because they contain a stress Foot, but rather because Heads require branching phonological structure.[29] As Dresher and van der Hulst argues, a branching requirement on head morphemes is one way of enforcing a Head-Dependent Asymmetry which is characteristic of phonological systems cross-linguistically. Chapter 3 shows that this morpheme-based version of the GTT provides a coherent analysis of the correlation between prosodic morpheme size restrictions and canonical morpheme form for a wider range of data than the Prosodic Hierarchy-based version of the GTT does. Chapter 4 discusses the role of phonological factors in conditioning the realization of canonical forms.

Chapter 5 concludes the book. The goal of this chapter is to summarize the most important results of the morpheme-based approach to defining canonical forms, while also pointing out areas for future research.

[29] Stems are defined in this theory as polymorphemic Root-Affix complexes, following the traditional definition found in work like Matthews (1991), Spencer (1991), Urbanczyk (1996), and Stonham (2004). Confusingly, another common definition of Stem is that it is the Word minus the outermost (inflectional) Affix (Nida 1949, Bauer 1988), potentially a monomorphemic Root. We shall return to this point in Chapter 3, as the contrast between polymorphemic Stems and monomorphemic Roots plays an important role in the theory of canonical forms developed there.

2

Prosodic Hierarchy-Based Templates

The central proposal of the Generalized Template Theory (GTT) of prosodic morpheme shapes is that prosodic morphemes have a restricted repertoire of prosodic shapes because they draw on the canonical shapes of a restricted repertoire of morphological categories. These canonical shapes follow from general theoretical principles correlating particular morphological categories (Stem, Root, Affix) with particular prosodic constituents and from a constraint grammar defining the canonical shapes as unmarked. The theory predicts that all prosodic morphemes of the same morphological category should be subject to identical constraints defining canonical shape. Further, it predicts that prosodic morphemes of a particular morphological category should have other phonological and morphological properties (besides shape) that are characteristic of that category. As we saw in section 4 of the preceding chapter, previous work developing the GTT (McCarthy and Prince 1994*a*, 1994*b*, 1995*a*, 1995*b*, 1998, 1999; Urbanczyk 1996, 2000) posits that the canonical shapes of morphemes follow from the Prosodic Word-stress Foot correlation defined by the Prosodic Hierarchy. The goal of this chapter is to provide a critical evaluation of the Prosodic Hierarchy-based version of the GTT (henceforth 'PBT'). The first section discusses the theoretical underpinnings of the approach. The second section provides analyses of a range of constructions drawn from a variety of languages to show what sorts of prosodic morpheme size restrictions this approach easily accounts for. The third section discusses empirical problems with the PBT. It is this final section which motivates the alternative theory of generalized templates developed in Chapter 3.

2.1. Prosodic Hierarchy-Based Generalized Template Theory (PBT)

As noted in Chapter 1, reduplicative morphemes are typically one or two syllables in size (Moravcsik 1978, McCarthy and Prince 1986). Other prosodic morphemes that can be independent words (e.g. minimal words, nicknames and other truncations, stems of root-and-pattern morphology) tend to be bimoraic or disyllabic (McCarthy and Prince 1986; Hayes 1995; Itô 1990). PBT, developed within OT, proposes that these two target shapes, Foot (bimoraic or disyllabic) and syllable, are derivable through two families of theoretical principles correlating different morphological categories with different prosodic constituents. The Prosodic Hierarchy and the Stem-Prosodic Word Homology together establish a correlation between the morphological categories, Word and Stem, and the prosodic category, Foot. MARKEDNESS constraints and constraint rankings define a correlation between the morphological categories, Root and Affix, and the prosodic category, syllable. The next two sections develop each of these points in turn.

2.1.1. *The Stem-Prosodic Word Homology*

In many languages, words are required to have a minimal length of two syllables or two moras. Swati and Diyari, discussed in Chapter 1, provide examples of languages with such a disyllabic word minimality constraint. Work like Hayes (1995), McCarthy and Prince (1986, 1993, 1994*a*, 1994*b* 1995*a*, 1995*b*, 1999), McCarthy (2000), Prince and Smolensky (2004), and Selkirk (1995) has argued that the disyllabic/bimoraic minimal word requirement falls out from the Prosodic Hierarchy:

(1) Prosodic Hierarchy

Prosodic Word
|
Foot
|
σ
|
μ

In this Hierarchy, each element must contain at least one of the units it immediately dominates, by the HEADEDNESS principle (Itô and Mester 1992, Orie 1997, Selkirk 1995), given in (2*a*). This principle requires each Prosodic Word to contain at least one stress Foot. The BINARITY Principle (2*b*) requires each stress Foot to contain minimally (and maximally) two syllables or two moras.

(2) (*a*) HEADEDNESS (Itô and Mester 1992, Orie 1997, Selkirk 1995)
Any prosodic category C^{i} must dominate a C^{i-1} (e.g. Prosodic Word must dominate a Foot).

(*b*) BINARITY (McCarthy and Prince 1993, Prince and Smolensky 2004, Orie 1997)
A prosodic constituent contains exactly two of the units dominated by the constituent (i.e. Foot contains exactly two syllables or moras; syllable contains exactly two moras).

By transitivity, then, the required stress Foot of a Prosodic Word must minimally contain two syllables or two moras, at least in languages where Prosodic Words are parsed into stress Feet.[1]

The Prosodic Hierarchy in (1) and the constraints in (2) account for Prosodic Word minimality by establishing a necessary relationship between the morphological category Word and the prosodic

[1] Recall from section 1.2.1, above, that BINARITY (2*b*) actually predicts it is optimal for Prosodic Words to minimally (and maximally) contain two Feet, rather than one. However, Prosodic Word, unlike the constituents it dominates, is seldom subject to a BINARITY requirement. For Foot-sized minimality to fall out from the Prosodic Hierarchy, we must follow McCarthy and Prince (1986) in assuming that the non-binary Minimal Prosodic Word is a prosodic category. This is one reason why Prosodic Word is best not included in the Prosodic Hierarchy (1): it is not subject to BINARITY like Foot and syllable are. Other reasons for excluding Prosodic Word from the Prosodic Hierarchy will be developed in detail in section 3.1.1, below.

category, stress Foot. Morphological Words are parsed into Prosodic Words by default (Inkelas 1989, Prince and Smolensky 2004), and a Prosodic Word must dominate a stress Foot by Headedness (2*a*). As McCarthy and Prince (1994*a*, 1994*b*, 1995*a*, 1995*b*, 1999) and McCarthy (2000) argue, it would follow for other morphological constructions (reduplicated or truncated forms or the verb stems of root-and-pattern morphology, for example) to be subject to a Foot-sized minimality constraint if they are parsed as Prosodic Words. This would allow the size restriction to fall out from the canonical shape of Prosodic Words, rather than having to be stipulated in a construction-specific template. Two assumptions provide a principled motivation for parsing other constructions as Prosodic Words in this approach. First, every (prosodic) morpheme is assigned a morphological category: Stem, Root, or Affix (McCarthy and Prince 1994*b*, Urbanczyk 1996). This is formalized in (3*a*). The Stem → PrWord homology in (3*b*) defines the canonical realization of Stem as coextensive with Prosodic Word (McCarthy and Prince 1994*b*, 1999: 262, McCarthy 2000: 169).

(3) (*a*) Prosodic Morpheme (e.g. RED) = MCat (Stem, Root, Affix)[2]

(*b*) Stem → PrWord homology: Stem ≈ PrWord
Align the left and right edges of every Stem with the left and right edges of some Prosodic Word.

The constraints in (2) and (3) taken together define a correlation between the morphological category Stem and the prosodic category Foot. They require not only Words but also (prosodic) morphemes which are categorized as Stems to be minimally Foot-sized, as both Words and Stems are parsed into a Prosodic Word and, by Headedness, must contain a proper stress Foot.

[2] RED = MCAT (3*a*) is adapted from McCarthy and Prince (1994*b*) and Urbanczyk (1996: 18 ff.). In this work we adopt definitions of Stem, Root, and Affix which closely follow Urbanczyk: Root and Affix are both monomorphemic, while Stems are derived Root-Affix combinations. As is clear from (3*b*), McCarthy and Prince (1994*b*) and subsequent work define Stem as the morpheme type which most closely matches Prosodic Word, leaving the internal morphological complexity of Stems unspecified. We return to the definition of Stem, Root, and Affix in Chapter 3.

The complete formal analysis of the disyllabic minimality constraint on Words and on reduplicative prefixes in Diyari introduced in section 1.4 illustrates these points. Recall that Words in Diyari are minimally disyllabic (with one exception, the conjunction *ya* 'and'). If Foot Binarity (2*b*) is an inviolable constraint for lexical words, as argued in work like Prince and Smolensky (2004), then all stressed words—that is, all Prosodic Words—in a trochaic language like Diyari must be minimally disyllabic.[3] This is exemplified in the tableau in (4):

(4) Word Minimality in Diyari

	Headedness	Binarity
☞ *a.* (kánku)		
b. (kán)		*!
c. kan	*!	

As shown in (4), subminimal monosyllabic words like candidates (4*b*) and (4*c*) are non-optimal. If they are parsed into stress Feet (4*b*), as all lexical words must be, they violate Binarity (2*b*). If they are not parsed into stress Feet (4*c*), they violate Headedness (2*a*). In contrast, words that are minimally disyllabic, like candidate (4*a*), satisfy both of these constraints.

The reduplicative prefix (bolded), like the Prosodic Word, is minimally disyllabic in Diyari:

(5) Diyari reduplication (McCarthy and Prince 1994*a*: 350, fig. (29))

(*a*)	wíl̪a	**wíl̪a**-wíl̪a	'woman'
(*b*)	kánku	**kánku**-kánku	'boy'
(*c*)	kúɭkuŋa	**kúɭku**-kúɭkuŋa	'to jump'
(*d*)	tʲílparku	**tʲílpa**-tʲílparku	'bird sp.'
(*e*)	ŋánkan̪t̪i	**ŋánka**-ŋánkan̪t̪i	'catfish'

[3] It is a matter of some debate how best to formalize the observation that some constraints are inviolable in OT, acting as an absolute filter or control on possible outputs in a particular language. As all of the constraints in this section are a control set for Diyari and other languages where subminimal words simply are not found, the question of how to distinguish them formally in the tableaux from violable constraints does not arise. The interested reader can consult work like Orgun and Sprouse (1999) and Downing (2004) for discussion of inviolable constraints in OT grammars.

As McCarthy and Prince (1994*a*, 1994*b*, 1999) argues, labelling the reduplicant a Stem, so that the reduplicative construction is a Stem-Stem compound, correctly predicts its disyllabic minimal size, given the STEM → PRWORD HOMOLOGY (3*b*). This analysis is exemplified in (6):

(6) Reduplicative Minimality in Diyari

RED_{Stem} = tʲílparku	STEM→ PRWORD	HEADEDNESS	BINARITY
☞ *a.* (tʲílpa) = (tʲílpar)ku			
☹ *b.* (tʲílpar)ku = (tʲílpar)ku			
c. (tʲíl) = (tʲílpar)ku			*!
d. tʲíl = (tʲílpar)ku		*!	

In (6), the STEM → PRWORD HOMOLOGY (3*b*) is assumed to be satisfied in all candidates, by parsing both the reduplicative Stem and the Base Stem into Prosodic Words. Subminimal monosyllabic reduplicative prefixes like candidates (6*c*) and (6*d*) are non-optimal for the same reason the subminimal Words in tableau (4) are non-optimal. If the monosyllabic reduplicative Stems are parsed into stress Feet (6*c*), they violate BINARITY (2*b*). If they are not parsed into stress Feet (6*d*), they violate HEADEDNESS (2*a*).

The tableau in (6) makes clear, though, that the constraints so far only define a Foot-sized minimality requirement on Prosodic Words (morphological Words and Stems). They do not account for why prosodic morphemes like the Diyari reduplicative Stem are often also subject to a maximality requirement. Notice that the total reduplication candidate (6*b*), like the actual disyllabic Diyari output in (6*a*), satisfies all the constraints. McCarthy and Prince (1994*a*, 1994*b*; 1999) have argued that the disyllabic maximality constraint on Stem prosodic morphemes can be accounted for straightforwardly by the general constraint ranking schema which makes it optimal for prosodic morphemes to have less marked structure than corresponding Base morphemes. The role of markedness constraint ranking schemas in defining canonical morpheme shapes is discussed in the next section.

2.1.2. *Canonical forms and markedness*

2.1.2.1. *Foot as unmarked Prosodic Word* Work like Alderete et al. (1999), McCarthy and Prince (1994*a*, 1994*b*, 1999), and Steriade (1988) has shown that reduplicative morphemes often illustrate what one can call the Emergence of the Unmarked (TETU): marked structure that is optimal in the Base output is non-optimal in the reduplicative morpheme. Within Optimality Theory (OT) this tendency is formalized by the following constraint ranking schema:

(7) TETU constraint ranking (adapted McCarthy and Prince 1999: 261)
I-O FAITHFULNESS ≫ MARKEDNESS CONSTRAINTS ≫ B-R FAITHFULNESS

Under this constraint ranking, marked structure can occur in the output of the Base (and unreduplicated forms), as the I-O FAITHFULNESS constraint requiring Input structure to be realized in the Output outranks (some) markedness constraints. This same marked structure will be non-optimal in the reduplicative morpheme, as (some) markedness constraints outrank the B-R FAITHFULNESS constraint requiring Base structure to be realized in the reduplicant. An example of how this constraint ranking can optimize unmarked structure in the reduplicative morpheme is found in the analysis of Ilokano Light reduplication in Chapter 1, fig. (14), where the syllable markedness constraints NOCODA and *VV crucially outrank MAX-BR to define the light syllable requirement on the reduplicant. (We shall return to the analysis of Ilokano Heavy and Light reduplication shortly.)

McCarthy and Prince (1994*a*, 1999) propose that the TETU ranking schema in (7) can also account for the disyllabic maximality condition on reduplicative morphemes in languages like Diyari, by defining a single Foot as the unmarked Prosodic Word. The crucial markedness constraints in their analysis are PARSE-σ (8*a*), which is satisfied if the entire output string is parsed into stress Feet, and ALL-FT-L (8*b*), which is satisfied if the string is parsed into a single Foot aligned at the left edge of Prosodic Word. These two markedness constraints are in obvious conflict with each other in languages like Diyari which have alternating stress in longer words: e.g. *ŋándawàlka* 'to close'. PARSE-σ (8*a*) is satisfied if all syllables in the string are footed, while ALL-FT-L (8*b*) is satisfied if only the leftmost two syllables are. This conflict is resolved by ranking PARSE-σ above ALL-FT-L and below MAX-IO (8*c*).

(8) *Foot parsing constraints* (McCarthy and Prince 1999: 262–3)
   (*a*) PARSE-σ Every syllable belongs to some Foot.
   (*b*) ALL-FT-L: AlignL(Ft, PrWord)
   Every Foot is aligned at the left edge of some Prosodic Word.

   FAITHFULNESS constraints (McCarthy and Prince 1995*a*: 264)
   (*c*) MAX-IO: Every segment of the input has a correspondent in the output.
   (*d*) MAX-BR: Every segment of the Base has a correspondent in the reduplicant.

The analysis of Diyari stress is exemplified in the tableau in (9):[4]

(9) Diyari alternating stress (McCarthy and Prince 1999: 265)

/ŋandawalka/	MAX-IO	PARSE-σ	ALL-FT-L
☞ *a.* (ŋánda)(wàlka)			*
b. (ŋánda)walka		*!*	
c. (ŋánda)	*!****		

Crucial constraint ranking: MAX-IO>> PARSE-σ>> ALL-FT-L

Candidate (9*a*), with alternating stress, is optimal for non-reduplicative Prosodic Words. Even though the string is parsed into more than one Foot, violating ALL-FT-L, the higher ranked constraints requiring all input segments to be realized in the output (MAX-IO) and all syllables in the output string to be parsed (PARSE-σ) are satisfied. Candidates (9*b*) and (9*c*), which satisfy ALL-FT-L, are non-optimal as they violate higher-ranked PARSE-σ and MAX-IO.

[4] The constraints, STEM → PRWORD, BINARITY, and HEADEDNESS, are omitted from tableaux (9) and (11) as they are too high-ranked to play a role in choosing optimal candidates.

In reduplicative Prosodic Words, in contrast, the unmarked prosodic footing—a single Foot—is optimal if All-Ft-L is ranked above Max-BR, to give the TETU ranking in (10):

(10) TETU ranking defining a single stress Foot as the 'unmarked Prosodic Word' Max-IO ≫ Parse-σ ≫ All-Ft-L ≫ Max-BR

The tableau in (11) exemplifies the analysis:

(11) Diyari footing in reduplicated forms (McCarthy and Prince 1999: 264)

/RED$_{Stem}$= ŋandawalka/	Max-IO	Parse-σ	All-Ft-L	Max-BR
☞ *a.* (ŋánda) = (ŋánda)(wàlka)			*	*****
b. (ŋánda)(wálka) = (ŋánda)(wàlka)			**!	
c. (ŋánda) = (ŋánda)	*!****			

Candidate (11*a*), where the reduplicative Prosodic Word minimally and maximally parses a single stress Foot, is optimal. Since the reduplicative Prosodic Word contains a single Foot, All-Ft-L is only minimally violated, and the higher ranked constraints requiring all input segments to be realized in the output (Max-IO) and all syllables in the output string to be parsed (Parse-σ) are satisfied. The total reduplication candidate (11*b*) is non-optimal, as it incurs an additional All-Ft-L violation. Candidate (11*c*), where the reduplicative and Base Prosodic Word both contain a single Foot, is non-optimal as it violates high-ranked Max-IO.

To sum up, the Foot maximality condition on Prosodic Words is formalized through the interaction of Markedness and Faithfulness constraints. The constraint All-Ft-L defines the unmarked Prosodic Word as maximally containing a single Foot: only one Foot can be perfectly left aligned with Prosodic Word. (Recall that Headedness requires a Prosodic Word to minimally contain one Foot.) If All-Ft-L is ranked above Faithfulness constraints like Max-IO or Max-BR, then the unmarked Prosodic Word shape is optimal.

2.1.2.2. *Syllable as unmarked Root and Affix* So far, only the constraints defining the Foot as the canonical shape for morphemes categorized as Stems have been presented. We have not yet seen how monosyllabic canonical shapes—like those illustrated in Chapter 1 for Ilokano and Lushootseed reduplication—are to be accounted for. Indeed, as shown in tableau (6), monosyllabic outputs are non-optimal in languages where prosodic morphemes are categorized as Stems. However, non-Stem morphemes—i.e. ones categorized as Root or Affix—are not required to minimally contain one Foot as they are not parsed into a Prosodic Word. (The STEM → PRWORD HOMOLOGY (3*b*) is irrelevant for non-Stem morphemes.) Root and Affix prosodic morphemes can, then, be minimally monosyllabic by default: no constraint requires morphemes of those categories to be larger than a single syllable. As we saw in Urbanczyk's (2000) analysis of Lushootseed reduplication (Chapter 1, fig. (25)), the one-syllable maximality requirement, like the one-Foot maximality requirement, can be analysed as following from the TETU ranking in (7). In this case, the relevant markedness constraint is *STRUCσ, repeated in (12):[5]

(12) *STRUCσ—Minimize the number of syllables. (Urbanczyk 2000)

We know from the earlier discussion of Ilokano and Lushootseed that languages can have two different monosyllabic reduplication patterns, one with more marked syllable structure than the other. The Heavy and Light reduplication patterns of Ilokano, repeated below, illustrate this distinction, as the Heavy pattern has a marked Coda in the reduplicant, while the Light pattern does not (the reduplicative morpheme is underlined):

[5] I am following work like Urbanczyk (2000) in referring to constraints like *STRUCσ as markedness constraints, even though it is unclear why it is marked for an output to contain any syllables. Indeed, it is commonly argued that input segments are unpronounceable unless they are syllabified in the output (see e.g. Harris 1994, Itô 1986), so the presence of syllables is surely unmarked. It is more plausible to consider *STRUCσ as a constraint of the DEP-IO family, penalizing syllable-sized strings in the output that do not occur in the input. For the reduplicative morpheme to be realized at all, DEP-IO is necessarily violated, as the reduplicative morpheme has no input string. *STRUCσ has the effect of optimizing the minimal realization of the reduplicative morpheme: no more segments occur in the output than are necessary to constitute the minimal pronounceable unit in this position, namely, a syllable. See Pulleyblank (1998) and Howe and Pulleyblank (2004) for detailed arguments in favour of recasting many markedness constraints in terms of faithfulness.

(13) Ilokano (Hayes and Abad 1989: 357, figs. (26), (27))

(*a*) *Heavy reduplication*

kaldíŋ	'goat'	kal-kaldíŋ	'goats'
púsa	'cat'	pus-púsa	'cats'
na-ʔalsém	'sour'	naka-ʔal-ʔalsém	'very sour'
sáŋit	'to cry'	ʔag-saŋ-sáŋit	'is crying'
trabáho	'to work'	ʔag-trab-trabáho	'is working'

(b) *Light reduplication*

liŋʔét	'perspiration'	si-li-liŋʔét	'covered with perspiration'
bunéŋ	'kind of knife'	si-bu-bunéŋ	'carrying a *bunéŋ*'
pandilíŋ	'skirt'	si-pa-pandilíŋ	'wearing a skirt'
sáŋit	'to cry'	ʔagin-sa-sáŋit	'pretend to cry'
trabáho	'to work'	ʔagin-tra-trabáho	'pretend to work'

As noted in Chapter 1, Urbanczyk (2000) proposes that there is a principled basis for matching particular reduplicative morphemes with more marked output structure. Following work like Beckman (1997, 1998) and McCarthy and Prince (1995*a*: 364), she argues that, cross-linguistically, Roots (and Stems, which contain Roots) have more marked structure than Affixes. This generalization is formalized in OT by the harmonic ranking, Root ≫ Affix, implemented as an annotation on Faithfulness constraints: e.g. Max-IO-Root, Max-BR-Affix. This leads to the following refinement of the general TETU ranking in (7):

(14) TETU, refined to take into account Root ≫ Affix:
IO Faithfulness ≫ Markedness Constraints ≫ BR-Root Faithfulness ≫ Markedness Constraints ≫ BR-Affix Faithfulness

Given this ranking, all reduplicative morphemes must contain less marked structure than non-reduplicative outputs, but Stem and Root reduplicants contain more marked structure than Affixal ones do.

The distinction between Ilokano Heavy and Light reduplication can then be reanalysed in PBT by adapting Urbanczyk's (2000) analysis of Lushootseed (given in Chapter 1, fig. (25)).[6] The Heavy

[6] See Crowhurst (2004) and Hendricks (1999) for alternative analyses of the Heavy reduplication pattern of Ilokano.

reduplicative morpheme is categorized as a Root since it contains more marked structure, while the Light reduplicative morpheme is categorized as an Affix. The construction-specific templatic constraint, RED = σ (Chapter 1, fig. (11*e*)), can be replaced by the TETU ranking of the markedness constraints, *Strucσ (12) and No Coda (Syllables do not have codas), given in (15):

(15) TETU ranking for Ilokano reduplication:
Max-IO ≫ *Strucσ ≫ Max-BR-Root ≫ NoCoda ≫ Max-BR-Affix

Ranking Max-IO above *Strucσ optimizes realizing all input syllables in the output. Ranking *Strucσ above both Max-BR constraints optimizes realizing a single monosyllable in the reduplicative string.[7] Ranking NoCoda between the two Max-BR constraints, optimizes Codas in the Heavy (Root) reduplicative morphemes, but penalizes them in the Light (Affix) ones. The tableau in (16) exemplifies the analysis:

(16) Ilokano Heavy and Light reduplication (adapted, Urbanczyk 2000: figs. (39), (43)

	Max-IO	*Strucσ	Max-BR-Root	NoCoda	Max-BR-Affix
RED_{Afx}-trabaho					
☞ *a.* tra-trabaho		****			****
b. trabaho-trabaho		*****!*			
c. trab-trabaho		****		*!	***
d. trab-trab	*!**	**		**	
RED_{Root}-trabaho					
☞ *e.* trab-trabaho		****	***	*	
f. trabaho-trabaho		*****!*			
g. tra-trabaho		****	****!		

Candidate (16*a*) is optimal for Light (Affixal) reduplication, as it best satisfies the markedness constraints—NoCoda and *Strucσ

[7] I assume the constraint ParseMorpheme—a morph must be realized in the output (Akinlabi 1996)—rules out a candidate with a null realization of the reduplicative morpheme like *ø- trabaho.*

(12)—which optimize copying as much of the Base as possible while not exceeding a single open syllable. Candidate (16*e*) is optimal for Heavy (Root) reduplication. Since the Heavy reduplicant is a Root, it is optimal for the reduplicative syllable to contain a coda in order to better satisfy Max-BR-Root. (Notice that Max-BR-Root violations are only incurred if the reduplicant is specified Root; and only Affixal reduplicants incur Max-BR-Affix violations.)[8]

2.1.3. *Summary*

The PBT defines canonical morpheme shapes as follows. Minimally Foot-sized (bimoraic or disyllabic) prosodic morphemes are morphologically categorized as Words or Stems, both necessarily parsed into Prosodic Words. The minimality condition then follows from Headedness (2*a*) and Binarity (2*b*). Prosodic Word must dominate at least one stress Foot, and a stress Foot is minimally bimoraic or disyllabic. This proposal claims not only that Words are minimally no smaller than the minimal stress Foot of the language, but also that other (prosodic) morphemes which are parsed into a Prosodic Word will minimally contain a stress Foot. These morphemes are predicted to not only have the canonical shape of Prosodic Words, but also have other phonological properties in common with Prosodic Words.

Syllable-sized prosodic morphemes are accounted for by categorizing them as Roots or Affixes. Since these morpheme types are not obligatorily parsed into Prosodic Word, they need not minimally contain a stress Foot. The interaction of phonotactic markedness

[8] Although this analysis of the two Ilokano reduplication patterns works, it faces an important problem. The canonical Root shape in Ilokano, as in other Filipino languages, like Tagalog, is disyllabic (Rubino 2005, Schachter and Otanes 1972). Classifying the Heavy reduplicative morpheme as a Root is not, then, the most plausible means of accounting for its more marked structure, compared to the Light reduplicative morpheme. The analysis is retained here to illustrate with a language other than Lushootseed how the Root $\gg$ Affix ranking could account for markedness distinctions between monosyllabic reduplicative morphemes. In fact, as we shall see, it illustrates the limits of this approach. We return to this problem in section 5.1.2, below.

constraints and faithfulness constraints optimizes a syllable (not less than a syllable) as the minimal size for Roots or Affixes.

Other markedness constraints define Foot and Syllable maximality requirements, while the ROOT ≫ AFFIX harmonic ranking for FAITHFULNESS constraints accounts for the tendency for reductions in size (e.g. from Foot to syllable) to correlate with other phonological reductions. This predicts that in languages with, for example, both Stem (or Root) and Affixal reduplication, less marked structure will be found in the Affixal reduplication pattern than in the Stem or Root one. A further prediction is that Root and Affix prosodic morphemes will have other morphological and/or phonological properties in common with other Roots and Affixes of the language.

2.2. Exemplifying the PBT

This section presents data which confirm the predictions of the PBT. First, minimal Words and prosodic morphemes categorized as Words or Stems are discussed, to illustrate that the canonical size of these morphological categories often matches a stress Foot. Then prosodic morphemes categorized as Root and Affix are discussed, to illustrate that the canonical size of these morphological categories often matches a marked and unmarked monosyllable, respectively. When available, independent evidence supporting the morphological category assigned the prosodic morpheme on the basis of shape will also be presented. It is important to note that the goal of this section is to make the best possible case for the PBT by discussing the sort of data that is claimed to support the theory. We shall see in section 2.3, though, that a careful look at more data reveals problems with the Prosodic Word-stress Foot correlation that lies at the heart of this theory. Chapters 3 and 4 will develop an alternative version of the GTT that addresses these problems and also better accounts for the apparent successes of the Prosodic Hierarchy-based approach exemplified here.

2.2.1. *Prosodic Word is minimally one stress Foot*

Work since McCarthy and Prince (1986) has established that lexical words in unrelated languages spoken all over the world are required to have a minimal size, typically two moras or two syllables. As we saw in section 2.1, the PBT accounts for this tendency through the principle of HEADEDNESS (2*a*). Prosodic Words dominate a stress Foot, and proper stress Feet are minimally bimoraic or disyllabic by BINARITY (2*b*). In languages where the stress Foot is a quantity-insensitive syllabic trochee, we expect the minimal word to be disyllabic. In languages with quantity-sensitive stress Feet—iambs or moraic trochees—the minimal word can be bimoraic. Cross-linguistic surveys by Gordon (1999) and Hayes (1995) show the correlation between minimal stress Foot and minimal word predicted by HEADEDNESS (2*a*) is attested in a number of languages. A sampling of languages illustrating this correlation is presented below.[9]

In English, monosyllabic lexical words must be minimally bimoraic by containing either a coda consonant or a tense (diphthongized) vowel: fit, fee, *[fɪ] (Harris 1994, Kenstowicz 1994, McCarthy and Prince 1986). Since the Modern English stress Foot type is a moraic trochee, with syllables containing either tense vowels or coda consonants counting as heavy, the minimal word matches the minimal stress Foot. In other Germanic languages with quantity-sensitive stress systems—like German (Hall 1999), Dutch (Booij 1999), and Norwegian (Kristoffersen 2000)—a bimoraic monosyllable is also the minimal word. Within Romance languages, Scullen (1993) argues that French words are subject to a bimoraic minimality condition, which is consistent with the iambic stress

[9] This section does not pretend to be an exhaustive survey of languages where it has been claimed that lexical words are minimally two moras or two syllables long. The goal in this section is, rather, to show that there is a match between the minimal word and the minimal stress Foot in a geographically and genetically diverse set of languages. The interested reader is urged to consult Gordon (1999) for a very thorough survey of the correlation between word minimality and stress system. The other references cited here provide further examples and discussion.

system of the language. Thornton (1996) shows that Italian words are minimally disyllabic and argues that this is consistent with the basically trochaic stress system of the language.[10]

In Afro-Asiatic languages like Standard Arabic (McCarthy and Prince 1990*b*) and many Arabic dialects—Iraqi Arabic (Broselow 1982), Cairene, Cyrenaican Bedouin, Lebanese and Palestinian Arabic (Hayes 1995)—words are, with rare exceptions, minimally bimoraic. (Note that this generalization holds for nouns, while verb stems commonly must satisfy a disyllabic template. We shall return to this point below.) As the stress system in all these Arabic dialects is quantity sensitive, the minimal word size matches the minimal stress Foot. Mous (1993) shows that words are also minimally bimoraic in the Cushitic language, Iraqw, as expected given its quantity sensitive stress system.

In Australian languages, 'the normal phonotactic pattern is for words to be of two or more syllables' (Blake and Dixon 1979: 21). As the PBT predicts, there is a strong tendency for this disyllabic minimal word condition to correlate with a quantity-insensitive stress system. Languages like Aranda and Alyawarra (Downing 1998*b*), Diyari (Poser 1989), Dyirbal (Dixon 1972), and Guugu Yimidhirr (Dixon 2002, Kager 1996) provide examples. Australian

[10] A couple of notes on stress in French and Italian are in order. First, it may come as a surprise to some readers to see French characterized as an iambic system, when it is traditionally mischaracterized, according to Scullen (1993: 22), as having a quantity-insensitive, unbounded stress system, with stress most prominent on a phrase-final syllable. She presents work like Dell (1984) and Fónagy (1979) which convincingly support her claim that French has secondary stress, and that both secondary and main stress are quantity sensitive.

In contrast, it is harder to agree with Thornton (1996) that disyllabic word minimality matches trochaic stress footing in Italian. The stress system has some properties characteristic of syllabic trochaic systems. Main stress generally falls on the penult or antepenult, and alternating preceding syllables tend to be stressed. However, other properties obscure this system. All syllables with main stress are heavy, whereas syllabic trochees should be quantity insensitive (Hayes 1995). Further, morphological factors, rather than phonological ones, seem to be the main determinant of the placement of main stress within the three-syllable window at the right edge of a Word. We return to this problem in section 2.3.2.

languages with quantity-sensitive stress systems often have bimoraic minimal words, as predicted. This pattern is found in languages like Gumbayŋgir and Wargamay (Kager 1995). In the Austronesian family, too, the predicted bimoraic minimality condition on words can be found in languages like Fijian (Dixon 1988: 25; Hayes 1995) and Kambera (Klamer 1998) where the stress systems show a correlation between stress and quantity.

In the Americas, languages with a quantity-insensitive stress system and a disyllabic (content) word minimality requirement include: Cree (Russell 1999) and Mohawk (Broselow 1982, Hayes 1995, Piggott 1995). Languages with quantity-sensitive systems—like Axininca Campa (Spring 1990), Banawá (Buller, Buller, and Everett 1993) and Choctaw (Nicklas 1974, Lombardi and McCarthy 1991)—can have minimally bimoraic words.

In many Bantu languages of sub-Saharan Africa, words are minimally disyllabic. (See e.g. work like Batibo and Rottland (1992), Downing (2005*b*), Myers (1987) and Odden (1999).) As the penult syllable is stressed in many of these languages, it has been argued that the disyllabic minimal Word condition allows consistent penult stress.

Languages of Southeast Asia that have a major-minor syllable distinction are often analysed as having an iambic stress system (Hayes 1995). It then follows that words in these languages are required to minimally consist of a major (bimoraic) syllable. This has been shown for Burmese (Green 1995, 2003), Cambodian (Huffman 1972), and Thai (Bennett 1994).

In many of the languages listed above, the minimality requirement is a passive one. It just turns out that all lexical (content) words of the language consist minimally of two moras or two syllables. In other languages, minimality is an active requirement, triggering processes which expand potentially subminimal Words or blocking processes which would reduce a Word to a subminimal length.

In Choctaw, for example, vowels in even-numbered syllables (except the final syllable) regularly lengthen, as shown in (17):

(17) Choctaw Alternate Lengthening (Lombardi and McCarthy 1991: 44; these words are composed of the roots, /habina/ 'receive (a present)'and /pisa/ 'see', combined with the affixes, /tʃi-/ 'you sg.', /-tʃi/ 'causative', Ø 'he', and /-li/ 'I'.)

habiina	pisa
tʃihaabina	tʃipiisa
habiinali	pisaali
tʃihaabinaali	tʃipiisali
habiinatʃi	pisaatʃi
tʃihaabinaatʃi	tʃipiisatʃi
habiinatʃiili	pisaatʃili
tʃipiisatʃiili	

Lombardi and McCarthy (1991) argue that the best explanation for this pattern of vowel lengthening is that Words are parsed into iambic feet. Lengthening enforces the weight asymmetry characteristic of this quantity-sensitive Foot type. In an iambic stress system, the minimal stress Foot is bimoraic. The minimal word, then, should also be bimoraic.

As Lombardi and McCarthy (1991) and Nicklas (1974) show, there are, in fact, several pieces of evidence for a bimoraic minimal word constraint in Choctaw. First, the only monosyllabic nouns in the language are all bimoraic, containing a long vowel, as shown in (18*a*). Second, the vowel of monosyllabic particles is lengthened, as stated in (18*b*). Finally, as shown in (18*c*.i), some VCV verbs can begin with any vowel and retain the vowel when prefixes are added. Others (18*c*.ii) can only begin with *a*-, and lose this vowel when prefixes are added. Lombardi and McCarthy (1991) argue that the vowel of the stems in (18*c*.ii) is epenthesized to satisfy word minimality:

(18) Evidence for the bimoraic minimal word in Choctaw

(*a*) Monosyllabic nouns (Lombardi and McCarthy 1991: 47; Nicklas 1974: 22)

book	'river'
waak	'cow'
tiik	'female'
paaʃ	'slap'

(*b*) Monosyllabic particles (Nicklas 1974: 124)
'The operation of sound change (14) [a final vowel in a word of one syllable is lengthened] can be seen in the pronunciation of the particles *pi* 'just', *na* 'and' [subject case]' and *cha* 'and' [oblique case]'.

(*c*) VCV vs. CV verb stems (Lombardi and McCarthy 1991: 46; Nicklas 1974: 63–4)

(i)	ani	'to fill'	iʃ-ani	'for you to fill'
(ii)	abi	'to kill'	iʃ-bi	'for you to kill'

In an OT analysis, the minimality triggered lengthening and epenthesis illustrated in (18*b*,*c*) can be straightforwardly formalized by having the word minimality constraints, repeated as (19*a*,*b*)) outrank the Faithfulness constraint (19*c*) penalizing epenthesis and a markedness constraint penalizing long vowels (19*d*).[11]

(19) Constraints motivating minimality-triggered epenthesis:
(*a*) Headedness: Prosodic Word contains at least one stress Foot.
(*b*) Binarity: Feet are minimally and maximally bimoraic or disyllabic.
(*c*) Dep: Each element of the output has a correspondent in the input.
(*d*) *VV: Long vowels are marked. (Rosenthall 1994)

The tableaux exemplifying the analysis are given in (20) and (21).[12]

(20) Lengthening in monosyllabic particles (18*b*)

/na/	Headedness	Binarity	Dep	*VV
☞ *a.* (na:)			*	*
b. (na)		*!		
c. na	*!			

[11] I am following work since Hyman (1985) in assuming that short vowels are monomoraic, while long vowels and diphthongs are bimoraic.

[12] It is unexplained in the analysis presented in (19) and (20) why particles are made bimoraic by lengthening, while verb stems are made bimoraic by inserting an extra syllable. It also does not explain why the epenthesized *a* of CV stems is only deleted when prefixes are added, but is retained when suffixes are added, even though the suffix adds the syllable needed to satisfy minimality: e.g. *abi-lih* 'I kill him' (**bi-lih*). These facts suggest that morphological structure of nouns and verbs plays a role in defining minimality in Choctaw, along the lines suggested in section 3.2.1, below, for other languages. This question merits further study, but it is unfortunately beyond the scope of this work to take up the analysis of Choctaw morphology necessary to pursue this point.

Candidate (20*a*) shows that lengthening is optimal in unaffixed monosyllabic stems, even though lengthening violates Dep (19*a*) and *VV (19*b*). Not lengthening, as in candidate (20*b*), violates higher-ranked Binarity (19*b*), the constraint optimizing a bimoraic word minimum for footed Words in an iambic system. Not parsing *na* into a Foot, as in (20*c*), violates Headedness (19*a*).

(21) Epenthesis in CVverb stems (18*c*.ii)

/bi/	Headedness	Binarity	Dep	*VV
☞ *a.* (a-bi)			*	
b. (bi)		*!		
/iʃ-bi/				
☞ *c.* (iʃ-bi)				
d. (iʃ-a)-bi			*!	

In the first candidate set in (21), candidate (21*a*) is optimal. Even though epenthesizing a vowel violates Dep, not epenthesizing, as in (21*b*), violates higher-ranked Binarity. The next candidate set shows that epenthesizing the vowel in prefixed words, as in candidate (21*d*), is non-optimal as that gratuitously violates Dep. Since the prefix allows the word to satisfy Binarity, candidate (21*c*), where the input is identical to the output, is optimal: it satisfies all the constraints.

The imperative form of the verb in many Bantu languages also illustrates minimality-motivated epenthesis. For example, in Zezuru Shona, a Southern Bantu language spoken in Zimbabwe, multisyllabic stems form the imperative with the bare verb stem, as shown in (22*a*). The data in (22*b*) show that an /i-/ obligatorily occurs before monosyllabic stems:

(22) Shona (Zezuru dialect) imperative stems (Odden 1999, fig. (1))

		Infinitive	*Imperative singular*	*Gloss*
(*a*)	Multisyllabic stems	ku-rima	rima (*i-rima)	‘plough’
		ku-vereketa	veréketá	‘read’
(*b*)	Monosyllabic stem	ku-pá	i-pá (*pa)	‘give’

As the /i-/ is absent when the stem is prefixed (for example, in the infinitive form *ku-pá* 'to give'), Myers (1987) and Odden (1999) argue that its occurrence in the imperative is best motivated by a disyllabic word minimality constraint. Words in Zezuru Shona have stress on the penult. The motivation for this minimality constraint in PBT would be that it allows consistent assignment of stress to the penult of all words.

Other Southern Bantu languages which have penult stress and also epenthesize a default vowel or syllable to satisfy a disyllabic minimality constraint in the imperative include: Zulu (Doke 1992); Xhosa (Cassimjee 1998); Ndebele (Downing 2001*a*, Hyman et al. 1999); Venda (Ziervogel and Dau 1961); and Southern Sotho (Doke and Mofokeng 1957). Broselow (1982) and Piggott (1995) show that an essentially identical process of /i/-epenthesis in Mohawk is also motivated by a minimality requirement on verb stems, allowing the penult to be consistently stressed. Vowel insertion in Iraqi Arabic (Broselow 1982) and augmentation in Lardil (see (26*c*), below) provide examples of languages where epenthesis in unaffixed monosyllabic stems has been motivated by a bimoraic word minimality requirement argued to be consistent with the minimal stress Foot.[13]

The other common word minimality effect is for processes which delete segments to be blocked if the output would be subminimal. For example, in the Bantu language Swahili, a nasal prefix (the agreement class marker for class 9/10) is regularly deleted before a voiceless obstruent, as shown by the data in (23*a*).[14] However, as shown in (23*b*), deletion does not occur if the output would contain a single syllable. Notice that the nasal prefix is assigned regular penult stress (indicated by an acute accent):

[13] Section 2.3 and subsequent chapters, however, argue that stress footing does not provide a plausible explanation for minimality-motivated augmentation in Bantu languages or in Lardil.

[14] As work like Pater (1999) shows, nasal/voiceless obstruent clusters are marked, and commonly eliminated by processes like the one of nasal deletion illustrated in Swahili.

(23) Swahili n-deletion (Batibo and Rottland 1992: 93, figs. (6), (7))

(*a*)	pámba	'cotton'	(*m-pámba)
	tá.a	'lamp'	(*n-tá.a)
	chúpa	'bottle'	(*n-chúpa)
	kondó.o	'sheep'	(*n-kondó.o)
	físi	'hyena'	(*m-físi)
	símba	'lion'	(*n-símba)
(*b*)	´n-ta	'wax'	(*ta)
	´n-chi	'land'	(*chi)
	´m-chwa	'termites'	(*chwa)
	´n-swi	'fish'	(*swi)

As work like Brandon (1975) and Batibo and Rottland (1992) argues, the best explanation for why nasal deletion is blocked in (23*b*) is that the output would violate a disyllabic word minimality constraint. Retaining the nasal prefix and stressing it allows the words in (23*b*) to have regular penult stress.

The blocking effects of word minimality illustrated in (23*b*) can be accounted for within PBT along the same lines as the triggering effects illustrated in (18*b*, *c*). The constraints requiring Prosodic Words to minimally contain a stress Foot (Headedness and Binarity (24*a*, *b*)) outrank the constraints that optimize otherwise regular phonological processes. In the case of Swahili nasal deletion illustrated in (23*a*) is motivated by the constraint in (24*c*): nasal-voiceless obstruent sequences are marked. Ranking this constraint above the Faithfulness constraint in (24*d*) optimizes deletion as a regular process of Swahili. Ranking both these constraints below (24*a*, *b*) blocks nasal deletion if the output would violate word minimality:

(24) Constraints motivating minimality triggered epenthesis

(*a*) Headedness—Prosodic Word contains at least one stress Foot.

(*b*) Binarity—Feet are minimally and maximally bimoraic or disyllabic.

OUTRANK

(*c*) *NC—No nasal-voiceless obstruent sequences. (Pater 1999: 313)

OUTRANKS

(*d*) Max-IO—All segments of the input must occur in the output.

The analysis is exemplified in (25):

(25)

/n-ta/	HEADEDNESS	BINARITY	*NC	MAX-IO
☞ *a.* ('n-ta)			*	
b. (tá)		*!		*
/n-ta.a/				
☞ *c.* (tá.a)				*
d. (n-tá.a)			*!	

Candidate (25*a*) shows that it is optimal to retain the nasal prefix with monosyllabic stems. Even though this violates *NC (24*c*), deleting the nasal, as in candidate (25*b*), violates higher-ranked BINARITY (24*b*). (Not parsing [ta] into a stress Foot would violate HEADEDNESS (24*a*).) The next candidate set shows that nasal deletion, as in candidate (25*c*), is optimal for longer stems: the highest-ranked constraints are satisfied when the nasal deletes. Retaining the nasal prefix in longer stems, as in candidate (25*d*), is non-optimal as that gratuitously violates *NC.

Another well-known example of blocking and augmentation motivated by word minimality is found in the Australian language Lardil. As shown by the data in (26*a*), word-final vowels regularly delete. However, as shown in (26*b*), deletion is blocked if the output would contain a single mora. The data in (26*c*) shows that monomoraic roots are augmented when they occur in an uninflected form:

(26) Lardil apocope and augmentation (Kenstowicz and Kisseberth 1979: 111–12, 115 citing Hale (1973); McCarthy and Prince 1986: 26)

(*a*) *Polysyllabic words allow apocope*

yalul	yalulu-n	'flame'
mayar	mayara-n	'rainbow'
yiliyil	yiliyili	'oyster species'
peer	peer-in	'ti-tree sp.'
maan	maan-in	'spear gen.'

(*b*) *Apocope blocked if output would not be minimally bimoraic*

mela (*mel)	mela-n	'sea'
tjempe	tjempe-n	'mother's father'
wanka	wanka-n	'arm'
wiʈe	wiʈe-n	'interior'

(*c*) *Augmentation (by final -a) in monosyllabic roots*

wika	wik-in	'shade'
wunta	wun-in	'rain'
yaka	yak-in	'fish'
ʈilta	ʈil-in	'neck'

Work like Itô (1986), McCarthy and Prince (1986), Wilkinson (1988), and Prince and Smolensky (2004) argues that the best explanation for blocking of apocope in (26*b*) and augmentation in (26*c*) is that the output would violate a bimoraic word minimality constraint. McCarthy and Prince (1986) claims that this matches the minimal stress Foot of Lardil (but we shall question this in section 2.3.2, below). Similarly, in Estonian apocope is blocked if the output would be monomoraic (Kenstowicz 1994). As some aspects of the Estonian stress system are quantity sensitive, a bimoraic word minimality constraint is consistent with the PBT.

To sum up this section, we find in many languages that minimal words appear to be identical to minimal stress Feet, as required by Headedness and Binarity (2*a*, *b*). This minimality condition is often simply a passive generalization over the lexicon: no lexical words consist of a monomoraic monosyllable. It also can be an active requirement, triggering phonological processes that augment subminimal words and blocking regular phonological processes if the output is subminimal.

2.2.2. *Truncations and unmarked Prosodic Word*

In this work, I follow Weeda (1992) in using the term 'truncation' to refer to morphological processes which form new Words from a Base Word by deleting part of the Base. As Weeda notes, truncation is a cross-linguistically common way to form hypocoristics (nick-names) and abbreviations. The distinction between these two is that nicknames are truncations of names or titles, while abbreviations are semantically vacuous truncations of other lexical categories. In my sources, nicknames tend to be more commonly documented than abbreviations, perhaps because abbreviations—even more than nicknames—are features of informal or casual speech. Weeda further distinguishes two types of truncation, simple and subtractive. In simple truncation, it is the output of truncation which has a relatively fixed shape. In subtractive truncation, a fixed shape is truncated from the Base, so that the output of truncation has a variable shape. As this work is concerned with fixed output shapes, only simple truncation will be discussed here.

Truncated forms, by definition, are shorter than their Bases. Since the output of truncation is a morphological Word, PBT defines a limit on how short a truncated form can be. Like other Prosodic Words, it must minimally contain one proper stress Foot.[15] That is, truncations are minimal words (McCarthy and Prince 1986, Itô and Mester 1992). In quantity-sensitive stress languages like English and Thai, Words minimally contain a bimoraic monosyllable, as this is the minimal stress Foot. Truncations (nicknames and abbreviations) in English and Thai must also minimally contain a bimoraic syllable, as shown in (27):

(27) (*a*) English monosyllabic nicknames and abbreviations

Full form	Truncation	
David	Dave	
Joseph	Joe	
Susan	Sue	
Nancy	Nance	
magazine	mag	
refrigerator	fridge	
semper fidelis	semper fi	(USMC motto)
brother	bro	

[15] Only a sampling of languages is presented here. The interested reader can consult Weeda (1992), especially, for a more comprehensive discussion of truncations, and McCarthy and Prince (1986) for discussion and further references.

(*b*) Thai parent names (Weeda 1992: appendix B)

Full form	Truncation(s)		
prì:yà:	prì: (rare)	OR	yà:
sàlìn	lìn		
nàrút	rút	(*nà)	
pétcarat	pét	OR	rat

In Swahili and Italian, words minimally contain two syllables, and truncations (nicknames and abbreviations) in both languages must also minimally contain, generally, the first two syllables of the Base form:

(28) (*a*) Swahili nicknames (Batibo and Rottland 1992: 105)

Full form	Truncated form		
Ramandháni	Ráma		
Mwinyimbégu	Mwínyi		
Elizabéti	Líza	OR	Béti
Zainábu	Záina		

(*b*) Italian nicknames and abbreviations (Thornton 1996: 87–8)

Full form	Truncated form	
Alessandro	Ale	
Isabella	Isa	
Salvatore	Salva	
Enrico	Enri	
amplificatore	ampli	'amplifier'
bicicletta	bici	'bicycle'
frigorifero	frigo	'refrigerator'
sigaretta	siga	'cigarette'

Truncated forms have in common with other Prosodic Words that they are subject to a bimoraic/disyllabic minimality condition. Unlike other Prosodic Words, they are also subject to a maximality condition. As we can see, in Thai (27*b*), Swahili (28*a*) and Italian (28*b*), for example, nicknames are exactly bimoraic or disyllabic. Non-compound abbreviations in Italian are also maximally as well as minimally disyllabic. We saw in the analysis of Diyari reduplication in (11) that maximality conditions on reduplication are formalized by the Emergence of the Unmarked (TETU) constraint-ranking schema: markedness constraints on stress Footing outrank reduplication-specific FAITHFULNESS constraints. Maximality constraints for truncations can be given a parallel analysis. If the markedness constraint on stress Footing (29*a*) outranks the truncation-specific FAITHFULNESS constraint, MAX-BASE/TRUNCATION (or 'MAX-BT'), the canonical shape of truncated forms is a single stress Foot: the unmarked Prosodic Word.[16]

(29) Constraints and rankings defining the unmarked Prosodic Word
 (*a*) ALL-FT-R: AlignR(Ft, PrWord)
 Every Foot is aligned at the right edge of some Prosodic Word.
 (*b*) PARSE-σ—Every syllable is parsed into a stress Foot.
 (*c*) MAX-IO—Every element of the input must occur in the output.
 (*d*) MAX-BT—Every element of the Base must occur in the Truncation.
 (*e*) TETU ranking: MAX-IO ≫ ALL-FT-R ≫ PARSE-σ ≫ MAX-BT

The tableau in (30) exemplifies the analysis, taking Swahili nicknames like those in (28*a*) as representative of this type of truncation. (In the second candidate set of the tableau, the dash between the nickname and full form indicates that they are morphologically related forms of the same name, with the truncation phonologically dependent on the Base. It does not indicate that both are pronounced together in the same output, rather that the outputs are related by Correspondence constraints of the BT family.)

