OPTIMALITY IN BENUE-CONGO PROSODIC PHONOLOGY AND MORPHOLOGY

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ABSTRACT

This dissertation investigates the instantiation of prosodic constituents, from the level of the prosodic word to the mora, in several Benue-Congo languages spoken in Nigeria, Togo, and the Republic of Benin. The over-all analysis is couched within Optimality Theory (Prince and Smolensky 1993, P&S) which states that phonological constraints are hierarchically ranked and violable. The cross-dialectal and cross-linguistic diversities exhibited in the languages discussed are shown to be a consequence of different constraint rankings. The observed variations and their respective analyses can be summarized as follows.

First, only a subset of the total segmental inventory is moraic in all the languages examined. In some dialects of Yoruba (Ilaję), only vowels are tone-bearing and potential syllable peaks; in other dialects (Standard Yoruba and Onko), both vowels and nasals are tone-bearing, but only vowels may occupy the nucleus position in the syllable. In Idoma, vowels, liquids and nasals are tone-bearing, but only vowels and liquids are potential syllable peaks, nasals are excluded. These diversities are shown to follow from the different cut-off points established for non-nuclear moras as opposed to nuclear moras on the sonority hierarchy.

Second, it is observed that vowels differ in their syllabicity capabilities depending on whether they are preceded by onsets or not. In Standard Yoruba, Ọwọn-Afa, and Gokana, vowels are syllabified if onsets precede them; onsetless vowels are not syllabified. In Ondo Yoruba and Emai, vowels are syllabified regardless of whether they have onsets or not. The variation in the syllabification pattern is shown to follow from the variable ranking of ONSET and other syllable structure well-formedness constraints such as PARSENUCμ or PARSEμ.

Third, the properties of foot structure found in the non-stress tone languages examined are reminiscent of the properties associated with the metrical foot. In Yoruba, Ibibio and Ọwọn-Afa, feet are binary and headed. Ibibio utilizes trochaic feet while Ọwọn-Afa and Yoruba use iambic

feet. This finding confirms the proposal that non-stress processes utilize the metrical foot (M&P 1986, Inklelas 1989, Spring 1991, Downing 1994).

Fourth, prosodic minimality and maximality effects are observed at the level of the prosodic word. Two patterns of minimality effects are found. In languages like Idoma and Gokana, the minimal prosodic word is a binary foot, while in languages like Yoruba and Ebira, the minimal condition requires the presence of a syllable in every word. Foot binarity effects are only required of specific lexical classes, like nouns, in both languages. The minimal syllable requirement is proposed to follow from properheadedness, and the diversities found in the spellout of prosodic minimality derived by the variable ranking of Foot Binarity and Properheadedness. The emergence of unmarked words in child phonology in English, Dutch and Yoruba is cited as evidence in support of this view of minimality: children start with CV words and then move on to the CVCV stage. These two stages are proposed to follow from Properheadedness and Foot-Binarity assuming the "Continuity Hypothesis" which states that language acquisition is made up of a series of continuous stages determined by Universal Grammar (Pinker 1984). Concerning prosodic maximality, it is observed that the maximal instantiation of the prosodic word is two feet. This property is proposed to follow from the principle of binarity which limits the unmarked shape of phonological constituents to two tokens of a given phonological unit (Itô & Mester 1992).

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iṣẹ́ ni oògùn ìṣẹ́
múra sí iṣẹ́ ọ̀rẹ́ mi
iṣẹ́ ni a fi ń di ẹni gíga

(Proverbs 22: 29)

CHAPTER 1

INTRODUCTION

1.1. Overview

The prosodic hierarchy (Selkirk 1980a,b) constitutes the domain for the operation of both phonological and prosodically conditioned morphological phenomena. For example, phonological processes involving tones, prominence assignment, tongue root harmony, nasalization, and compensatory lengthening, make crucial reference to the mora (μ) or the syllable (σ), the foot (Ft) and the prosodic word (PrWd); segmental properties are accessed only indirectly via these prosodic constituents (Hyman 1985, Hayes 1989, Itô 1986, 1989, Archangeli and Pulleyblank 1994, Pulleyblank 1994, among others). Further on, morpho-phonological phenomena such as the minimal word condition, reduplication, truncation, and augmentative epenthesis may apply within the domain of the prosodic word, the foot, syllable, nucleus and the mora (Downing 1993, 1994, Hewitt 1992, 1994, Itô 1990, Itô and Mester 1992, McCarthy and Prince 1986, 1993a, 1993b, 1994, Ọla 1995, among others).

Starting at the level of the prosodic word,[1] the hierarchy progresses downwards to the constituency of the foot, is followed by the syllable and terminates at the level of the mora. Each level of constituency formation follows the markedness convention for that level. For example, the prosodic word should always contain at least a single unit of each constituent below it: foot, syllable, nucleus, and mora; a foot is binary at the moraic or syllabic level; a syllable should have an onset and a nucleus; and a mora is preferably the most sonorous set of segments in the sonority hierarchy (vowels). Additionally, by the strict layer hypothesis (Selkirk 1984) and the principle of exhaustivity (Prince 1980), each constituent must be properly contained within the next dominating

[1]The prosodic hierarchy actually begins with the phonological phrase (which includes the clitic group and intonational phrase) but the scope of this dissertation is restricted to the constituency of the prosodic word and the various levels beneath it (foot, syllable, nucleus, as will be motivated in chapter 2, and mora).

constituent. Thus, moras must belong to syllables, syllables must belong to feet, and every foot must belong to the prosodic word. The prosodic hierarchy is illustrated in (1).

(1) <u>The Standard Prosodic Hierarchy</u>

PrWd Prosodic Word

|

Ft Foot

|

σ Syllable

|

μ Mora

Despite its overall success, the prosodic hierarchy has been questioned on a number of grounds. For instance, recent works have raised issues concerning the standard assumptions on the universality of constituency formation at each level in the hierarchy. Questions have been raised on the issue of morafication especially with regard to certain asymmetric patterns exhibited by moras (Hyman 1992, Shaw 1992, 1993, Steriade 1991, Ọla 1994b). The notion of exhaustive syllabification has been challenged in work such as Bagemihl 1991, Hyman 1990, Downing 1993, Ọla 1993. Even though foot structure is assumed to be binary in the unmarked case, some unresolved issues still remain on the existence of degenerate feet and headedness (Hayes 1991, Poser 1990, Crowhurst 1991, Kager 1993, Hewitt 1994, among others). In addition, an issue has also been raised by works such as Bagemihl (1991) and Itô and Mester (1992) as to whether or not constituency is truly hierarchically layered in a strict dominant fashion as proposed for instance in Selkirk (1980, etc) and Nespor and Vogel (1980). The latter constitutes the strict vs. weak layering hypothesis debate. These issues arise from the cross-linguistic diversities observed across languages, diversities which standard phonological theory cannot explain without resorting to ad hoc devices.

Optimality Theory (OT, Prince & Smolensky 1993, McCarthy & Prince 1993a,b) offers a formal mechanism through which the cross-linguistic variation observed in natural languages can be explained. Linguistic diversity follows from constraint interaction in OT. Specifically, different rankings of the same set of universal constraints yield different grammars. For example, given two constraints (A,B), we can produce two languages by ranking these constraints differently: A >> B or B >> A. The dominance relation (signified by >>) determines the significance of a given constraint within a specific grammar. The satisfaction of higher ranked constraints is more important than the satisfaction of lower ranked constraints. In fact, a lower ranked constraint may be violated to ensure the satisfaction of a higher ranked constraint.

This dissertation examines prosodically conditioned phenomena in a number of Benue-Congo languages of Nigeria, Togo, and Benin Republic (Bendor-Samuel ed., 1989 classification, also cited as Niger-Congo Languages elsewhere). In Yoruba (Standard, Onko, Ondo, Ilaję), cross-dialectal diversty is attested in how segments are assigned moras, and differences also occur in the syllabicity of vocoids. The variation is carried over into the constituency of prosodic units which are higher up the hierarchy. Thus, variation occurs in the spellout of a foot and the prosodic word in these dialects. Similar variation is observed in other languages such as Ọwọn- Afa, Idoma, Ebira, Ẹmai, Gokana, and Ibibio. The variation observed in these languages is shown to follow from the different rankings of the same set of constraints provided by Universal Grammar for the well-formedness of moras, syllables, foot structure and the prosodic word.

The dissertation contains five chapters. Chapter 1 provides an introduction to Optimality Theory and some of the relevant constraints for the phenomena under discussion are presented. Chapter 2 discusses the formation of moras. Three major patterns are found: (a) in Ilaję-type languages, only vowels are possible moras, (b) in Standard Yoruba type languages, vowels and nasals are potentially moraic, (c) in Idoma type languages, vowels, liquids and nasals are potential moras. These languages also vary with respect to the selection of moras which may serve as syllable nucleus. In Standard Yoruba and Onko Yoruba, only vocalic moras may occur as syllable peaks with a preceding onset consonant, while in Idoma vowels and liquids may group together

with onsets into syllables. In both cases, nasals (although moraic) are systematically excluded from occurring as syllable peaks. These asymmetries are shown to follow from the different cut-off points established for moraic entities and nuclear entities (Shaw 1992, Steriade 1991).

Syllabification is examined in chapter 3. Two different patterns are observed interdialectally and cross-lingusitically. In Ondo Yoruba and Ẹmai, vowels are syllabic regardless of whether they have onsets or not. In Standard Yoruba, Ọwọn-Afa and Gokana, the syllabicity of vowels is tied to the presence of onsets. The two patterns are derived from the variable ranking of ONSET and other constraints governing the well-formedness of syllable structure.

Chapter 4 examines footing in non-stress tonal languages like Yoruba, Ọwọn-Afa, and Ibibio, and discusses issues relating to binarity and headedness. In these languages, the unmarked foot is binary and the moraic and syllabic constituents contained within the foot exhibit some asymmetries which are consistent with an analysis in which the foot distinguishes between a head and non-head position (M&P 1986). The conclusion that follows is that non-metrical systems utilize metrical feet for phonological processes.

Chapter 5 investigates the prosodic constituency of the prosodic word and shows that minimality and maximality effects are attested at that level. M&P (1986, 1993a) propose that the minimal prosodic word is a binary foot (Ft-Bin); however, the languages examined here exhibit some variation in the spellout of the minimal word. In Idoma and Gokana, the minimal word is a binary foot, whereas in Yoruba and Ebira, the minimal requirement is that a syllable be present in every word. Binary footed words exist in these languages but are usually restricted to the domain of nouns. Child phonology, as is well-known, is a good testing ground for any principle of linguistic universals. Across languages (English, Dutch, Yoruba), children start out with CV words, that is, all words are truncated to a single syllable; following this stage, binary footed words (CVCV) emerge (Ingram 1978, Fikkert 1994, Demuth 1995, Demuth & Fee 1995). This evidence is quite telling: the unmarked word in child phonology is first a CV word and later a CVCV, exactly the same minimal patterns found in adult grammars across languages. If the stages of acquisition are determined by Universal Grammar (UG) as assumed by the "Continuity

Hypothesis" (Hyams 1987, Pinker 1984, for example), these two stages must follow from principles provided by UG. Following Itô and Mester (1992), the minimal syllable requirement is proposed to follow from properheadedness (PROP-HEAD, Ọla 1995). In Optimality Theory, the differences in the spellout of the minimal prosodic word are shown to result from the variable ranking of Ft-Bin and PROP-HEAD. The faithfulness family of constraints, namely PARSE and RECOVERABILITY (defined as LEX, following A&P 1994), are also shown to interact in interesting ways with Ft-Bin and PROP-HEAD to derive either augmentation, the lack of augmentation (to Ft-Bin or PROP-HEAD) or the failure to parse segments in child phonology. Maximality effects are also attested at the prosodic word level: the maximal prosodic word is two feet. This restriction is argued to follow from the principle of binarity which constrains unmarked phonological constituents to two tokens of a given phonological unit (Itô and Mester 1992).

1.2. Optimality Theory

The fundamental principles of Optimality Theory are laid out in this section and my assumptions on the information contained in lexical entries made explicit. Some constraints governing the well-formedness of prosodic constituents such as mora, syllable foot and the prosodic word are briefly discussed.

1.2.1. Basic Principles of Optimality Theory

The central hypotheses of Optimality Theory (Prince & Smolensky 1993, McCarthy & Prince 1993a) are the following. First, the output of phonology or morphology is determined by the wellformedness constraints provided by Universal Grammar (UG). Optimality Theory assumes that all UG constraints are present in every grammar and the relative activity or inertness of constraints in each language is determined by ranking. Constraint ranking is the second major principle of OT: the grammar of a language is obtained by constraint rankings, these rankings are

carried out in a dominance order, so that some constraints are highly ranked, while some are lowly ranked. OT differs in this regard from other constraint-based theories such as the parameterized-based approaches (Paradis 1989, 1990, Kaye 1990), theories in which constraints are either turned "on" or "off". These two approaches (OT vs. parameterized approaches) differ in no trivial measure in their empirical coverage. In OT, since all UG constraints are present and hierarchically ranked in a language, the effect of a given constraint is predicted to be active under the appropriate conditions. In contrast, the parameterized approaches predict that only the effects of constraints which are turned "on" in a language will be manifested, contraints that are turned "off" are predicted to be totally inert, a prediction which is not borne out in a lot of languages.

Third, phonological and templatic constraints are in principle, violable, but violation is minimal. Priority is given to the undominated and highly ranked constraints; hence they are preferrably, non-violable. Lowly ranked constraints are functional in the grammar, but less priority is accorded them,;hence they may be violated under pressure to satisfy higher ranked constraints. The grammar generates, by the function GEN, an infinite number of candidate forms from a given input, and the candidates are evaluated in a parallel fashion against the hierachically ranked set of constraints. The optimal (or winning) candidate is the one that best satisfies the ranked hierarchy of constraints. The basic properties of OT outlined above may be summarized as follows.

(2) <u>Basic principles of Optimality Theory</u>

a. Violability: constraints are violable; but violation is minimal

b. Ranking: constraints are ranked on a language particular basis; the notion of minimal violation (or best satisfaction) is defined in terms of this ranking

c. Parallelism: best satisfaction of the constraint hierarchy is computed over the whole hierarchy and the whole candidate set

Consider a schematic implementation of the above principles. First, assume that a

grammar consists of two constraints (A,B) and that the following ranking is established between the constraints: A >> B. For any given input the optimal candidate is one that satisfies both constraints or the higher ranked constraint, A. This situation is made more explicit in a tableau. The basic conventions developed by Prince and Smolensky for interpreting a tableau are the following: (a) A >> B means constraint A dominates constraint B, (b) left-to-right column order shows the domination order of the constraints, (c) violation of a constraint is marked by "*", (d) constraint fatal violation (which results in the rejection of a candidate) is marked by an exclamation mark "*!", (e) constraint satisfaction is indicated by a blank cell, and (f) a ✓ sign indicates the optimal or winning candidate.[2]

(3) A >> B, /input/

Candidates	A	B
✓cand.1		*
cand.2	*!	

In (3), cand.2 incurs a violation of A, the higher ranked constraint, and is rejected in favor of cand.1 which satisfies A. Thus, even though cand.1 violates B, a lower-ranked constraint, it is still chosen as the optimal candidate because it obeys higher ranked A. Another possible scenario is one in which the two candidates violate the higher ranked constraint. In such a case, the selection of the winning candidate is determined by the satisfaction of the lower- ranked constraint. The following tableau depicts this situation.

(4) A >> B, /input/

Candidates	A	B
cand.1	*	*!
✓ cand.2	*	

[2]This is equivalent to the pointing finger convention of (P&S 1993, M&P 1993a,b,) or the thumbs up convention of (A&P 1994, Pulleyblank 1994).

The tableau in (4) shows how the candidates are evaluated for constraint satisfaction. Both candidates violate A, and so they tie on this count. In other words, the choice of the optimal form cannot be made at this point. Evaluation is thus passed on to the lower ranked constraint B. Candidate (4b) as shown in the tableau is the optimal candidate because it obeys constraint B which is violated by its competitor, candidate (4a).

In a situation where both candidates violate or obey the two constraints, the selection of the optimal form is determined by multiple versus fewer violation of constraint. In other words, the candidate that incurrs fewer violations of a constraint will emerge as the winner as demonstrated in the following tableaux.

(5) A >> B, /input/

Candidates	A	B
cand.1	*	**!
✓ cand.2	*	*

(6) A >> B, /input/

Candidates	A	B
cand.1		**!
✓ cand.2		*

If two constraints do not dominated each other in a grammar (that is A does not crucially dominate B, and B does not crucially dominate A),[3] they are said to be unranked with respect to each other.[4] The optimal candidate in such a situation is one that satisfies the two constraints. Any candidate form that violates any of these constraints is considered sub-optimal. The following tableau illustrates this situation.

[3]Lack of crucial domination may occur anywhere in the hierarchy of constraint ranking within a grammar.

[4]This case is different from a case involving crucial non-ranking (Blake 1993), a ranking that is proposed to account for optional processes. The analysis of optional phenomena still remains a topic of debate in OT. It is accounted for in Pesetsky (1995) as the surface effect of tied constraints; and, in Grimshaw (1995), it is analyzed as forms having different inputs.

(7) A, B: /input/

Candidates	A	B
cand.1	*!	
cand.2		*!
✓ cand.3		

1.2.2. Lexical entry and underlying structure in Optimality Theory

In standard generative phonology (SPE and its autosegmental-based descendants), a phonological representation is assumed to have a unique underlying representation (UR). Rules are then posited and applied in a step-by-step fashion to the UR to derive the correct surface representation (SR). One fundamental assumption in Optimality Theory which contrasts sharply with the previous (standard) assumption is that constraints do not hold of UR, the satisfaction of a constraint is determined at the surface.[5] This raises a question on the status of underlying structure within this theory: what is the equivalent of the standard theory's underlying structure in Optimality Theory? In Optimality Theory, the input structure consists of lexical entries in which lexically contrastive constituents, featural or prosodic, are encoded (Archangeli & Pulleyblank 1994, Pulleyblank 1994, Shaw 1995, to mention a few). I assume in the present work that the underlying representation is encoded as follows (culled from Shaw 1995):

(8) <u>The lexical entry in Optimality Theory</u>

a. Moraic representation:

Underlying Representation consists of segmental string annotated with moras on vowels and long segments (Hayes 1989, Pulleyblank 1994, M&P 1993a)

[5]Surface here implies phonological surface rather than phonetic surface.

b. Melodic representation:

Segments are formally represented as Root Nodes

Segments consist of feature-sets

Feature sets are organized in terms of hierarchical dependence

Features are monovalent, with specification reflecting markedness

1.2.3. Constraints governing the well-formedness of prosodic constituents

Assuming that lexical entries consist of segments and moras, what the grammar must do is devise a way of grouping these phonological constituents together to receive phonetic interpretation. The syllable functions as the basic organizing node for the grouping of segments and moras. Segments that are incorporated into the syllable are prosodically licensed (Itô 1986, 1989).[6] In Optimality Theory, the work of prosodic licensing is carried out by the faithfulness family of constraints commonly referred to as PARSE, constraints which require the parsing of segments, moras (nuclear and non-nuclear), syllables, and feet.

