ROOT MINIMALITY PATTERNS

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BY

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PBT, MBT
“subminimality”
stems from plain Markedness,
but then he thought:

How’s there binarity
monosegmentally,
if you need branching that
you haven’t got?

V, CV, CVC –
it’s PROPERHEADEDNESS,
but one more feature was
what he still sought:

monomoraically,
pitch-accent, tone, and stress –
most of Earth’s languages
counts for a lot.

## ACKNOWLEDGEMENTS

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This thesis is the evolution of a few activities. First, a paper presented at the 43rd Annual Conference on African Linguistics, hosted by Tulane University. I would especially like thank commentary, critique, and suggestions from my audience, specifically including Douglas Pulleyblank and Akinbiyi Akinlabi. Foremost, the encouragement from my panel chair, Laura J. Downing, to expand the question of tone and "subminimality" to other languages was a tremendous affirmation.

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Thirdly, although Haitian Creole is only mentioned once, the summer of 2012, spent at Florida International University, funded by a FLAS Summer Fellowship for Haitian Creole, gave me an opportunity to expand my research into Japanese and to begin entertaining novel ways of looking at two of my interests: West African languages and

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My gratitude for Elizabeth Poe's unconditional support since I was a freshman conspicuous in "loving grammar" cannot be well captured within an here. Similarly, the greater ripples of the influence Judith Maxwell has had on my taking the plunge into linguistics have yet to be seen. Although, the mention of the Tunica language is brief, I hope that this contributes (even if just a bit) to increasing its presence.

Penultimately, I must thank those not implicated in linguistics: my family, friends, and roommates who have listened to me despite and compassionately feigned total, unmerited interest in my research.

Lastly, I must express most extreme gratitude to my advisor, Ọlanikẹ Ọla Orie. Between assisting with data that I, otherwise, would not have been aware of, late night emails, translating Zachspeak into coherent, professional English, and reminders that I need to [choose one: rest, eat, sleep, relax]. She has been a driving force for in the completion of this thesis – even if that driving is to an urgent care clinic! I cannot belabor the extent of my thankfulness for her help, so I won't try to. Hopefully, future success rather than a mere acknowledgements section will belie the caliber of her advising.

Despite others' best efforts and intentions, it is quite possible that this thesis didn't manage to escape the corrupting touch of my writing skills. Naturally, all errors, typos, or any other affronts are mine alone and not those of the helpful and the blameless.

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# CHAPTER 1: INTRODUCTION

This thesis has two goals. The first is to provide a close reanalysis of minimal Roots in Yoruba and Japanese. The second is to develop a theory accounting for Root minimality that builds from a universal, cross-linguistic base, into language-specific minimal Root forms, arguing that language-specific minimal forms can be predicted using the Generalized Template Theory (GTT, McCarthy & Prince 1994b), but that what are common to all forms are constraints that require syllabicity and autosegmental phonology.

## 1.1 Optimality Theory in This Thesis

This thesis presents some analyses in the Optimality Theory framework (McCarthy & Prince 1993). In Optimality Theory, phonological forms are explained as resulting from a three-part process of selection (EVAL) of a generated list of potential phonological forms (GEN) based on weighted criteria (CON); phonological processes are driven by constraints favoring certain forms over others, instead of rules that general outputs, as in *The Sound Pattern of English* (Chomsky & Halle 1986).

First, GEN, which produces a set of potential phonological outputs or surface forms from a given input or underlying, canonical form. Second is CON, which constitutes a language's overall preferences for outputs. These preferences are formalized through a set of hierarchically ranked, violable constraints. Finally, EVAL, which evaluates all potential outputs generated by GEN and selects an optimal candidate, which appears as the surface form. The optimal candidate is the one that satisfies as many of the higher ranked constraints as possible.

Constraints typically fall into one of two categories: Markedness and Faithfulness. Markedness constraints require unmarked phonological structure, even at the expense of consistency between an input or underlying form and a surface form. Thus, common Markedness constraints that are widely used in Optimality Theory and which will be used in this thesis include:

(1) NOCODA: Syllables do not have Codas, or syllables are open.

(2) *VV: Sequences of vowels are marked.

(3) ONS(ET): Syllables must have Onsets

Faithfulness constraints, on the other hand, require the preservation of identity between inputs and outputs, even if that entails outputs having a more linguistically marked structure. Common faithfulness constraints that appear in this thesis include

(4) DEP(ENDENCE): Content in the output must correspond to content in the input; no insertion/epenthesis.

(5) MAX(IMALITY): Content in the input must be present in the output; no deletion.

Other, more theory-specific constraints will also be used and defined as they are invoked.

Constraints in Optimality Theory have two important characteristics. First, constraints are violable, meaning they are not always obeyed. The more highly-ranked constraints an output candidate violates, the less favored it is by the language, and the less likely it will be the optimal output. Second, constraints are hierarchically ranked; some constraints are crucially more important than others and are obeyed, even at the expense of violating many other more lowly-ranked constraints. Thus, a surface form that violates many lowly-ranked constraints may be selected as optimal, because it violates few highly-ranked constraints. While constraint rankings are language- or language family-specific, it is generally assumed that all constraints are available to all speakers; however, not all constraints are actively used.

GEN, CON, and EVAL are portrayed in tableaux, in which the set of output candidates given by GEN are tested against a ranked set of constraints (CON), resulting in the selection of the optimal candidate by EVAL. This is exemplified below, in (6), a hypothetical account of how a language that strongly prefers unmarked syllables might borrow the English word ‘aboard’ /əboʊrd/ as ‘habodu’ /həbodu/. GEN takes the input sequence CVVCC and generates potential candidates (6a-d); while a serious theoretical concern of Optimality Theory is how many candidates GEN actually generates, this tableau is being used to demonstrate how EVAL works and provide a simplistic account of the cross-linguistic tendency for the emergence of unmarked syllables, despite more marked underlying forms, also known as The Emergence of the Unmarked (TETU, McCarthy & Prince 1994a). For demonstrative purposes, the candidate set is restricted to the forms presented in (6a-d).

Candidates (6a-d) are then evaluated against the constraints presented in (1-5). Constraints are entirely evaluated one-by-one, as opposed to candidates being evaluated one-by-one for all constraints. For every violation a candidate incurs, it receives a mark, denoted be an asterisk (*). Candidates that violate too many highly-ranked constraints are deemed not optimal. The asterisk representing the violation that rules a candidate out of the running for optimal candidate is followed by an exclamation point (!). This violation is described as being “fatal” and the ruling-out of its associated candidate is referred to as a “fatality.” This process continues until enough constraints have been tested to rule out all but one optimal candidate, denoted by the pointing finger (☞).

(6) ONSET, *VV, NOCODA >> DEP, MAX

| ‘aboard’ əboʊrd | ONSET | *VV | NOCODA | DEP | MAX |
|---|---|---|---|---|---|
| a) əboʊrd | *! | * | * | | |
| b) h̲əboʊrd | | *! | * | * | |
| c) h̲əbod | | | *! | | ** |
| d) ☞ h̲əbodu̲ | | | | ** | ** |

In the tableau above (6), the perfectly faithful candidate (6a) is ruled out, because it fatally violates highly-ranked ONSET. To make it easy to follow, I have underlined inserted segments. Candidate (6b), does not violate ONSET, because of its epenthesized /h/; however, it still fatally violates *VV. Candidate (6c) obeys ONSET and, because its Rhyme has been simplified, also obeys *VV; however, it nevertheless violates NOCODA. Candidate (6d) is the optimal candidate, because it obeys ONSET, *VV, and NOCODA; it should be noted, though, that is does so at the cost of two violations of DEP, for inserting /h/ and /u/, and two violations of MAX, for deleting /ʊ/ and /r/. Because DEP and MAX are not valued in this ranking, they are considered dominated by the Markedness constraints ONSET, *VV, and NOCODA. It should be noted that in this case the hierarchy among the three Markedness constraints is irrelevant. No matter what order they may be ranked in, (6d) would always be the optimal candidate. Thus the constraint hierarchy can be exemplified ONSET, *VV, NOCODA >> DEP, MAX – where the three Markedness constraints are freely ranked among one another (i.e., no hierarchy is demonstrated among them), but critically outrank the Faithfulness constraints. In (6), the free ranking versus hierarchical ranking is demonstrated by the use of dashed lines to denote a non-hierarchical relationship and solid lines to demonstrate dominance.

The ranking in (6) has been argued as important for explaining ostensibly subminimal shapes of Roots (Ọla 1995; Orie & Pulleyblank 2002; Downing 2006); however, this thesis will demonstrate that while Markedness may be important in explaining minimal Root outputs, it is insufficient for an account of underlying or canonical minimal Root forms and that these forms require novel constraints.

## 1.2 Outline of Thesis

Chapter 2 gives a critical overview of current popular accounts of Root minimality. Generally, these accounts fall into one of two camps: Prosodic Hierarchy-Based GTT (PBT), which predicts that the cross-linguistic minimal word size is motivated by the Prosodic Hierarchy and is minimally a binary Foot (McCarthy & Prince 1986, 1993), and the Morpheme-Based GTT (MBT), in which word minimality primarily manifested in phonological branching, not prosody (Downing 2006). Unfortunately, neither version of the GTT manages to account for all attested minimal Roots. In these cases, ostensible "subminimality" is explained by subordinating the motivating forces of either version of the GTT to the universally attested preference of unmarked syllables (McCarthy & Prince 1994a), that is, CV syllables (Ọla 1995; Orie & Pulleyblank 2002; Downing 2006). Chapter 2 then concludes with a call for a theory of Root minimality that begins at the cross-linguistic level, since all languages have Roots.

Chapters 3 and 4 discuss Root minimality in two languages with well-attested "subminimal" Roots: the Yoruba dialects Standard Yoruba, Yagba, and Ondo (Chapter

3), and Standard or Tokyo Japanese (Chapter 4). Both chapters offer evidence that in their respective languages, "subminimal" Roots are both well-formed and canonical and that lexically-specified tonal information is crucial to their identity and well-formedness.

Chapter 5 takes up the critique made in Chapter 2, revisiting PBT and MBT in light of the evidence presented in Chapters 3 and 4, arguing that neither PBT, nor MBT, nor subordination of the GTT to Markedness can easily predict cross-linguistic Root minimality. Chapter 5 also offers a solution, observing that since all Roots have at least one syllable in their surface forms and require tonal, pitch-accent, or stress information, canonical underlying forms of Roots are minimally a single segment that is lexically specified for prominence-related autosegmental information, minimally tone, pitch-accent, or stress. It argues that this minimal form provides the minimal input necessary, from which constraints implicated in various forms of the GTT may motivate language-specific well-formedness of output shapes.

Chapter 6 concludes the thesis, pointing out the general, overarching ideas developed, along with their caveats and areas for future research and theory-testing.

# CHAPTER 2: TEMPLATE-BASED ACCOUNTS OF MINIMAL WORD

Explanations of what motivates minimal word size are part of what is referred to as the Generalized Template Theory (GTT), which suggests that morpheme shapes arise from phonological constraints (McCarthy & Prince 1994b). This chapter provides an overview and critique of two popular interpretations of the GTT. The first, the Prosodic-Hierarchy Based GTT (PBT), predicts that the cross-linguistic minimal word size is motivated by the Prosodic Hierarchy and is minimally a binary Foot, and thus disyllabic or bimoraic (McCarthy & Prince 1986, 1993). The second interpretation is the Morpheme-Based GTT (MBT), which proposes that minimal word size is motivated by the relationship between morphological and phonological complexity; thus, word minimality is manifested in phonological branching, not prosody (Downing 2006). This allows some monomoraic words, all of which unaccounted for by PBT, to satisfy minimality requirements by having a segmentally branching rhyme.

In order to provide a powerful cross-linguistic explanation of word minimality, the GTT must be able to account for (C)V minimal words in a manner similar to how it accounts for the minimal word sizes already captured by PBT and MBT.

The first section gives an overview of Word minimality in PBT. The second section gives an overview of Root minimality in MBT. The third section presents the issue of “subminimality” in both PBT and MBT, how accounts framed in either version of the GTT uses Markedness to address subminimality, and the issue inherent to using Markedness, namely, that it creates a split account of minimality. The fourth section summarizes the various popular accounts of minimality and discusses the explanatory difficulties that arise from their respective frames of reference: prosody for PBT and segments for MBT. The fifth introduces the position that this thesis argues: that a distinction can be made between Root minimality constraints that appear to be obeyed cross-linguistically and constraints that drive language-specific minimality conditions, often associated with "minimality effects" of outputs.

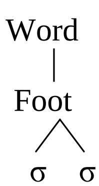
## 2.1 Prosody-Based Generalized Template Theory

McCarthy & Prince's (1986, 1993) account of word minimality states that a word must minimally be a binary stress Foot. This is exemplified in the constraint:

(1) FOOT BINARITY or FTBIN (McCarthy & Prince 1993: 46)

Feet must be binary under syllabic or moraic analysis.

This prosody-based account requires minimal word sizes to be disyllabic (2a) or bimoraic (2b).

(2a)



(2b)



Given this proposal, grammatical minimal words are expressed as CVCV, VCV, CVV, or VV. Words expressed at CVC can also be analyzed as meeting minimality requirements if Codas are moraic. Secondly, PBT does not account for languages with V or CV Root minimality.