(30) Tableau for Swahili nicknames (28*a*)

/Elizabeti/	MAX-IO	ALL-FT-R	PARSE-σ	MAX-BT
☞ *a.* Eliza(béti)			***	
b. (Béti)	*!****			
/TRUNC/—/Elizabeti/				
☞ *c.* (Béti)—Eliza(béti)			***	*****
d. Eliza(béti)—Eliza(béti)			****!**	

16 In contrast to the foot alignment constraint for Diyari in (8*b*), the foot alignment constraint in (29*a*) targets the right edge of a Prosodic Word, since in Thai, Swahili, and Italian main stress is located with respect to the right edge of the Word. Note, too, that the parallel with the Diyari analysis in (11) is imperfect, as Swahili has an unbounded stress system. In OT terms, this means that the relative ranking of the foot alignment constraints and PARSE-σ are reversed in Swahili, compared to Diyari. As a result, it is PARSE-σ rather than foot alignment which optimizes a disyllabic truncation in Swahili, as shown in (30).

The first candidate set shows that ranking MAX-IO (29*c*) above the markedness constraints makes it optimal to realize the entire input of the name (and other Words) even if markedness constraints are violated. In the second candidate set, MAX-IO (29*c*) is satisfied by the full form of the name in all output candidates, while the markedness constraints play a decisive role in choosing the optimal truncated form. Candidate (30*c*) is optimal, as truncating the nickname to a single Foot means that it incurs fewer violations of PARSE-σ than candidate (30*d*) where the nickname is identical to the full form.

In other languages, the maximal and minimal size of truncations is not identical. Instead, there is restricted variation in size. For example, in English, while names of two syllables have bimoraic one syllable nicknames like those shown in (27*a*), some longer names have two syllable nicknames (in addition, in some cases, to monosyllabic nicknames on the model of those in (27*a*)): e.g. *Alexander / Sander; Theodore / Theo; Arabella / Bella; Vanessa / Nessa.* As Weeda (1992) shows, these nicknames are identical to the main stress Foot of the Base. The range of variation in the length of English nicknames is, therefore, between the minimal and maximal stress Foot. A similar range of variation in size between the minimal and maximal stress Foot is found in Central Alaskan Yupik hypocoristics (Weeda 1992: sect. 3.7.2).[17] We can account for this variation in the length of the nicknames by proposing that the truncations match the minimality and maximality conditions on the stress Feet of the language.

However, in other languages, the range of variation in nickname size does not match the variation in minimal and maximal Foot size. For example, van de Vijver (1998) shows that one pattern of Dutch

[17] Central Alaskan Yupik (CAY) is analysed by Weeda (1992) and Hayes (1995) as having an iambic stress system. The minimal stress Foot is, then, a bimoraic monosyllable; the maximal stress Foot is a disyllable with the second syllable heavy. This correctly defines the attested size range for CAY hypocoristics. A further argument for proposing that the minimal hypocoristic is the minimal word comes from the fact that both are CVC. Indeed, all Word-initial syllables have that shape in CAY (Gordon 1999), and, like other CVC syllables, are arguably bimoraic as they are preferentially stressed (Hayes 1995: 249).

nicknames, illustrated in (31), can be one or two syllables long. While the nicknames never exceed a disyllabic maximum, either (or both) of the syllables in the two-syllable combinations can be heavy. As a result, some nicknames in this pattern cannot be parsed as a single Foot in the quantity-sensitive stress system of Dutch:

(31) Dutch nicknames (van de Vijver 1998: 229–30)

Full form	Nickname
Kírsten	Kirs
Dávid	Daaf
Nàvratilóva	Návra
Górbatsjov	Górba
Aníta	Aníet
Pàndóra	Pàndór

And in French (32), Weeda (1992), and Scullen (1993) show that abbreviations typically range from one bimoraic syllable to four (heavy and/or light) syllables in size, whereas the iambic stress Foot of French contains at most two syllables (and only the second one can be heavy):

(32) French abbreviations (Scullen 1993: appendix A)

Full form	Abbreviation	
matin	mat	'morning'
diamant	diam	'diamond'
appartement	appart	'apartment'
décaféiné	déca	'decaffeinated'
encyclopédie	encyclop	'encyclopedia'
désintoxication	désintox	'detoxification'

Itô (1990) describes an identical maximality constraint for Japanese loanword truncations. We will return to the problem of how best to analyse these kinds of maximality constraints on truncations and other Prosodic Words (more than one Foot but no more than four syllables) in Chapters 3 and 5.

To sum up, the PBT predicts that truncations, as a type of Prosodic Word, are subject to the same minimality constraint as other Prosodic Words, namely, they minimally contain a single stress Foot. Like reduplicative morphemes, but unlike other Prosodic Words, simple truncations are also commonly subject to a maximality condition. In some languages, we have seen that truncated forms are both minimally and maximally one bimoraic or disyllabic Foot. This is straightforwardly analysed in PBT by adopting the TETU constraint-ranking schema, as shown in (30), above. However, cases like Dutch and French (31*a*, *b*), where the truncated form is subject to a maximality condition which is longer than a Foot, are a problem for PBT, as these strings do not straightforwardly define any prosodic constituent and so cannot be fit into any of the MCat-PCat mappings in (3*b*), above.

2.2.3. *Reduplication and unmarked morpheme shape*

Since reduplication is defined as a morphological process of 'repeating' a co-occurring Base string (Bauer 1988, Matthews 1991, Wilbur 1973), we expect a close match between the pronunciation of a reduplicative morpheme and its Base.[18] Mismatches are found frequently, however, and analysing these mismatches has been an important area of phonological research since work like Marantz (1982). As we saw in Chapter 1, a common source of mismatch is for the reduplicative morpheme to be required to have a fixed minimal and/or maximal shape of one to two syllables, even though the Base can be variable in length. Recall from section 2.1 that in PBT the fixed shape is defined as follows. Reduplicative morphemes categorized as Word or Stem are parsed into a Prosodic Word and, like other Prosodic Words, must minimally contain a binary stress Foot. Reduplicative morphemes categorized as Root or Affix can be monosyllabic (shorter than a Foot). Maximality conditions on reduplicative morphemes—like truncations—are considered a type of reduction to the unmarked morpheme shape, analysed by ranking Markedness constraints above morpheme-specific Faithfulness constraints (the TETU ranking schemas in (7), (10), and (29*e*)).

[18] Reduplication is very widespread in the world's languages, and this work necessarily can only present a small sampling of patterns. See Hurch (2005) for a recent collection of papers on reduplication. The references cited throughout this book will lead interested readers to many more.

The following subsections show how the relative ranking of Markedness and Faithfulness constraints defines the range of reduplicative morpheme shapes. When all Faithfulness constraints are high-ranked, both the reduplicative morpheme and its Base can be variable in shape. This is exactly what we find in total reduplication, illustrated in section 2.2.3.1: the reduplicative morpheme matches the size of its Base. When the relevant markedness constraints outrank B-R Faithfulness constraints, reduction of the reduplicative morpheme to the unmarked shape for its morphological category is optimal. Section 2.2.3.2 presents more examples of languages like Diyari (see (10) and (11), above), where the reduplicative morpheme is Foot-sized: that is, an unmarked Prosodic Word in PBT. And section 2.2.3.3 presents more examples of languages like Ilokano (see (15) and (16), above), where the reduplicative morpheme is syllable sized: that is, an unmarked Root or Affix in PBT.

2.2.3.1. *Total reduplication* Work like Eulenberg (1971) and Niepokuj (1991) has argued that total reduplication is the historically primary reduplication process and is a form of self-compounding—or morphological doubling in Inkelas and Zoll's (2000, 2005) terminology—at the Word, Stem, or Root level. Like other compounds, the total reduplication complex is made up of two lexical morphemes. Unlike other compounds, each half of the total reduplication complex is identical, as the reduplicative string matches both the morpho-syntactic structure and the phonological content of the Base.[19] In current, traditional Optimality Theory (McCarthy and Prince 1994*a*, 1994*b*, 1995*a*, 1995*b*, 1998, 1999) the requirement of phonological identity between the Base and the reduplicative string is formalized

[19] In the reduplication theory developed by Inkelas (2005) and Inkelas and Zoll (2000, 2005) reduplication is morpho-syntactic or semantic doubling, a form of compounding, with phonological identity between the two strings a by-product. Notice that this approach is essentially the mirror image of GTT. See work like Downing (2003), Fabb (1998), Kiparsky (1986), McCarthy and Prince (1995*a*, 1999), and Yip (1998, 2001) for other arguments that both total and partial reduplicative complexes cross-linguistically show many morphological and phonological parallels with compounds. A number of these arguments will be illustrated below.

through Base-Reduplicant Faithfulness constraints (like Max-BR (8*d*)). The morphological category of the two strings is not required to match, as the constraint assigning a morphological category to the reduplicative string ((3*a*), above) makes no reference to the morphological category of the Base. However, as we shall see in the examples below, total reduplicative complexes often have properties in common with compounds, showing the two halves are also arguably morphologically identical. Assigning compound status to the reduplicative complex explains why the prosody of the reduplicative string only variably matches the prosody of the Base in some languages, even though reduplication is total at the segmental level.

We begin our survey of total reduplication with languages where the entire word is reduplicated, and each half of the reduplicative complex has identical prosody. In Afrikaans (a West Germanic language closely related to Dutch spoken mainly in South Africa), Botha (1988) shows that all lexical categories productively undergo reduplication to indicate a variety of changes in meaning in the Base word. This is illustrated in the data below (the reduplicated forms are underlined):

(33) Afrikaans total Word reduplication (Botha 1988: 1–2, 38)

(*a*) Die kinders drink bottels-bottels limonade.
the children drink bottles bottles lemonade
The children drink bottles and bottles of lemonade.

(*b*) Die pad was ent-ent sleg.
the road was stretch-stretch bad
The road was bad in some (scattered) stretches.

(*c*) Moeisaam pantoffel-pantoffel hy in die hospitaalgang af.
laboriously slipper-slipper he in the hospital corridor down
Padding laboriously on slippered feet, he makes his way down the hospital corridor.

(*d*) Hy dra tien-tien boeke die trap op.
he carry ten-ten books the stairs up
He carries the books up the stairs ten at a time.

According to Botha (1988: 83), all Afrikaans reduplications have main stress on each member of the reduplicative complex: e.g.

bóttels-bóttels 'bottles and bottles'. This contrasts with compounds, where the first member only has main stress and the second member has secondary stress: e.g. *hékse-bèsem* 'witch's broom', *wínkel-mèisie* 'shop girl'.[20]

Similarly, in Kambera, an Austronesian language spoken on Sumba Island, Klamer (1998) shows that entire words can undergo reduplication, and each half of the reduplicative complex is assigned main stress (in the translation, the meaning of the Base is underlined):

(34) Kambera total Word reduplication (Klamer 1998: 38)

(*a*)	ha-púngu = ha-púngu	'various poles'
(*b*)	ha-átu = ha-átu	'each and every one' (people)
(*c*)	ka-lémbi = ka-lémbi	'various family members'
(*d*)	ma-rámba = ma-rámba	'various (kinds of) kings'
(*e*)	pa-múla = pa-múla	'keep on planting (rice)'

As in Afrikaans, stress in total Word reduplication contrasts with stress in compounds. Kambera compounds assign main stress to the second member of the compound, while the first member has secondary stress: e.g. *wài máta* 'tears (water + eye)'; *tàda ngáru* 'lip (skin/bark + mouth)'.

Given the constraints so far, the Afrikaans and Kambera total Word reduplication patterns with equal stress can be analysed as follows. Recall from (3*a*), above, that all prosodic morphemes must be assigned a morphological category. As the reduplicative string can be several syllables long in both languages, the reduplicative morpheme is plausibly a Word or a Stem, like the Base. Following work like Eulenberg (1971), Inkelas and Zoll (2000, 2005), and Niepokuj (1991), I assume that total reduplication is a form of self-compounding. Morpho-syntactic identity between the reduplicative string and its Base can be formalized by allowing FAITHFULNESS

[20] See Botha (1988) for discussion of other phonological differences between reduplicative compounds and other compounds in Afrikaans. All of these differences can plausibly be accounted for along the lines of the analysis in (38): reduplicative compounds are subject to IDENT-BR constraints, while non-reduplicative compounds are not.

constraints to refer to morphological structure as well as segmental structure:[21]

(35) Ident-BR(MCat):
The morphological category of the reduplicant must be identical to that of the Base.

When the Base for reduplication is a Word, as in Afrikaans and Kambera, the reduplicative morpheme is also a Word when (35) is high-ranked. As a result, the reduplicative complex has the morphological status of a compound and, as in other compounds, each half is potentially a separate stress domain (Nespor and Vogel 1986, Downing 2003). The difference in stress assignment to reduplicative compound Words and non-reduplicative compound Words can be accounted for by proposing, following work like Gafos (1998*a*, 1998*b*), Kenstowicz (1995), McCarthy and Prince (1999) and Steriade (1988), that the prosody of reduplicative strings can be required to match the prosody of the Base. This requirement is formalized in the correspondence constraint in (36*a*):

(36) (*a*) Ident-BR(Stress) (adapted, Kenstowicz 1995: 414):
The stress level of the reduplicant must be identical to the stress level of the Base.

(*b*) CompStr: Assign main stress to the right (left) member of a compound.

As Kenstowicz (1995) shows in accounting for stress in Indonesian reduplicated forms, if the constraint in (36*a*) outranks the usual constraint assigning asymmetrical compound stress (36*b*), reduplicative compounds will optimally have matching main stress on each half of the compound, while non-reduplicative ones will have the usual asymmetrical compound stress pattern.

In section 2.1, we saw that the fixed shape of partial reduplicative morphemes is defined as the unmarked shape of their morphological category. This generalization is formalized by the TETU

[21] See Downing (1999*c*, 2000) for discussion of other morphological Faithfulness constraints holding between Base and reduplicant. And see Inkelas (2005) and Inkelas and Zoll (2000, 2005) for an alternative theory of morpho-syntactic identity between the Base and reduplicant.

constraint-ranking schema repeated in (37*a*), below, which optimizes a fixed, unmarked shape for the reduplicative string, in contrast to the Base, which can have a variable shape. The reverse ranking of MAX-BR and the constraints defining unmarked morpheme shape given in (37*b*) allows both the Base and reduplicative string to have the marked, variable shape characteristic of total reduplication. The constraints motivating reductions to the canonical shape of any particular morphological category are too low-ranked in schema (37*b*) to influence the shape of the reduplicative string (or its Base).

(37) (*a*) Partial reduplication as TETU constraint ranking:
MAX-IO ≫ SHAPE MARKEDNESS CONSTRAINTS ≫ MAX-BR

(*b*) Total reduplication constraint ranking:
MAX-IO, MAX-BR ≫ SHAPE MARKEDNESS CONSTRAINTS

The analysis of total reduplication is exemplified in (38), using Afrikaans data to illustrate. (Square brackets indicate Words in the tableau.)[22]

(38) Afrikaans total reduplication and compounds

RED-bottels	MAX-BR (SEG)	IDENT(MCAT)	IDENT (STRESS)	COMPSTR
☞ *a.* [bóttels]-[bóttels]				*
b. [bóttels]-[bòttels]			*!	
hekse-besem				
☞ *c.* [hékse]-[bèsem]				
d. [hékse]-[bésem]				*!

In the first candidate set, both reduplicative morphemes satisfy MAX-BR and IDENT(MCAT), by copying the segments and the morphological category of the Base. Candidate (38*a*) is optimal, as the reduplicative string in this candidate is also prosodically identical to its Base. Candidate (38*b*) is non-optimal as it violates the

[22] Constraints defining morpheme shape markedness have been omitted from the tableau in this section on total reduplication, as they are too low ranked to play a role in choosing optimal candidates.

constraint on prosodic identity (36) by having the usual asymmetrical compound stress pattern. In the second candidate set, illustrating non-reduplicative compounding, both candidates vacuously satisfy the high-ranked constraints on reduplicative identity, as there is no reduplicative string in these forms. Candidate (38*c*) is optimal, as it has the usual compound stress pattern, while candidate (38*d*) has equal stress on each half of the compound, gratuitously violating CompStr (36*b*).

Factorial typology predicts that there should also be languages with the grammar defined by reversing the ranking of IdentStress (36*a*) and CompStr (36*b*). In these languages, we would find total Word reduplication where the reduplicative complex has the same asymmetrical prosody found with non-reduplicative compounds. As Faraclas (1996) shows, Nigerian Pidgin is such a language.[23] In both reduplicated and non-reduplicated 'polytonal' compounds, stress is assigned to the final tone-bearing unit of the complex. Other members of the compound are not stressed. This is illustrated by the data in (39):[24]

(39) Nigerian Pidgin (Faraclas 1996: 242–53; accents on the vowels indicate tone; the main stressed syllable is preceded by a raised line; underlined vowels are [–ATR])

(*a*) Stress assignment to non-reduplicative polytonal compounds

mòto	'car'	mòto-ˈman	'driver'
wo̱sh	'wash'	wo̱sh-ˈples	'washing area'
bè̱le̱ 'belly' + ful 'be full'		bè̱le̱-ˈful	'be satiated'
mo̱ning 'morning' + taym 'time'		mo̱ning-ˈtaym	'mornings'

(*b*) Stress assignment to reduplicative polytonal compounds

mòto	'car'	mòto-ˈmòto	'many cars'
wàka	'walk'	wàka-ˈwàka	'walking'
trowê	'overflow'	trowe-ˈtrowê	'overflow profusely'
wo̱sh	'wash'	wo̱sh-ˈwo̱sh	'wash repeatedly'

[23] Reduplication is well attested in pidgins and creoles, as the collection of papers in Kouwenberg (2003) shows.

[24] As Faraclas (1996) shows, stress affects tone realization in Nigerian Pidgin, so there is also a mismatch in the tone of each member of the reduplicative complex in (39*b*). Unfortunately, Faraclas marks only lexical tone in his data, indicating Low tone with a grave accent, High tone with no accent, and falling tone with a circumflex accent.

The tableau in (40) shows that ranking CompStr (36*b*) above IdentStress (36*a*)—the opposite ranking from that motivated for Afrikaans and Kambera, exemplified in (38)—correctly optimizes asymmetrical compound stress assignment to the reduplicative forms in (39*b*):

(40) Nigerian Pidgin total reduplication and compounds

/Red-mòto/	Max-BR (seg)	Ident(MCat)	CompStr	Ident] (Stress)
☞ *a.* [mòto]-[ˈmòto]				*
b. [ˈmòto]-[ˈmòto]			*!	
/mòto-man/				
☞ *c.* [mòto]-[ˈman]				
d. [ˈmòto]-[ˈman]			*!	

Languages with total Stem or Root reduplication show the same range of variation in the reduplicative prosody found with total Word reduplication. This is, in fact, expected if the reduplicative complex is a compound. Each half is an independent domain for the assignment of Stem or Root prosody. The prosody of each half of the complex will match exactly when all Ident-BR constraints are high-ranked, as in (38), above. Asymmetrical prosody will be optimal when the relevant Ident-BR constraints are low-ranked, as in (40). For example, total verb Stem reduplication is productive in Chichewa and Shona, Bantu languages spoken in Malawi and Zimbabwe, respectively. As work like Myers and Carleton (1996), Hyman and Mtenje (1999), and Odden (1984) shows, the tone of the Base and reduplicative Stem match in Chichewa, while in Shona only the first half of the reduplicative complex realizes the Stem tone pattern:[25]

I have followed this convention in (39), adapting the presentation only to indicate where main stress should fall, based on Faraclas's discussion of stress assignment to polytonal compounds.

[25] Tone realization in the reduplicative verb Stem complex is slightly simplified here for ease of comparison with the other languages presented in this section. See the references cited, along with Downing (2003, 2005*a*), for more detailed discussion.

(41) (*a*) Chichewa verb Stem reduplication (Myers and Carleton 1996: 39, 49)

Base verb form	*Gloss*	*X repeatedly*
nda-namizá	'I have deceived'	nda-namizá-namizá
ndíma-sangalátsa	'I please'	ndíma-sangalátsa-sangalátsa
tambalalá	'stretch your legs!'	tambalalá-tambalalá
phikitsá	'really cook!'	phikitsá-phikitsá

(*b*) Shona verb Stem reduplication (Odden 1984: (35); only stems are given, with the tone pattern they have following, *handáká*-'I didn't X')

Base verb form	*Gloss*	*X frequently*
-bikísa	'I didn't make cook'	-bikísa-bikisa
-bikísíra	'I didn't make cook for'	-bikísíra-bikisira
-tóresá	'I didn't make take'	-tóresá-toresa
-tóréserá	'I didn't make take for'	-tóréserá-toresera

Similarly, Ka (1988) shows that in Wolof (a West Atlantic language spoken in Senegal) both total Stem and total Word reduplicative complexes have the same stress pattern as compounds, namely, main stress is assigned only to the first member of the complex.

According to Fabricius (1998: 29), total Root reduplication is a productive form of nominal derivation in numerous Australian languages: Arrernte (Aranda), Djaru, Dyirbal, Kayardild, KukuYalanji, Margany, Martuthunira, Pitta Pitta, Ungarinyin, Victorian, Warlpiri, Watjarri, Yankunytjatjara, and Yukulta. Of these languages, symmetrical stress is assigned to reduplicated forms only in Dyirbal: 'reduplicated forms have reduplicated stress' (Dixon 1972: 274). In the other languages Fabricius (1998) surveys, the reduplicative complex is a single domain for stress assignment. For example, in Arrernte, reduplicated forms take main stress only on the first element of the reduplicative complex.

To sum up this section, I have followed work like Eulenberg (1971), Fabb (1998), Inkelas and Zoll (2000, 2005), Inkelas (2005), Kiparsky (1986), and Niepokuj (1991) in proposing that total reduplication is a form of compounding at the Word, Stem or Root level, with morphological and phonological identity holding between the reduplicative morpheme and its Base. If the reduplicative morpheme matches the morphological category of the Base, it follows that it can be assigned the same prosody found in other compounds. As we have seen, this is not always the case. Sometimes reduplicative prosody matches that of the Base, even in languages like Afrikaans where other compounds have asymmetrical prosody. In other languages, like Shona, reduplicative prosody is asymmetrical. Prosodic asymmetries represent one way the reduplicative morpheme can move away from perfect identity towards less marked structure. The reductions in size to canonical morpheme shape discussed in the next two sections lead to more striking mismatches between the reduplicative morpheme and its Base.

2.2.3.2. *Unmarked Prosodic Word reduplication* In PBT, reduplicative morphemes which are categorized morphologically as Words or Stems are parsed as Prosodic Words. If they are not identical in shape to their Base, as in the total reduplication examples just discussed, the only other option is for them to have the unmarked Prosodic Word shape: a single stress Foot. This makes them asymmetrical compounds, morphologically identical to the Base but with a fixed shape compared to the variable shape of the Base. As we saw in the analysis of Diyari ((11), above), this falls out from the interaction of Headedness (2*a*), which requires Prosodic Words to minimally contain a stress Foot, and Markedness constraints on the stress Foot parse, which are satisfied if Prosodic Word maximally contains one stress Foot. In Diyari, proposing the disyllabic reduplicative morpheme is an unmarked Prosodic Word has the advantage of explaining why the reduplicative morpheme has other properties in common with Prosodic Word. It is identical in size to the minimal word. It is an independent stress domain. And it meets other phonotactic requirements on Prosodic Words (like being obligatorily vowel final). This section presents examples of other languages supporting the PBT, as they have disyllabic or bimoraic reduplicative morphemes which meet these independent criteria for unmarked Prosodic Word status.

According to Fabricius (1998: 37), initial disyllabic reduplication like that found in Diyari is, in fact, the most frequent pattern of verbal reduplication in Australian languages. Other languages with this pattern include: Bandjalang, Djapu, Dyirbal, Mara, Ngiyambaa, Nunggubuyu, Nyigina, Rembarrnga, Ritharngu, Waray, Yanyuwa, Yidiɲ, and Yukulta. In at least some of these languages, the reduplicative morpheme is arguably an unmarked Prosodic Word as it is a separate stress domain and meets the minimality requirement holding of other Prosodic Words.

For example, in Dyirbal, Dixon (1972) shows that words are stressed on the initial syllable, and on every other following syllable (except final syllables, which are never stressed). In the productive process of verb reduplication illustrated in (42), meaning to perform the action to excess, the reduplicative morpheme is disyllabic and assigned main stress like the Base:

(42) Dyirbal verbal reduplication (Dixon 1972: 251)[26]

(*a*)	bániɲu	'come'	báni-bániɲu
(*b*)	bálgan	'hit'	bálga-bálgan
(*c*)	míyandáɲu	'laugh'	míya-míyandáɲu
(*d*)	bánagáɲu	'return'	bána-bánagáɲu

In Yidiɲ, Dixon (1977) shows that primary stress is generally assigned to the first long vowel of a word, or to the first syllable if there is no long vowel. Secondary stress is assigned to alternating syllables preceding and following the primary stressed syllable:[27]

[26] All stressed syllables in Dyirbal are transcribed in (42) with main stress, consistent with Dixon's (1972) claim that there is no distinction between main and secondary stress. See Dixon (1972: 274–6) for a more detailed discussion of the Dyirbal stress system.

As shown in (42), the final consonant of the second syllable of the Base is only optionally reduplicated. From Dixon's (1972) discussion, it is not clear what factors account for the lack of reduplication, and no analysis will be attempted here. (This distinguishes Dyirbal from Diyari, where all analyses agree that the Foot-final consonant of the Base is not reduplicated because the reduplicative string is a Prosodic Word, and Prosodic Words of Diyari cannot end in consonants.) Indeed, Fabricius (1998) notes that disyllabic reduplicative morphemes in many Australian languages must be vowel final, even though this does not seem to be a general requirement on words or other morphemes of the language. More research is needed to understand why this should be so.

[27] The Yidiɲ stress facts, and the interaction of stress and vowel length have been somewhat simplified here in order to concentrate on the mismatch between reduplicative and Base prosody. See Dixon (1977) for a thorough discussion of Yidiɲ prosody and work like Hayes (1995, 1999) and Crowhurst and Hewitt (1995) for recent analyses as well as references to other work.

(43) Yidiɲ stress (Dixon 1977: 40 ff.)

(*a*)	gúdagáni	'dog-GEN'
(*b*)	gulúgulú:y	'black bream-COMIT'
(*c*)	yábulámgu	'loya-cane sp.-PURP'
(*d*)	burwá:liŋá:lna	'jump-GOING-COMIT-PURP'
(*e*)	gudágayí:da	'for fear of the dog'

Nouns and adjectives are productively made plural by reduplicating the first two syllables of the root. Main stress is consistently assigned to the first syllable of the reduplicative prefix, following the general principles of stress assignment. (Long vowels do not occur in the reduplicative morpheme, so the initial vowel must be stressed):[28]

(44) Yidiɲ nominal/adjectival reduplication (Dixon 1977: 156)

(*a*)	búɲa	'woman'	búɲa-búɲa	'women'
(*b*)	ŋálal	'big'	ŋálal-ŋálal	'lots of big [ones]'
(*c*)	mulá:ri	'initiated man'	múla-mulá:ri	'initiated men'
(*d*)	gindá:lba	'lizard sp.'	gíndal-gindá:lba	'lizards'

As Dixon notes, the reduplicative morpheme in both languages is arguably a distinct Prosodic Word from the Base, as it is a separate stress domain. This is especially clear in Yidiɲ, where different syllables are assigned main stress in the Base and the reduplicative morpheme if the Base contains a long vowel (44*c*, *d*). Further evidence that the reduplicative morpheme is a Prosodic Word comes from the fact that it satisfies the disyllabic minimality requirement on Words that holds for both languages (see Dixon

As shown in (43), Dixon does not mark primary and secondary stress differently. The data in (43) and (44) adopt Dixon's practice, as it is the footing and location of stressed syllables, rather than the position of main stress, which are important to the analysis of reduplication.

[28] As McCarthy and Prince (1986) note, an interesting aspect of this Yidiɲ reduplication pattern is that we would expect all reduplicative strings to end with a consonant, as this would best satisfy Max-BR (as many segments from the Base as possible should occur in the reduplicative Foot). Instead, we see that some reduplicative strings (44*b*, *d*) end in a consonant, while others (44*a*, *c*) do not. The generalization accounting for this, as work since Marantz (1982) points out, is that the syllabification of the reduplicative string matches the syllabification of the corresponding Base segments. That is, even though Max-BR is not respected at the level of stress Footing, it is respected at the level of syllabification.

(1972: 272), for Dyirbal; Dixon (1977: 35), for Yidiɲ). Although the reduplicative morpheme is a distinct Prosodic Word from the Base, the reduplicative complex is morphologically a compound, since the entire complex counts as a single Word for the assignment of inflectional morphology. The analysis for these two languages would, then, be essentially identical to the Diyari analysis in (11).

Several Austronesian languages have bimoraic reduplication patterns. In several of these languages, the reduplicative morpheme and Base form distinct stress domains, as we expect if they are each distinct Prosodic Words. Although the reduplicative morpheme does not always receive main stress, the range of stress realization is consistent with assigning compound Prosodic Word status to the reduplicative complex. For example, Fijian illustrates a language with a reduplication pattern very similar to the Australian languages just discussed. In the productive pattern of verbal reduplication illustrated in (45), we see that the first two moras of the verb root are copied, and main stress is assigned to the initial syllable of the reduplicative morpheme:

(45) Fijian stress and reduplication (Dixon 1988)

(*a*)	rábe	'kick'	rábe-rábe	'do a lot of kicking'
(*b*)	cúla	'sew'	cúla-cúla	'sew for a while'
(*c*)	màaráu	'be happy'	máa-màaráu	'be permanently happy'
(*d*)	qòolóu	'shout'	qóo-qòolóu	'shout for a while'
(*e*)	butá'o	'steal'	búta-butá'o	'steal often'
(*f*)	tu'í-a	'hammer it'	tú'i-tu'í-a	'hammer it a lot'

As Dixon (1988) shows, in non-reduplicated words, the penultimate mora receives primary stress, and every other preceding mora receives secondary stress. The reduplicative prefix is, then, identical in size and prominence to the other stress Feet of Fijian. It is also arguably a minimal Prosodic Word, as it is a separate stress domain, with main stress assigned to the penult like other Prosodic Words, and it meets the bimoraic minimality condition on Words. The analysis of Fijian, too, would be essentially identical to that of Diyari exemplified in (11), above, except that the relevant Foot parsing constraint would be ALL-FT-RT (cf ALL-FT-L (8*b*) for Diyari), since the parse begins at the right edge of Prosodic Word in a language with main stress on the penult.

In the languages discussed so far, the fact that the reduplicative morpheme is an independent stress domain from the Base and receives main stress provides evidence that the reduplicative morpheme is parsed as a distinct Prosodic Word. In other Austronesian languages where the bimoraic reduplicative morpheme is an independent stress domain, we find asymmetrical stress assignment to the reduplicative complex. As noted in discussing the Nigerian Pidgin total Word reduplication pattern in (39), an asymmetrical stress pattern is common for compounds, and so is still consistent with a Prosodic Word parse of the reduplicative morpheme. Partial reduplication in Samoan and Maori illustrates this pattern.

Mosel and Hovdhaugen (1992) show that in Samoan stress is regularly assigned to the penultimate mora of a word, and no other syllables are reported as stressed. In compounds, the second member retains its stress, but at a normal rate of speech the stress on the first member is generally lost.

(46) Samoan compound stress (Mosel and Hovdhaugen 1992: 37)

(*a*)	tála	'story'	leléi	'good'	tala-leléi	'Evangel'
(*b*)	fále	'house'	'olóa'	'shop'	fale'olóa	'shop'
(*c*)	igóa	'name'	'ípu'	'cup'	igoa'í:pu	'cup name'
(*d*)	vái=la:'áu	'water=plant'			vai=la:'áu	'medicine'

As shown in (47), one productive reduplicative morpheme of Samoan is exactly bimoraic in size:

(47) Samoan reduplication (Mosel and Hovdhaugen 1992)

(*a*)	fíti	'flick'	fiti-fíti	pl.
(*b*)	maanáva	'energy'	maanava-náva	pl.
(*c*)	maalúu	'cooling'	maaluu-lúu	'cold'
(*d*)	magóto	'sunk'	magoto-góto	'boggy; apt to overturn'
(*e*)	ta'óto	'lie'	ta'oto-'óto	'rest, recline'

Evidence that this reduplicative morpheme is parsed as a Prosodic Word is that it satisfies the bimoraic minimality condition on Prosodic Words expected for languages like Samoan where stress is quantity sensitive. Further evidence for its Prosodic Word status is that stress in reduplicated forms is identical to compound stress. The reduplicative morpheme, as the second half of the reduplicative complex, is assigned penult stress; the Base is unstressed. This asymmetrical stress pattern can be accounted for by an analysis essentially identical to the one given for Nigerian Pidgin in (40). (Samoan would, of course, also require the constraints optimizing partial, rather than total, reduplication to be high-ranked.)

As Meyerhoff and Reynolds (1996) show, in Maori (spoken in New Zealand) main stress is assigned to the leftmost mora of the Word, and secondary stress is assigned to every other following (non-final mora):

(48) Maori stress (Meyerhoff and Reynolds 1996: fig. (1))

(*a*)	mánuhìri	'whitebait'
(*b*)	páarà.i	'screen; push back'
(*c*)	éetàhi	'some'
(*d*)	páakèe	'rough cloak'

One common reduplication pattern is for the reduplicative morpheme to be bimoraic. This morpheme is always assigned secondary stress, as shown in (49), matching both the footing and stress of the corresponding Base string. Note, too, in (49*d*–*f*), the vowel of the initial (main stressed) syllable is lengthened when trimoraic forms are reduplicated, but not in bimoraic and quadrimoraic forms (49*a*–*c*):

(49) Stress in reduplicated forms (Meyerhoff and Reynolds 1996: 148, figs. (7), (8))

(*a*)	páku	'dry, shrivel'	páku-pàku	'dried'
(*b*)	mátapìhi	'window'	mátapìhi-pìhi	'open up'
(*c*)	tíitàka	'unsteady'	tíitàka-tàka	'turn over and over'
(*d*)	kóhiko	'interrupt'	kóohìko-hìko	'do irregularly'
(*e*)	pórahu	'awkward'	póoràhu-ràhu	'awkward, annoying'
(*f*)	páhuu	'explode'	páahùu-hùu	'pop, crackle'

Evidence that this reduplicative morpheme is parsed as a Prosodic Word is that it satisfies the bimoraic minimality condition on Prosodic Words found in Maori (de Lacy 2004). It is also crucially footed separately from the Base string. As Meyerhoff and Reynolds (1996) shows, the vowel length alternation in the initial syllable of the trimoraic forms falls out straightforwardly, if Maori has a high-ranked constraint requiring the reduplicative morpheme to be parsed into a stress Foot which matches the footing of the corresponding Base string. If the reduplicative complex is a compound, the secondary stress on the reduplicative morpheme can be attributed to the same sort of asymmetrical compound stress found in other Austronesian languages, like Samoan (46).

The new constraints necessary to account for the Maori reduplication pattern in (49) are given below:

(50) (*a*) All-Ft-L: AlignL(Foot, Word):
Every stress Foot should be left-aligned with Word.

(*b*) Ident-BR(Pros):
The footing of the reduplicative string should match the footing of the corresponding Base string.

(*c*) Dep-IO(μ):
Every mora of the Output should have a correspondent in the Input.

As shown in (51), ranking Ident-BR(Pros) (50*b*) above Dep-IO, (50*c*), the constraint penalizing epenthetic structure, optimizes lengthening the initial vowel, as this allows the reduplicative Foot to match the footing of the corresponding Base string while keeping main stress at the left edge of the word. Since the reduplicative morpheme is a separate Prosodic Word from the Base, ranking All-Ft-L above Max-BR correctly imposes a bimoraic maximum on the reduplicative morpheme:[29]

[29] To account for the fact that the initial syllable of all Maori words must be stressed, Maori must have a constraint requiring a Foot to be aligned at the left edge of every Word: AlignL(Word, Foot). This constraint, omitted here to save space, must outrank Ident-BR(Pros) so that incorrect reduplicative candidates like, **ko(híko)-(hìko)*, are not optimal. Note that the analysis presented here closely follows that of Meyerhoff and Reynolds, except that the constraints have been updated to make them consistent with the remainder of the chapter.

(51)

kohiko-RED$_{Stem}$	BINARITY	IDENT-BR (PROS)	DEP-IO	ALL-FT-L	MAX-BR
☞ *a.* (kóo)(hìko)-(hìko)			*	*	**
b. (kóhi)ko-(hìko)		*!			**
c. (ko)(hìko)-(hìko)	*!			*	**
matapihi-RED$_{Stem}$					
☞ *d.* (máta)(pìhi)-(pìhi)				*	****

Candidate (51*a*) is optimal, as the reduplicative string matches the footing of the corresponding Base string. Lengthening the initial syllable, while it violates DEP-IO, allows that syllable to be parsed into a single bimoraic Foot. Candidate (51*b*) is non-optimal, as the footing (and stress) of the reduplicative morpheme do not match that of the corresponding Base segments. Candidate (51*c*) is non-optimal as the initial syllable is footed but not lengthened, violating high-ranked BINARITY (24*b*). Candidate (51*d*) shows that Bases with an even number of moras automatically satisfy IDENT-BR (PROS) and BINARITY. The reduplicated form can be parsed into bimoraic Feet, with a match between Base and reduplicative morpheme footing, without violating DEP-IO.

In the languages presented so far in this section, the asymmetries in the reduplicative complex have been at the prosodic level. The reduplicative morpheme is reduced in size compared to the Base, and often one-half of the reduplicative complex has reduced stress, but segmental features of each half of the reduplicative complex have matched. For Foot-sized partial reduplication, a few languages are also reported to show reduction at the segmental level. For example, Aronoff et al. (1987) shows that Makassarese (a major language of South Sulawesi in Indonesia) productively uses disyllabic reduplication to express a variety of meanings. As shown in (52*a*), if the Base is also disyllabic, then there is a perfect segmental match between the reduplicative morpheme and the Base. However, if the Base is longer than two syllables, as in (52*b*) the reduplicative morpheme ends with a glottal stop. In all reduplicated forms, only the Base is assigned penult stress:

(52) Makassarese reduplication (Aronoff et al. 1987: 3)

(*a*)	*Disyllabic bases*		
	/batu/	batu-bátu	‘small stones’
	/golla/	golla-gólla	‘sweets’
	/bulaŋ/	bulaŋ–búlaŋ	‘monthly’
	/tau/	tau-táu	‘doll’
(*b*)	*Longer bases*		
	/manara/	manaʔ-manára	‘sort of tower’
	/baine/	baiʔ-baíne	‘many women’
	/baramban/	baraʔ-barámban	‘sort of chest’
	/balao/	balaʔ-baláo	‘toy rat’

The glottal stop in the data in (52*b*) can straightforwardly be analysed as an instance of the emergence of the unmarked (TETU (7)): the unmarked consonant (glottal stop) replaces marked structure of the Base if the Base exceeds two syllables.[30] The segmental reduction is still compatible with a compound analysis of the reduplicative complex. The reduplicative morpheme can be parsed as a Prosodic Word, as it satisfies the disyllabic minimality requirement holding for other Prosodic Words of Makassarese (Aronoff et al. 1987). Although the penult of the reduplicant is not stressed, this asymmetric stress pattern is one we have seen in other compound-like reduplicative complexes above.

To sum up this section, we have seen that in a number of languages a disyllabic/bimoraic size condition on reduplicative morphemes can be accounted for by parsing them as Prosodic Words. In all the languages discussed, the reduplicative morpheme is the size of a minimal Word, and is parsed into exactly one stress Foot, as expected if the reduplicative morpheme is an unmarked Prosodic Word. The reduplicative complex in the languages discussed has a stress pattern consistent with its compound status: either both halves are assigned main stress, or the complex has the asymmetrical stress pattern commonly found in compounds. Interestingly, it has

[30] See Aronoff et al. (1987), Niepokuj (1991), McCarthy and Prince (1986, 1994*a*), Steriade (1997), Alderete et al. (1999), and Downing (2000) for analyses of Makassarese reduplication and discussion of why the glottal stop is found only when reduplicating Bases longer than two syllables.

turned out to be hard to find evidence independent of stress in these languages for the Prosodic Word status of the reduplicative morpheme similar to the vowel-final requirement of Diyari. It is also striking that Foot-sized reduplicative morphemes seldom show reductions in segmental markedness accompanying the reductions in size and prosody. Reductions in segmental markedness are more common in syllable-sized reduplicative morphemes, as we shall see in the next section.

2.2.4. *Unmarked Root and Affix truncation and reduplication*

In PBT, morphemes which are categorized morphologically as Root or Affix are not obligatorily parsed as Prosodic Words. This allows them to be shorter than a minimal stress Foot, as they are not subject to Headedness (2*a*), which requires Prosodic Words to minimally contain a stress Foot. As we saw in the analysis of Ilokano in (16), Markedness constraints define both Roots and Affixes as maximally monosyllabic. The interaction of Markedness constraints with Root $\gg$ Affix Faithfulness constraints optimizes less marked structure in Affixes than in Roots. This section presents more examples of monosyllabic prosodic morphemes that are analysable as unmarked Roots or Affixes.

As Niepokuj (1991: sect. 2.2.3) argues, there are strong parallels between stages in the historical development of affixes from compounds (e.g. in the development of the English suffix -*ly* from -*like*) and patterns of reduplication, which range from compounding total and partial reduplication to affixal reduplication. Some synchronic processes of compounding, in fact, involve truncation to a monosyllable, a pattern strongly reminiscent of the reduplicative 'truncation' of the Base to a fixed monosyllabic shape illustrated above for Ilokano (13). An example of compounding truncation is provided by Zuni, a language isolate spoken in New Mexico (USA). As McCarthy and Prince (1986) show, stems are reduced to a single light syllable (underlined) when they form the left branch of a compound:

(53) Zuni compounds (McCarthy and Prince 1986: fig. (80))

tukni	tu-mok^{w}k^{w}'anne	toe-shoe = stocking
melika	me-k^{w}iʃʃo	Non-Indian-negro = black man
melika	me-ʔoʃe	Non-Indian-be:hungry = hobo
patʃu	pa-lokk'a-ak^{w}e	Navajo-be:gray = Ramah Navajo

McCarthy and Prince argue that the truncated forms are Roots, as they match the minimal bound Root size in Zuni. (Minimal lexical words, in contrast, are bimoraic.)

The parallel between compounding truncation to a monosyllable and reduplicative 'truncation' is strikingly illustrated in Madurese, an Austronesian language spoken in Indonesia (McCarthy and Prince 1986, Stevens 1968, Weeda 1987). As shown by the data in (54), truncation to the stressed, root-final syllable (underlined) is found in the left member of compounds (54*a*) and in one pattern of reduplication (54*b*):

(54) Madurese truncation (McCarthy and Prince 1986: fig. (81); Stevens 1968; Weeda 1987)

(*a*) Compounding

usap	sap-lati	handkerchief (wipe+lip)
uriŋ	riŋtua	parents (person+old)
tuzhuʔ	zhuʔ-ənpul	pinky (finger+pinky)
pasar	sar-suri	afternoon market (market+ afternoon)

(*b*) Partial reduplication

Root		
abit	bit-abit	finally
buwaʔ	waʔ-buwaʔ-an	fruits
maen	en-maen-an	toys
ŋastan	tan-ŋastan-e	to hold
estre	tre-estre	wives
chapphluk	phluk-chapphluk-an	a noise

(*c*) Total Root reduplication (Stevens 1968: 34; Weeda 1987: 407)

buwaʔ	buwaʔ-buwaʔ-an	fruits
nyokor	pa-nyokor-nyokor-a	his constant shaving
ka.budi	ma-kabudi-kabudi-yakhi	keep on moving back (trans.)

McCarthy and Prince (1986) argue that the monosyllabic prosodic morphemes in (54*a*) and (54*b*) cannot be minimal Root or minimal

Word, as both Root and Word are minimally disyllabic in Madurese.[31] This can be clearly seen by comparing the forms in (54*b*) with the total Root reduplication pattern in (54*c*). They must, then, be morphologically categorized as an Affix.[32]

A surprising aspect of these compounding truncation examples is that the open monosyllable of Zuni is arguably a Root, while the optionally closed monosyllable of Madurese is arguably an Affix. The ROOT ≫ AFFIX harmonic ranking would lead us to expect the opposite correlation. The general ROOT ≫ AFFIX ranking alone clearly does not determine the optimal canonical size of Roots and Affixes in particular languages. We shall return to this problem in Chapters 4 and 5.

Regarding reduplication, it turns out to be difficult to find clear examples of reduplicative morphemes which can easily be classified as Root because either their canonical shape or other morphological characteristics match other Roots of the language.[33] One example is provided by Palauan, a Western Malayo-Polynesian language spoken in Belau (Palau) and Guam. As shown by Finer (1986–7), Zuraw (2003), and Kawamura (2003, 2004), there are two patterns of reduplication in Palauan. One has the fixed form Cε, while the other has the form CVX (with three partially predictable variants;

[31] It is not clear whether the disyllabic minimal word requirement correlates with the minimal stress Foot of Madurese. According to Weeda (1987: n. 15), stress generally falls on one of the last three syllables of the word, with free variation attested in some forms. The best evidence for a disyllabic minimal Foot, in contrast, would be a regular, alternating quantity-insensitive stress pattern, and this is, apparently, not found. We return to this point in Chapters 3 and 4.

[32] As Stevens (1968), Kiparsky (1986), and Weeda (1987) point out, the truncated monosyllabic prosodic morphemes in (54*a*, *b*) result in numerous violations of the usual word-internal phonotactics of Madurese. One way of accounting for this would be to propose that a constraint requiring the right edge of the truncated form to be anchored to the right edge of the Root outranks these phonotactic constraints.

[33] See work like Broselow (1983), Niepokuj (1991), Shaw (2005, to appear *a*, to appear *b*) and Urbanczyk (1996, 2000) for discussion of other Salishan languages with CVC Distributive reduplication patterns very similar to the one described for Lushootseed. In all of these languages, Roots are canonically CVC, so the Distributive reduplicative morpheme could potentially be analysed as a Root in these languages as well.

see Finer (1986–7), Kawamura (2004), and Zuraw (2003) for discussion). Both patterns are illustrated in (55) below:

(55) Palauan reduplication (Finer 1986–7: 110; Zuraw 2003)

	unreduplicated		*reduplicated*	
(*a*) Cɛ reduplication				
	bətók^{h}	'many'	<u>bɛ</u>-bətók^{h}	'just more than enough'
	rəgós	'sweet'	mə–<u>rɛ</u>-rəgós	'rather sweet'
	ol-ðíŋəl	'visit'	ol-ðɛ-ðíŋəl	'keep visiting'
(*b*) CVX reduplication				
	tórð	'frustration'	bəkə-<u>tər</u>-tórð	'easily frustrated'
	síkt^{h}	'cluster of fruit'	mə-<u>sək</u>-síkt^{h}	'covered with fruit'
	mə-rám	'get mixed'	mə-<u>rəm</u>-rám	'easy to mix'

Kawamura (2003, 2004) argues that PBT can account for the difference in phonological form between the two reduplicative morphemes by proposing they have different morphological categories: the shorter Cɛ is an affix, while the longer CVX is a Root. And indeed, as Finer (1986–7) shows, there is independent evidence for these classifications. For example, the nasal of the imperfect prefix fuses with the first consonant of the Root of unreduplicated forms. It also fuses with the first consonant of the CVX reduplicative prefix, as shown in (56*a*), but it does not fuse with the first consonant of the Cɛ reduplicative prefix (56*b*):

(56) Palauan imperfect reduplication (Finer 1986–7: 118)

	base		*imperfect*		*reduplicated*
(*a*) CVX reduplication					
	tub	'spit (N)'	mə-lub	'imperfect'	mə-<u>ləb</u>-tub
	kimdii	'trim it'	mə-ŋimd	'trim'	mə-<u>ŋəm</u>-kimd
(*b*) Cɛ reduplication					
	bəkall	'sailing'	o-məkall	'sail, drive'	om-<u>bɛ</u>-bəkall
	ʔəlebəd	'club (N)'	mə-ŋəlebəd	'hit'	məŋ-<u>ʔɛ</u>-ʔəlebəd

Kawamura (2003) proposes that this difference in whether the reduplicative initial consonant undergoes fusion follows from the morphological category distinction in the two reduplicative morphemes that also accounts for their difference in size.[34] We find fusion with the CVX reduplicative morpheme just like we do with other Roots. As the Cɛ reduplicative morpheme is an Affix, it does not provide the context for fusion.

Similar markedness asymmetries for monosyllabic reduplicative morphemes are found in Salishan languages. As Niepokuj's (1991) survey shows, many languages in this group have the two reduplication patterns illustrated in Chapter 1 for Lushootseed: a CVC Distributive reduplicative morpheme and a CV Diminutive, with the CV reduplicative morpheme often having less marked segments as well as less marked syllable structure. This distinction can be analysed in the other Salishan languages along the lines of Urbanczyk's (1996, 2000) analysis for Lushootseed sketched in Chapter 1: the CVC reduplicative morpheme is a Root, while the CV reduplicative morpheme is an Affix. As Urbanczyk (1996, 2000) shows, independent evidence for this analysis is that Roots are canonically CVC in Salishan languages, while prefixes in many of the languages are canonically CV.

We find numerous other languages like Palauan and Salishan languages where a reduplicative morpheme is a light monosyllable, and there is independent evidence for its Affixal status. As we saw in the preceding section, the Austronesian language Kambera has a total Word reduplication pattern, illustrated in (34). It also has the light monosyllable pattern of reduplication shown in (57). The first (C)V of the Root is reduplicated, and the reduplicative morpheme (underlined) occurs just before the Root.

[34] As Kawamura (2003, 2004) notes, the Cɛ prefix is less marked that the CVX in the sense that it contains, overall fewer segments. However, its fixed vowel appears to be more marked than the schwa in CVX prefix, complicating the comparison of the overall markedness of the two reduplicative morphemes. Sḵwx̱wú7mesh (Squamish) Salish, discussed in sections 4.4 and 5.1.2, below, illustrates another language where reduplicative Roots have reduced vowels. Section 5.1.2 demonstrates that reduplicative cophonologies can account for these sorts of cases.