(9) <u>PARSE family of constraints</u>

a. PARSE (broadly defined):

phonological constituents are licensed by higher prosodic structure

b. PARSE-segment (PARSE-seg): root nodes are parsed by the syllable

c. PARSE-mora (PARSE-μ): moras are parsed into syllables

d. PARSE-nuclear mora (PARSENUC-μ): nuclear-moras are parsed into syllables

e. PARSE-syllable (PARSE-σ): syllables are parsed into feet

f. PARSE-foot (PARSE-Ft): feet are parsed into prosodic words

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[6]The mora is proposed to be a prosodic licenser in work such as Zec (1988), Hyman (1990), Bagemihl (1991) and others. Chapter 3 of this work argues for moraic licensing in some languages of Benue-Congo.

As far as syllabification is concerned, under the framework of assumptions in moraic theory, the relevant PARSE constraints are PARSE-seg and PARSE-μ. Other relevant syllable structure well-formedness constraints are ONSET and NO-CODA.

(10) Syllable Structure Well-formedness constraints

a. ONSET: Syllables must have onsets

b. NUCLEUS: Syllables must have nuclei

c. NO-CODA: Syllables are open

Notice that the syllable well-formedness conditions in (9) state that certain syllabic constituents are universally preferred, while some are universally dispreferred. These conditions say nothing about the location of syllabic constituents within the syllable. For example, given a CV string input, as the constraints in (9) stand, in formal terms, nothing prohibits either the onset-C from occupying the right edge of the syllable, or the nucleus-V from occupying the leftmost position within the syllable, an undesirable result for syllabification. To prevent such illicit parses, alignment constraints are crucial. Alignment constraints are constraints which govern the well-formedness of constituent edges, prosodic, morphological, or grammatical. The formal statement of constituent Alignment appears below (M&P 1993b).

(11) Generalized Alignment

Align(Cat1, Edge 1, Cat2, Edge 2) = def

$\forall$ Cat1 $\exists$ Cat2 such that Edge 1 of Cat 1 and Edge 2 of Cat 2 coincide,

Where

Cat1, Cat2 $\in$ PCat $\cup$ GCat

Edge1, Edge2 $\in$ {Right, Left}

Alignment constraints may hold of prosodic constituents such as moras, syllables, feet and prosodic words. Using syllabification as an illustration (Itô & Mester 1994), these two alignment constraints are needed to formalize ONSET and NO-CODA:[7]

(12) Syllable Structure Alignment constraints

a. ONSET (ONS): ALIGNLEFT (σ, L; C-Rt, L)

The left edge of a syllable is directly aligned with the left edge of a consonantal rootnode

b. NO-CODA: ALIGNRIGHT (σ, R; NUC, R)

The right edge of a syllable is directly aligned with the right edge of a nucleus

Languages differ with respect to their tolerance of segment clusters: some languages permit segment (consonant or vocalic) clusters while others simply disallow clustering. Prince & Smolensky propose the *COMPLEX family of constraints to capture the differences between the language types described above. *COMPLEX ranges over syllable structure positions such as ONSET, NUCLEUS and CODA.

(13) *COMPLEX family of constraints

a. *COMPLEX-ONS: No more than one segment may directly link to the syllable node

b. *COMPLEX-NUC: No more than one segment may directly link to the nuclear position

c. *COMPLEX-COD: No more than one segment may directly link to the coda position

If a language does not tolerate segment clusters, and if it so happens that such a language borrows words from a language that permits clusters, such clusters, as is well-known, are either

[7]Even though ONSET and NO-CODA are reinterpreted in Alignment terms, these terminologies are still used throughtout this dissertation for expository ease, not as formal constituents.

deleted or broken up by an epenthetic vowel. The insertion of epenthetic segments into syllable positions is captured by the constraint FILL (another family of constraint that ranges over syllable positions like *COMPLEX) in Optimality Theory. Languages that permit epenthetic segments violate FILL, while languages which disallow epenthesis do not tolerate violations of FILL.[8]

(14) FILL: Syllable positions are filled with segmental material

Recoverability (defined in this dissertation as LEX, following A&P 1994) is also crucial in determining the well-formedness of output forms in Optimality Theory. Recoverability (of feature (F) or of the path (P) between a feature and a prosodic anchor) ensures faithfulness between a given input and the successful output candidate. Since recoverability is linked to the faithfulness of input-output relation, the class of phonological constituents which it governs are those present in the lexical entry: features, segments (root nodes) and moras. Recoverability is defined as follows.

(15) <u>LEX</u>

a. LEX-F: an F-element (feature) that is present in an output form is also present in the input (A&P 1994, (Itô, Mester & Padgett 1993, McCarthy 1993)

b. LEX-P: for any path between an F-element α and some anchor β, if α is associated to β in the output, then α is associated to β in the input (A&P 1994, (Itô, Mester & Padgett 1993, Kirchner 1993)

c. LEXRT: a root node that is present in the output form is also present in the input form

d. LEXμ: a mora (nuclear or non-nuclear) that is present in the output form is also present in the input form

[8]When featural content is assigned to an epenthesized mora, FILL is not violated, rather, LEXμ is (defined in (15d) of the text).

Once segments are parsed into syllables , PARSE-σ, the constraint governing the grouping of syllables into feet becomes relevant. At this stage, a binarity constraint which limits the organization of syllables (or moras) into feet to two tokens of each constituent is crucial:

(16) Ft-Binarity (Ft-Bin): A foot is binary at the moraic or syllabic level

The distinction between trochees and iambs is captured by head alignment constraints, the head of a trochee is realised at the left edge of the foot, while the head of an iamb surfaces at the right edge of the foot.[9]

(17) Foot typology alignment constraints

a. Trochee: ALIGN-HEAD (Ft,L; HEAD, L)

The left edge of the head of a trochaic foot (μ or σ) is aligned with the left edge of the foot

b. Iamb: ALIGN-HEAD (Ft,R; HEAD, R)

The right edge of the head of a iambic foot (μ or σ) is aligned with the right edge of the foot

PARSE-foot is the constraint that requires the parsing of feet into prosodic words. At this level, too, the grouping of feet into prosodic words is also governed by binarity (Itô and Mester 1992, Ọla 1995):

(18) Prosodic Word Binarity (PrWd-Bin):

Prosodic word is maximally binary at the level of the foot

A summary of the constraints discussed so far is given in (19).

[9]Note that alignment constraints can only refer to formal predicates (PCat, GCat), thus, ALIGN-HEAD is used here just as a functional label for the iambic and trochaic parse.

(19) Summary of constraints

a. Faithfulness Constraints

PARSE: phonological constituents are licensed by higher prosodic structure

FILL: Syllable positions are filled with segmental material

LEX: a phonological constituent (feature, root node, path, μ) that is present in the output form is also present in the input form

b. Syllable structure constraints

ONSET: Syllables must have onsets

NUCLEUS: Syllables must have nuclei

NO-CODA: Syllables are open

*COMPLEX: No more than one segment may link to a syllable position

c. Alignment constraints

ALIGN-LEFT:

align the left edge of a constituent (phonological or grammatical) with the left edge of a constituent (phonological or grammatical)

ALIGN-RIGHT:

align the right edge of a constituent (phonological or grammatical) with the right edge of a constituent (phonological or grammatical)

d. Binarity constraints

Ft-Binarity (Ft-Bin): Foot is binary at the moraic or syllabic level

Prosodic Word Binarity (PrWd-Bin): Prosodic word is maximally binary at the level of the foot

In accounting for the expression of morphological processes such as reduplicative copying and truncation processes, I assume the theory of Correspondence developed in M&P (1993a, 1994, 1995). Defined below is Correspondence, a type of input-output faithfulness condition on the relation of base-reduplicant, or base-truncative identity:

(20) Correspondence

Given two strings S_1 and S_2, related to one another by some linguistic processes, Correspondence is a relation f from any subset of the elements S_1 to S_2. Any element α of S_1 and any element β of S_2 are correspondents of one another if β is the image of α under Correspondence, that is, $\beta = f(\alpha)$.

The following constraints on correspondent elements are important in the dicussions on reduplication and truncation in this work. First, there is MAX (21) which demands that copying be total or complete such that the reduplicant is identical to the base; and there is DEP (22) which states that the copy must be like the base in all respects, thus excluding the addition of extra phonological materials in the copy:

(21) MAX (or Completeness of mapping)

Every element of S_1 has a correspondent in S_2

Domain $f = S_1$

(22) DEP (Faithfulness of the copy to the base)

Every element of S_2 has a correspondent in S_1

Range $(f) = S_2$

Second, prefixation and suffixation are controlled by ANCHORING (ANCHOR is an Alignment-type constraint used in templatic morphology) such that prefixal forms surface with materials which

correspond to those found at the left edge of the base, while suffixal forms correspond to materials which occur at the right edge of the base:

(23) <u>{RIGHT, LEFT}-ANCHOR (S_1, S_2)</u>

Any element at the designated periphery of S_1 has a correspondent at the designated periphery of S_2

Third, CONTIGUITY requires that the copy or reduplicated form be a continuous substring of the base in order to prevent the skipping over of segmental melody in mapping:

(24) <u>CONTIGUITY</u>

a. I(NPUT)-CONTIG ("No Skipping")

The portion of S_1 standing in correspondence forms a continuous substring

b. O(UTPUT)-CONTIG ("No Intrusion")

The portion of S_2 standing in correspondence forms a continuous substring

Fourth, there is LINEARITY, the constraint that preserves segmental linearity and prohibits metathesis when segments are mapped onto prosodic structure:

(25) <u>LINEARITY (of mapping)</u>

S_1 reflects the precedent structure of S_2 and vice versa

Fifth, the input-output relation between segmental features in the base-reduplicant is governed by IDENT (F) defined as follows:

(26) <u>IDENT (F) (Faithfulness of copy-base featural identity)</u>

Correspondent segments have identical values for the feature F

Finally, I would like to make two points on data exposition and the analyses offered for feature-based phenomena. First, the elucidation of data is duplicated because of the diverse theoretical implications which they have for the issues addressed in this dissertation. Second, because this work is focused on the characterization of prosodic consitutents, theoretical analyses of feature-based phenomena such as assimilation, deletion, nasalization, and aspiration are not offered in detail.

CHAPTER 2

Sonority Constraints on Moras in Benue-Congo

2.1. Introduction

In moraic theory, the mora (μ) is the prosodic level mediating between the syllable node and the melodic tier,[1] and it performs diverse roles in phonology. In current understanding, springing from Hyman (1985), the mora variously functions as the weight unit (WU), tone unit (TBU), and a sub-syllabic unit (see also Hayes 1989, McCarthy & Prince 1986, Pulleyblank 1994). Zec (1988) argues that the mora performs an additional role in phonology, the role of a prosodic licenser, a property that makes the mora an autonomous constituent which need not constitute part of the syllable to be prosodically licensed (see also Hyman 1990, Bagemihl 1991, Downing 1993, Ọla 1993).

There are three basic proposals on the moraic represensation of segments. In Hyman (1985), every segment starts out with a mora; as segments are assigned to syllable positions, onset-type segments lose their moras and are adjoined to the moras of sonorous segments whose moras are consistently retained throughout the derivation. In McCarthy & Prince (1986), only geminates and long vowels are assigned one mora underlyingly; the assignment of single moras to short vowels and a second mora to long vowels is assumed to be a redundant property; consequently, morafication for this class of segments is not a lexical property. In Hayes (1989), all vowels, whether long or short, are assigned moras in underlying structure; under this approach, moras constitute part of the lexical information required for vowels. Pulleyblank (1994) provides evidence for Hayes' position from the tonal facts of Yoruba and demonstrates that the non-

[1]The moraic level corresponds in certain respects to the CV tier (McCarthy 1979, Clements & Keyser 1983, Steriade 1982) or the "x" tier in skeletal theories (Levin 1985, Kaye and Lowenstamm 1984).

predictable nature of tonal linking in underived words warrants the prelinking of tones to tone bearing units in underlying structure.

The issue of morafication is sharply focused in Zec (1988) and sonority constraints are shown to play a fundamental role in determining whether or not a segment is moraic. Under this approach, only sonorous segments are assigned moras. Sonority constraints, both universal and language specific in nature, combine to select the moraic inventory within a given language. Zec identifies four ways in which languages may delimit the class of moraic and/or syllabic segments.[2] A type 1 language involves a situation where syllabic and moraic segments are coextensive and form a subset distinct from the non-syllabic and non-moraic segmental inventory (Khalkha Mongolian). A type 2 language is one in which syllabic and moraic segments are a subset of the segmental inventory, and syllabic segments in turn form a subset of the moraic set (Danish, Lithuanian). A type three language involves cases where the set of moraic segments is coextensive with the segmental inventory while a subset of the moraic set functions as syllabic (English). A type four language permits any segment - obstruents, sonorants and vowels - to function as moraic (Imdlawn Tashlhiyt Berber, Dell & Elmedlaoui 1985; Mon-Khmer languages, Shaw 1993 and references cited therein).

This chapter is dual-purposed. First, empirical evidence is presented from Benue-Congo languages for Zec's type 1 and type 2 languages; the diverse sonority settings for syllabic and moraic segments are characterized in Optimality Theory (Prince & Smolensky 1993, McCarthy and Prince 1993) as resulting from the various cut-off points established for each language, and the relative ranking of PARSE within the sonority scale.

The second goal concerns the structural characterization of moraic asymmetries. Zec proposes that the mora is a prosodic constituent and also notes that moras differ in two respects. First, moras are different in terms of syllabicity (moraic vs. syllabic distinction). Secondly, it is observed that distinctions often occur in terms of the strength of the position of moras within the syllable (strong vs. weak mora distinctions). Even though this proposal may account for

[2]The typology of languages is not ordered exactly as given in Zec (1988).

asymmetric cases involving bimoraic forms, it encounters some difficulties when asymmetries involving monomoraic forms are considered. In two dialects of Yoruba (Standard Yoruba and Onko Yoruba), vocalic moras behave differently from consonantal moras in terms of syllabicity and reduplicative morphology. This asymmetry cannot be analyzed as following from the distinction between strong and weak moras because a single mora is analyzed as strong under Zec's model. It is proposed here that moraic asymmetries are better encoded in structural terms within a moraic theory that recognizes the Nucleus as a prosodic constituent (Shaw 1992, 1993, Steriade 1991).[3] Under this approach, vowels are formally characterized as nuclear moras and consonantal moras as non-nuclear moras.

The discussion begins with an account of a type 1 language, Ilaję Yoruba. Among the whole segmental inventory, only vowels are moraic and potentially syllabic segments. The discussion of Ilaję is followed by an account of two type 2 languages, Idoma and two dialects of Yoruba (Standard Yoruba and Onko Yoruba), where sonorants and vowels act as moraic entities. Standard Yoruba and Onko Yoruba, however, differ from Idoma in two regards. First, only vowels and nasals may be moraic in the Yoruba dialects; liquids are impermissible moras. In Idoma, on the other hand, vowels, liquids and nasals are moraic. Second, in Yoruba only vowels are syllabifiable with onsets; consonantal moras, i.e., nasals, are excluded. In Idoma too, only vowels may function as syllable nuclei; liquids and nasals, however, group into syllables subject to certain restrictions, the chief constraining factor being the CODA-CONDITION principle (Itô 1986, 1989, Goldsmith 1990, Yip 1991, Itô & Mester 1993).

[3]Steriade (1991) proposes that there is a distinction between nuclear and non-nuclear segments. However, this proposal does not explicitly argue for the Nucleus as a formal prosodic consituent. In this regard, it differs minimally from Shaw (1992).

2.2. Type 1 language Syl = Mor ⊂ Seg: Ilaję Yoruba

This section provides an introduction to the segmental inventory of Ilaję and shows that only vowels are moraic and potential syllabic moras. In Zec's framework, only the class of segments that constitute a proper extension (defined in (7) below) of other segments, that is, vowels, are assigned moras. In Optimality Theory, the cut-off point for moraic and nuclear segments is ranges from *P/i to *P/a; that is, the set of peak preferring segments begin with high vowels and terminate with low vowels.

2.2.1. Ilaję Yoruba: Syllabic/moraic segments, distributional facts

Ilaję has a phonemic segmental inventory consisting of eighteen consonants and twelve vowels as shown below (Ogunpolu 1973, Ayela 1988).[4]

(1) Consonantal inventory

	t	dʒ	k	kp	
b	d		g	gb	gw
m	n				
f	s		ɣ	h	
w		j			

(2) Vocalic inventory

Oral vowels: ɪ, e, ɛ, a, ɔ, o, u

Nasalized vowels: ɪ̃, ɛ̃, ã, ɔ̃, ũ

[4]The Yoruba Standard Orthography is adopted in the citation of examples: ẹ = [ɛ], ọ = [ɔ], Vn = nasalized vowel, ṣ = [ʃ], p = [kp], gh = [ɣ], = H-tone, = L-tone, and absence of tonal marking on a vowel or moraic nasal indicates M-tone.

Of the entire segmental inventory, only vowels may bear tones. Vowels may surface with any of three lexical tones; high, low or mid (Pulleyblank 1986, Akinlabi 1985), as illustrated by the representative data given below.

(3) Only vowels are tone bearing in Ilaje

lọ	go	ıgı	stick
mọn	drink	ọ̀la	tomorrow
gé	cut	ọdún	festival
fà	pull	àrírẹ̀	tiredness

In contrast, consonants (be they sonorant or non-sonorant), do not bear tones. For example, Ilaję does not have homorganic tone bearing nasals which are common in the Standard dialect (the tone-bearing nasal is a progressive marker).

(4)	a. Standard Yoruba:	Olú	n	lọ	"Olu prog go: Olu is going"
		Olú	ḿ	bọ̀	"Olu prog come: Olu is coming"
	b. Ilaję Yoruba:	Olú	mí	lọ	"Olu prog go: Olu is going"
		Olú	mí	wá	"Olu prog come: Olu is coming"

As is evident from the above examples, the corresponding form of the Standard dialect's homorganic nasal is a CV in Ilaję and the vowel bears the tone of the morpheme. Under the assumption that tone bearing units are necessarily moraic (Hyman 1985), these vowels must be moraic in Ilaję Yoruba. Following Pulleyblank (1994), I assume that the mora is the prosodic anchor to which tones are linked in this dialect.

The facts of syllabification also show that only vowels are potentially syllabic in Ilaję. Words having the syllable shape CV are commonly found in Ilaję, while in contrast, *CC words are completely unattested.

(5) Only vowels are syllabified with a preceding consonant

CV syllable		*CC
bú	abuse	*br
tì	shut	*tl
ga	tall	*gn
ɣa	to be	*ɣj

The distribution described above, namely, the fact that only vowels act as syllabic, is explained if we adopt proposals by Zec (1988) that vowels are preferred syllable peaks across languages because they occupy the sonorous end of the sonority scale. The question that arises concerns how exactly the sonority distinction between vowels and consonants is to be formally encoded? In the following subsection, the characterization of segmental sonority in Ilaję is formalized in Zec's proposals and then translated into an Optimality Theoretic version to fit in with the over-all threoretical approach adopted for characterizing typological variation in this work.