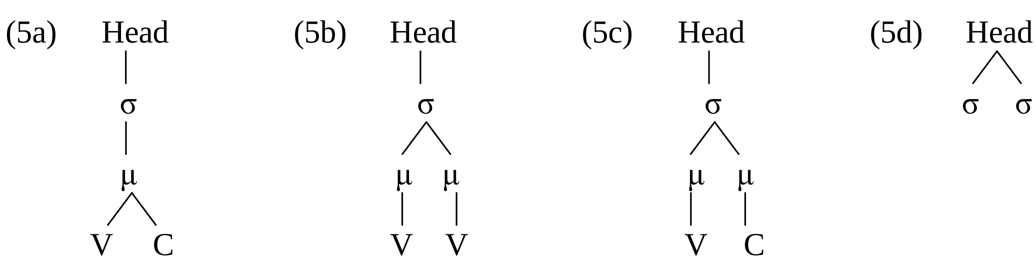
## 2.2 Morpheme-Based Generalized Template Theory

The Morpheme-Based Generalized Template Theory, or MBT (Downing 2006), provides a reinterpretation of the Generalized Template Theory (GTT). MBT shifts the interpretation of word minimality from one in which the minimal word size is a binary stress Foot, to one in which minimality results from the relationship between morphological and phonological complexity: lexical morphemes are Heads licensing phonologically complex structure. This is enforced by the interaction of two constraints:

(3) MORPHEME-SYLLABLE CORRELATION, or MORPH-SYLL (Downing 2006: 120, adapted from Russell 1997: 121):
"Each morpheme contains exactly one syllable."

(4) HEADS BRANCH, or HEADSBRANCH (Downing 2006: 122, adapted from Dresher & van der Hulst 1998):
"Lexical heads (Roots) must prosodically branch."

Thus, MBT introduces the segmentally branching rhyme (5a) as a means of satisfying minimality requirements, allowing Heads to satisfy branching through mono- or bimoraic Rhyme complexity (5a-c) or through being disyllabic (5d). MBT's interpretation of word minimality requires monosyllabic words' rhymes to be minimally VX[1], where X is a segment, and demonstrates that these words are acceptable, because they obey HEADSBRANCH.




[1] Or CX, if C is a syllabic consonant

This accounts for languages already compliant with FTBIN (5b-d) and also languages with CVC as the minimal word size, but in which Codas are *not* moraic (5a).

Those minimal words that satisfy FTBIN implicitly satisfy HEADSBRANCH and may either obey MORPH-SYLL (5a-c) or violate it (5d), in which case they would be minimally disyllabic. Downing's (2006) addition, through MBT, accounts for minimal words that do not obey FTBIN (5a), without rendering invalid the minimal word sizes that obey FTBIN. We can say that while Downing (2006) urges us to "divorce" prosodic explanations (indeed, prosody need not necessarily be invoked), prosodic effects/processes do not necessarily need to be jettisoned from the GTT; rather, the prosodic branching required by FTBIN is subsumed into the branching required by HEADSBRANCH and might account for other processes, such as elision. We will see below that there are instances where it can be argued that FTBIN is obeyed if possible, even if it does not play a role in Root minimality, for example in Yoruba verb phrase elision (Orie & Pulleyblank 2002).

### 2.3 PBT and MBT Accounts of "Subminimal" Forms

Neither PBT nor MBT inherently accounts for the well-formedness of monomoraic, codaless words, which "branch" neither prosodically, nor phonologically. This poses a serious issue, because the majority of the world's languages have CV as their minimal word size (6).

(6)

| Minimal word sizes of 334 languages. Reproduced from Downing (2006: 168), itself compiled from Appendix 2 of Gordon (1999). | | | | |
|---|---|---|---|---|
| Minimal Word | Quantity insensitive | Quantity sensitive | n.a. (no stress) | Total |
| CV | 88 | 43 | 55 | 186 |
| CVX | 53 | 30 | 19 | 132 |
| CVCV | 13 | 11 | 2 | 26 |
| Total | 154 | 114 | 76 | 344 |

Ọla (1995) provides an explanation framed in PBT for one such language: Yoruba. The essence of Ọla's (1995) account of CV as Standard Yoruba's minimal word size is the proposition that Yoruba's Markedness constraints – ONSET, NOCODA, and *VV – work in concert with PROPERHEADEDNESS, which requires the heads of Yoruba words to contain a syllable, and ALIGN-HEAD-R, which requires right-headedness, and that they all outrank FTBIN. This explanation suggests that when it comes to satisfying minimality requirements, languages have the option of using language-specific well-formedness constraint rankings as an alternative to satisfying FTBIN.

Interestingly, it is proposed that FTBIN, albeit lowly-ranked, is still functional in Yoruba. Ọla (1995: 287) refers to noun canonicity; Yoruba nouns are canonically minimally VCV, thus obeying both the Markedness/PROPERHEADEDNESS combo by containing a right-anchored CV syllable and FTBIN by being disyllabic/bimoraic. Orie & Pulleyblank (2002) further underscore the relevance of FTBIN, even in its low-rankedness by using Verb+Object elision[2] to demonstrate that while verbs in isolation may use PROPERHEADEDNESS and Markedness to satisfy minimality, they prefer to elide with their

[2] Interestingly enough, V+O elision is also what will be used in support of Yoruba meeting a reinterpretation of Downing's (2006) account of word minimality.

objects to create minimally disyllabic Stems, thus satisfying PROPERHEADEDNESS, Markedness, *and* FTBIN.

The conjunction of PROPERHEADEDNESS and Markedness, specifically ONSET, is specific to Standard Yoruba and would cause languages such as Japanese and the Yoruba dialect Ondo to fail minimality, because their Roots are minimally V; note, however, that their failure would be as a result of violating ONSET, not PROPERHEADEDNESS. Downing (2006) retools Ọla's (1995) account to be applicable to all "subminimal" languages by arguing that "subminimality," i.e., failure to obey HEADSBRANCH, results from Markedness constraints outranking MBT's hallmark HEADSBRANCH.

Just as Ọla (1995) subordinates FTBIN to Yoruba well-formedness and Markedness constraints, Downing (2006: 170) subordinates HEADSBRANCH to MORPH-SYLL and Markedness constraints, effectively creating a prosody-blind analogue of Ọla's (1995) and Orie & Pulleyblank's (2002) account, which operated within the stricter FTBIN as the motivator of minimal word sizes. The following tableau is presented in Downing (2006: 213) to exemplify (C)V minimality[3]:

(7) NOCODA, *VV, MORPH-SYLL >> HEADSBRANCH

| | NOCODA | *VV | MORPH-SYLL | HEADSBRANCH |
|---|---|---|---|---|
| CVCV | | | *! | |
| CVV | | *! | | |
| CVC | *! | | | |
| ☞ (C)V | | | | * |

Downing (2006: 213) falls on factorial typology predicting the popularity of (C)V minimality and more or less leaves the discussion of (C)V minimality there. What

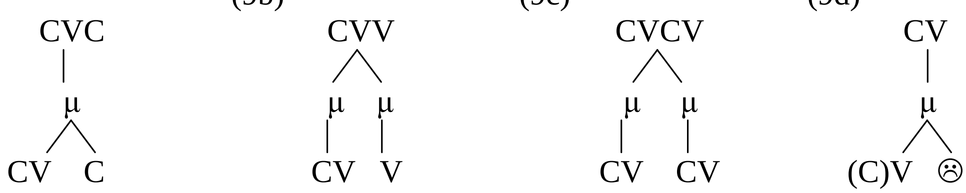
[3] I have modified it to include V minimality. This does not significantly alter Downing's (2006) account, as MBT targets Rhymes only – not Onsets.

follows is an explanation of why, after CV, CVC is the most common minimal word type. The reason given is essentially that CVC words, although violating NOCODA, satisfy MORPH-SYLL, HEADSBRANCH, *VV. Further strength is given to preference of CVC over CVV minimal words by the fact that many languages require all words to end in a consonant (Downing 2006: 214). This requirement is formalized in McCarthy & Prince's (1994a: 357) FINAL-C constraint:

(8) FINAL-C
Every PrWd is consonant-final.

And it is here that Downing (2006: 214) finds it "curious" that there is somewhat of a contradiction: in some languages, words *must* end in a consonant (CVC minimal word languages), while in others (CV and CVV minimal), words *cannot*. Of the four minimal types, only one fails to satisfy MBT's version of MORPH-SYLL and HEADSBRANCH:

(9a) (9b) (9c) (9d)




Considering the frequency table in (4), this means that about 54% of the 344 languages that Downing (2006) presents from Gordon (1999) do not satisfy MBT's hallmark constraint of HEADSBRANCH. Downing's (2006) explanation that HEADSBRANCH is essentially buried MORPH-SYLL by other, higher-ranking phonological and Markedness constraints, to account for (C)V word minimality creates a huge exception to an otherwise powerful constraint. This thorn in HEADSBRANCH renders it much weaker, such that instead of an explanation of word minimality, it explains why some languages have minimal words that are not (C)V.

Even MBT's wider reinterpretation of GTT was not enough to provide an account of monomoraic Roots with codaless Rhymes. Instead, MBT requires us to continue to rely on an account of (C)V minimality originally formulated within PBT's stricter definition of branching or binarity, FTBIN: that Roots obey minimality constraints, except when they don't, in which cases (the majority of the world's languages), they obey Markedness first and GTT-specific constraints second.

Downing's (2006: 100) critique of the prosodic explanation of minimality can, to some extent, be applied to MBT, as well:

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

With the prominence of CV as the minimal word size, as seen in (10), MBT's interpretation of the observed correlation between segmentally complex rhymes and minimal word size requirements does not yet provide the base for a satisfying cross-linguistic account of word minimality. Although MBT provides an improvement over PBT by having the same explanation for disyllabic, bimoraic, and some monomoraic minimal word sizes, it, too, is forced to account for some stressless and quantity-insensitive stress languages in a separate manner, similar to PBT's account. Indeed, as McCarthy & Prince's (1986, 1993) prosodic account of minimal word size required subordination of its hallmark constraint, FTBIN, to Markedness constraints to explain CV minimality (cf. Ọla 1995 for Standard Yoruba), MBT alone, as it stands in Downing (2006), does not actively motivate minimal word size in (C)V-minimal languages so much as it recasts the theory that languages with subminimal minimal word sizes can obey Markedness as an alternative, a theory already developed within PBT.

Like PROPERHEADEDNESS in PBT, MORPH-SYLL with Markedness constraints can be used as an "escape hatch" to still be well-formed while failing to branch. In light of the popularity of CV minimality among the world's languages (10), a more accurate description of MBT is that it can be used to explain deviance from CV minimality.

## 2.4 Theoretical Issues of Current Minimality Accounts

Downing's (2006) Morpheme-Based Templates (MBT) departs from Prosodic Hierarchy-Based Templates by requiring phonological branching of morphological types. In MBT, this branching extends all the way down to the minimal word, which must minimally be a branching rhyme. This new description splits from the FTBIN constraint (McCarthy & Prince 1993), which requires the minimal prosodic word to be one binary Foot, and provides an explanation for minimal words that not only includes all words fulfilling FTBIN, but also languages whose minimal words are monomoraic CVC or CVV syllables. Unfortunately, MBT, like its predecessor PBT, does not account for those languages that are (C)V minimal. In light of the observation that (C)V is the most popular minimal word size, a more accurate description of both PBT and MBT is that they explain deviance from CV as the minimal word size, that is, that they can be used to account for the minimal shapes of Root morphemes that are larger than (C)V.

Booij (2011: 2055), in his chapter discussing the issue of morpheme shape constraints, points out that:

> Prosodic conditions on morphemes [PBT] create a problem . . . the syllable structure of a morpheme is not part of its lexical representations, but a derived property. Therefore, [morpheme shape constraints] cannot refer to derived prosodic properties such as bimoraicity (McCarthy 1986). The only way to circumvent this problem is to phrase the constraint in terms of segment sequences [MBT]: a lexical morpheme must contain either a long vowel, or a short vowel followed by at least one consonant. However we miss the generalization that it is a prosodic syllable weight condition that is involved. . . . Again, this [morpheme shape constraint] refers to the derived property of syllable structure (cf. Downing 2006).

It is here that we meet the imposition that prevents absolute morpheme shape constraints: it is assumed that weight plays an essential factor. Booij (2011) aptly goes on to suggest that both PBT- and MBT-related constraints govern, and thus derive, outputs, rather than provide absolute prescriptions of morpheme shapes. What is not considered is that "weight" is not always a critical phenomenon in many languages of the world, not only in stressless tonal and pitch-accent systems, but also in unbounded stress systems. Booij (2011) concludes by calling for a way to implicate both prosody and phonotactics.

### 2.5 Toward a Novel Account of Root Minimality

This thesis offers an improvement upon MBT: that Rhymes of minimal words of languages typically described as (C)V minimal, while not having a fully expressed codas or second vowels (through length or diphthong), actually are complex by having lexical autosegmental content. This thesis, then, suggests that these minimal words should be considered well-formed, because they critically utilize autosegmental phonology. The next two chapters demonstrate the crucial nature of autosegmental phonology in two languages, Yoruba and Japanese, whose Roots are considered "subminimal" by both PBT and MBT.