(57) Kambera CV reduplication (Klamer 1998: 35)

wátu	'stone'	wa-wátu
wéi	'pig'	we-wéi
háila	'saddle'	ha-háila
ha-ngángi	'be ready'	ha-nga-ngángi
pa-íta-ng(u)	'show X to Y'	pa-i-íta-ng(u)

Similarly, Samoan not only has the Foot-sized reduplication pattern illustrated in (47), but also a light monosyllable pattern. As shown in (58), the stressed penult is reduplicated if it is a CV syllable, and the reduplicative morpheme (underlined) occurs just before this stressed syllable:[35]

(58) Samoan CV reduplication (Mosel and Hovdhaugen 1992: 220–5)

atamái	non-erg. v. 'clever'	ata-ma-mái	pl.
mótu	non-erg. v. 'break'	mo-mótu	erg. v. 'break'
alófa	non-erg. v. 'love'	a:-lo-lófa	pl.
a:vága	non-erg. v. 'elope'	a:-va-vága	pl.
ma'alíli	non-erg. v. 'cold'	ma'a-li-líli	pl.

There is evidence in both languages that these CV reduplicative morphemes are to be categorized as Affix. Klamer (1998) shows that in Kambera CV is the canonical form of Affixes and, like other Affixes, this one is not stressed. (Compare the forms in (57) with the compounding reduplication patterns in (34) and (72).) In Samoan, Roots are minimally bimoraic, so this reduplicative morpheme must be an Affix. Further, in both languages the reduplicative morpheme has less marked syllable structure than the Base: no long vowels or diphthongs in Kambera, an obligatory Onset in Samoan. These reductions in size and structure are consistent with an Affix analysis.

Dahlstrom (1997) shows that the Algonquian language Fox has two patterns of verbal reduplication: a monosyllabic pattern, which generally indicates continuative or habitual aspect, and a disyllabic

[35] As work like Broselow and McCarthy (1983–4) and McCarthy and Prince (1986) argues, the infixing position of the Samoan CV reduplicative morpheme is straightforwardly accounted for by proposing it takes a prosodic constituent, the stress Foot, rather than a morphological constituent as its Base for affixation. See these works for further discussion.

pattern, which generally indicates iterative or distributive action. The monosyllabic reduplicative morpheme (middle column) contains the fixed vowel 'a:' and the onset is frequently simplified, as in (59*d*). The disyllabic reduplicative morpheme (right-hand column) copies the first syllable of the Base exactly, but the second syllable cannot contain a long vowel (59*a*), and must contain an open syllable (59*f*):[36]

(59) Fox reduplication (Dahlstrom 1997: 206, 212, 218)

(*a*)	nowi:-wa 'he goes out'	na:-nowi:-wa	nowi-nowi:-wa
(*b*)	wi:tamaw-e:wa 'he tells him'	wa:-wi:tamaw-e:wa	wi:ta-wi:tamaw-e:wa
(*c*)	ko:kenike:-wa 'he does the washing'	ka:-ko:kenike:-wa	
(*d*)	kya:t-amwa 'he keeps it for himself'	ka:-kya:t-amwa	
(*e*)	pye:taw-e:wa 'he brings it for him'		pye:ta-pye:taw-e:wa
(*f*)	nakiʃkaw-e:wa 'he meets him'		naki-nakiʃkaw-e:wa

As Inkelas and Zoll (2005) show, morphologically the disyllabic reduplicative morpheme forms a Stem-Stem compound with its Base. By the Stem-Prosodic Word Homology (3*b*), it should be a Prosodic Word. And, indeed, as Dahlstrom (1997) argues, it meets the disyllabic minimal Word requirement, and the restrictions on the second syllable match general restrictions on Prosodic Word-final syllables. (Unfortunately, no information on the Fox stress system seems to be available, so we do not know whether the disyllabic reduplicative morpheme is a separate stress domain or a minimal stress Foot.) In contrast, the subminimal length and the structural restrictions on the monosyllabic reduplicative morpheme are consistent with categorizing it as an Affix.

[36] The presentation of these two patterns has been simplified here to ease comparison with the other languages discussed. The interested reader should consult Dahlstrom (1997) and Inkelas and Zoll (2005) for a detailed discussion of Fox reduplication. We shall return to the Fox disyllabic reduplication pattern in Chapter 3.

Many Niger-Congo languages spoken from Ghana to Cameroon have a verbal reduplication pattern that consists of a monosyllable with a fixed, unmarked vowel (see e.g. Akinlabi 1997, Alderete et al. 1999, Capo 1991, Dolphyne 1988, Faraclas and Williamson 1984, Kawu 2002, Niepokuj 1991, Orie 1997, Smith 1969, Walker 2000). For example, in Nupe, a Benue-Congo language spoken in Nigeria, the gerundive is formed by partially reduplicating the Base verb. As shown in (60), the reduplicative morpheme is always a single CV syllable, no matter how long the Base is, with a fixed high vowel, no matter what height the corresponding Base vowel is, and a Mid tone, no matter what the tone of the corresponding Base vowel is:

(60) Nupe gerundive reduplication (Akinlabi 1997, Smith 1969, Kawu 2002)

(*a*) *Monosyllabic verbs*

gí	'eat'	gi-gí	'eating'
bé	'come'	bi-bé	'coming'
kpà	'drizzle'	kpi-kpà	'drizzling'
tswá	'take care'	tsu-tswá	'care'

(*b*) *Polysyllabic verbs*

jákpe	'stoop'	ji-jákpe	'stooping'
gãya	'be too long'	gi-gãya	'being too long'
gòba	'surround'	gu-gòba	'surrounding'
kúta	'overlap'	ku-kúta	'overlapping'
pàbàci	'follow'	pi-pàbàci	'following'

Even though, as we can see, verb stems can be monosyllabic, like this reduplicative morpheme, verb stems can also be longer. In contrast, the reduplicative morpheme, like other affixes of Nupe, is maximally monosyllabic. Other evidence for the Affix status of the reduplicative morpheme is that the initial syllable of verb stems can have complex Onsets and realize the complete range of tone and vowel contrasts. The reduplicative morpheme must have a simplex Onset, unmarked Mid tone and an unmarked, non-nasal [+high] vowel.[37]

[37] See Steriade (1995) and Howe and Pulleyblank (2004) for discussion of why [+high] vowels are unmarked epenthetic vowels cross-linguistically and Faraclas and Williamson (1984) for discussion of why a [+high] vowel would be the most likely reduced vowel in reduplicative morphemes in Nupe and related languages. See Pulleyblank (1986) for discussion of why Mid is the unmarked tone in a three-tone system like that of Nupe.

To sum up this section, this brief survey confirms the observation found in earlier work like Steriade (1988), McCarthy and Prince (1994*a*, 1995*a*, 1999), and Alderete et al. (1999) that it is common to have less marked prosodic or segmental structure in reduplicative morphemes. It also confirms the observation found in work like Steriade (1988), Niepokuj (1991), and Urbanczyk (1996, 2000) that unmarked structure correlates with the size and morphological category of the reduplicative morpheme. Longer reduplicative morphemes, morphologically categorized as Word, Stem, or Root, form a compound with the Base and tend to have more marked segments and syllables even if they are reduced in size compared to the Base. Monosyllabic morphemes, especially those categorized as Affix, tend to have less marked segments and syllables.

2.2.5. *Summary*

The PBT successfully accounts for the attested range of canonical morpheme shapes in a variety of languages by proposing there is a strong correlation between morphological category and unmarked (minimal and maximal) shape. Morphemes required to be minimally disyllabic or bimoraic are categorized as Stems, parsed as Prosodic Words. The minimality requirement falls out from the Prosodic Hierarchy: Prosodic Words minimally contain one proper stress Foot, and stress Feet are minimally disyllabic or bimoraic. PBT predicts that the invariant disyllabic/bimoraic shapes characteristic of root-and-pattern morphology match the stress Foot. It predicts that the minimal word in all stress languages is identical in size to the minimal stress Foot, and that all Words of a language should be subject to the same minimality condition. It predicts that languages without stress should not have minimality restrictions, as there is no motivation to parse Prosodic Words into Feet. The theory predicts that truncations should be the same size as the minimal Word of a language, namely, one stress Foot. And it predicts that disyllabic/bimoraic reduplicative morphemes should be independent Prosodic Words and independent stress domains from their Base. As we shall see in the remainder of this chapter, however, there is a significant body of evidence contradicting these predictions.

2.3. Problems with the PBT

2.3.1. *Templates for root-and-pattern morphology do not match stress Feet*

The attentive reader will have noticed that so far in this chapter there has been no discussion of the root-and-pattern morphology which has been considered an important source of evidence supporting phonological theories of Prosodic Morphology since McCarthy (1979) showed the characteristic invariant shapes could be reified as autosegmental templates. As noted in sections 1.1 and 1.2, above, the verb stems of Semitic languages like Arabic and Modern Hebrew are required to be minimally and maximally disyllabic in most conjugations (Bat-el 2003; McCarthy 1979, 1993; McCarthy and Prince 1986; Ussishkin 2000, 2003, 2005). This is illustrated for Classical Arabic verb Measures (McCarthy 1979, 1993; McCarthy and Prince 1986, 1995*b*, 1998) by the paradigm for *katab* (repeated from Chapter 1, fig. (3)):

(61) Classical Arabic (McCarthy 1979: 240)

Measure	*Arabic verb*	*Gloss of stem*
I	katab	'write'
II	kattab	'cause to write'
III	kaatab	'correspond'
IV	ʔaktab	'cause to write'
VI	ta-kaatab	'write to each other'
VII	n-katab	'subscribe'
VIII	k-tatab	'write, be registered'
X	s-taktab	'write, make write'

An almost identical disyllabicity requirement holds for Modern Hebrew, as shown by the binyanim which form the paradigm for *gadal*:[38]

[38] As Ussishkin (2000: 100) notes, the system of binyan names comes from associating the triliteral verb consonantism, /p ʕ l/, for 'act' with the vocalism and shape which characterize each binyan. As we can see, verb stems in all binyanim are disyllabic, while different arrangements of consonants and vowels, and, in some cases, the addition of affixes, distinguish the binyanim. In the data cited here, the affixes are incorporated into the disyllabic verb stem. In others, like the *hit-paʕel* binyan, the affix is adjoined to the disyllabic stem. The Arabic verb measures are constructed following the same principles.

(62) Modern Hebrew (Ussishkin 2000: 103, fig. (5))

Binyan	*Hebrew verb*	*Gloss*
paʕal	gadal	'he grew' (intransitive)
piʕel	gidel	'he raised'
puʕal	gudal	'he was raised'
hifʕil	higdil	'he enlarged'
hufʕal	hugdal	'he was enlarged'

Outside Semitic, the Penutian language Sierra Miwok (McCarthy 1989, Bullock 1990) has also been shown to have disyllabic templates for non-primary verb stems:

(63) Sierra Miwok Verb Stem Forms (Bullock 1990: 19)

Primary	*Second*	*Third*	*Fourth*	*Gloss of stem*
polá:n-	polán:-	pól:an-	pólna-	'fall'
telé:y-	teléy:-	tél:ey-	télye-	'hear'
kóypa-	koyáp:-	kóy:ap-	kóypa-	'suck'
nákpa-	nakáp:-	nák:ap-	nákpa-	'catch up'
hám:e-	hameʔ-	hám:eʔ-	hámʔe-	'bury'

The analysis of the disyllabicity requirement on verb stems in all of these languages should be quite straightforward in PBT. If the stem is parsed as a Prosodic Word, it dominates stress Foot. If the stress Foot is minimally disyllabic, the stems inherit this requirement. As Hayes (1995) has argued, pressure for disyllabic minimality is most consistent with syllabic trochee stress systems, as iambic or moraic trochee systems can parse heavy (bimoraic) monosyllables as well-formed minimal Feet. Unfortunately, the syllabic trochee is not the stress Foot in any of these languages. As McCarthy (1979, 1993) and Hayes (1995) show, Classical Arabic, like most modern Arabic dialects, has a moraic trochee stress system. And Ussishkin (2000) and Graf and Ussishkin (2003) argue that the regular final stress found in Modern Hebrew is most consistent with an 'emergent iamb' analysis which allows for a minimal degenerate (light monosyllabic) Foot. It is also significant that in both Arabic and Modern Hebrew, nouns—which are not required to fit into a conjugational template—have the minimal monosyllabic size predicted by the respective stress systems. (See McCarthy (1993); McCarthy and Prince (1986, 1995*b*, 1998) for Arabic; Ussishkin (2000) for Modern Hebrew.) This emphasizes that the disyllabicity requirement on verb stems cannot follow from the stress system, as then all lexical words would be expected to have the same minimal size.

In Sierra Miwok, too, the stress system does not motivate the disyllabicity requirement on non-primary verb stems illustrated in (63). According to Bullock (1990: 18), stress in Sierra Miwok is quantity sensitive and unbounded. The first syllable is stressed if it is heavy (bimoraic); otherwise the second syllable is stressed (and must also be bimoraic). In a quantity sensitive stress system, we expect a heavy monosyllable to satisfy a Foot-based minimality requirement. The Arabic nouns just mentioned and many other languages discussed in preceding sections illustrate this point.

Other well-known cases of root-and-pattern morphology also cannot be reanalysed in the PBT, as the proposed templatic Feet do not match the stress Feet which are the only source of templates in PBT. For example, McCarthy and Prince (1990*a*, 1995*b*, 1998) argue that the morphology of the Arabic broken plural, illustrated in (64), is based on the iamb:

(64) Arabic broken plural (McCarthy and Prince 1990*a*: 217)

	Singular	*Plural*	*Gloss*
(*a*)	nafs	nufuus	'soul'
(*b*)	qidħ	qidaaħ	'arrow'
(*c*)	rajul	rijaal	'man'
(*d*)	ʔasad	ʔusuud	'lion'
(*e*)	jundub	janaadib	'locust'

However, as Hayes (1995: 78) notes, an iambic templatic foot is inconsistent with the moraic trochee which defines the stress system. A similar problem is found with Archangeli's (1991) proposal that the templatic morphology of Yawelmani verb stems, illustrated in (65), makes use of the iamb (F_I):

(65) Yawelmani stem forms (Archangeli 1991: 247)

	CV form	*template*	*UR*	*SR*	*Gloss*
(*a*)	CVC	σ	caw-hin	cawhin	'shouted'
(*b*)	CVCC	σ	hogn-hin	hoginhin	'floated'
(*c*)	CVVC	$\sigma_{\mu\mu}$	c'uum-hin	c'omhum	'devoured'
(*d*)	CVVCC	$\sigma_{\mu\mu}$	cuupn-hin	coopunhun	'consented'
(*e*)	CVCVV	F_I	ninii-hin	nineehin	'became quiet'
(*f*)	CVCVVC	F_I	yawaal-hin	yawalhin	'followed'

Hayes (1995: 204) classifies the stress system of Yawelmani as based on syllabic trochees not iambs: the penult is regularly stressed, with some exceptional words receiving antepenult stress. A further problem for a generalized template theory (GTT) analysis of both the Arabic broken plural and Yawelmani stems is that, in contrast to other examples of Prosodic Morphology discussed so far, the proposed templates do not consistently define a target output shape for the entire morpheme, but only for a substring (e.g. janaadib (64*e*) and coopunhun (65*d*)). We return to the problem of what constitutes a template in root-and-pattern morphology in the next chapter.

To sum up this section, it is a striking weakness of PBT that it has no account for the disyllabicity requirement holding for verb stems in Semitic languages and Sierra Miwok, especially as this data has been a central concern for theories of prosodic morphology since McCarthy (1979). Although a disyllable matches a possible Foot type, it cannot be appealed to as a template in PBT, as it does not match the stress Foot of any of these languages. Indeed, it is unexpected in PBT for Arabic, Modern Hebrew, and Sierra Miwok to share a disyllabicity requirement on verb stems when they have such diverse stress systems. PBT also has no account for why this requirement only holds of verb stems and not for nouns, when both categories are stressed following identical principles. It is clear there must be some other motivation than the stress Foot for stem disyllabicity.

2.3.2. *Minimal word is not minimal stress Foot*

In the PBT, word minimality reduces to stress Foot minimality by the principle of HEADEDNESS (2*a*): Prosodic Word dominates stress Foot in the Prosodic Hierarchy (1). This predicts we should find a strong correlation between minimal word size and the independently motivated minimal stress Foot of the language. As proper stress Feet are minimally bimoraic or disyllabic by BINARITY (2*b*), we expect words to also have this minimum size. Section 2.2.1, above, lists several languages which bear out this prediction.

Hayes (1995: 87) argues that the strong prohibition on non-binary Feet must be weakened, as a few languages do allow them in main stress position. It then follows that we must also weaken the word minimality requirement slightly and predict that minimal words must satisfy Binarity (2*b*) in languages where stress Feet in polysyllabic words must satisfy Binarity (2*b*). Minimal words can violate Binarity (2*b*) only in languages where main stress Feet in polysyllabic words can also violate Binarity (2*b*). This prediction is borne out in languages like Auca (Hayes 1995: 90) and Modern Hebrew (Ussishkin 2000). For example, as Ussishkin (2000: 77) shows, Modern Hebrew has many monosyllabic, monomoraic lexical words: *gé* 'proud', *rá* 'bad', *pé* 'mouth'. The stress pattern of trisyllabic words shows that Modern Hebrew also has degenerate (non-binary) stress Feet: *mèdabrót* 'speak, fem.pl.pres.', *nìxnesú* 'enter, 3.pl.past', *hùxtevú* 'to be dictated, 3.pl.past' (Ussishkin 2000: 69). As Ussishkin (2000) argues, in order for both the initial and final syllables to be stressed, these trisyllabic words must have one of the following footings: (σσ)(σ) or (σ)(σσ). Notice that both require one of the Feet to be non-binary.

Languages where minimal Foot and minimal word coincide do not turn out to be representative, however. Hayes's (1995), Garrett's (1999), and Gordon's (1999) comprehensive cross-linguistic surveys of the correlation between minimal stress Foot and minimal word requirements all show that there is, in fact, no strong correlation. Hayes's (1995: 88–9) survey of 70 languages finds that 30 show a mismatch between minimal word size and minimal stress Foot size. Garrett's (1999) survey of 50 languages finds that in the majority of cases minimal word size is not connected either to foot structure or to stress patterns. Gordon's (1999) survey of the weight properties of some 344 languages finds that only 158 (46%) require minimal words to be larger than a light (CV) monosyllable. The languages in Gordon's sample that require minimal words to be bimoraic or disyllabic often do not provide evidence from the stress system that this is also the minimum stress Foot size. For example, about half of the languages that have a disyllabic minimal word requirement do not have the quantity-insensitive stress system that should correlate with this requirement. And about half of the languages with a CVV minimum word requirement have either a quantity-insensitive stress system or no stress. The characteristic mismatches between minimal stress Foot and minimal word revealed by these surveys are reviewed below.

Hayes's (1995) weakened claim for the stress Foot-minimal word correlation is that languages should allow subminimal (CV) words if polysyllabic Words allow subminimal Feet. However, in many languages subminimal Feet are only found in monomoraic, monosyllabic words. They are not independently attested in the stress system of the language. Both Hayes's (1995: 198–205) and Garrett's (1999: fig. (9)) surveys list many examples like this. To cite just one, Manam (Austronesian; Lichtenberk 1983; Halle and Kenstowicz 1991; Buckley 1998*a*) regularly places main stress on the penultimate mora of polysyllabic words, yet it has some monomoraic words: *ú* 'kind of fish trap; *gá* 'Morinda citrifolia'. And some languages with unbounded quantity-sensitive stress systems have subminimal words, emphasizing that there is no connection between stress Footing and minimality. For example, Ka (1988: chapter 6) shows that in Wolof (West Atlantic) stress is assigned to the leftmost heavy syllable of polysyllabic words, else the initial syllable. Wolof also has numerous CV words, even though a CV syllable could never be a stress Foot in a longer word: *bá* 'to abandon'; *fó* 'to play'; *já* 'market'.

Conversely, in other languages we find that minimal words can be required to be larger than the minimal stress Foot. In the Australian languages, Uradhi and Yidiɲ (Kager 1995), the minimal word is required to be disyllabic, while the minimal stress Foot is a bimoraic monosyllable. In another Australian language, Alyawarra (Downing 1998*b*, Goedemans 1996), the minimal word is disyllabic, while the minimal stress Foot is a monomoraic monosyllable. Similarly, Buller et al. (1993) show that Banawá, an Arawakan language spoken in Brazil, has monomoraic stress Feet but a bimoraic minimal word requirement. Garrett (1999: fig. (6)) and Gordon (1999) list several other examples of this type.

Another sort of discrepancy between word minimality and stress Feet is found in languages with lexical stress Footing. As noted in section 2.2.2.1, above, lexical words in the native vocabulary of Italian are minimally disyllabic. While Thornton (1996) argues that this is consistent with Italian's 'basically trochaic' stress system, in fact, stress in Italian is not entirely phonologically predictable, and stressed syllables are heavy. It is not clear how these stress facts motivate a disyllable as the minimal stress Foot.

As Garrett (1999) argues, one does not expect languages with unbounded stress systems to have word minima, as these stress systems can be analysed without appealing to binary footing (Hayes 1995, Prince and Smolensky 2004, van der Hulst 1996, 1999). However, one finds that many languages with unbounded main stress have the same sorts of word minimality requirements as languages with alternating stress. For example, a word minimality requirement is traditionally invoked to explain the blocking and augmentation alternations of Lardil, illustrated in (26), above. However, Klokeid (1976: 29) describes Lardil as having an unbounded stress system, with main stress consistently on the initial syllable, whether it has a long or a short vowel. There is, then, no evidence from stress for a minimal bimoraic foot that could motivate the word minimality requirement. The Bantu languages discussed in section 2.2.2.1, above (e.g. Shona and Swahili) provide another example of this type. The disyllabic minimal word constraint found in many of these languages should, in PBT, match disyllabic stress footing. However, work like Doke (1954) notes that stress is phrasal in many Bantu languages, including Shona, and found only on the penult, not in an alternating pattern throughout the word. As Mutaka and Hyman (1990) argue, there is, then, no good evidence for disyllabic footing at the Prosodic Word level to motivate the word minimality requirement.

Examples like this can easily be multiplied. Fitzpatrick Cole (1990) shows that all monosyllabic words in Bengali have a long vowel (66*a*), even though vowel length is not contrastive. As shown in (66*b*), this length is lost when the stems occur with affixes which allow the word to satisfy the bimoraic minimality requirement:

(66) Bengali monosyllabic stems (Fitzpatrick Cole 1990: figs. (20*a*,*b*))

(a) Vowel lengthening in monosyllabic words

/ca/	[ca:]	'tea'
/nɔʈ/	[nɔ:ʈ]	'dancer'
/rag/	[ra:g]	'anger'
/din/	[di:n]	'day'

(b) No lengthening when monosyllabic stems are affixed

/ca-e/	[cae]	'tea-OBL'
/nɔʈ-i/	[nɔʈi]	'dancer-FEM'
/rag-i/	[ragi]	'angry (ADJ)'
/din-er/	[diner]	'day-GEN'

Fitzpatrick Cole (1990) argues that the best motivation for the lengthening in (66*a*) is to satisfy a bimoraic minimality constraint on words. However, according to Hayes and Lahiri (1991), Bengali has a quantity-insensitive unbounded stress system: the initial syllable of the word is consistently stressed. The CVV minimal word motivated by the data in (66), then, does not match the minimal stress Foot. A vowel lengthening process identical to that illustrated in (66*a*) is also found in the Australian language, Waray (Borowsky and Harvey 1997). As vowel length is not contrastive in Waray, CVV is not a possible syllable (or minimal stress Foot) in polysyllabic words. The bimoraic minimality requirement is, therefore, not plausibly motivated by a Prosodic Word-stress Foot correlation. Finally, Siptár and Törkenczy (2000) argue that the minimal word in Hungarian is CVV/CVC.[39] Hungarian has an unbounded stress system like Bengali's: the initial syllable is consistently stressed. There is, then, no motivation from the stress system for the word minimality requirement.

Another common mismatch comes from languages where CVC is the minimal word, yet CVC cannot be a minimal main stress Foot. Indeed, the most common minimum word size (larger than CV) in Gordon's (1999) survey is a CVC monosyllable. However, in a significant majority of these languages (70%), CVC does not count as heavy for other weight-sensitive processes, like (main) stress

[39] There are a handful of exceptional CV words in Hungarian. See Siptár and Törkenczy (2000) and Morén (2001) for discussion.

assignment or tone realization. (Garrett's (1999) survey makes the same point, as does Kager (1992).) For example, as noted in section 1.4, the minimal word in Lushootseed morphologically consists of a Root, which is canonically CVC (Urbanczyk 1996, 2000). There is no evidence from stress that CVC syllables are parsed as bimoraic Feet, though, as only vowel quality plays a role in stress assignment in Lushootseed (full vowels are stressed in preference to schwa). A further example is provided by Yapese, an Austronesian language spoken in the Caroline Islands. Jensen (1977) shows that both minimal words and vocative truncations in this language are CVC. McCarthy and Prince (1986: 45) propose that this size restriction corresponds to the minimal Foot of Yapese. However, Jensen (1977: 92–3) shows that, while long vowels attract main stress in this language, closed syllables never do (though they seem to receive secondary stress). Since CVC syllables never receive main stress except in monosyllabic words, it is circular to propose that CVC minimal words are bimoraic and correspond to the minimal main stress Foot of Yapese.

Modern Hebrew presents a similar problem. As noted above, it has monosyllabic minimal words, consistent with the monosyllabic feet motivated by the stress system. Ussishkin (2000: 76–7) shows that while both CV and CVC monosyllabic words are found, there is a clear skewing in favour of CVC monosyllables: there are only 35 CV words compared to 1,080 CVC words. As Modern Hebrew has a quantity-insensitive stress system, there is no motivation from stress for this skewing.

A final problem for the Prosodic Hierarchy-based theory of word minimality is that, if this property falls out automatically from stress footing, we expect that languages without word stress should not have minimality requirements. If words are not parsed into stress Feet, there is no reason for words to satisfy BINARITY (2*b*). In many cases, we do, indeed, find that languages which are not reported to have word stress can have monomoraic/monosyllabic lexical words. For example, verbs in many Nigerian Benue-Congo tone languages are canonically CV in form (Akinlabi and Urua 2002, Hyman 2004, Orie 1997).

However, many languages which do not have word stress do impose a minimality constraint on words. For example, in

Ethiopian Semitic languages, verbs are minimally bimoraic (Rose 1997). A bimoraic or disyllabic minimality requirement holds for words in Chadic tone languages like Hausa (Newman 2000: 409) and Miya (Schuh 1998: 31), Khoisan languages like !Xoo (Traill 1985) and Ju|'hoansi (Miller-Ockhuizen 1999, 2001), and a few Nigerian languages like Idoma and Gokana (Orie 1997).[40] Although Standard Chinese is traditionally described as a language where most words are monosyllabic, work like Chen (2000), Feng (2002), and Duanmu (2000) shows that at least 75 percent of all words are actually disyllabic or longer, and all words introduced into Standard Chinese in the past 100 years are minimally disyllabic (and, morphologically, compounds). Further, monosyllabic words cannot form an independent utterance (Chen 2000, Feng 2002).[41] Gordon's (1999) survey lists many more examples of languages with no reported word stress which nonetheless have minimal word requirements.

Clearly, the Prosodic Hierarchy (1) alone is not motivating Word minimality if there is no consistent cross-linguistic correlation between independently motivated minimal stress Foot size and minimal word size, and if languages with no word stress are subject to word minimality requirements.

2.3.3. *All Words are not subject to the same minimality condition*

In PBT, word minimality correlates with stress footing. This predicts that all words of a language should be subject to the same minimality condition if they are all subject to the same stress footing principles. However, in some languages different categories of

[40] It has been argued for these Khoisan languages and also some West African tone languages that morpheme structure constraints provide evidence for footing, as disyllabic roots show asymmetries in the licensing of segmental contrasts that are highly reminiscent of those found within a stress Foot. As Miller-Ockhuizen (1999) points out, though, the segmental and prosodic asymmetries of Khoisan languages like Ju|'hoansi do not all converge on the same syllable as strong, so more work needs to be done to determine how analogous these asymmetries are to stress. See Akinlabi and Urua (2002), Downing (to appear *a*) and Harris (2004) for further discussion and references.

[41] See Yip (1992, 1993) for discussion of evidence from the loanword phonology and prosodic morphology of Chinese for a disyllabic word minimality constraint.

words are subject to different minimality conditions. We already noted this problem in section 2.3.1, above, as we find a disyllabicity requirement holds only for derived verb stems in Arabic and Modern Hebrew; nouns can be monosyllabic to match (roughly) the minimal stress Foot. A further example is provided by Axininca Campa, an Arawakan language spoken in Peru. Spring (1990, 1991) shows that nouns and adjectives, which can be monomorphemic Roots, minimally contain a heavy monosyllable, as expected given Axininca Campa's iambic stress system. However, minimally bimorphemic verbs are minimally disyllabic. As Hargus and Tuttle (1997) shows, in many Athabaskan languages verbs, which are minimally bimorphemic—containing a root and a tense prefix—must be disyllabic, while monomorphemic nouns may occur as monosyllables. And in many Nigerian Benue-Congo languages, nouns are subject to a disyllabic minimality constraint, reflecting their bimorphemic structure, while (monomorphemic) verbs are canonically monosyllabic (Akinlabi and Urua 2002; Hyman 2004; Orie 1997).

As work since Itô (1990) has observed, it is also common for derived words to be subject to different minimality conditions from underived words of the same category. For example, Uhrbach (1987) shows that fusion of a nasal (N-) prefix with a stem initial consonant is productive for polysyllabic roots in several Indonesian languages. Data from Javanese illustrating this is given in (67*a*). However, the process is blocked for monosyllabic roots. Instead, as shown in (67*b*), a schwa is epenthesized between the nasal prefix and the stem. As Uhrbach (1987) argues, the best explanation for the lack of fusion with monosyllabic stems is that the output of nasal fusion is subject to a disyllabic minimality constraint. Since the monosyllabic stems can occur unaffixed, the disyllabic minimality requirement clearly does not hold generally of all words of the language, but only of (certain) derived constructions:[42]

[42] Interestingly, Dudas (1976) claims that most roots of Javanese are disyllabic, with CVCVC the most frequently occurring shape. As we can see in (67*b*), the monosyllabic roots achieve this canonical shape with N-prefixation. That is, the canonical root shape 'emerges' in certain derived constructions, although it is not always found in non-derived roots. We will return to this point in section 3.2.1.1, below.

(67) Nasal fusion in Javanese (from Uhrbach 1987: 233, fig. (11))

(*a*) *Polysyllabic roots*

cukur	ɲukur	'shave someone'
bali	mbaleni	'return something'
tulis	nulis	'to write'
dudut	ndudut	'pull/interesting'
sapu	ɲapu	'broom/to sweep'

(*b*) *Monosyllabic roots*

cet	ŋəcet (*ɲet)	'(to) print'
bom	ŋəbom	'(to) bomb'
dol	ŋədol	'(to) sell'
tik	ŋətik	'typewrite/to type'
bis	ŋəbis	'(to ride the) bus'

Inkelas and Orgun (1995) and Orgun (1996) show that some speakers of Istanbul Turkish impose a disyllabic minimal size condition on derived words, even though underived words consisting of a bimoraic monosyllable are common. And Féry (1991) shows there is a disyllabic minimality requirement on German infinitives, even though underived words can consist of a single bimoraic monosyllable. Since derived and underived words are stressed according to the same principles in these languages (for the languages which have stress), the different minimality constraints holding for derived and underived words cannot fall out from the correlation between stress Foot size and Prosodic Word minimality defined through the Prosodic Hierarchy (1). There must be some other explanation for why morphologically complex words can be subject to a different minimality constraint from the one holding for simplex words.

2.3.4. *Truncations are not identical to minimal word*

As we saw in section 2.2.2, above, PBT predicts that truncations, as a type of Prosodic Word, are subject to the same minimality constraint as other Prosodic Words, namely, they must minimally contain a single stress Foot. However, truncations are also morphologically derived words. As we have just seen, derived words in some languages are subject to different minimality constraints from underived words. It is, then, unsurprising that this can also hold true of truncations.

Work by Poser (1990) and Itô (1990) demonstrates that truncations are subject to minimality requirements in Japanese. Both nicknames and loanword truncations are minimally bimoraic, if they are bound forms, and disyllabic if they are free forms. However, as Itô (1990: 218) shows, numerous common underived words of Japanese are monomoraic. Minimality requirements are imposed only on derived words, like truncations. (Note, too, that since Japanese is not a stress language, binary stress footing cannot be motivating the minimality effects found in truncations.)

In Madurese, Stevens (1968) shows that Roots truncate to the final syllable, not only in forming compounds and reduplication, as shown in (54), above, but also to form some vocatives and, sporadically, to shorten other common words. As noted above, words are minimally disyllabic in Madurese (McCarthy and Prince 1986, Weeda 1987). The truncated forms in (68) violate this general word minimality condition, plausibly to satisfy the morphological requirement that a truncation is, by definition, shorter than its Base.[43] Madurese truncations, then, provide an additional example of a language where different minimality conditions hold for different types of words.

(68) Madurese truncations (Stevens 1968: 83; Weeda 1987; McCarthy and Prince 1986: fig. (81))

Full	*Gloss*	*Truncation*
ibhu	'mother'	bhu(ʔ)
settoŋ	'one'	toŋ
duwaʔ	'two'	waʔ
enghi	'yes'	ghi
uriŋ	'person'	riŋ

[43] According to Cohn (2003), the pattern of vocative truncation illustrated in (68) for Madurese is found in many Austronesian languages. For example, in Indonesian, too, vocative truncations are typically CVC, violating a general disyllabic word minimality constraint (which matches the disyllabic stress Foot of Indonesian). As Cohn notes, the Indonesian truncation pattern clearly violates PBT's prediction that truncation size should match minimal word size should match stress Foot.

In other languages, truncations—by definition, derived words—are longer than non-derived minimal words of the language. For example, as we saw in Chapter 1, fig. (4), in one productive pattern of forming nicknames and abbreviations in German, the output is always exactly two syllables long and ends in the fixed vowel, *–i*:

(69) German 'Spitznamen' (Itô and Mester 1997: 119, fig. (3); Féry 1997: 6)

Full name or word	*Abbreviated form*	
Gabriele	Gabi	
Waldemar	Waldi	
Oliver	Olli	
Gorbatschow	Gorbi	
Wilhelm	Willi	
Alkoholiker	Alki	'alcoholic'
Amerikaner	Ami	'American'
Trabant	Trabi	(type of DDR car)
Student	Studi	'student'

As noted above (sects. 2.2.1, 2.3.3), minimal underived words in German are bimoraic monosyllables (Féry 1991, Hall 1999). A plausible explanation for why these truncations are minimally disyllabic is that the truncations are derived words, and like some other derived constructions in German—for example, the infinitives mentioned in the preceding section—are required to be longer than underived words.

Truncations, then, provide additional evidence that morphological structure plays an important role in defining minimal word size. PBT does not predict this, as minimal word size should follow from strictly phonological principles, namely, minimal stress Foot size, which is uniform across different word types.

2.3.5. *Not all Stems are Prosodic Words or stress Feet*

In PBT, a Foot-sized (bimoraic/disyllabic) minimality condition on prosodic morphemes (e.g. reduplicative morphemes) is accounted for by categorizing them as Stems. By the STEM → PRWORD HOMOLOGY (3*b*), these morphemes are parsed as Prosodic Words. Like other Prosodic Words, they must form a separate stress domain, containing a minimal stress Foot, and satisfy other phonotactic requirements on Prosodic Words. However, in many languages, Foot-sized reduplicative morphemes do not satisfy all of these requirements. One example was noted in discussing the Fox disyllabic reduplication pattern illustrated in (59), above. While Dahlstrom (1997) shows there is phonotactic evidence for Prosodic Word status of this reduplicative morpheme, no information on stress is provided. As a result, we do not know whether the disyllabic size is consistent with stress footing or whether the reduplicative morpheme is an independent stress domain.

Verbal reduplication in many Bantu languages shows more conclusively that disyllabic reduplicative morphemes are not always Prosodic Words. In Swati, for example, the verbal reduplicative morpheme contains exactly two syllables even though the Base stem is variable in length:

(70) Swati verbal reduplication (Downing 1994, 1999*b*, field notes; stem follows '=' and reduplicative morpheme is underlined)

	Verb stem	*Gloss*	*X here and there; from time to time*
(*a*)	ba-yá=li:ma	'they plough'	ba-ya-limá=li:ma
(*b*)	ba-ya=líme:la	'they plough for'	ba-ya-lime=líme:la
(*c*)	ba-ya=hlábe:la	'they sing'	ba-ya-hlabe= hlábe:la
(*d*)	ba-ya=hlabéla:na	'they sing for each other'	ba-ya-hlabe=hlabéla:na

In PBT, the disyllabicity requirement would be motivated by parsing the reduplicative morpheme as a Prosodic Word, dominating a disyllabic stress Foot. As noted in section 1.4, above, Downing (1999*b*) presents two main arguments against parsing the reduplicative morpheme as a Prosodic Word. First, High tones in Swati never cross Prosodic Word boundaries. As shown by the data in (70), the rightmost High tone in Swati, as in other Nguni languages, generally surfaces on the antepenultimate syllable of the word, even if the syllable which contributes it is several syllables to the left.[44]

[44] See Downing (2003) for a recent analysis of tone in Swati verbal reduplication. And see Downing (2001*a*) for discussion of the morphological conditions on tone realization and vowel length in the related Nguni language, Ndebele.

(In these data, the only High-toned morpheme is the subject prefix *bá-* 'they'.) Notice that the High tone can cross over both the reduplicative morpheme boundary and the verb stem boundary to reach the antepenult. Therefore, if the reduplicative morpheme were parsed as a Prosodic Word, we would expect it to block High tone shift. Further, in Swati stress is assigned to the penultimate syllable, indicated by length on this syllable. The reduplicative morpheme is never realized with a lengthened vowel, even though we would expect this to be possible if it were parsed as a Prosodic Word. (There are no non-reduplicative verb compounds in Swati, so one cannot attribute the lack of stress to a general asymmetrical compound stress pattern.) The disyllabic size condition on the Swati reduplicative morpheme, then, cannot fall out from the Prosodic Hierarchy, as this morpheme is not a Prosodic Word.

Another example is provided by Axininca Campa, an Arawakan language spoken in Peru. As Payne (1981) and Spring (1990, 1991) show, subminimal stems like *na* 'carry' must be augmented to two moras or two syllables when reduplicated (and when other suffixes are added): *[na**ta**]-nata-waitaki* 'carry' (*[na]–na–waitaki). Work like McCarthy and Prince (1993) and Spring (1990, 1991) account for this minimality condition on the Base by proposing it is a Prosodic Word. However, as McCarthy and Prince (1993: appendix A1) acknowledge, the Prosodic Word constituency motivated by augmentation "is incompatible with several elementary properties of the Word-level phonology". Notably, the reduplicative morpheme is not a distinct stress domain from the Base, as we would expect if it were a distinct Prosodic Word.

The Prosodic Hierarchy also provides no account for bimoraic or disyllabic minimality requirements on reduplicative morphemes in languages which have no word stress. Numerous African tone languages fit this description. For example, as Dimmendaal (1983) and Noske (1991) show, in Turkana (a Nilotic language spoken in Kenya), verb roots can be productively reduplicated to give an intensive meaning to the verb. As shown in (71), the reduplicative morpheme (underlined) does not contain just a copy of the root. An epenthetic vowel (usually a copy of the root vowel) separates the Base root from the reduplicated root:

(71) Turkana intensive verbs (Noske 1991: fig. (17); tone is not marked)

	Root	*Intensive*	*Gloss (Intensive)*
(*a*)	-poc-	-poc=o.poc-	to pinch repeatedly
(*b*)	-pet-	-pet=e.pet-	to kick repeatedly
(*c*)	-sur-	-sur=u.sur-	to disturb
(*d*)	-per-	-per=e.per-	to sleep at different places
(*e*)	-da	-da=i.da	to crumple
(*f*)	-en	-en=eʔen	to tie with many bindings

Noske (1991) argues that the best motivation for the epenthetic vowel in the reduplicative construction is to satisfy a bimoraic minimality requirement on the reduplicant. All the roots in (71) are monomoraic, and the epenthetic vowel provides a second mora for the reduplicative morpheme. We can see most clearly that the epenthetic vowel is satisfying a reduplicative size requirement in (71*e*, *f*). The epenthetic vowel in (71*a*-*d*) could also be motivated by the syllable structure of Turkana: if the epenthetic vowel did not occur, the resulting consonant sequences could not be syllabified (e.g. *poc=poc-). The forms in (71*e*, *f*), though, would be syllabifiable without the epenthetic vowel. The only plausible motivation for the epenthetic vowel in these cases is to augment the size of the reduplicative morpheme. However, the PBT cannot account for this bimoraic minimality requirement, as there is no independent motivation from stress footing in Turkana for parsing the reduplicative morpheme into a minimally bimoraic constituent.

2.3.6. *Not all stress domains are Prosodic Words*

Klamer (1998) shows that Kambera has a pattern of partial Root reduplication, as well as the total Word reduplication pattern given in (35) and the Affixal partial reduplication pattern in (57), above. (All types of reduplication seem to express the same range of meanings.) The stress pattern of the partial Root reduplication pattern provides evidence that it is a compound construction, like the total Word reduplication pattern. In unreduplicated forms of

Kambera, only the Root-initial syllable is stressed. Other syllables in the Root and Affixes are not stressed. As shown in (72), the initial syllable of the reduplicative morpheme (underlined) and that of the Base Root are both stressed. Further, both halves of the complex can have either main stress, as shown in (72), or the compound stress pattern (secondary stress on the first half of the complex and main stress on the second half):

(72) Kambera Foot reduplication (Klamer 1998: 37, fig. (48))[45]

(*a*)	táu	'person'	táu-táu
(*b*)	ráma	'work'	ráma-ráma
(*c*)	káunda	'stalk away'	káunda-káunda
(*d*)	wúna-ng(u)	'priest'	wúna-wúnangu
(*e*)	tángar(u)	'watch X'	tánga-tángaru
(*f*)	ka-háu-ng(u)	'separate X'	ka-háu-háungu
(*g*)	pa-bánjar(u)-ng(u)	'talk'	pa-bánja-bánjarungu

This partial reduplicative morpheme, then, meets some of the same tests for Prosodic Word as the total Word reduplicative morpheme in (35). It is assigned main stress and is a distinct stress domain from the Base. Moreover, it satisfies the bimoraic Prosodic Word minimality condition Klamer (1998) motivates for Kambera. The reduplicative morpheme, in fact, ranges in size from the bimoraic minimum Foot to the disyllabic maximal Foot of Kambera. This variation is what you would expect given MAX-BR: the reduplicative morpheme should contain as much of the Base Root as possible without violating BINARITY.

There is an important problem with analysing the Root reduplicative morpheme in (72) as a distinct Prosodic Word, however. First, it is unclear what morpho-prosodic parse to assign the prefixes in (72*f*, *g*). Recall from the analysis of Diyari in (11) that reduplicative maximality is formalized by defining the reduplicative morpheme as a Prosodic Word that optimally parses a single stress Foot. As the prefixes are part of the morphological word, it is expected for them to be parsed into some Prosodic Word. However, if the prefixes are

[45] Klamer (1998) argues convincingly that word-final '*u*' in Kambera is not part of the input, but rather occurs due to epenthesis. (Only open syllables are found in Kambera.) Parentheses around a final *u* in (72) indicate its epenthetic status.

parsed into a Prosodic Word with the adjacent reduplicative morpheme, that morpheme would violate the single Foot maximum imposed on minimal words. (The Swati data in (70) illustrate the same problem.) Further, since the stress system is unbounded—only the Root-initial syllable is stressed regardless of its weight—stress does not provide evidence for the binary footing that is supposed to motivate word minimality. (See the discussion in sect. 2.3.2, above.)

A more plausible analysis of the structure of the reduplicative complex in the forms in (72) is to propose that it is a Root-Root compound. As only the Root-initial syllable is assigned stress in Kambera, there is no reason to equate the stress domain with Prosodic Word. If the reduplicative morpheme is morphologically categorized as a Root and the reduplicative complex is a Root-Root compound, both halves of the complex will be assigned stress by the usual constraints optimizing Root-initial stress (and requiring a prosodic match between the reduplicative morpheme and its Base). Analysing the complex as a Root-Root compound further predicts that only the Root is reduplicated, affixes are not, even when they fall within the disyllabic window of reduplication (compare (72*c*) with (72*f*)). Finally, analysing the complex as a Root-Root compound allows the prefixes to be parsed with the reduplicative complex into a single Prosodic Word. The next chapter develops an alternative theory of morphological minimality which straightforwardly accounts for why Roots can be required to be minimally bimoraic in languages like Kambera where Roots are not plausibly parsed into binary stress Feet.

2.4. Summary

To sum up, the PBT does not provide a complete theory of canonical morpheme shape, because there is no consistent cross-linguistic correlation between Stem, minimal Prosodic Word, and minimal stress Foot. As we have seen, the most common minimal word shapes, CV and CVC, are not minimal Feet in most languages where they are minimal words. Words and morphemes that are not parsed into stress Feet are still subject to minimality constraints. Morphemes that are stressed and subject to minimality are not always Prosodic Words. Words with different morphological structures can be subject to different minimality constraints even though they have the same stress footing or no stress footing. In particular, derived words in many languages, including those with root-and-pattern morphology, are subject to a disyllabic minimality constraint which is not motivated by the stress Foot. As a result of these problems, we cannot maintain the central claim of the PBT, namely that Word and Stem minimality follows from HEADEDNESS (2*b*). In the next chapter I argue for an alternative version of the GTT that resolves the problems for the Prosodic Hierarchy-based version reviewed here.

3

Morpheme-Based Templates

In this chapter I will argue for an alternative conception of the Generalized Template Theory (GTT) of prosodic morpheme shapes. This approach shares with the Prosodic Hierarchy- based template theory (PBT), critiqued in Chapter 2, the proposal that prosodic morphemes have a restricted repertoire of prosodic shapes because they draw on the canonical shapes of a restricted repertoire of morphological categories. This alternative approach also argues that canonical shapes follow from general theoretical principles correlating particular morphological categories (Root, Affix) with particular prosodic constituents. It similarly predicts that all prosodic morphemes of the same morphological category should be subject to identical shape constraints and have other phonological and morphological properties (besides shape) that are characteristic of that category.

What is new about this version of the GTT is it argues that the motivation for canonical shape is independent of the Prosodic Hierarchy. Instead, the approach builds on Dresher and van der Hulst's (1998) proposal that canonical morpheme shape follows from a correlation between morphological complexity and phonological complexity. Lexical morphemes meet minimality requirements, not because they contain a stress Foot, but rather because they are heads and license complex phonological structure. Arguments for this approach are developed as follows. The first section of this chapter discusses the general theoretical motivations for divorcing canonical shape from the Prosodic Hierarchy and instead relating it to morphological complexity. Then I show how this morpheme-based version of the GTT solves the problems with the

Prosodic Hierarchy-based version discussed in section 2.3. The remainder of this chapter presents a detailed exemplification of the theory through a series of case studies of the role of Stem, Root, and Affix in defining the canonical shapes we have seen as characteristic of prosodic morphemes.

3.1. Divorcing templates from the Prosodic Hierarchy

3.1.1. *Morphemes, syllables, and branching heads*

We saw in the preceding chapter that in PBT canonical morpheme shape falls out from the correlation between the morphological constituent, Stem, and the prosodic constituent, stress Foot. This correlation is derived through the interaction of two constraints. One, the Stem → PrWord Homology, optimizes parsing Stems as Prosodic Words (Chapter 2, fig. (3*b*)). The other is the principle of Headedness (Chapter 2, fig. (2*a*)), which requires Prosodic Words to minimally contain one stress Foot, the constituent dominated by Prosodic Word in the Prosodic Hierarchy:

(1) Sublexical Prosodic Hierarchy (McCarthy and Prince 1986)
Prosodic Word
|
Foot
|
σ
|
μ

As we saw in section 2.3, however, these two constraints, which formalize the core claims of PBT, are empirically inadequate. Stems can be subject to minimality conditions even though they are not parsed as Prosodic Word, and Prosodic Words can be subject to minimality conditions even though they do not parse stress Feet. Further, cross-linguistic studies of minimal Word size show that in most languages minimal word and minimal stress Foot size do not match. This result should come as no surprise, since work beginning with Inkelas (1989) has shown that the assumptions underlying both of these constraints are conceptually flawed. Problems with each constraint are taken up in turn.

Stems are obligatorily parsed as Prosodic Words in PBT (by the STEM → PRWORD HOMOLOGY), as Prosodic Word is the only prosodic constituent in the Hierarchy which could correlate with the morphological constituent Stem. The constituents below Prosodic Word in the Hierarchy in (1)—Foot, syllable, and mora—are defined purely phonologically. This makes them inappropriate prosodic domain correlates for a morphological constituent like Stem. The prosodic constituents which dominate Prosodic Word in the Hierarchy, given in (2), are phrasal entities, defined with reference to syntactic information, and so are not plausible prosodic correlates to Stem:

(2) Superlexical Prosodic Hierarchy (Nespor and Vogel 1986, Selkirk 1986)

Utterance
|
Intonational Phrase
|
Phonological Phrase

The paucity of non-phonological sublexical prosodic constituents is problematic, as Inkelas (1989, 1993) argues, if we take seriously Selkirk's (1986) proposal that all phonological processes apply within prosodic domains, rather than domains defined directly on morpho-syntactic structure. In prosodic domains theory, sublexical morphological constituents, like the superlexical morpho-syntactic ones, cannot directly define the domain for phonological processes. Instead, every morphological constituent which serves as a domain for phonological or prosodic processes must have a corresponding morpho-prosodic constituent, and it is this constituent which interacts with the sublexical phonology. To have sufficient domains to account for morphologically conditioned sublexical phonological processes, it is obvious that the prosodic hierarchy in (2) must be expanded to include constituents which are smaller than a Prosodic

Word but also distinct from the metrical prosodic constituents dominated by Prosodic Word in (1).

Some of the arguments in favour of expanding the repertoire of morpho-prosodic constituents below the level of Prosodic Word to include at least Stem and Root have already been presented.[1] In the Bantu language, Swati, for example, discussed in Chapters 1 and 2, we saw that tone realization takes the Prosodic Word as its domain, while reduplication takes the Stem as the Base domain. As Downing (1999*b*) shows, other phonological processes in Swati, like labial dissimilation in the passive, also take the Stem as their domain. The need to recognize (Prosodic) Stem as a distinct phonological domain from Prosodic Word has been argued for in numerous other Bantu languages: see e.g. Hyman (1993), Hyman and Mtenje (1999), Mchombo (1993), Myers (1987), and Mutaka (1994).