2.2.1.1. Morification in Ilaję

Zec, following Clements (1983), assumes that the sonority scale is universally represented as in (6) ("O" stands for Obstruent, "N" stands for nasal, "L" stands for liquid, "V" stands for vowel).

(6)

O <	N <	L <	V	
			-	Consonantal [-cons]
		+	+	Approximant [+approx]
	+	+	+	Sonorant [+son]

Under this approach, there is an algorithm that enables the sonority information to be directly encoded into the root node, the organizing node for features in phonology. Sonority ranking and

computation is then obtained by appealing to the notion of *extension* and *proper extension* defined below.

(7) a. Extension:

Segment A is an extension of segment B iff all feature specifications in B are also found in A.

b. Proper extension:

Segment A is a proper extension of segment B iff all feature specifications in B are also found in A, and A has at least one feature specification not found in B.

Under the approach defined in (7), the feature specification of segments in (6) is defined as follows (a) vowels form a proper extension of all other segments; (b) liquids are a proper extension of all other segments excluding vowels; and (c) nasals are a proper extension of obstruents. How is Ilaję accounted for in this approach?

In Ilaję, evidence from tone and syllabification show that only vowels are moraic and syllabic. All other segments, liquids, nasals and obstruents function as syllable onsets in the phonology. By implication, only segments that form a proper extension of all other segments, i.e. vowels, are computed as moraic and syllabic by the sonority scale.

2.2.1.2. An Optimality Account

Across languages, the variation in the sets of possible onsets and nuclei are governed by two parameters: π_{ONS} and π_{NUC}. π_{ONS} is the sonority cut-off point in the Margin hierarchy, while π_{NUC} is the sonority cut point in the Peak hierarchy. The possible onsets are segments with less sonority or equal to π_{ONS}, whereas the possible peaks are segments with greater sonority or equal to π_{NUC}. In Optimality Theory, Prince & Smolensky (1993) assume that Universal Grammar

provides a universal peak hierarchy as well as a universal margin hierarchy, a type of default hierarchical organization of sonority sequencing which languages may rank in specific ways.

Canonically, vowels are peak-preferring and consonants are margin-preferring. Codas define the middle-point: sometimes they occur in peak positions, sometimes they appear in margin positions. The properties of this class of segments tend to vary from language to language, and it is actually at this point in the scale that variability in rankings occurs the most. Possible tenable and untenable peaks and margins are defined as follows in Optimality Theory. (The reading of the ranked notation is as follows: *P/O >> *P/L means it is worse to have an obstruent in the peak position than it is to have a liquid in the peak position, whereas *M/LO >> *M/HI means it is worse to have a low vowel in the margin position than it is to have a high in the margin position. Peak position is here read as Nucleus position, while Margin corresponds to Onset position).

(8) <u>Peak and Margin Hierarchies</u> (adapted from Prince & Smolensky 1993: 141)

a. Universal Peak Hierarchy

*P/O >> *P/N >> *P/L >> *P/HI >> *P/LO

b. Universal Margin Hierarchy

*M/LO >> *M/HI >> *M/L >> *M/N >> *M/O

PARSE, the constraint governing the prosodic incorporation of segments into higher structures like the mora or syllable interacts with the peak and margin hierachies to select the segments that are suited to occur in a particular prosodic constituent based on their sonority values. Thus, if the maximum sonority of possible onsets and peaks is set at /i,u/, assuming that the difference between high vowels and glides is structural not featural, following Guerssel (1986), this means that PARSE will be ranked above *M/LO and *P/HI to ensure that high vowels are either parsed into the margin or the peak:

(9) *M/LO >> PARSE >> *M/HI, *P/HI

By the ranking in (9), low vowels (by the undominated status of *M/LO) are prohibited from being parsed into margin positions while high vowels are potential margin or peak segments.

To illustrate this Optimality account of the sonority properties of segments, let us reexamine the segmental inventory of Ilaję. The basic generalization in Ilaję is that only vowels are potential moraic or nuclei elements, all other segments are margin preferring. Following Guerssel (1986), if we assume that the difference between high vowels and glides is structural not featural, the ranking that will account for Ilaję is the following:

(10) *M/LO, *P/O, *P/N, *PL >> PARSE >> *M/O, *M/N, *M/L, *M/HI, *P/HI, *P/LO

This ranking, whereby PARSE is crucially dominated by *M/LO, *P/O, *P/N, and *P/L derives the following facts: (a) low vowels never occur in onset position, (b) obstruents, nasals and liquids never appear in peak positions. The crucial domination of PARSE over *M/O, *M/N, *ML, *M/HI, *P/HI and *P/LO forces the parsing of these segments in either margin or peak positions. The moraic interpretation of the ranking in (10) is given below:

(11) **Possible Nucleus or** **Possible Mora** $= \pi_{NUC}$

[low] [-hi] >> [+hi] >> liquid nasal >> obstruent

$\Downarrow\rightarrow$ **Possible Pre-nuclear consonant (Onset)** $= \pi_{ONS}$

The Ilaję forms in (5: ga "be tall" vs. *gn) where obstruents, nasals and liquids are prohibited from appearing in peak positions support the established ranking in (10) as follows.

(12) *P/N >> PARSE >> *M/O, *P/LO

Input: /ga/	*P/N	PARSE	*M/O	*P/LO
a. ✓ σ NUC μ [g] [a]				
b. σ NUC μ <g> [a]		*!	*	
c. σ [g] <a>		*!		*

The tableau in (12) shows that the parsing of segments into margin and peak positions must respect the ranking in (10): candidate (b) is rejected because the obstruent [g] is not parsed into the margin (PARSE >> *M/O), candidate (c) fails because the vowel is not parsed into the peak position (PARSE >> *P/LO), candidate (a) is the winner because it respects the established ranking: the segments respect the sonority constraints imposed on peak/margin hierarchies and are parsed into the appropriate margin and peak positions.

In contrast, in tableau (13), the ranking *P/N >> PARSE rules out the candidates (a, b) that parse nasals into the peak position. The optimal candidate, (c), respects the ranking; consequently, the nasal is not parsed as illustrated below:[5]

(13) *P/N >> PARSE >> *M/O, *P/LO

Input: /g n/	*P/N	PARSE	*M/O	*P/LO
a. σ NUC μ [g] [n]	*!			
b. σ NUC μ <g> [n]	*!	*		
c. ✓ <g> <n>		**	*	

2.3. Type 2 languages Syl ⊂ Mor ⊂ Seg: Idoma, Standard Yoruba, and Onko Yoruba

Two categories of type 2 languages are presented in this section: Standard Yoruba and Onko Yoruba constitute one category, while Idoma constitutes another category. The two dialects of Yoruba treat vowels and nasals as moraic for tone, weight, and prosodic processes involving

[5]A fourth plausible candidate which is not considered in the tableau is one in which the nasal is unparsed as in (c) but the obstruent, by the ranking (PARSE >> *M/O) is parsed, as in candidate (12c). This form is arguably ruled out on independent grounds by the principles of syllabification which prohibit onset segments from constituting syllables without peak segments.

templatically driven lengthening. However, only vowels are potentially syllabic; nasals are never syllabified. A problem arises in Yoruba with respect to the general prediction made about the universal property of the sonority of liquids: liquids are supposed to be higher in sonority than nasals, yet, in Yoruba, liquids are never moraic or syllabic. This problem is proposed to follow from the ranking of PARSE [nasal] and PARSE [+approximant]. In Idoma, the moraic inventory encompasses vowels, liquids, and nasals which are all tone bearing, but only vowels may appear in syllable nuclei positions.

2.3.1. Standard Yoruba

This section documents the properties of moraic segments in Standard Yoruba. Standard Yoruba exhibits the same vocalic inventory as Ilaję, but differs from Ilaję in that the set of moraic segments include vowels and nasals. Moraic properties, both symmetrical and asymmetrical, are highlighted and characterised in formal terms as similarities and differences following from structural distinctions between nuclear-moras and non-nuclear moras.

2.3.1.1. Moraic symmetries

Standard Yoruba exhibits a phonological regularity whereby nasals and vowels pattern together for tone assignment (Pulleyblank 1994), and weight assignment (Ọla 1994a). As shown in (14), vowels and nasals are tone-bearing, and as the alternating forms in (15) show, vowels and nasals may interchangebly occur in the same position:

(14) *Tone-bearing unit*: vowels and nasals.

Word	Gloss
ò ró m̀ bó	orange
a lá m̀ gbá	lizard
ǹ dà ò	never
gbà ǹ jo	sale

(15) *Weight-bearing unit:* vowels and nasals as evidenced by alternating patterns of the underlined segments.

Base	Aternation 1	Alternation 2	Gloss
òtìtẹ̀	ò<u>n</u>̀tẹ̀	ò<u>ò</u>tẹ̀	stamp
òwìwẹ̀	ò<u>ŋ</u>̀wẹ̀	ò<u>ò</u>wẹ̀	swimmer
ògbìgbẹ	ò<u>m</u>̀gbẹ	ò<u>ò</u>gbẹ	thirst
òkìkọ̀wé	ò<u>ŋ</u>̀kọ̀wé	ò<u>ò</u>kọ̀wé	writer

The point of interest in the alternating data in (15) is that when a tone bearing nasal is deleted, it often triggers compensatory lengthening. That is, the vocalic features of the preceding vowel spread onto the position vacated by the nasal. Following Hayes (1989), I assume that the compensatory lengthening effect is guided by the prosodic frame encompassing the relevant segments, vowels and nasals in this instance. The formal description of this prosodic frame is the mora.

The claim that vowels and nasals are moraic predicts that both should participate in prosodically defined processes which make reference to the mora. This prediction is borne out. To form hypocoristics, the presence of four vowels is required in a word, so that the tonal melody of the hypocoristic template, HHLM, may have sufficient tonal anchors to link to. Examples appear in (16) of hypocoristic formatives which are productively produced by suffixing a monomoraic

possessive marker /mi/ to a VCV or CVCV name. As shown in the data, /mi/ systematically lengthens to CVV in the output.

(16) Hypocoristics (Bamgbose 1987)

ọ̀rẹ́ mı	→	ọ́rẹ́	mıì	'my friend'
ìyàwó mı	→	yáwó	mıì	'my wife'
ẹ̀gbọ́n mı	→	ẹ́gbọ́n	mıì	'my senior'
ọ̀gá mı	→	ọ́gá	mıì	'my boss'

Alternatively, some speakers lengthen the initial vowel of the name which serves as the base for the suffixal possessive; in this case, the possessive vowel does not lengthen The following data show this process.

(17) Hypocoristics: initial V-lengthening

ọ̀rẹ́ mı	→	ọ́ọ́rẹ	mì	'my friend'
ìyàwó mı	→	yaáwo	mì	'my wife'
ẹ̀gbọ́n mı	→	ẹẹ́gbọn	mì	'my senior'
ọ̀gá mı	→	ọ́ọ́ga	mì	'my boss'

The hypocoristic template is formally defined as a prosodic word consisting of two feet. By the principle of binarity, a foot must be binary (Prince 1980). The name to which the possessive marker is suffixed in (16) is a binary foot (VCV or CVCV), the possessive marker however, is monomoraic, a form which does not satisfy foot binarity. This leads to augmentation by final V-lengthening to enable the output of augmentation to satisfy the prosodic requirement. Alternatively, augmentation by V-lengthening may take place at the left edge of the hypocorated word, as shown in (17). The important factor given the variation in the position of lengthening (right as in (16), or left as in (17)) then appears to be the satisfaction of the templatic four mora

requirement, which cannot be met by the input shape of the name and the monomoraic possessive marker. This process provides evidence that the vocalic mora may constitute part of a prosodic constituent.

Similarly, the tone bearing nasal performs a prosodic function in reduplicative morphology. In denoting "end of utterance" in Ẹnà, a language game which reduplicates every syllable in the word,[6] the nasal surfaces before the consonant of the final syllable, as seen in the following data.

(18) Ẹnà (Language game: nasal denotes end of utterance, Iṣọla 1982)

	Sentence	Ẹnà variant
a.	Mo fẹ́ẹ́ lọ 'I want to go'	Mo-go fẹ́-gẹ́ lọ-ŋgọ
b.	Mo wá sí káligirì 'I came to Calgary'	Mo-go wá-gá sı-gí ká-gá lı-gí gí-gí rì-ŋ̀gì
c.	Mo mọ Bádé 'I know Bade'	Mo-go mọ-gọn Bá-gá dé-ŋ́gé
d.	Fìlà pupa dà Cap red where 'where is the red cap'	Fì-gì là-gà pu-gu pa-ga dà-ŋ̀gà

From the foregoing, we see that vowels and nasals perform functions which are associated with moraic segments in phonology: both vowels and nasals are tone bearing, weight units, and constitute part of prosodic constituents in prosodic morphology. However, there is a difference in the way nasal and vowels are utilized as moraic entities in prosodic morphology. For example, whereas vowels may count for constructing a minimal binary foot, nasals do not count. Therefore, it is common to find VCV nouns such as those shown in (17), but NCV nouns are unattested in Standard Yoruba. In the language game presented in (18), only a consonantal nasal denotes end of

[6]As shown in the data, there is not total correspondence between the base and the reduplicant because the onset of the reduplicated syllable is fixed, a voiced velar /g/. A copy of the vowel and tone, however appear in the reduplicated form.

utterance, vocalic nasals are prohibited from carrying out this function. For example, the ena equivalent of (17d) can only stated as Fì-gì là-gà pu-gu pa-ga dà-ŋ̀gà, not as *Fì-gì là-gà pu-gu pa-ga dà-ĩ̀ga, where the nasal denoting end of utterance is vocalic. In the following subsection, I show that other differences occur in how these moraic segments function in other phonological processes.

2.3.1.2. Moraic asymmetries

Moraic segments (vowels and nasals) differ in two important ways. First, only vowels are potential syllable nuclei, nasals are not - ✓[CV]σ, *[CN]σ:

(19) *Syllabification*: only vowels group into well-formed syllables with a preceding onset

tọ̀	'urinate'	*tǹ
gbá	'sweep'	*gbń
dá	'contribute, break'	*dḿ
sùn	'sleep'	*sm̀

The second kind of evidence that shows a distinction between vowels and nasals comes from reduplication. As established in Ọla (1993), nasals and (onsetless) vowels are not syllabified, hence, neither reduplicates when a template is morphologically specified as a syllable.[7] However, the striking asymmetry that emerges between nasals and vowels from reduplicative processes is that nasals, not vowels are skipped over in mapping melody to reduplicative templates. Two reduplication processes illustrate this phenomenon, ideophone suffixal syllable reduplication and nominal distributive reduplication. Consider each process in turn below.

[7]The assumption that (onsetless) vowels and nasals are not syllables derives the fact that neither reduplicates as syllable. For details on syllabification, see chapter 3.

In the ideophonic reduplication pattern denoting light intensity of action given in (20), the reduplicant is a syllable and always corresponds with the rightmost CV in the base. The data in (20a) illustrate this fact.

(20) Ideophone σ suffixal Reduplication (denotes light intensity, Awoyale 1989):

a. CV-final

Base	Reduplicated Form	Gloss
hábá	hábá-bá	clumsy
rogodo	rogodo-do	small and round
fẹ̀rẹ̀gẹ̀dẹ̀	fẹ̀rẹ̀gẹ̀dẹ̀-dẹ̀	large and wide

Notice in (20b) that the base-reduplicant correspondence is somewhat different from that of (20a). The rightmost segment in (20b), the moraic nasal, is not reduplicated as a syllable, but is skipped over in order to reduplicate a CV.

(20b). N-final: moraic nasal is skipped over

bàm̀	bàm̀-ba	*bàm̀-m *bàm̀-a	'hard and heavy'
gbẹ̀m̀	gbẹ̀m̀-gbẹ̀	*gbẹ̀m̀-m̀ *gbẹ̀m̀-ẹ̀	'soft and heavy'

The scenario in (20c) is completely different from what obtains in (20a,b). Here, the rightmost segment is an onsetless vowel preceded by a sequence of two CVs. Reduplication fails in (20c), however; this shows that a vowel cannot be skipped over to copy the required CV syllable. In this regard, vocalic moras contrast with nasal moras.

(20c). V-final; vocalic mora cannot be skipped over

páláú	*palau-u *palau-au *palau-lu	'flat and empty'
	*palau-la *palau-lau *palau-pa	
gbàyàù	*gbayau-u *gbayau-au *gbayau-yu	'large and loose'
	*gbayau-ya *gbayau-yau *gbayau-gba	

From (20), we see that moraic nasals are treated differently from vocalic moras. The second reduplication process that illustrates an asymmetry in the behaviour of moraic segments is nominal distributives. As illustrated in (21a), the reduplicated prefix is always realised as a VCV whose segmental content is identical to the leftmost segment of the base.

(21) Nominal Distributive, reduplicant is a foot prefix.

a. VCV-initial noun

Base	Reduplicated Form	Gloss	Distributive
ẹ̀bá	ẹ̀bẹ̀-ẹ̀bá	side	every side
ẹ̀bádò	ẹ̀bẹ̀-ẹ̀bádò	river-bank	every river-bank
apẹ̀rẹ̀	apa-apẹ̀rẹ̀	basket	every basket
ojúmọ́	ojo-ojúmọ́	day	every day

When a noun begins either with sequences of vowels (VV) or a sequence of a vowel followed by a nasal, a different pattern emerges. Consider the data in (21b).

(21b). VN-initial noun; moraic nasal is skipped over

Base	Reduplicated Form	Gloss	Distributive meaning
ò̀ǹtẹ̀	òtò-ò̀ǹtẹ̀	stamp	every stamp
	*ò̀ǹ-ò̀ǹtẹ̀		
ò̀ŋ̀wẹ̀	òwò-ò̀ŋ̀wẹ̀	swimmer	every swimmer
	*ò̀ŋ̀-ò̀ŋ̀wẹ̀		

Notice in (21b) that the reduplicant, as in (21a), is a VCV. Observe, however, that the nasal does not constitute part of the reduplicated form, suggesting that the nasal was skipped over in mapping melody to the prosodic template. In contrast, a vowel cannot be skipped over in the same manner as evidenced by the failure of reduplication in (21c).

(21c). VV-initial noun: vocalic moras are not skipped over

òúrọ̀	*òò-òúrọ	*òrò-òúrọ	'morning'
eúrẹ́	*ee-eúrẹ́	*ere-eúrẹ́	'goat'

The above differences, to wit, (i) that vowels are potential syllabic constituents, and that nasals are not, and (ii) the skipping over of nasals in reduplication and the impossibility of the same with vowels, clearly demonstrate that moras may pattern unevenly in the phonology of the same language, *moraic mismatches* following Hyman (1992).[8] The following table summarizes the generalizations obtained so far:

(22) Generalizations: moraic similarities and differences

Function	Tone Bearing Unit	Weight Bearing Unit	Prosodic unit	Syllabic unit
Segment	Vowels, Nasals	Vowels, Nasals	Vowels, Nasals	Vowels

The main task to be handled now concerns how to capture the asymmetric properties of moras in a principled way. Before an attempt is made at doing that, let us consider Onko, another dialect of Yoruba in which moras exhibit distinct properties.