The observation that the active constraints in PBT and MBT predict minimal morphemic output shapes suggests that minimality can be discussed in two ways. First, the typology/factorial/branching-based or "counting" approach, in which we find explanations of minimal word shapes (McCarthy & Prince 1986, 1993, 1994b; Downing 2006) and in which we see minimality having "effects" such as compensatory lengthening, phonological reduplication, elision (Orie & Pulleyblank 2002) to obey constraints such as FTBIN or HEADSBRANCH, and situations where Markedness reigns, as originally described by Ọla (1995), where unmarked syllables are encouraged and, perhaps, conspire with MORPH-SYLL to give monomoraic minimal words with monosegmental Rhymes.

Secondly, this thesis proposes what can be described as an "essentialist" approach to minimality, in that it does not, at its core, generate morpheme shapes or necessarily produce minimality effects; rather, it attempts to describe the minimal conditions necessary for Language to allow a phonological entity to even be a candidate Root, i.e., what must Roots have universally *or* what makes Roots Roots. Strictly segmental and/or prosodic analyses clearly present an incomplete account of many languages' minimal words. Indeed, segmental and prosodic analyses of Yoruba and Japanese words ignore the role of tone in assigning lexical identity. While arguably universal accounts of "subminimality" have been made (Ọla 1995 for Yoruba, Downing 2006 more generally), these accounts suggest that PBT and MBT are weaker than we would like at describing what Roots are phonologically, and none suggests a strong, common, uniting quality of Roots – rather, that there are many weak strategies employed. Interestingly, the distinction between an absolute constraint on morpheme shapes and constraints driving "minimality effects" harkens to Booij's (2011) critique of PBT- and MBT-related accounts and answers his concluding call to implicate both prosody and phonotactics by suggesting that all Roots are minimally monomoraic, having a Nucleus that must bear either lexical tone, pitch-accent, or stress, but without making an appeal to syllable weight. The theory which will be laid out in this thesis is different from PBT and MBT, because it appeals neither to syllable weight (as in PBT), nor to segmental branching (as in MBT) for the satisfaction of minimality.

## 2.6 Summary

In summary, prosodic and segmental versions of the GTT offer interesting observations on minimality effects in different languages. Ultimately, however, these accounts of Root minimality fail to directly predict the minimal Root shape of the majority of the world's languages (6): monomoraic, codaless monosyllables. Accounts of subminimality in either framework subordinate their hallmark constraints, FTBIN or HEADSBRANCH, allowing Markedness constraints to account for these "subminimal" languages. In this way, either version of the GTT could be more accurately described as accounting for why some languages do not use Markedness and PROPERHEADEDNESS for minimal Root forms. Where one version of the GTT shows usefulness, the other version is found lacking. Booij (2011) calls for an account that can implicate both prosody and phonotactics.

This thesis argues that autosegmental phonology plays a crucial role in Root minimality, specifically, that it works with PROPERHEADEDNESS in providing the absolute minimal form for Roots, cross-linguistically. In doing so, this thesis draws a distinction between the cross-linguistic minimality requirements, PROPERHEADEDNESS and autosegmental phonology, and language-specific well-formedness constraints. The former are obeyed no matter what and their effects can be seen cross-linguistically, even on underlying forms of Roots, while the latter, constraints associated with PBT, MBT, and Markedness, drive language-specific minimality effects.

The next two chapters present evidence from the Yoruba dialects, Standard Yoruba, Yagba and Ondo (Chapter 3), and from Standard (Tokyo) Japanese (Chapter 4), supporting existence of monomoraic, monosyllabic, codaless minimal Roots and that Roots are lexically specified for autosegmental phonology, such as tone or pitch-accent, that plays a crucial role in the well-formedness of Root's underlying forms.

# CHAPTER 3: MINIMALITY IN YORUBA: STANDARD YORUBA, YAGBA, AND ONDO

As we saw in section 2.3, MBT and PBT take similar approaches to minimality in Standard Yoruba – specifically, that Markedness constraints outrank whatever theory-specific constraints motivate word minimality (FTBIN for PBT, HEADSBRANCH and MORPH-SYLL for MBT). The importance of tone in Yoruba minimality will be exemplified through comparing and contrasting verbs in isolation (when used as imperatives) with verbs in Verb + Object elision outputs. The first section presents the nature of Root minimality in Standard Yoruba verbs, which are canonically CV. The second section presents verbs from Yagba. In Yagba, H- and L-tone verbs lengthen to CVV when in isolation, while M-tone verbs remain CV, a phenomenon which Standard Yoruba's segment-based minimality account cannot explain. In the third section, we will see that although of Verbs in Standard Yoruba and Yagba show different segmental behaviors when in isolation, they yield identical outputs in Verb + Object elision, suggesting that although Standard Yoruba and Yagba verbs behave differently in isolation, they are all underlyingly CV. In the fourth section, we will turn to the Ondo dialect, in which the well-formedness of verb Roots of a single vowel is attested. Ondo serves as evidence from Yoruba against Onsets being necessary to account for word minimality, something which will be taken up, again, for Japanese, as evidence against moraic Onsets (Topintzi 2010) and in Chapter 5 as evidence against Markedness-based accounts of minimal Root shapes. The fifth section brings together this chapter's findings in light of Yoruba having no toneless vowels and concludes that Standard Yoruba, Yagba, and Ondo minimal Roots satisfy minimality by containing monosegmental Nuclei bearing an autosegmental tone unit.

Note that instead of IPA, this chapter uses the Yoruba alphabet. In general, letters correspond to their IPA homographs, with the following exceptions for coarticulated consonants, graphemes with underdots, and the representation of nasal vowels:

| **Consonants** | **Vowels** | **Nasal Vowels** |
| --- | --- | --- |
| ṣ [ʃ] | ẹ [ɛ] | Vowels written with a tautosyllabic n following them are nasal: |
| p [k͡p] | ọ [ɔ] | an [ã] in [ĩ] un [ũ] ẹn [ɛ̃] ọn [ɔ̃] |
| gb [g͡b] | | |

Also, Yoruba is an example of a language with lexical register tone. Any tonal contours are derived and must be analyzed as sequences of register tones in Yoruba (Siertsema 1959) and, indeed, tone languages in general (Woo 1969/1972). Yoruba vowels carry register tones. These will be indicated with a grave accent for low [L] tones, an acute accent for high [H] tones, and no accent for mid [M] tones.

## 3.1 Standard Yoruba

Ọla (1995) provides thorough evidence for CV as the minimal word size in Standard Yoruba. For example, she observes that imperative verbs do not lengthen or change in any way – rather, they remain CV (1). She further notes that the truncated form of English loan verbs is optimally CV (2) (reproduced from Ọla 1995: 276).

(1)

| Verb | | Imperative | | Banned |
|---|---|---|---|---|
| *sá* 'run' | ~ | *sá!* 'run!' | ~ | **sáá, *saá, *sáa* 'run!' |
| *fò* 'jump' | ~ | *fò!* 'jump!' | ~ | **fòò, *foò, * fòo* 'jump!' |
| *mu* 'drink' | ~ | *mu!* 'drink!' | ~ | **muu*, 'drink!' |

(2)

| Borrowing | | Truncation | |
|---|---|---|---|
| *páàsì* | ~ | *pá* | 'to pass' |
| *pọ́mbù* | ~ | *pọ́* | 'to pump' |

CV as the optimal truncation target for Yoruba loan verbs is unusual. Many languages with well-formed CV words tend *not* to truncate to a single mora and instead tend to use binary Foot (disyllabic or bimoraic) templates, for example, in the truncation of loan words (3) (for Japanese, Itô 1990) or formation of hypocoristics (for English Lappe 2007; Weeda 1992), where a heavy syllable is targeted and /i/ may be added, if it does not cause the name to exceed two syllables, seen in (4).

(3) **Truncation of loanwords in Japanese (from Itô 1990: 213)**

| | Loan | Truncation | Gloss |
|---|---|---|---|
| (a) | amachua | ama | 'amateur' |
| | herikoputaa | heri | 'helicopter' |
| | chokoreeto | choko | 'chocolate' |
| | terorizumu | tero | 'terrorism' |
| (b) | haNkachiifu | haNkachi | 'handkerchief' |
| | sukatorojii | sukatoro | 'scatology' |
| | akuserureetaa | aluseru | 'accelerator' |
| | asuparagasu | asupara | 'asparagus' |

(4) **English hypocoristic formation**

| Name | Truncation |
|---|---|
| Abraham | Abe, *Abra |
| Bartholomew | Bart, *Bartho, *Bartholo |
| Cynthia | Cindy, *Cynthy |
| David | Dave, Davy, *Davidy |
| Elizabeth | Beth, Liz(zie), Eli, *Eliz, *Eliza |
| Judith | Judie, *Judithy |
| Nicholas | Nick, |
| Nicole | Nikki, Nicoly |
| Samantha | Sam, Sammy, *Saman, *Samanthy |

Yoruba, however, still prefers a target which the prosodic account of word minimality would consider "subminimal."

In fact, Ọla (1995) shows that it is impossible for a Standard Yoruba word to be well-formed and *not* contain a CV syllable by demonstrating that consonant deletion is impossible if the output does not contain at least one right-anchored CV. This requirement is formalized in the constraint PROPERHEADEDNESS or PROP-HEAD, which, for Standard Yoruba, conspires with ONSET and ALIGN-HEAD-R, which requires Head syllables to align with the right Word boundary. Since onsetless Standard Yoruba vowels are not syllabified (Orie 2000), the right-aligned Head syllable must have an onset. The essence of this account of CV as Standard Yoruba's minimal word size is a constraint ranking specific to Standard Yoruba, in which PROP-HEAD, ONSET, ALIGN-HEAD-R all outrank FTBIN (5).

(5) PROP-HEAD, ONSET, ALIGN-HEAD-R, NOCODA, *DEPV >> FTBIN (adapted from Ọla 1995)

| sá | PROP-HEAD | ONSET | ALIGN-HEAD-R | NOCODA | *DEPV | FTBIN |
|---|---|---|---|---|---|---|
| á | | * | * | | | * |
| ☞sá | | | | | | * |
| sáa | | | * | | * | |
| asá | | * | | | * | |

This explanation suggests that when it comes to satisfying minimality requirements, languages have the option of using language-specific well-formedness constraint rankings as an alternative to FTBIN.

Interestingly, it is proposed that FTBIN, albeit lowly-ranked, is still functional in Yoruba. Ọla (1995: 287) refers to noun canonicity; Yoruba nouns are canonically minimally VCV, thus obeying both PROPERHEADEDNESS by containing a right-anchored CV syllable and FTBIN by being disyllabic/bimoraic. Orie & Pulleyblank (2002) further underscore the relevance of FTBIN, even in its low-rankedness by using Verb+Oject elision[1] to demonstrate that while verbs in isolation may use PROPERHEADEDNESS and Markedness constraints to satisfy minimality, they prefer to elide with their objects to create minimally disyllabic Stems, thus satisfying PROPERHEADEDNESS, Markedness constraints, *and* FTBIN, even at the expense of MAX (6).

(6) PROP-HEAD, ONSET, ALIGN-HEAD-R, NOCODA, *DEPV >> FTBIN >> MAX (adapted from Orie & Pulleyblank 2002)

| tà ọtí | PROP-HEAD | ONSET | ALIGN-HEAD-R | NOCODA | *DEPV | FTBIN | MAX |
|---|---|---|---|---|---|---|---|
| tà ọtí | | * | | | | * | |
| tàa ọtí | | * | | | * | | |
| ☞tọtí | | | | | | | * |

Downing's (2006) MBT also has problems explaining (C)V minimality. Just as Ọla (1995) subordinates FTBIN to Yoruba well-formedness and Markedness constraints, Downing (2006: 170) subordinates HEADSBRANCH to MORPH-SYLL Markedness constraints, effectively creating a prosody-blind analogue of Ọla's (1995) account, which operated within the stricter FTBIN as the motivator of minimal word sizes. The tableau in (7) is repeated from Chapter 2 for easy reference:

(7) NOCODA, *VV, MORPH-SYLL >> HEADSBRANCH

| | NOCODA | *VV | MORPH-SYLL | HEADSBRANCH |
|---|---|---|---|---|
| CVCV | | | *! | |
| CVV | | *! | | |
| CVC | *! | | | |
| ☞CV | | | | * |

[1] Interestingly enough, V+O elision is also what will be used in support of Yoruba meeting a reinterpretation of Downing's (2006) account of word minimality.

Even MBT's wider reinterpretation of GTT was not enough to provide an account of CV minimality. Instead, MBT requires us to continue to rely on an account of CV minimality originally formulated within PBT's stricter definition of branching or binarity, FTBIN.

### 3.2 Yagba Verb Lengthening

In Yagba (Oyebade 1980; Orie n.d.), CV verbs that canonically bear H or L tones lengthen by the insertion of a segmentally identical, but tonally dissimilar, M-tone-bearing, vowel at the left edge of the nucleus, forming a CVV, with the lexical tone specification on the second vowel (*joó* 'dance'; *foò* 'jump, fly'), as seen in (8a, b). Verbs that canonically bear the M tone, however, behave exactly the same as Standard Yoruba verbs, remaining in a CV form (*bi* 'ask'), as seen in (8c).

| (8) | **Standard Yoruba** | **Yagba Yoruba** | |
|---|---|---|---|
| a) | *jó* | *joó* | 'dance' |
| b) | *fò* | *foò* | 'jump, fly' |
| c) | *bi* | *bi* *bii | 'ask' |

The behavior of H- and L-tone bearing Yagba verbs could be explained in PBT and/or MBT, as seen in (9a-b), by altering Standard Yoruba's minimality constraint rankings such that PROP-HEAD, FTBIN, HEADSBRANCH, MORPH-SYLL, NOCODA >> DEPV, ALIGN-HEAD-R to allow vowel insertion.