Similar arguments for distinguishing Prosodic Word from other sublexical morpho-prosodic domains have been developed by Czaykowska-Higgins (1996, 1998) for Salishan languages like Lushootseed, also discussed in Chapters 1 and 2. In many Salishan languages, only the Stem is the domain for stress assignment. Prefixes to the Stem are outside the stress domain: see e.g. Czaykowska-Higgins for Moses Columbia Salish, Shaw et al. (1999) for Musqueam Salish, Bar-el (2000*b*) for S<u>k</u>w<u>x</u>ú7mesh, and Urbanczyk (1996) for Lushootseed. The Prosodic Word, which includes prefixes, is a distinct phonological domain in these languages. For example, Czaykowska-Higgins shows that Moses Columbia Salish has a process of regressive retraction which applies optionally between Roots and prefixes and is bounded by a Prosodic Word edge.

Finally, as Klamer (1998) shows, in Kambera, the Root is the domain for stress assignment. Prefixes to the Root are outside the stress domain. And the Root is also the Base for one pattern of partial reduplication, discussed in section 2.3.5, above. Evidence that the Prosodic Word is a distinct phonological domain comes from a

[1] The interested reader can find more detailed arguments in favour of expanding the number of sublexical morpho-prosodic constituents in Inkelas (1989, 1993), Czaykowska-Higgins (1996, 1998), and Downing (1998*b*, 1999*b*).

pattern of total word reduplication, discussed in section 2.2.3.1, above. The Prosodic Word, not the morphological word, must be considered the Base for the total reduplication pattern, as epenthetic final -*u* occurs in both halves of the reduplicative complex. Indeed, distinguishing Stem vs. Word or Root vs. Word as phonological domains is crucial to the analysis of a variety of languages, as work like Kiparsky (2000) and Harris (1994) shows.

To account for facts like these, I follow Inkelas (1989, 1993) and Downing (1998*a*, 1999*b*) in proposing to modify the Prosodic Hierarchy as shown in (3*a*). In this hierarchy, Prosodic Stem and Prosodic Root are universally available as sublexical morpho-prosodic constituents, the prosodic equivalents of the morphological constituents, bimorphemic Stem and monomorphemic Root:[2]

(3) Morphological and metrical prosodic hierarchies (adapted Inkelas 1989: 46)

(*a*) Prosodic Hierarchy

Utterance
|
Intonational Phrase
|
Phonological Phrase
|
Prosodic Word
|
Prosodic Stem
|
Prosodic Root

(*b*) Metrical Hierarchy

Foot
|
σ
|
μ

The distinction between Root and Stem assumed here is familiar from traditional morphological usage (see e.g. Matthews (1991), Stonham (2004), Urbanczyk (1996)). Root is defined, morphologically, as a simplex lexical morpheme, the obligatory core for word

[2] Inkelas (1989, 1993) argues that bound Roots, at least, are not mapped to morpho-prosodic constituents. She does, however, leave open the possibility that free Roots (which she terms free 'Stems') can be. As Root can be the domain of phonological processes like stress in languages like Kambera, Prosodic Root must be an available constituent in the revised Prosodic Hierarchy in (3).

formation, though it may also be free- standing in languages like English. Stem, the constituent dominating Root, is a morphologically complex constituent, consisting minimally of a Root plus an Affix. Stem is distinct from Word, since, as noted above, it is often a separate phonological domain. Morphologically, the Stem complex is a base for obligatory affixation in many languages. For example, as we shall see below, in Bantu languages the verb stem consists of a Root plus at least one Suffix. This unit forms a base for inflectional prefixes which are obligatory to form verb words except in the imperative (see e.g. Myers (1987)).

Inkelas (1989, 1993, 1998) proposes that more sublexical morpho-prosodic constituents are necessary for languages which demonstrate more complex morphologically conditioned phonology. For example, Hausa, a Chadic language spoken in Nigeria and Niger, has a number of nominal and nominalizing affixes. As shown in (4), the tone of some of the affixes 'dominates' the tone of the morphological construction, while the tone of others is 'recessive':

(4) Hausa affixal tone (Inkelas 1998: 125–6)

(*a*) Dominant affixation—Participial suffix -*aCCee*

gaagara	+ aCCee	→	gaagararree
L HL	L H H		L L H H
'behave rebelliously'			'unmanageable'
dafaa	+ aCCee	→	dafaffee
H L	L H H		L H H
'cook'			'cooked'

(*b*) Recessive affixation—Participial suffix -*waa*

koomoo	+ waa	→	koomoowaa
H H	LH		H HL H
'return here'			'returning here'
dafaa	+ waa	→	dafaawaa
H L	LH		HL H
'cook'			'cooking'

Inkelas (1998) proposes that the distinction between dominant and recessive affixes in Hausa is best accounted for if each affixal construction forms a sublexical morpho-prosodic constituent, defining a distinct domain of tone realization by introducing a distinct co-phonology.[3] We shall return in Chapter 5 to the question of whether the categories Stem, Root, and Affix provide sufficient canonical shapes for prosodic morphology. This chapter and the next demonstrate the advantages of assuming this restricted repertoire.

The revised Prosodic Hierarchy in (3*a*) omits the metrical constituents (Foot, syllable, and mora), placing them in a separate Metrical Hierarchy (3*b*). This restructuring eliminates the hierarchical connection between Prosodic Word and stress Foot that crucially motivates minimality conditions in PBT. What justifies this restructuring? It has, in fact, long been recognized that there is a discontinuity in the traditional Prosodic Hierarchy between Prosodic Word and higher constituents in (2) and the sublexical metrical constituents in (3*b*). As Nespor and Vogel (1986), Selkirk (1986), and Inkelas (1989) point out, the prosodic constituents in (2) are all defined mainly with respect to morpho-syntactic constituents. While the prosodic constituents can be mismatched with the corresponding morpho-syntactic constituents to satisfy phonological conditions, the default parse presumes a match. In contrast, the metrical constituents in (3*b*) are constructed by phonological principles, referring to phonological properties of the string.

Another difference between the two sets of constituents is that the prosodic constituents in (3*a*) are defined as domains for phonological processes. Indeed, we have just seen that an important motivation for the replacement Hierarchy in (3*a*) is the need for more sublexical phonological domains. While Nespor and Vogel (1986) argue that Foot and syllable can be domains for phonological processes, subsequent work has shown that all of the examples discussed by Nespor and Vogel (1986) can be reanalysed without defining Foot or syllable as a phonological domain. Inkelas (1989)

[3] Recall from Chapter 1 that a co-phonology is a morphological construction-specific constraint ranking, proposed to account for patterns like the contrast between dominant and recessive tonal melodies in Hausa illustrated in (4). It is a question for future research to determine whether there are—or should be—any restrictions on the number of co-phonologies a language might have. The interested reader should consult work like Inkelas (1998), Inkelas and Orgun (1998), Inkelas and Zoll (2000, 2005), and Orgun (1996, 1998) for discussion of this point and for detailed exemplification and motivation for this approach to morphologically conditioned phonology in OT.

and Steriade (1998), for example, argue that either principles of syllable phonotactics or perceptual salience better account for processes said to apply in the syllable domain. And work like Inkelas (1989), Harris (1994, 2004), Beckman (1998), and Downing (to appear) argues that processes said to apply in the Foot domain are similarly best accounted for in terms of conditions on Foot phonotactics or in terms of some other domain, like Prosodic Word. One important motivation for proposing that the metrical constituents in (3*b*) form a distinct hierarchy from the prosodic constituents in (3*a*), then, is that they are constituents of a different type, metrical parsing units rather than domains for phonological processes.

Work like Nespor and Vogel (1986), Selkirk (1986), and Inkelas (1989) presents a related problem with considering the metrical constituents in (3*b*) domains on a par with the constituents in (3*a*). The problem becomes clear if we compare the relation of Prosodic Word to Foot, on the one hand, and the relation of Foot to syllable, on the other. It is meaningful to speak of Prosodic Word as the domain for parsing a string into Feet, with the phonological properties of Prosodic Word determining the number and form of the Feet it contains. This is one of the principal reasons for relating Foot and Prosodic Word in the traditional Prosodic Hierarchy (1). However, it is not meaningful to speak of the Foot as the domain for parsing a string into syllables. Even though the same hierarchical relation holds in (1), the opposite parsing relation holds: Feet parse syllables, and it is the phonological properties of the syllables that determine the number and form of the Feet.

A final reason to sever the hierarchical relationship between Prosodic Word and Foot is that the Prosodic Hierarchy should formalize (near) universal correlations among prosodic constituents. However, as we saw in Chapter 2, there is little evidence for a consistent correlation between Prosodic Word and stress Foot. Even though Selkirk (1984: 30) suggests that Prosodic Word is mainly motivated by stress, this is obviously only true in languages with binary stress or accent. In other languages, where stress Foot is not a relevant prosodic constituent, other processes have been shown to motivate Prosodic Word. For example, in Igbo it defines the domain for vowel harmony (Zsiga 1992). In short, Foot cannot be said to define Prosodic Word or condition its form, as Prosodic Word is not necessarily made up of optimal stress Feet. This sets the stress Foot apart from the other constituents in the Hierarchies in (3*a*) and (3*b*) which appear to be motivated in all languages. Each unit in the Prosodic Hierarchy in (3*a*), for example, defines the next one up: a Phonological Phrase is necessarily made up of well-formed Prosodic Words, the constituent it dominates in the Hierarchy.

To successfully divorce canonical shape from the Prosodic Hierarchy in (1), it is not enough to point out failings with that approach. An alternative theory must, first, motivate a morphology-prosody correlation to replace the Stem → PrWord Homology. The alternative developed here, which I term 'morpheme-based GTT' (hereafter, 'MBT'), argues that the basic morphology-prosody correlation is between a single morpheme and a single syllable. The alternative theory also must replace Foot binarity as a motivation for the tendency prosodic morphemes show towards binary minimality. In MBT, a branching requirement on morphological heads accounts for this tendency. Each of these proposals is developed in turn below.

To replace the Stem → PrWord Homology, MBT takes up another line of thinking found in the recent OT literature about the correlation between morphological structure and prosodic constituents, namely, that the minimal morphology-prosody correlation is between a single morpheme and a single syllable (see e.g. Feng (2004, in prep), McCarthy and Prince (1994*b*), Russell (1997), and Urbanczyk (1996)). This correlation is formalized in (5):[4]

[4] As Bob Ladd (p.c.) points out, autosegmental (floating) morphemes are an obvious exception to the claim that morphemes canonically contain a syllable, as they are unaffiliated with syllables or segments in the input, and are often realized over several syllables in the output. It is uncontroversial that autosegmental morphemes are marked. The claim here is that one reason they are marked is because they violate the Morpheme-Syllable Correlation (5).

One can also easily think of less marked exceptions to the Morpheme-Syllable Correlation: segmental morphemes which are longer or shorter than a syllable or

(5) MORPHEME-SYLLABLE CORRELATION (MORPH-SYLL, adapted, Russell 1997: 121) Each morpheme contains exactly one syllable.

As argued in Downing (2000), following McCarthy and Prince (1999), constraints like MORPH-SYLL (5) which evaluate the prosodic weight of a string can be considered a variety of correspondence constraint, establishing a relationship between the segments and prosody of a single morpheme. Further, I follow van Oostendorp (2004) in assuming that constraints like (5) which define correspondence between a string and a syllable are only satisfied if some element of the string which realizes the morpheme is associated with the head (nucleus) of a syllable.

There is considerable evidence for the MORPHEME-SYLLABLE CORRELATION. First, it mirrors the traditional definition of a Word as the minimal independently pronounceable meaningful unit of language (e.g. Bloomfield 1984). From this definition, it follows that, morphologically, a Word must minimally contain a Root (a single free content morpheme) and, phonologically, a syllable (Anderson and Ewen 1987, Harris 1994, Itô 1986). This traditional definition finds confirmation in the cross-linguistic studies by Garrett (1999), Gordon (1999), Hayes (1995), and Kager (1992) discussed in section 2.3.2, above. Recall from this discussion that we find no consistent correlation between foot size and word size, though the PBT predicts one. Instead, the most common minimal word size is a single syllable. (Over 300 of the 396 languages in Gordon's (1999) survey have monosyllabic CV or CVC as the minimal word size.) Studies of particular languages or language families show that canonical lexical morpheme size is often a single syllable. Examples are provided by: Chinese (Feng 2002; Feng 2004; Yip 1992, 1994), Bantu languages (Downing, 2005*b*), Lushootseed (Urbanczyk 1996), Nuuchahnulth (Kim 2003, Stonham 2004), Fijian (Dixon 1988), and ASL (Wilbur 1990). Further, Peters and Menn (1993)

processes like haplology that delete syllable-sized morphemes if they are identical to an adjacent string. These kinds of exceptions find a straightforward account in OT. The interaction of MORPH-SYLL (5) with other constraints determines how well the constraint is satisfied in any particular morphological construction.

and Russell (1997) suggest that children use a syllable-based strategy in acquiring the morphological structure of their language, as grammatical morphemes are easier to learn if they correspond to a syllable. This would follow if a child's first morpheme-identification and production strategy is to assume there is a morpheme-syllable correlation.

I propose that any tendency for (prosodic) morphemes to satisfy a binary minimality requirement falls out from Dresher and van der Hulst's (1998) proposal that there is a correlation between morphological complexity and phonological complexity. Lexical heads (Roots) meet minimality requirements, not because they contain a stress Foot, but rather because heads require branching phonological structure.[5] As Dresher and van der Hulst argue, a branching requirement on heads is one way of enforcing a Head-Dependent complexity asymmetry which is characteristic of linguistic systems cross-linguistically (Anderson and Ewen 1987).

Theoretical precedent for the proposal that phonological complexity correlates with head status is found in work on positional markedness by e.g. Beckman (1997, 1998), Harris (1990, 1994, 1997, 2004), Steriade (1994), and Barnes (2002). Beckman (1997, 1998) proposes that the ROOT ≫ AFFIX FAITHFULNESS ranking hierarchy discussed in the preceding chapters is one instantiation of a theory of positional markedness, which shares with Dresher and van der Hulst's (1998) Head-Dependent Asymmetry (HDA) theory the goal of providing a general account of the correlation between prominent positions (or heads) and marked (or complex) structure. Positional markedness theory and HDA theory agree that the repertoire

[5] In dependency phonology (Anderson and Ewen 1987; Dresher and van der Hulst 1998), the Root is the morphological and semantic Head of a word, as the Root is a lexical morpheme, the obligatory core constituent of word formation. (See Stonham (2004: 33) for a useful overview of the definition of Root.) Confusingly, syntactic theories of morphology (see e.g. Lieber (1992) for an overview) commonly define Affixes as Heads. The motivation for this is that derivational Affixes can determine the lexical category of the word, which is what is relevant for the syntax. Phonologically, however, Roots, not Affixes, are uncontroversially Heads, as Roots, not Affixes, are typically the locus for distinctive phonological information. See Beckman (1997, 1998) and other references in this section for more detailed discussion.

of prominent positions (heads) includes both morphological entities, like Root or Root-initial position, and phonological ones, like stressed syllable. Where the two differ is that positional markedness theory follows other work (e.g. Harris 1990, 1994, 1997, 2004; Steriade 1994; Barnes 2002) in proposing that prominent positions passively license marked structure, by penalizing marked structure in non-prominent (non-head) positions. In contrast, HDA theory proposes that languages can actively require marked structure in prominent (head) positions, by penalizing unmarked structure in those positions. As Dresher and van der Hulst (1998) observe, it is familiar from work on stress systems that languages like Norwegian (Kristoffersen 2000) and Choctaw (Nicklas 1974, Lombardi and McCarthy 1991) can require every stressed syllable to be heavy. HDA theory extends this 'obligatory branching principle' (Hayes 1980)—or Stress-to-Weight Principle (SWP) in OT (Kager 1999: 172)—from stressed syllables to morphologically prominent entities like Root. It is an advantage of the alternative approach to minimality argued for here that it explicitly formalizes this parallel between the asymmetrical complexity requirements of phonologically and morphologically prominent entities.

The branching principle motivating binary minimality is formalized by the markedness constraint in (6); branching is defined in (7):

(6) HEADS BRANCH (adapted Dresher and van der Hulst 1998)
Lexical heads (Roots) must prosodically branch.

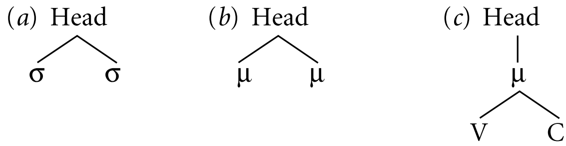
(7) PROSODIC BRANCHING (adapted Ussishkin 2000: 43)
A constituent branches *iff* it or its daughter contains more than one daughter.

The representations in (8) all satisfy HEADSBRANCH.[6] The heads in (8*a*) and (8*b*) contain two syllables or moras as daughters; the head in (8*c*) dominates a mora with two daughters:

[6] See Dresher and van der Hulst (1998: 320) for discussion of how representations nearly identical to those in (8) satisfy complexity, one of the properties that they show asymmetrically characterize Heads.

Ussishkin (2000) also redefines minimality in terms of branching, and the theory developed here adopts his definition of PROSODIC BRANCHING. Unfortunately, Ussishkin (2000) does not give any clear motivation for why certain prosodic morphemes

(8)



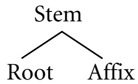
Roots, as monomorphemic heads, are predicted to be monosyllabic by Morph-Syll (5) and to optimally satisfy branching by matching (8*b*) or (8*c*). Affixes, as monomorphemic non-heads, are also predicted to be monosyllabic by Morph-Syll (5), but are not required to branch. Lushootseed (discussed in Chapters 1 and 2) provides an example of a language where Roots are canonically CVC (and satisfy branching by matching (8*c*)), while Prefixes typically are non-branching CV. And Golston (1991) shows that in English and Ancient Greek, Roots are minimally bimoraic while (lexical) Affixes are minimally monomoraic. The case studies presented in the rest of this chapter discuss more examples like this in detail. (We shall discuss in Chapter 4 examples of languages where the phonotactics of the language optimize Roots which are larger or smaller than a branching monosyllable.)

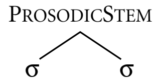
This morphologically based approach to minimality straightforwardly accounts for the problem raised in section 2.3, above, of why derived words are often required to be minimally disyllabic in languages where underived words can be monosyllabic. The disyllabicity condition clearly falls out from the Morpheme-Syllable Correlation (5). Derived words and other morphologically complex structures are, by definition, minimally bimorphemic. The representation in (9*a*) illustrates the morphologically complex structure of Stems. (Recall, Stems are defined here as a constituent minimally consisting of a Root plus an Affix.) By the Morpheme-Syllable Correlation (5), Stems must therefore minimally contain two syllables, one for each morpheme. The constraint in (9*b*), a corollary of Morph-Syll (5), formalizes this disyllabic minimality

should branch. An advantage of Dresher and van der Hulst's approach is that it links the branching requirement on Heads to a larger research programme on Head-Dependent Asymmetries.

requirement on Prosodic Stem, the morpho-prosodic constituent which corresponds to the morphological Stem in the replacement prosodic hierarchy in (3):

(9) Prosodic Stem Minimality

(*a*) 

(*b*) 

Compounds, which are minimally bimorphemic, by definition, also are required to be minimally disyllabic. This requirement would be formalized by a Compound constraint analogous to ProsodicStem (9*b*).

Theoretical precedents for the disyllabic Stem requirement in (9*b*) are found in Itô (1990), Itô and Mester (1992), and Ussishkin (2000, 2005). In their analyses, disyllabic minimality is accounted for by constraints like WordBinarity (Itô and Mester 1992, fig. (32)) or ProsodicWordBranch (Ussishkin 2000: 109) which simply stipulate that derived words must be prosodically binary branching (i.e. disyllabic).[7] The approach argued for here improves on these accounts by proposing that the disyllabic minimality condition on derived constructions follows from a general principle, namely, the Morpheme-Syllable Correlation (5).

A further conceptual advantage of appealing to the branching constraints in (6) and (9*b*) to account for binary minimality constraints on Root and Stem is that this allows minimality to be defined for the sublexical constituents in the Prosodic Hierarchy in (3*a*) in the same way as for the superlexical constituent, Phonological Phrase.[8] As Inkelas (1989) shows, a branchingness requirement

[7] Ussishkin (2000, 2005) actually argues that it is the constraint ranking Faith-IO $\gg$ ProsodicWordBranch which optimizes the disyllabic requirement for derived words. This analysis works well for languages like Modern Hebrew, where the input provides the segmental source for both syllables. It does not work for languages like Swati or KiNande, discussed in section 3.2.1.4, where epenthesis—a process which, by definition, violates Faith-IO—provides a second syllable to satisfy the disyllabicity requirement on Stems.

[8] As Intonational Phrase and Utterance are not as well studied as Phonological Phrase, their prosodic properties, including potential minimality requirements, are not well enough documented to make generalizations.

holds for Phonological Phrases in languages like Serbo-Croatian, Chinese, and Kinyambo. The PBT, which links minimal binarity to Foot form rather than branching, cannot straightforwardly be extended to motivate binarity requirements holding for constituents above the level of the Prosodic Word.

The branching constraints in (6), (7), and (9) require optimal (unmarked) lexical constituents to be minimally binary branching, but they do not suffice to define the binary maximality requirement that we have seen is typical of reduced prosodic morphemes like reduplicants and truncations. In PBT the binary maximality constraint falls out from the Prosodic Word-stress Foot correlation: stress Feet are minimally and maximally bimoraic or disyllabic by BINARITY (Chapter 2, fig. (2*b*)). As discussed in section 1.2.1, a more general motivation for binary maximality comes from the Locality Principle, which limits all phonological processes to a binary window: 'a specified element and [. . .] a structurally adjacent element and no other' (McCarthy and Prince 1986: 1). Following work like Harris (1994), Halle and Vergnaud (1987), and Ussishkin (2000: 53), I propose that the relevant adjacent elements for defining binarity are a constituent daughter and a constituent edge:

(10) BINARITY:[9]
Each daughter of a constituent must be adjacent to some edge of the constituent.

The representation in (11*a*) shows that binary constituents—Root in this example—satisfy this constraint, as each daughter—mora in this example—is edge adjacent. Non-binary constituents necessarily contain non-edge adjacent daughters (bolded in (11*b*)), in violation of (10):

(11) (*a*) Binary constituent $[\mu \quad \mu]_{Root}$ (*b*) Non-binary constituent $[\mu \quad \boldsymbol{\mu} \quad \boldsymbol{\mu} \quad \mu]_{Root}$

As in PBT, I assume that the markedness constraint in (10) is outranked by FAITHFULNESS constraints in the regular vocabulary, as it

[9] See Ussishkin (2000: 53) for an alternative OT formalization in terms of Alignment.

appears to be uncommon for languages to require all words to contain exactly two moras or two syllables. The unmarked status of binary constituents emerges only in certain morphological constructions. As we shall see in the case studies in the next section, the TETU constraint ranking (Chapter 2, fig. (7)) that optimizes maximally binary canonical shape in PBT plays the same role in MBT.

Let me sum up this section by comparing the MBT approach with PBT. The core concept driving both approaches is that the minimality and maximality requirements characterizing canonical morpheme shape should fall out from general prosodic principles. To implement this concept, one needs, first, to establish a correlation between a morphological constituent and some prosodic constituent. In PBT, the basic correlation is between Stem (not explicitly defined in this theory) and stress Foot, via Prosodic Word. The binary minimality and maximality constraint defining stress Foot is automatically 'inherited' by any prosodic morpheme parsed as Prosodic Word. While this theory is very elegant, it faces the important problem that stress Foot is not a universally relevant prosodic constituent: many languages do not provide evidence for obligatory binary stress footing. For this reason, PBT cannot provide a general account of canonical shape. In MBT, the basic morphology-prosody correlation is between a single morpheme and a single syllable, both uncontroversially universal constituents. Binary minimality follows from a general branching requirement holding for phonological heads, like stressed syllables, and morphological heads, like Root. Monomorphemic Roots are expected to be branching monosyllables, while monomorphemic Affixes (non-Heads) are expected to be non-branching monosyllables. It follows from this that Stems, defined as minimally bimorphemic Root-Affix complexes in MBT, are expected to branch minimally into two syllables. Binary maximality constraints on morphological constructions follow from the general phonological principle of Locality and the TETU constraint ranking. MBT has, then, the important conceptual advantage of appealing to universally relevant constituents and general prosodic principles to account for canonical shape, avoiding PBT's reliance on the more parochial stress Foot.

3.1.2. *The advantages of the MBT*

In section 2.3, above, we saw that the Prosodic Word-stress Foot correlation which is the central claim of PBT leads to a number of empirical problems in accounting for canonical morpheme shape. In this section, we shall see how MBT straightforwardly solves most of these problems.

The central claim of PBT is that minimal Prosodic Word size will be identical to the minimal stress Foot of the language. However, as shown in section 2.3.2, there are numerous exceptions to this prediction. First, languages with unbounded stress, like Bengali, or no stress, like Hausa—and so no motivation for binary footing—have binary minimal word constraints. In MBT, in contrast, minimality is divorced from the stress Foot. As a result, it is unproblematic to account for these cases. Words, by definition, dominate Heads (Roots or Stems) and must branch to satisfy (6) or (9*b*). MBT further correctly accounts for Gordon's (1999) finding that minimal words are most commonly monosyllabic, and that CVC monosyllables are a common minimal word type, even in languages where CVC is monomoraic. Monomorphemic words are expected to be minimally monosyllabic, and monomoraic CVC monosyllables satisfy branching by matching (8*c*). It is a problem for MBT, as for PBT, that non-branching CV is the most common minimal word size. Note, however, that CV is the least marked type of monosyllable. We shall see in Chapter 4 how the interaction of syllable markedness constraints with MorphSyll (5) and HeadsBranch (6) optimize a CV minimal word. In contrast, there is no account for the prevalence of CV minimal words in PBT, as few of the languages discussed above which have CV minimal words provide the required evidence from their stress systems for monomoraic minimal stress Feet.

PBT predicts that all Stems should be subject to the same minimality conditions, as the parse of Stem into Prosodic Word is not sensitive to the internal make-up of the Stem. However, as work like Itô (1990), Itô and Mester (1992), and Ussishkin (2000) observes, it is common for (derived) Stems to be subject to a disyllabic minimality constraint, while underived words can be monosyllabic. Several examples of this are provided in sections 2.3.1 and 2.3.2, above. MBT, in contrast, predicts a distinction in the minimality requirements of derived vs. underived forms. In this theory, underived (monomorphemic) Roots are optimally branching monosyllables, matching the representation in (8*b*) or (8*c*). Derived Stems are minimally bimorphemic. As a result, they are minimally disyllabic (see (9*b*)), to satisfy MORPH-SYLL (5) which requires each morpheme to contain one syllable.

Truncations, a special kind of derived word, pose a similar problem for PBT. They are predicted to be subject to the same minimality requirements as other words, yet they are sometimes minimally larger and sometimes minimally smaller than other words. In MBT, truncations, like other derived words, are predicted to be minimally disyllabic, independent of the minimality constraints holding for underived words. This prediction is borne out by German truncations, discussed in section 2.3.4, which contain two overt morphemes, a Base and a diminutive suffix. Other morphological and phonological motivations for truncations that are optimally of a different size than non-derived minimal words are discussed in more detail later in this chapter and the next.

PBT crucially claims that all Stems are Prosodic Words, and that only Prosodic Word defines the domain for stress footing. However, in sections 2.3.5 and 2.3.6, above, we saw several examples of languages where Stems are not Prosodic Words and are not parsed into Feet, or where the stress domain is Root or Stem, not Prosodic Word. PBT has no account for the minimality requirements imposed on these prosodic morphemes, since the Prosodic Word-stress Foot correlation which is central to that theory cannot be established. In MBT, binary minimality is divorced from stress footing and holds for all head morphemes, not just Prosodic Word. As a result, it can straightforwardly account for cases of binary Root or Stem minimality conditions through the constraints HEADSBRANCH (6) and PROSODICSTEM (9*b*).

In sum, because MBT does not account for binarity by appealing to the Prosodic Word-stress Foot correlation, it automatically avoids most of the incorrect predictions made by PBT. Further, since MBT does correlate morphological complexity with prosodic minimality, it automatically accounts for the fact that derived words, including truncations, are subject to different minimality constraints than underived words. These points are developed in detail in the case studies which take up the remainder of this chapter.

3.2. Exemplifying MBT: Case studies

3.2.1. *Stems in prosodic morphology*

In MBT, Stems are defined as canonically bimorphemic, Root-Affix complexes. Therefore they are minimally disyllabic by the PROSODICSTEM constraint (9*b*). Two types of Stems play a role in prosodic morphology. Derived words—including truncations—are, by definition, Root-Affix complexes. And in many languages certain lexical categories obligatorily (or canonically) consist, minimally, of a Root-Affix complex. The theory predicts that canonical morphemes analysable as Stems based on one of these two criteria are subject to disyllabic minimality (and maximality) constraints. The next sections present case studies exemplifying the Stem-disyllabicity correlation.

3.2.1.1. *Stems in root-and-pattern morphology* In section 2.3.1, above, we saw that an important problem for the PBT is that it can provide no motivation for the disyllabicity requirement on verb stems in Arabic, Modern Hebrew, and Sierra Miwok—languages with the non-concatenative root-and-pattern morphology that has been a central concern of phonological theories of prosodic morphology since McCarthy (1979). Some data from each language is repeated below:

(12) (*a*) Classical Arabic (McCarthy 1979: 240)

Measure	*Arabic verb*	*Gloss of stem*
I	katab	'write'
II	kattab	'cause to write'
III	kaatab	'correspond'
IV	ʔaktab	'cause to write'

(*b*) Modern Hebrew (Ussishkin 2000: 103, fig. (5))

Binyan	*Hebrew verb*	*Gloss*
paʕal	gadal	'he grew' (intransitive)
piʕel	gidel	'he raised'
hifʕil	higdil	'he enlarged'

(*c*) Sierra Miwok Verb Stem Forms (Bullock 1990: 19)

Primary	*Second*	*Third*	*Fourth*	*Gloss of stem*
polá:n-	polán:-	pól:an-	pólna-	'fall'
telé:y-	teléy:-	tél:ey-	télye-	'hear'
kóypa-	koyáp:-	kóy:ap-	kóypa-	'suck'

Recall from section 2.3.1 that the problem for the PBT is that the disyllabicity requirement cannot fall out from the minimal stress Foot of any of these languages. However, in MBT their invariant shape follows straightforwardly from the fact that these constructions are Stems as defined in (9): Root-Affix complexes. They, then, exemplify the derived form disyllabicity syndrome identified by Itô (1990), Itô and Mester (1992), and Ussishkin (2000) and formalized in MBT as the ProsodicStem constraint (9*b*).

The non-concatenative root-and-pattern morphology of the Stems in (12) does not obviously fit the branching affixational structure given in (9*a*). It is useful, then, to briefly summarize arguments for why they are derived forms. As work like Aronoff (1994) and McCarthy (1979) make clear, all verbs in Hebrew and Arabic, respectively, must be assigned membership in some binyan (or 'Measure' in Arabic) in order to be eligible for further inflection. That is, the shapes are an obligatory attribute of a verb, an expression of the verb stem's inflectional class, not an optional or accidental property of verb stems. Verb stems, then, must consist of a Root or Base form (however that is defined) plus an abstract inflectional class marker linking a particular verb stem to the constraint grammar (i.e. co-phonology) defining the output properties of the inflectional class.[10] This gives Semitic verb stems the branching morphological structure shown in (13):

[10] It is currently controversial whether all binyanim are derived. Aronoff (1994) and Bat-el (2003) argue that they are. In Bat-el's work, as in this one, this means that the canonical shape for all binyanim are defined through constraint interaction. Ussishkin's

(13) Semitic verb stems

(*a*) Stem

Root/Base [InflClassMarker]

The Sierra Miwok verb stems would have a similar structure. According to Freeland (1951: 11), 'At least four different forms of the stem occur in the conjugation of all simple regular verbs, and derivational modifications may give yet different ones.' That is, the verb stems in (12*c*) are also derived from the non-concatenative realization of a Base plus an abstract marker that determines the conjugational class. Although the output morphological and phonological structure do not directly mirror each other in non-concatenative systems like these, the essence of the Prosodic-Stem proposal in (9*b*) is respected, as output prosodic branching is motivated by the abstract input morphological branching shown in (13).

The tableau in (14) illustrates the analysis of Stem disyllabicity for two Modern Hebrew binyanim. The remaining data in (12) would have a similar analysis. In this tableau, the input stems contain a Base (with an arbitrarily chosen vowel, for concreteness) and the traditional binyan name to indicate the inflectional class marker.

(2000, 2003, 2005) analysis of Modern Hebrew crucially claims that the *paʕal* binyan is basic, and the others are derived from it, as only this binyan allows monosyllabic (CVC) Stems. However, it is straightforward to write a co-phonology that makes it optimal to expand monosyllabic Stems in some binyanim—ones Aronoff (1994) suggests are most productive—but not others, as expanding monosyllabic Stems to make them disyllabic necessarily violates some Faithfulness constraint, like Integrity (a constraint against copying/doubling discussed in Gafos (1998*a*, 1998*b*) and Ussishkin (1999)). It is, moreover, controversial whether there are any monosyllabic Stems (i.e. biliteral Roots) in Arabic, as Gafos (2003) makes clear. One cannot use this for a test to determine a basic vs. derived verb Measure in Arabic, so Ussishkin's (2000, 2003) analysis of Modern Hebrew disyllabicity fails to generalize to the very similar Arabic data. Finally, there is considerable controversy about the status of the consonantal Root in Semitic morphology. See Ussishkin (1999, 2000, 2005) and the papers in Shimron (2003) for discussion and further references. It is beyond the scope of this work to discuss these controversies in detail, as it is uncontroversial, as far as I can tell, that the main templatic constraint that MBT attempts to account for—namely, the disyllabicity requirement—is a robust condition on productive Semitic verb stems.

There is one new constraint in the tableau. REALIZEMORPHEME requires the segmental properties of the binyan—for example, the appropriate vocalism—to be realized in the output, whatever the input values for these properties might be. It must, then, outrank FAITH-IO:

(14) Disyllabic binyanim in Modern Hebrew

/gadal–[PIʕEL]/	PRSTEM	BINARITY	REALIZE MORPHEME	FAITH-IO
☞ *a.* gidel				a, a
b. gadal			*!	
/gidel–[HIFʕIL]/				
☞ *c.* higdil				i, e
d. gidil			*!	e
e. higidil		*!		e

REALIZEMORPHEME (Akinlabi 1996, Walker 2000):
Every input morpheme must have [the appropriate] output realization.

The first candidate in each set is optimal. These outputs are exactly disyllabic, satisfying PROSODICSTEM (9*b*) and BINARITY (10). Candidate (14*b*) is non-optimal in the first candidate set, as it violates REALIZEMORPHEME (15) by not realizing the binyan-appropriate vocalism. Candidate (14*e*) is non-optimal in the second set, as it violates BINARITY (10) by exceeding the disyllabic maximality condition this constraint imposes. Notice that the binyan in the second candidate set specifies a fixed syllable (*hi*-) as well as fixed vocalism, which is also parsed as part of the Stem constituent evaluated by BINARITY. One cannot omit this string from the output without violating REALIZEMORPHEME, as shown by candidate (14*d*). Both candidate sets emphasize that whatever input vocalism one assumes, ranking REALIZEMORPHEME above FAITH-IO correctly optimizes realizing the vocalism specified by the input binyan in the output.

The attentive reader will have noted that not all of the invariant properties of the various conjugations in (12) are accounted for in the MBT analysis in (14). This is because, like all GTT approaches to

Prosodic Morphology, this one has a very restricted definition of 'template': namely, the fixed syllable count of a prosodic morpheme. This contrasts sharply with the unrestricted *CV* theory of templates argued for in work beginning with McCarthy (1979), which could specify such details as whether the first syllable of the stem in the Arabic verb measures in (12*a*) is CV (as in Measure I), CVC (Measure II) or CV: (Measure III). A constraint like ProsodicStem (9*b*) is also too general to express constraints found on the second syllable of the Arabic verb stem: that it must contain a short vowel and end in a consonant (McCarthy 2005, McCarthy and Prince 1994*a*).[11]

These invariant subsyllabic properties are accounted for, in recent work, by other formal strategies. For example, McCarthy (2005) argues that Paradigm Uniformity explains why the second stem syllable optimally contains a short vowel, while the first syllable can contain a long or a short vowel. Due to the phonotactic constraints of Arabic, the second stem syllable must contain a short vowel when followed by a consonant-initial suffix. This requirement is generalized so that all forms of the stem contain a short vowel in the second syllable even in contexts (i.e. when followed by a vowel-initial suffix) where the phonotactics would allow a long vowel to occur. Rose (1997: 135) suggests that the final consonant requirement for Stems is also a Paradigm Uniformity effect: it is phonotactically motivated before vowel-initial stems, to avoid hiatus, and generalized to other contexts so that stems have a uniform output shape.[12]

Other invariant properties, like the medial geminate consonant (Measure II) vs. geminate vowel (Measure III), is accounted for in recent work, like McCarthy and Prince (1986, 1995*b*, 1998) and Ussishkin (2000, 2003), by proposing that a mora is affixed to the Base (along with the Inflectional Class Marker), and alignment constraints determine the output position of the mora. Similarly,

[11] The generalization that the Stem must end in a consonant is, apparently, widespread in Semitic languages. See work like Rose (1997), Bat-el (2003), and Ussishkin (2000) for further discussion.

[12] See McCarthy (2005) for detailed discussion of the role of Paradigm Uniformity in Arabic verb stems. And see Gafos (2003) for discussion of other data in Arabic verb conjugations which is best accounted for by appealing to Paradigm Uniformity.

work like Zoll (1993) and van de Vijver (1998) shows that prosodic affixation and alignment can account for the fixed position of long vowels in the 'iambic' Yawelmani verb templates illustrated in section 2.3.1, above.

It is not our goal here to go in to the details of how invariant subsyllabic structure of Stems is to be accounted for or to evaluate recent proposals. However these details are accounted for, it is important to take note of how the notion of templates in phonological theory has become steadily more restrictive.[13] The complex of properties expressed as a gestalt in a CV template (like CVCVC for a Measure I Arabic verb stem)—number of syllables, type of syllables, distribution of geminate segments—is broken down into a number of independent components in GTT, each accounting for a different aspect of the invariant shape. This development has the general advantage of restrictive theories defined in Chomsky (1965: 35): it narrows the range of potential grammars compatible with a set of data by proposing a set of explicit and universal formal properties to account for the data. In the case of the conjugation classes in (12), MBT allows us to see that the disyllabicity requirement falls out from universal principles optimizing prosodic branching in derived words. It is unclear whether the other invariant properties (those accounted for in recent work by Paradigm Uniformity or affixation) are universal in the same way. CV templates are too unrestricted to identify which of the properties they embody are universal and which are language (or even construction) specific. (See Chapter 1 for other criticisms of CV templates.) And previous theories, including PBT, miss the generalization that the verb stems in (12) share prosodic properties with each other—and with Stems in other languages—because they share the morphological property of being derived constructions.

3.2.1.2. *Stems as derived words* The analysis of the disyllabicity requirement holding for verb stems in root-and-pattern morphology can be straightforwardly extended to account for languages

[13] Though see Gafos (1998*b*, 2003) for recent analyses of the non-concatenative morphology of Arabic and Sierra Miwok which adopt CV templates.

where a disyllabicity minimality condition holds for derived words while underived can be monosyllabic. Several languages with this property are cited in section 2.3.3, above. For example, we saw that nasal fusion—a process which accompanies nasal prefixation in a number of Indonesian languages—is blocked before monosyllabic bases in Javanese. As Uhrbach (1987) shows, the output of nasal affixation (and fusion) must be minimally disyllabic, even though monomorphemic roots can be monosyllabic:

(15) Nasal fusion in Javanese (from Uhrbach 1987: 233, fig. (11))

(*a*) *Polysyllabic bases*

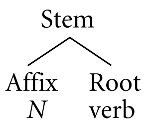
cukur	ɲukur	'shave someone'
bali	mbaleni	'return something'
tulis	nulis	'to write'

(*b*) *Monosyllabic bases*

cet	ŋəcet (*ɲet)	'(to) print'
bom	ŋəbom	'(to) bomb'

The disyllabic minimality condition on Javanese nasal fusion can be accounted for with essentially the same analysis developed for Hebrew binyanim in the preceding section. The constructions in (15) are clearly bimorphemic Stems:

(16) Javanese nasal affixation structure



They are, therefore, subject to the ProsodicStem constraint in (9*b*) which requires them to be minimally disyllabic. The analysis is exemplified in (17):[14]

[14] In OT, one must also consider the possibility that the nasal prefix (or the 'monosyllabic' root) contains a schwa in the input which is deleted in some contexts. The problem with this alternative is that there is no obvious phonological constraint motivating schwa deletion which could counterbalance pressure from Morph-Syll (5) for the syllabic status of the infinitive morpheme to be maintained in the output. As Uhrbach (1987: 232) argues, the schwa cannot be part of the input of what she calls the monosyllabic roots, as the schwa only surfaces after the nasal prefix. There is also no

(17) Disyllabicity in Javanese nasal affixation

/N-tulis/	ProsodicStem	Nasal Fusion	Faith-IO
a. n-tulis		*!	
☞ *b.* nulis			*
/N-bom/			
☞ *c.* ŋəbom		*	*
d. mbom	*!		

In the first candidate set, with a polysyllabic root, the optimal candidate, (17*a*), satisfies NasalFusion as the output does not violate ProsodicStem (9*b*). This candidate set emphasizes that, even though ProsodicStem (9*b*) is a corollary of the Morph-Syll Correlation (5), it must be considered a distinct constraint. Candidate (17*a*) violates Morph-Syll, as the nasal affix does not contain its own syllable. However, this candidate satisfies ProsodicStem, as it contains two syllables, the minimum imposed by this constraint. In the second candidate set, we see that nasal fusion is optimally blocked and a vowel is epenthesized to satisfy the disyllabicity requirement imposed by high-ranked ProsodicStem (9*b*). Although candidate (17*d*) satisfies NasalFusion, the output is non-optimal as it is monosyllabic. A monosyllabic Base root, like /bom/ is optimally monosyllabic in the output, however, as non-derived roots are exempt from the disyllabicity requirement imposed by ProsodicStem (9*b*).

The other cases of derived word disyllabicity discussed in section 2.3.3 can be analysed along the same lines. For example, Féry (1991) argues that German infinitives are subject to a disyllabic minimality condition. This is illustrated by the data in (18*a*), where we see that the syllabic pronunciation of the infinitive suffix /-n/ is required for monosyllabic bases. It is not required with the longer bases in (18*b*). The data in (18*c*) show that the syllabic nasal realization

motivation in Javanese for deleting a schwa before the polysyllabic roots. See Uhrbach (1987) for detailed discussion of nasal fusion and monosyllabic blocking in Javanese. And see Pater (1999) for a more recent analysis of nasal fusion.

of the infinitive is not motivated by general phonotactic requirements of German, as there are numerous underived monosyllabic words with virtually identical phonological structure to the words in (18*a*):

(18) Disyllabic minimum in German infinitives (Ussishkin 2000: 38–9)

	Orthography	*IPA*	*Gloss*
(*a*)	sehen	[ze:.n̩] *[ze:n]	'to see'
	bauen	[bau.n̩]	'to build'
	fliehen	[fli:.n̩]	'to flee'
	wollen	[vɔln̩]	'to want'
(*b*)	fordern	[fɔrdərn]	'to demand'
	segeln	[ze:gəln]	'to sell'
(*c*)	zehn	[tse:n]	'ten'
	Zaun	[tsaun]	'fence'
	Köln	[kœln]	'Cologne'

Inkelas and Orgun (1995) and Orgun (1996) have demonstrated that derived words are subject to a disyllabicity condition for many speakers of Istanbul Turkish, while monomorphemic words are minimally monosyllabic (and, with few exceptions, bimoraic) for all speakers, as shown in (19):

(19) Turkish minimality (Inkelas and Orgun 1995: 769–74)

(*a*) Disyllabicity condition for derived words

*ye-n	'eat-PASSIVE' (='be eaten!')	cf. ye-di	'eat-PAST'
*de-n	'say-PASSIVE' (='be said!')	cf. de-mek	'say-INFINITIVE'

(*b*) Monosyllabic underived words

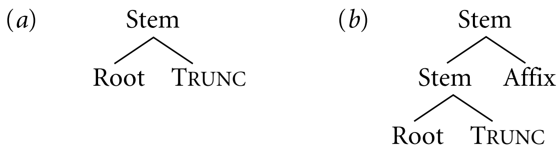
ye	'eat'	de	'say'
at	'horse'	ev	'house'
hap	'pill'	dil	'tongue'

The disyllabic condition on derived words in these languages can also be accounted for by high-ranked PROSODICSTEM (9*b*). In German, this constraint ranks above constraints conditioning a non-syllabic realization of the infinitive. In Turkish, PROSODICSTEM (9*b*) must act as a filter on possible outputs, blocking morphological derivations that result in a monosyllabic form.

To sum up this section, I have shown that MBT easily accounts for the disyllabic minimality condition on derived words which is widely attested cross-linguistically. Indeed, this condition is explicitly formalized in the ProsodicStem constraint (9*b*). PBT cannot account for derived disyllabicity, as all Prosodic Words are subject to the same minimality condition in this approach, namely, they are minimal stress Feet. The internal morphological structure of words plays no role in determining minimality as it plays no role in determining stress Footing. In contrast, MBT correlates prosodic branching with morphological branching. This provides an intrinsic motivation for derived word disyllabicity which the alternatives crucially lack.

3.2.1.3. *Stems derived through truncation* The morphological process of affixation is one source of derived Stems. Another is the process of truncation. In the case of concatenative affixation, both branches of the Stem are filled by segmental material. As we saw in the analysis of non-concatenative root-and-pattern morphology in section 3.2.1.1, in order to maintain our definition of Stems as morphologically branching, we must assume that all processes of morphological derivation lead to an identical structure. The representation for truncation is shown in (20*a*). Languages where truncation is accompanied by a diminutive affix would have the structure in (20*b*):

(20) Stem structure for truncated forms



For both types of truncated forms, MBT predicts that the output of truncation can be required to be a minimally disyllabic ProsodicStem (9*b*), while non-derived words in the same language can be monosyllabic. In contrast, PBT makes a different prediction. In that theory, truncations are a type of Prosodic Word and so should be subject to the same minimality requirements as other words. The list in (21), below, shows that truncations—both affixed (20*b*) and unaffixed (20*a*)—commonly are required to be disyllabic, as MBT predicts, even in languages where underived words are minimally monosyllabic.[15]

(21) Languages with disyllabic truncations

Language	*Affix*	*Minimum word*	*Source*
Japanese	No	monosyllable	Itô (1990)
Swahili	No	disyllable	Batibo and Rottland (1992)
Dutch	No	bimoraic syllable	van de Vijver (1998)
Spanish	No	monosyllable	Piñeros (1998)
Modern Greek	No	monosyllable	Topintzi (2003)
Italian	No	disyllable	Thornton (1996)
German	Yes	bimoraic syllable	Féry (1997)
Hebrew	Yes	monosyllable	Bat-el (2005)
Czech	Yes	monosyllable	Bethin (2003)
Nuuhchahnulth	Yes	disyllable	Stonham (2004)
Polish	Yes	monosyllable	Glowacka (2004)
Hungarian	Yes	monosyllable	van de Weijer (1989)

This section presents analyses of one language of each type: Japanese, for unaffixed truncations, and German, for affixed.

Itô (1990) provides a detailed study of loanword truncations in Japanese. One striking result of the study is that free truncations (that is, ones that can be words) are minimally disyllabic. Examples are given in (22); the portion of the full word omitted in the truncation is in parentheses:

(22) Japanese disyllabic loanword truncations (Itô 1990: 219)

suto(raiki)	'strike'	ope(reeshoN)	'operation'
ado(resu)	'address'	poji(chibu)	'positive'
ama(chua)	'amateur'	hazu(baNdo)	'husband'
nega(chibu)	'negative'	roke(eshoN)	'location'
ita(rikku)	'italic'	piri(odo)	'period'
maiku(rohoN)	'microphone'	(*mai)	
saike(derikku)	'psychedelic'	(*sai)	
saNdo(ichi)	'sandwich'	(*saN)	

As Itô (1990: 218) points out, it is unexpected for truncations to be subject to a disyllabic minimality condition, as many common lexical items in the native Japanese vocabulary are monomoraic:

[15] The source for minimum word size for most of the languages listed here is Hayes (1995), else the source given.

e.g. *su* 'vinegar', *na* 'name', *no* 'field', *te* 'hand'. To account for the minimality condition on free truncations, Itô (1990: 227) proposes there is a disyllabic minimal word requirement, holding only of derived words. While this constraint accounts for data like that in (22), it does not follow from any independent theoretical principle that derived words should be disyllabic.

In MBT, the disyllabicity constraint on Japanese truncations follows from the PROSODICSTEM constraint (9*b*). As in the examples of non-concatenative morphology discussed in section 3.2.1.1, above, the mirroring of morphological and prosodic structure is indirect, since each syllable in the truncation is not a morpheme. The essence of the minimal PROSODICSTEM (9*b*) proposal is respected, however, as input morphological branching is reflected in the output by branching into two syllables.[16]

The disyllabic minimality and maximality conditions on Japanese truncations are accounted for with essentially the same constraints and rankings which define the disyllabicity requirement on Modern Hebrew binyanim, exemplified in the tableau in (14). (As in the previous chapter, while both the base and the truncated form are listed together as output candidates, this does not mean that they must occur in the same output. This convention serves to emphasize that INPUT-OUTPUT FAITHFULNESS evaluates (and is satisfied by) the full form, while INPUT-TRUNCATION FAITHFULNESS evaluates the truncation.)

(23)

/sutoraiki - TRUNC/	PRSTEM	FAITH-IO	BINARITY	MAX-BT
☞ *a.* sutoraiki - suto				**
b. sutoraiki - sutoraiki			**!	
c. sutoraiki - su	*!			***
/su/				
☞ *d.* su				
e. suu		*!		

[16] There are obviously other constraints on the form of Japanese loanword truncations besides the disyllabic minimality constraint. For example, the truncations may not end in a heavy syllable. See Labrune (2002) for a recent OT analysis of problems like these.

Candidate (23*a*) is optimal in the first set, as it satisfies PrStem (9*b*), the constraint optimizing minimally disyllabic derived Stems, as well as Binarity (10), the constraint optimizing maximally binary constituents.[17] The competing candidates are non-optimal, as the truncations in these candidates violate either PrStem (candidate (23*b*)) or Binarity (candidate (23*c*)). The second candidate set has as its input an underived word. The output is optimally identical to the input in this case, as in candidate (23*d*), as this incurs no constraint violations. Augmenting the input, as in candidate (23*e*) gratuitously violates Faith-IO, as no high-ranked constraint motivates augmentation. Minimally disyllabic truncations with the structure in (20*a*) in other languages—like the Swahili disyllabic nicknames presented in section 2.2.2, above—would have an identical analysis.