[8]This case is analogous to the Bantu case (Luganda, Cibemba, and Runyambo-Haya) where a pre-consonantal nasal counts as a mora for prosodic processes, but does not count as a mora for tonal processes (Hyman 1992). Hyman analyses the Bantu moraic mismatches as following from the hypothesis that only a subset of moras may be tone-bearing in a given language (Zec 1988, Steriade 1991), and predicts the non-existence of cases where only a subset of tone-bearing units are moraic for the purpose of calculating syllable weight. This prediction, however, is not borne out, as shown by the Yoruba case where all moras are tone-bearing, but only a subset is selected for purposes of syllabification and prosodic reduplication.

2.3.2. Onko Yoruba

Unlike Standard Yoruba, where nouns do not begin with moraic nasals, both vowels and consonantal moras may begin nouns in Onko Yoruba. As a matter of fact, nasals and the high front vowel [i] occur in different contexts in these two dialects. Cognate forms which begin with nasals in Onko surface with an [i] in the Standard dialect as the following data illustrates.

(23)	Standard Yoruba	Onko Yoruba	Gloss
	ìyá	ǹyá	mother
	iṣu	ntṣu	yam
	ìgbà	ǹgbà	time
	itọ́	ntọ́	saliva
	ìrọ̀lẹ́	ǹrọ̀lẹ̀	evening
	ìtàdógún	ǹtàdógún	fifteen days

The complementarity is neutralized in syllables. Thus, in CV syllables, high front vowels are represented alike in both dialects as shown in the following data.

(24)	Standard Yoruba	Onko Yoruba		Gloss
	rí	rí	*rn	see
	bı	bí	*bn	give birth
	kí	kı	*kn	greet
	etí	etí	*etn	ear
	orí	erí	*ern	head
	ìdí	ǹdí	*ǹdn	buttock

To confirm that nasals are impossible syllabic constituents, consider distributive formatives. In forming distributives in Onko Yoruba, initial vowels and nasals may count as part of the distributive prefixal foot template. Thus the reduplicant in (25) is expressed either as VCV or NCV. This fact constitutes evidence that vowels and nasals may serve as part of prosodic constituents in prosodic processes (distributive forms in Standard Yoruba and Onko Yoruba are cited as examples, but the discussion is mainly focussed on the latter dialect).

(25) Distributive reduplication

	Standard Yoruba		Onko Yoruba			
	Base	Reduplicant	Base	Reduplicant	Gloss	Distributive
a.	òru	òrò-òru	òru	òrò-òru	night	every night
	òwúrọ̀	òwò-òwúrọ̀	òwúrọ̀	òwò-òwúrọ̀	morning	every morning
b.	ılà	ìlì-ìla	ǹlà	ǹlì-ìla	line	every line
	ìrọ̀lẹ́	ìrì-ìrọ̀lẹ́	ǹrọ̀lẹ́	ǹrì-ìrọ̀lẹ́	evening	every evening
	ìtàdógún	ìtì-ìtàdógún	ǹtàdógún	ǹtì-ìtàdógún	15 days	every 15 days
	ìyálẹ̀ta	ìyì-ìyálẹ̀ta	ǹyálẹ̀ta	ǹyì-ìyálẹ̀ta	dawn	every morning

Notice in (25a), where the reduplicant is realised as VCV, that the final vowel of the reduplicant is identical to the initial vowel of the base.. In the Onko forms in (25b), however, the nasal only surfaces at the begining of the reduplicant, it no longer appears at the begining of the base, and as a consequence it does not surface in the final position of the reduplicated form either. What we find instead is a denasalized and vocalized segment, a high front vowel [i].

The data presented above can be summarized as follows:

(26) Summary of generalizations

a. the tone bearing nasal and high front vowel [i] are in complementary distribution in Onko Yoruba: [i] occurs after consonants in CV syllables, while [n] never occurs after a consonant (23-25).

b. [n] denasalizes and vocalizes to [i] when preceded by a consonant (25).

The challenge for standard moraic theory is how to provide a principled prosodic explanation for the moraic asymmetries. In the following subsection, this problem is laid out and a prosodic solution offered.

2.3.3. A prosodic account of moraic asymmetries

Under the standard version of moraic theory (Hyman 1985, Hayes 1989, Zec 1988, to mention a few), the distribution of moraic segments in Yoruba presents a startling paradox. Why do vowels and nasals count for tone and weight assignment? Why does syllabification single vowels out as possible syllabic constituents? Why are nasals excluded as syllabic constituents?

One way of explaining the asymmetric patterns observed is to assume that there are two moraic projections in the grammar: one serves as tonal anchor while the other serves as syllable nuclei. This option is rejected by Hyman (1992), specifically because it fails to capture the fact that some segments are selected as tonal anchors and syllable nuclei. To rule out a situation where two moraic projections occur in phonology, Hyman proposes the *moraic uniqueness hypothesis* which states that "At any given stage of derivation, there is only one moraic projection". Assuming that there is only one moraic tier, one could account for moraic asymmetries by *directly* encoding segmental properties into prosodic structure. Under such an analysis, consonantal nasal moras would be different from vocalic moras since the prosodic structure would be able to access segmental features in a *direct* fashion. This assumption would warrant direct reference to segmental materials in stating prosodic templates. So, in specifying the foot reduplicative template

in (20&21), a negative condition ruling out nasal moras would be needed to prohibit nasals from mapping into the prosodic template. This analysis works, but is in direct conflict with McCarthy & Prince's (1986, 1993a) Prosodic Morphology Hypothesis which states that "Templates are defined in terms of authentic units of prosody" - mora, syllable, foot or prosodic word. This conflict is non-trivial, since this hypothesis is well instantiated cross-lingusitically.

There is an alternative prosodic explanation for the moraic asymmetries within moraic framework of assumptions: the nuclear-mora hypothesis of Shaw (1992). According to this view, sonority requirements constrain vowels to link to nuclear-moras, and constrain nasals to link to non-nuclear moras. Under this account, the featural/Sonority properties of vowels and nasals are *indirectly* encoded in the nuclear vs. non-nuclear distinction. Assuming that *nuclear and non-nuclear moras* are *authentic prosodic constituents*, templatic processes would be able to access them without direct reference to features. This enables us to explain the moraic asymmetry by *constituency*, i.e., nuclear vs. non-nuclear distinction, not by *segmental/featural* properties. A comparison of the two moraic models is summarized in the following table:

(27)

Standard Moraic Theory	Nuclear Moraic Model
a. Incorrectly predicts *moraic symmetry.*	Correctly predicts both *moraic symmetry and asymmetry.*
b. Marks asymmetry via *diacritic notation*: σ / μ_s μ_w	Asymmetry captured by *constituency*, i.e., *nuclear vs. non-nuclear distinction.*
c. Referencing *at least some degree of featural content* in templatic processes in violation of the Prosodic Morphology Hypothesis: *Templates are defined in terms of authentic units of prosody* (McCarthy and Prince 1986, 1993a).	Featural/Sonority properties encoded in the nuclear vs. non-nuclear distinction. Since *nuclear and non-nuclear moras are authentic prosodic constituents*, templatic processes access them without direct reference to features.

The recognition of the nucleus as a prosodic constituent calls for a revised prosodic hierarchy of the type given in (28b):

(28) Standard Prosodic Hierarchy

PrWd	Prosodic Word
|	
Ft	Foot
|	
σ	Syllable
|	
μ	Mora

(28b) Revised Prosodic Hierarchy

PrWd	Prosodic Word
|	
Ft	Foot
|	
σ	Syllable
|	
N	Nucleus
|	
μ	Mora

The structure in (28b) is assumed throughout this dissertation.

2.3.4. Nuclear and non-nuclear moras in Optimality Theory

The preceding section considered the prosodic characterization of moraic asymmetries and proposes, following Shaw (1992), that the distinctions be structurally encoded as differences between nuclear moras and non-nuclear moras. What this means in Optimality Theory is that the cut-off point set for moraic segments can be different from that established for nuclear segments. The behavior of liquids is particularly striking in view of the ranking established by Universal Grammar, which rates liquids as higher ranked than nasals: in Yoruba, nasals are possible moras but liquids never exhibit any of the properties associated with moraic segments (tonal processes and compensatory lengthening); liquids only function as prenuclear segments (onset). This suggests that nasals have higher sonority value than liquids in Yoruba. The problem that arises is how to capture this property given that the sonority hierarchy is supposed to be organized in strictly dominance fashion.

Technically, this is not a problem for OT because of the prediction that languages could rank constraints in specific orders. Under this view, the nasal-liquid sonority asymmetry can be captured by ranking nasals higher than liquids on the sonority scale, a language particular ranking as predicted by Optimality Theory:

(29) Nasal/liquid asymmetry: reversal of sonority ranking

Moraic segments: sonority cut point

⇐ **Possible Nucleus** ⇐ **Possible Mora**

(vowels) low, non-high > high > nasal > liquid > obstruent

⇓→ **Possible Pre-nuclear consonant (Onset)** = π_{ONS}

By this ranking nasals and vowels are well-formed when linked to moras (30), whereas other segments are considered ill-formed when linked to moras (31):

(30) <u>Well-formed moras</u>

```
 μ      μ      μ      μ
 |      |      |      |
[i]    [e]    [a]    [n]
```

(31) <u>Illicit Moras</u>

```
*  μ    * μ
   |      |
  [l]    [t]
```

This ranking futher permits vowels to link to nuclear moras and disallows nasals from being linked to nuclear moras:

(32) Well-formed nuclear moras:

```
NUC    NUC    NUC
 |      |      |
 μ      μ      μ
 |      |      |
[i]    [e]    [a]
```

(33) Illicit Nuclear Mora

```
* NUC
   |
   μ
   |
  [n]
```

The problem with this technical solution is that it permits the reranking of any sonority value: for example, the ranking Obstruents >> Vowels ought to be as licit as Nasal >> Liquid. No known language provides justification for a ranking where obstruents are rated higher in sonority than vowels. How do we achieve a limit reranking within a harmonic scale?

To get around this problem, one may spell out the featural values for capturing the sonority scale as follows (as in (6) but assuming a fully specified matrix here):

(34)

O <	N <	L <	V		
+	+	+	-	Consonantal [-cons]	= Vowel
-	-	+	+	Approximant [+approx]	= Liquids
-	+	+	+	Sonorant [+son]	= V, L, N
-	+	-	-	Nasal [+nasal]	= Nasal

The augmented scale enables us to make reference to nasality in rating sonority values: nasals are like liquids and vowels in terms of sonority [+son], but are distinct from liquids by being nasals [nasal]. The nasal-liquid asymmetry can now be explained by ranking PARSE [nasal] and PARSE [+approximant].

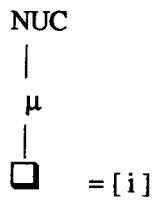
(35) PARSE[-cons] >> *P/[-approx] >> *P/[+approx] >> PARSE [+nasal]>> PARSE [+approx]
PARSE [+son]

According to the ranking in (35), highly ranked PARSE[-cons] incorporates the standard assumption that vowels are the most sonorous set of segments, and demands that vowels [-cons] be obligatorily parsed as moras. The ranking *P/[-approx] >> *P/[+approx] states that it is worse to have a non-approximant (that is, nasal) in peak position than it is to have an approximant (liquids and vowel); establishing the standard claim that liquids and nasal are more sonorous than nasals. At this point, the nasal-liquid asymmetry still remains unexplained. The dividing point is at the bottom of the scale where PARSE [+nasal] outranks PARSE [+appox], and PARSE [+son]. The ranking here enforces the parsing of nasals over that of liquids, the parsing of vowels is essentially guaranteed by undominated PARSE[-cons]. The inference to be drawn from this analysis is that the asymmetry between nasals and liquids lies not in the reversal of the sonority scale, but in the variable ranking of this scale with the parsing constraints governing the incorporation of sonority values into prosody. The reward that follows is the preservation of the hierarchical ordering of the sonority scale.

A final point concerns the interaction of featural markedness and moraic representation. Pulleyblank (1988) proposed, based on various asymmetries involving the high front vowel [i] and other vowels that [i] is the least marked vowel in Yoruba. Structurally, whereas other vowels are specified with one feature or the other, [i] is represented as a root node which does not dominate any featural specifications in the lexical entry. Given the assumptions of underspecification theory,

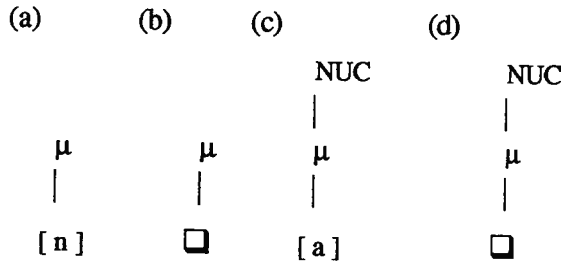
and the claim that vowels are nuclear segments, a high front vowel has only prosodic structure and is represented as a NUCμ node (□ denotes featureless segment or a bare root node):

(36) Prosodic representation of underspecified [i]



When featural markedness is combined with nuclear distinction in moraic representation, four representations are predicted for Yoruba (37): (a) a moraic node specified for lexical features, (b) a moraic node which is unspecified for lexical features, (c) a nuclear node which is specified for lexical features, (d) a nuclear node which is unspecified for lexical features:

(37) Featural specification and moraic representation



There is evidence for the four representations in (37) in Standard Yoruba and Onko Yoruba. Evidence for the representations in (37a) and (37c), representations involving lexically specified features, is demonstrated in various ways in Yoruba phonology. Firstly, robust evidence for (37c) is documented in Pulleyblank (1988) where asymmetries involving vowels are shown to require the specification of all vowels except [i]. Secondly, with regard to (37a), in most cases,

nasals exhibit three properties which suggest that they weaker than vowels. First of all, nasals always assimilate to preceding vowels, as was shown for example, in (15, òtìtẹ̀ ~ ò̀ǹtẹ̀ ~ ò̀ò̀tẹ̀ "stamp").[9] This may be viewed as a spreading process involving a specified vowel and an unspecified (or weak) nasal. Second of all, nasals are skipped-over in reduplication as depicted for example in (21b, Base: ò̀ǹtẹ̀ "stamp" Reduplicated form: òtò-ò̀ǹtẹ̀ "every stamp"). Third, moraic nasals are always homorganic to the following consonant (15, ò̀ǹtẹ̀ "stamp" ò̀ŋ̀wẹ̀ "swimmer") because they lack Place specifications (Pulleyblank 1988, Itô, Mester and Padgett 1993). These facts suggest an analysis that warrants minimal featural specification for nasals. However, in the language game, ẹnà, in which a nasal consonant denotes "end of utterance", the nasal cannot be assimilated to the preceding vowel (18, Fìlà pupa dà is realised as: Fì-gì là-gà pu-gu pa-ga dà-ŋ̀ga not as *Fì-gì là-gà pu-gu pa-ga dà-àga). The fact that assimilation is blocked in this context suggests that we are dealing with a specified nasal here.[10] The conclusion which appears apparent from these facts is that there are two types of moraic nasals in Yoruba, one is lexically specified, the other is minimally specified for features.

Evidence for representations (37b) and (37d) (representations where the prosodic strutures are not anchored to lexically specified features), comes from [n] vocalization in distributive formatives in Onko where [n] is shown to vocalize to [i] when preceded by a consonant (25). This process is mysterious if the prosodic representation is not taken into consederation: why should a nasal consonant vocalize to a high front vowel [i] given that there is no known phonetic or phonological correlation between nasality and highness or fronting. However, once we take the

---

[9]The only exception involves the a case where the negative marker /o/ assimilates to the first person singular subject pronoun /n/ a reduced form of /mi/: n ò lọ becomes n ǹ lọ or mi ò lọ becomes mi ì lọ "I am not going". This processes, as argued by Owolabi (1989), is governed by syntactic considerations as the requirement that the featural properties of the subject, a lexical/syntactic head overides the those of the negative marker, a functional/syntactic head. Thus, the featural properties of the subject, be it vocalic or nasal, appears in the output form.

[10]In a way, the nasal constitutes a single domain with the preceding and following syllable as evident by the fact that it bears the same tone as the preceding vowel and has the same place specification as the following consonant. These properties are exactly the same as those exhibited by nasals in (15: ò̀ǹtẹ̀ ~ ò̀ò̀tẹ̀ "stamp"). These properties tend to lead one to expect the application of assimilation in the language game data.

prosodic and featural characterization of nasals and vowels into consideration, the vocalization phenomenon receives a straightforward account. I propose that the vocalization process entails a shift in prosodic structure as dictated by the syllabfication algorithm which selects nuclear-moras rather than non-nuclear moras in constructing syllables. This shift is constrained by markedness considerations. If markedness were not a factor in the choice of the nuclear mora that replaced the nasal, any vowel should be a likely candidate for this shift. That markedness is involved is supported by the fact that the least marked NUCμ, that is, [i], rather any other vowel is chosen.[11]

In sum, the analysis of moraic asymmetries in terms of distinctions between nuclear-moras and non-nuclear moras enables us to specify the moraic entities required for the processes of tone, ẹnà language game, and syllabification as follows.

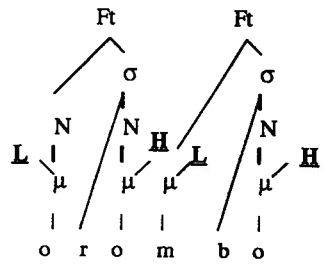
(38) Moraic units in Yoruba (Standard, Onko) prosodic phonology

Process	Mora
a. Tonal anchor	(μ) mora
b. Ẹnà language game "end of utterance"	(μ) mora
c. Syllabification	(NUCμ) nuclear-mora

Under this theoretical view, the structural configuration for the representation of tones is shown below where vowels and nasals bear tones (Tones are bolded and underlined.):

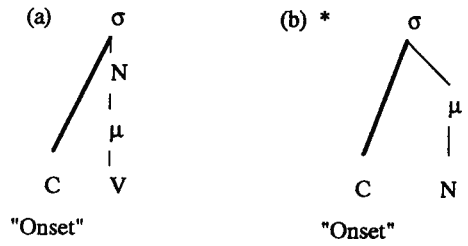
[11]The major competitor is a nasalized high front vowel which would result from adding the vocalic features of [i] to nasality. This option is not salient in the speech of informants consulted. Whereas a low -level nasality effect is observed in the speech of some speakers, some speakers consistently produced a non-nasalized variant.

(39)



Syllabification, in contrast can select only a NUCμ as peak as illustrated below:

(40) Yoruba syllable structure



2.3.5. Idoma

There have been two types of variation among the three grammars examined so far. Firstly, in Ilaję, only vowels function as moraic for tone assignment and syllabification. This property is shown to follow from the sonority cut point of moraic segments, which is set between high vowels and low vowels. PARSE, is ranked at par with this sonority setting, such that the range of segments that fall into this group are well-formed if parsed into moraic structure.