(9a)

| **jó** | PROPHEAD | FTBIN | HEADS BRANCH | MORPH-SYLL | NOCODA | DEPV | ALIGN-HEAD-R |
|---|---|---|---|---|---|---|---|
| jó | | *! | * | | | | |
| ☞joó | | | | | | * | * |

(9b)

| **jò** | PROPHEAD | FTBIN | HEADS BRANCH | MORPH-SYLL | NOCODA | DEPV | ALIGN-HEAD-R |
|---|---|---|---|---|---|---|---|
| jò | | *! | * | | | | |
| ☞foò | | | | | | * | * |

(9c)

| **bi** | PROPHEAD | FTBIN | HEADS BRANCH | MORPH-SYLL | NOCODA | DEPV | ALIGN-HEAD-R |
|---|---|---|---|---|---|---|---|
| bi | | *! | * | | | | |
| ☹ bii | | | | | | * | |

Similarly to Standard Yoruba, Yagba verbs would contain a CV syllable; although, unlike in Standard Yoruba, it would not necessarily *always* be right-anchored, resulting in the violations of Align-Head-R seen in (9a, b). With this observation in mind, an argument could be made that Yagba ranks PROP-HEAD highly, but, unlike in Standard Yoruba, ALIGN-HEAD-R is not as powerful. Only Ọla's (1995) Standard Yoruba account might be able to account for the special case of M-tone verbs, at least without invoking tone-specific constraints; on the other hand, McCarthy & Prince (1993) and Downing (2006) would predict an incorrect form (9c). What is interesting is that as it stands, this would suggest that both Ọla's (1995) minimality account and a PBT or MBT (McCarthy & Prince 1993, Downing 2006) account are active in Yagba, but in some sort of complementary distribution. The duality of Yagba verb well-formedness alone is vexing for both PBT and MBT; however, when those verbs take objects, the uniformity of their elision outputs is even more perplexing.

## 3. 3 Verb + Object elision outputs

Pulleyblank (2004: 423) explains that it is generally accepted that in Yoruba, high tones (H) are more marked than mid (M) and low (L) tones and that L tones are marked relative to M tones, thus creates a scale from most to least marked:

(10) Most Marked H>L>M Least Marked

Pulleyblank (2004: 421) also provides a frequency table of the distribution of CV form lexical entries (10). It is interesting to note that the more marked tonal forms are more popular.

(11)

| Tones of Yoruba CV lexical entries (all verbs) | | | |
|---|---|---|---|
| H | M | L | Total |
| 367 | 159 | 229 | 775 |
| 49% | 21% | 30% | |

Since Yoruba verbs are canonically CV, at first blush, it would appear that too much content would be lost in the elision for it to yield an acceptable output; however, note that while the vowel of the verb is typically lost, its tone remains and is expressed on the initial vowel of the verb phrase’s object, exemplified for Standard Yoruba in (12). Although Yoruba nouns are canonically vowel-initial, they cannot begin in an H tone (Ọla 1995), thus in the elisions seen in (12), the verb’s tone always remains. While the preference of marked tonal forms in Yoruba verbs is interesting, an appeal to the tonal hierarchy in resolving tone clash is worth investigating, but is not crucial.

(12)

| Yoruba verb phrase elisions | | |
|---|---|---|
| Verb | Object | Phrase |
| With an M-initial noun | | |
| gbé 'lift' | ata 'pepper' | gbata 'lift pepper' |
| jẹ 'eat' | ata 'pepper' | jata 'eat pepper' |
| tà 'sell' | ọtí 'liquor' | tọtí 'sell liquor' [2] |
| With an L-initial noun | | |
| gbé 'lift' | àga 'chair' | gbága 'lift chair' |
| ta 'sting' | ètè 'lips' | tètè 'sting lips' |
| tì 'to close' | ìlɛ̀kun 'door' | tìlɛ̀kun 'close book' |

In Yagba, when a verb is elided with its object, the output is exactly the same as the output of a corresponding elision in Standard Yoruba (Oyebade 1980: 31). This is to say that the entirety of the segmental content of the verb's Rhyme is deleted, regardless of size[3] (V in Standard Yoruba, V(V) in Yagba), and the Yagba output's tonal realization is identical to the Standard Yoruba output's realization. Thus, the Yagba output of V+O elision, in which the verb when in isolation is CVV, is also CVCV, not *CVVCV, and the result of the tone clash in elision is based on the Yagba verb's rightmost, or canonical, tone. This is portrayed in the (13):

(13)

| Verb | | Object | Output |
|---|---|---|---|
| Standard Yoruba | Yagba | Standard Yoruba/Yagba | Standard Yoruba/Yagba |
| gbé | gbeé | àga | gbága |
| *lift* | *lift* | *Chair* | *lift a chair* |
| jẹ | jẹ | edé | jedé |
| *eat* | *lat* | *shrimp/prawns* | *eat shrimp/prawns* |
| tà | taà | ọtí | tọtí |
| *sell* | *sell* | *liquor* | *sell liquor* |

---

[2] Ajiboye *et al.* (2011) prove a distinction between M tones that are M underlyingly and M tones resulting from the process of L-raising.

[3] Standard Yoruba does have some exceptions, for example: *bí* 'to give birth' + *ọmọ* 'child' -> *bímọ* 'to bear a child'; however, the point is that Standard Yoruba and Yagba outputs are identical.

While this thesis does not address what causes or prevents vowel epenthesis in canonically M-tone Yagba verbs, what is clear is that in both Standard Yoruba and Yagba, the entirety of the segmental content of the verb's Rhyme is targeted in deletion, epenthetic or not. While Yagba verbs do not behave categorically similarly to Standard Yoruba verbs when in isolation, the observation that they yield similar outputs suggests that all Yagba verbs are canonically CV (a segment and a tone in the Rhyme), while the observed epenthesis could be attributed to minimality *effects* as differentiated in 2.5.

### 3.4 Lessons from Ondo: Onsets and Words of a Single Vowel

Up to this point, minimality issues in this thesis have focused on CV as the minimal word size. This does not mean that it excludes languages whose minimal word size is a single V syllable. Indeed, MBT does not require onsets, because MBT's minimality requirement limits its counting to segments in Rhymes. Nor does PBT, because its minimal words are either disyllabic or monosyllables with two morae associated with one Rhyme, i.e., a function of prosody. Following this, although what is proposed in this thesis relies on a distinction between a phonologically and segmentally simple Rhyme in a CV syllable and a segmentally simple, but phonologically complex Rhyme in a CV syllable, the account for V as a minimal word size would be the same as for CV. The Rhyme of a single syllable that is, segmentally, just a V has a Rhyme similar to that of a single CV syllable.

V as a minimal word is attested in the Ondo Yoruba dialect (Orie 2000). Because Ondo has lost /r/, verbs that are CV in Standard Yoruba are only V in Ondo (14).

| (14) | **Std. Yoruba** | **Ondo** | **Gloss** |
|---|---|---|---|
| | rí | í | ‘to see’ |
| | rìn | ìn | ‘to travel, walk’ |
| | rà | à | ‘to buy’ |
| | rò | ò | ‘to think’ |
| | ro | o | ‘to hoe; to ache’ |

Similarly to other Yoruba dialects, Ondo verbs are lexically contrasted by register tone. As in Yoruba, but unlike in Yagba, Ondo verbs never lengthen in isolation; however, unique among the three dialects compared in this chapter, monosegmental Ondo verbs *do not* elide when they take an object. For example, the input *í owó* ‘see money’ would result in *í owó, *ówó, *íwó, *iwó* (Ọ. Orie, personal communication, March 22, 2013). In this case, no PBT- or MBT-framed account of minimality would easily work for Ondo, nor would an appeal to Markedness work, because onsetless, minimally V verbs are allowed.

The lesson to be learned from the Ondo verb data is that in monomoraic minimal Roots, Markedness is not necessarily an ideal minimality alternative, evidenced by Ondo’s onsetless minimal Roots. Thus, the case of Ondo Verb + Object outputs has not been treated as thoroughly as with Standard Yoruba and Yagba. Nevertheless, this is an interesting area for future investigation and an opportunity both to revisit Casali’s (1997) discussion of elision in vowel hiatus being blocked if it would result in a word losing all its segmental content and to revisit Orie & Pulleyblank’s (2002) notion of very small, “subminimal” Yoruba words being “shielded” from other phonological processes and effects.

### 3.5 Tone and Minimal Roots in Yoruba, Yagba, and Ondo

It has been demonstrated that the Rhymes of words in Standard Yoruba, Yagba, and Ondo are canonically monosegmental. While this itself is not a novel finding (Yoruba is a classic counterpoint to any account of minimality), the pervasiveness of monomoraic canonicity and well-formedness is impressive. Minimality in Standard Yoruba has received a tone-excluding analysis that is arguably applicable to all contexts (Ọla 1995); however, this account is specific to Standard Yoruba and does not handle Yagba or Ondo as elegantly. Yagba further complicates the matter, because its verbs do not all segmentally or prosodically behave in a similar fashion, meaning neither Yoruba PROPERHEADEDNESS (Ọla 1995), nor PBT, nor MBT can account for the entire range of verbs. Why is it that H- and L-tone verbs in isolation satisfy segmental branching, while M tone verbs do not? Since they do not receive an epenthetic M-bearing vowel, it appears that the CV forms are sometimes, nevertheless, well-formed. This is because canonically monomoraic Roots use the tonal tier to satisfy minimality.

In light of the behavior presented above, the canonical form of Rhymes of Standard Yoruba and Yagba verbs and Ondo nouns can be interpreted as Heads containing a segmental and a register tone that, as demonstrated in elision, operate somewhat independently of one another. This helps explain the issue of Yagba's M-tone verbs by suggesting that the epenthesis seen with canonically H- and L tone-bearing verbs is not part of the verbs' canonical forms. It also accounts for the well-formedness of all Standard Yoruba verbs, specifically that they are simplex, not "subminimal," because the Rhymes of their canonical forms are complex. Even if prosodically and segmentally simplex, they are minimally complex because they bear a lexical tone. Toneless vowels do not exist in Yoruba:

(15)

| | **Word** | **Tone** | **Gloss** |
|---|---|---|---|
| | *bí* | H | 'give birth' |
| | *bī* | M | 'ask' |
| | *bì* | L | 'vomit' |
| | **bi (toneless)* | Ø | Ø |

Meanwhile, binarity or branching effects seen in phenomena such as Yagba epenthesis or verb phrase elision can be analyzed as just that: effects of Markedness constrains such as FTBIN or HEADSBRANCH.

The next chapter addresses the Tokyo or Standard variety of Japanese, a language which, unlike Yoruba, has contrastive vowel length, moraic codas, and moraic geminates; however, like Standard Yoruba, Japanese has monomoraic, codaless Roots, and like Ondo, it has onsetless, codaless, monomoraic Roots. It is also somewhat different form the languages investigated in this chapter in that Japanese is a pitch-accent language, so while it is often classified as, at the very least, tonal with some stress-like features (Hyman 2006, 2009) and even though it can be analyzed in terms of melodies of H and L tones, is not necessarily a register tone language, like Yoruba.

### 3.6 Summary

This chapter has demonstrated that in three Yoruba dialects, Standard Yoruba, Yagba, and Ondo, underlying forms of Roots that would otherwise be considered "subminimal" are actually well-formed, because they have a single nuclear segment a lexical register tone specification, and not because of Markedness constraints, as Ondo minimal Roots demonstrate by being onsetless, but nevertheless well-formed.

The next chapter presents a discussion of minimal Roots in Standard (Tokyo) Japanese, and comes to a similar conclusion regarding the well-formedness of minimal Roots, with the only difference being that Japanese uses a pitch-accent, which is arguably produced as melodies of register tone, but is not necessarily an underlyingly register tone language.

## CHAPTER 4: MINIMALITY IN TOKYO JAPANESE

Japanese has contrast both between long and short vowels and between singleton and geminate consonants. The language also uses pitch-accent to make lexical distinctions, in which the location of a pitch-accent is lexically determined. Although Japanese shows a strong preference for open syllables and simple onsets, the few codas that do occur, nasals and geminates, do carry moraic weight.

This chapter begins with an overview of Roots in Tokyo Japanese, focusing on prosodic minimality, i.e. FOOT BINARITY. The second section presents pitch-accent. Japanese is a pitch-accent language, meaning that while it uses tonal phonology, its tonal melodies result from its accentual system (Hyman 2006, 2009). The third section provides an explanation of pitch-accent insofar as it is relevant to the issue of minimality. It predicts that in monomoraic Roots, pitch-accentual information plays a crucial role in Root identity. The fourth and fifth sections present evidence in support of this prediction, first from child acquisition of prosody (Ota 1998, 1998/2005, 2001, 2003a, 2003b, 2006), then from adult perceptual studies of autosegmental phonology in lexical recognition (Cutler & Otake 1998, 1999). The sixth section pulls together the findings presented in this chapter to discuss the role of autosegmental content in Root identity and its special importance in monomoraic Root identity, concluding that, similarly to Yoruba, Yagba, and Ondo, Tokyo Japanese minimal Roots are acceptable, because they are minimally lexically specified for pitch-accented or tone-bearing segments.