German truncations are also minimally and maximally disyllabic, as work by Itô and Mester (1997) and Féry (1997) demonstrates. The data in (25) shows that nicknames and other abbreviations in German have the morphological structure in (22*b*). They consist of a truncated form of the base word, plus a diminutive suffix *-i,* also used to form nicknames in other Germanic languages like English and Swedish (Weeda 1992) and in neighbouring languages like Hungarian (van de Weijer 1989):

(24) German nicknames and abbreviations (Itô and Mester 1997: 119, fig. (3); Féry 1997: 6)

Full name or word	*Abbreviated form*	
Gabriele	Gabi	
Waldemar	Waldi	
Dagmar	Daggi	
Gorbatschow	Gorbi	
Alkoholiker	Alki	'alcoholic'
Amerikaner	Ami	'American'
Trabant	Trabi	(type of DDR car)

[17] The analysis of Japanese truncations is simplified here, as some truncations are up to four syllables long, not maximally disyllabic as implied here. We will return to the problem of how to account for non-binary maximality holding for truncations in Japanese and other languages in Chapter 5.

As these truncations are clearly bimorphemic Stems, they are expected to be minimally disyllabic by ProsodicStem (9*b*), just like the German infinitives discussed in the preceding section. The size condition on these truncations would have the same analysis, then, as that given in (23) for the Japanese truncations.

What is not yet explained is why the truncation-medial consonant clusters often undergo simplification. If '*br*' is a possible onset in the Base name, *Gabriele*, for example, it is puzzling that it is disallowed in the corresponding nickname, *Gabi*. Itô and Mester (1997) account for truncation medial consonant simplification by proposing that the derivation of the truncations proceeds in two stages: the base word is shortened to a single possible syllable of German, and this syllable is the base for affixation of the diminutive *-i*: e.g. Gabriele → Gab → Gab-i. *Gabr-i* is an impossible truncation in this analysis, as *Gabr* is an impossible German syllable. As Itô and Mester (1997) note, this analysis is problematic as it is inherently opaque, in the OT sense (McCarthy 1999). As *Gab* is not a syllable in either the input or the output of this Base-truncation pair, a constraint defining a syllable as the Base for diminutive affixation cannot identify *Gab* as the optimal Base string in a traditional OT analysis. (Recall that in OT there are only two levels of representation, input and output, available to the phonology.)

As Harris (1997) and Zerbian (2003) argue, though, there is a straightforward alternative solution to truncation-medial simplification which is not derivationally opaque. The observation on which the alternative rests is that the simplification of medial consonant clusters always results in a simplex coda and onset, and, moreover, the only allowable coda-onset sequences are the least marked: sonorant-obstruent or *s*-obstruent. It is also relevant that the truncations are parsed into a trochaic stress Foot (like other disyllabic words of German). Harris (1997, 2004) shows that it is extremely common, cross-linguistically, for consonants and consonant sequences to be reduced in markedness or complexity in Foot-medial position, as this is a weak position. (Foot-medial weakening represents another instantiation of Head-Dependent Asymmetry.) As shown in (25), ranking the Markedness constraint, *Complex (an abbreviatory constraint referring to the set of constraints defining unmarked Foot-medial sequences in German[18]) above MAX-BT accounts for the emergence of unmarked consonant sequences in the truncations:

(25)

/[Gabriele—TRUNC]- i/	PR STEM	FAITH-IO	*COMPLEX	BINARITY	MAX-BT
☞ *a.* Gabriele — Gab- i					**
b. Gabriele — Gabr- i			*!		**
c. Gabriele — Gabriel- i				**!	*

Candidate (25*a*) is optimal, as it satisfies the constraints defining disyllabic minimality (PRSTEM) and maximality (BINARITY), and it also satisfies *COMPLEX. The competing candidates either violate *COMPLEX by including a complex truncation-medial Onset, as in (25*b*), or violate BINARITY by exceeding the disyllabic maximality restriction on truncations, as in candidate (25*c*).

To sum up this section, the disyllabicity requirement holding for truncations in languages like Japanese and German falls out from the general disyllabicity condition on derived forms which is formalized in PROSODIC STEM (9*b*). Truncations also show some interesting differences from other derived words. Truncations do not always introduce additional segmental material. Rather, it is the addition of the truncation process which derives the branching Stem structure characteristic of derived words. Further, truncations, unlike other derived words, are often maximally, as well as minimally, disyllabic. In this, truncations are like reduplicative morphemes and the verb stems of root-and-pattern morphology illustrated in

[18] See Zerbian (2003) for detailed discussion of the various markedness constraints defining the possible consonant sequences in truncation-medial position.

The truncation-medial simplification found in German is not found in all the languages in (21) with disyllabic nicknames. For example, in Nuuhchahnulth (Stonham 1994, 2004) as many segments of the Base as possible are fitted into the portion of the truncation which precedes the suffix while not exceeding the disyllabic limit. This can be straightforwardly accounted for by ranking *COMPLEX below MAX-BT.

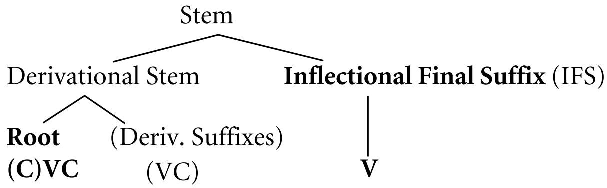
(12). Finally, truncations share another similarity with reduplicative morphemes, in being restricted to contain less marked structure than their Base in some languages. Both types of reduction are accounted for by ranking MARKEDNESS constraints above truncation-specific FAITHFULNESS constraints. (This is the TETU effect.) The canonical shape of truncations is, then, straightforwardly accounted for with minimal modification of the basic analysis of Stem disyllabicity developed for other derived Stems in the preceding section.

3.2.1.4. *Stem as a core lexical constituent* Derived words form one source of necessarily bimorphemic Stems. Another source is found in languages where certain lexical categories obligatorily (or canonically) consist minimally of a Root-Affix complex, or Stem. In these languages, too, MBT predicts that the Stems will be minimally disyllabic, to mirror their branching morphological structure. In contrast, PBT predicts that bimorphemic Stems are minimally disyllabic only if they are parsed into Prosodic Words containing stress Feet. As we saw in section 3.2.1.1, above, non-concatenative verb stem morphology provides one source of evidence favouring the MBT analysis of such constructions. In this section, languages with concatenative verb stem morphology provide another source of evidence in favour of the MBT analysis. In these cases, too, we shall see that MBT can straightforwardly account for Stem disyllabicity, while a PBT analysis cannot.

3.2.1.4.1. *Bantu verbal constructions* Verbal constructions in Bantu languages (a major subgroup of the Benue-Congo family spoken in sub-Saharan Africa, comprising 500+ languages) clearly illustrate the sort of Stem disyllabicity requirement which is problematic for PBT. Bantu verbs consist of two constituents, a Stem and inflectional prefixes (obligatory except in the imperative form of the verb). The Stem itself is also morphologically complex. As shown in (26), Bantu verb Stems consist of a string of canonically monosyllabic morphemes: a Root (canonically CVC-), optional derivational suffixes (extensions; canonically -VC) and an obligatory

Inflectional Suffix (canonically -V). The obligatory morphemes, Root and IFS, are bolded:[19]

(26) Verb Stem Structure (Doke 1954; Meeussen 1967; Mutaka 1994; Myers 1987)



Most Bantu languages have a certain number of monosyllabic Stems, and these are often augmented to two syllables in certain morphological constructions, most frequently in the imperative and reduplicative (Downing 2005*b*).[20] In numerous Bantu languages, the imperative form of the verb consists of the bare verb Stem, if the verb has two or more syllables. Monosyllabic stems must be augmented. We have already seen an example of imperative augmentation in Zezuru Shona, repeated in (27), below. An epenthetic /i-/ obligatorily occurs before the monosyllabic stem in (27*b*):

(27) Shona (Zezuru dialect) imperative stems (Odden 1999: fig. (1))

		Infinitive	*Imperative singular*	*Gloss*
(*a*)	Polysyllabic stems	ku-rima	rima (*i-rima)	'plough'
		ku-vereketa	verékétá	'read'
(*b*)	Monosyllabic stem	ku-pá	i-pá (*pa)	'give'

KiNande (Mutaka and Hyman 1990, Mutaka 1994) provides a further example. In KiNande, monosyllabic stems are preceded by the expletive morpheme *u*-. This morpheme is usually the second person singular subject prefix. However, as Mutaka (1994) argues, if it

[19] Most of the grammars cited in the references make the observation that these canonical morpheme shapes are also typical of those particular languages.

[20] See Downing (2005*b*) for a detailed survey and analysis of minimality effects in Bantu languages.

were being used as a subject prefix here, it would require a different Final Vowel morpheme:

(28) KiNande Imperative augmentation (Mutaka 1994: 128)

		Infinitive	*Imperative*	*Gloss*
(*a*)	Polysyllabic Stems	eri=huma	huma	'hit'
		eri=humirira	humirira	'hit on purpose'
		eri=subala	subala	'pee'
		erí=korogota	korogota	'scratch'
(*b*)	Monosyllabic Stems	eri=swa	u=swa	'grind'
		erí=twa	u=twa	'dig'

The verbal reduplicative morpheme is also commonly required to be disyllabic (and often ends in - *a*, no matter what the corresponding Base vowel is). These points are illustrated from Swati (also discussed above in Chapters 1 and 2) and KiNande. (In both languages reduplication adds the meaning, to do the action here and there or from time to time.) In Swati, when the base stem is shorter than two syllables, as in (29*b*), an epenthetic-*yi*-occurs following the copy of the Base.[21]

(29) Swati verbal reduplication (Downing 1994, 1999*b*, field notes; stem follows '=', and reduplicative morpheme is underlined)

	Multisyllabic stems		
	Verb stem	*Gloss*	*Reduplicated*
(*a*)	ba- yá=li:ma	'they plough'	ba-ya-<u>limá</u>=li:ma
	ba-ya=líme:la	'they plough for'	ba-ya-<u>lime</u>=líme:la
			~ ba-ya-<u>lima</u>=lime:la
	u-ya=tfutsé:la	'you move for	u-ya-<u>tfutse</u>=tfutsé:la
			~ u-ya-<u>tfutsa</u>=tfutsé:la
	Monosyllabic stem		
(*b*)	u-ya-phá	'you give'	u-ya-<u>phayí:</u>=pha

In KiNande, monosyllabic Base Stems are repeated twice to achieve disyllabicity, as shown in (30b):

[21] See Downing (1994, 1997, 1999*c*, 2000) and Hyman et al. (1999) for detailed discussion of the factors conditioning when the *a*-final variant of the reduplicant occurs.

(30) KiNande reduplication (Mutaka 1994, Mutaka and Hyman 1990)

(*a*) *Multisyllabic Stems*

Infinitive	Reduplicated	Gloss of Stem
eri=huma	eri=huma-huma	'hit'
eri=humira	eri=huma-humirira	'hit for'
eri=humirana	eri=huma-humirana	'hit for each other'

(*b*) *Monosyllabic Stems*

eri=swa	eri=swa-swa-swa	'grind'
erí=twa	erí=twa-twa-twa	'dig'

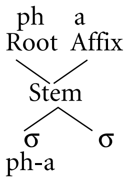
In PBT, the disyllabicity condition on the imperative and reduplicative verb forms would follow from parsing these morphemes into a Prosodic Word, dominating a stress Foot. However, as discussed in section 2.3.2, above, the only form of stress found in many Bantu languages, including KiNande, Shona, and Swati, is the prepausal lengthening of penult vowels. This means, first, that the reduplicative morpheme is never in a position to be footed, as it occurs too early in the word. Further, unbounded phrasal stress (only the phrase penult syllable is significantly stressed) does not provide good evidence for binary footing of the Prosodic Word domain. As a result, the Prosodic Word-stress Foot correlation which is the basis for the Prosodic Hierarchy-based theory of minimality cannot be established.[22] The reduplicative morpheme not only cannot be parsed into a stress Foot, it also cannot be parsed into a distinct Prosodic Word in these languages. As work like Downing (1999*b*, 2001*a*, 2003) shows, the reduplicative morpheme is not a barrier to phonological processes which are Prosodic Word bound. Instead, it systematically patterns as a Stem, a subconstituent of Prosodic Word. (Some of these arguments are mentioned in the discussion of Swati reduplication in section 2.3.4, above.) Since PBT enforces minimality requirements only on Prosodic Words, it has no account for these data.

[22] See Mutaka and Hyman (1990), Mutaka (1994), and Downing (1999*b*, 2000) for further discussion of phonological domains and minimality in KiNande verbal morphology.

Finally, PBT does not explain why, in languages like KiNande, minimality is satisfied by an expletive verbal morpheme in the imperative, rather than by a phonologically unmarked syllable. In the reduplicative, too, the second syllable is filled by an expletive second copy of the Base Stem rather than by a phonologically unmarked syllable. Since the motivation for disyllabicity is purely prosodic in this approach, it is surprising that expletive morphemes, rather than phonologically unmarked material, should provide a means of augmenting subminimal forms.

In MBT, in contrast, the analysis of the disyllabic minimality constraint on imperative and reduplicative verb stems in Bantu languages is entirely straightforward. As the verb stem is minimally bimorphemic (see (26)), it is expected to be minimally disyllabic to satisfy ProsodicStem (9*b*), just like the other bimorphemic constructions discussed so far in this section. Monosyllabic stems are ill formed, as they constitute a mismatch between morphological and prosodic branching. Even though they are morphologically branching—they contain two morphemes, Root and IFS—they do not branch into two syllables, one per morpheme:

(31)



Augmentation to a disyllabic minimum repairs this mismatch, satisfying ProsodicStem (9*b*). Because the disyllabic branching constraint mirrors the morphological branching of the Stem, it is not surprising that languages like KiNande satisfy ProsodicStem (9*b*) by inserting an expletive morpheme, as this maintains the canonical Morpheme-Syllable Correlation (5) which is characteristic of Bantu languages.

The analysis of the KiNande imperative is exemplified in (32). Notice that this tableau is essentially identical to the analysis of Javanese nasal fusion in (17), above.

(32)

/hum-a/	ProsodicStem	Faith-IO
☞ *a.* huma		
b. u=huma		*!
/sw-a/		
☞ *c.* u=swa		*
d. swa	*!	

Ranking ProsodicStem (9*b*) above Faith-IO optimizes augmenting monosyllabic inputs which are morphologically categorized as Stems and penalizes augmenting Stems which are disyllabic in the input. For this reason, candidate (32*a*) is optimal in the first set, as it incurs no constraint violations. However, the subminimal input in the second candidate set must be augmented to satisfy high-ranking PrStem. Monosyllabic candidate (32*d*), which matches the input, is non-optimal as it violates ProsodicStem.[23]

The disyllabic fixed size of the reduplicative morpheme in KiNande (and many other Bantu languages) receives a similar analysis. The verbal reduplicative morpheme is also a Stem, so that reduplication represents a form of Stem-Stem compounding in Bantu languages. (See Downing (2000, 2003), Hyman et al. (1999), and Inkelas and Zoll (2005) for detailed arguments supporting a Stem analysis of the reduplicative morpheme.) It then must be disyllabic, to satisfy ProsodicStem (9*b*). As we can see from (30*b*), not all Stems of KiNande are augmented to satisfy the disyllabicity requirement. The Base Stem for reduplication, for example, remains monosyllabic. This shows that the minimality requirement is construction specific. We can account for this by proposing that PrStem outranks Faith-IO in the Imperative

[23] The analyses in (32) and (33) are obviously incomplete, as they do not account for the choice of epenthetic material in the augmented monosyllabic Stems in (32*c*) and (33*c*). See Downing (2000, 2005*b*) for detailed discussion of the factors that motivate different strategies for augmenting subminimal Stems in Bantu languages.

co-phonology.[24] In the reduplicative construction, the opposite ranking holds. As we saw in discussing truncations (see tableau (23), above), disyllabic maximality is optimized by ranking BINARITY (10) above some FAITHFULNESS constraint—in this case, MAX-BR. (Other constraints, not given here for ease of comparison with the other analyses in this section, optimize the segmental realization of the reduplicative morpheme.)

(33)

/RED_{Stem}=humir-a/	FAITH-IO	PRSTEM	BINARITY	MAX-BR
☞ *a.* huma=humira			*	**
b. humira=humira			**!	
/sw-a/				
☞ *c.* swa-swa=swa		*		
d. swa=swa		**!		
e. swa-swa=swa-swa	*!**			

Candidate (33*a*) is optimal in the first set, as the reduplicative morpheme is exactly disyllabic. As a result, it better satisfies BINARITY (10) than the competing, total reduplication candidate (33*b*). In the second set, candidate (33*c*) is optimal, as the reduplicative Stem is exactly disyllabic. The competing candidate (33*d*) is non-optimal because it violates PROSODICSTEM (9*b*) twice: both the reduplicative Stem and Base Stem are monosyllabic. Candidate (33*e*) is non-optimal, as expanding the Base Stem to satisfy PRSTEM violates higher-ranked FAITH-IO.

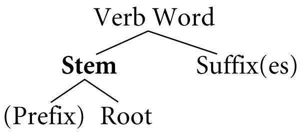
To sum up this section, a disyllabic minimality requirement is commonly imposed in Bantu languages in constructions based on verb Stems. PBT cannot account for this minimality condition on Stems, as the Stem-Prosodic Word-stress Foot correlation necessary to motivate minimality cannot be established. In contrast, MBT

[24] See the Ilokano analysis in section 1.2.2, above, for an introduction to the concept of co-phonology. The use of co-phonologies in prosodic morphology is discussed further in section 5.1.2, below. See Inkelas and Zoll (2005) for a detailed introduction to the role of co-phonologies in reduplicative morphology.

straightforwardly predicts that Stems should be disyllabic as they are morphologically complex, containing two canonically monosyllabic morphemes, Root and Inflectional Final Suffix (see (26)). Monosyllabic stems sound as if they contain a single morpheme: it is in this sense that they are ill formed. Augmenting them to two syllables results in prosodic branching, mirroring the canonical morphological branching that characterizes Bantu verb Stems.

3.2.1.4.2. *Axininca Campa reduplication*[25] Axininca Campa is an Arawakan language spoken in Peru. Verbs in Axininca Campa, as in Bantu languages, have the morphologically complex structure in (34):

(34) Verb structure of Axininca Campa (Payne 1981, Wise 1986)



All verbs consist minimally of a Stem plus Tense-Aspect suffix(es). As in Bantu languages, the Stem ((Prefix)—Root complex) is the Base for reduplication (and inflectional affixation), and forms a distinct phonological domain from the rest of the word (Payne 1981, McCarthy and Prince 1993). Unlike Bantu languages, the Stem is not obligatorily bimorphemic, as the prefixes do not occur in the infinitive. Both the Base Stem and the reduplicative morpheme are subject to minimality requirements in Axininca Campa. A careful review of McCarthy and Prince's (1993, 1995*a*) analysis of these minimality effects shows, however, that their account contradicts the central claims and predictions of the PBT approach to minimality. In contrast, MBT provides a straightforward account of the data.

As shown in (35), total Stem reduplication is productive for verbs. Note, though, that the Prefix is not reduplicated if the Root has two

[25] The sources for the Axininca Campa data are: Payne (1981), Spring (1990, 1991), and McCarthy and Prince (1993, 1995*a*). McCarthy and Prince's presentation of the data is cited here for ease of comparison with their work.

or more syllables. (The reduplicative morpheme is underlined in these data sets):[26]

(35) C-initial Stems of two or more syllables (McCarthy and Prince 1993: 63, fig. (1), 64, fig. (4); Spring 1990: 106)

(*a*)	WITHOUT PREFIX		(*b*)	WITH PREFIX
	kawosi]-kawosi-wai-*t*-aki	'bathe'		*noŋ*-kawosi]-kawosi-wai-*t*-aki
	thaaŋki]-thaaŋki-wai-*t*-aki	'hurry'		*non*-thaaŋki]-thaaŋki-wai-*t*-aki
	kintha]-kintha-wai-*t*-aki	'tell'		*noŋ*-kintha]-kintha-wai-*t*-aki

The role of minimality in Axininca Campa reduplication is illustrated by the monosyllabic and vowel-initial Roots in (36) and (37). As shown in (36), monosyllabic C-initial Bases are augmented either by epenthesis (36*a*) or by including the Prefix in Base (36*b*). A further point illustrated by the prefixed forms is that the Base and reduplicative morpheme are both disyllabic if the Base is a bimorphemic Prefix-Root complex. Bimoraic Bases (and reduplicative morphemes) are not augmented to disyllabicity, though, showing that this is an alternative minimality target:

(36) C-initial monosyllabic Stems (McCarthy and Prince 1993: 63, 64)

(*a*)	WITHOUT PREFIX		(*b*)	WITH PREFIX	
	p*aa*]-paa-wai-*t*-aki	'feed'		*no*-wa]-nowa-wai-*t*-aki	/p-/
	naa]-naa-wai-*t*-aki	'chew'		*no*-naa]-no-naa-wai-*t*-aki	/naa-/
				**no*-naa]-naa-wai-*t*-aki	
	na*ta*]-nata-wai-*t*-aki	'carry'		*no*-na]-no-na-wai-*t*-aki	/na-/
	t^{h}o*ta*]-t^{h}ota-wai-*t*-aki	'kiss, suck'		*non*-t^{h}o]-nont^{h}o-wai-*t*-aki	/t^{h}o-/

The vowel-initial roots in (37) confirm the role of a disyllabic minimality condition on the reduplicative morpheme. The data in

[26] In the data and tableaux in this section, ']' marks the right Stem edge; the reduplicative morpheme (RED) is underlined; prefixes are italicized; epenthesized material is also italicized.

(37*a*, *b*) show that the initial vowel of longer roots does not appear in the reduplicative morpheme, arguably to avoid hiatus between the Base and the reduplicative morpheme. However, the initial vowel of disyllabic Roots (37*c*, *d*) does appear in the reduplicative morpheme, even if the remainder would be bimoraic (compare the first two forms in (36*a*) with (37*c*)). The motivation for including the initial vowel must be to satisfy disyllabic minimality:

(37) V-initial Roots (McCarthy and Prince 1993: 63, 64)

Roots of 3 or more syllables

(*a*)	Without prefix		(*b*)	With Prefix
	osaŋkina]-saŋkina-wai-*t*-aki	'write'		*n*-osaŋkina]-saŋkina-wai-*t*-aki
	osampi]-sampi-wai-*t*-aki	'ask'		*n*-osampi]-sampi-wai-*t*-aki
	aacik*a*]-cika-wai-*t*-aki	'stop'		*n*-aacik*a*]-cika-wai-*t*-aki

Disyllabic Roots ('||' *indicates Prosodic Word break)*

(*c*)	Without prefix		(*d*)	With prefix
	api || apii-wai-*t*-aki	'repeat'		*n*-apii]-n-apii-wai-*t*-aki
	*api || pii-wai-*t*-aki			
	asi || asi-wai-*t*-aki	'cover'		*n*-asi]-n-asi-wai-*t*-aki
	ooka || ooka-wai-*t*-aki	'abandon'		*n*-ooka]-n-ooka-wai-*t*-aki

McCarthy and Prince (1993, 1995*a*) develop a detailed analysis of these reduplication patterns. The data in (36) show that bimoraic Roots satisfy a minimality condition on the Base. This is accounted for by the constraint in (38) defining the Base for suffixation (including reduplication) as a Prosodic Word. As the minimal stress Foot in Axininca Campa is minimally bimoraic, Prosodic Words must also be minimally bimoraic (McCarthy and Prince 1995*a*). The constraint in (38), then, is consistent with the Prosodic Hierarchy-based approach in accounting for the minimality conditions on the Base by parsing it as a Prosodic Word. The constraint in (39) accounts for why CV Bases are augmented to two syllables rather than only two moras: augmenting to two moras by lengthening the input vowel would misalign the input stem with a syllable.

(38) Align-Sfx: Align(L, Suffix; R, Prosodic Word)
The left edge of every suffix coincides with the right edge of some Prosodic Word. (McCarthy and Prince 1995*a*: 300)

(39) Align-R: Align(Stem, Right, σ, Right)
The right edge of every [lexical] stem coincides with the right edge of some syllable. (McCarthy and Prince 1995*a*: 306)

These points are illustrated by the tableau in (40):

(40)

/ t^ho-RED - /	Align Sfx	Align-R	Rt-Anchor -BR	Dep-IO	Max-BR
a. ☞ t^ho*ta*]-<u>t^hota</u>]-				**	
b. t^ho]-<u>t^ho</u>]-	*!				
c. t^ho*ta*]-<u>t^ho</u>]-			*!	**	**
d. t^ho*o*]-<u>t^hoo</u>]-		*!		*	

Candidate (40*a*) is optimal, as it only violates constraints against epenthesis into the Base. Not epenthesizing, as in candidate (40*b*), is non-optimal because this violates Align-Sfx (38): the Base is not a bimoraic Prosodic Word. Rt-Anchor-BR requires material at the right edges of the Base and the reduplicative morpheme to match. It is violated when epenthetic material in Base does not appear in RED, as candidate (40*c*) illustrates. Candidate (40*d*) is non-optimal, as lengthening the Base vowel misaligns the input stem */to-/* with the output syllable, in violation of Align-R (39).

As we saw in (36) and (37), there is a disyllabic minimality condition on the reduplicative morpheme. As Prosodic Words are only required to be minimally bimoraic, a distinct minimality constraint is required to account for this, namely, the reduplication-specific templatic constraint Disyll:

(41) Disyll (McCarthy and Prince 1993: 87, fig. (49)):
The left and right edges of the Reduplicant [RED] must coincide, respectively, with the left and right edges of *different* syllables.

The constraint ranking, Dep-BR/Dep-IO $\gg$ Disyll $\gg$ RED $\leq$ Root, optimizes copying the prefix to satisfy disyllabic minimality. (The constraint, RED $\leq$ Root, accounts for the fact that prefixes are only copied in order to satisfy disyllabic minimality.) The tableau in (42) exemplifies the analysis with a prefixed form of the verb in (36):

(42)

/*non*-t^{h}o-RED - /	ALIGN SFX	RT-ANCHOR -BR	DEP-IO	DISYLL	RED≤ ROOT	MAX-BR
a.☞ *non*-t^{h}o]- nont^{h}o]-					*	
b. non-t^{h}o]-t^{h}o*ta*]-		*!				***
c. non-t^{h}o]-t^{h}o]-				*!		***

Notice that the winning candidate, (42*a*), violates only RED≤ROOT by copying prefixal material. Other candidates violate higher-ranked constraints. The reduplicative morpheme in candidate (42*b*) satisfies DISYLL by epenthesizing material not found in the Base, in violation of RT–ANCHOR–BR. The reduplicative morpheme in candidate (42*c*) violates DISYLL.

Tableau (43) shows why it is optimal not to augment bimoraic Bases:

(43)

/naa-RED-/	ALIGN SFX	RT-ANCHOR-BR	DEP-IO	DISYLL	RED≤ ROOT	MAX-BR
a. ☞naa]-naa]-				*		
b. naa]-naa*ta*]-		*!				
c. naa*ta*]-naata]-			*!*			
/*no*-naa-RED-/						
d. ☞*no*-naa]-no-naa]-					*	
e. no-naa]-naa]-				*!		**

Candidate (43*a*) is optimal, even though it violates DISYLL, as competing candidates violate higher-ranked constraints. Because bimoraic Bases satisfy ALIGN-SFX (38), augmentation of a bimoraic Base incurs gratuitous DEP violations. This is why candidate (43*c*) is non-optimal. Augmenting only the reduplicative morpheme to a disyllable leads to a violation of RT-ANCH-BR, as shown by non-optimal candidate (43*b*). The prefixed forms in the second candidate set in (43) show the independent roles of AlignSfx (38) and Disyll (41) in choosing the optimal candidate. In non-optimal (43*e*), the Base satisfies minimality (AlignSfx), but the reduplicative morpheme violates the reduplicative minimality constraint (Disyll).

While the analysis works well so far, it is obvious that Disyll (41) violates the principles of PBT. All minimality constraints should fall out from parsing the relevant morpheme as Prosodic Word. Construction-specific size constraints like Disyll (41) are never to be resorted to. The vowel-initial forms emphasize why the reduplicative morpheme cannot be parsed as a Prosodic Word to account for disyllabic minimality. If the reduplicative morpheme were a Prosodic Word, it would be optimal to copy the initial vowel. (Prosodic-Word initial position is the one place where onsetless syllables are tolerated in Axininca Campa (Payne 1981, Spring 1990, McCarthy and Prince 1993).) This is demonstrated in the analysis of disyllabic Roots in (44).[27] As we see, a Prosodic Word break obligatorily separates the Base and the reduplicative morpheme in the optimal candidate (44*a*). (AlignSfx (38) is omitted in this tableau and the next. The inputs satisfy the constraint, so it cannot play a role in choosing optimal candidates.)

(44) Analysis of disyllabic V-initial Root, prefixed and unprefixed

<table>
<tr><td>/ api||-RED-/</td><td>Rt-Anchor-BR</td><td>Onset</td><td>Dep-IO</td><td>Disyll</td><td>RED≤ Root</td><td>Max-BR</td></tr>
<tr><td>a.☞api || apii-</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>b. apii]-pii]-</td><td></td><td></td><td></td><td>*!</td><td></td><td>*</td></tr>
<tr><td>c. api]-apii]-</td><td></td><td>*!</td><td></td><td></td><td></td><td></td></tr>
<tr><td>/ n-apii-RED-/</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>d.☞n-apii]-n-apii]-</td><td></td><td></td><td></td><td></td><td>*</td><td></td></tr>
<tr><td>e. n-apii]-pii]-</td><td></td><td></td><td></td><td>*!</td><td></td><td>**</td></tr>
<tr><td>f. n-apii]-apii]-</td><td></td><td>*!</td><td></td><td></td><td></td><td>*</td></tr>
</table>

[27] Prosodic Word-initial Onset violations are not counted in (44) and (45) as an abbreviatory convention to keep the tableaux to a more manageable size. In McCarthy and Prince's (1993) full analysis, Onset violations in Prosodic Word-initial position do not 'count' in choosing optimal candidates for the usual OT reason: a higher-ranked constraint requires left-edge alignment of Prosodic Word and Stem.

In the optimal candidate (44*a*), the reduplicative morpheme begins a new Prosodic Word. This allows it to satisfy the Onset constraint, as only Onset violations which are not in Prosodic Word-initial position are counted. The initial vowel allows this candidate to also satisfy Disyll.[28] Candidate (44*b*), which omits the initial vowel in the reduplicative morpheme, violates Disyll, while candidate (44*c*), with a suffixal reduplicative morpheme, violates Onset.

The analysis of the disyllabic vowel-initial verb stems cannot be extended straightforwardly to longer vowel-initial stems, however. The problem is, if the Base and the reduplicative morpheme can be parsed in separate Prosodic Words, the pattern found with longer verb stems in (37*a*, *b*), where the reduplicative morpheme omits the initial vowel, should not be optimal. This is illustrated by the tableau in (45):

(45)Analysis of longer V-initial Root

/ osaŋkina-RED-/	Rt-Anchor -BR	On set	Dep-IO	RED≤ Root	Max-BR
a. ☹ osaŋkina]-saŋkina]-					*!
b. 💣 osaŋkina-‖osaŋkina]-					
c. osaŋkina]- osaŋkina]-		*!			
/ *n*-osaŋkina-RED-/					
d. ☹ *n*-osaŋkina]- saŋkina]-					*!
e. 💣 *n*-osaŋkina- ‖ osaŋkina]-					
f. *n*-osaŋkina]- *n*-osaŋkina]-				*!	

As we can see, the analysis so far predicts the incorrect optimal output. Candidates (45*a*, *d*) are the correct forms, but (45*b*, *e*) are optimal if the same set of constraints and rankings as for the disyllabic V-initial Roots is adopted, *and if* it is possible to have an output candidate with a Prosodic Word break before the reduplicative morpheme, as required with the disyllabic V-initial

28 In candidate (44*a*), the input Base long vowel is shortened as it occurs word finally, by a regular process of Axininca Campa phonology (Payne 1981, McCarthy and Prince 1993).

Roots. (Compare (45*b*, *e*) with (44*a*).) To resolve this problem, McCarthy and Prince (1993: 91) propose a new constraint, RED = SUFFIX, to penalize outputs like (45*b*, *e*) by defining the reduplicative morpheme as a Suffix, morphologically and prosodically dependent on the Base. This constraint is violated by outputs like (45*b*, *e*) where the reduplicative morpheme begins an independent Prosodic Word, forming a Prosodic Word compound with the Base rather than a suffixation structure. Correct ranking of RED = SUFFIX gives the right results. However, a constraint defining the reduplicative morpheme as a Suffix emphasizes that reduplicative minimality cannot fall out, in their account, from Prosodic Word status of the reduplicative morpheme.

McCarthy and Prince's (1993, 1995*a*) analysis of Axininca Campa reduplicative minimality, then, poses a number of problems for PBT. First, the central claim of this approach is not fulfilled, as the disyllabic minimality constraint on reduplicative morphemes is not accounted for by parsing it as Prosodic Word. In fact, the reduplicative morpheme is explicitly defined as a Suffix rather than a Prosodic Word. A templatic constraint, DISYLL (41), is therefore needed to account for reduplicative minimality. The important predictions of this approach are also not borne out, as McCarthy and Prince (1993: appendix 1, p. 155) acknowledge. Because the Base is a Prosodic Word, it should be stressed following the same principles as other Prosodic Words. However, while Prosodic Word-final syllables that coincide with morphological word-final position are not stressed, Base-final syllables can be, as shown in (46). (']' denotes Prosodic Word edges posited by their analysis.) Further, all Prosodic Words should undergo or trigger the same phonological processes. However, while Prosodic Word-final syllables in morphological word-final position must be short, internal Prosodic Word final syllables can be long, as shown in (47).

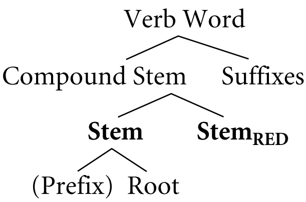
(46) kowà]-<u>kowa]</u>-wáitaki] 'has continued to search more and more'
(cf. máto] 'moth')

(47) n-apii]-<u>n-apii</u>]-waitaki] 'I will continue to repeat more and more'
api] [<u>apii</u>]-waitaki] 'has continued to repeat more and more'

To resolve these problems, McCarthy and Prince (1993) propose that there are two levels of Axininca Campa phonology: one with internal Prosodic Word constituency motivated by minimality, and one without. However, it is clearly undesirable to have a distinct level of phonology motivated by a single process, the definition of prosodic well-formedness constraints on the Base for suffixation, if an alternative analysis is available. As we shall see, MBT provides a straightforward analysis of minimality effects in Axininca Campa reduplication that avoids all of these problems.

The key proposal underlying the MBT analysis is that the Base and reduplicative morpheme are subject to similar minimality requirements because both are Stems. As we have seen, in many languages reduplication is essentially compounding, and each half of the complex has the same morphological category:

(48) Reduplicative Compound Verb Stem structure for Axininca Campa



The constraint in (49) formally defines the Prosodic Stem as the Base for reduplication. Even though the Stem is the Base for reduplication, prefixes are not copied except to satisfy minimality. This is accounted for by the constraint in (50) restricting Prefixes to Word-initial position:

(49) AlignPrStem: Align(L,RED; R, PrStem)

(50) AlignPrefix: AlignL(Prefix, Prosodic Word)

AlignPrefix must outrank Max-BR, as it optimizes a mismatch between the segments in the Base and the reduplicative morpheme. Constraints (49) and (50) account for total reduplication found in C-initial verbs (35). (AlignPrStem is omitted from the tableaux in this section, however, as it is never violated and so never chooses the optimal candidate.)

As shown by the data in (36) and (37), above, the Base Stem and the reduplicative Stem are subject to the following minimality requirements. As we can see from this data, the Base and the reduplicative Stems are always identical in size, and the reduplicative Stem matches the augmentation strategy of the Base. Both the Base and the reduplicative Stems are mostly minimally disyllabic, and the disyllabic minimality requirement is never violated when the Base contains a prefix. This is, indeed, what we expect: the Base and the reduplicative morpheme are defined as minimally disyllabic by ProsodicStem (9*b*). However, we can see that, in a few cases when the Base is a monomorphemic Root, the Base and reduplicative Stems can be bimoraic. Bimoraic Base stems are not augmented, and consonantal stems, like 'feed', are augmented to a bimoraic monosyllable not a disyllable. These conflicting minimality constraints on the Base Stem—bimoraic vs. disyllabic—reflect that the Base for reduplication is only optionally bimorphemic. When it does not contain a prefix, it can be bimoraic, the minimum size required for Roots by HeadsBranch (6). When the Base Stem does include a prefix, it is always minimally disyllabic, satisfying ProsodicStem (9*b*).

The role of these conflicting minimality requirements in accounting for Axininca Campa reduplication patterns is defined by the constraint ranking: HeadsBranch (6) ≫ Dep-IO ≫ ProsodicStem (9*b*). HeadsBranch (6) outranks Dep-IO, as moras (and segments to realize the moras) are optimally epenthesized to satisfy the bimoraic minimality requirement on monomorphemic Bases.[29] Dep-IO outranks ProsodicStem (9*b*), as only material present in the input is recruited to satisfy the disyllabic minimality requirement imposed on Prosodic Stems.

The analysis of the bimoraic C-initial Roots is exemplified in (51):[30]

[29] Dep-IO and Dep-BR evaluate moras and associations between segments and moras in this analysis, rather than segments, as in McCarthy and Prince's (1993, 1995*a*) analysis. The motivation for this is that material is being epenthesized to satisfy constraints on the prosodic, rather than the segmental, composition of these forms.

[30] In the MBT analysis in this section, '[]' indicates PrStem edges.

(51)

/ naa-Stem$_{RED}$-/	HEADS BRANCH	DEP-IO DEP-BR	PR STEM	ALIGN PREFIX	MAX-BR
a.☞[naa]-[naa]-			**		
b. [naa]-[naa*ta*]-		*! (BR)	*		
c. [naa*ta*]-[naata]-		*! (IO)			
/*no*-naa-Stem$_{RED}$-/					
d. ☞[*no*-naa]-[no-naa]-				*	
e. [*no*-naa]-[naa]-			*!		**
f. [*no*-naa]-[naa*ta*]-		*! (BR)			**

In the first candidate set, the bimoraic Stem (containing only a Root) satisfies high-ranked HEADSBRANCH, so it is optimally not augmented (candidate (51*a*)). Competing candidates are non-optimal as they gratuitously violate DEP, the constraint banning augmentation. In the second candidate set, we see that a bimorphemic Stem is also minimally disyllabic, and the optimal reduplicative Stem, candidate (51*d*), copies the disyllabic Base. Competing candidates either violate the disyllabic minimality requirement (51*e*) or satisfy it by some other means than copying the Base (51*f*).

The data in (36) shows that some monomorphemic Base Stems are augmented by epenthesizing a syllable. In McCarthy and Prince's (1993, 1995*a*) analysis, a special constraint, Align-R (39), was required to account for this. As shown by the tableau in (52), no new constraints are required in this analysis:

(52)

/ t^ho-Stem$_{RED}$-/	HEAD BR	DEP-IO DEP-BR	PRSTEM	ALIGN PREFX	MAX-BR
a. ☞[t^ho*ta*]-[t^hota]-		* (IO)			
b. [t^ho]-[t^ho]-	*!*		**		
c. [t^ho*o*]-[t^hoo]-		**! (IO)	**		
/*non*-t^ho - Stem$_{RED}$-/					
d. ☞[*non*-t^ho]-[non-t^ho]-				*	
e. [*non*-t^ho]-[t^ho]-	*!		*		***
f. [*non*-t^ho]-[t^ho*ta*]-		*! (BR)			***

In the first candidate set, the monomoraic Root is optimally augmented by epenthesizing a mora (candidate (52*a*)). This allows it to satisfy both HeadsBranch (6) and PrStem (9*b*). Not augmenting, as in candidate (52*b*), violates both these constraints. Since the Stem consists only of a single morpheme, the Root, we might expect it to be optimal to augment it to a single bimoraic syllable by lengthening the vowel. Notice in candidate (52*c*) that this satisfies HeadsBranch. However, candidate (52*c*) is non-optimal as it incurs extra Dep violations: lengthening an input vowel involves not only inserting a mora (as in (52*a*)) but also changing the prosodic linking of an input segment. In other words, disyllabicity is optimal for phonotactic reasons, not because the morphological structure requires it. In the second candidate set, (52*d*) is optimal for the same reasons discussed for the prefixed candidate in tableau (51). A bimorphemic Base Stem is optimally disyllabic, and the prefix providing the second syllable is optimally copied by the reduplicative morpheme.

Recall that the vowel-initial stems were especially problematic for McCarthy and Prince's (1993, 1995*a*) analysis. In this analysis, we need just one additional constraint. To account for the fact that an initial vowel is not copied for longer stems, I follow Downing (1998*a*, 1998*b*) in proposing that the PrStem, the Base for reduplication (see (49)), must be left-aligned with an Onset:

(53) AlignOnset: AlignL(PrStem, σ) ∩ Onset.[31]

Ranking this constraint below Dep-IO and PrStem (9*b*) optimizes making the initial vowel extraprosodic—i.e. parsed outside the Prosodic Stem which is the Base for reduplication (and the string for evaluation by Max-BR)—except to satisfy minimality. The analysis of the V-initial Roots is exemplified in tableaux (54) and (55):

[31] See Downing (1998*b*) for detailed arguments in favour of formalizing this constraint as a logical conjunction, and for more examples of the role of Onset alignment in reduplication and other prosodic phenomena.

(54) Analysis of longer V-initial Root, prefixed and unprefixed

/ osaŋkina-<u>Stem</u>RED- /	HEADS BRANCH	DEPIO DEPBR	ALIGN ONSET	ALIGN PREFIX	MAX-BR
a. ☞o[saŋkina]-[<u>saŋkina</u>]-					
b. [osaŋkina]-[<u>osaŋkina</u>]-			*!*		
/*n*-osaŋkina—StemRED-/					
c. ☞ [*n*-osaŋkina]-[<u>saŋkina</u>]-					**
d. [*n*-osaŋkina]-[*n*-<u>osaŋkina</u>]-				*!	

Candidate (54*a*) is optimal in the first set, as this candidate violates none of the constraints once the initial vowel is made extraprosodic. In the second candidate set, it remains optimal to exclude the initial vowel from the reduplicative morpheme. Including it would require also reduplicating the prefix, in violation of ALIGNPREFIX. As a result, candidate (54*d*) is non-optimal. (PROSODICSTEM (9*b*) is omitted from this tableau, as it plays no role in choosing optimal candidates for Roots longer than two syllables.)

The same constraints and ranking straightforwardly optimize including the initial vowel to satisfy PROSODICSTEM (9*b*):

(55) Analysis of disyllabic V-initial Root, prefixed and unprefixed

/ apii – $\underline{\text{Stem}}_{\text{RED}}$-/	HEADS BRANCH	DEP-IO DEP-BR	PRSTEM	ALIGN ONSET	ALGN PRFX
a.☞[api] ‖ [<u>apii</u>]-				**	
b. a[pii]-[<u>pii</u>]-			*!*		
c. a[pii]-[<u>pii*ta*</u>]-		*! (BR)	*		
/*n*-apii-$\underline{\text{Stem}}_{\text{RED}}$-/					
d.☞[*n*-apii]-[<u>napii</u>]-					*
e. [*n*-apii]-[<u>pii</u>]-			*!		
f. [*n*-apii]-[<u>pii*ta*</u>]-		*! (BR)			

Candidate (55*a*) is optimal when the Root is unprefixed. Even though it violates ALIGNONSET, all the other constraints are satisfied. (This candidate shows that PRSTEM crucially outranks ALIGNONSET.) Not copying the initial vowel, as in candidate (55*b*), violates higher-ranked PrStem. (As noted above, independent constraints account for word-final shortening in (55*a*).) This candidate also shows why the relationship between branching morphological structure and the disyllabic minimality requirement, PrStem (9*b*), can be an indirect one. Since both the Base and the reduplicative morpheme are defined as Prosodic Stems, they are subject to PrStem (9*b*) minimality, even when the Base is monomorphemic. However, as PrStem (9*b*) is ranked below Dep, it plays a role in motivating a disyllabic Base Prosodic Stem only in this particular case: when the Base Stem provides a second syllable without epenthesis.

In the second candidate set, the prefix is optimally copied, as in candidate (55*d*). Competing candidates either violate higher-ranked PrStem (candidate (55*e*)) or incur Dep violations (55*f*). (Max-BR is omitted from this tableau, as it plays no role in choosing the optimal candidate.)

To sum up the analysis of Axininca Campa reduplication, I have shown that minimality constraints on the Base and the reduplicative morpheme follow from the fact that both are optimally disyllabic ProsodicStems (9*b*). This analysis has been developed in more detail than most others in this work, as, first, the data is complex. For this reason, the analysis of Axininca Campa reduplication forms a central argument in favour of the OT approach to reduplication in McCarthy and Prince (1993, 1995*a*). It is likewise an important argument in favour of MBT to show that it provides a coherent account which improves on the earlier analysis in the following ways. No reference is made to Prosodic Word to define minimality, so there is no need to parse strings into Prosodic Word at one level to account for prosodic well-formedness, and reparse them at a separate level to account for all other phonological processes. Moreover, McCarthy and Prince's (1993, 1995*a*) minimality constraint on the reduplicative morpheme, Disyll (41), violates the basic tenet of GTT, which bans construction-specific size constraints. In MBT, the minimality requirements for both the Base and the reduplicative morpheme fall out from the general constraints requiring Stems to satisfy HeadsBranch (6) and PrStem (9*b*). As a result, the MBT analysis better fulfils the goal of GTT: to account for canonical form through general morphological and prosodic principles.

3.2.1.5. *Stems vs. Roots as Minimal Words* Axininca Campa illustrates another problem for PBT, as minimal Word requirements in this language depend on the lexical category of the word. A search through Payne's (1981) lexicon reveals that only function words are monomoraic: e.g. *ha* 'oh', *hi* 'yes', *ti* 'no'. Monomorphemic nouns are minimally bimoraic: e.g. *çaa* 'anteater', *mii* 'otter', *soo* 'sloth'. However verbs, which are necessarily minimally bimorphemic, (see (34), above) are also necessarily minimally disyllabic (Spring 1991).[32]

This contrast in the minimality requirements of different lexical categories is found in other languages. An augmentation process found in many Athabaskan languages is restricted to verbs; nouns do not undergo it. Hargus and Tuttle (1997) argue that the apparent prosodic distinction simply reflects differences between nominal and verbal morphology, as verbs are minimally bimorphemic, consisting at least of a Root plus Tense affix. Independent nouns do not undergo augmentation, as they can be monomorphemic.

In Yoruba and other Nigerian Benue-Congo languages (like Ebira and Igbo), verbs are minimally CV, while nouns are minimally VCV (Akinlabi in progress; Clark 1990; Hyman 2004; Orie 1997; Zsiga 1992). This contrast is illustrated in the data below in (56). The truncated form of verbs borrowed from English (56*a*) shows especially strikingly that CV is a minimality target for verbs.

[32] Spring's (1991) survey of Payne's (1981) lexicon of Axininca Campa concludes that the minimal word is disyllabic, rather than bimoraic, as the three nouns listed here are the only monosyllabic words in the lexicon. While these forms are, admittedly, few in number, it is striking that they are all monomorphemic nouns. Verbs, which are minimally bimorphemic, are without exception minimally disyllabic. It should be pointed out that there is a phonotactic explanation for why there are so few monosyllabic nouns. As long vowels do not normally occur in word-final position, and words cannot end in a consonant, a disyllabic form is the least marked way for a monomorphemic word to satisfy branching. We shall return to phonotactic motivations for disyllabic minimality in monomorphemic words in Chapter 4.

(56) Yoruba

Minimal CV verbs (Orie 1997: 121–2)

(*a*)	*Full Form, English borrowing*	*Truncated Form*	*Gloss*
	páàsì	pá	to pass
	póm̀bù	pó	to pump
	ọ́gìlì	hó	to be ugly
(*b*)	*Verb*	*Imperative*	*Gloss*
	bi	bì	vomit!
	ba	ba	hide!
	lọ	lọ	go!

Minimal VCV nouns (Orie 1997: 130)

(*c*)	aṣọ	'cloth'	ọmọ	'child'
	oṣù	'month'	alẹ́	'night'

The source of the initial vowel of nouns in Yoruba and related languages is often, synchronically, a nominalizing prefix. In other cases, the morpheme break posited after the initial vowel has a historical source, as the relic of a noun class prefix (Adetugbo 1967; Akinlabi in progress; Clark 1990; Fresco 1970). The importance of the initial vowel in identifying nouns is highlighted in a study by Orie (2002) which shows that in other dialects of Yoruba and in some other Nigerian Benue-Congo languages (Ekiti Yoruba, Owon-Afa, and Iyala-Ogoja), borrowed nouns must be augmented with an initial vowel: e.g. i-biriki 'brick' (Owon-Afa). Orie (2002) demonstrates that there is no phonological motivation for epenthesizing a vowel word initially. The only plausible motivation is that nouns canonically begin with a vowel. Nouns are minimally longer than verbs in these languages, then, because they obligatorily have more complex morphological structure.

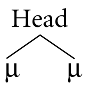
PBT provides no explanation for why different lexical categories of words should be subject to different minimality conditions. As all words of a language are, presumably, footed according to identical principles, they should all be of the same minimal size, an optimal stress Foot. (Note that it is an additional problem that Yoruba is a tone language with no reported evidence of stress Footing, yet it imposes a canonical bimoraic minimum on nouns.) In contrast, these differences fall out from the principles of MBT, where prosodic minimality correlates with morphological complexity. Since monomorphemic Roots are minimally monosyllabic, while bimorphemic Stems are minimally disyllabic, we expect word types with different morphological structures to be subject to different minimality requirements.

3.2.2. *Roots in prosodic morphology*

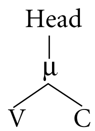
In MBT Roots are defined as monomorphemic Head morphemes. As a result, they should optimally have the prosodic form of a branching monosyllable, either by being bimoraic (57*a*) or by having a monomoraic branching rhyme (57*b*):

(57)

(*a*)



(*b*)



In PBT, Roots are not specifically subject to prosodic minimality requirements, as Stem is the only morphological constituent which is necessarily parsed by a constituent of the Prosodic Hierarchy—Prosodic Word. However, since Roots, defined as monomorphemic lexical morphemes, can also form words, they are also presumably parsable as Prosodic Words. This predicts that free Roots should be subject to the same minimality requirements as Stems: bimoraic or disyllabic, depending on the minimal stress Foot of the language.