Secondly, in Standard Yoruba and Onko Yoruba, the class of moraic segments includes vowels and nasals, as evident from the facts of tone, compensatory lengthening. Syllabification and reduplication processes, however, reveal some asymmetries between vowels and nasals, and a prosodic characterization is offered in terms of distinctions between nuclear moras and non-nuclear moras. The sonority setting for possible moras is set between nasals and vowels, and that of nuclear segments includes only vowels. One striking factor about the characterization of moraic

segments in Yoruba is that liquids are prohibited moras: they are neither tone bearing nor syllabic. This fact is argued not to follow from the reranking of the universal sonority scale but a factor which follows from the ranking of PARSE [nasal] and PARSE [+approximant] in Yoruba.

The third type of variation is found in Idoma, a Benue-Congo language spoken in Nigeria. Idoma offers evidence for the universal sonority scale: vowels, liquids and nasals are tone-bearing, hence moraic. Thus, the scope of the sonority cut point in Idoma is wider than the two language types examined previously. Vowels are undoubtedly nuclear because they may occur independently as syllable nuclei. Liquids, however, exhibit interesting characteristics in syllables. The properties associated with liquids and the analyses proposed are summarized as follows. First, liquids may only occur as prevocalic moras (CLV or CRV); they never appear in postvocalic position (*CVL or *CVR): a result of a general prohibition against Place specification in Coda position (CODA CONDITION, the inventory of moraic segments is restricted to homorganic nasals and germinates (Itô 1986, 1989, Goldsmith 1990, Yip 1991, Itô & Mester 1993).[12] Further, liquids do not appear independently as syllable nuclei (*CL or *CR): this shows that only nuclear-moras (vowels) are possible syllable peaks, as was shown to be the case in Yoruba.

2.3.5.1. Distibutional facts and analysis

Idoma displays a larger inventory of tone-bearing segments than those found in Yoruba: Tone-bearing segments in Idoma include nasals, liquids, and vowels (Abraham 1951, Aina 1983).

(41)	a. vowels		b. vowels and nasals		c. vowels, nasals and liquids	
	à lɛ	palm	óǹdú	owner	ò d ɾ̀ é	food
	è té	pot	émḿkpɔ	water	ú k l ɔ́	work
	ò pìà	cutlass	kúńlè	swallow	ú d ɾ́ o	navel
	è gùa	snake	òkómkpınù	door way	ò ḿ b l̀ ì	jump

[12]Some languages permit placeless consonants such as glottal stop (as in Makassarese cf. M&P 1993a, also Gokana cf. Aremkhare 1972) or [ŋ] (as in Chinese cf. Jiang-King 1994).

As proposed for the Yoruba dialects, tone bearers are always moraic. Following this line of reasoning, then, by implication, vowels, liquids and nasals are moraic in Idoma. This shows that the cut-off point for moraic segments is set between nasals, liquids and vowels:

(42) Moraic segments: sonority cut point

⇐ **Possible Mora**

(vowels) low, non-high > high > liquid nasal > obstruent

⇓→ **Possible Pre-nuclear consonant (Onset)**

In forming syllables, however, Abraham (1951) observes that these (moraic) segments are restricted in distribution. Not all moraic segments are syllabifiable: only vowels and liquids may occur as syllable peaks with a preceding onset consonant. This gives rise to syllable types CV, CRV or CLV as shown in the data in (43).

(43)

a. CV sequences		b. CRV or CLV sequences	
gba	pay	ú d ŕ o	navel
mú	see	ú k l ɔ́	work
dzèdzè	dance	a b l á kp á	slippers
tẽ́nĩ	look for	ɔ́ ḿ b l í	basket

That liquids are syllabified with preceding consonants is noted in Abraham (1951 in The Idoma Language as follows): "a consonant followed by "l" or "r" employs these two sounds as vowels, not as consonants; and the combination forms one syllable". Phonologically, however, liquids do not pattern exactly like vowels. Whereas vowels syllabify freely with preceding consonants, there are no syllable type *CR or *CL. This means that only vowels are potential syllable nuclei, that is, nuclear-moras. Because liquids are not nuclear-moras, *CR, *CL syllables are thus correctly ruled out.

Given the existemce of CRV/CLV syllables, one might expect to find syllables such as *CVR/*CVL where the position of the moraic segments (vowels and liquids) are reversed. However, such syllables are not reported in Idoma. Why are *CVR/*CVL syllables impossible? Before addressing this question, let us examine the distributional properties of moraic nasals.

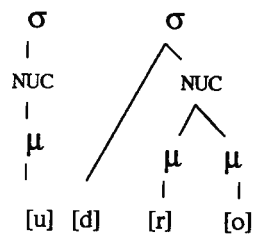
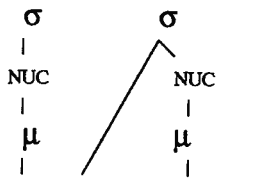
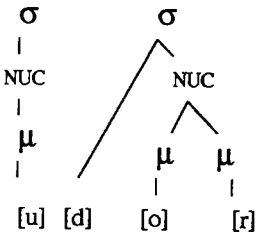
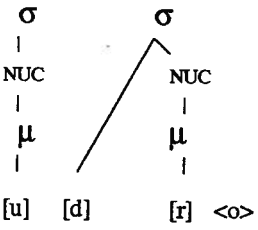
Nasals in Idoma, unlike liquids, do not syllabify prevocalically: nasals occur only in postvocalic positions: CVN *CNV.

(44)	a.	CVN sequences		b.	*CNVsequences
		óǹdú	owner		*ódùú
		ó ḿ b l í	basket		*obmí
		ɛ́ḿkpɔ	water		*ɛ́kṕmɔ
		òkómkpınù	door way		*òkmókpınù

Notice in (44) that nasals are homorganic, assimilating in place to a following consonant. Nasals thus obey the CODA CONDITION (CODA COND), which restricts the inventory of moraic segments is restricted to homorganic nasals and geminates (Itô 1986, 1989, Goldsmith 1990, Yip 1991, Itô & Mester 1993). The fact that liquids are banned from occurring in this same context suggests that they are specified for Place and consequently ruled out by the CODA COND. This explains why *CVR/*CVL are impermissible syllables in Idoma. In other words, CODA COND is highly ranked in the grammar of Idoma. The data discussed in (43b: ú d ŕ o "navel") is accounted for by this ranking (only the interaction of *P/L, CODA COND >> PARSE, is shown in the tableau):

(45) PARSEV, *P/O, *P/N, *P/L, *M/LO, CODA COND >> PARSE

*P/L, CODA COND >> PARSE

Input: /u d ŕ o/	P/L	*CODA COND	PARSE
a. ✓ 			
b. 			*!
c. 		*!	
d. 	*!		

*P/L and CODA COND are higher-ranking constraints which determine the well-formedness of peak and coda segments. Both constraints are respected by the optimal candidate (a), candidate (b) is a permissible sequence in Idoma (as in data 41a), but it loses because it incurs a PARSE

violation which the winning candidate obeys, candidates (c,d) are penalized and rejected because they violate *P/L and CODA COND repectively.

The evidence presented so far leds one to conclude that the cut-off point for nuclear segments ranges over the set of vowels, while liquids and nasals, on the other hand, are moraic not nuclear segments.

(46) Sonority cut point for moraic and nuclear segments

⇐ **Possible Nucleus** ⇐ **Possible Mora**

(vowels) low, non-high > high > liquid > nasal > obstruent

⇓→ **Possible Pre-nuclear consonant (Onset)**

The sonority ranking in (47) permits the following nuclear structures in (48) and rules out structures such as shown in (49):

(47) <u>Well-formed nuclear-moras</u>

```
NUC   NUC   NUC
 |     |     |
 μ     μ     μ
 |     |     |
[i]   [e]   [a]
```

(48) <u>Illicit nuclear-moras</u>

```
* NUC  * NUC  *NUC
   |     |     |
   μ     μ     μ
   |     |     |
  [n]   [f]   [t]
```

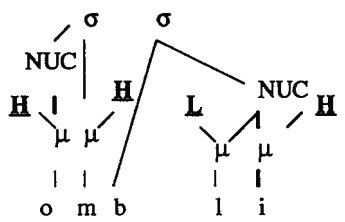
The analysis presented above is summarized in the following table:

(49) Moraic units in Idoma prosodic phonology

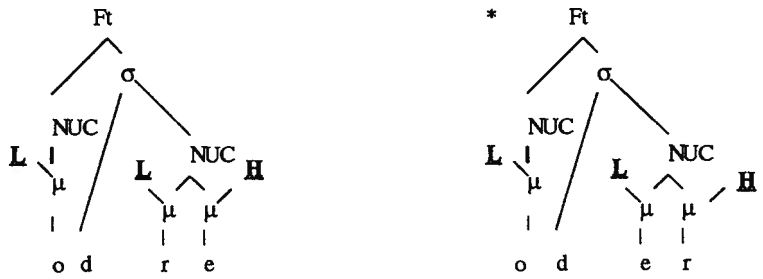
Process	Mora
a. Tonal anchor	(μ) mora
b. Syllabification	(NUCμ) nuclear-mora

Under this formal conception of morafication, tonal anchors (i.e. moras) are as shown in (51), while nuclear moras which constitute syllable peaks are shown in (52):

(50) Tone-bearing moras



(51)



2.4. Summary

In this chapter, I have presented evidence motivating moraic structure in three dialects of Yoruba (Standard, Onko, and Ilaję), and Idoma, all Benue-Congo languages of Nigeria. Evidence was adduced from various sources, including tone, compensatory lengthening, syllabification and reduplicative morphology. Moraic segments are also shown to exhibit interesting asymmetries in

syllabification and reduplication. The asymmetries are analyzed in prosodic terms as distinctions following from nuclear-moras and non-nuclear moras.

The delimitation of segments into moraic and non-moraic entities on the one hand, and nuclear or non-nuclear on the other, is analyzed as difference following from the sonority properties of segments as defined by Universal Grammar and language particular factors, following Zec (1988). In Optimality Theory, the differences in sonority sequencing is derived not by reranking the universal sonority scale, but by the variable ranking in different languages, of PARSE feature constraints. The CODA COND constraint is also demonstrated to play an important role in restricting the distributional properties of moras in Idoma: only homorganic nasals (which are not inherently specified for Place) occur postvocalically, liquids, in contrast, (which are specified for Place) are banned in this position.

Throughout this dissertation, I will rely on two assumptions for moraic representation. First, I will assume that vowels are linked to nuclear-moras. Thus, for a dialect like Ilaję-Yoruba where the Standard- or Onko-type nuclear versus non-nuclear distinction is absent, this assumption still holds. This is so since the dialect does not present any negative evidence against such a view. I assume that consonantal moras (liquids and nasals) are generally linked to non-nuclear moras. Second, following Pulleyblank (1994), I assume that moraic representation constitutes part of the lexical information given that lexical tone is unpredictable in the languages presented.[13]

[13]The question arises, however, on whether the nuclear projection is also part of the lexical information. The answer is in the affirmative. As will be shown in chapter 3, there are certain restrictions on the tonal specification of initial vowels in Standard Yoruba which suggest that the moraic and nuclear levels are present in the lexical entry.

CHAPTER 3

Syllable Structure Typology in Benue-Congo

3.1. Introduction

The principle of prosodic licensing requires that segments must be linked to some higher level of prosodic structure in order to surface; otherwise, they are deleted by Stray Erasure (Itô 1986, 1989; Steriade 1982; McCarthy 1979). By the strict layer hypothesis (Selkirk 1984), the syllable (σ) functions as the prosodic licenser for all sub-syllabic segments (moraic and non-moraic). Three sub-syllabic segments are universally recognized: onset, nucleus and coda. Onset segments occupy the leftmost position (margin) in the syllable, and nuclei segments occupy the rightmost position (peak), but may be followed by coda segments (if any), in which case, the coda, rather than the nuclear segment, surfaces as the rightmost element in the syllable. Minimally, this sequencing results in a CVC syllable. Markedness considerations, however, select the CV syllable type as the unmarked form (Jackobson 1969, Clements & Keyser 1983, P&S 1993, M&P 1994). But, in spite of markedness restrictions, language particular requirements allow marked syllables such as onsetless syllables (V) and/or syllables with coda (CVC or VC).

Cross-linguistically, marked syllables often exhibit interesting exceptional properties. For example, onsetless syllables (V) are known to display two distinct characteristics across languages. They either exhibit the same phonological properties as CV syllables or display asymmetric properties which clearly distinguish them from CV syllables. When there is no phonological contrast between onset-less (V) and onset-ful syllables (CV), there is a general consensus among phonologists that these forms are syllabified. Such characteristics often confirm some of the basic assumptions of moraic theory that the onset is neither syllabic nor contributes to syllable weight (Hayes 1989, Hyman 1985). However, when onsetless Vs behave distinctly from CVs in phonology, an issue arises as to how to give a structural characterization of this contrast.

Two analyses of exceptional onsetless syllables are established in the literature, the Extraprosodicity-based approach and the Moraic Licensing-based approach. Diagnostically, extraprosodic onsetless Vs often occur on the periphery of phonological or morphological constituents and are either ignored or skipped-over for syllable counting processes (Downing 1995, Itô 1986, 1989, Inkelas 1989, McCarthy and Prince 1986). On the other hand, moraically licensed segments may either occur on the periphery of defined constituents or in any position in the phonological string. Like extraprosodic onsetless Vs, moraically licensed Vs do not participate in syllable processes (Hyman 1990, Bagemihl 1991, Downing 1993, Ọla 1993). In terms of susceptibility to skipping, moraically licensed segments exhibit a two-way split pattern: in Salish languages such as Bella Coola, they are ignored (skipped-over, see Bagemihl 1991), while in Benue-Congo languages like Ọwọn-Afa and Yoruba, they are never skipped, but in fact required for the well-formedness of certain prosodic constituents (as shown in the reduplicative processes discussed in this dissertation). Extraprosodic onsetless syllables are common in Austronesian and Bantu languages, while moraically licensed segments are familiar in Salish and Benue-Congo languages.

Couched in terms of exhaustivity (Prince 1985), extraprosodicity is a formal device adopted in an exhaustive parsing analysis to render exceptional onsetless syllables invisible for syllable counting processes. In other words, the inertness of onsetless syllables in syllable counting processes is explained via extraprosodicity. Crucially, syllables (whether "normal" or exceptional) are not distinguished structurally: syllables may differ in segmental terms (onsetless V vs. onset-ful CV), but by the principle of exhaustivity, syllables are not different in prosodic terms. In contrast, the moraic licensing approach establishes a structural distinction between syllables and moraically licensed segments: syllabic segments are syllabifed, but moraically licensed segments are not parsed into syllables. Thus, syllabification is not achieved in an exhaustive fashion. Even though Extraprosodicity-based and Moraically licensed-based approaches are required to capture cross-linguistic variations in syllabification, there is no formal mechanism in the pre-Optimality standard theory to express this parametric diversity. In Optimality Theory (OT, P&S 1993, M&P

1993a,b), the attested divergence is analyzed by varying the ranking of two constraint families, Faithfulness and Alignment. Specifically, syllabification (exhaustive or non-exhaustive), is derived from the variable ranking of (a) PARSE (SEGMENT, μ, NUCμ), and (b) syllable well-formedness conditions such as ONSET, NUCLEUS and NO-CODA.

This chapter examines the inter-linguistic and cross-dialectal characterization of syllables in Benue-Congo languages. Briefly, in the languages to be examined, whereas the syllabification of CV syllables is uncontroversial, the syllabic status of onsetless vowels is a subject of theoretical debate: in some languages, onsetless Vs exhibit exceptional properties which distinguish them from onset-ful syllables in phonology, while in others there is no such distinction. The chapter begins by presenting schematic illustrations and analysis of the unmarked syllable type in Optimality Theory. Considered next is the representation of marked syllables, and the predicted rankings for analyzing such forms within an Optimality-based approach. Following, cases are presented from Benue-Congo languages to illustrate the predicted rankings. The empirical presentation starts with languages in which CV syllables are distinguished from onsetless ones. Gokana, a language well-known for its tolerance for strings of vowels, is presented first. It will be shown that the basic interaction between syllable structure constraints and faithfulness constraints derives the requirement that stems begin with a CV in Gokana. The non-syllabicity of word-internal onsetless vowels will also be derived from constraint ranking. A discussion of Ọwọn-Afa follows, and evidence from reduplication is presented to illustrate the asymmetric patterning of syllables with onsets and those without onsets. The analysis of Ọwọn-Afa will be along the lines of that of Gokana since both languages distinguish vowels with onsets from those without onsets. Next, the facts of Standard Yoruba are presented. Like Gokana and Ọwọn-Afa, Standard Yoruba discriminates the syllabicity of vowels based on the presence or absence of onsets. A whole range of evidence from minimality effects, truncation, reduplication, and morpheme structure conditions is presented to show the distinct chacteristics of CV syllables and onsetless Vs. Again, these asymmetries are shown to follow from constraint ranking in Optimality Theory. The discussion then shifts to languages that display exhaustivity in syllabification, that is, cases where vowels with

or without onsets typically pattern symmetrically in phonology. Two languages are presented. The first case to be considered is Ondo Yoruba, a dialect of Yoruba that treats CVs and Vs alike in prosodic and morphological processes. Unlike Standard Yoruba, where the onset is required for syllabification, Ondo Yoruba syllabifies vowels even if they do not have onsets. This interdialectal variation is shown to follow from the different ranking of the same set of constraints. The second case to be considered is Ẹmai, another language that allows onsetless syllables (V) to behave parallel to CVs in prosodic processes. The basic ranking established for Ondo Yoruba will be shown to derive the Ẹmai syllabification pattern.

3.2. The unmarked syllable structure

The unmarked syllable is a CV, a syllable consisting of an onset and a vocalic mora (a nuclear-mora, as claimed in chapter 2). No known natural language forbids this syllable. Thus, even though languages may disallow either syllables without onsets (V) or syllables with codas (CVC), all languages permit CV syllables (Jakobson 1969, Clements & Keyser 1983, Steriade 1982, P & S 1993). The basic syllable conditions deriving the unmarked syllable shape are formalized in Optimality Theory as follows (M&P 1993b, Itô & Mester 1994):

(1) <u>Syllable Structure Alignment constraints</u>

a. ONSET (ONS): ALIGNLEFT (σ, L; C-Rt, L)

The left edge of a syllable is aligned with the left edge of a consonantal root-node

b. NO-CODA: ALIGNRIGHT (σ, R; NUCμ, R)

The right edge of a syllable is aligned with the right edge of a nuclear mora

The realization of the unmarked syllable as a CV demands that ONS and NO-CODA be obeyed. Cases which would otherwise yield a violation of any of these constraints are generally rescued by

violating the constraints that require the faithful parsing of input representations in the output, PARSE and LEX.

(2) PARSE

a. PARSE (broadly defined):

phonological constituents are licensed by higher prosodic structure.

b. PARSE-segment (PARSE-seg): non-moraic segments are parsed by the syllable.

(3) LEX: phonological materials which are present in the output are also present in the input

Schematic examples illustrating the effect of the ranking of ONS and NO-CODA above PARSE are shown below (an angled indicates an unparsed segment). In (4),candidates (a,b) are less harmonic becuase they either violate highly ranked ONS or NO-CODA. The optimal candidate (a) obeys ONS and NO-CODA even though it does not consitute a faithful parse of the input.