## 4.1 Japanese Roots

Itô's (1990) study of prosodic minimality in Japanese shows the target size for truncation of loanwords to be based on the binary Foot, truncating to either a single Foot (1a) or two Feet (1b). The following examples are repeated from Chapter 3:

(1) Truncation of loanwords in Japanese (from Itô 1990: 213)

| | **Loan** | **Truncation** | **Gloss** |
|---|---|---|---|
| (a) | amachua | ama | 'amateur' |
| | herikoputaa | heri | 'helicopter' |
| | chokoreeto | choko | 'chocolate' |
| | terorizumu | tero | 'terrorism' |
| (b) | haNkachiifu | haNkachi | 'handkerchief' |
| | sukatorojii | sukatoro | 'scatology' |
| | akuserureetaa | aluseru | 'accelerator' |
| | asuparagasu | asupara | 'asparagus' |

However, while there is abundant evidence for Foot binarity playing an important role in Japanese (Itô 1990; Itô & Mester 1993; Mester 1990; Poser 1990), monomoraic Roots do exist in Japanese (Itô 1990; Ota 2006). Itô & Mester (1995, 1999, 2001) posit that there are different phonologies for different lexical strata in Japanese, of which there are at least four: Yamato (native Japanese), Sino-Japanese, loanwords, and mimetics, and that the Yamato lexical stratum shows the most evidence for monomoraic Roots. According to Ota (2006: 266) these monomoraic Roots are found in the Eastern dialects of Japanese, including Tokyo and Nagoya dialects. Although, Ota (2006) mentions the Nagoya dialect, it should be noted that the analysis presented in this chapter is made for Tokyo Japanese (also referred to as Standard Japanese) only[1]. Since Japanese Codas attribute moraic weight, these words are codaless and, thus, can be explained neither by

[1] A similar analysis of Nagoya Japanese is encouraged, because it might provide further support, clarity, or nuance to this chapter's and this thesis's argument.

PBT, since they are monomoraic, nor by MBT, since their Rhymes contain only short vowels and are codaless.

(2) Monomoraic Japanese Roots (A ↓ indicates that a lexical pitch-accent is specified for the immediately preceding moraic segment.)

| | |
|---|---|
| /ki/ | 'yellow' |
| /ki↓/ | 'tree' |
| /hi/ | 'sun' |
| /hi↓/ | 'fire' |
| /e/ | 'handle' |
| /e↓/ | 'picture' |
| /i/ | 'stomach' |
| /i↓/ | 'medicine' |

In all these words, tone is the feature which distinguishes two segmentally identical minimal pairs.

### 4.2 Describing Pitch-Accent: Pitch-Accent and Roots

McCawley (1968: 130-183), Pierrehumbert & Beckman (1988), Fox (2000: 138-145), Haraguchi (1977) and Yamaguchi (2007: 33-4) are among the many works attempting to give the most accurate description of Japanese pitch-accent. What is generally accepted is that the tonal melodies of surface forms result from presence and location of pitch-accent, which is unpredictable and lexically specified, and that that melody extends from the Root, through the Stem. Beckman (1986) demonstrates that the only reliable correlate of pitch-accent is the fundamental frequency ($F_0$).The default tonal melody, that of unaccented words, is an L-tone on the initial mora, followed by H-tones on the remaining morae of the Root/Stem. In accented words, this LHHH… pattern is modified; the accent-bearing mora receives an H-tone, and all following morae of the same Root/Stem receive L-tones.

In this thesis, I will classify words in types based on presence and location of accent, with Type 0 words being unaccented, Type 1 or initial-accented (the accent being on the first mora), Type 2 having an accent on the second mora, Type 3 accented on the third mora, and so on. Cross-cutting these will be the term "final-accented," meaning that the accent falls on the final mora of the word. Thus, we can expect the number of potential phonologically distinct Roots for a string of prosodified segments to be the number of morae plus one.

In polymoraic, accented, but not final-accented, Roots (i.e., non-final-accented Roots that are *not* Type 0), location of accent is easily discerned by the downward tonal contour; however, unaccented and final-accented Roots are predicted to have identical tonal melodies, which would only differentiate when they receive affixes, which are not canonically specified for tone, on which to express the existence or absence of tonal contour. In (3), the tonal melodies of the final-accented and unaccented Roots are phonologically identical; however, they are differentiated by the tone that their suffixes receive. In Stems with accented Roots, the existence of the pitch-accent gives all morae following it an L tone, including /ga/, while in Stems with unaccented Roots, the lack of a pitch-accent means that the tone on /ga/ is predicted by the default tonal melody of LHHH…. The tone that /ga/ receives clarifies the Root's identity, in terms of existence of accent.

(3)

| **Initial-accented** | | **Final-accented** | | **Unaccented** | |
|---|---|---|---|---|---|
| H↓L(L) | | LH↓(L) | | LH(H) | |
| ha↓na(ga) | '[girl's name]' | hana↓ (ga) | 'flower' | hana(ga) | 'nose' |
| ha↓si(ga) | 'edge' | hasi↓ (ga) | 'chopstick' | hasi(ga) | 'bridge' |

Haraguchi (1991) and Kubozono (2006) observes that while position of pitch-accent in verbs and adverbs *is* fairly predictable, being either the penultimate mora or Root-final vowel, the presence of accent is *not* predictable and is, therefore, also lexically specified.

While the issue of unaccented versus final-accented Roots is an interesting one and is typically one of the key points in different accounts of pitch-accent[2], this does not prove to be an issue for monomoraic forms, because while existence of accent is lexically determined, location of accent is punitively predictable; there is only one mora on which it might be lexically specified. Thus, this thesis will not attempt to make predictions regarding final-accent versus no-accent in polymoraic Roots; instead, it will only address the much less popularly considered accented versus unaccented distinction in monomoraic Roots where accent (and thus, tone) plays a crucial role in disambiguating Root identity and is immune to issues of melodic ambiguity associated with prosodically longer Roots.

### 4.3 Pitch-Accent in Monomoraic Roots

Recalling that the number of potential phonologically distinct Roots for a string of prosodified segments is the number of morae plus one, a monomoraic string of segments only has two potential phonologically distinct Root forms. While polymoraic Roots face potential phonological ambiguity, this is not the case in monomoraic forms, because pitch-accent overrides the default melody. This means that a monomoraic Root with be either H-initial (accented) or L-initial (unaccented).

Bearing this in mind, we see tonal phonology as playing an important role in minimal Root well-formedness – namely, that all morae of Japanese Roots carry tones in

[2] See Warner (1997) for a review of different theories.

the output; that the existence and location of a pitch-accent is lexically encoded; that the interplay of the default melody and pitch-accent information determine a Root's tone; and that in monomoraic Roots, surface register tone and underlying pitch-accent are analytically identical. Thus, accentuation yields tonal minimal pairs in monomoraic Roots, below, where the Roots presented earlier, in (4), are specified for accent/tone:

(4)

| **Unaccented, L-tone** | | **Accented, H-tone** | |
|---|---|---|---|
| /ki/ | 'yellow' | /ki↓/ | 'tree' |
| /hi/ | 'sun' | /hi↓/ | 'fire' |
| /e/ | 'handle' | /e↓/ | 'picture' |
| /i/ | 'stomach' | /i↓/ | 'medicine' |

The analysis so far has only demonstrated that monomoraic Roots have only two accentual forms (accented or unaccented) and, thus, only two potential tonal melodies (L(H)… or (H)L…). The next section presents evidence from language acquisition of the sufficiency of monomoraic syllables for minimal Root well-formedness and perhaps sheds some light on the acquisition of pitch-accent. Following that is a section offering perceptual evidence of the critical role of autosegmental phonology in Root identification: that perceivers use tone and, more specifically, tonal register independently of tonal contour, to restrict lexical candidates.

### 4.4 Evidence of Monomoraicity and Underlying Pitch-Accent from Acquisition

Ota (1998/2005, 2001) offers the earliness of adult-like pronunciations of light syllables and compensatory lengthening or geminate/nasal epenthesis resulting from deleted moraic segments, but not from deleted Onsets, as evidence of children having access to the mora. This is interesting, because if Japanese were to comply with prosodic binarity, we might expect Onsets to show evidence of moraic weight as well (Topinzti 2010); however, this is not the case.

Ota (1998/2005) asserts that there is no prosodic binarity restriction on underived lexical words, placing him in the same camp as Itô (1990) and Itô & Mester (1995, 1999, 2001); however, Ota (2001) finds that children initially tend *not* to produce monomoraic Roots and, instead, almost categorically lengthen monomoraic vowels to bimoraic forms. Unfortunately, Ota's (1998/2005) analysis does not separate target-like production of monomoraic Roots from target-like production of polymoraic Roots. Instead, the analysis presents "correct weight outputs," so as long as the output weight was adult-like, the output was counted as correct. The analysis does not specify whether the observed errors were monomoraic-to-polymoraic augmentation or polymoraic truncation (to monomoraic or otherwise).

Ota's (2001) treatment of the same data is a bit clearer: all monomoraic Roots are produced without any sort of lengthening as early as 1;9 in one child and 1;10 in another, which is around the time (2;0) that compensatory lengthening begins to disappear. Thus, the analyses, although difficult to digest, do not discredit one another.

What can be concluded from Ota's research is that up to about two years of age, while Japanese children do exhibit weight sensitivity (Ota 1998/2005, 2001), they also categorically compensatorily lengthen monomoraic Roots. At around 2;0, however, children begin to produce target-like monomoraic outputs (5). Ota (2001) also observes that when monomoraic outputs undergo compensatory lengthening, they accurately reveal their lexical tonal contour, yet once children categorically produce target-like monomoraic Roots, the contours do not entirely disappear; they reemerge when an affix provides suprasegementally unspecified content on which the Root's contour can be expressed (cf. Roots with or without /ga/ in (3)).

(5)

| Proportion of monomoraic targets produced with vowel lengthening (Ota 2001) | | | | | |
|---|---|---|---|---|---|
| Hiromi | 1;9 | 1;10 | 1;11 | 2;0 | -- |
| | 100.0% (19/19) | 69.2% (9/13) | 0.0% (0/2) | -- (0/0) | -- |
| Takeru | 1;8 | 1;9 | 1;10 | 1;11 | 2;0 |
| | 100.0% (2/2) | -- (0/0) | 25.0% (1/4) | 50.0% (4/8) | 0.0% (0/3) |
| Kenta | 2;2 | 2;3 | 2;4 | 2;5 | 2;6 |
| | 83.3% (5/6) | 50.0% (5/10) | 0.0% (0/8) | 0.0% (0/3) | -- (0/0) |

Ota (2001) suggests that this shift toward target-like monomoraic outputs is indicative of a general constraint shift from Markedness>>Faithfulness to Faithfulness>>Markedness, increasingly privileging target-like outputs over unmarked forms. In this specific case, Ota (2001) suggests that it is a shift from FTBIN>>DEPμ to DEPμ>>FTBIN, a shift away from imposed Foot binarity, toward one that fatally penalizes compensatory lengthening. Ota (2006: 266) suggests that this supports the view that it is in avoidance of "subminimal words," which is suggested to occur in other languages (Demuth 1995, 1996; Demuth & Fee, 1995; Pater 1997). This is interesting because it provides further discussion of the difference between constraint-driven "minimality effects" and universal morpheme shape constraints, as discussed in 2.5 – specifically, that FTBIN operates as a Markedness constraint. Indeed, an identical analysis could be made substituting HEADSBRANCH for FTBIN, further suggesting that HEADSBRANCH is a powerful minimality effect constraint, but not necessarily a morpheme shape constraint. Of course, as the reranking proceeds, Faithful monomoraic outputs are favored. This would make sense, because adult-like Japanese would benefit from a constraint ranking that allowed for language-wide length contrast.

It should also be noted that Ota (1998/2005; 2006) mentions the possibility of frequency of prosodically binary input forms in Child-Directed Japanese as a possible contributor to the early primacy of prosodically binary forms. Ota (2001; 2006) continues this discussion in discussing the monomoraic syllable as a banned truncation target and the binary Foot as the widely common form.

The goal of this section has been to demonstrate that children have access to the mora early on, even if they do not immediately produce target-like monomoraic outputs. They do, however, acquire target-like monomoraic outputs by around age 2;0, but that they acquire lexical pitch-accent specification before this (Ota 2001). While this section has focus on child production, the next section focuses on adult perception to provide evidence that adult native listeners actively use autosegmental content to restrict lexical candidate activation.