MBT and PBT, then, make clearly contrasting predictions about the canonical size of free Roots. MBT predicts that in languages where words can be monomorphemic Roots, they can also be minimally branching monosyllables. That is, there should be a skewing in favour of monosyllabic minimality in languages where words are morphologically simplex. PBT predicts that a preference for monosyllabic words should correlate with a binary quantity-sensitive stress system, as a monosyllable can only regularly be a minimal Foot in languages where heavy syllables attract stress. A further difference is that MBT defines minimality in terms of branching, not weight. As a result, a syllable with a monomoraic branching rhyme like (57*b*) can satisfy Root minimality. In PBT, CVC syllables are predicted to satisfy word minimality only in languages where CVC can independently be shown (from stress or tone or syllable phonotactics) to be bimoraic, as in (57*a*). This section shows that MBT provides a better account of Root minimality, not only in defining minimal words but also for Root truncations and reduplications.

3.2.2.1. *Roots as minimal words* PBT predicts that monosyllabic minimal words, including truncations, are necessarily bimoraic. It further predicts that a CVC syllable can only be a minimal word if CVC can be a bimoraic Foot. Finally, CV minimal words should only be found in the few languages which allow main stress on a monomoraic degenerate foot. (It is not clear what predictions this theory makes about minimality in languages without word stress.) However, as noted in section 2.3, cross-linguistic studies like Garrett (1999), Gordon (1999) and Hayes (1995) on the correlation between minimal word and minimal stress Foot do not support these predictions. The most thorough of these studies is Gordon's (1999) survey of the syllable weight properties of 396 languages (of which 344 are evaluated for both word minimality and stress). The main results of this survey, presented in (58), clearly demonstrate that stress system type is not a good predictor of minimal word size:[33]

(58)

Minimal Word	Quantity insensitive	Quantity sensitive	n.a. (no stress)	Total
CV	88	43	55	186
CVX	53	60	19	132
CVCV	13	11	2	26
Total	154	114	76	344

[33] The tables in (58) and (59) were compiled based on a manual search and count of Gordon's (1999) Appendix 2. Any mistakes in these tables, due to miscounting or misinterpretation, are, of course, my responsibility.

A monomoraic monosyllable (CV) is the most common minimal word size, even in languages with quantity-sensitive stress, where this sort of syllable would presumably never constitute a main stress Foot in polysyllabic words. The next most common minimal word size is CVX. Strikingly, this minimal word size is more common in languages with quantity-insensitive stress or no stress than in languages with quantity-sensitive stress systems where CVX is potentially a bimoraic Foot. Disyllabic (CVCV) is the least common, and is found nearly as often in languages with quantity-sensitive stress, where a bimoraic monosyllable should be sufficient to satisfy word minimality, as in quantity-insensitive languages, where disyllabic minimality is expected.

A closer look at the distribution of CVX minimal words, distinguishing between CVV and CVC for both minimal words and what counts as heavy for stress, emphasizes that minimal stress Foot is not a good predictor of minimal word size:

(59)

Minimal word	Quantity sensitive - CVV	Quantity sensitive - CVC	Quantity insensitive	n.a. (no stress)	Total
CVV	21	∅	15	6	42
CVC	20	19	38	13	90
Total	41	19	53	19	132

As we can see, CVV minimal words are equally well represented in languages where CVV is heavy for stress, and so potentially a minimal Foot, as in languages where it is not. CVC minimal words are well represented in all groups. This is surprising because CVC cannot be a potential minimal Foot in languages where only a CVV syllable is heavy for stress, or in languages with quantity-insensitive stress systems or no stress.

One can only join Gordon (1999: 81) in concluding from this survey that there is no strong cross-linguistic evidence for a correlation between weight criteria for stress and minimal word requirements.

Gordon's (1999) results confirm earlier cross-linguistic studies involving fewer languages. Garrett (1999) and Kager (1992) also show that a CVC monosyllable is the minimal word in numerous languages where it does not count as heavy for stress. Hayes (1995) also shows that many languages have minimal words that do not match the minimal stress Foot: light monosyllables in quantity-sensitive languages, and monosyllables in quantity-insensitive syllabic trochee languages. Stress Foot type does not turn out to be a good predictor of minimal word size, then, even though it is a central claim of PBT that word minimality falls out from Foot minimality.

How well does MBT account for the same range of data? The fact that CV is the most common minimal word size is as unexpected in this theory as in the Prosodic Hierarchy-based approach. Words minimally contain Roots, and so are expected to minimally be branching monosyllables, matching (57). Even though, as we shall see in the next chapter, the interaction of syllable markedness constraints with branching requirements can easily account for CV minimal words, it is surprising that so many languages fail to enforce an asymmetry between Heads and non-Heads. MBT also predicts that the majority of languages in Gordon's (1999) survey impose a monosyllabic minimality requirement because they are minimally monomorphemic. As we saw in the preceding section, it often turns out to be the case that minimally disyllabic words are minimally bimorphemic, while monomorphemic words, even in the same language, can be monosyllabic. This correlation has, however, not yet been tested on as large a sample as included in Gordon's (1999) survey, and is an important area for future research.

These caveats aside, MBT has clear advantages over PBT in accounting for the distribution of monosyllabic minimum word types attested in (58) and (59). First, divorcing word minimality from the stress Foot correctly predicts that CVX (a branching monosyllable matching either (57*a*) or (57*b*)) is universally available as a possible minimal word, not only in languages with quantity-sensitive systems, where it potentially correlates with a stress Foot, but also in quantity-insensitive stress and no-stress languages where it does not. To give some examples, in the Chadic languages Miya (Schuh 1998: 31) and Hausa (Newman 2000: 409), words are minimally bimoraic CVX. Neither of these languages is reported as having a stress system, so the word minimality requirement cannot be motivated from stress footing. Many quantity-insensitive languages have a CVX word minimality requirement, even though CVX would not normally be a Foot in polysyllabic words with this kind of stress system. Garrett (1999: fig. (9)) lists a number of syllabic trochee languages with a CVX word minimality requirement: Polish, Garawa, Dalabon, Pintupi, and Anguthimri. Languages with a quantity-insensitive unbounded stress system, which provides no evidence for binary footing, and a CVX word minimality requirement include Bengali (Fitzpatrick Cole 1990), Kambera (Klamer 1998), and Lardil (Klokeid 1976), all discussed in Chapter 2, as well as Macedonian (Garrett 1999). Turkish can also be included in this group. As Inkelas and Orgun (1995) show, Turkish has a bimoraic word minimality condition for underived words. (See section 3.2.1.1, above, for a discussion of disyllabic minimality in derived words.) This is unexpected since stress is unbounded in Turkish, assigned regularly to the final syllable whether it is heavy or light.[34]

Another important advantage of MBT is that it defines minimality in terms of branching, rather than weight, the parameter relevant for evaluating Foot binarity. This allows MBT to provide an account for why CVC is a possible minimal word in the many languages where there is no independent evidence from stress that CVC is bimoraic. These languages are problematic for PBT, as only bimoraic monosyllabic minimal words maintain the minimal word-minimal stress Foot correlation at the heart of the theory. In MBT a CVC syllable satisfies HeadsBranch whether it is bimoraic or

[34] As Inkelas and Orgun (2003) show, there is some evidence for bimoraic Feet in Turkish, as place names are assigned 'Latin' stress: main stress on the antepenult, except the penult is stressed if heavy. But since this pattern is confined to one well-defined lexical space—place names—it is still fair to conclude that the bimoraic minimality requirement on words of the regular vocabulary is not predicted from the stress principles which apply to those words.

monomoraic, as shown in (57), and so is predicted to be a universally available as a possible minimal Root. One finds examples of languages where CVC is a minimal word even though it is not heavy for stress in all types of stress system, as shown in (59). To give some examples, Orie (1997: 118) reports that words in Gokana, a Nigerian tone language with no reported stress, are minimally CVC.[35] Subminimal CV Roots are augmented by glottal stop epenthesis to satisfy this minimality requirement when they occur in isolation: ké [kéʔ] 'egg'; dù [dùʔ] 'come'. As noted in Chapter 2, Modern Hebrew (Ussishkin 2000) and Lushootseed (Urbanczyk 1996) provide examples of languages with quantity-insensitive stress systems and (predominantly) CVC minimal words, while in Yapese (Jensen 1977) only CVV counts as heavy for main stress assignment, yet words are minimally CVC.[36] Garrett (1999: fig. (7)) lists several other languages where only CVV counts as heavy for stress, yet both CVV and CVC satisfy word minimality: Khalkha Mongolian, Buriat, Gurkhali, Hupa, Huasteco, Aguacatec (Mayan), and Murik.

To sum up this section, cross-linguistic surveys of the minimal word-minimal stress Foot correlation like Gordon (1999), Garrett (1999), and Hayes (1995) show that minimal stress Foot often does not correlate with minimal word size. This finding undermines the central claim of PBT, namely, that word minimality reduces to stress Foot minimality. In contrast, in MBT the fact that minimal words are monosyllabic in the majority of the languages in Gordon's (1999) survey follows from the proposal that words are minimally monomorphemic Roots. The fact that branching monosyllables are a

[35] It should be pointed out that work like Hyman (1990), Harris (2004), and Downing (to appear) has suggested that footing the initial two syllables of words in Gokana could account for the reduced inventory of consonants allowed in the Onset of the second syllable. This would be another example of foot-medial reduction discussed in connection with German truncations. An alternative analysis that does not appeal to foot structure would be that Root-medial consonants are reduced. Note that reduction is motivated by a Head-Dependent Asymmetry in both analyses. The point of difference is whether the asymmetry is related to prosody or morphology: a fascinating topic for future research.

[36] In fact, all words in Yapese must end with a consonant. We shall discuss further in Chapter 4 phonotactic motivations for the choice of optimal branching.

common minimal word size and roughly evenly distributed, as possible minimal words, in different types of stress systems (including quantity insensitive and no stress) is expected, as a minimal Root is universally expected to be a branching monosyllable: this is the optimal way for a simplex morpheme to satisfy HEADSBRANCH, as shown in (57). It is an important advantage of MBT that it better accounts for the attested distribution of minimal word types in the languages of the world.

3.2.2.2. *Roots as truncations* Truncations are a form of morphologically derived word and so are, morphologically, Stems. In section 3.2.1.2, above, we saw that truncations in many languages are exactly disyllabic, satisfying PROSODICSTEM (9*b*) like other kinds of derived words. In some languages, though, truncations are monosyllabic, often having the same minimal size as underived words. In English and Thai for example, as we saw in section 2.2.2, above, both regular Words and truncations (nicknames and abbreviations) minimally contain a bimoraic syllable:

(60) (*a*) English monosyllabic nicknames and abbreviations

Full form	Truncation	
David	Dave	
Joseph	Joe	
Susan	Sue	
Nancy	Nance	
magazine	mag	
refrigerator	fridge	
semper fidelis	semper fi	(USMC motto)
brother	bro	

(*b*) Thai parent names (Weeda 1992: appendix B)

Full form	Truncation(s)		
prì:yà:	prì: (rare)	OR	yà:
sàlìn	lìn		
nàrút	rút	(*nà)	
pétcarat	pét	OR	rat

Why should these truncations be shorter than the disyllabic minimum expected for derived words? A solution suggests itself if we remember the definition of truncation: part of a word is deleted to form a new word (Weeda 1992: 1). Looking again at the full forms in (60), we can see that many are disyllabic, and can only be made shorter by reducing the words to a single syllable. A single syllable is, then, an optimal (minimal) size for a truncation, because a monosyllabic form is almost always bound to be shorter than the full form on which it is based.

In MBT, these generalizations can be formalized as follows. A monosyllabic free morpheme is a well-formed word type, namely, a canonical Prosodic Root. The distinction between disyllabic and monosyllabic truncations can then follow from their prosodic parse. Disyllabic truncations are parsed as Prosodic Stem, as expected given their branching morphological structure. Monosyllabic truncations are parsed as the minimal morpho-prosodic unit which can define a lexical word, namely, Prosodic Root. These contrasting representations are given in (61*a*, *b*). The constraint in (61*c*), when high-ranked, optimizes the representation in (61*a*); (61*d*) optimizes the representation in (61*b*):[37]

(61) Competing prosodic parses of truncated Stems

(*a*) Prosodic Stem parse (*b*) Prosodic Root parse

(*c*) TRUNC(ATION)=PRSTEM: A truncated Stem is parsed as a Prosodic Stem.

(*d*) TRUNC(ATION)=PRROOT: A truncated Stem is parsed as a Prosodic Root.

Defining the truncation as a PRROOT means that it is considered a single morpheme and so optimally monosyllabic if MORPH-SYLL (5) is also high-ranked.

The analysis of Thai monosyllabic truncations is given in (62). The analysis of the English truncations in (60*a*) would be essentially identical.

[37] It is, of course, the default parse, for a morphologically derived word to be a Prosodic Stem.

(62)

nàrút-TRUNC	MORPH-SYLL	TRUNC=PRROOT	HEADS BRANCH	MAX-BT
☞ *a.* nàrút—rút$_{Root}$				**
b. nàrút—nà$_{Root}$			*!	***
c. nàrút—nàrút$_{Root}$	*!			

Candidate (62*a*) is optimal as it satisfies the highest-ranked constraints defining the truncation as a branching, monosyllabic Root. Candidate (62*b*) is non-optimal, as truncating to the CV initial syllable violates HEADSBRANCH (57). (I assume a high-ranked Base-Truncation syllable correspondence constraint requires the Truncate syllable to match a Base syllable.) Candidate (62*c*) is non-optimal as it violates MORPH-SYLL (5), the constraint requiring simplex morphemes like Prosodic Root to be optimally a single syllable. (As the Base is a disyllabic Root, this constraint is obviously outranked by INPUT-OUTPUT FAITHFULNESS.)

Dutch nicknames confirm the observation that truncations can be shorter than the disyllabic minimum expected for derived words in order to satisfy the requirement that truncations are shorter than their Base. As van de Vijver (1998) shows, Dutch truncations in the pattern he documents in (63) are mostly disyllabic, as expected if they have the default Prosodic Stem parse in (61*a*). (Notice, this means that truncations are generally longer than minimal words in the normal vocabulary, which are minimally a bimoraic monosyllable (Booij 1999). They also can contain two Feet. Both of these generalizations make this pattern problematic for PBT.) However, disyllabic Bases are truncated to a single syllable:

(63) Dutch nicknames (van de Vijver 1998: 229–30)

Full form	Nickname
Chárlotte	Char
Dávid	Daaf
Nàvratilóva	Návra
Górbatsjov	Górba
Aníta	Aníet
Pàndóra	Pàndór

To account for the generalization that Dutch nicknames are monosyllabic if the Base is disyllabic I propose that an ANTIFAITHFULNESS constraint requires truncated Stems to not match their Bases: BASE ≠ TRUNC.[38] As shown in (64), ranking this constraint above TRUNC=PRSTEM (61*c*) optimizes disyllabic truncations except when the Base is itself disyllabic:

(64)

Aníta-TRUNC	BASE ≠ TRUNC	TRUNC = PRSTEM	MORPH-SYLL	TRUNC = PRROOT	MAX-BT
☞ *a.* Aníta—Aníet$_{\text{Stem}}$				*	*
b. Aníta—Aníta$_{\text{Stem}}$	*!			*	
c. Aníta—An$_{\text{Root}}$		*!			***
Dávid-TRUNC					
☞ *d.* Dávid—Daaf$_{\text{Root}}$		*			**
e. Dávid—Dávid$_{\text{Stem}}$	*!			*	

BASE≠TRUNC: A truncation is not identical to the corresponding Base.

Disyllabic candidate (64*a*) is optimal when the Base is longer than disyllabic, as this candidate satisfies the highest-ranked constraints. Notably, the disyllabic candidate in (64*a*) shows that truncations have the canonical length expected for derived words, rather than matching the bimoraic minimality requirement on monomorphemic words. The competing candidates are non-optimal as they either match the Base (64*b*) or truncate to a monosyllable (64*c*). The second candidate set shows that the monosyllabic candidate (64*d*) is optimal for a disyllabic Base. A disyllabic candidate like (64*e*) violates the highest-ranked constraint requiring the truncation to be distinct from its Base.

[38] See Alderete (2001) for further discussion and motivation of this sort of transderivational Anti-Faithfulness constraint. And see Kenstowicz (2005), Rebrus and Törkenczy (2005), and Urbanczyk (2005) for further discussion of the role of transderivational contrast (or Anti-Faithfulness) constraints in phonological systems.

This basic approach straightforwardly extends to the monosyllabic Madurese truncations presented in Chapter 2, repeated below for convenience:

(65) Madurese truncations (Stevens 1968: 83; Weeda 1987; McCarthy and Prince 1986: fig. (81))

(*a*) *Compounding*

usap	sap-lati	‘handkerchief (wipe+lip)’
uriŋ	riŋ-tua	‘parents (person+old)’
tuzhuʔ	zhuʔ-ənpul	‘pinky (finger+pinky)’
pasar	sar-suri	‘afternoon market (market+ afternoon)’

(*b*) *Vocative*

ibhu	bhu(ʔ)	‘mother’
settoŋ	toŋ	‘one’
duwaʔ	waʔ	‘two’
enghi	ghi	‘yes’
uriŋ	riŋ	‘person’

Words are minimally disyllabic in Madurese (McCarthy and Prince 1986; Weeda 1987). The truncated forms in (65) violate this general word minimality condition, satisfying instead the constraints motivating monosyllabic Prosodic Root as the canonical truncated form. The tableau in (66) shows that Madurese can be given essentially the same analysis as Thai in (62), except that in Madurese the truncate must be identical to the final syllable of the full form whether it branches or not.[39]

(66)

enghi-TRUNC	MORPH-SYLL	TRUNC=PRROOT	ANCHOR RIGHT	TRUNC=PRSTEM	MAX-BT
☞ *a.* enghi—ghi$_{\text{Root}}$				*	**
b. enghi—en$_{\text{Root}}$			*!	*	**
c. enghi—enghi $_{\text{Root}}$	*!			*	

[39] See Cohn (2003) for discussion and analysis of a similar truncation pattern in Indonesian.

Candidate (66*a*) is optimal as it satisfies the highest-ranked constraints defining the truncation as a monosyllabic Root, matching the final syllable of the full form. Candidate (66*b*) is non-optimal, as the truncated form matches the first syllable of the full form rather than the last. Candidate (66*c*) is non-optimal as it violates the MORPH-SYLL (5), the constraint requiring simplex morphemes like Prosodic Root to be optimally a single syllable. (As the Base is a disyllabic Root, this constraint is obviously outranked by INPUT-OUTPUT FAITHFULNESS.[40])

One factor favouring Prosodic Root truncations over Prosodic Stem truncations is that a monosyllabic Root truncation is almost always shorter than the full form on which it is based. As Itô (1990) shows, another factor is the prosodic independence of the truncations: bound truncations can be optimally shorter than free truncations. Itô (1990) presents a striking example of this distinction from Japanese. As we saw in (23), above, free loanword truncations in Japanese are minimally disyllabic. However, in truncation compounds, each half is minimally and maximally bimoraic. As shown in (67), both monosyllabic and disyllabic bimoraic truncations are found:

(67) Japanese truncation compounds

Full form	*Truncation*	*Gloss*
waado purosessaa	waa puro	'word processor'
hebii metaru	hebi meta	'heavy metal'
rajio kasetto rekoodaa	raji kase	'radio cassette recorder'
sukeeto boodo	suke boo	'skateboard'
paasonaru koNpyuutaa	paso koN	'personal computer'
paNtii SutokkiNgu	paN suto	'panty stockings'

I follow Itô (1990: 222) in proposing that the difference in the minimality requirements on the two truncation types falls out from giving them different morphological categorizations. Free disyllabic truncations are Prosodic Stems, while the bound bimoraic

40 The analysis exemplified in (66) does not account for the fact that the truncation is variable in size, to match the Base syllable. This is accounted for in section 4.1, below. Section 4.3 takes up the question of why non-truncated Madurese Roots are canonically disyllabic.

truncations are Prosodic Roots.[41] The truncated compounds are PrRoot-PrRoot compounds. That is, as shown in (68), each member of the truncated compound is parsed as a Prosodic Root (PrRoot):

(68)

Stem   Stem

Root TRUNC   Root TRUNC

[[ ]PRROOT   [ ]PRROOT] PRROOT COMPOUND

As Itô (1990) shows, other Root compounds in Japanese are also subject to a bimoraic minimality requirement on each half of the compound.

The analysis of the Japanese Root truncations in (67) would be analogous to that of Thai Root truncations given in (62), except that MORPH-SYLL (5) must be low-ranked, as the Japanese Root truncations can be disyllabic if the corresponding two moras of the base are distributed over two syllables. This is optimal if DEP-μ-LINK is ranked high enough to penalize lengthening input short vowels to satisfy HEADSBRANCH. BINARITY (10) imposes bimoraic maximality on each half of the compound truncation:

(69)

hebii metaru -TRUNC	TRUNC= PRROOT	HEADS BRANCH	DEP -μ- LINK	BINARITY (σ)	MORPH-SYLL
☞ *a.* hebii metaru— hebi$_{Root}$meta$_{Root}$					**
b. hebii metaru— hee$_{Root}$mee$_{Root}$			*!*		
c. hebii metaru— hebii$_{Root}$metaru$_{Root}$				*!*	**

Candidate (69*a*) is optimal as it satisfies the highest-ranked constraints defining the truncation as a branching Root. Candidate

[41] Itô (1990: 222) attributes the distinction to one between Word and Stem rather than between Prosodic Stem and Prosodic Root, respectively. The defining characteristics for the two categories are the same in the two approaches, however.

(69*b*) is non-optimal, as truncating to bimoraic monosyllables violates Dep-μ-Link: each of the vowels is linked to an additional mora in the output than in the input. The non-truncating candidate (69*c*) is non-optimal as it violates Binarity. Each half of the compound exceeds the bimoraic maximum this constraint optimizes.

To sum up this section, disyllabic truncations and monosyllabic (or bimoraic) truncations are accounted for by giving them a different morpho-prosodic parse. Disyllabic truncations, like other derived words, are parsed as Prosodic Stems. By the ProsodicStem constraint (9*b*), they are optimally disyllabic. Monosyllabic and bimoraic truncations are parsed as Prosodic Roots. This parse follows from the generalization that truncations, like Roots, are morphologically and prosodically minimal lexical forms. Furthermore, truncations are, by definition, shorter than their Base. As Itô (1990) points out, it is unclear how a Prosodic Hierarchy-based theory of minimality can account for the length distinctions defining Stem vs. Root truncations, as that theory provides no non-stipulative way of correlating different minimality requirements with different morphological categories.

3.2.2.3. *Root reduplication* In MBT Root reduplicative morphemes are expected to have the following morphological and phonological characteristics. Because reduplication is, in the unmarked case, a form of compounding, if the Base for reduplication is a monomorphemic Root, then the reduplicative morpheme is also a Root (see e.g. Inkelas and Zoll 2005). Independent evidence for the Root classification would be that the canonical form of the reduplicative morpheme matches the canonical form of other Roots, and/or that the reduplicative morpheme undergoes morphological or phonological processes which apply specifically to Roots. PBT shares these properties. The distinction between the two approaches is in how canonical Root size is defined.

As we noted in discussing Roots as minimal words and truncations, Roots have no special status in PBT. However, Roots—reduplicative and other—can be parsed as Prosodic Words. They then are subject to the same size constraints as other Prosodic

Words, namely, they minimally contain a bimoraic or disyllabic stress Foot. In MBT, in contrast, Roots are defined as simplex Head morphemes. Root reduplications are expected to have the same canonical shape as other Roots, namely the structures given in (57). An important advantage of MBT for reduplication, as for word minimality, is that it allows CVC to be defined as a canonical Root shape whether it is bimoraic (57*a*) or monomoraic (57*b*). In PBT, in contrast, CVC can only be positively defined as a canonical morpheme shape if it is parsed as a bimoraic stress Foot. As we shall see in this section, this property allows MBT to provide a more general account of why Root minimality requirements for reduplicative morphemes echo Root minimality requirements in other morphological constructions, for a wider ranger of languages, than PBT.

These advantages are strikingly illustrated by the Root reduplication patterns found in Lushootseed, a Salishan language spoken along the Northwest Coast of North America (Urbanczyk 1996, 2000), and Palauan, an Austronesian language (Finer 1986–7; Kawamura 2003, 2004; Zuraw 2003). Both of these languages have a reduplicative morpheme with the canonical form, CVC:

(70) (*a*) Lushootseed Distributive reduplication (Urbanczyk 2000: fig. (24))

sáq$^{w'}$	‘fly’	sáq$^{w'}$-saq$^{w'}$	‘fly here and there’
gə́lk’	‘entangle’	ʔəs-gə́l-gəlk’	‘all tangled up’
tʃəg^{w}ás	‘wife’	tʃəg^{w}-tʃəg^{w}ás	‘seeking a woman to marry’
pástəd	‘Caucasian’	pás-pastəd	‘many white folks’

(*b*) Palauan CVX reduplication (Finer 1986–7: 110; Zuraw 2003)

tórð	‘frustration’	bəkə-tər-tórð	‘easily frustrated’
síkt^{h}	‘cluster of fruit’	mə-sək-síkt^{h}	‘covered with fruit’
mə-rám	‘get mixed’	mə-rəm-rám	‘easy to mix’

(*c*) Palauan CVX imperfect reduplication (Finer 1986–7: 118)

base		*imperfect*		*reduplicated*
tub	‘spit (N)’	mə-lub	‘imperfect’	mə-ləb-tub
kimdii	‘trim it’	mə-ŋimd	‘trim’	mə-ŋəm-kimd

As Urbanczyk (1996, 2000) argues, the CVC shape of the distributive reduplicative morpheme in (70*a*) is best accounted for if it is categorized as a Root, as the canonical form of Root morphemes in Lushootseed is CVC.[42] According to Urbanczyk (2000), 68 per cent of all Roots in Lushootseed are CVC. The data in (70) is not representative, as it is meant to illustrate fixed reduplicative shape.

In Palauan, too, the sources cited show that Roots are minimally monosyllabic (C)VX. Further evidence in favour of categorizing the CVX reduplicative morpheme as a Root in Palauan is presented in Finer (1986–7). The nasal of the imperfect prefix fuses with the first consonant of the Root of unreduplicated forms, as shown in (70*b*). It does not fuse with other prefixes to the Root, yet it does fuse with the first consonant of the CVX reduplicative morpheme. As Finer argues, fusion is expected if the CVX reduplicative morpheme is also a Root.

In PBT, CVX can only be defined as a minimality condition on Root reduplication in Lushootseed and Palauan by proposing that the reduplicative (or other Root) morpheme is parsed as a Prosodic Word and contains a bimoraic stress Foot. However, there is no evidence in either language that the Root-reduplicant is a separate Prosodic Word from the Base. Further, there is no evidence from stress that CVC syllables are bimoraic stress Feet. As Urbanczyk (1996, 2000) shows, while stress in Lushootseed is sensitive to vowel quality—full vowels are stressed in preference to schwa—CVC syllables do not attract stress and would never constitute a stress Foot in a polysyllabic word. In Palauan, too, we find no evidence that CVC is a minimal stress Foot. Kawamura (2003) and Zuraw (2003) state that there is only one main stress per word, usually on

[42] As Urbanczyk (1996: chapter 5) shows, the distributive can also occur preceding the diminutive (CV) prefix illustrated in (84). In this case, it matches the CV shape of the diminutive. Urbanczyk (1996) argues that the distributive is still a Root in this context, and that phonological factors account for its CV shape. Morphologically, it is unexpected for a Root morpheme (the distributive) to occur preceding an Affix (the diminutive). It is also unusual for the same morpheme to have two different positions—immediately preceding the Root or immediately preceding an Affix. This problem emphasizes that more research is needed into the morphological status and morphological category of reduplicative morphemes in Lushootseed and other languages.

the penult or Root-initial syllable. As we have already noted, in unbounded quantity-insensitive stress systems like these, a CVC syllable would never constitute a stress Foot in a polysyllabic word. The Prosodic Word-stress Foot correlation, then, cannot be motivating the CVX minimal (and maximal) shape of these reduplicative morphemes.

Urbanczyk (2000) avoids these problems by proposing an alternative means of formalizing the CVC canonical Root shape for reduplicative morphemes which is consistent with PBT. Instead of constraints correlating morphological categories with particular prosodic constituents, the size restriction is defined through ranking the constraints in (71):

(71) Constraints accounting for CVX Root reduplication
Faithfulness Constraints
(*a*) MAX-BR-ROOT
All the segments of the Base are contained in the Root RED.
(*b*) MAX-BR—All the segments of the Base are contained in the RED.
Markedness Constraints
(*c*) NOCODA—Syllables do not have codas.
(*d*) *STRUCσ—Minimize the number of syllables.[43]

Root reduplicative morphemes are optimally CVX monosyllables due to the ranking: MAX-BR-ROOT (71*a*) $\gg$ NOCODA (71*c*) $\gg$ MAX-BR (71*b*). (Recall that in positional markedness theory (Beckman 1997, 1998), Roots passively license more marked structure through ranking Root Faithfulness constraints above more general Faithfulness constraints.) The analysis is exemplified in (72):

[43] *STRUCσ has a similar effect to the MORPHEME-SYLLABLE CORRELATION (5) proposed in this approach, namely, it optimizes (reduplicative) Roots and Affixes with exactly one syllable in the output. Unlike the MORPHEME-SYLLABLE CORRELATION, however, the correlation between these morphemes and a syllable is not explicitly motivated by any independent theoretical principle. Why isn't *STRUC-FT or *STRUCμ the relevant markedness constraint defining maximal Roots (and Affixes), instead?

(72) Lushootseed Root reduplication (adapted Urbanczyk 2000, figs. (39), (43)

/DIST$_{ROOT}$-pastəd/	*STRUCσ	MAX-BR-ROOT	NOCODA	MAX-BR
☞ *a.* pas-pastəd	*	***	***	***
b. pa-pastəd	*	****!	**	****
c. past əd-pastəd	**!		****	

Candidate (72*a*) is optimal for distributive (Root) reduplication, as it best satisfies the highest-ranked constraints. (Notice that MAX-BR-ROOT violations are only incurred if the reduplicant is specified Root; all reduplicants incur MAX-BR violations.) Candidate (72*b*), which contains a CV syllable, is non-optimal as it incurs more MAX-BR-ROOT violations by copying fewer Base segments. Candidate (72*c*), the total reduplication candidate, is non-optimal, as it incurs more violations of *STRUCσ. (*STRUCσ violations are only counted for the reduplicative string.) Palauan CVX reduplicative Root shape could be given a similar analysis.[44]

This approach provides an elegant account of CVX Root reduplication and meets the GTT goal of accounting for prosodic morpheme size restrictions in terms of general markedness constraints. However, notice that the CVX Root shape is derived through a constraint ranking that crucially contains reduplication-specific Faithfulness constraints: MAX-BR and MAX-BR-ROOT. As a result, the analysis in (72) fails the GTT goal of avoiding construction-specific definitions of the size restrictions. For this reason, it cannot generalize to account for why non-reduplicative Roots in Lushootseed, and Palauan are minimally CVX in size just like Root reduplicative morphemes are. This is shown in (73), where we see

[44] The Palauan CVX reduplication pattern is more complicated than presented here. Space does not permit going in to the complications, some of which seem to be lexically determined in any case. The interested reader can consult Finer (1986–7), Kawamura (2003, 2004), and Zuraw (2003) for more detailed discussion. Kawamura (2003) develops an alternative analysis of the CVX pattern. Some of the constraints in Kawamura's analysis are not consistent with the PBT, making it hard to evaluate and compare with other analyses presented in this work. For this reason, it is not discussed.

that a CV input Root like hypothetical /pa/ optimally surfaces as [pa]:

(73)

/pa/	MAX-IO	*STRUCσ	NOCODA	DEP-IO
☞ *a.* pa		*		
b. paʔ		*	*!	*

While inserting a glottal stop (arbitrarily chosen as a default consonant) would allow candidate (73*b*) to match the canonical CVC Root shape, it not only violates DEP-IO but also leads to a NOCODA violation. As CVC is not a binary stress Foot, there is no constraint available in PBT to enforce binarity and optimize this more marked output syllable structure.

An MBT analysis of CVX canonical Root shape does not face these problems. Monomoraic CVC is a canonical Root shape as shown in (57*b*), above. As a result, the high-ranked MORPHEME-SYLLABLE constraint (5) and HEADSBRANCH (57) define both reduplicative and non-reduplicative Roots as minimally CVC and optimally a monosyllable. (As there is no vowel length contrast in Lushootseed, CVC is the only branching monosyllable attested in the language.) These points are exemplified in (74) and (75):

(74) Lushootseed Root reduplication, MBT analysis

/DIST$_{ROOT}$-pastəd/	MORPH-SYLL	HEADS BRANCH	NOCODA	MAX-BR
☞ *a.*pas-pastəd			***	***
b. pa-pastəd		*!	**	****
c. pastəd-pastəd	*!		****	

Candidate (74*a*) is optimal, as the reduplicative Root satisfies the high-ranked constraints defining a Root morpheme as a branching monosyllable. (MORPH-SYLL only evaluates the reduplicative morpheme in this tableau, as MAX-IO ≫ MORPH-SYLL optimizes realizing a Base of any length in the output.) Candidate (74*b*) is non-optimal as the reduplicative Root does not branch. Candidate (74*c*) is non-optimal as the reduplicative Root contains more than one syllable.

The tableau in (75) shows that ranking MORPH-SYLL, HEADS BRANCH, and NOCODA above DEP-IO also straightforwardly optimizes CVX as the minimal shape for non-reduplicative Roots:

(75)

/pa/$_{\text{ROOT}}$	MAX-IO	MORPH-SYLL	HEADS BRANCH	NOCODA	DEP-IO
a. pa			*!		
☞ *b.* paʔ				*	*

Subminimal candidate (75*a*) is non-optimal in this analysis, as it violates HEADSBRANCH (57*b*). Optimal (75*b*) satisfies this constraint. Ranking MAX-IO above MORPH-SYLL optimizes realizing Roots longer than CVX in the output. This tableau clearly shows the advantage of MBT in providing a motivation independent of stress for branching structure in Head morphemes like Roots. This is what allows the canonical shape of Roots in all morphological constructions, not just reduplication, to be defined in a uniform way.

This point is also made by the partial reduplication pattern of Madurese illustrated in (76). As we saw in discussing the data in (64), above, in Madurese a truncated monosyllabic Root is a truncation target in vocatives and in compounds. The data below shows that this same truncated Root shape also characterizes partial reduplication:

(76) Madurese partial reduplication (McCarthy and Prince 1986: fig. (81); Stevens 1968; Weeda 1987)

abit	<u>bit</u>-abit	finally
buwaʔ	<u>waʔ</u>-buwaʔ-an	fruits
maen	<u>en</u>-maen-an	toys
ŋastan	<u>tan</u>-ŋastan-e	to hold
estre	<u>tre</u>-estre	wives
chapphluk	<u>phluk</u>-chapphluk-an	a noise

Both MBT and PBT can straightforwardly account for this pattern. It would have an analysis identical to that provided for

Lushootseed—(72) for PBT and (74) in MBT—except that, as in the other truncated Roots of Madurese, a high-ranked constraint must optimize matching the reduplicative morpheme exactly to the final syllable of the Base, whether it is branching or not. The MBT analysis of Madurese reduplication has the conceptual advantages of providing a principled reason for why the partial reduplicative morpheme has the same canonical shape as the other truncations. Like the others, it is defined as a Prosodic Root. In PBT, the similarity in output shapes is coincidental. As shown in the tableau below, the monosyllabic output in both truncations and reduplication is an accidental by-product of the similarity in constraint rankings in the two constructions. Nothing in the analysis necessarily leads us to expect this similarity:

(77)

RED-abit	*STRUCσ	MAX-BR	NOCODA
☞ *a.* bit-abit		*	**
b. abit-abit	*!		**
c. bi-abit		**!	
abit-TRUNC	*STRUCσ	MAX-BT	NOCODA
☞ *d.* abit-bit		*	**
e. abit-abit	*!		**
f. abit-bi		**!	*

PBT also has problems accounting for reduplicative shape in languages like Kambera and Turkana where, at first blush, the reduplicative morpheme seems to be subject to the sort of bimoraic minimality requirement that could match a minimal stress Foot. An example of this is provided by Kambera (Austronesian) Root reduplication. As shown by the data in (78), the reduplicative morpheme is minimally bimoraic (and maximally disyllabic), and is always stressed on its initial syllable, just like the Base. These properties would seem to follow from the principles of PBT: the reduplicative morpheme is parsed as a Prosodic Word dominating a stress Foot:

(78) Kambera Root reduplication (Klamer 1998: 37, fig. (48))[45]

(*a*)	táu	'person'	táu-táu
(*b*)	ráma	'work'	ráma-ráma
(*c*)	káunda	'stalk away'	káunda-káunda
(*d*)	wúna-ng(u)	'priest'	wúna-wúnangu
(*e*)	tángar(u)	'watch X'	tánga-tángaru
(*f*)	ka-háu-ng(u)	'separate X'	ka-háu-háungu
(*g*)	pa-bánjar(u)-ng(u)	'talk'	pa-bánja-bánjarungu

There are problems, discussed in section 2.3.6, above, with analysing the reduplicative morpheme in (78) as a distinct Prosodic Word, however. Kambera has an unbounded stress system: only the Root-initial syllable is stressed regardless of its weight. As a result, the domain of stress is the Root, not the Prosodic Word, and stress does not provide evidence for the binary footing that Klamer (1998) argues motivates the canonical shape of the reduplicative morpheme.

In MBT, the reduplicative pattern in (78) has a straightforward analysis. The reduplicative morpheme is morphologically categorized as a Root and the reduplicative complex is a Root-Root compound with the following morphological structure: [Prefixes [RED$_{\text{ROOT}}$—Root]$_{\text{ROOT}}$ Suffixes]. Both halves of the complex realize a main stress on the Root-initial syllable due to the stress correspondence constraints for reduplication discussed in section 2.2.3.1, above. Analysing the complex as a Root-Root compound further predicts that only the Root is reduplicated, affixes are not, even when they fall within the disyllabic window of reduplication (compare (78*c*) with (78*f*)). (Because the reduplicative complex is a Root-Root compound, the affixes are adjoined to the entire complex, outside the scope of reduplication.) The analysis is exemplified in (79):

[45] Recall from Chapter 2, footnote 44, that word-final '*u*' in Kambera is not part of the input, but rather occurs due to epenthesis. (Only open syllables are found in Kambera.) See Klamer (1998) for discussion.

(79) Kambera Root reduplication

RED_{ROOT}-[hau]-ngu	BINARITY(σ)	HEADS BRANCH	DEP-BR	MAX-BR
☞ *a.* hau-[hau]-ngu				
b. haungu-[hau]-ngu			**!	
RED_{ROOT}-[banjar(u)]				
☞ *c.* banja-[banjaru]				**
d. banjaru-[banjaru]	**!			
e. ba-[banjaru]		*!		****

In the first candidate set, candidate (79*a*), which reduplicates only the Root, is optimal because it satisfies all the constraints. The competing candidate, (79*b*), is non-optimal as it violates DEP-BR by including the suffix, which is not part of the Base Root. In the second candidate set, (79*d*) is optimal, as the reduplicative Root contains as much of the Base Root as possible without violating BINARITY. Competing candidates are non-optimal, because they either violate BINARITY (79*d*) or do not reduplicate enough of the Base to satisfy HEADSBRANCH.

Turkana (Nilotic), discussed in section 2.3.5, above, provides another example of a language where a bimoraic minimality requirement in a reduplicative construction cannot follow from parsing the reduplicative morpheme into a Prosodic Word and stress Foot. As shown in (80), in the intensive form of the verb, an extra vowel occurs between the Base and the following reduplicative morpheme, so that, in all cases, the reduplicative morpheme is bimoraic (coda consonants, which only occur word finally, are not analysed as moraic by either Dimmendaal (1983) or Noske (1991):

(80) Turkana intensive verbs (Noske 1991; fig. (17); tone is not marked)

	Root	Intensive	Gloss (Intensive)
(*a*)	-poc-	-poc=o.poc-	to pinch repeatedly
(*b*)	-pet-	-pet=e.pet-	to kick repeatedly
(*c*)	-sur-	-sur=u.sur-	to disturb
(*d*)	-da	-da=i.da	to crumple
(*e*)	-en	-en=eʔen	to tie with many bindings

Noske (1991) argues that the best motivation for the epenthetic vowel in the reduplicative construction is to satisfy a bimoraic minimality requirement on the reduplicative morpheme. All the Base Roots in (80) are monomoraic, and the epenthetic vowel provides a second mora for the reduplicative morpheme. We can see most clearly that the epenthetic vowel is satisfying a reduplicative size requirement in (80*d*, *e*). The epenthetic vowel in (80*a*–*c*) is also motivated by the syllable structure of Turkana: if the epenthetic vowel did not occur, the resulting consonant sequences could not be syllabified (e.g. *poc=poc-). The forms in (80*d*, *e*), though, would be syllabifiable without the epenthetic vowel. The only plausible motivation for the epenthetic vowel in these cases is to augment the size of the reduplicative morpheme.

While the generalization appears straightforward, it cannot be analysed in PBT, because Turkana is not a stress language. Without independent evidence that a bimoraic unit constitutes a stress Foot, the bimoraic minimality condition cannot follow from the Prosodic Hierarchy. In MBT, in contrast, this size condition falls out from defining the reduplicative morpheme as a Root, to match the morphological category of its Base, and the reduplicative complex as a Root-Root compound.[46] In (80*a*-*c*), the reduplicative morpheme is augmented for phonotactic reasons, and this also satisfies the branching constraint in (57). The reduplicative Root in (80*d*), though, is not augmented to improve syllabification, but rather only to satisfy branching. Since the VC Root in (80*e*) is augmented even though it satisfies branching (57*b*), it must be that in Turkana only moraic elements satisfy HeadsBranch (6). We return to this point in section 4.3, below.

Finally, an MBT analysis of Fijian and Samoan, both Austronesian, is presented to show that even reduplication patterns which seem to present strong evidence for PBT are easily accounted for in the alternative approach. Both Fijian and Samoan have a bimoraic reduplicative morpheme. In Fijian, the reduplicative morpheme is a

[46] See Dimmendaal (1983) for arguments from Turkana phonology that intensive reduplicative complexes pattern with compounds.

prefix, and both the Base and the reduplicative morpheme have main stress on the penult:

(81) Fijian stress and reduplication (Dixon 1988)

(*a*)	rábe	'kick'	rábe-rábe	'do a lot of kicking'
(*b*)	cúla	'sew'	cúla-cúla	'sew for a while'
(*c*)	mààráu	'be happy'	máa-mààráu	'be permanently happy'
(*d*)	qòolóu	'shout'	qóo-qòolóu	'shout for a while'
(*e*)	butá'o	'steal'	búta-butá'o	'steal often'
(*f*)	tu'í-a	'hammer it'	tú'i-tu'í-a	'hammer it a lot'

In Samoan, the reduplicative morpheme is a suffix, receiving main stress on the penult while the Base is not stressed:

(82) Samoan reduplication (Mosel and Hovdhaugen 1992)

(*a*)	fíti	'flick'	fiti-fíti	pl.
(*b*)	maanáva	'energy'	maanava-náva	pl.
(*c*)	maalúu	'cooling'	maaluu-lúu	'cold'
(*d*)	magóto	'sunk'	magoto-góto	'boggy; apt to overturn'
(*e*)	ta'óto	'lie'	ta'oto-'óto	'rest, recline'

In both languages, the reduplicative morpheme is clearly stressed, and so also potentially footed in a separate Prosodic Word from the Base. These reduplicative morphemes are also the same minimal size as independent words of each language. They are, then, amenable to a PBT analysis of minimality, as we saw in section 2.2.3.2.

The MBT analysis is equally unproblematic. As both of these reduplicative morphemes take a monomorphemic Root as Base, they are categorized as Roots, forming a Root-Root compound with the Base. Neither Fijian nor Samoan allows syllables with Codas, making bimoraic (57*a*) the optimal minimal Root in these languages. As in Japanese Root truncations analysed in (69), above, constraints requiring a match between the prosody of the Base and the corresponding morpheme account for why the bimoraic reduplicative morpheme is monosyllabic if the corresponding Base bimoraic string is monosyllabic and disyllabic if the corresponding Base string is disyllabic. The analysis, essentially identical to that of Kambera (79), is exemplified below with data from Fijian (81):

(83)

RED_{ROOT}-maarau	BINARITY (μ)	DEP-BR(σ)	MAX-BR	HEADS BRANCH
☞ *a.* maa-maarau			***	
b. maarau-maarau	*!			
RED_{ROOT}-cula				
☞ *c.* cula-cula			**	
d. cu-cula			**	*!
e. cuu-cula		*!	**	

Candidate (83*a*) is optimal in the first set, as it satisfies the constraints requiring the reduplicative morpheme to be exactly bimoraic while matching the Base mora and syllable parse. Candidate (83*b*) is non-optimal as it exceeds the bimoraic size limit, in violation of BINARITY (10). In the second candidate set, (83*c*) is optimal, for the same reasons as (83*a*). Candidate (83*d*) is non-optimal as the reduplicative morpheme is monomoraic, violating HEADSBRANCH (57*a*). Candidate (83*e*) is non-optimal as it satisfies HEADSBRANCH by lengthening an input vowel, in violation of DEP-BR (σ).[47]

To sum up this section, we have seen that MBT provides a straightforward analysis of a number of Root reduplication patterns that PBT cannot account for. One advantage of MBT is that it defines monomoraic CVC as satisfying Root minimality requirements, while in PBT only bimoraic CVC satisfies minimality. This allows MBT to account for why monomoraic CVC defines a

[47] Stress assignment in the Fijian and Samoan reduplicative forms illustrated in (81) and (82) is not included in the analysis to save space, as it is entirely straightforward. In Fijian, bimoraic stress Feet are aligned with the right edge of the word and the parse is exhaustive. (That is, the entire word is parsed into Feet.) Parsing must begin again at the right reduplicative Root edge. Both halves of the reduplicative compound are assigned main stress. (As noted in Chapter 2, above, it is common for compounds to have even prosody.) In Samoan, only the penult of words, including compounds is stressed. Samoan, then, has an unbounded system: the rightmost non-final mora of the word is assigned main stress. Notice that since Samoan does not have an alternating stress pattern, the bimoraic size of the reduplicative morpheme does not actually follow from the stress footing of the language.

minimal Root for reduplication and independent words in languages like Palauan and Salishan languages like Lushootseed (see e.g. Broselow (1983), Niepokuj (1991), Shaw (2005)).[48] MBT can also account for minimality constraints on Root reduplications in languages with unbounded stress systems, like Palauan, Kambera, Madurese and Samoan, as well as languages with no stress system, like Turkana. As these languages do not provide evidence for binary stress Footing, PBT cannot establish the correlation between stress Foot and Prosodic Word which motivates minimality. In short, MBT provides a more generally valid definition of possible Root shapes, allowing it to account for a larger range of cases of reduplicative minimality than the Prosodic Hierarchy-based approach.

3.2.3. *Affixes in prosodic morphology*

In MBT, Affixes are defined as simplex non-head morphemes. As simplex morphemes, they are optimally monosyllabic, as required by Morph-Syll (5). As non-heads, they optimally do not branch to maintain an asymmetry with monosyllabic Roots. In PBT, Affixes are also optimally non-branching monosyllables, but for different reasons. Affixes are not parsed as Prosodic Words, so they are not required to be larger than a monomoraic monosyllable. Because of the similarity in how Affix is characterized in the two theories, there are no important empirical differences in the two approaches. However, for the sake of completeness, this section sketches how canonical monosyllabic shape is optimized for prosodic morphemes classified as Affixes.

3.2.3.1. *Affixal reduplication* Several of the languages with Root reduplication discussed in the preceding section also have an Affixal reduplication pattern. As shown in (84)–(87), the Affixal reduplicative morpheme is non-branching (C)V in all the languages, in contrast to the branching Root reduplicative morpheme:

[48] See Inkelas and Zoll (2005) and Zoll (2002) for discussion of CVC reduplication in Klamath, which they characterize as Root-Root compounding.

(84) Lushootseed Diminutive reduplication (Urbanczyk 2000: fig. (24))

ʔálʔal	'house'	ʔá-ʔalʔal	'hut'
ʔúq^{w}'ud	'pull out'	ʔú-ʔuq^{w}'ud	'pull part way out'
híw-il	'go ahead'	hí-hiw-il	'go on ahead a bit'
q'íx^{w}	'upstream'	q'í-q'ix^{w}	'a little upstream'

(85) Kambera CV reduplication (Klamer 1998: 35)

wátu	stone	wa-wátu
wéi	pig	we-wéi
háila	saddle	ha-háila
ha-ngángi	be ready	ha-nga-ngángi
pa-íta-ng(u)	show X to Y	pa-i-íta-ng(u)

(86) Samoan CV reduplication (Mosel and Hovdhaugen 1992: 220–5)

atamái	non-erg. v. 'clever'	ata-ma-mái	pl.
mótu	non-erg. v. 'break'	mo-mótu	erg. v. 'break'
alófa	non-erg. v. 'love'	a:-lo-lófa	pl.
a:vága	non-erg. v. 'elope'	a:-va-vága	pl.
ma'alíli	non-erg. v. 'cold'	ma'a-li-líli	pl.

(87) Palauan Cɛ reduplication (Finer 1986–7: 110; Zuraw 2003)

(*a*)

bətók^{h}	'many'	bɛ-bətók^{h}	'just more than enough'
rəgós	'sweet'	mə–rɛ-rəgós	'rather sweet'
ol-ðíŋəl	'visit'	ol-ðɛ-ðíŋəl	'keep visiting'

(*b*) Palauan imperfect Cɛ reduplication (Finer 1986–7: 118)

bəkall	'sailing'	o-məkall	'sail, drive'	om-bɛ-bəkall
ʔəlebəd	'club (N)'	mə-ŋəlebəd	'hit'	mə-ʔɛ-ʔəlebəd

There is independent evidence in all the languages that these CV reduplicative morphemes are to be categorized as Affix. CV is the canonical form of Affixes in Kambera (Klamer 1998) and Lushootseed (Urbanczyk 1996), and in Kambera this reduplicative morpheme, like other prefixes, is not stressed. In Kambera and Samoan, the reduplicative morpheme has less marked syllable structure than the Base: no long vowels or diphthongs in Kambera, an obligatory Onset in Samoan. These reductions in size and structure are consistent with an Affix analysis. And in Palauan, Finer (1986–7) argues that the reduplicative morpheme illustrated in (87) is an Affix as it blocks nasal fusion, a process that the Root reduplicative morpheme—like other Roots—undergoes, as we saw above in (70).