(4) ONS, NO-CODA >> PARSE

/CVC/	ONS	NO-CODA	PARSE
✓a. CV < C >			*
b. CVC		*!	
c. < C > V < C >	*!		**

Schematic examples showing the effect of ranking ONS and NO-CODA above LEXRT appear in (5) (epenthetic consonants are bold-faced)

(5) ONS, NO-CODA >> LEXRT

/V/	ONS	NO-CODA	LEXRT
✓a. CV			*
b. CVC		*!	**
c. V	*!		

As shown in tableau (5), LEXRT (a root node which is present in the output is also present in the input) may be violated to satisfy ONS, as evident from the fact that a violator of LEXRT emerges as the optimal form. On the other hand (5b), a form in which FILL is violated to create a coda consonant, yields a NO-CODA violation and is considered less harmonic than (5a). Lastly, the faithful parse of candidate (c) creates a sub-optimal onsetless syllable.

As seen in the schematic examples in (4,5), the optimal syllable is a CV. Across languages, this syllable type is attested, but in general, not all syllables obey ONS and NO-CODA. That is, languages admit marked syllables, syllables without onsets, and syllables with codas. I turn to a brief discussion of marked syllables in Optimality Theory in the following section.

3.3. Marked Syllables

Languages within the Benue-Congo family generally tend to admit open syllables; closed syllables, in contrast, are mostly forbidden. Open syllables are either CV or V. The former syllable shape, CV, obeys the unmarked syllable structure constraints ONS and NO-CODA. Whereas the latter type, a V obeys NO-CODA, and lacks an onset. In Optimality Theory, the basic interpretation of this defect is to say that an onset-less V violates ONS. The violation of ONS may either be permitted or prohibited in a given language. Assuming ONS is violable, this demands ranking ONS below PARSENUCμ, the constraint that requires the parsing of nuclear moras into syllables. PARSENUCμ, previously defined in chapter 1, is repeated below for reference.

(6) PARSE-nuclear mora (PARSENUC-μ): nuclear-moras are parsed into syllables

Assuming that PARSE-seg and LEXRT are undominated, the following ranking, whose effect is shown in the tableau below, is needed.

(7) PARSENUCμ, PARSE-seg, LEXRT >> ONS

input:	PARSENUCμ	PARSE-seg	LEXRT	ONS
NUC NUC | | μ μ | | V C V				
✓a. σ σ | / NUC NUC | | μ μ | | V C V				*
b. σ σ / / NUC NUC | | μ μ | | C V C V			*!	
c. σ < NUC > NUC | < μ > μ | <V> C V	vacuously	*!		
d. σ NUC NUC | | μ μ | | V C V	*!			vacuously

The candidate in (7b) is ruled out because it contains an epenthetic consonant, a LEXRT violation. Candidates (c,d) are rejected by different violations of PARSE; PARSE-seg violation which results in the underparsing of the prosodic anchor of the vowel, that is, the nuclear-mora, rules out (c), while (d) is rejected by PARSE-NUCμ violation. The optimal form is one where the undominated

constraints are respected. I assume that ONS does not contribute to the rejection of (c) because the underparsing of the vowel and its prosodic anchor, the nuclear-mora, ensures that syllable structure is not erected. In the same vein, the candidate in (d) does not violate ONS because a violation of PARSE-NUCμ implies the absence of syllable parsing.

Optimality Theory predicts the opposite pattern of domination; that is, a situation whereby ONS outranks other constraints. The effect of this ranking is demonstrated in the following tableau.

(8) ONS >> PARSENUCμ, PARSE-seg, LEXRT

input: NUC NUC, μ μ, V C V	ONS	PARSENUCμ	LEXRT	PARSE-seg
a. σ σ, NUC NUC, μ μ, V C V	*!			
✓b. σ σ, NUC NUC, μ μ, C V C V			*	
✓c. σ, < NUC > NUC, < μ > μ, <V> C V	vacuously			*
✓d. σ, NUC NUC, μ μ, V C V	vacuously	*		

Candidate (a) is illicit because it violates highly ranked ONS. The other three candidates (b,c,d) are possible output forms given their lowly ranked status. Candidate (b) obeys ONS by incuring a FILL violation; candidate (c) avoids an ONS violation by violating PARSE-seg, thus preventing the projection of syllable structure; similarly, candidate (d) avoids a violation of ONS by failing to parse the nuclear-mora into syllable structure. The nuclear-mora serves as the prosodic licenser for the vowel in (d).

For the remainder of the chapter, cases illustrating the various rankings predicted by Optimality Theory for the representation of onsetless vowels are presented. The latter type of ranking illustrating the dominance of ONS over PARSENUCμ is considered first.

3.4. Non-exhaustive syllabification in Gokana

Hyman (1985) was the first to hypothesize that segments need not belong to syllables in order to surface in Benue-Congo. He observes that Gokana, an Ogoni language of Eastern Nigeria permits sequences of vowels which do not give any hint of how syllable structure is constructed. Representative examples are given below:

(9)	a.	méé è kɔ m m̀ kɛ̃ ɛ̃ ɛ̃ ɛ̃ ɛ̃ ɛ̃	"who$_i$ said I woke him$_i$ up?"
	b.	kɛ̃ ɛ̃ ɛ̃ ɛ̃ ɛ̃	
		wake-CAUS- LOG - HIM - FOC	
	c.	kuuaɪ	"to open (intr. 2pl.)
	d.	kuùàè	"to open (intr. log.)

The pervasive sequencing of vowels in Gokana led Hyman to conclude that the language has no syllable structure. He argues that segments are licensed by the mora (moraic licensing), not the syllable. While still maintaining the moraic licensing view, Hyman (1990) in a recent work shows

that the syllable does play some roles in Gokana: every stem must have a syllable at the left edge, and a reduplicative template is expressed as a syllable. I summarize each of these arguments below and give an Optimality Theoretic interpretation of what it means for a system to have non-exhaustive syllabification.

3.4.1. Evidence for syllable structure in Gokana

Stem-internally (a stem consists of a verbal root and suffixes), Gokana permits sequences of vowels with no intervening consonants as demonstrated in (1) and in the additional examples given in (10):

(10)	ɲáááá	"to change (intr.)"	ɲáaaɪ	"to change (intr.2pl.)"
	kɛ̃ɛ̃ɛ̃ɛ̃	"to wake up (tr.)"	kɛ̃ɛ̃ɛ̃ɪ	"to wake up (tr. 2pl.)"

However, stems obligatorily begin with a CV. This requirement forces underlying V-initial stems to surface with an epenthetic glottal stop as shown below (data from Arekamhe 1972 and Hyman 1990):[1]

(11) a. C-initial words		b. V-initial words: glottal stop insertion			
zob	'dance'	/ɛg/	→	[ʔɛ́g]	'go up'
kɪl	'go'	/ól/	→	[ʔól]	'farm'
pɪg	'mix'	/ú/	→	[ʔúʔ]	'die'
láo	'cow'	/ɛ̃/	→	[ʔɛ̃ʔ]	'moon'

[1]Notice the occurrence of glottal stop in the post-vocalic position in forms like [ʔúʔ] 'die' and [ʔɛʔ] 'moon'. I shall return to provide an account of this set of data in chapter five, where I address the issue of prosodic words in Benue-Congo.

According to Hyman (1990), the stem-initial obligatory onset requirement is accounted for if we assume that syllables are present in Gokana and that such syllables are constructed at the left edge of a stem. If this prosodic requirement is a general one, one would expect the process of glottal epenthesis to apply inside stems, however, epenthetic glottals are not found inside stems. As a result, the forms in (9) do not surface as follows:

(12) *a. mɛʔɛ́ ʔɛ̀ kɔ m m̀ kɛ̃ ʔɛ̃ ʔɛ̃ ʔɛ̃ ʔɛ̃ ʔɛ̃ "who$_i$ said I woke him$_i$ up?"

*b. kɛ̃ ʔɛ̃ ʔɛ̃ ʔɛ̃ ʔɛ̃

The fact that the obligatory onset condition does not hold word-internally as in the starred examples in (12) is explained if these vowels do not necessarily have to belong to syllables.

The second piece of evidence for syllable structure in Gokana comes from reduplication. As exemplified in (13), the reduplicant is realized as a CV corresponding to the leftmost CV in the verb stem:

(13)	Base	Gloss	Reduplicant	Gloss
	dɔʔ	fall	dɔ- dɔʔ	falling
	dɪb	hit	dɪ- dɪb	hitting
	dara	pick up	da- dara	picking up
	pììga	try	pì- pììga	trying

Given that reduplicants are only statable as prosodic templates by the Prosodic Morphology Hypothesis (M&P 1986), the reduplicative prefix in the above process can only be expressed as a syllable (σ), thus constituting additional evidence that the syllable is a licit prosodic constituent in Gokana (Hyman 1990).

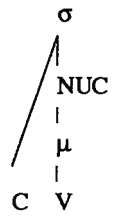
Obviously, the basic generalization that emerges from the data in (3,4) is that syllable structure is present in Gokana. The well-formedness of syllables is however dependent on the

presence of onsets, as evidenced by the glottal stop insertion in (13). This can be argued to show that the Onset Principle is strongly enforced in Gokana:

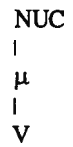
(14) Onset Principle (Itô 1989): Avoid $_{\sigma}$[V

The syllabicity of morpheme-internal onsetless Vs still remains doubtful, and in Hyman's view they are licensed by the mora not the syllable. This claim is supported by the absence of glottal stop insertion stem-internally in the forms in (9,10). If this analysis is valid, by implication only syllables with onsets are guaranteed syllabification in Gokana. The surface realisation of unsyllabifed moras is ensured by moraic licensing, which shields them from deletion by Stray Erasure (a condition on the phonetic realisation of segments). Structurally, the difference between a syllabified vowel and an unsyllabified vowel is as shown below:

(15) a. <u>Syllabified vowel</u>



b. <u>Moraically licensed vowel</u>



In the following section, I will develop an OT model for how non-exhaustive syllabification could be accounted for via constraint ranking.

3.4.2. Optimality Theoretic account of non-exhaustive syllabification

To begin establishing the appropriate constraint ranking for Gokana syllabification, recall that syllables are constructed if they have onsets. The Optimality Theoretic interpretation of this is that ONS must be respected for syllabification. The data in (12b), where glottal stops are

obligatorily epenthesized stem-initially, establishes this. What this means in OT is that ONS crucially dominates LEXRT (ONS >> LEXRT); this ranking forces epenthesis. Since the presence of a syllable is only required in the stem-initial position, an Alignment constraint is required. Alignment constraints, as mentioned in chapter 1, are OT constraints which govern the well-formedness of constituent edges, prosodic, morphological, or grammatical. This constraint is defined as ALIGN-STEM-LEFT (ALIGN-L):

(16) ALIGN-L: ALIGN (STEM, L; σ, L)

The left edge of a Stem is aligned with the left edge of a syllable

This establishes the following ranking: ALIGN-L, ONS >> LEXRT. Assuming that postvocalic consonants are moras which link to the syllable, this implies that NO-CODA is low-ranking in Gokana. The ranking and the relevant tableau are given in (17).

(17) input /ólʊ/ "farm": ALIGN-L, ONS >> LEXRT, NO-CODA

Candidates	ALIGN-L	ONS	LEXRT	NO-CODA
✓ a. ʔólʊ			*	*
b. ólʊ	*!	*		*

The failure of candidate (b) establishes the claim that ALIGN-L and ONS are undominated and inviolable in Gokana. On the other hand, candidate (a) is the optimal form because it obeys ALIGN-L and ONS. Even though it violates LEXRT, this violation is not costly because the constraint is lowly-ranked. In fact, it is by violating LEXRT that (a) is able to escape a fatal violation of higher-ranked ALIGN-L and ONS.

Let us now turn to the verbal reduplication process exemplified in (13: dɪb → dɪ- dɪb). As earlier analysed, the reduplicative prefix is a monomoraic syllable, expressed as CV. Thus, we see from the data that even if the base has a postvocalic consonant, it is never copied. Only the leftmost CV of the base is reduplicated. This is a case of emergence of the umarked (M&P 1994,

Shaw 1995): even though NO-CODA is generally violated in Gokana, it is respected in the prosodic domain of the reduplicant. In conjunction with high-ranking ONS and NO-CODA, the following constraints governing reduplicative correspondence are required to account for the reduplication process (McCarthy & Prince 1993, 1994):

(18) B = Base, RED = Reduplicant (underlined in the tableau)

a. MAX: Every element of B has a correspondence in RED

b. ANCH-L: The left peripheral element of RED corresponds to the left peripheral element of B, if RED is to the left of B

(19) ONS, NO-CODA, RED = σ, B = Verbal root, ANCH-L >> MAX

BASE: /dɪb/	ONS	NO-CODA	RED = σ	B = Verb Root	ANCH-L	MAX
REDUP: a. dɪb -dɪb		*!				
b. ɪ - dɪb	*!		*		*	**
✓ c. dɪ - dɪb						*
d. go - dɪb				*!		***

The optimal form in (19) is candidate (c) where ONS and NO-CODA are obeyed. Other highly-ranked constraints such as RED = σ, B = Verbal Root and ANCH-L are also respected by the candidate in (19c). Because the canonical pattern in OT is a case where at least a constraint violation may be incurred, the optimal candidate, (19c); violates MAX, but receives a minimal penalty as a result of the low ranking of this constraint. Other candidates are eliminated for violating one higher-ranked constraint or the other: (19a) violates NO-CODA, (19b) violates ONS and RED = σ, and (19d) incurs a violation of B = Verb Root.

At this point, it is appropriate to ask how moraic licensing is accounted for in Optimality Theory. The constraint governing the syllabification of vowels is PARSENμ, a constraint that requires nuclear-moras to parse into higher prosodic structure, which, by strict layering (Selkirk 1982, 1984) is the syllable node. Assuming onsetless moras are unsyllabified in Gokana, as

argued by Hyman, the appropriate ranking for the language is one where ONS is undominated and PARSE-NUCμ, a violable and lowly ranked constraint: ONS >> PARSENUCμ. The undominated ranking of ONS captures the fact that syllables are only erected if onsets are present, while the low ranking of PARSENUCμ captures the fact that moras are not parsed into syllables if onsets are not present. The violation of PARSENUCμ provides an escape hatch to avoid a fatal violation of undominated ONS: if onsetless moras are not parsed into syllables there will be no syllable structure and ONS will be satisfied vacuously. Let us now adapt this ranking to the analysis of stem-internal unsyllabified moras in Gokana as exemplified by the data in (9,10). Some examples from (9) are repeated below for convenience:

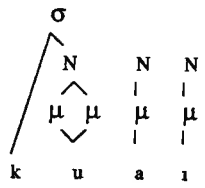
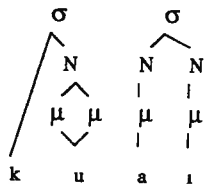
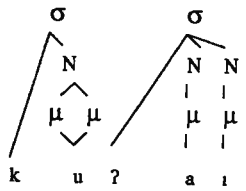
(20)	a.	kuuaɪ	*kuʔuʔaʔɪ	"to open (intr. 2pl.)"
	b.	kuùàè	*kuʔùʔàʔè	"to open (intr. log.)"

In (20), glottal epenthesis is prohibited stem-internally because word-internal moras do not have to be syllabified. This prohibition contrasts with the well-formedness of the same vowel-initial stems where the presence of a syllable is required in stem-initial position:

(21)	/ɛg/	→	[ʔɛ́g]	'go up'
	/ɔ́l/	→	[ʔɔ́l]	'farm'

In order to account for the data in (20), ALIGN-L, ONS and LEXRT must outrank PARSENUCμ as follows:

(22) ALIGN-L, ONS >> LEXRT >> PARSENUCμ

Candidates	ALIGN-L	ONS	LEXRT	PARSENUCμ
✓a. 				**
b. 		*!		
c. 			*!	

In all the candidate forms in (22), ALIGN-L is satisfied because the stem begins with a well-formed syllable, that is a CV. What the tableau in (22) shows then is the effect of the crucial ranking of PARSENUCμ below ONS and LEXRT. In Gokana, the constraint ONS rejects the candidate with an onsetless syllable (b), while the constraint LEXRT rules out candidate (c) as the winner because the violation incurred is not induced by ALIGN-L (the left-edge of the candidate is properly aligned with the left-edge of a syllable). None of these violations are incurred by the optimal form, candidate (a). Notice in this candidate that the nuclear moras are unsyllabifed, so that there is no syllable projection. This makes it possible for this candidate to satisfy ONS vacuously. Also, the

fact that there is no syllable projection makes glottal epenthesis unnecessary and therefore it is ruled out by general constraints against the insertion of features and/or segments.

3.5. Syllable structure in Ọwọn-Afa

The next language that I shall examine is Ọwọn-Afa, an Akokoid language spoken in Oke-Agbe, Ondo-State, Nigeria.[2] Syntactic information plays a crucial role in determining the prosodic shape of lexical items in Ọwọn-Afa: verbs are typically C-initial, while nouns are typically V-initial. Consonant-initial nouns also exist in this language, but they are optionally realised with an epenthetic high front vowel /ɪ/ which is inserted word-initially. A process of reduplication applies to nouns and obligatorily requires the presence of an initial vowel in the base. This makes reduplication possible in C-initial nouns if only an epenthetic vowel is present. This fact is presented as evidence to show that in Ọwọn-Afa Vs without onsets differ from CVs. Specifically, only syllables with onsets (CV) are analysed as phonological syllables. Onset-less syllables (V) are analysed as unsyllabifed nuclei as established in Gokana.

3.5.1. Syllabic asymmetries in Ọwọn-Afa

Ọwọn-Afa has a productive process of numeral reduplication which signifies counting done in a uniform fashion. As shown in (23), no matter how long the root is, the reduplicant is always realised as a VCV prefix :

[2]Previous work on Ọwọn-Afa includes Awobuluyi (1973) and Aina (1983). The reduplication data was elicited from Sunday Adewumi, Ojo Adu, and Dele Awobuluyi.

(23)

Base	Gloss	Reduplicated form	Gloss
ɪkã̌ã̃	one	ɪkɪ - ɪkã̌ã̃	one by one
ìjí	two	ìjì - ìjí	two by two
ɪda	three	ɪdɪ - ɪda	three by three
ídʒè	ten	ídʒí - ídʒè	ten by ten
orĩ̌tã̌	1hundred	oro - orĩ̌tã̌	1 hundred by 1 hundred
ígbɔ́rɔ	2 hundered	ígbí - ígbɔ́rɔ	2 hundred by 2 hundred

Another reduplication process which expresses the reduplicant as a VCV is distributive nominals. As shown by the data below, the reduplicated form is always a VCV prefix.

(24) Distributive reduplication, V-initial nouns

Base	Gloss	Reduplicated form	Gloss
oʃù	month	oʃo - oʃu	every month
ɔrũ̃ɣɔ́	morning	ɔrɔ - ɔrũ̃ɣɔ́	every morning
ɛrɛtẽ̃	afternoon	ɛrɛ -ɛrɛtẽ̃	every afternoon
èrérè	night	èrè - èrérè	every night

Consonant-initial nouns also participate in this process, but they reduplicate under one condition: an epenthetic [ɪ] must be inserted in the word-initial position for reduplication to apply, as exemplified below.