## 4.5 Listeners Can Use Register Separately from Contour for Root/Stem Identification

Cutler & Otake (1999) present three experiments. The first concludes that native Tokyo Japanese speakers can determine which of two tonally different (C)VCV words a single syllable is extracted from. The second, a gating experiment, finds that as soon as vocalic information of Roots of three or four morae became available, their subjects used it to restrict potential accent pattern, meaning that while they were not immediately able to predict the word itself from the first mora (indeed, they rarely did), they were able to restrict the potential tonal pattern (i.e., whether accented), and while the accentual pattern-detection success rate rose upon access to more segmental information, initial vocalic information was enough to make better-than-chance predictions of accentual pattern. The results of the third experiment suggest that pitch-accent information does restrict potential lexical candidates, because while prior presentation of a (C)VCV word did produce a repetition priming effect for recognition, prior presentation of that word's tonal melodic pair (i.e., segmentally identical, but tonally opposite) did not produce a priming effect.

The observation that listeners may utilize a single tone, rather than wait for tonal contrast through contour to determine accentual information has an interesting implication for monomoraic Roots, specifically, that they do not need an affix, upon which the tonal contour can be built, to lexically identify the utterance. A single H or L tone is sufficient. It is interesting to note that Cutler & Otake (1996, 1999) observe that there appears to be much greater ability in listeners to distinguish between H and L in initial syllables than non-initial ones and that this is intriguing, because Root/Stem-initially is exactly when listeners can make the most use of autosegmental information in lexical identification.

### 4.6 Pitch-Accent and Standard Japanese Minimal Roots

This chapter has provided an overview of Root shapes and pitch-accent in Tokyo Japanese, recalling that while different lexical strata may exist and be subject to different phonological constraints (Itô & Mester 1995, 1999, 2001), monomoraic Roots are allowed "native" lexical Roots (2). Since location of accent is not an issue in monomoraic Roots, they do not suffer potential suprasegmental ambiguity (cf. unaccented versus final-accented); their only suprasegmental distinction is whether a lexically-coded pitch-accent exists. Since the only reliable perceptual correlate of pitch-accent is pitch (Beckman 1986), this suggests that monomoraic forms should be distinguishable by register tone, where accented Roots carry an H-tone and unaccented Roots carry an L-tone.

This casting of monomoraic Roots is supported by evidence from acquisition of prosody, where Ota (1998/2005, 2001) offers evidence that children have early access to the mora, but that until about have 2;0, they categorically lengthen monomoraic Roots (Ota 1998/2005, 1998b, 2001, 2003, 2006). When they do so, they produce a suprasegmental contour identical to what would be expressed in a target-like production plus an affix, as in (3). Although children eventually rerank DEPμ over FTBIN, ending compensatory lengthening and empowering Japanese's length contrast, thus producing target-like forms, the contour does not entirely disappear. Only the first tone is expressed when the Root is an isolated utterance, but when the Root receives a suprasegmentally unspecified affix, the contour emerges across the entire Stem. In this way, the suprasegmental phonology exists somewhat independently of the segments, reminiscent of what was seen in Yoruba and Yagba verb phrase elision.

Cutler & Otake (1998, 1999) provide evidence that native Japanese speakers actively use suprasegmental information to limit potential lexical candidates, needing only initial vocalic information to begin limiting potential Roots. Specifically, Cutler & Otake (1999) say that listeners are using this information to narrow down potential accentual patterns. By extension, this should mean that in monomoraic forms, the accentual pattern is categorically identifiable by initial vocalic information alone; while listeners can arguably use contour, they can also use register. Cutler & Otake (1998, 1999) emphasize that listeners tend to more actively use pitch information earlier in strings, which suggests that listeners' pitch-accent perception is tuned to detect lexical contrast by register tone in monomoraic Roots.

Bringing these findings together, Japanese Roots also crucially implicate autosegmental phonology – in this case, pitch-accent – in lexical Root minimality. It must be noted that this analysis is applied only to the Tokyo variety of Japanese. While all varieties of Japanese use pitch-accent, they do not necessarily do so similarly to Tokyo Japanese (Kubozono 2012); however, since these other varieties are pitch-accent, it would be expected that tone plays a similar role in the well-formedness and recognition of monomoraic Roots, in varieties that have monomoraic Roots.

### 4.7 Summary

This chapter has demonstrated that while pitch-accent can allow identical surface tonal melodies on Roots with underlying different autosegmental specifications when those Roots are uttered in isolation, this is really only a problem of ambiguity for Japanese Roots that are longer than a single syllable with a monosegmetnal, codaless Rhyme. Outputs of "subminimal" Japanese Roots (1, 3) do not suffer from this ambiguity, because if they are pitch-accented, their surface forms will bear H-tones, while if they are not accented, they will bear L-tones.

This chapter has observed that from a very early age, Japanese speakers actively target monomoraic Roots, and actively use pitch-accent. It has also offered evidence from adult perceptual studies, suggesting that adult speakers actively use minimal tonal material to accurately limit candidates in word recognition. In light of the theoretical basis for the importance of autosegmental phonology in minimal Root well-formedness in Japanese and experimental evidence corroborating that theoretical proposition, this chapter has concluded that “subminimal” Roots in Tokyo Japanese are also acceptable, because they are minimally specified for a segment bearing lexical autosegmental content.

The next chapter revisits the issues raised in Chapter 2, regarding how to account for Root minimality and “subminimality,” and considers them in light of the conclusions drawn from Standard Yoruba, Yagba, Ondo, and Tokyo Japanese in Chapters 3 and 4, specifically what PBT and MBT can and cannot tell us about autosegmental phonology. It then outlines the framework of a theory to account for underlying Root shapes and language-specific well-formedness. It is followed by a concluding chapter that summarizes the main points of this thesis and presents areas for future research.

# CHAPTER 5: LEXICALLY SPECIFIED AUTOSEGMENTAL UNITS IN ROOT MINIMALITY

The previous two chapters have argued that minimal Roots that would be considered by the GTT to be "subminimal" are acceptable because their Rhymes minimally consist of a single, nuclear segment lexically specified for autosegmental phonology, which in the case of Standard Yoruba, Yagba, and Ondo was register tone, and in the case of Tokyo Japanese was pitch-accent. This chapter extends the argument through the entire tone-pitch-accent-stress typological spectrum (Hyman 2006, 2009) in the first section, by exploring how the account of Root minimality relates to PBT and, in the second section, to MBT. The third section discusses the universal properties of Roots, it demonstrates that minimal Roots obey PROPERHEADEDNESS, and that they require autosegmental content. This section also dispels the option of Markedness as an alternative to PBT or MBT in explaining "subminimal" Roots, by observing that ONSET is unique in that it is not necessarily obeyed in "subminimal" forms, while *VV and NOCODA are.

The fourth section turns to the other side of the coin, how to account for language-specific minimal Root shapes. It discusses how constraints invoked in PBT, MBT, and their Markedness "subminimality" alternatives can be used to explain language-specific aspects of Root minimality patterns. Doing this requires the redefining of certain constraints, so that the ways in which they can be violated are more limited and conducive to predictable prosodic and segmental minimality effects, a discussion which will be picked up in the final chapter.

### 5.1 Prosodic Stress, Binarity, and Root Minimality

PBT does not directly address Roots; rather, it addresses Prosodic Words. McCarthy & Prince (1994b: 322) explain that "Minimal Word" is not an independent phenomenon; rather, it is driven by the Prosodic Hierarchy and Foot Binarity. PBT predicts quantity-insensitive languages to have disyllabic minimal words and quantity-sensitive ones to have bimoraic minimal words. Therein is PBT's weakness: it cannot easily account for stressless languages, because its constraint, FTBIN, implicates the conjunct phenomena of prosody and stress, yet while all languages appear to use the Prosodic Hierarchy, not all languages use stress. Even among stress languages, there does not appear to be a universal dependence of stress on weight; that is, stress can fall on monomoraic syllables. Baković (2004) demonstrates this using binary feet; however, Walker (1996) and Garret (1999) offer stress accounts that do not depend exclusively on weight. We see that quantity-insensitive languages do not necessarily have disyllabic minimal words. Indeed, monosyllabic, monomoraic minimal words abound, even in stress languages (Gordon 1999; cf. figure (6), section 2.3). This begs the question: what if stress is attested in monomoraic minimal words? If such cases are attested, any foot binarity-based account of stress placement for languages with monomoraic minimal words becomes suspect. This suggests that stress – although often highly influenced by prosody – is not always determined by prosody, allowing us to have the default-to-left, default-to-right, and consistently edgemost stress placement in unbounded stress languages (Hayes 1995: 296-7; Baković 2004: 203). Since quantity-insensitive stress languages, such as French (Indo-European, stress is phrase-final; Harris 1990), Haitian Creole (Creole, stress is word-final; d'Ans 1968), Maricopa (Hokan, stress is Root-final; Gordon 1982), Tunica (Isolate, stress is word-initial Swanton 1921; Haas 1946)[1], can have monomoraic minimal Roots, stress placement would have no choice but to fall on the sole mora of the word, as it is both the rightmost and leftmost syllable. Barring compensatory lengthening, Foot binarity plays no active role in such cases.

### 5.2 Segmental Phonology, Branching, and Root Minimality

Since the conjunction of stress and prosody in explaining word minimality already creates problems from stress languages, it should be no surprise that stressless languages are challenging for PBT as well. The fact that PBT-framed accounts of minimality either relegate ostensibly "subminimal" words to special constraint rankings or special lexical sets (cf. "native" Roots in Japanese, Itô 1990) or subordinate FTBIN, the driving force of PBT, to language-specific well-formedness conditions in the form of a suite of highly-ranked Markedness constraints (Ọla 1995) reflect that difficulty. Of PBT's conspiring forces – the Prosodic Hierarchy and Foot Binarity – Root minimality appears to obey the Prosodic Hierarchy in the form of in PROPERHEADEDNESS (Itô & Mester 1992, for Japanese; Ọla 1995, citing Itô & Mester 1992, for Yoruba), that is, Roots consistently have syllables; however, Root minimality does not universally obey Foot Binarity. Prosodic heads are not always binary at the syllabic or moraic level.

MBT would reframe this issue of "binarity" in terms of "branching," specifically, that one will not always find prosodic binarity at the syllabic or moraic levels: Feet of

[1] These analyses come from Gordon (1999).

minimal Roots do not necessarily branch into two syllables, nor do they necessarily dominate a syllable that branches into two morae. Instead, MBT predicts that all minimal Roots branch *somewhere*, either at the Foot level (into two syllables) or at the syllabic/moraic level (into two morae [a long vowel, diphthong, or Rhyme with moraic Coda] or into two segments [a Nuclear segment and non-moraic Coda segment]). MBT relieves minimality of prosodic weight, by arguing that the light syllable still branches; however, while the branching, monosyllabic Rhyme seems more appealing, than the Binary Foot, it is arguably a recasting of PBT's binarity one level lower: if a Foot contains only one syllable, that syllable will have a branching Rhyme. Note that the nature of monosyllabic branching is somewhat fuzzy: monosyllables may take either a prosodic route by being bimoraic or a purely segmental route by having a Rhyme of two segments. The differences between long vowels, diphthongs, moraic and non-moraic Codas become unclear.

To escape the issue of ostensible "subminimality," PBT requires alternative rankings for minimal forms smaller than the moraically branching syllable. MBT has its own issues, both for "subminimality" and "supraminimality" (minimal forms larger than what is predicted by HEADSBRANCH). It requires finagling both for forms smaller than a monomoraic, closed syllable *and* for minimal forms larger than monosyllable with a branching Rhyme (i.e, disyllabic minimal words). MBT deals with supraminimal words by suggesting that MORPHEME-SYLLABLE CORRELATION (MORPH-SYLL) is outranked by, instead of equally ranked with, HEADSBRANCH. Once again, Markedness is used to explain why branching or binarity does not occur at the predicted level (in this case, the syllable). This in itself (Roots being larger than predicted) is not particularly problematic when discussing minimality. MBT's problem is the existence of those minimal words that nevertheless do not appear to branch or exhibit segmental binarity, even within the Rhyme: monosyllabic, monomoraic, codaless Roots. Since these words still obey MORPH-SYLL a strategy similar PBT-framed accounts of ostensible subminimality is used: Markedness constraints, once again, critically dominate HEADSBRANCH.

### 5.3 Universal Properties of Roots

Three things from these accounts are striking. First, PROPERHEADEDNESS appears to be obeyed in minimal Roots, no matter what. Second, prominence-related phonological issues, such as stress, pitch-accent, and tone, seem to stick out in "trouble languages" for PBT and MBT, such as Yoruba and Japanese, either as classes of languages that are marginalized by one theory's account of minimality or as features common to languages often cited as highly exceptional to PBT and MBT. Third, although Markedness is invoked in both PBT- and MBT-based accounts of "subminimality," one might expect full-blown Markedness– that is, *VV, NOCODA, and ONSET – to be at work at the syllabic level in predicting the *most* subminimal Roots; however, this cannot be the case, because in terms of segments, onsetless, syllabic V is the "smallest" Root, even though it is more marked than CV. Interestingly, only *VV and NOCODA appeal to those looking for prosodic binarity (bimoraicity from long vowels or moraic codas) or for segmentally branching Rhymes (long vowels, diphthongs, or Codas, no matter the moraic status). Rightly so – moraic Onsets are rare (Topintzi 2010) and controversial (Booij 2011), and we do not see languages with Roots whose canonical forms are rhymeless. Perhaps this is why Onsets have not received much attention or consideration in Root minimality; they clearly play no critical role in it. Why, then, should only *part* of Markedness be invoked? It seems questionable that one part of the TETU alternative, ONSET, to PBT and MBT should be optional.