In MBT, the monosyllabic size of the Affix is accounted for by the same constraint relevant for Roots: the MORPHEME-SYLLABLE CORRELATION (5) optimizes monosyllabic morphemes. Unlike Roots, Affixes are not subject to HEADSBRANCH (57), so nothing compels Affixes to be longer than CV. What optimizes maximal CV Affix shape is the converse of HEADSBRANCH: a constraint enforcing the asymmetry between Heads and non-Heads by penalizing branching structure in Non-Heads:

(88) BRANCHING ASYMMETRY: Non-Heads do not branch.

This constraint formalizes the proposal, familiar from work on Licensing and Heads like Beckman (1997, 1998), Dresher and van der Hulst (1998), and Harris (1990), that non-Heads cannot license complex or branching structure. Ranking this constraint and MORPH-SYLL (5) above MAX-BR optimizes CV as the canonical shape for Affixes. The analysis is exemplified in (89), with data from Lushootseed (84):

(89) Lushootseed diminutive(Affixal) reduplication

/DIM$_{AFX}$-hiw-il/	MORPH-SYLL	BRANCH ASYMM	MAX-BR
☞*a.* hi-hiwil			***
b. hiw-hiwil		*!	**
c. hiwil-hiwil	*!	*	

Candidate (89*a*) is optimal, as it satisfies the two high-ranked constraints defining a monomoraic monosyllable as the optimal Affix shape. Candidates (89*b*) and (89*c*) are both non-optimal, as they branch. Moreover, candidate (89*c*) violates MORPH-SYLL (5), as it is disyllabic.

An apparent exception to the generalization that reduplicative Affixes do not branch is found in Fox (Algonquian). This language, too, contrasts two types of reduplicative morphemes, in this case a monosyllabic (middle column) and a disyllabic (rightmost column):

(90) Fox reduplication (Dahlstrom 1997: 206, 212, 218)

(*a*)	nowi:-wa 'he goes out'	na:-nowi:-wa	nowi-nowi:-wa
(*b*)	wi:tamaw-e:wa 'he tells him'	wa:-wi:tamaw-e:wa	wi:ta-wi:tamaw-e:wa
(*c*)	ko:kenike:-wa 'he does the washing'	ka:-ko:kenike:-wa	
(*d*)	kya:t-amwa 'he keeps it for himself'	ka:-kya:t-amwa	

The monosyllabic reduplicative morpheme contains the fixed vowel *a:* and the onset is frequently simplified, as in (90*d*). The disyllabic reduplicative morpheme copies the first syllable of the Base exactly, but the second syllable cannot contain a long vowel and must contain an open syllable.[49]

As Inkelas and Zoll (2005) show, morphologically the disyllabic reduplicative morpheme is a bimorphemic Stem, forming a Stem-Stem compound with its Base. The restrictions on the second syllable of this morpheme are consistent with a Stem-Stem compound analysis. MBT straightforwardly accounts for the disyllabic size through ProsodicStem (9*b*): the bimorphemic structure of a Stem is reflected in a disyllabic minimality requirement. (Recall, it is a potential problem for PBT that no information on the Fox stress system is available, so we do not know whether the disyllabic reduplicative morpheme is a separate stress domain or a minimal stress Foot.) The length of the monosyllabic reduplicative morpheme is consistent with categorizing it as an Affix. However, the long vowel in this morpheme violates the Branching Asymmetry constraint (88). Notice that the quality as well as the length of this morpheme are fixed, though, suggesting this vowel is in the input, and reduplication supplies only a simplex Onset for the vowel. The analysis would then be identical to (89), except that high-ranked Faith-IO would optimize maintaining the input long vowel in

[49] The presentation of these two patterns has been simplified to ease comparison with the other languages discussed. The interested reader should consult Dahlstrom (1997) and Inkelas and Zoll (2005) for detailed discussion.

the output, rather than copying in the reduplicative morpheme a vowel corresponding to the Base. (Other cases like this, where only a single segment of the Base is reduplicated, are discussed further in Chapter 5.)

3.2.3.2. *Affixal truncations (or Root?) in Zuni* Zuni presents an example where a CV syllable is a target for compounding truncation, like the Root compounding truncation in Japanese and Madurese discussed above:

(91) Zuni compounds (McCarthy and Prince 1986: fig. (80))

tukni	<u>tu</u>-mok^{w}k^{w}'anne	'toe-shoe = stocking'
melika	<u>me</u>-k^{w}iʃʃo	'Non-Indian-negro = black man'
melika	<u>me</u>-ʔoʃe	'Non-Indian-be:hungry = hobo'
patʃu	<u>pa</u>-lokk'a-ak^{w}e	'Navajo-be:gray = Ramah Navajo'

McCarthy and Prince argue that the truncated forms are, in fact, Roots, as they match the minimal bound Root size in Zuni. (Minimal lexical words, in contrast, are bimoraic.) I propose, instead, that these truncated compounds are Affixes, as this is consistent with their shape. Indeed, Niepokuj (1991) argues that over time compounds typically undergo this kind of phonological reduction, from a full Root or Stem to a reduced Root or Stem to an Affix. The Zuni data does, however, illustrate how difficult it can be to distinguish when reduction in size has led to a change in category from Root to Affix. As all generalized template theories of canonical form rest on the claim that there is a correlation between morphological category and prosodic shape, it is crucial to an analysis to be able to determine the morphological category. Uncertainty like that found in Zuni about the correct category is a problem, and we will return to it in Chapter 5.

3.3. Summary

To sum up, in this chapter I have argued for an alternative version of GTT which divorces canonical shape from the Prosodic Hierarchy. The key claim of this theory is that the basic morpheme-prosody correlation is between a single morpheme and a single syllable. The cross-linguistic tendency for words and major morphemes to be subject to minimality constraints that exceed a single light syllable are attributed to a Head-Dependent Asymmetry: Heads must branch while non-heads may not (Dresher and van der Hulst 1998). Further, minimally bimorphemic Stems must minimally branch into two syllables, one for each morpheme.

The case studies presented in this chapter show that divorcing canonical size constraints from the Prosodic Hierarchy allows MBT to account for minimality effects in a wider range of morphological categories—Stem, Root, and Affix—and for a wider range of languages, as binary stress footing need not be attested to motivate minimality in this alternative. Correlating bimorphemic Stem structure with disyllabicity immediately accounts for the derived word disyllabicity condition we saw is found in many languages. In PBT, there is no reason for derived words to be subject to a different minimality condition than underived. A Stem disyllabicity requirement is also found in languages where Stem is a core lexical category: e.g. Bantu languages, Axininca Campa, Fox, and the non-concatenative verb conjugations of Arabic, Modern Hebrew, and Sierra Miwok. Stem disyllabicity falls out from MBT's ProsodicStem constraint (9*b*). PBT can only account for disyllabic minimality, if there is evidence from the stress system that the Stem is parsed as a Prosodic Word dominating a disyllabic stress Foot. As we saw, this sort of evidence is often lacking.

Similar problems are raised by Root prosodic morphemes. Monomoraic CVC is a common minimal Root, even in languages where this string cannot be a minimal stress Foot. As a result, PBT has no explanation for why CVC is a canonical Root shape. In MBT, where minimality is defined in terms of branchingness rather than weight, a CVC string satisfies minimality requirements as it contains a branching rhyme whether it is monomoraic or bimoraic. MBT can also account for Root minimality in languages with unbounded stress, like Samoan, or no stress, like Hausa or Turkana. PBT fails to provide an account, as minimality requirements must correlate with independently motivated binary stress footing.

In some cases, though, we have seen that morphological category alone does not predict optimal branching. For example, Roots must be minimally bimoraic (not CVC) in languages like Fijian and Samoan because they do not allow syllables with Coda consonants. And prosodic Root strings can be required to match the syllable parse of the Base string in languages like Japanese or Madurese, leading to Prosodic Roots which are larger or smaller than morphological branching constraints alone would predict. The role of non-morphological factors like these in defining optimal canonical shapes is the topic of the next chapter.

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4

The Role of Phonology in Defining Canonical Form in MBT

The preceding chapter concentrates on the role of morphologically motivated branching in accounting for the canonical form of prosodic morphemes. Monomorphemic Root correlates, in MBT, with a branching monosyllable. Bimorphemic Stem correlates with branching into a disyllable. The Stem-disyllabicity correlation appears to be quite stable and consistent. It is not difficult, however, to find Roots which are either larger or smaller than predicted. The most common minimal word size in Gordon's (1999) survey, for example, is CV, even though a Root (the minimal constituent of a Word and its Head) is expected to minimally branch. And Roots in Diyari and other Australian languages discussed in Chapter 2 are disyllabic, rather than the expected monosyllable. Prosodic Roots can also be variable in size, for example, we saw that Root truncations in Madurese are always monosyllabic, as expected for Roots, but its branching matches that of the corresponding Base syllable. In this chapter, we shall see that many apparent exceptions to optimal Root branching like these can straightforwardly be accounted for through the standard OT technique of variable constraint ranking. Constraints on prosodic and segmental well-formedness interact with the morphologically motivated branching constraints developed in Chapter 3 to determine the optimal canonical form.

4.1. Prosodic faithfulness and prosodic variability

A defining property of partial reduplication (as opposed to total) and of simple truncation, illustrated in most of the examples discussed, is that these prosodic morphemes have a fixed shape. In the case of Prosodic Root reduplication or truncation, the optimal fixed shape, in MBT, is a branching monosyllable. Variability in shape is fairly common, however. In this section, I show that constraints requiring a match in the prosodic parse of the reduplicative or truncate string and a corresponding Base string account for many cases of shape variability.[1]

We begin our discussion of the role of prosodic correspondence and shape variability by taking another look at the Madurese Root truncation and partial reduplication patterns presented in section 3.2.2 and repeated below. Recall that monosyllabic Prosodic Root is a truncation target in this data. Notice that the monosyllable is sometimes branching and sometimes not, to match the Base-final syllable:

(1) Madurese (McCarthy and Prince 1986: fig. (81); Stevens 1968; Weeda 1987)

(*a*) *Partial reduplication*

abit	bit-abit	'finally'
buwaʔ	waʔ-buwaʔ-an	'fruits'
estre	tre-estre	'wives'

(*b*) *Vocative*

settoŋ	toŋ	'one'
duwaʔ	waʔ	'two'
enghi	ghi	'yes'

The generalization that the truncation syllable and the corresponding Base syllable must match is formalized by the correspondence constraint in (2*a*). The constraints defining optimal Roots as branching monosyllables which were motivated in section 3.1.1, above, are repeated in (2*b*) and (2*c*):

[1] See work like Spaelti (1997) for discussion of other sources of variability in reduplicative morpheme shape.

(2) (*a*) Dep-BT: The truncation string matches the corresponding Base string.

(*b*) Morph-Syll: Morphemes are coextensive with syllables.

(*c*) HeadsBranch:
Lexical heads (Roots) must prosodically branch [i.e. have more than one daughter].

The role of Dep-BT in optimizing the variably branching realization of the truncations in (1*b*) is exemplified in (3).[2]

(3)

enghi-Trunc	Morph-Syll	Trunc=PrRoot	Dep-BT	Heads Branch	Max-BT
☞ *a.* enghi—ghi$_{Root}$				*	**
b. enghi—ghiʔ $_{Root}$			*!		**
c. enghi—enghi $_{Root}$	*!*				
settoŋ—Trunc					
☞ *d.* settoŋ—toŋ$_{Root}$					***
e. settoŋ—settoŋ$_{Root}$	*!				

Candidate (3*a*) is optimal in the first candidate set, as it satisfies the highest-ranked constraints defining the truncation as a monosyllabic Root, matching the final syllable of the full form. Candidate (3*b*) is non-optimal, as a glottal stop has been epenthesized to allow the truncated syllable to branch, in violation of higher-ranked Dep-BT. Candidate (3*c*) is non-optimal, as the truncation violates Morph-Syll (2*b*), the constraint requiring simplex morphemes like Prosodic Root to be a single syllable. (This constraint can be violated by the Base, as it is outranked by Faith-IO. No violations of Morph-Syll are counted for the Base to simplify the presentation.) In the second candidate set, (3*d*) is optimal, as truncating to the final syllable in this case satisfies all the highest-ranked constraints. The

[2] The tableau in (3) omits two constraints, Anchor-Right and ProsodicStem, found in tableau (66) in Chapter 3 analysing the same data, to simplify the presentation. As Anchor-Right is satisfied by all the candidates in (66) and ProsodicStem is violated by all the candidates, these constraints do not play a role in choosing the optimal output.

disyllabic candidate (3*e*) is non-optimal because it gratuitously violates Morph-Syll. The partial reduplication data in (1*a*) would have an essentially identical analysis.

In the case of Madurese, a correspondence constraint optimizes a prosodic morpheme that is shorter than expected: a non-branching monosyllabic Root. In some other Austronesian languages—Manam, Maori and Malagasy—prosodic correspondence constraints optimize the variability which leads to reduplicative morphemes which are longer than expected: disyllabic Roots. In each case, we will see that Foot correspondence is the main factor motivating the variability in reduplicative length.

In Manam, an Austronesian language spoken in Papua New Guinea, for example, words are generally assigned main stress on the penultimate mora and secondary stress on every other mora preceding the main stress.[3] Lichtenberk (1983) shows that one productive pattern of reduplication in Manam copies the final two moras of the Root. The reduplicative morpheme receives main stress, while the corresponding, adjacent Base string is assigned secondary stress (other secondary stresses are not indicated). Notice that the reduplicative morpheme (underlined) is sometimes monosyllabic and sometimes disyllabic, to match the syllabification of the corresponding bimoraic Base string:

(4) Manam reduplication (Lichtenberk 1983: 598–613; McCarthy and Prince 1986; Buckley 1998*b*)

salága	'be long'	salàga-lága	'long (sg.)'
malípi	'work'	malìpi-lípi	'work'
moatúbu	'be sweet'	moatùbu-túbu	'sweet'
ʔarái	'ko ginger'	ʔaràì-rái	'green (sg.)'
malabóŋ	'flying fox'	malabòm-bóŋ	'pl.'

[3] As Buckley (1998*a*, 1998*b*), Halle and Kenstowicz (1991), and McCarthy and Prince (1986) argue, this stress pattern can be accounted for if the stress foot in Manam is a moraic trochee. (Coda nasals are moraic.) See these works for more detailed discussion of stress and reduplication in Manam.

As Buckley (1998*b*) shows, the reduplicative morpheme can also be monosyllabic if disyllabic reduplication would lead to four identical syllables in a row: *ragogo-go* (**ragogo-gogo*). See Buckley for detailed discussion and analysis.

The mirror image stress and near identical reduplication pattern is found in Maori, an Austronesian language spoken in New Zealand. As we saw in section 2.2.3.2, main stress is assigned to the leftmost mora of the Word, and secondary stress is assigned to every other following non-final mora. One common reduplication pattern copies the final two moras of the Root. As shown in (5), the reduplicative morpheme (underlined) is sometimes monosyllabic and sometimes disyllabic, to match the syllabification of the corresponding bimoraic Base Foot. As shown in (5*c*–*d*), the vowel of the initial (main stressed) syllable is lengthened when trimoraic forms are reduplicated to allow a match in footing of the corresponding strings:[4]

(5) Maori reduplicaton (Meyerhoff and Reynolds 1996: 148, figs. (7), (8))

(*a*)	páku	'dry, shrivel'	páku-pàku	'dried'
(*b*)	mátapìhi	'window'	mátapìhi-pìhi	'open up'
(*c*)	kóhiko	'interrupt'	kóohìko-hìko	'do irregularly'
			(*kóhiko-híko; *kóhikó-hiko)	
(*d*)	páhuu	'explode'	páahùu-hùu	'pop, crackle'

A final variation on this theme comes from Malagasy, an Austronesian language spoken on the island of Madagascar. As Keenan and Polinsky (1998) show, most Malagasy words have almost the same stress pattern as Manam: main stress is assigned to the penult and secondary stress to every other syllable preceding the main stress (see (6*a*–*c*)). There are also two lexically determined exceptional stress patterns. In one, the final syllable is stressed (6*d*). In the other, the final syllable cannot be footed, and main stress is assigned to the antepenult (6*e*–*f*). One common reduplication pattern copies the final Foot of the Root. As shown in (6), the reduplicative morpheme (underlined) is sometimes monosyllabic and sometimes disyllabic (or slightly longer), to match the length of the corresponding Base Foot:[5]

[4] See Chapter 2, fig. (51), for the PBT analysis of the Maori foot-matching reduplication pattern.

[5] As Keenan and Polinsky (1998) show, a Root-initial continuant consonant corresponds with a non-continuant in the reduplicative morpheme. It is beyond the scope of this analysis to account for these alternations. See Keenan and Polinsky for discussion.

(6) Malagasy reduplication (Keenan and Polinsky 1998: 571, 578)

(*a*)	máimbo	'stinky'	màimbo-máimbo	'somewhat stinky'
(*b*)	hadíno	'forget'	ha-dìno-díno	'forget a bit'
(*c*)	àlahélo	'sadness'	àla-hèlo-hélo	'little sadness'
(*d*)	lèhibé	'big, numerous'	lèhi-bè-bé	'fairly big, numerous'
(*e*)	évotra	'bouncing back'	èvotr-évotra	FREQUENTATIVE
(*f*)	fántatra	'known'	fànta-pántatra	'fairly known'

In the MBT analysis, the reduplicative morpheme is a Root in Manam, Maori, and Malagasy. This matches the category of the Base, arguably a Root, as affixes are not reduplicated. Also, the reduplicative morphemes are minimally bimoraic (except in Malagasy), matching the canonical size of other Roots in each language. The generalization that we want to account for is that the reduplicative morpheme is not always a branching monosyllable as expected for Roots. It can be disyllabic or monomoraic, if the corresponding Base Foot is. This match in footing between corresponding Base and reduplicative segments is defined by the following constraint, motivated in section 2.2.3.2, above, for Maori:

(7) Ident-BR(Pros):
The footing of the Reduplicative segment string must match the footing of the corresponding Base string.

Ranking the constraint in (7) above Morph-Syll (2*b*) and Heads-Branch (2*c*) makes it optimal for the reduplicative morpheme to be variable in size to match the corresponding stress Foot of the Base, instead of being a fixed branching monosyllable, as expected for Root morphemes:

(8) Constraint ranking accounting for reduplicative Foot correspondence:[6]
Ident-BR(Pros) (7) $\gg$ Morph-Syll (2*b*), HeadsBranch (2*c*) $\gg$ Max-BR(seg)

[6] Recall from section 3.1.1 that Binarity is the constraint which penalizes non-binary constituents. Ranking Binarity above Faithfulness constraints—in this case Max-BR(seg)—accounts for a binary maximality constraint on a prosodic morpheme. Binarity is omitted to save space in (9), as it does not play a crucial role in the analysis of Manam.

The tableau in (9) shows that the analysis straightforwardly accounts for the variable size of the reduplicative morpheme in Manam, illustrated in (4):

(9) Manam reduplication

salaga-RED$_{Root}$	IDENT-BR(PROS)	MORPH-SYLL	HEADS BRANCH	MAX-BR(SEG)
☞ *a.* sa(làga)-(lága)		*		**
b. sa(làga)-(gá)	*!		*	****
malaboŋ-RED$_{Root}$				
☞ *c.* mala(bòŋ)-(bóŋ)				****
d. mala (bòŋ)-la(bóŋ)		*!		**

Candidate (9*a*) is optimal in the first candidate set. Even though it is disyllabic, a non-optimal Root size, it satisfies the higher-ranked constraint, IDENT-BR(PROS) (7), requiring a match in the segments parsed by the Base Foot and the reduplicative Foot. Monosyllabic candidate (9*b*) is non-optimal as it violates this constraint. In the second candidate set, monosyllabic (9*c*) is optimal, as it satisfies all of the highest-ranked constraints. Candidate (9*d*) is non-optimal, as it gratuitously violates MORPH-SYLL (2*b*): it is disyllabic even though the corresponding Base Foot is a branching monosyllable.

The analysis of the Maori pattern illustrated in (5) is almost identical. We need only add the familiar constraint, DEP-IO, ranked below IDENT-BR(PROS) (7), to account for the fact that input vowels are lengthened to allow a match in the footing of the corresponding Base-reduplicative strings. The tableau in (10) illustrates this:

(10) Maori reduplication

matapihi-RED$_{Root}$	IDENT-BR(PROS)	MORPH-SYLL	DEP-IO	HEADS BRANCH	MAX-BR(SEG)
☞ *a.* (mata)(píhi)- (píhi)		*			****
b. (máta)(píhi)- (híi)	*!				******
pahuu-RED$_{Root}$	IDENT-BR(PROS)	MORPH-SYLL	DEP-IO	HEADS BRANCH	MAX-BR(SEG)
☞ *c.* (páa)(hùu)-((hùu)			*		**
d. (páhu)u-(hùu)	*!				**
e. (páhu)u-(páhu)		*!			*

In the first candidate set, disyllabic (10*a*) is optimal, as the Base Foot and the corresponding reduplicative Foot parse the same string, satisfying highest-ranked IDENT-BR(PROS) (7). The monosyllabic competing candidate (10*b*) is non-optimal, as it violates this constraint. (It also violates DEP-BR, not shown, as the length of the reduplicative vowel does not match the length of the corresponding Base vowel.) In the second candidate set, it is optimal to lengthen the input vowel of the initial syllable, as in (10*c*). Even though lengthening the vowel violates DEP-IO, it allows the higher-ranked constraints on reduplicative shape to be satisfied. Not lengthening the vowel necessarily leads to either a mismatch between Base and reduplicative footing, as in (10*d*), or a gratuitous violation of MORPH-SYLL (2*b*), as in (10*e*).

The analysis of the Malagasy pattern in (6) requires another minor modification of the Manam analysis in (9). I follow Hannahs (2004) in proposing that the variable shape and position of the reduplicative morpheme is best accounted for if it is infixed, aligned before the main stress Foot. (Recall from section 2.2.4, above, that one reduplicative morpheme of Samoan is also aligned before the main stress Foot.) The constraint in (11) formalizes this proposal:

(11) ALIGNFT: Align(R, RED; L, Head Foot)
Align the right edge of the reduplicative morpheme with the left edge of the Head Foot.

This constraint defines the final Foot, rather than the Root, as the Base for reduplication. Ranking this constraint above HEADS-BRANCH (and BINARITY) accounts for the fact that the position and shape of the Malagasy reduplicative morpheme is determined by the main stress Foot. Ranking FTBIN, the constraint requiring Feet to be minimally disyllabic, below MAX-IO, the constraint requiring input and output footing to match, penalizes monosyllabic Base (and reduplicative) Feet except in the case of Bases with final stress. The analysis is exemplified in (12)–(14); the reduplicative morpheme is underlined in the tableaux.

In Bases with regular penult stress, the final two syllables—the main stress Foot—are optimally reduplicated, as shown in tableau (12):

(12) Malagasy reduplication with penultstress

alahelo, RED$_{\text{ROOT}}$	MAX-IO (SEG, FT)	FT-BIN	MORPH-SYLL	ALIGN-FT	HEADS-BRANCH	MAX-BR (SEG)
☞ *a.* (àla)-(<u>hélo</u>)- (hélo)			**			***
b. (<u>àla)(hélo</u>)- (àla)(hélo)			**	*!		
c. a(làhe)- (l<u>ò)</u>- (ló)		*!*			*	*****

Constraint ranking for Malagasy: IDENT-BR(PROS), MAX-IO(SEG, FT) ≫ FTBIN ≫ MORPHSYLL ≫ ALIGNFT ≫ HEADSBRANCH, BINARITY ≫ MAX-BR (SEG)[7]

Candidate (12*a*) is optimal, as reduplicating the final two syllables allows the reduplicative morpheme to be properly aligned with a well-formed stress Foot, satisfying the two highest ranked constraints. Total reduplication, as in candidate (12*b*), is non-optimal because the reduplicative morpheme is not aligned with the stress Foot. (It also violates BINARITY, as the reduplicative morpheme exceeds the two syllable maximal size defined by BINARITY.) Reduplicating only the final syllable (and stressing it), as in (12*c*), violates FTBIN: all things being equal, stress is on the penult, parsing the final two syllables in a binary foot, in Malagasy.

Bases with lexically marked final stress optimally reduplicate just the final stressed syllable, as shown in (13):

(13) Malagasy reduplication with final stress

lehi(bé-RED$_{\text{ROOT}}$	MAX-IO (SEG,FT)	FT-BIN	MORPH-SYLL	ALIGN-FT	HEADS-BRANCH	MAX-BR (SEG)
☞ *a.* lehi- (<u>bè</u>)-(bé)		*	*		*	****
b. le-(<u>hìbe</u>)- (híbe)	*!		**			**

I am following work like Inkelas (1999) in proposing that exceptional stress patterns are best formalized by prespecifying the

7 IDENT-BR(PROS) is omitted from (12) and (13), as it is too high-ranked to play a role in choosing optimal candidates. Any contender must satisfy it. BINARITY is also omitted, as it is too low ranked to play a role in choosing optimal candidates in words with these stress patterns.

footing in the input. Candidate (13*a*) is optimal, as it satisfies the high-ranked constraint requiring the input footing to be realized in the output. The reduplicative morpheme optimally matches this Base footing. The competing candidate does not maintain the input footing in the Base. As a result, it is non-optimal.

Tableau (14) exemplifies the role of high-ranked ONSET in optimizing reduplicative overcopy in vowel-initial Roots with antepenult stress:[8]

(14)

evo)tra-RED$_{\mathrm{ROOT}}$	MAX-IO (SEG,FT)	IDENT-BR(PROS)	ON-SET	ALIGN-FT	BIN-ARITY	MAX-BR(SEG)
☞ *a.* (èvo)tr-(évo)tra				**	*	
b. (èvo)-(évo)tra			*!			
c. e-(vòtra)-(vótra)	*!					
d. (èvo)(tr-évo)tra		*!				**

ONSET: Syllables must begin with an Onset. $\left({}^{*}{}_{\sigma}\left[\mathrm{V}\right.\right)$

Candidate (14*a*) is optimal, as it satisfies the highest ranked constraints: MAX-IO(SEG, FOOT), requiring input footing to be realized in the output, and IDENT-BR(PROS), requiring Base footing to be matched by the reduplicative morpheme, and ONSET. Reduplicating just the main stress Foot, as in candidate (14*b*), is non-optimal as it violates ONSET. The candidates that satisfy ALIGNFT, (14*c*, *d*), are non-optimal as they violate higher-ranked constraints. In (14*c*), the output footing does not match the input, in violation of MAX-IO(SEG,FT). In (14*d*), the Base and reduplicative Feet do not parse the same string, in violation of IDENT-BR(PROS) (7).[9]

To sum up this section, the Manam, Maori, and Malagasy reduplication patterns at first seem problematic for MBT. Roots are expected to be branching monosyllables in this theory, yet in

[8] See Crowhurst (2004), Downing (1998*a*, 1999*a*, 2000) and Fitzpatrick Cole (1994) for discussion and analysis of other languages where various kinds of overcopy occur in reduplicating vowel-initial Bases to satisfy ONSET.

[9] FTBIN and MORPH-SYLL are omitted from (14) to keep the tableau to a manageable size. FTBIN is so highly ranked, that it is necessarily satisfied by the optimal output candidate. Any candidate which satisfies FTBIN necessarily violates MORPH-SYLL, so it also can play no role in choosing the optimal candidate.

these languages prosodic morphemes classified as Roots are variable in size, sometimes larger and sometimes smaller than expected. In all these cases, though, the variable shape can be straightforwardly analysed by ranking constraints requiring the prosodic morphemes to match the prosodic constituency of the Base above the constraints defining Roots as branching monosyllables (Morph-Syll (2*b*) and HeadsBranch (2*c*)). This shows that prosodic well-formedness constraints can influence canonical morpheme shape by determining optimal satisfaction of the branching requirements. The next sections further develop this point.

4.2. Phonotactics and branching

As noted in Chapter 3, it is a problem for MBT, as for PBT, that CV is the most common minimal word size. This minimal syllable does not satisfy either HeadsBranch (2*c*), as required in MBT, or the minimal Prosodic Word-stress Foot correlation, as required in PBT. We have also not explained so far why CVC, rather than CVV, is the next most common minimal word size. Finally, we have not explained why words which are monomorphemic Roots are minimally disyllabic in some languages, rather than monosyllabic, as expected in MBT. In this section I show that many apparent mismatches between the branching predicted by MBT and the attested minimal branching are straightforwardly accounted for by taking a closer look at the phonotactics of the particular language. As we shall see, variably ranking phonotactic constraints with HeadsBranch (2*c*) and Morph-Syll (2*b*) defines a more fine-grained factorial typology of prosodic morpheme size that better accounts for the attested range in canonical Root size.

One of the most striking results of Gordon's (1999) survey of minimal word size, summarized in fig. (58) of Chapter 3, is that a significant majority of languages—including stress languages—have CV minimal words. This means that, contrary to the predictions of PBT, most languages do not, in fact, require minimal words to contain a minimal binary stress Foot. Instead, this finding is more compatible with MBT's prediction that minimal words should be minimally monosyllabic Roots. However, MBT also requires monosyllabic Roots to branch, so that CVV or CVC monosyllables would be the optimal minimal word sizes. Why, then, is CV so common instead?

In order for CVV to be a possible minimal word, the language must independently allow a vowel length contrast, and allow this contrast to be realized in word-final position. Maddieson's (1984) survey of some 300 languages, though, shows that only around 40 (less than 15%) have a phonemic vowel length contrast. As work like Buckley (1998*c*) and Gordon (1999: 266) shows, it is also common cross-linguistically for word-final syllables to contain only short vowels, even though long vowels can occur elsewhere in the word. Choctaw, discussed in section 2.2.1, is an example of such a language. (Although we also saw in section 2.3.1 that Bengali, a language without a vowel length contrast, lengthens vowels of CV Roots to satisfy word minimality, this would have to be considered an unusual case rather than a representative one, as word-final syllables with distinctively long vowels are marked. In the next section, motivation from intonation for lengthening is discussed.)

In order for CVC to be a possible minimal word, the language must independently allow coda consonants in word-final position. Syllables with codas are uncontroversially considered more marked (Clements and Keyser 1983; Jakobson 1962: 526; Prince and Smolensky 2004). Furthermore, as work like Harris (1994: 162) and Harris and Gussmann (1998) demonstrates, many languages which allow word-internal Codas ban them in word-final syllables. In short, CV is a common minimal word size, even though it violates branching because the syllabic constraints—NoCoda and *VV—severely restrict the number of languages where branching monosyllabic Roots are possible outputs.

In MBT, the generalization that CV is the least marked Root minimal word type can be formalized by ranking the constraints optimizing minimal Root structure—Morph-Syll (2*b*), NoCoda, *VV—above the constraint, HeadsBranch (2*c*), optimizing (marked) branching structure in Roots. The analysis is exemplified in (15):

(15)

	NoCoda	*VV	Morph-Syll	HeadsBranch
CVCV			*!	
CVV		*!		
CVC	*!			
☞CV				*

NoCoda: Syllables do not have codas. (Prince and Smolensky 2004)
*VV: Long vowels are marked. (Rosenthall 1994)

It is unclear how PBT could account for why CV is the most common minimal word. In this theory, CV should only be a possible minimal word in languages where CV is also a possible main stress Foot (Hayes 1995). Because the basic morpheme-prosody correlation is between Prosodic Word and stress Foot, it is entirely unexpected that the most common minimal word turns out to be the most marked Foot. In MBT, in contrast, where the basic morpheme-prosody correlation is between Prosodic Word (Root) and syllable, factorial typology predicts that the least marked syllable should be a common minimal word type, as shown in (15).

Gordon's (1999) survey shows that CVC is by far the most common minimal word type that is longer than CV, widespread even in languages where CVC is not a minimal stress Foot. I suggest that CVC is a more common monosyllabic minimal word type than CVV for a couple of reasons. First, even though CVC monosyllabic words contain a marked Coda consonant, they satisfy HeadsBranch (2*c*) and Morph-Syll (2*b*) without relying on a relatively rare contrast in (word-final) vowel length.[10] Indeed, Gordon (1999: 267) confirms this correlation, noting that 'a great many languages without

[10] As work like Harris (1994) and Harris and Gussmann (1998) argues, in many languages, word-final consonants pattern phonologically as Onsets rather than Codas. In languages like these, CVC words would not violate NoCoda. (It is unclear to me whether they could still qualify as monosyllables.)

contrastive vowel length have CVC minimal word requirements'. Lushootseed, discussed above, provides an example. Another factor favouring CVC as a minimal word type is that many languages (even languages with vowel length contrasts) require all words to end in a consonant. (This tendency is formalized in McCarthy and Prince's (1994*a*: 357) FINAL-C constraint.[11] It is curious that word-final syllables have these contradictory special properties: they must end a consonant in some languages, and cannot in others.) The Austronesian language Yapese, discussed in section 2.3.1, provides an example. As Jensen (1977) shows, while CV(V) syllables are possible in other positions, all word-final syllables must end in a consonant. A CVC syllable is therefore the minimal form which satisfies HEADS-BRANCH and FINAL-C.

In Gordon's (1999) survey, CVCV is the least common minimal word type. One explanation for this is that only languages in which all words are minimally bimorphemic Stems are expected to impose a disyllabic word minimality requirement. Verbs in Axininca Campa and Bantu languages provide examples of this correlation between a disyllabicity requirement and morphological complexity. Under the assumption that words in most languages are minimally monomorphemic Roots, we would expect the disyllabic minimality constraint to be relatively rare. We still need to explain why a certain number of languages require monomorphemic Roots to be disyllabic, however. As shown in the tableau in (16), a factorial typology based on the constraints in (15) actually predicts this possibility. Reversing the ranking of HEADSBRANCH (2*c*) and MORPH-SYLL (2*b*) which optimizes CV minimal words in (15) optimizes disyllabic minimality in languages where NOCODA and *VV remain highly ranked:

[11] As noted in section 3.2.1.1, above, McCarthy (2005) argues that the FINAL-C constraint in Classical Arabic is a paradigm uniformity effect. Consonant-final Stems are always syllabifiable on their own and never create vowel hiatus with a following vowel-initial suffix. It is an interesting question for future research whether this account can generalize to other languages where Stems and Roots are required to end in a consonant.

(16)

	NoCoda	*VV	HeadsBranch	Morph-Syll
☞CVCV				*
CVV		*!		
CVC	*!			
CV			*!	

The analysis in (16) straightforwardly accounts for the disyllabic Root minimality requirement found in languages like Diyari. Recall from the discussion in sections 1.4 and 2.1, that McCarthy and Prince's (1994*a*, 1994*b*, 1995*a*, 1995*b*, 1999) analysis of the Diyari reduplication pattern in (17) is considered to provide an especially strong motivation for PBT. Recall that the reduplicated string (bolded) always contains exactly two syllables no matter how long the Base is:

(17) Diyari reduplication (McCarthy and Prince 1994*a*: 350, fig. (29))

(*a*)	wíl̪a	**wíl̪a**-wíl̪a	'woman'
(*b*)	kánku	**kánku**-kánku	'boy'
(*c*)	kúɭkuŋa	**kúɭku**-kúɭkuŋa	'to jump'
(*d*)	tʲílparku	**tʲílpa**-tʲílparku	'bird sp.'
(*e*)	ŋánkan̪t̪i	**ŋánka**-ŋánkan̪t̪i	'catfish'

In PBT, parsing the reduplicant as a Prosodic Word correctly predicts not only its disyllabic minimal size, but also accounts for the fact that it has main stress. Both fall out from the requirement that Prosodic Words contain at least one stress Foot. (The alternating stress pattern in words like *ŋándawàlka* 'to close' shows that stress Feet in Diyari are disyllabic.) Further, it accounts for why the reduplicated string is vowel final. Consonant-final syllables can only occur word medially in Diyari; all words must end with vowels.

In MBT, these same facts fall out from proposing that Prosodic Words—including the Prosodic Word reduplicative compounds in (17)—are minimally (Prosodic) Roots, subject to HeadsBranch. As Diyari does not have contrastive vowel length and does not allow word-final Codas, it fits the typology defined in (16) of languages with optimally disyllabic Roots.

Numerous other languages with a disyllabic Root minimality requirement are accounted for by the typology in (16). Many Australian languages are like Diyari in having a disyllabic word minimality requirement correlating with the same phonotactic constraints: no contrastive vowel length, and a ban on word-final consonants (Dixon 2002). And non-Australian languages like Italian also have a disyllabic minimality requirement on native Roots correlating with a ban on word-final Coda consonants in the native vocabulary and no contrastive vowel length (Thornton 1996).

To sum up this section, as Roots correlate with syllables in MBT, it is expected that the prosodic constraints holding on (word-final) syllables will play an important role in determining the attested range of minimal word types. This allows the theory to easily account for the fact that the least marked syllable type, CV, is also the most common minimal word. It correctly predicts that the relative rarity of (word-final) vowel length contrasts will correlate with the relative rarity of CVV as a minimal word type. And it correctly predicts that disyllabic minimal Root requirements will be more common in languages where severe restrictions on the complexity of word-final syllables—no long vowels and no Codas—make a disyllabic form the optimal means of satisfying HeadsBranch (2*c*).

In contrast, PBT, which correlates Prosodic Word with stress Foot, cannot account for why CV is the most common minimal word size, as this is a marked Foot type. It also cannot account for why the disyllabic Root requirement better correlates with word-final syllable phonotactics than with Foot structure. Finally, it has no explanation for why bimoraic CVV is a less common minimal word type than monomoraic CVC. Indeed, the exact opposite prediction is made, as only a bimoraic string is a possible minimal Foot.

4.3. Enhancing prosodic salience

Syllable phonotactics is one factor that can favour disyllabic Roots in languages where HeadsBranch (2*c*) is highly ranked. As Garrett (1999) argues, another prosodic factor that often correlates with a disyllabic word minimality requirement is metrical Non-finality: a constraint that penalizes assigning stress to word-final syllables. As stressed monosyllabic words necessarily violate Non-finality, we expect languages where this constraint is active to ban monosyllabic words. Garrett (1999: fig. (6)) lists several languages where this prediction is borne out.

While Non-finality is stress related, Garrett (1999) demonstrates that this parameter is distinct from stress Foot type. Non-finality correlates with disyllabic minimality not just in languages where the minimal stress Foot is disyllabic, but also in languages with unbounded stress and quantity-sensitive stress. For example, Aronoff et al. (1987) show that words are minimally disyllabic in Makassarese. As stress is unbounded, assigned only to the penult syllable, there is no good evidence from stress for disyllabic footing. The constraint Non-finality alone can account for penult stress assignment and also for the disyllabic word minimality requirement.

The Non-finality parameter also predicts a different word minimality typology from PBT's stress footing. For example, quantity-sensitive stress systems are uniformly predicted to allow bimoraic minimal words in this theory, because this matches the minimal Foot in a quantity-sensitive system. Gordon's (1999) and Garrett's (1999) surveys show, though, that there are many exceptions. For example, the Australian language Yidiɲ has a binary, quantity-sensitive stress system: long vowels must be stressed; the initial syllable is stressed if there are no long vowels (see e.g. Dixon 1977, Hayes 1980, 1995, 1999). PBT would predict that the minimal word is CVV, as this is the minimal stress Foot. However, as Dixon (1977) shows, the minimal word is disyllabic. Non-finality and the word phonotactics of Yidiɲ combine to optimize this result. CVV cannot be the minimal word, as long vowels are never found in the odd-numbered syllable of an odd-syllabled word. CV(C) cannot be the minimal word due to Non-finality: final syllables are not generally stressed unless they contain a long vowel.[12] Disyllabicity is, then, the only way to satisfy HeadsBranch.

[12] The only case where a CV(C) final syllable would be stressed is if it occurs in an even-syllabled word containing a long vowel in an even-numbered syllable. Words of this length, and this long vowel configuration appear to be rare in Yidiɲ (Kager 1995).

Garrett (1999) shows that other quantity-sensitive (iambic) languages where Non-finality is highly ranked, like Carib and Hixkaryana, likewise impose a disyllabic minimal word requirement. The fact that the Heavy-Light disyllable which defines minimal word size in Carib and Hixkaryana is a prohibited iambic Foot type emphasizes that Non-finality is an independent parameter from foot structure. The tableau in (18) exemplifies how adding Non-finality to the set of high-ranked markedness constraints in (15) and (16) optimizes disyllabic minimality in monomorphemic Roots:

(18)

	Non-finality	NoCoda	*VV	Heads Branch	Morph Syll
☞ ˈCVCV					*
ˈCVV	*!		*		
ˈCVC	*!	*			
ˈCV	*!			*	

The explanation for the importance of the principle of Non-finality in stress systems and word minimality seems more closely tied to the phonetic realization of main stress than to foot structure. As Hyman (1977) argues, the most effective cue for stress is an intonation contour, and pitch intonation contours are more perceptible if realized over two syllables or moras than over one. This would account for the cross-linguistic tendency Hyman (1977) observes for final syllables to 'repel' stress which is formalized in the Non-finality constraint: the pitch change which signals main stress is more saliently realized in pre-final position. As Gordon (1999: 265) notes, disyllabic and bimoraic minimal words satisfy this same requirement, of realizing the intonational pitch contour more saliently than CV or CVC minimal words. An example of how intonational pitch contour correlates with a bimoraic minimality requirement comes from Bengali. Recall from sections 2.3.1 and 3.2.2.1, that CV Roots are lengthened when pronounced in isolation. As Bengali stress is quantity insensitive, there is no motivation from stress footing for this lengthening. Hayes and Lahiri (1991) demonstrate that the basic intonational contour for Bengali is *HL. A plausible motivation for vowel lengthening is that it allows this contour to be saliently realized in these monosyllabic words.

Tone realization principles also seem to provide some motivation for the minimal word requirements found in Mandarin Chinese and Mixtec. Chen (2000: 366 ff.) argues that a disyllabic 'Minimal Rhythmic Unit' both motivates the disyllabic minimal word size of Mandarin Chinese and also defines the basic tone sandhi domain. That is, one motivation for disyllabic word minimality is that it allows more salient realization of some tone patterns of the language.[13] (Words in Mandarin Chinese are typically bimorphemic (Packard 1998, Duanmu 2000), and that is certainly another important motivation for the minimal disyllabicity requirement.) In Mixtec languages (Otomanguean languages of Mexico), too, all lexical morphemes are minimally bimoraic 'couplets' (Pike 1948, Gerfen 1999). The couplet not only defines the canonical shape of morphemes but also is crucial to defining contrastive tone distribution. (Stress is realized on the penultimate mora of the word-final Root. This means stress is non-final, and perhaps this reinforces the bimoraic minimal size of the couplet.) It is worth mentioning that Norwegian (Kristoffersen 2000) presents a puzzling example of a language where word minimality and accent minimality conditions disagree. The minimal word is bimoraic, consistent with its quantity-sensitive stress system and with the monosyllabic branching requirement. However, one of the pitch accents of Norwegian requires a disyllabic minimum for its realization. Pitch realization alone, then, is not an absolute factor in determining minimal word requirements. Indeed, if that were the case, then CV would not be such a common minimal word size in stress languages.

There is a small residue of larger than expected Roots in the data presented in Chapters 2 and 3. Madurese Roots are canonically

[13] See Yip (1999, 2003) for recent reviews of such '"covert" prosody and binarity effects' in Chinese. And see Duanmu (1998, 2000) for further discussion of binary association domains in Chinese dialects.

disyllabic (McCarthy and Prince 1986), even though truncations show that monosyllabic outputs are possible.[14] Roots are canonically disyllabic in other Austronesian languages—Ilokano (Rubino 2005), Malay (Onn 1980), Tagalog (Schachter and Otanes 1972), Indonesian (Cohn 2003)—even though CVC word-final syllables are possible (and could also satisfy HeadsBranch). The stress systems of these languages do not all provide evidence for a disyllabic stress Foot as the motivation for the disyllabicity requirement, so PBT is equally unable to explain this minimal word size. And as we saw in sections 2.3.5 and 3.2.2.3, above, Roots are minimally bimoraic in some constructions in Turkana (like intensive reduplication), even though CVC Roots are common. To account for cases like these, where the phonotactics of the language do not seem to motivate the disyllabic canonical form, I follow Garrett (1999) and Gordon (1999: 265) in proposing that there is a functional motivation for Head morphemes to 'be long'. Increased duration enhances their salience because, in the terms of the theory adopted here, it enhances their asymmetrical prominence compared to non-Heads. This generalization is expressed by the following harmonic ranking of branching structures (which closely follows Garrett's (1999) Be-Long family of constraints):

(19) Harmonic Branching of Heads
$*CVC \gg *[\mu\mu]_\sigma \gg *\sigma\sigma$

Disyllabic forms are optimal Heads, as they provide the most contrastive asymmetry with monosyllabic non-Heads. Both branching monosyllable types are less distinct from non-heads, with the shorter monomoraic CVC less distinct. (HeadsBranch (2*c*) outranks the hierarchy, as non-branching Heads are least distinct from Affixes.) The tableau in (20) exemplifies the proposal:

[14] It is clear from Weeda's (1987) discussion that the disyllabic Root minimum is not motivated by the Madurese stress system. There is only one main stress per word, on one of the final three syllables of the word, depending on lexical factors. Unbounded stress systems provide no evidence for a binary stress Foot.

(20)

	Heads Branch	*CVC	*μμ	*σσ	Morph-Syll
☞ˈCVCV				*	*
ˈCVV			*!		
ˈCVC		*!			
ˈCV	*!				

A factorial typology incorporating the constraints in (20) with those in (15) and (16), above, accounts for the range of attested word minimality sizes.

In sum, disyllabic and bimoraic minimality can be motivated by factors that enhance the prosodic prominence of Head morphemes. Intonational contours and tone distribution patterns characteristic of head morphemes are more saliently realized in a minimally disyllabic or bimoraic window. Increasing the duration of a Head morpheme enhances its salience compared to non-Head morphemes. While the prosody of prominence is certainly stress related, as we have seen, these prominence effects do not always correlate with foot structure. For example, intonation-related Non-finality often motivates minimal words which do not match the minimal stress Foot. The interesting question raised by these prosodic enhancement strategies is why they crucially condition word minimality in some languages, but not in others. One can only agree with Gordon (1999: 265) that more careful studies of more individual languages are needed to understand the role of tone, intonation, and prosodic salience in determining minimal word requirements.

4.4. Reduction and category ambiguity

A final phonological factor which can determine the realization of canonical form is the reduction in markedness and complexity which is characteristic of reduplicative and truncated morphemes. What these two morphological constructions have in common, as

Steriade (1988) observes, is that they reproduce a reduced form of their Base (and, in the case of reduplication, the reduced morpheme co-occurs in the same construction as the Base). These reductions are well studied in the recent literature, and are characterized under the rubric of the Emergence of the Unmarked (TETU) in Optimality Theory.[15] Preceding chapters have illustrated how constraint ranking optimizes less marked structure in reduplicative and truncated morphemes while allowing marked structure in the corresponding Base. The concern of this section is not to review TETU effects in general, but rather to show how phonological reduction can lead to ambiguity in the morphological category to be assigned to bound truncations and reduplications. The next chapter pursues the theoretical implications of category ambiguity.

A first example of potential category ambiguity due to reduction comes from verbal reduplication in CiYao, a Bantu language spoken in Malawi. In the dialect discussed by Myers and Carleton (1996), Base verb tone is not copied in the reduplicative morpheme (underlined):[16]

(21) CiYao verb reduplication (Myers and Carleton 1996: 64-5)

	Unreduplicated	*Gloss*	*X repeatedly*
(*a*)	ku-[télék-a]	'to cook'	ku-[télék-a][telek-a]
(*b*)	ku-[wómbók- a]	'to save'	ku-[wómbók-a] [wombok-a]
(*c*)	ku-[súlúmund- a]	'to sift (flour)'	ku-[súlúmund-a] [sulumund-a]
(*d*)	tím-[déleche- e]	'I will cook'	tím-[déleche-e] [telech-e]
(*e*)	tím-[wómboch- e]	'I will save'	tím-[wómboch-e] [womboch-e]
(*f*)	tím-[súlumund- e]	'I will sift'	tím-[súlumund-e] [sulumund-e]

[15] The reader interested in more background on the Emergence of the Unmarked can consult Alderete et al. (1999) and McCarthy and Prince (1994*a*, 1994*b*, 1999).

[16] See Mtenje (2003) for discussion of verbal reduplication in another Malawian CiYao dialect, where High tones are distributed over both halves of the reduplicative complex.

Myers and Carleton (1996) propose that the lack of tonal transfer in (21) falls out if the reduplicative morpheme is an Affix, as verbal Affixes do not generally have contrastive tone. As noted in section 1.3, above, the reduplicative strings have other characteristics that are not consistent with an affixal analysis. They are polysyllabic, as they include the entire Base verb stem which, moreover, always consists of at least two morphemes (Root plus optional derivational suffixes and an obligatory final inflectional suffix). This is in sharp contrast to true affixes, like the infinitive prefix *ku-*, which are monosyllabic and, by definition, monomorphemic. A more plausible analysis of the reduplicative morpheme, as Downing (2003) argues, is that it is a Stem, and that the reduplicative complex is a verb Stem compound. Indeed, as we saw in section 2.2.3.1, above, it is very common for reduplicative compounds—like other compounds—to be prosodically asymmetrical. Tonal reduction in reduplication can straightforwardly be analysed as an Emergence of the Unmarked (TETU) effect, as shown in (22), without labelling the reduplicative morpheme an Affix.[17] As seen by comparing (22*a*) with (22*b*), copying the Base tone (22*b*) incurs more violations of the markedness constraint *H (banning High tones in the output) than not copying, as in (22*a*):

(22)

ku-[télék-a]-RED$_{STEM}$	MAX-IO	*H	MAX-BR(SEG)	MAX-BR (TONE)
☞*a.* ku-[télék-a]-[telek-a]		**		**
b. ku-[télék-a]-[télék-a]		***!*		

In CiYao, then, the tonal reduction of the reduplicative morpheme has not conclusively led to a change in its morphological category from Stem to Affix, even though tonal reduction might well be one step on the path towards more Affix-like status.

[17] The analysis in (22) simplifies the approach motivated in Downing (2003) for ease of presentation.