(25) Distributive reduplication, C-initial nouns

Base	Gloss	Reduplicated form		Gloss
bàtà	shoe	ɪbɪ - ɪbàtà	*bàtà-bàtà	every shoe
kòkó	cocoa	ɪkɪ - ɪkòkó	*kòkó-kòkó	every cocoa
kèké	bicycle	ɪkɪ - ɪkèké	*kèké-kèké	every bicycle
kpákó	wood	ɪkpɪ - ɪkpákó	*kpákó-kpákó	every wood

Evidence for the epenthetic status of [ɪ] is provided by the productive loan restructuring processes where this vowel is used to break consonant clusters, as well as to restructure C-initial names to V-initial. Consider the form of the following English names in Ọwọn-Afa (note: non-initial epenthetic vowels may surface as [ɪ] or [u], depending on whether the preceding vowel is back or front. This is parallel to the situation found in Yoruba, analyzed as Back Harmony in Pulleyblank 1988).

(26) Loan word restructuring: [ɪ] epenthesis

Name	Restructured form
Comfort	ɪ-kọmfọ́ọ̀tì
Janet	ɪ-jèénẹ́ẹ̀tì
Thomas	ɪ-tọ́mọ́ọ̀sì
Samuel	ɪ-sámúẹ̀lì

Vowel-initial names do not permit initial V epenthesis:

(27) Vowel-initial names

Name	Restructured form	
Edward	ẹdıwọ́ọ̀dù	*ı-ẹdıwọ́ọ̀du
Emmanuel	ìmánúẹ̀lì	*ı-ìmánúẹ̀lì
Abraham	ébíráàmù	*ı-ébíráàmu
Elizabeth	èlísábẹ́ẹ̀tì	*ı-èlísábẹ́ẹ̀tì

Having established that [ı] is the epenthetic vowel in Ọwọn-Afa, let us return to the discussion of reduplication. The Ọwọn-Afa pattern of reduplication (exemplified in 25, where bàtà is reduplicated as ıbı - ıbàtà *bàtà-bàta) where the reduplicative prefix is well-formed if attached to a V-initial base, contrasts with reduplication pattern found in languages such as Timugon Murut (TM, M&P 1986, 1993a,b) and SiSwati (SSW, Downing 1994) where the reduplicant is preferably realised as a prefix occurring next to the leftmost CV in the base. Thus, in consonant-initial bases, the reduplicant surfaces as a prefix, while in vowel-initial bases it surfaces as an infix. Examples are given in (28) and (29).

(28) Timugon Murut Reduplication (McCarthy & Prince 1993a,b)

Base	Reduplicated form	Gloss
bulud	bu - bulud	hill/ridge
lımo	lı - lımo	five/about five
abalan	a-ba-balan	bathes/often bathes
ompodon	om-po-podon	flatter/always flatter

(29) SiSwati Reduplication (action done on a small scale or from time to time; Downing1994)

Base	Reduplicated form	Gloss
-bóna	-boná-bona	see
-bonísa	-bonı-bonísa	show
-esúla	-e-sulá-sula	wipe
-elusa	-e-lusa-lusa	herd

In McCarthy & Prince (1986), the infixation pattern is accounted for by prosodic circumscription, which excludes onset-less syllables from the base of reduplication. This enables the reduplicative prefix to attach directly to the leftmost CV of the base. But, as argued in McCarthy & Prince (1993a,b), an onsetless syllable is not a prosodic constituent, hence, cannot be circumscribed. They offer another analysis within the theory of Generalized Alignment by proposing that the constraint that requires that all syllables have onsets outranks the constraint which requires the left edge of the prefix to be aligned with the left edge of the stem. Downing (1994), in her analysis of SiSwati, reinterprets McCarthy & Prince's (1993a,b) account as an instance of misalignment between the left edge of the morphological stem and the prosodic stem. The morphological word may begin with either a consonant or vowel, however, the prosodic stem must begin with the leftmost well-formed syllable (that is, CV) within the stem. It is this requirement that causes onsetless Vs to be left out of the prosodic domain of reduplication. Essentially, these two accounts uphold the view that higher-ranked ONS compels the delimitation of the prosodic base to the leftmost onset-ful syllable, onset-less Vs are violators and are consequently by-passed.

The existing analyses of onsetless syllables as presented in McCarthy and Prince and Downing (1994, 1995) makes the Ọwọn-Afa pattern quite interesting for two reasons. First, unlike Timugon Murut and SiSwati where onsetless syllables are ignored and skipped-over in reduplication, initial vowels are neither ignored nor skipped-over in Ọwọn-Afa. Second, unlike the TM and SSW cases, where the prosodic base begins with an onset-ful syllable, the prosodic base in

Ọwọn-Afa is well-formed only if it begins with an onsetless syllable. A base that begins with a CV is considered relatively ill-formed, as evident from the epenthesis effects in (21). How do we account for this generalization? A satisfactory account of these facts must answer two questions: 1, why are onsetless Vs skipped in some languages and not in others? 2, why are onset-ful syllables required to begin the prosodic base in some languages and why are onsetless Vs required in other languages? In the following subsection, these questions are addressed within an Optimality-based framework.

3.5.2. Ọwọn-Afa Asymmetry: an Optimality solution

Let us address the questions posed in the previous section. First, why are onsetless Vs skipped in some languages and not in others? In OT, the observed asymmetry in skipping is accounted for by ranking ANCH-L and ONS constraints differently in these languages:

(30) ANCH-L: The left peripheral element of RED corresponds to the left peripheral element of B, if RED is to the left of B

In cases such as Ọwọn-Afa, where initial onsetless Vs are not ignored, ANCH-L would outrank ONS preventing the skipping of initial vowels, while in cases such as TM and SSW, where onsetless Vs are ignored, ONS would outrank the same set of constraints such that violations of them would be permitted:

(31) a. Ọwọn-Afa: ANCH-L >> ONS

b. TM, SSW: ONS >> ANCH-L

Concerning the second question (why are onset-ful syllables required to begin the prosodic base in some languages while onsetless Vs required in other languages), two plausible solutions are

available in the theory. The first solution is offered within an analysis that does not recognize the mora as a licit prosodic constituent (M&P 1993a,b; Downing 1994). As earlier summarized, in accounting for cases such as TM where the base and the reduplicant obligatorily begin with onset-ful syllables, M&P argue that ONS, the constraint that requires that all syllables have onsets, outranks the constraint which requires the left edge of the prefix to be aligned with the left edge of the stem. In Downing's account, the prosodic base must begin with the optimal syllable, a CV, a requirement that forces a misalignment between the prosodic base which excludes onsetless syllables and the morphological base which includes vowels with or without onsets. The ranking in (31b) accounts for this fact.

Now, in accounting for the obligatoriness of onsetless Vs in data such as illustrated in (25-27) in an analysis where the mora is not considered an independent phonological constituent, one would have to analyse onsetless Vs as syllables. To account for the V-initial requirement imposed on the base, one could propose that ONS is ranked below the alignment constraint that requires the left edge of the prefix to align with the left edge of the morphological word. But this would incorrectly predict that both onset-ful initial (CV) and onset-less-initial (V) bases would participate in reduplication. It does not explain why the prosodic base is well-formed only if it begins with an onsetless V. To obtain this effect, one would need a negative constraint that crucially rules out onset-ful syllables from beginning the prosodic base and at the same time requires that an ONS violation be incurred at the left edge of the base:

(32) *ALIGN-L (B, L; ONS, L):

The left edge of the base must not be aligned with the left edge of an onset

The negative constraint in (32) is suspicious, however. Syllables are considered optimal if they have onsets, not if they lack onsets. There is a robust amount of evidence in the literature that syllable counting prosodic processes prefer to be expressed as CV (the unmarked syllable type) rather than as onsetless Vs, which are relatively disfavoured syllables. If one admits the constraint

in (32), then one would have to assume that the universal onset constraint is statable either positively (34a) or negatively (34b) as follows:

(33) ONSET:

a. syllables must have onsets (CV)

b. syllables must not have onsets (V)

Apart from the fact that the reformulation of ONSET in (33) is counter-intuitive, it neither explains why onset-less syllables are not as common in languages as onset-ful ones, nor why onset-less syllables exhibit exceptional properties.

Alternatively, suppose we say that onsetless Vs are not syllabified, but licensed by the nuclear-mora. Further, following proposals by Hyman (1985, 1990), Zec (1988), suppose we assume that the mora is a licit prosodic constituent. Given these two assumptions, here is an alternative account of the Ọwọn-Afa data in (25-27). First, B is defined as a Binary Foot. Second, the alignment constraint is set up such that the left edge of the foot is aligned with the left edge of a nuclear-mora. With this alignment requirement, the epenthetic V is analyzed as a LEXNUCμ violation induced by higher-ranked ALIGN-L:

(34) RED = Ft, ALIGN-L >> LEXNUCμ, PARSENUCμ

a. ALIGN-L (B, L; NUCμ, L):

The left edge of the base must be aligned with the left edge of a nuclear-mora

b. LEXNUCμ:

A nuclear-mora that is present in the output is present in the input

Together with ANCH-L, the constraints in (34) are ranked in order of preference and illustrated in a tableau in (35).

(35) RED = Ft, ALIGN-L, ANCH-L >> LEXNUCμ, PARSENμ

BASE /bàtà/	RED = Ft	ALIGN-L	ANCH-L	LEXNUCμ	PARSENμ
RED:✓ a. ɪbɪ ɪbàtà				*	*
b. bàtà bàtà		*!			
c. àtà ɪbàtà			*!	*	**
d. bà bàtà	*!	*			

Let us examine the candidate set generated in tableau (35). Candidate (b) fails the ALIGN-L constraint for lack of initial nuclear-mora in the base, candidate (c) passes the same constraint but fails higher ranked ANCH-L because the initial consonant in the base is ignored in reduplication; candidate (d), a degenerate foot, passes ANCH-L but fails RED = Ft since it is not binary footed. Even though candidate (a) fails LEXNUCμ, the constraint that enables it to augment the base to the required prosodic shape, it still surfaces as the winner because it respects all the higher-ranked constraints violated by the other competitors.

The analysis presented above, where the nuclear-mora serves as a prosodic constituent for onsetless Vs, has two advantages over the alternative where the syllable licenses vowels without onsets. First, it enables us to get around the problem of defining the ONSET constraint (34b) in a counter-intuitive fashion. Second, the proposal that onsetless Vs are unparsed nuclear-moras enables the vacuous satisfaction of ONS, thus eliminating unnecessary violations of this constraint from the grammar.

It is reasonable to ask if ONS plays any role in Ọwọn-Afa, though. There is a syllable reduplication process that demonstrates the importance of ONS in syllabification. Consider the verbal reduplication signifying "action done anyhow" in (36).[3]

[3]Other interesting observation which will be accounted for in chapter four are the following: 1, the reduction of the reduplicated vowel to the least marked vowel [i], and 2, the V-lengthening effect in the base. Observe also that the tonal specification deriving this reduplication pattern is LHH.

(36)	Verb	Gloss	Reduplicated form	Gloss
	dʒù	eat	dʒì - dʒúú	eat anyhow
	kpɛ́	dig	kpì - kpɛ́ɛ́	dig anyhow
	kò	sing	kì - kóó	sing anyhow
	jɛ́	dance	jì - jɛ́ɛ́	dance anyhow

As shown by the data in (36), the reduplicant is consistently realised as a CV syllable. The consonant of the reduplicant is identical to the initial consonant of the base and the vowel of the reduplicant consistently surfaces as [ɪ], the least marked V as evident from the fact that this vowel is the epenthetic vowel (26-27). This data contrasts with the set of data illustrated in (25): (bàtà ɪbɪ - ɪbàta *bàtà-bàtà), where the left edge of the base and the reduplicant must not coincide with the left edge of a CV syllable. The fact that the initial consonant is copied in (36) shows that V is not sufficient to satisfy the templatic requirement: a syllable is well-formed if it has an onset. Structurally, the proposal that onset-less Vs are nuclear moras and that onset-ful ones are syllables accounts for this contrast quite nicely. If RED is defined as NUCμ, then ONS is irrelevant, but if RED is stated as σ, then the satisfaction of ONS becomes crucial. The ranking that derives this effect is the one already established for Gokana, where ONS dominates PARSENUCμ: nuclear-moras are syllabified only if they have onsets, and otherwise they remain unsyllabified, that is, are not parsed into syllables.

3.6. Syllabification in Standard Yoruba

There are a number of phenomena that require the presence of a syllable in Yoruba phonology. Such phenomena include the minimal word condition, morpheme structure conditions, and templatically induced truncation and reduplication. Dialects of Yoruba differ with respect to the syllabification of vowels, causing syllable conditioned processes to diverge in interesting ways. In the Standard dialect, onset-ful Vs differ from their onsetless counterparts in many ways. For

example, a word must minimally contain a CV (3.5.1), a syllable truncative template is expressed as CV causing V-initial verbs to augment to CV by [h] epenthesis (3.5.2), three morpheme structure conditions require the presence of CV word-initially to license High-tone, nasal vowels and backness in High vowels (3.5.3), in forming distributives, the reduplicant is well-formed if spelt out as VCV, not as CVCV or VV (3.5.4), and deletion is triggered when Vs occur adjacently across morpheme boundary, while the same process is blocked in cases where CVs occur adjacently in the same context (3.5.5). Onsetless Vs, on the other hand, neither satisfy the minimal word condition nor any of the templatic requirements requiring syllables. The focus of this section is to lay out the asymmetric behavior of vowels showing that an onset is required for syllabification in Standard Yoruba.

3.6.1. Minimal Word Condition: No [r] deletion

Every word in Standard Yoruba must contain a CV. Thus, no matter how many Vs are present in a word, word well-formedness is satisfied only if a CV is present in it (Ọla 1994, 1995). This requirement blocks consonant deletion in a context where it would otherwise have applied. Consider for example the process of intervocalic [r] deletion that is triggered when one of the following conditions is met (Akinlabi 1993):[4]

(37) a. The two vowels flanking [r] are identical, *or*

b. One of the vowels is high

(38a) illustrates the process of [r] deletion (which is accompanied by progressive assimilation of vocalic features), while the forms in (38b) show that an [r] in any VCV noun canon consistently resists deletion:

[4]A formal account of this process is given in chapter 4.

(38) [r] deletion

	Full form	[r] deletion		Gloss
a.	erùpẹ̀	eèpẹ̀		sand
	òrìṣà	òòṣà		god
	oríkì	oókì		praise name
	orórì	oórì	*oóì	mausoleum
b.	orí	*oi		head
	àrá	*aa		thunder
	oró	*oó		pain
	ọrọ̀	*ọọ̀		wealth

Notice in (38b) that the environment for deletion is appropriate, yet [r] does not delete. Why is [r] shielded from deletion in (38b)? If CVs and Vs group into licit syllables, the presence or absence of an onset should not be phonologically significant for the satisfaction of the minimal word condition: a lexical word must contain a σ. The data in (38) suggest that an onset is crucial for syllabification. When compared with a CV, the examined set of data strongly suggests that a V is degenerate in syllabic terms. Some questions immediately arise about the phonological status of onsetless Vs. Why do Vs not behave as syllables in Standard Yoruba? If Vs are not syllables, what are they? Before an attempt is made at providing plausible answers to these questions, let us examine other processes that contrast CVs and Vs in significant ways.

3.6.2. Loan Verb Truncation: V augmentation by [h] epenthesis

Consider next a productive process of truncation that reduces loan verbs to the initial syllable in the word (reduced verbs signify an action done secretly).

(39) Loan verb truncation

Base	Truncated form	Gloss
páàsì	pá	to pass
pọ̀mbù	pọ́	to pump
ẹ́ńfì	hẹ́ *ẹ́/ *ẹ́ń/ *fì *hẹ́ń	to envy
ọ́gìlì	họ́ / *ọ́ / *gì / *lì	to be ugly

Note in the above examples that consonant-initial loan verbs shorten to the initial CV in the word. In vowel-initial forms, however, prevocalic [h] epenthesis obligatorily accompanies the truncation of postvocalic materials.[5] This is again another case where CVs and Vs pattern asymmetrically in a syllabic process, a situation that should not hold under the assumption that both are well-formed phonological syllables.

3.6.3. Word-initial Morpheme Structure Condition: No H-tone, Nasal or H-back V

Supporting evidence showing that CVs behave differently from onsetless Vs comes from three morphemic constraints involving the occurrence of a high tone, nasality, and backness in the word initial position. Briefly, the constraints require that a high tone vowel (✓# cv́), a nasalized vowel (✓# cṽ)[6] and a high back vowel (✓# cu) may occur word-initially only if such words are

[5][h] epenthesis may occur in the untruncated V-initial forms as well, but it is optional. As shown in (39), the segments of the truncative σ prefix always corresponds strictly to the leftmost segments of the Base. Thus, in a Base such as /ọ́gìlì/, even though there are segmental materials which could potentially satisfy the templatic requirement (e.g.,*gi, *li), they are never copied. These forms are illicit because copying in this case would entail the skipping over of the initial vowel of the Base. As it turns out, vowels cannot be skipped over in Standard Yoruba. Phrased in Optimality terms, *mis-alignment* (M&P 1993b) is prohibited in prosodic processes involving vowels in Yoruba (Ọla 1994b). Note that the property of onsetless Vs in Yoruba contrasts with that of onsetless Vs in Timugon Murut which are skipped in reduplication; see discussion above in section 3 and M&P (1993a,b) for details.
[6]A nasal vowel is indicated by a superimposed tilde.

consonant-initial:[7] (*# v́), (*# ṽ), (*# u). Examples illustrating word-initial high tones are shown in (40). By contrast, vowel-initial high tone words are completely unattested in the native vocabulary.

(40) High toned vowels do not occur word initially: cv́cv, *v́v, *v́cv

Word	Gloss
ké	shout
bẹ́	cut
wúrà	gold
púpọ̀	many
nípọn	thick
rárà	allergy
rógódó	small and round

Prefixation provides additional evidence for the general ban on vowel-initial High tone words. In Standard Yoruba, V prefixes either bear a mid or a low tone. The only high tone prefix in the dialect is consonant-initial. As shown below in (41a,b), both the mid tone and low tone prefix are expressed as V. The High tone prefix, in contrast, is expressed as CV. An additional interesting observation is that the consonant of the prefix is identical to that of the verb, suggesting that consonantal copying is triggered by the need to avoid a violation of the (*#v́) constraint. The data in (41c) exemplify these observations.

[7]In loan phonology, these constraints are violable as shown by forms such as [ẹ́ńfì] 'envy', [ĩ̀ǹkì] 'ink' when not augmented to CV-initial forms by [h] epenthesis.