### 5.3.1 Roots Obey PROPERHEADEDNESS

What we observe from ostensibly "subminimal" words is that Root minimality may extend all the way to a single Nuclear segment, such as in Ondo or Japanese. Once again, even in these forms, PROPERHEADEDNESS is still obeyed. Thus, let the first criterion of a minimal Root be PROPERHEADEDNESS. This is unremarkable; of course, a monomoraic Root would also be monosyllabic; MBT accounts for this with MORPH-SYLL. Moreover, that monosyllable would be part of a single Foot, and that Foot a single Prosodic Word. This in itself is not particularly powerful and, on its own, is not a sufficient alternative to PBT and MBT for accounting for minimal Roots, because it makes no distinction between Roots, Stems, and Affixes.

The problem that obtains when relying solely on PROPERHEADEDNESS is the same that Booij (2011: 2055) observes for MBT: "we miss the generalization that it is a prosodic syllable weight condition that is involved." How, then, can apparent stress (when weight is a requirement) be pulled into minimality without doing so at the expense of minimal Roots in the many languages that actively use neither stress nor weight? The answer lies in the other phenomenon common to all Roots: required autosegmental content.

### 5.3.2 Roots Require Autosegmental Content

Let us return to our odd man out, the minimal Root – V – which obeys neither Foot Binarity, nor segmental branching, nor Markedness. Downing's (2006: 111) assertion that "lexical morphemes meet minimality requirements, not because they contain a stress foot, but rather because they are heads and license complex phonological structure" hints at a distinction not widely made in the discussion of phonological complexity: that a syllable consisting of a V-only Rhyme may, indeed, exhibit phonological complexity if one expands the range of analysis to include autosegmental information that drives Root identity – more succinctly, if one considers autosegmental phonology to contribute to the "counting" done in the pursuit of binarity and branching. The discussion of binarity or branching presented in PBT and MBT focuses only on prosody and the segmental tier. If, as Hyman (2011) suggests, "tone is like segmental phonology in every way – only more so!" an expansion of what makes a rhyme "complex" such that it considers tone, when tone creates lexical contrast, should not be terribly jarring. Similarly, at the other end of the spectrum, a Root with no stress does not occur in stress languages. These generalizations motivate constraints such as ROOT/TONE for tone languages and ROOT/STRESS for stress-timed languages:

(1) ROOT/TONE
A root vowel or syllable must have lexical tone.

(2) ROOT/STRESS
A root vowel or syllable must have stress.

This thesis has demonstrated that autosegmental units can operate separately from segments and play a decisive role in Root identity: register tone in Standard Yoruba, Yagba, and Ondo, and pitch-accent in Tokyo Japanese. Typically, although the exact classification of a language as tonal, pitch-accent, or stress is not always clear (Hyman 2009), any language can be accurately described as either one or a combination of the above three "types." All Roots, then, require autosegmental units. Indeed, without exception, there is no Root output that is well-formed without some sort of lexical specification for tone and/or stress or, as Hyman (2006, 2009) argues is the case for pitch-accent languages, some combination of the properties of both tone and stress.

As predicted, taking this approach acknowledges stress-weight requirements without excluding languages in which stress and/or weight do not play relevant roles; in stress languages that require heavy syllables for stress placement, stress Foot Binarity can be derived, as it is already argued to be (Booij 2011: 2055, citing McCarthy 1998). However, in some languages, stress assignment does not require the existence of a heavy syllable. While unbounded stress placement might fall on the right- or left-most heavy syllable, the existence of a heavy syllable is not required for stress. In such instances, stress placement defaults to one side; meanwhile, other unbounded stress languages do not even consider weight in placement, instead relying only on edges (Baković 2004). This dichotomy of stress languages that absolutely require Roots to have heavy syllables and stress languages that do not supports the argument that stress and weight, although closely related, can operate somewhat independently: that stress attraction is not necessarily based on segment- or mora-counting.

At the same time, the approach of this thesis to stress does not force a prediction that minimality in stressless languages and languages with segmentally simplex Rhymes results from "opting out," into an alternative constraint-based minimality theory. Instead, these Roots also utilize lexically specified autosegmental content: tone. Issues of lexical contour tones might highlight the difference in morae being involved isochrony and tone-bearing and morae being involved in weight. For example, Japanese does have bimoraic syllables; however, the bimoraicity has no "attracting" effect regarding tonal melody. Instead, the mora plays a role in tone-bearing and duration: vowels are moraic and bear tone/pitch-accent, and morae are implicated in the phonemic distinction between long and short vowels and in nasal codas and geminates.

### 5.4 The Role of PBT, MBT, and Their Constraints

So far this chapter has predicted the following: first, all Roots will minimally obey PROPERHEADEDNESS. Second, that all Roots will utilize lexically specified, autosegmental phonology of the tone-pitch-accent-stress system. What, then, is to be made of the many valuable observations and generalizations developed in PBT and MBT? As mentioned in 2.5, this requires a distinction to be made between cross-linguistic minimality and language-specific minimality: specifically, PROPERHEADEDNESS and lexically-specified, autosegmental phonology pose cross-linguistic requirements of Roots minimality, while the constraints active in PBT and MBT, which Booij (2011: 2055) argues predict output shapes only, drive language-specific minimality patterns by putting additional constraints onto Roots.

While it is possible to simply add the minimality requirements argued for in this thesis on top of existing accounts of minimality, it is desirable to outline a system that unifies the observations made in all forms of the GTT. However, in order for PBT, MBT, and Markedness to work in concert, the definitions and roles of their active constraints should be made clearer and the bifurcation of PBT's and MBT's motivating constraints must especially be addressed. This undertaking is an avenue for further research, and a discussion of potentially fruitful paths is presented in the following chapter.

## 5.6 Summary

This chapter recaps the general issues PBT and MBT have in accounting for subminimal Roots. This was followed by a discussion of what properties are cross-linguistically observed in Roots: PROPERHEADEDNESS and specification of autosegmental phonology. It is argued that while PROPERHEADEDNESS and autosegmental phonology are alone in motivating cross-linguistic Root minimality, they work with the constraints invoked in PBT, MBT, and their accounts of alternative minimality, i.e., Markedness, to generate the various language-specific minimality patterns found in languages of the world.

The next chapter discusses areas of concern and potential future research and gives an overall conclusion to this thesis, highlighting its main points.

## CHAPTER 6: FUTURE RESEARCH AND CONCLUSION

Coming from the previous chapter's presentation of a theory of Root minimality, this chapter presents areas of future research and a summative conclusion to the thesis. The first section presents a case for differentiating between morpheme shape conditions on inputs and constraints on outputs. The second section explores potential ways to bring existing accounts of minimality together, under a single GTT. The third section brings up the issue of mapping morphological constituents, specifically Stems and Affixes, to metrical units. The next section calls for further investigation into the distinction between the autosegmental phonology implicated in this thesis's Root minimality theory and other autosegmental phonological phenomena. This is followed by a call for analysis within the most recent generation of Optimality Theory, Harmonic Serialism (McCarthy 2010; McCarthy & Pruitt 2013). The proceeding section brings up the need for continued acquisition studies, especially ones explicitly testing the theory set out in this thesis, and finally, a section suggesting continued research in the role of autosegmental phonology in general in morpho-phonological processes; tone, pitch-accent, and stress must be the tip of the iceberg. The final section is a conclusion summarizing the general argument made in this thesis.

## 6.1 Areas of Future Research

### 6.1.1 Distinguishing between Morpheme Shape Conditions and Constraints

Why must a distinction between minimality in underlying forms and surface forms be made? Why can't input conditions be implemented as universally inviolable constraints?

First, the very nature of Optimality Theory, that all constraints are violable, implies that if PROPERHEADEDNESS and required, lexically specified autosegmental content were constraints, there would be a language with minimal Roots that violated these. As it stands, this is not observed, as far as Roots are concerned. Indeed, this seems to apply only to Roots. How do we know this refers only to Roots? Two examples: the first would be where PROPERHEADEDNESS is obeyed but Autosegmental Specification is not. This is observable in Japanese particles, such as /ga/, as discussed in Chapter 4, which obey PROPERHEADEDNESS, but receive their autosegmental content from the Root. The converse of this, where Autosegmental Specification is obeyed, but PROPERHEADEDNESS is not, would be evidenced by purely tonal morphemes, such as the Yoruba future marking morpheme, which is a segmentless H tone, but the observation that purely tonal Roots are unattested in Yoruba.

The second argument for why input conditions should not be implemented as universally inviolable constraints is that monomoraic, codaless Roots that appear to surface primarily or even only as parts of segmentally branching or disyllabic Stems are attested. Downing (2006: 115-116), too, acknowledges this, noting that in some language, like English, Roots may indeed stand alone; as seen in chapter 3, ostensibly "subminimal" Yoruba Roots may, too, stand alone. However, in other cases, monomoraic, codaless Roots may never surface alone, instead only ever emerging as heads of Stems. Indeed, in Japanese, it is attested but rare for Roots not to emerge as Stems in spontaneous speech.

In a more extreme example, Salidis & Johnson (1997: 5, citing Demuth & Fee 1995 and Doke & Mofokeng 1957) offer the Sesotho verb /já/ 'eat'. The infinitive form is disyllabic Stem /Ho-já/ 'to eat.' Sesotho imperatives, however, are typically made by removing the /Ho/ morpheme. A lone CV appears to be banned, and so the imperative form must have an epenthetic vowel to be a well-formed output: /ejá/ or /jáa/ 'eat!' It is interesting to note that the epenthetic vowel may go before or after the Root, so long as the output is disyllabic or long.

Another example would be Yagba verbs (cf. section 3.2), where H- and L-tone-bearing verbs are lengthened in isolation. Although, these verbs are never CV outputs in isolation, Chapter 3 has demonstrated that they are underlyingly CV Roots. What is interesting is that in both the Sesotho and Yagba examples, these CV forms obey PROPERHEADEDNESS and have lexically specified tone. Bearing this in mind it is useful to make a distinction between Root minimality in underlying forms and Root minimality in surface forms; more specifically, that while cases can be made that all outputs obey constrains additional to PROPERHEADEDNESS and autosegmental content, it is possible that the canonical, underlying forms of Roots themselves can have fewer minimality conditions, but that those conditions are applied to inputs.

### 6.1.2 Unifying the GTT

Picking up where section 5.4 left off, it would be useful to bring together the observations made from various accounts of minimality; however, doing so would require modifying the existing constraints.

#### 6.1.2.1 Delimiting the Relationship between Morphology and Prosody

First, MORPH-SYLL requiring a correlation of all morphemes with the syllable presents issues from two fronts: first, this correlation is clearly violated, as many affixes are sub-syllabic, which Downing (2006) acknowledges. Second, having MORPH-SYLL require a correlation between a supercategory (Morphemes), which can be broken down into further morphological constituents (Roots, Affixes, Stems…), and a single prosodic constituent, means MORPH-SYLL can be violated in more ways than one: a morpheme can be sub-syllabic or polysyllabic.

MORPH-SYLL should continue to be used as a Markedness constraint to explain why a minority of languages have disyllabic minimal words. However, it should also be recast as ROOT-SYLL (Roots are coextensive with the syllable). Because the autosegmental content this thesis argues as being required for Roots must be associated with the Nucleus, Roots must obey PROPERHEADEDNESS; this means ROOT-SYLL can only be violated one way, by being polysyllabic. Assumedly, syllables of disyllabic minimal Roots would nevertheless obey PROPERHEADEDNESS and the condition of being lexically specified for autosegmental content; however, they would be marked by violating ROOT-SYLL. This raises the question of how to address other morphological constituents, specifically Affixes and Stems. Since this thesis addresses Roots, its scope does not extend to Affixes and Stems; however a discussion of other morphological constituents and how they might map to prosodic constituents is an area for future research.

#### 6.1.2.2 Clarifying HEADSBRANCH

Second, Downing (2006: 122-123) extends HEADSBRANCH to account for non-prosodic branching, specifically conflating syllables, morae, and Rhymes, so that a monomoraic syllable can satisfy prosodic branching by having a Rhyme that minimally branches into two segments. Having the conflation of syllabic constituents, prosodic constituents, and segments presents an issue that is seemingly the inverse of MORPH-SYLL's multiple ways of being violated; MBT's conflationary HEADSBRANCH allows multiple strategies, Rooted in segmental phonology, prosody, and syllabic structure, by which it could be satisfied. This conflation must be clarified to exclude prosody and only address segmental phonology and its relative, syllable structure – namely, that phonological Heads of morphological Heads branch segmentally, or that Head syllables of morphological Heads branch segmentally, *not necessarily moraically*. A syllable may have a long vowel, diphthong, or coda. As argued in 5.2, weight, the computation of which belonging exclusively to the mora, must be derived separately. Since the mora must no longer be considered by HEADSBRANCH, the conflation of Rhymes branching segmentally and Rhymes branching prosodically becomes a non-issue; HEADSBRANCH must no longer consider whether Rhymes or any other constituent branches prosodically.