A more problematic example is presented by two productive reduplication patterns of Sk̲wx̲wú7mesh (Squamish), a Central Salish language spoken north of Vancouver, British Columbia (Canada). As Bar-el (2000*a*, 2000*b*) shows, based on her own fieldwork and Kuipers (1967), in one pattern the reduplicative morpheme is a CəC string, no matter what the Base vowel is (23*a*). In the other it is a CV string, copying exactly the vowel of the Base (23*b*). (The data is cited in IPA; see Bar-el (2000*a*, 2000*b*) for presentation of the data in the standard orthography. Note that stressed vowels cannot be [+high]):

(23) Sk̲wx̲wú7mesh reduplication (Bar-el 2000*a*: figs. (7), (10))

(*a*) *CəC reduplication*

p’əq’^{w}-p’éq’^{w}	‘yellow’
təc-téc	‘skinny’
k’^{w}əs-k’^{w}ás	‘burn’
təq^{w}-tóq^{w}	‘red codfish’

(*b*) *CV reduplication*

k’^{w}á-k’^{w}ayʔ	‘very hungry’
sé-siq	‘fly’
pó-pumʔ	‘swell’

These two reduplication patterns appear very similar to those found in the related language, Lushootseed, discussed in preceding chapters. However, Bar-el (2000*a*, 2000*b*) demonstrates that it is not possible to extend Urbanczyk’s (1996, 2000) analysis of Lushootseed (given in sections 1.4 and 3.2.2) to account for the Sk̲wx̲wú7mesh data. The problem arises in trying to assign morphological categories to the reduplicative morphemes. In Urbanczyk’s (1996, 2000) approach, different markedness restrictions on different reduplicative morphemes like those in Sk̲wx̲wú7mesh should fall out from the universal Faith-Root $\gg$ Faith-Affix ranking (Beckman 1997, 1998; Urbanczyk 1996, 2000). But if the CVC reduplicative morpheme is a Root and the CV reduplicative morpheme an Affix, parallel to Lushootseed, then the incorrect outputs are optimal, as shown in (24):

(24) (adapted, Bar-el (2000a))

/RED$_{AFX}$-k'ʷayʔ/	*Strucσ	*V-Place	Max-BR-Root	NO-CODA	Max-BR
a. k'ʷa-k'ʷayʔ	*	*!		*	**
b. k'ʷə-k'ʷayʔ	*			*	***
c. k'ʷayʔ- k'ʷayʔ	*	*!		**	
/RED$_{ROOT}$ - k'ʷás/					
☞*d.* k'ʷəs-k'ʷas	*		* (ə)	**	
e. k'ʷá- k'ʷas	*	*!	**	*	*
f. k'ʷás-k'ʷas	*	*!		**	

As we can see from the first candidate set, the same constraint ranking that correctly optimizes a schwa in the CVC Root reduplicative morpheme (24*d*), also wrongly optimizes a schwa in the CV Affix reduplicative morpheme (24*b*). (*V-Place is the constraint violated by any vowel except placeless schwa.) Reversing the morphological labelling of the two reduplicative morphemes (and moving *V-Place down in the ranking) would give the correct results, but would conflict with the strong cross-Salish requirement that Roots satisfy HeadsBranch (2*c*) by having the minimal form CVC, while affixes can violate this constraint. Reversing the ranking of Max-BR-Root and Max-BR-[Affix] would also give the correct results, but at the expense of violating what is claimed to be the universal ranking of these two constraints.

A further problem is that, as Bar-el (2000*b*) argues, both reduplicative morphemes have Root-like properties. Both can be stressed, while prefixes are never stressed. (The Stem, comprising the Root and suffixes, is the domain for stress.) And while CV is not the canonical Root shape, it is also not the canonical Affix shape in S<u>k</u>w<u>x</u>wú7mesh. This example shows that all markedness distinctions between reduplicative affixes cannot be accounted for simply through the universal Faith- Root ≫ Faith-Affix ranking.[18]

[18] Reducing the vowel to schwa is a very common pattern in CVC reduplication in other Salishan languages, as Bar-el (2000*a*, 2000*b*) and Niepokuj (1991) show, and in neighbouring Tsimshianic languages like Nisga'a (Shaw 1987, 2005, to appear *a*) where

Affix is not the only category of prosodic morpheme to undergo reduction, and prosodic morphemes of identical category can undergo different patterns of reduction.

A similar point is made by Ilokano Heavy and Light reduplication, discussed in section 2.1.2, above. As noted in presenting the analysis, it is possible to formalize the contrast between more marked Heavy reduplication and less marked Light reduplication by labelling the Heavy reduplicative morpheme a Root and the Light reduplicative morpheme an Affix. The problem with this classification is that Roots are canonically disyllabic in Ilokano (Rubino 2005). In related Madurese, we saw in section 4.1, above, that monosyllabic reduplicative morphemes are arguably truncated Roots, as they match truncated full words. There is, though, no independent evidence from Ilokano for classifying the Heavy reduplicative morpheme as a truncated Root in order to license its more marked structure. This makes it problematic to argue that a difference in morphological category accounts for the reduction in markedness that distinguishes Light reduplication from Heavy. In the next chapter, an alternative approach to these Sk̲wx̲wú7mesh and Ilokano reduplication patterns will be discussed.

A final reduplication pattern which illustrates how phonological reduction can obscure the morphological category of a reduplicative morpheme comes from the Nigerian Benue-Congo languages, Nupe and Yoruba.[19] Both form gerundive nouns from verbs by partially reduplicating the Base verb. (As noted in section 2.2.4, this pattern is widespread in the Benue-Congo languages of this region of Africa.) In both languages, the reduplicative morpheme is always a single CV syllable, no matter how long the Base is, with a fixed high vowel, no matter what height the corresponding Base vowel is. As shown in

Roots are canonically CVC. This emphasizes that unmarked structure can be found in Root reduplication as well as Affix reduplication. The morphological category of the reduplicative morpheme alone does not predict the likelihood of reduction.

[19] Both of these patterns have received quite a bit of attention in the phonological literature. See work like Akinlabi (1997), Downing (2005*a*), Kawu (2002), and Smith (1969) on Nupe and Alderete et al. (1999), Akinlabi (2003), Downing (2005*a*), Orie (1997), and Pulleyblank (1988, to appear) on Yoruba for further discussion.

(25), in Nupe the gerundive has a Mid tone, no matter what the tone of the corresponding Base vowel is:

(25) Nupe gerundive reduplication (Akinlabi 1997; Kawu 2002; Smith 1969)

(*a*)	bé	'come'	bi-bé	'coming'
(*b*)	kpà	'drizzle'	kpi-kpà	'drizzling'
(*c*)	jákpe	'stoop'	ji-jákpe	'stooping'
(*d*)	kúta	'overlap'	ku-kúta	'overlapping'

In Yoruba, the prefix has a fixed High tone, no matter what the tone of the Base is:

(26) Yoruba gerundives (Akinlabi 2003; Orie 1997; Pulleyblank 1988)

(*a*)	jɛ	'eat'	jí-jɛ	'act of eating'
(*b*)	là	'split'	lí-là	'splitting'
(*c*)	gbóná	'be warm'	gbí-gbóná	'warmth; heat'
(*d*)	dára	'be good'	dí-dára	'goodness'

As Akinlabi (1997, 2003) and Pulleyblank (1986, to appear) argue, Mid tone is the unmarked tone in three-tone languages like Yoruba and Nupe. In Nupe, then, the tone and the vowel quality of the reduplicative morpheme are reduced to the unmarked value as an Emergence of the Unmarked effect. In Yoruba, though, the fixed High tone on the reduplicative morpheme must be contributed by the input of the reduplicative construction, as it is not the unmarked tone.

The analytical question now is, what morphological category is consistent with these generalizations about reduction in the reduplicative morpheme. As noted in section 3.2.1.5, verbs in both Nupe and Yoruba are canonically CV. The fixed shape of the reduplicative morpheme is, therefore, compatible with either a Root or Affix analysis.[20] The derivational function of the morpheme is perhaps more compatible with an Affix analysis. However, as nominal affixes are typically vowel initial in these languages, the gerundive is more Root-like in being consonant initial. The Emergence of the Unmarked ranking (FAITH-IO ≫ MARKEDNESS ≫ FAITH-BR) can account for the reductions we find in the size and vowel quality

[20] We noted a similar problem in discussing Zuni compounding truncation in section 3.2.3.2.

(and in Nupe, also the tone) whichever of these labels is assigned. This is illustrated in (27), where the reduplicative morpheme is labelled ROOT/AFFIX to emphasize that the category plays no crucial role in the analysis:

(27) Yoruba gerundive reduplication

$RED_{ROOT/AFFIX}$ H-dára	MAX-IO	*V[-HI]	*H	MORPH-SYLL	MAX-BR
☞ *a.* dí-dára		**	**	*	***
b. di-dára	*!	**	*	*	**
c. dá-dára		***!	**	*	**
d. dára-dára		***!*	**	**	

Candidate (27*a*) is optimal, as the reduplicative morpheme realizes its input High tone and best satisfies the markedness constraints favouring reduction in size (MORPH-SYLL) and in vowel markedness (*V[-HI]). (See tableau (15), above, for the rankings optimizing a CV Root output.) Candidate (27*b*) is non-optimal, as the reduplicative morpheme does not realize the input High tone. Candidates (27*c*) and (27*d*) are non-optimal as the vowel quality and, in (27*d*), the size of the reduplicative morphemes have not been reduced to the unmarked value. The analysis of Nupe would be essentially identical, except that there is no High tone in the input of the reduplicative morpheme. As a result, the ranking given here of *H (the constraint designating High tones as marked) would optimize the Mid tone on the reduplicative morpheme.

The analysis in (27) assumes that reduplication is driven by the morphology: a reduplicative morpheme is present in the input and motivates copying the Base consonant. However, work since Orie (1997) on the Yoruba gerundive has argued that an alternative motivation is available. All nouns (like the gerundive) in Yoruba must begin with a vowel, but no noun begins with a High-toned vowel (Orie 1997: 58; Akinlabi 2003; Pulleyblank to appear). As the input of the gerundive uncontroversially contains a High tone, a plausible motivation for copying the consonant is to avoid a noun beginning with a High-toned vowel (*#V_H (Orie 1997)). Following

Pulleyblank's (to appear) version of this approach, copying the Base consonant is the optimal way to provide an Onset to the gerundive vowel, as epenthesizing *h*, the usual epenthetic consonant in Yoruba, incurs a DEP-IO violation; copying does not:[21]

(28) Yoruba gerundive revisited (adapted, Pulleyblank (to appear))

µH–dára	MAX-IO	$*\#V_H$	DEP-C	*V[-HI]	DEP-V
☞ *a.* dí-dára				**	*
b. i-dára	*!			**	*
c. dà-dára				***!	*
d. hí-dára			*!	**	
e. í-dára		*!		**	*

Candidate (28*a*) is optimal, as it satisfies the high-ranked constraint banning an initial high-toned vowel in the least marked way: by copying the Base consonant to provide an onset to the gerundive and filling in the empty mora with the least marked vowel. Candidate (28*b*) is non-optimal as the gerundive does not have its input high tone. The other candidates are non-optimal as they give the gerundive segmental content in more marked ways than the optimal candidate.

It is unclear how easy it would be to extend the analysis in (28) to Nupe, as one would need a motivation for copying the Base consonant equivalent to the $*\#V_H$ constraint. Still, the Yoruba pattern shows that CV reduplication with a fixed vowel is potentially multiply ambiguous. The output CV can be optimized by an input specifying a segmentally empty Root or Affix accompanied by the reduplicative operation, as in (27), or by an incompletely specified morpheme, with copying serving a phonological purpose like providing an Onset to an otherwise ill-formed vowel, as in (28). We

[21] See Pulleyblank (to appear) for detailed discussion of why reduplication does not incur DEP violations, while epenthesis does. And see Inkelas and Zoll (2005) for arguments that single segment reduplication like that found in the Yoruba gerundive in general has a phonological rather than a morphological motivation.

return to the problem of indeterminate morphological category and canonical form in the next chapter.

To sum up this section, phonological reduction is a characteristic phonological property of reduplication, and it is claimed to be especially favoured in Affixal reduplication, due to the ROOT ≫ AFFIX harmonic ranking. As we have seen, though, we cannot simply assume that a reduction in markedness in a reduplicative morpheme correlates straightforwardly with an Affixal analysis. In Bantu languages and in Salishan languages, we find prosodic or segmental reduction in Stem and Root reduplicative morphemes, respectively. In both of these cases, the branching requirement on the reduplicative morpheme unambiguously supports a Root analysis. In languages like Yoruba and Nupe, though, verbs are minimally non-branching CV, eliminating this test for Root vs. Affix status of bound prosodic morphemes. Indeed, as we have seen, the reduced gerundive morph in these languages lends itself to several different analyses. This data provides further examples of how phonological constraints can outrank morphological ones in defining the output form of prosodic morphemes, as it shows that morphological category alone does not determine the optimal degree of complexity or markedness. Indeed, in Yoruba, it is unclear whether gerundive reduplication has a morphological (27) or purely phonological (28) motivation.

4.5. Summary

The main problem addressed in this chapter is why Roots in some languages are larger or smaller than the branching monosyllable defined by the morphological constraints, MORPH-SYLL (2*b*) and HEADSBRANCH (2*c*). As we have seen, several prosodic factors turn out to have an influence on word minimality, masking the influence of the morphological constraints: prosodic correspondence, the phonotactics of word-final syllables, and the prosodic prominence enhancement of Head morphemes. These prosodic influences help explain why PBT so often appears to work. Prosody does play an indirect role in determining optimal form, so that canonical forms often do coincide with prosodic units of the language. As we have seen, though, the occasional accidental similarities between canonical form and stress Foot do not support PBT's claim that canonical form follows directly from Foot structure. On the contrary, the discussion in this chapter has emphasized that canonical form mostly does not match stress footing. The common CV minimal word size is a marginal stress Foot type, for example. The stress-related constraint NON-FINALITY optimizes disyllabic minimality in languages where a disyllable is not the minimal stress Foot. These cases were shown to have a straightforward analysis in MBT. A factorial typology defined by variably ranking phonotactic markedness constraints and the morpho-prosodic constraints, MORPH-SYLL (2*b*) and HEADSBRANCH (2*c*) accounts for the attested range of canonical forms. The masking of the morphological constraints by phonotactics is, in fact, expected in OT given variable ranking of constraints.

Another theme of this chapter has been to show that phonological markedness constraints often have the effect of obscuring the morphological category of a prosodic morpheme. Both Roots and Affixes can optimally be CV monosyllables, for example. CV is an optimal Affix as it does not branch; it is an optimal Root as it is the least marked syllable. This is one reason the markedness reductions which are typical of constructions like reduplication or bound truncations can lead to category ambiguity. It can be hard to determine whether the reduced form is best characterized as a reduced Root or a canonical Affix. This is an issue for all versions of GTT because these theories propose that canonical form is dependent on the category (Stem, Root, or Affix) assigned a morpheme. The theoretical consequences of category ambiguity are discussed further in the next chapter. For now, we can note that the analytical ambiguity has the advantage that it can help explain the parallels in the historical development of truncations, reduplications, and compounds noted by Niepokuj (1991). These constructions have in common that they are lexical morphemes at the earliest stage of development, like their respective Bases. The dependent member of the construction undergoes progressive reduction, in prosody, size, and in segmentism, to a final stage where its phonological properties are more Affix-like than Root- or Stem-like. The overlap in the prosodic characteristics of Roots and Affixes is certainly one of the factors motivating this reanalysis.

5

Questions for Future Research and Conclusion

The central proposal of any version of Generalized Template Theory (GTT) is that particular prosodic morphemes have the canonical forms that are typical for their morphological category. The basic claims underlying the theory are that the morphological categories—Stem, Root, and Affix—can be reliably identified and matched with canonical forms defined in terms of general prosodic principles. The approach assumes that only the metrical units of the Prosodic Hierarchy (Foot, syllable, and mora) can be referred to in constraints correlating morphological constituents with prosody. General principles limit the possible repertoire of canonical forms to being minimally monosyllabic and maximally disyllabic. In the course of the book, though, we have noted some cases which challenge these assumptions. One set of problems arises when a prosodic morpheme does not match a prosodic constituent, because it is either too small (a single segment, as in the Yoruba gerundive or Fox Affixal reduplication) or too large (as in the maximally four-syllable truncations in French). Another set of problems arises when the canonical form of a morpheme cannot be matched with a particular morphological category. (As in Ilokano reduplication, when the Heavy vs. Light reduplicative morpheme distinction cannot be matched with a distinction in morphological category.) In section 1 of this chapter, these problems will be discussed as questions for future research, with promising current solutions briefly sketched.

On the whole, though, this book joins previous surveys of prosodic morphology beginning with McCarthy and Prince (1986) in demonstrating that particular morphemes in many languages do, indeed, have distinctive canonical forms that follow from general prosodic principles. The concluding section of this chapter, and of the book, summarizes the important findings of the preceding chapters and the main arguments supporting Morpheme-Based Template Theory (MBT).

5.1. Questions for future research

5.1.1. *Defining the range of minimal and maximal canonical forms*

Both versions of GTT define canonical form by correlating morphological constituents with constituents in the Prosodic Hierarchy. While there are crucial differences between PBT and the morpheme-based version developed in this work, both versions define a monosyllable as the minimal canonical form and a disyllable as the maximal. In MBT, a monosyllable is a minimal Root or Affix, while a disyllable is a maximal Root or Stem. It is potentially problematic that there are languages where some reduplicative morphemes are minimally smaller than a monosyllable—a single consonant or bare consonant string—and also languages where truncations and other words are maximally larger than a disyllable, with four syllables a common maximal size. As we shall see below, both types of mismatch between possible prosodic constituent and canonical form raise important questions for future research.

5.1.1.1. *What constrains single segment reduplication?* In some languages, reduplicative strings can consist of a single consonant or bare consonant string, in violation of our expectation that morphemes consist minimally of a monosyllable. There are two main types of bare consonant reduplication. In one type, the consonant accompanies a fixed segment morpheme. We have seen examples of this in the Yoruba gerundive, discussed in section 4.4, above, and in Fox Affixal reduplication, discussed in section 3.2.3. The relevant data is repeated below for convenience; the reduplicated consonant is underlined:

(1) Single consonant plus fixed segment

(*a*) Yoruba gerundives (Akinlabi 2003; Orie 1997; Pulleyblank to appear)

jɛ	'eat'	jí-jɛ	'act of eating'
là	'split'	lí-là	'splitting'
gbóná	'be warm'	gbí-gbóná	'warmth; heat'
dára	'be good'	dí-dára	'goodness'

(*b*) Fox Affixal reduplication (Dahlstrom 1997: 206, 212, 218)

nowi:-wa	'he goes out'	na:-nowi:-wa
wi:tamaw-e:wa	'he tells him'	wa:-wi:tamaw-e:wa
ko:kenike:-wa	'he does the washing'	ka:-ko:kenike:-wa
kya:t-amwa	'he keeps it for himself'	ka:-kya:t-amwa

In the second main type, the morpheme consists of just a bare consonant (string). Examples of this type are found in Salishan languages, as shown in (2*a*) and in Mon-Khmer languages like Semai, Temiar, and Kammu, as shown in (2*b*).[1] The reduplicated string is underlined:

(2) (*a*) Lillooet/St'at'imcets Diminutive reduplication (Shaw 2001; citing van Eijk 1997)

Root/Stem	*Gloss*	*Diminutive*	*Gloss*
núχʷaʔ	sweetheart	nə́-n-χʷaʔ	little sweetheart
ptákɬ	legend	ptə́-t-kɬ	little legend
sqáχaʔ	dog	sqə́-q-zχaʔ	puppy

(*b*) Semai Indeterminate reduplication (Shaw 1993)

ci:p	cp-ci:p	'walk'
yɛ:r	yr-yɛ:r	'unfold'
cʔu:l	c-l-ʔu:l	'choke'
sma:ɲ	s-ɲ-ma:ɲ	'ask'

Cases like these are especially challenging for pre-Optimality Theory (OT) prosodic morphology theory (McCarthy and Prince 1986). Recall from section 1.2.1, above, that the canonical shape of a reduplicative morpheme is accounted for in that approach by

[1] As Al-Hassan (1998) and Newman (2000) show, both types of bare consonant reduplication are also extremely common in Chadic languages. See Inkelas and Zoll (2005) for recent discussion.

positing that the input for the morpheme contains the prosodic constituent (Foot, syllable, or mora) defining its fixed shape. In the data in (1) and (2), no prosodic constituent defines the reduplicative string, so it is unclear what the input of the reduplicative morpheme should be. The analysis fails at the initial step.

Recent work in OT, however, has shown that minimal reduplicative strings like these can be accounted for in the same fashion that longer canonical shapes are. As we have seen, the canonical form of a reduplicative (or other) morpheme is not defined in its input in OT, but rather through constraint interaction. For example, in one analysis of the Yoruba gerundive exemplified in fig. (27), section 4.4, repeated below for convenience, the reduplicative morpheme is categorized in the input as an Affix (or Root), with a fixed High tone. Reduplicating the Base consonant and reducing the corresponding vowel is the least marked way to give the morpheme segmental structure, given the appropriate ranking of the morpheme-prosody constraint, MORPH-SYLL, with MARKEDNESS and FAITHFULNESS constraints, NOCODA and *[-HIGH] and MAX-BR:

(3) Yoruba gerundive reduplication, reduplicative Root/Affix

$RED_{ROOT/AFFIX}$ H-dára	MAX-IO	*V[-HI]	*H	MORPH-SYLL	MAX-BR
☞ *a.* dí-dára		**	**	*	***
b. di-dára	*!	**	*	*	***
c. dá-dára		***!	**	*	**
d. dára-dára		***!*	**	**	

The Fox data in (1*b*) could be given a similar analysis. The input contains a reduplicative Affix with fixed material: in this case /-a:/. Reduplicating just a consonant would be the least marked way to fill out the Affix in a way that satisfies MORPH-SYLL, the constraint defining affixes as optimally monosyllabic.[2]

[2] See Gafos (1998*a*, 1999) and Walker (2000) for other analyses which account for bare consonant reduplication through inputs which combine fixed featural content with a reduplication operation.

Turning to the single segment reduplication patterns illustrated in (2), unstressed vowels are often syncopated in Salishan languages like Lillooet (2*a*). As work like (Shaw 2001, 2005, to appear *a*) and Urbanczyk (1996)) argues, the bare consonant reduplication patterns found in these languages are best accounted for by proposing that the canonical shape of the reduplicative morpheme is CV; regular syncope in this context optimizes not realizing the vowel. In Semai (2*b*), Shaw (1993), and Gafos (1998*a*, 1998*b*; 1999) show that syllables with vowels (major syllables) are restricted to occur word finally. Pre-finally, minor (CC) syllables are preferred. Further, the indeterminate construction in (2*b*) is maximally disyllabic (a minor syllable-major syllable sequence). These two factors explain why the reduplicated string is at most two consonants. The reduplicative string occurs pre-finally, so can be at most a minor (CC) syllable. When the Base already contains a minor-major syllable sequence, only a single consonant is copied because that is all that can be fitted into the minor syllable.[3] For both these cases, too, then, the input can contain a reduplicative Affix, and markedness constraints account for why the output often is smaller than a syllable. Other recent studies of bare consonant reduplication (Hendricks 1999, 2001, Urbanczyk 1996, Walker 2000) show that minimal reduplicative morpheme realization in other languages can be accounted for along similar lines.

In the discussion of the Yoruba gerundive in section 4.4, though, we saw that single consonant reduplication still raises the question of whether a reduplicative morpheme in the input is the only motivation for reduplication. In the alternative analysis of the gerundive, in (28) repeated below, reduplication is purely phonologically motivated: it provides the least marked means of providing an Onset for an otherwise ill-formed word-initial High-toned vowel.

[3] See Gafos (1998*b*, 1999), Hendricks (1999, 2001), and Shaw (1993) for more detailed discussion and alternative analyses of minor syllable reduplication in Mon-Khmer languages.

(4) Yoruba gerundive revisited (adapted, Pulleyblank (to appear))

µH-dára	MAX-IO	*#V_H	DEP-C	*V[-HI]	DEP -V
☞ *a.* dí-dára				**	*
b. i-dára	*!			**	*
c. dá-dára				***!	*
d. hí-dára			*!	**	
e. dára-dára			**!	****	**
f. í-dára		*!		**	*

The Fox data in (1*b*) could potentially be given a similar analysis. The input morpheme would contain a fixed string, /—a:/, and the reduplicated consonant would be reducing the markedness of this morpheme by providing it with an Onset.[4] Recent work by Gafos (1998*b*, 1999) and Inkelas and Zoll (2005) discuss other cases where single consonant reduplication can be accounted for by phonological constraints rather than by an input reduplication operator.

It is beyond the scope of this work to critique all of these analyses in detail. Rather, if we concentrate on the Yoruba gerundive case, we can see that the analysis of single consonant reduplication has implications for the historical and comparative development of reduced reduplicative patterns. As noted in sections 2.2.4 and 4.4, above, the reduced CV reduplication pattern found in Yoruba is very widespread in related western African languages. Faraclas and Williamson (1984) and Niepokuj (1991) propose that this reduced reduplication pattern developed historically from total reduplication (still found in some of the languages). As shown by the tableau in (5), ranking MAX-BR above the markedness constraints optimizes total reduplication. The reduced reduplication patterns are analytically related to the historically and synchronically related total (and less reduced) reduplication patterns, then, through a factorial typology derived by varying the ranking of MARKEDNESS constraints and MAX-BR:

[4] Word-initial onsetless syllables are usually grammatical in Fox, though, so the Onset requirement would be a property of this particular morpheme, formalized either in the input or in a co-phonology.

(5) Constraint reranking (based on (3), above) motivating total reduplication

$RED_{ROOT/AFFIX}$-dara	MAX-IO	MAX-BR	*V[-HI]	*H	MORPH-SYLL
a. dí-dára		*!**	**	**	*
b. di-dára	*!	***	**	*	*
c. dá-dára		*!*	***	**	*
☞ *d.* dára-dára			****	**	**

If we turn back to (4), we can see that no permutation of the constraints given can optimize total reduplication. Candidate (4*e*)—the total reduplication candidate—satisfies the same constraints that are also satisfied by the single segment candidate (4*a*), while also violating all of the remaining constraints more severely than (4*a*). If Faraclas and Williamson (1984) and Niepokuj (1991) are correct in proposing that reduced reduplicative systems develop from total reduplication, then it is an important question for future research to determine what constraints define a factorial typology linking total reduplication to reduced reduplication in analyses where reduplication is phonologically motivated. Niepokuj (1991) suggests that the development of fixed segmentism in reduplicative morphemes can trigger a reanalysis of the morpheme as non-reduplicative, but this hypothesis requires further testing. It is also a question for future research whether all examples of single segment or bare consonant reduplication can be analysed as what one might term, the emergence of the least marked—either phonologically or morphologically—as current research suggests.

5.1.1.2. *What constrains non-binary maximality?* In some languages, prosodic words and truncations reveal the converse analytical problem: they are maximally larger than the disyllabic maximum licensed by the principle of BINARITY in any version of Generalized Template Theory. The commonly recurring non-binary maximum word size is four syllables. For example, as noted in section 2.2.2, above, Weeda (1992) and Scullen (1993) show that French abbreviations typically range from one bimoraic monosyllable to four (heavy and/or light) syllables in size:

(6) French abbreviations (Scullen 1993: appendix A)

Full form	Abbreviation	
matin	mat	'morning'
diamant	diam	'diamond'
appartement	appart	'apartment'
décaféiné	déca	'decaffeinated'
encyclopédie	encyclop	'encyclopedia'
désintoxication	désintox	'detoxification'
anatomie pathologique	ana-patho	'pathological anatomy'
général de commission	géned commis	ARMY TITLE

Itô (1990) describes an identical maximality constraint for the Japanese loanword truncations presented in section 3.2, above. (As noted in that section, the earlier presentation is simplified somewhat, concentrating on the majority of truncations which fit the binary maximum illustrated.) Both Stem and Root compound truncations are subject to a four-syllable maximality constraint, and both range in size from a bimoraic monosyllable to four syllables, just like in French:

(7) Japanese loanword truncations (Itô 1990)

suto(raiki)	'strike'	ope(reeshoN)	'operation'
ado(resu)	'address'	poji(chibu)	'positive'
ama(chua)	'amateur'	hazu(baNdo)	'husband'
terebi(joN)	'television'	rihabiri(teeshoN)	'rehabiliation'

waado purosessaa	waa puro	'word processor'
hebii metaru	hebi meta	'heavy metal'
rajio kasetto rekoodaa	raji kase	'radio cassette recorder'

Orie (1997: 146) shows that nicknames in Yoruba are also maximally four syllables. This limit also holds of Buin names (van de Vijver 1998: chapter 5). Further, in many Nigerian Benue-Congo languages surveyed by Orie (1997), underived Roots of the regular vocabulary are never longer than four syllables. Newman (2000) notes that while most Hausa words are disyllabic, words are minimally monosyllabic and can be 'even quadrisyllabic', but not longer. A similar four-syllable limit on roots is found in Carib (van de Vijver 1998: chapter 5). Finally, Kager (1995) shows that in some Australian languages, words of longer than four syllables are extremely rare. A four-syllable word maximality requirement is attested, then, in a number of unrelated languages cross-linguistically. A theory of canonical form should be able to account for this.

The problem for PBT is that a disyllable is the maximum definable Prosodic Word size, as the maximum stress Foot is disyllabic. In MBT, too, a disyllable is the maximum expansion of HEADSBRANCH which satisfies BINARITY, making a disyllable the maximum definable Prosodic Word size. Previous work on four-syllable maximality has proposed that the four-syllable limit could still be derivable from the more common two-syllable limit, if we assume that Prosodic Words, like other prosodic constituents, are maximally binary, in the sense of dominating two binary sublexical constituents. One possibility, developed in Itô (1990), is that four-syllable truncations are Prosodic Compounds, made up of two disyllabic Prosodic Words (or Prosodic Stems, in MBT). This proposal fits some of the data well. The last two abbreviated forms in (6) and in (7) are, indeed, truncated forms of Base compounds. However, in (7) we see that a four-syllable maximum is also imposed on monomorphemic words. Giving them a compound analysis to account for the maximality constraint is exceedingly abstract.

Another possibility, developed in Orie (1997), is that four-syllable truncations are made up of two disyllabic stress Feet. In the version of the Prosodic Hierarchy where Prosodic Word dominates stress Foot, this maximum would satisfy what Orie (1997: 147) calls 'categorial binarity': each unit maximally consists of two of the units it dominates in the Hierarchy. The problem with this proposal is the familiar one, that stress Feet are not found in every language. For example, neither Yoruba nor Japanese has a stress system, so there is no independent evidence outside of word minimality and maximality conditions for disyllabic footing. In sum, while it seems logical that four-syllable maximality should be derivable by combining two disyllabic constituents into some higher constituent, it is an important question for future research to determine what that higher constituent might be.[5]

[5] A similar problem is faced by de Lacy's (2004) analysis of word maximality in Maori. Maori roots are maximally four moras. As de Lacy shows, for Maori, the generalization motivating this maximality constraint is that a Prosodic Word can

5.1.2. *When morphological category is indeterminate or insufficient*

Both versions of GTT assume that canonical form correlates with morphological category.[6] In both versions, Stems and Roots are expected to be longer and contain more marked structure than Affixes. In PBT, this is because Stems are parsed as Prosodic Words, and so must minimally contain binary stress Feet. Affixes are not subject to a Prosodic Word parse. The Root ≫ Affix Faithfulness harmonic ranking also correlates differences in the relative markedness of prosodic morphemes with a difference in morphological category. In MBT, Stems and Roots are generally larger than Affixes because they are Heads, and optimally branch, while Affixes are non-Heads, optimally simplex. The Root ≫ Affix Faithfulness harmonic ranking is also available to this theory to account for other markedness asymmetries between Heads and non-Heads. It is problematic for both theories, then, when morphological category and relative markedness do not match. It is also a problem when several morphemes of the same category have different canonical forms or morphemes of different categories have the same canonical form. All of these cases lead to mismatches between morphological category and the expected markedness or complexity of the canonical form. In this section, I show first how co-phonologies—different constraint rankings introduced by different morphological constructions—can account for many of these mismatches.[7]

contain only one stress Foot, plus unfootable material. While this proposal works well for Maori, it obviously cannot be extended to account for a four-syllable maximality condition in languages where the four syllables are parsed into two stress Feet, like those discussed in Kager (1995) or to languages with no stress footing (Japanese and Yoruba, for example).

[6] Both versions of GTT also assume that a reduplicative string is the exponent of a single morpheme, as the canonical size of the reduplicative string falls out from the specification of morpheme type. See Stonham (1994) for discussion of reduplicative patterns which are problematic for this assumption.

[7] See work like Inkelas (1998), Inkelas and Orgun (1998), Inkelas and Zoll (2005), and Orgun (1996, 1998) for detailed discussion and motivation of co-phonologies as a way of accounting for morphological-construction specific exceptions in the phonology.

In sections 1.2.1 and 2.1.2, above, two different analyses were presented of the Ilokano reduplication patterns repeated in (9). The interest of these patterns is that the reduplicative morpheme in each case is a monosyllable, containing a Coda consonant in the 'Heavy' pattern, and no Coda consonant in the 'Light' pattern:

(8) Ilokano (Hayes and Abad 1989: 357, figs. (26), (27))

(*a*) *Heavy reduplication*

kaldíŋ	'goat'	kal-kaldíŋ	'goats'
púsa	'cat'	pus-púsa	'cats'
na-ʔalsém	'sour'	naka-ʔal-ʔalsém	'very sour'
sáŋit	'to cry'	ʔag-saŋ-sáŋit	'is crying'
trabáho	'to work'	ʔag-trab-trabáho	'is working'

(*b*) *Light reduplication*

liŋʔét	'perspiration'	si-li-liŋʔét	'covered with perspiration'
bunéŋ	'kind of knife'	si-bu-bunéŋ	'carrying a *bunéŋ*'
pandilíŋ	'skirt'	si-pa-pandilíŋ	'wearing a skirt'
sáŋit	'to cry'	ʔagin-sa-sáŋit	'pretend to cry'
trabáho	'to work'	ʔagin-tra-trabáho	'pretend to work'

The 'Heavy' pattern has a more marked syllable in the reduplicative morpheme than the 'Light' pattern does. If we assume that there is a direct correlation between relative markedness and morphological category, then we can account for this markedness distinction by analysing the 'Heavy' reduplicative morpheme as a Root and the 'Light' reduplicative morpheme as an Affix. As shown in section 2.1.2, above, the following uniform constraint ranking will then optimize the two distinct monosyllabic reduplication patterns.[8]

(9) TETU ranking for Ilokano reduplication:
Max-IO ≫ Morph-Syll ≫ Max-BR-Root ≫ NoCoda ≫ Max-BR-Affix

Ranking Max-IO above Morph-Syll optimizes realizing all input syllables in the output. Ranking Morph-Syll above both Max-BR

[8] In (9), the constraint *Strucσ adopted in section 2.1.2 to illustrate PBT has been replaced with Morph-Syll, the equivalent MBT constraint motivating monosyllabic reduplicative morphemes.

constraints optimizes realizing a single monosyllable in the reduplicative string.[9] Ranking NoCoda between the two Max-BR constraints, optimizes Codas in the Heavy (Root) reduplicative morphemes, but penalizes them in the Light (Affix) ones. The tableau in (10) exemplifies this analysis:

(10) Ilokano Heavy and Light reduplication

RED_{Afx}-trabaho	Max-IO	Morph-Syll	Max-BR -Root	No-Coda	Max-BR-Affix
☞ *a.* trabaho		*			****
b. trabaho-trabaho		*!*			
c. trab-trabaho		*		*!	***
d. trab-trab	*!*			**	
RED_{Root}-trabaho	Max-IO	Morph-Syll	Max-BR -Root	No-Coda	Max-BR-Affix
☞ *e.* trab-trabaho		*	***	*	
f. trabaho-trabaho		*!*			
g. tra-trabaho		*	****!		

In the first candidate set, illustrating 'Light' reduplication, we can see that candidate (10*a*), with an open syllable reduplicative morpheme, is optimal as it best satisfies the high-ranked markedness constraints on Affixal reduplicative morphemes. Competing candidates violate those high-ranked constraints. In the second candidate set, illustrating 'Heavy' reduplication, candidate (10*e*), with a closed syllable reduplicative morpheme, is optimal, as it best satisfies the constraint ranking optimizing reduplicating as much of the Base as will fill a well-formed syllable (Morph-Syll ≫ Max-BR-Root). The competing candidates violate these constraints.

While this analysis works well, it crucially rests on the assumption that 'Heavy' reduplicated morphemes match independently motivated canonical Root shapes of Ilokano. As noted in section 4.4,

9 I assume the constraint RealizeMorpheme—an input morph must be realized in the output (Akinlabi 1996)—rules out a candidate with a null realization of the reduplicative morpheme like *ø-trabaho*.

above, this assumption turns out not to be well founded. Roots are canonically disyllabic, while Affixes can be either Heavy or Light monosyllables (Rubino 2005, p.c.). Further, as Rubino (2005) shows, there are other reduplicative morphemes in Ilokano, including ones with a fixed disyllabic shape. If the Heavy reduplicative morphemes are Roots, then how is one to distinguish them from the disyllabic reduplicative morphemes? And if Heavy reduplicative morphemes are Roots, why do they not, in fact, match canonical Root shape? The more plausible analysis of the two Ilokano reduplication patterns is to propose that both morphemes are Affixes. The difference in the markedness of the two is accounted for by proposing that each reduplication pattern introduces a distinct co-phonology (constraint ranking). This is, in fact, the approach adopted in section 1.2.1, above. The MBT version of this analysis of Heavy reduplication is exemplified in (11) and Light reduplication in (12):[10]

(11) Ilokano Light reduplication co-phonology, MBT

$\text{RED}_{\text{AFFIXL}}$-trabaho	Morph-Syll	NoCoda	*VV	Max-BR
☞ *a.* trab-trabaho	*	*!		***
b. tra:-trabaho	*		*!	****
c. trabaho-trabaho	**!			
d. tra-trabaho	*			****

Co-phonology accounting for Light reduplication:
Morph-Syll, <u>NoCoda, *VV</u> ≫ Max-BR

As shown in (11), in the Light reduplication co-phonology syllable markedness constraints are ranked above Max-BR. Candidate (11*d*) is optimal given this ranking, as the reduplicative string violates none of the highest-ranked constraints on reduplicant size or syllable markedness. The competing candidates each violate one.

[10] In tableaux (10)–(12), violations of Morph-Syll are only counted in the reduplicative string. Since the Base syllables remain identical in all candidates, Base violations of Morph-Syll also are identical and cannot determine the choice of optimal reduplicative string.

Heavy reduplication introduces the opposite relative ranking of syllable markedness constraints and MAX-BR:

(12) Ilokano Heavy reduplication co-phonology, MBT

$\text{RED}_{\text{AFFIXH}}$-trabaho	MORPH-SYLL	MAX-BR	NOCODA	*VV
☞ *a.* trab-trabaho	*	***	*	
b. tra:-trabaho	*	****!		*
c. trabaho-trabaho	**!			
d. tra-trabaho	*	****!		

Co-phonology accounting for Heavy reduplication:
MORPH-SYLL ≫ MAX-BR ≫ NOCODA, *VV

Candidate (12*a*) is optimal given this ranking, as it best satisfies the constraints MAX-BR and MORPH-SYLL, which optimize copying as many Base segments as possible, while still not exceeding a single syllable. The competing candidates violate these high-ranked constraints.

Co-phonologies can also resolve the very similar problem presented by the Sḵwx̱wú7mesh (Squamish) reduplication patterns discussed in section 4.4, and repeated below for convenience. As Bar-el (2000*a*, 2000*b*) shows, these two reduplication patterns both show reductions in markedness compared to the Base, one by reducing the Base vowel to schwa (13*a*), the other by not allowing Codas (13*b*):

(13) Sḵwx̱wú7mesh reduplication (Bar-el 2000*a*: figs. (7), (10))
(*a*) *CəC reduplication*
p'əq'ʷ—p'éq'ʷ 'yellow'
təc—téc 'skinny'
k'ʷəs—k'ʷás 'burn'
təqʷ—tóqʷ 'red codfish'
(*b*) *CV reduplication*
k'ʷá—k'ʷayʔ 'very hungry'
sé—siq 'fly'
pó—pumʔ 'swell'

As we saw in the earlier discussion, Bar-el (2000*a*, 2000*b*) demonstrates that two problems arise in trying to account for the two patterns by adapting Urbanczyk's (1996, 2000) analysis of the related language, Lushootseed. The tableau in (14) reminds us that the distinct patterns of reduction found in the two reduplication types cannot be resolved by labelling one reduplicative morpheme a Root and the other an Affix. In a uniform constraint ranking that respects MAX-BR-ROOT ≫ MAX-BR-AFFIX, any markedness effect (like vowel reduction) holding of Roots should also be found in Affixes:

(14) (adapted, Bar-el (2000*a*, 2000*b*))

/RED$_{AFX}$- k'ʷayʔ/	MORPH-SYLL	*V-PLACE	MAX-BR-ROOT	NO CODA	MAX-BR-AFX
☹ *a.* k'ʷa-k'ʷayʔ	*	*!		*	**
💣 *b.* k'ʷə -k'ʷayʔ	*			*	***
c. k'ʷayʔ-k'ʷayʔ	*	*!		**	
/RED$_{ROOT}$-k'ʷás/					
☞ *d.* k'ʷəs-k'ʷás	*		*(ə)	**	
e. k'ʷá-k'ʷas	*	*!	**	*	*
f. k'ʷás-k'ʷas	*	*!		**	

As we can see from the first candidate set, the same constraint ranking that correctly optimizes a schwa in the CVC reduplicative morpheme (14*d*), also wrongly optimizes a schwa in the CV reduplicative morpheme (14*b*). The second, and more important, problem is that, as Bar-el (2000*b*) demonstrates, the CV reduplicative morpheme has Root-like phonological properties, even though it does not have the canonical Root shape. It is not plausible, then, to attribute the markedness reduction found in the CV reduplicative morpheme to a putative Affix status.

Both problems are straightforwardly resolved in a co-phonology analysis, where each reduplicative morpheme is labelled as a Root and introduces a distinct constraint ranking. (I am following Bar-el (2000*b*) in labelling the CVC reduplicative morpheme Root_1 and the CV reduplicative morpheme Root_2):[11]

[11] Bar-el (2000*b*) formalizes the morphological conditioning on these two patterns differently, by indexing particular Faithfulness constraints to particular constructions, rather than by appealing to distinct co-phonologies. Bar-el's (2000*b*) analysis has been

(15) Co-phonology rankings for Sḵwx̱wú7mesh reduplication:
  (*a*) Root$_1$ co-phonology: <u>*V-PLACE</u> ≫ MAX-BR ≫ <u>NOCODA</u>
  (*b*) Root$_2$ co-phonology: <u>NOCODA</u> ≫ MAX-BR ≫ <u>*V-PLACE</u>

The analysis is exemplified in (16) and (17):

(16) Root$_2$ (CV) reduplication in Skwx̱wú7mesh

/RED$_{AFX}$-k'ʷayʔ/	MORPH-SYLL	NOCODA	MAX-BR (V-PLACE, SEG)	*V-PLACE
☞*a.* k'ʷa-k'ʷayʔ		*	**	*
b. k'ʷə-k'ʷayʔ		*	***!	
c. k'ʷayʔ-k'ʷayʔ		**!		*

As shown in (17*a*), when NOCODA and MAX-BR are high-ranked, it is optimal for the reduplicative morpheme to copy exactly the vowel of the Base, in an open syllable. Competing candidates violate these two high-ranked constraints. As shown in (18), reversing the relative ranking of the two markedness constraints correctly optimizes vowel reduction in the CVC Root reduplicative morpheme:

(17) Root$_1$ (CVC) reduplication in Sḵwx̱wú7mesh

/RED$_{ROOT}$ -k'ʷás/	MORPH-SYLL	*V-PLACE	MAX-BR (V-PLACE, SEG)	NOCODA
☞ *d.* k'ʷəs-k'ʷás	*		*	**
e. k'ʷá-k'ʷás	*	*!	*	*
f. k'ʷás-k'ʷas	*	*!		**

Abandoning uniform constraint rankings in favour of co-phonologies accounts well for cases where we do not find the expected match between morphological category and degree of markedness or where reduplicative morphemes with identical categories show different patterns of markedness reduction. These reduplicative patterns then simply confirm the thesis of Chapter 4: morphological

recast in co-phonology terms for ease of comparison with other analyses presented in this book and in other recent work on morphologically conditioned reduplication patterns like Inkelas and Zoll (2005).

category alone does not determine canonical form. Phonotactic (and other markedness) constraints also play an important role.

In Ilokano and Sḵwx̱wú7mesh, independent evidence is available to decide the appropriate morphological category of the reduplicative morphemes, although the degree of markedness in the canonical form does not. The analytical problem is how to account for the fact that the morphemes have more or less marked structure than one might expect for the relevant category. The converse problem is found in the Yoruba gerundive. We noted in section 4.4, above, that the canonical CV shape of the gerundive is compatible with either Root or Affix canonical shape in Yoruba. And, as shown in (3), above, the correct output is chosen whether the reduplicative morpheme is labelled a Root or an Affix. Zuni compounding truncation discussed in section 3.2.3, above, provides a similar example. The CV truncated syllable illustrated in (18) is analysed as a reduced bound Root by McCarthy and Prince (1986), but it could equally well be analysed as an Affix, as no independent evidence appears to be available to decide between the two analyses:

(18) Zuni compounds (McCarthy and Prince 1986: fig. (80))

tukni	tu-mokʷkʷ'anne	toe-shoe = stocking
melika	me-kʷiʃʃo	Non-Indian-negro = black man
melika	me-ʔoʃe	Non-Indian-be:hungry = hobo
patʃu	pa-lokk'a-akʷe	Navajo-be:gray = Ramah Navajo

As shown in (3), above, it is not technically difficult to provide an analysis for prosodic morphemes with an indeterminate morphological category. One can either leave the input morphological category ambiguous, as shown in (3), or make a rather arbitrary choice of category: for example, that bound CV morphemes are, in the absence of independent evidence, Affixes. Both approaches derive the correct optimal output canonical form.

The interesting issue for future research raised by cases where canonical form and morphological category do not match is how they fit into the historical development of reduplicative morphemes and other bound truncations. Niepokuj (1991) argues that what compounding and reduplication have in common is that in the earliest stage both halves are full morphemes, with the same morphological category (Root or Stem). Both constructions are subject to reduction processes in one-half of the complex, which eventually lead to a more Affix-like morpheme. All of the cases discussed in this section raise the question of how much reduction and what kinds of reduction lead to reclassifying a morpheme from a Root (Head) to an Affix (non-Head).

5.2. Conclusion

This work has presented a survey of the role of canonical forms in word miminality, root-and-pattern morphology, truncation, and reduplication. It confirms the results of previous surveys (notably, Moravcsik (1978) and McCarthy and Prince (1986)) showing that the minimal size of canonical forms is typically one to two syllables and the common maximal size is two syllables. The theoretical aim of the work has been to develop a formal approach within Optimality Theory, termed morpheme-based template theory (MBT), to account for these generalizations. Arguments for the approach have been presented in two main steps. First, Chapter 2 presents a critical assessment of a popular current theory accounting for canonical forms. In this approach—Prosodic Hierarchy-Based Generalized Template Theory (PBT)—canonical morpheme shape follows from the correlation between minimal Prosodic Word and minimal stress Foot defined by the Prosodic Hierarchy. Morphemes are canonically bimoraic or disyllabic because these are canonical stress Foot types. Parsing the morpheme as a Prosodic Word dominating a stress Foot automatically derives the canonical form.

Chapter 2 shows that while this theory appears to work well for a certain number of cases, there are many reasons to be dissatisfied with it as a general explanation for canonical form. The most serious is that there is no consistent cross-linguistic correlation between minimal word size and minimal stress Foot. Further, words and morphemes that are not parsed into stress Feet are still subject to minimality constraints. Morphemes that are stressed and subject to minimality are not always Prosodic Words. Finally, words with different morphological structures can be subject to different minimality constraints even though they have the same stress footing.

Chapter 3 develops the alternative, morpheme-based approach, MBT. The central proposal of this theory is that the basic morpheme-prosody correlation is between a single morpheme and a single syllable, rather than between Stem and stress Foot. The cross-linguistic tendency for words and major morphemes to be subject to minimality constraints that exceed a single light syllable are attributed to a Head-Dependent Asymmetry: Head morphemes (Roots) must branch while non-Heads (Affixes) may not. Further, minimally bimorphemic Stems must minimally branch into two syllables, one for each morpheme. The case studies presented in this chapter show that divorcing canonical size constraints from the Prosodic Hierarchy allows MBT greater empirical coverage. Correlating bimorphemic Stem structure with disyllabicity immediately accounts for the derived word disyllabicity condition found in many languages and generalizes to account for the Stem disyllabicity requirement found in languages where Stem is a core lexical category. Stem disyllabicity falls out from the MBT proposal that bimorphemic lexical categories (Stem) are canonically disyllabic. In PBT, Stems are only predicted to be disyllabic, if there is evidence from the stress system for a disyllabic minimal stress Foot. As we saw, this sort of evidence is often lacking. MBT solves similar problems raised by Root morphemes. Monomoraic CVC is a common minimal Root size. In most of these languages, CVC cannot be a minimal stress Foot. As a result, PBT has no explanation for why CVC is a canonical Root shape. In MBT, a CVC string satisfies minimal branching requirements on Roots as it contains a branching rhyme. MBT can also account for Root minimality in languages with unbounded stress, or no stress. PBT fails to provide an account, as minimality requirements must find independent motivation in binary stress footing.

Both variants of GTT assume there is a reliable correlation between morphological category and canonical form. Head morpheme status (Stem or Root) should correlate with more complex, marked phonological structure, while non-Head Affix status should correlate with less marked phonological structure. We find a variety of mismatches, however, where Roots and Affixes do not show the relative degree of complexity and markedness expected. Chapters 4 and 5 show that many of the mismatches can be explained by taking a closer look at the prosodic and other markedness constraints active in the language. When these constraints are high-ranked they can mask the influence of the morphological constraints matching a particular morphological category in general to a particular canonical form. It is, in fact, an advantage of MBT that there often turns out to be a good correlation between syllable phonotactics—especially the phonotactics of the final syllable—and Root or Word minimality. Since the basic prosodic correlation is between a morpheme and a syllable, it is expected that syllable markedness constraints should play an important role in determining canonical form.

While the theory developed in this work accounts for most aspects of canonical form, some questions must be left for future research. In order to implement a theory that correlates morphological category with prosodic constituents, as GTT proposes to do, one needs a complete independent theory of possible prosodic constituents and a complete theory of how to identify morphological categories, especially for bound morphemes. As we saw, there are a couple of ways in which our theories fail us. First, it is cross-linguistically common for languages to set a four-syllable maximum on words and truncations. As there is no available stress-independent prosodic constituent of exactly four syllables, more research is needed to understand the motivation for this maximality restriction. Further, there seems to be a great deal of overlap between the canonical forms of Root and Affix. Both are monosyllabic, so that reduced bound Roots are phonologically confoundable with Affixes. More research is needed to better understand what properties independent of size reliably distinguish Roots and Affixes. This work will have served its purpose if it has laid the groundwork for research that will lead to a better understanding of these problems.

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