Since properties of stress-attraction and weight are exclusive to the syllable, HEADSBRANCH could play the role originally set out for FTBIN, by allowing causing the segmental branching that we see responsible for closed syllables being able to attract stress – even when there might not be evidence for them as being bimoraic (Bakovć 2004) – and that we see as being responsible for computing weight in terms of mora-counting; or, in stressless and weightless languages, HEADSBRANCH could be responsible for the language-specific case of some words being minimally closed and monosyllabic. Since HEADSBRANCH can serve purposes for all languages' outputs, HEADSBRANCH suggests that morae are derived in the output.

**6.1.2.3 Applying Strict Layering to Foot Binarity**

Third, the binarity of FTBIN must be held accountable to the Strict Layer Hypothesis (Selkirk 1984). Since Feet must consist exclusively of Syllables, a Binary Foot must only be disyllabic and must not be defined by the number of morae in its syllables. What might be described as a bimoraic, monosyllabic Foot, is not a Binary Foot; rather, it is a monosyllabic Foot containing a binary (bimoraic) syllable. This restriction of Foot Binarity to only disyllabicity creates some potential issues, specifically for non-tonal languages, regarding stress and weight; however, noting the high infrequency of disyllabic Roots as languages' minimal forms, this is not a much of a concern as the unattestedly high frequency of Binary Feet, both in the bimoraic-or-disyllabic and in the disyllabic-only definitions of FTBIN, predicted by PBT (cf. section 2.3, especially figure 6).

**6.1.2.4 Limiting Segmental Markedness Segmental Phonology**

Finally, phonological Markedness constraints previously invoked for explaining minimal forms not predicted by PBT and MBT, specifically *VV, NOCODA, and ONSET, are relieved from predicting ostensibly subminimal canonical Root forms. This allows

ONSET to have equal footing as *VV and NOCODA and dissolves the somewhat surprising observation made in 5.1 by PBT- and MBT-based accounts, that Markedness outranking FTBIN, HEADSBRANCH, and MORPH-SYLL crucially refers to activation of *VV and NOCODA, but not to ONSET.

### 6.1.3 Mapping Morpho-Prosodic Constituents to Metrical Units

Downing (2006:115) carries over a revised Prosodic Hierarchy (Inkelas 1989, 1993; Downing 1998, 1999) in which morpho-prosodic constituents and metrical constituents are separated into two hierarchies in order to remove the dominance of Foot by Prosodic Word, the connection motivating PBT. The separated hierarchies are portrayed in (1)

| (1a) Prosodic Hierarchy | (1b) Metrical Hierarchy |
| --- | --- |
| Utterance | Foot |
| \| | \| |
| Intonational Phrase | σ |
| \| | \| |
| Phonological Phrase | μ |
| \| | |
| Prosodic Word | |
| \| | |
| Prosodic Stem | |
| \| | |
| Prosodic Root | |

From this, ROOT-SYLL can be considered a constraint mapping a morpho-prosodic constituent onto the metrical hierarchy, specifically, the Prosodic Root onto the Syllable as the least marked metrical form of Roots. As mentioned in 5.4.1, shifting from MORPH-SYLL to ROOT-SYLL shifts from a many-to-one to a one-to-one mapping, leaving non-

Root constituents hanging. This raises the question of how other morphemes, Affixes and Stems, should be mapped.

### 6.1.3.1 Mapping Prosodic Stem

Since the next level up in (1) from Prosodic Root and Syllable are Prosodic Stem and Foot, this is a worthy area of exploration for another mapping constraint, STEM-FOOT CORRELATION.

Downing (2006: 123-124) entertains the concept of a constraint PROSODICSTEM as a corollary of MORPH-SYLL, such that requires the Prosodic Stem to be disyllabic. This presents a new form of lopsided (sub)minimality, that of monosyllabic Stems – for example, English plurals (2), in which the plural morpheme /z/ is canonically non-syllabic, which does not pose a significant problem for MBT. What is difficult for MBT to explain is why disyllabicity of Stems is not always enforced, specifically, why (2a,b) are monosyllabic, while (2c) is disyllabic.

(2)

| | | | |
|---|---|---|---|
| (a) | cats | /kæt/ + /z/ | [kæts] |
| | naps | /næp/ + /z/ | [næps] |
| (b) | dogs | /dɔg/ + /z/ | [dɔgz] |
| | beds | /bɛd/ +/z/ | [bɛdz] |
| (c) | ashes | /æʃ/ + /z/ | [æ.ʃɪz] |
| | phases | /feɪz/ + /z/ | [feɪ.zɪz] |

PBT's account of minimality, which conflates Roots and Stems, would analyze (2a-c) as all being acceptable, because (2a-b) would be bimoraic, while (2c) would be disyllabic; all would be a Binary Stress Foot; although, it should be noted that PBT would also analyze all Roots of the Stems in (2) as being acceptable, because they are bimoraic.

Clearly, this avenue merits further exploration and might prove fruitful for a deeper understanding of PROSODICSTEM and FTBIN, especially in languages, such as Yoruba and Japanese, in which weight and stress are non-issues. This might serve to further explain well-formedness of phenomena such as Yoruba's Verb+Object elision (Orie & Pulleyblank 2002) or of languages permitting monosyllabic, monomoraic Roots, but targeting disyllabic Stems for borrowing and truncation, as in Japanese (Itô 1990). This, in turn, might provide novel insight on the distinction between Prosodic Word and Prosodic Stem urged by Downing (2006: 114, citing Hyman 1993; Hyman & Mtenje 1999; Mchombo 1993; Myers 1987; and Mutaka 1994).

**6.1.3.2 Mapping Affixes**

Note that "Prosodic Affix" is not a constituent listed in (1a). It is interesting to note that Affixes, insofar as segmental Affixes, may minimally be sub-syllabic. This begs the question of whether a potentially sub-syllabic morphological constituent should be mapped to a metrical hierarchy. On the one hand, the use of Affixes to meet prosodic well-formedness in the output is arguably attested (e.g., Sesotho and Yagba verbs, this chapter). On the other hand, some affixes appear not to be crucially associated with metrical constituents; for example, affixed Codas in languages in which Codas do not contribute moraic weight or, as in (2), instances where Codas do contribute moraic weight, but the Affix only adds another segment to the Coda, without changing weight.

An interesting comparison to the ametrical segmental Affix is the ametrical tonal morpheme – for example, the Yoruba future-marking H-tone morpheme. It appears that minimally, non-Root and non-Stem morphemes are neither inherently specified for prosody, nor are they necessarily even segmental. This is interesting, because it intuitively follows Roots in terms of minimal complexity. Roots, as argued in this thesis, are minimally specified for autosegmental content and, by nature of being minimally syllabic, are also minimally a Nuclear segment. Affixes, on the other hand, appear to minimally be one of these things – an autosegmental unit or a segment; although, that segment is not necessarily minimally Nuclear.

As with the case laid out for minimal Roots and for Stems, these observations suggest nothing about maximality. That is, just as Roots may overall tend to be monosyllabic but may be disyllabic, and just as Stems may overall tend to be disyllabic but are not necessarily so, so too, may Affixes be moraic, syllabic, or more. The point is that minimally, they are not.

### 6.1.4 Types of Autosegmental Units

The argument put forth in this thesis is that lexically specified autosegmental units of tone, stress, or pitch-accent, are necessarily part of Root minimality. It should be highlighted, however, that autosegmental phonology is not limited to tone, stress, and pitch-accent. Thus, future research investigating what makes these autosegmental units different from other autosegmental phenomena, such as [±ATR], vowel harmony, nasality, creaky voice, or breathiness. A few observations are that tone, stress, and pitch-accent necessarily implicate the fundamental frequency, that they necessarily implicate Nuclear segments, and that they are associated with syllabic prominence. Moreover, the autosegmental phonology implicated in this thesis's theory or Root minimality exists as part of a complete typology or spectrum (Hyman 2006, 2009) that does not necessarily implicate other autosegmental phonological phenomena, such as [±ATR], vowel harmony, nasality, creaky voice, or breathiness.

### 6.1.5 Integration into Harmonic Serialism

Although, this thesis implicates metrical constituents, specifically the Syllable, but also potentially the Foot, it does so through violable constraints. Ultimately, it predicts that the minimal candidate for a Root will be a segment with a lexically specified autosegmental unit. The observation of PROPERHEADEDNESS, then, is an artifact of parsing. The monosegment of the Root will punitively be the Nucleus of a Syllable. Thus, it is worth investigating how the argument put forth in this thesis might work within current lines of research, specifically Harmonic Serialism (McCarthy 2010; McCarthy & Pruitt 2013) and ongoing accounts of stress placement.

McCarthy & Pruitt (2013) argue that phonological inputs have minimal or no structure. This is to say that lexical items have phonological specifications, such as segments and tone, but that these are not necessarily given full structure, such as weight, syllabification, footing, stress placement, or tonal association.

### 6.1.6 More Evidence from Acquisition

The above discussion of acquisition issues associated with the autosegmental units implicated in this thesis supports the claim that (C)V words that occur with these phenomena and with which these phenomena are lexically associated are inherently more complex than a typical (C)V syllable, because for their respective languages, these Roots, if stripped of their having tone, pitch-accent, or stress, would not contain enough phonological content to be well-formed lexical morphemes. Since adult-like use of these features must be occur on a phonological syllable, it stands to reason that they must acquired after the acquisition of the phonological syllable.

The foundation for the argument for rhyme complexity that I have made is that these complicating features must be acquired *after* the syllables to which they would apply. Thus, timing of acquisition of these features relative to the acquisition of other features would give solid evidence regarding their complexity. Further investigation of the acquisition of Yoruba tones, Japanese pitch-accent, and phenomena associated with them, especially in monosyllabic Roots, could yield evidence further evidence supporting the account of Root minimality made here.

### 6.1.7 The Importance of Autosegmental Units

The general notion of phonological branching is not necessarily lost in minimal Roots. Indeed, the argument made in this thesis is that they contain minimally two phonological units; however, the departure from previous literature (McCarthy & Prince 1986, 1993; Downing 2006) is that now, one of those phonological units is autosegmental. There is an unfortunate dearth of literature regarding the role of autosegmental phonology in canonical forms. This thesis opens that discussion by arguing that autosegmental phonology, specifically, what can be analyzed as discrete autosegmental units, is crucially implicated in canonical forms. While it has generally focused on tonal aspects of autosegmental phonology, because unlike stress languages, they are underrepresented in the discussion of minimality, more insight into the overall relationship between the tone-pitch-accent-stress spectrum, the fundamental frequency, and the concept of prominence within the word would shed tremendous light on the implications and potential applications of the theory this thesis presents.

## 6.2 Conclusion

This thesis has provided a critical review of accounts of Root minimality by the GTT, specifically PBT, MBT, and Markedness as an alternative when neither PBT nor MBT can explain "subminimal" forms. It argues that Root minimality must be seen as having two components, underlying minimality and output minimality or minimality effects.

Underlying Root minimality is universal. It requires underlying forms of all Roots to minimally have a segment that can be the Nucleus in output and an autosegmental specification in the form of tone, pitch-accent, or stress. These two conditions prevent the surfacing of segmentless, more specifically Nucleus-lacking, outputs and the surfacing of words with no stress in stress languages, with no tone in tone languages, or with no indication of existence or location of pitch-accent in pitch-accent languages. It suggests that all surface Roots have underlying potential to minimally form a single syllable and that all Roots utilize autosegmental aspects of phonological prominence.

The crucial role of autosegmental phonology has been demonstrated in Chapter 3, for three Yoruba dialects, Standard Yoruba, Yagba and Ondo, and in Chapter 4 for Tokyo Japanese. All four of these languages have been demonstrated as being "subminimal" in terms of PBT and MBT, yet, with the exception of Standard Yoruba (Ọla 1995), unexplainable by Markedness constraint dominance alone; although, underlying Root minimality in Standard Yoruba is also accounted for by the theory presented in this thesis.

Minimality effects, on the other hand, are not universal. Instead, minimal surface forms of Roots are language-specific and result from language-specific constraint rankings. This thesis has proposed that with some redefinition, the constraints originally used in PBT and MBT are used to predict language-specific minimal surface forms of Roots. This formalization dissolves the either/or system in PBT and MBT, in which minimal Roots defaulted to Markedness constraint dominance, when PBT and MBT constraints, such as FTBIN and HEADSBRANCH would analyze those Roots as "subminimal." This is convenient, because pure Markedness is not always obeyed, as evidenced by minimal Roots that violate the Markedness constraint ONSET.

Indeed, the theory proposed in this thesis altogether rejects the notion of "subminimality." By requiring a distinction between minimality of underlying, canonical forms of Roots and minimality of output, surface forms of Roots and their Stems, ostensibly "subminimal" Roots are underlyingly explainable and are subject to well-formedness in outputs. The observed minimal output size of a language may be larger than its demonstrated minimal underlying Root size, but this minimal output size is derived through minimality effects.

As mentioned, there are still some unknowns that would benefit from future research, especially, more detail on how stress and prosodification work within the framework presented here and further investigation of how other morphological and, by extension, morpho-prosodic constituents might be accounted for in a manner analogous to this thesis's treatment of Roots. The goal of this thesis will be met if it can join previous accounts of minimality (McCarthy & Prince 1986, 1993; Ọla 1995; Downing 2006) in pushing forward an understanding of the nature of Roots and the relationship between their underlying, canonical forms and their identity in their various surface forms.

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Just kidding – those were all linguistics, too. Everything's linguistics.

Seriously.