(41) Prefixation: H-tone prefix must be C-initial

a. Mid-toned Prefix		b. Low-toned Prefix		c. High-toned Prefix		
ɪ-jó	'dance'	ɪ̀-jó	'dancing'	ɪ́-jó	*ɪ-jó	'dancing'
ɪ-kú	'death'	ɪ̀-kú	'dying'	kí-kú	*ɪ-kú	'dying'
ɪ-só	'fart'	ɪ̀-só	'farting'	sí-só	*ɪ-só	'farting'
ɪ-là	'marks (e.g. facial)'	ɪ̀-là	'splitting'	lí-là	*ɪ-là	'spliting'

Consider the restriction on the occurrence of word initial nasals next. As the examples in (42) show, nasalised vowels are permitted in word-initial position if preceded by an onset consonant. Nasalised vowel-initial words, on the other hand, are systematically absent in the Standard Yoruba word inventory.

(42) Nasalised vowels do not occur word initially: cṽ, *ṽv, *ṽcv

Word		Gloss
rǐn	[rĩ]	walk
fọ́nrọ́n	[fɔ̃rɔ̃]	strand
kìnnìún	[kĩnĩũ]	lion
kánún	[kãũ]	potash
kànga	[kãga]	well, bore hole
gángan	[gãgã]	a talking drum

Word-initial high back vowels are also sensitive to the presence or absence of preceding consonants. Specifically, [u] can only occur word-initially if a word is consonant-initial. Thus in (43), we see that the first vowel of consonant-initial words may be a high back vowel [u]. Completely unattested in Standard Yoruba, however, is the occurrence of onsetless vowel-initial high back vowel words.

(43) High back vowels do not occur word-initially: cu, cucv, *u *ucv

Word	Gloss
kú	die
rù	carry
lu	pierce
kùtà	unsuccessful
burú	wicked, bad
ṣubú	fall

The three morpheme structure conditions show that there is a phonological contrast between vowels depending on whether they have onsets or not. A structural explanation of this systematic contrast will be presented presently, but before that, more evidence is presented below from reduplication to illustrate the difference in the syllabicity of vowels in Standard Yoruba.

3.6.4. Distributive Reduplication: RED = Ft & Ft is VCV, *CVCV, *VV

Let us now turn to reduplication for further evidence to show that CV and V contrast in striking ways. Yoruba forms distributives by a process of reduplication. The reduplicative prefix is a foot (RED = Ft, Fọlarin 1987, Pulleyblank 1988). Under the standard moraic framework of assumptions, where the onset does not count for syllabification, one would expect any of CVCV, VV, or VCV noun to satisfy the templatic requirement RED is a Ft. As it turns out, the reduplicant is always realized as VCV, never as VV or CVCV, as shown in (44). Again, this is an unexpected requirement if CV and V are characterized as phonological syllables.

(44) Distributive Reduplication

VCV-initial noun

	Base	Reduplicated Form	Gloss	Distributive
a.	ewé	ewe-ewé	leaf	every leaf
	ìla	ìlì-ìlà	line	every line
	òru	òrò-òru	midnight	every midnight
	ìrọ̀lẹ́	ìrì-ìrọ̀lẹ́	evening	every evening

b. VV-initial noun: does not reduplicate

Base	Reduplicated Form	Gloss	Distributive
owúrọ̀	òwò-òwúrọ̀	morning	every morning
òórọ̀	òrò-òórọ̀	morning	every morning
òúrọ̀	*òò-òúrọ *òrò-òúrọ	morning	every morning

In (44b), observe that reduplication is possible in forms with an identical initial VV sequence but impossible in an unidentical initial VV. This is explained if we assume that (i) long vowels are represented as two moras linked to one segment, (ii) non-identical vowels are represented as two moras linked to two different segments, (iii) copying targets melody not prosody (McCarthy & Prince 1986). Under this assumption, initial identical VVs are copied as monosegments whereas non-identical VVs are copied as two different segments. If the reduplicant is obligatorily spelt out as VCV, copying would simply select the first VCV in a strictly linear fashion (skipping of vocalic melody is prohibited, see note 3) as follows: *orọ* (*ooro*) vs. *ou*orọ* (*ourọ*). If the grammar treats CVs differently from Vs, the contrast in VCV reduplication in *òórọ̀* and *òúrọ̀* follows straightforwardly. Similarly, CVCV nouns do not reduplicate because the left-edge of the base does not begin with a V as required by this process. A plausible but non-occurring ìlà→ *ìlà-ìlà

is ruled out by ANCH-L because the reduplicant does not begin with the same segment that the base begins with.

c. CVCV: does not reduplicate

Base		No Reduplication	Gloss	
fìlà	→	*fìlà-fìlà *ìlà-fìla	cap	every cap
bàtá	→	*bàtá-bàtá *àtá-bàtá	a type of drum	every bata drum

In (44), we see that the leftmost constituent of the base must be an onsetless V, a familiar requirement from Ọwọn-Afa (3.4.). The ill-formedness of (38c) demonstrates the validity of this claim. Recall that in Ọwọn-Afa, the ill-formedness of C-initial nouns is redeemed by [i] epenthesis. Even though Standard Yoruba also has epenthetic [i] (Pulleyblank 1988), it does not exploit the option of augmenting the nominal base to the desired prosodic shape for reduplication. Instead, Standard Yoruba simply does not reduplicate non-conforming nominals such as the forms in (44c). The distributive is expressed in consonant-initial forms by prefixing the lexical item "gbogbo" which means "all" to unreduplicated nouns. Thus, "every cap" is expressed as "gbogbo fìlà".

3.6.5. Vowel Hiatus Resolution

The final evidence is offered by vowel hiatus resolution in Standard Yoruba. When vowel hiatus arises via morpheme concatenation as in verb-noun collocations, vowel deletion is triggered to eliminate the hiatus.[8] As shown by the data in (45), when the noun is consonant-initial, deletion does not apply. However, a hiatus environment is created when a vowel-initial noun is collocated

[8]See Pulleyblank (1988) and the references cited therein for a detailed account of various vocalic processes such as assimilation and coalescence which result from hiatus contexts.

with a verb. To resolve the hiatus, the vowel of the verb deletes,[9] and the initial vowel of the noun consequently incorporates into the onset of the verb. The following data illustrates this point:

(45) Vowel Hiatus Resolution: vowel deletion

rí bàtà	'see the shoe'	vs.	rí aṣọ	→	ráṣọ	'see the dress'
ta kòkó	'sell cocoa'	vs.	ta ewé	→	tewé	'sell leaves'
se kókò	'cook cocoyam'	vs.	se ẹran	→	sẹran	'cook meat'
gbẹ́ kanga	'drill a borehole'	vs.	gbẹ́ ère	→	gbére	'carve a wood'

The deletion process described above is another instance where consonant-initial syllables behave differently from vowel-initial ones. This contrast is accounted for if we adopt proposals by Kaye (1989), Downing (1990), and others that vowel hiatus resolution processes such as deletion are usually driven by the requirement to build syllables with onsets. Thus, the vulnerability of onsetless Vs to deletion is naturally expected if they are not licit syllables.

Let us summarize briefly at this point. In the foregoing, we have examined syllabic processes in Standard Yoruba. The generalization that emerges is that onset-ful Vs, i.e., CVs, contrast sharply and in important ways from onsetless Vs in this dialect. Crucially, syllable conditioned processes require the presence of an onset in a phonological syllable. Why?

As proposed in Ọla (1993), a straightforward explanation for the observed differences is that the Onset Principle is strictly enforced in syllabifying vowels in Standard Yoruba:

(46) Onset Principle (Itô 1989): Avoid $_{\sigma}[V$

By the onset principle in (46), syllables must have onsets. Violators, i.e., onsetless Vs, are simply not syllabically affiliated. This analysis explains some of the asymmetries observed earlier. For

[9]This is not always the case; sometimes, the vowel of the noun deletes. See Ọla (1990), Pulleyblank (1987) and the references cited in these works for a full account of vowel deletion in Standard Yoruba.

example, if the presence of a syllable is required for minimality conditions, then the seemingly mysterious variations in intervocalic [r] deletion in (32: orórĩ → oórĩ *oõĩ 'mausoleum' vs. orí *oí 'head') follow straightforwardly. If [r] deletion were to apply in these forms, word minimality would be violated, since onsetless Vs are not phonological syllables. In addition, the obligatory requirement that an epenthetic [h] be present in shortened loan verbs is also accounted for, since the truncative form always corresponds to the leftmost syllable, a condition which cannot be satisfied by an onsetless vowel in a vowel-initial loan verb (páàsì → pá vs. ẹ́ńfì → hẹ́ *ẹ́). Further, an analysis of the word-initial morphemic constraints follows automatically if the proposal is adopted that the onset is required for syllabification: word-initial high tone, vowel nasalization and backness in high vowels are obligatorily licensed within a left-edge syllable. The questions that remain unanswered though are: what is the prosodic status of an onsetless V, and how is it licensed in the phonology?

As regards the first question, as already established in my analysis of Gokana and Ọwọn-Afa, an onsetless V is an unsyllabified mora, that is, a mora that is not dominated by syllable structure in the phonology. Concerning the second question, there are two possible solutions within moraic framework. First, one may adopt the exhaustive view of syllabification, an approach that holds the view that all moras must belong to syllables by the Mora Confinement Condition (Itô & Mester 1992:11): μ is licensed only by σ. Under this account, all non-peripheral moras must be syllabified. However, peripheral moras may or may not be syllabified, depending on the language. In a case where a constituent peripheral mora is unsyllabified, it is rendered extraprosodic, *a.k.a.* invisibility, a form of *covert licensing* which applies strictly at constituent edges (Itô 1986, 1989, Inkelas 1989, McCarthy and Prince 1986). This puts an onsetless mora outside the domain of syllabification. This yields the prediction that non-peripheral onsetless vowels will behave as phonological syllables, whereas their peripheral counterparts will not. Three sets of data invalidate this prediction. First, this view incorrectly predicts that an illicit output such as (38: orórĩ → *oõĩ 'mausoleum') should be well-formed, since the non-peripheral mora ought to syllabify, meeting the minimality condition that requires the presence of a syllable in every lexical item. Second, if a

peripheral V is outside the domain of syllabification, there is no reason why it should not be rendered extraprosodic and consequently ignored in truncation: as depicted by the illicitness of ẹ́ńfi → *fi, a peripheral V cannot be ignored to fill the truncative template in loan verbs. Third, it fails to account for why word-initial unsyllabified moras count as part of the prosodic template in distributives; the reduplicant, which is a foot, is obligatorily spelt out as VCV, not CVCV, as shown by comparing the licitness of (47a) with the illicitness of (47b):

(47)	Base	Reduplicated Form	Gloss	Distributive meaning
a.	òru	òrò-òru	midnight	every midnight
b.	fílà	*filà-filà	cap	every cap

The implication of data such as shown in (47) is that unsyllabified left edge moras may count for prosodic processes. If peripheral moras are available for prosodic processes, as is the case in (47a), then they must be prosodically licensed overtly in some way.

This is exactly where the second view, the non-exhaustive hypothesis, plays a crucial role. As argued by works such as Downing (1993) and Spring (1990), in languages where the Onset Principle is strictly invoked onsetless vowels may remain unsyllabified in the phonology because they are prosodically licensed by the mora, *moraic licensing* (Bagemihl 1991, Zec 1988, Hyman 1985, 1990).[10] The idea that a mora is a valid prosodic licenser derives a straightforward account for why the left edge mora is not ignored in the reduplication data shown in (41a), and challenges the standard assumption that onsetless Vs are not a (prosodic) constituent (see M&P 1993a,b).[11] If the Prosodic Morphology Hypothesis entails that reduplicants in templatically conditioned reduplication be formally specified as prosodic units (μ, σ, Ft, PrWd), then the initial unsyllabified mora in distributives, which constitutes part of the foot template, ought to be prosodically defined.

[10]In Spring (1990), the rhyme constituent serves as the prosodic licensers for unsyllabified segments.
[11]Left edge Vs are also not ignored in truncation, see data in example 34.

The account proposed so far for syllabification in Standard Yoruba is the following: the language strongly enforces the Onset Principle (46); hence, moras can only group into well-formed syllables if an onset is present, otherwise moras remain phonologically unaffiliated to the syllable. Unsyllabified vowels are not deleted by Stray Erasure because they are licensed by the mora. Consequently, they remain in the representation participating actively in the phonology.[12]

3.6.7. An OT account of Non-exhaustive syllabification in Standard Yoruba

Recall that in Standard Yoruba, a phonological syllable is obligatorily spelt out as CV. In Optimality Theory, this means that ONS and NO-CODA must be satisfied. To exemplify, recall the loan verb truncation data: (páàsì → pá 'pass' vs. ẹ́ńfi → hẹ́ *ẹ́ 'envy') where the Truncative affix is a syllable prefix (TRUNC = σ). In consonant-initial verbs, truncation targets the leftmost CV, whereas in vowel-initial verbs [h] epenthesis must accompany truncation to satisfy the templatic requirement. This clearly shows that a nuclear-mora is incorporated into a syllable node only if preceded by an onset. [h] epenthesis forces the insertion of a root node which was not present in the input. This shows that a LEXICAL ROOT (LEXRT)[13] violation is permited in the prosodic domain of TRUNC, though not tolerated elsewhere in the grammar (for example, VCV nouns do not augment to CVCV).

(48) LEXRT: A root node that is present in the ouput must also be present in the input

The templatic constraint, ONS, PARSENUC and LEXRT are ranked as follows.

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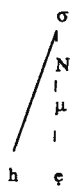
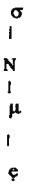
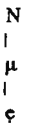
[12]Word-initial moras are visible to tonal processes (Akinlabi 1984, Pulleyblank 1986) and tongue root harmony (Archangeli & Pulleyblank 1994 among others).

[13]The constraints governing epenthesis in Optimality Theory are formulated as FILL: FILLONSET (Onset position is filled by lexical material), and FILLNUCLEUS (Nucleus position is filled by lexical material). I refrain from using FILLONSET to account for [h] epenthesis for theory-internal reasons, specifically because of the standpoint of moraic theory (Hayes 1989, Hyman 1985) which does not regard the onset as a prosodic constituent.

(49) TRUNCATIVE = σ prefix, ONS, NO-CODA, >> LEXRT >> PARSENUC

(50) Templatically induced LEXRT violation: TRUNCATIVE = σ prefix

Input: /ẹ́ńfi/	TRUNCσ	ONS	NO-CODA	LEXRT	PARSENUC
✓a. 				*	
b. 		*!			
c. 	*!				*
d. 	*!				
e. 			*!		

The first candidate in (50) violates LEXRT, a lower ranked constraint, but is evaluated as the best because it satisfies the templatic requirement: the Truncative affix is a σ prefix. The violation of

LEXRT enables candidate (a) to satisfy higher-ranked ONS which would otherwise be violated if LEXRT was obeyed. The second candidate is ruled out by an ONS violation because the left edge of the syllable is not aligned with the left edge of a consonantal root node. Its satisfaction of LEXRT does not salvage, it because the violation of ONS is costlier than the satisfaction of LEXRT. The third candidate also fails to win because it does not satisfy the templatic requirement: it is an unparsed nuclear-mora, not a syllable. Candidate (d) is identical to the input, but is non-optimal because the TRUNCATIVE is strictly restricted to a σ prefix.[14] The final candidate in (e) is less harmonic when compared with the optimal form because it does not respect NO-CODA.

The analysis presented above suggests that PARSE-NUCμ is highly ranked in Yoruba. However, when a process such as distributive reduplication is considered, we find that this ranking cannot be maintained for PARSE-NUCμ. As in the ranking established for Gokana and Ọwọn-Afa, PARSE-NUCμ is ranked below ONS in Standard Yoruba. This ranking explains the various asymmetries between vowels with onsets and those without onsets. The distributives are repeated below for reference.

(51)	Base	Reduplicated Form	Gloss	Distributive
a.	òru	òrò-òru	midnight	every midnight
b.	fílà	*filà-filà *ɪfi-ɪfilà	cap	every cap

Crucially, the base and the reduplicant in distributives must be V-initial, i.e. an unparsed nucleus in Optimality Theory. Parsed Nuclei (i.e., syllabified vowels) are disqualified in the initial position of the base and the reduplicant. This is demonstrated by the illicitness of disyllabic (51b), showing clearly that the reduplicative template is a foot whose left edge is aligned with a nuclear-mora, a familiar requirement from the Ọwọn-Afa data. That the epenthesis option witnessed in Ọwọn-Afa is not available in Standard Yoruba shows that LEXNUCμ is undominated. Further, the fact that

[14]See footnote 4 for why a plausible output such */fi/ is disallowed.

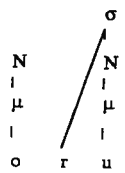
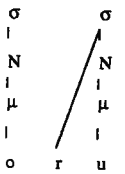
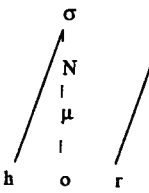
initial vowels do not augment to CV in VCV nouns is accounted for by ranking LEXRT above PARSENUCμ. The ranking that derives this effect is given in (52).[15]

(52) Non-exhaustive syllabification: PARSENUCμ violation

ONS, LEXNUCμ, LEXRT >> PARSENUCμ

The tableaux in (53) and (54) demonstrates the implementation of the established ranking in (52).

(53) PARSENUCμ is violable: ONS, LEXRT >> PARSENUCμ[16]

Input: /òru/	ONS	LEXRT	PARSENUC
✓a. 			*
b. 	*!		
c. 		*!	

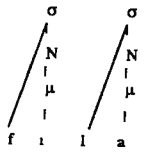
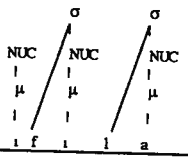
[15]Because *COMPLEX is neither violated nor crucially ranked with any other constraint in the processes discussed in this paper, it is left out of the discussion.

[16]Because the nuclear-mora is not syllabified, I assume, by the Weak Layering Hypothesis (Itô & Mester 1993), it incorporates into a foot with the syllable. Even though the unsyllabified mora does not respect PARSENUCμ, it still satisfies the principle of prosodic licensing as much as much as it can by linking to the foot.

In (53), the rightmost syllables in candidates (a), (b) and (c) are properly aligned; however, in (b) the leftmost syllable is ill-aligned at the left edge, since it lacks an onset consonant. This ill-alignment causes (b) to violate higher-ranked ONS and is consequently knocked out of the competition. Even though candidate (c) obeys ONS, it is still rejected because it violates high-ranking LEXRT. Candidate (a) does not violate ONS because it is not a syllable, it is properly licensed by the nuclear-mora. Notice that PARSENUC is violated by this candidate, but it still passes because of the low ranking status of the constraint.

LEXNUCμ, like LEXRT is a highly ranked constraint. Unlike LEXRT which may be violated under pressure to satisfy TRUNCσ,[17] the violation of LEXNUCμ is never induced by any high-ranking constraint in Yoruba. For example, ANCH-L never induces the violation of LEXNUCμ in forming distributives. The undominated status of LEXNUCμ is demonstrated in the following tableau.[18]

(54) LEXNUCμ is undominated: Failure of distributive reduplication in C-initial base

Input: /fìlà/	ANCH-L	LEXNUCμ
✓a. 		
b. 		*!

[17]The satisfaction of ONS in this context is further induced by PROP-HEAD, defined in (57). If the truncated forms are prosodic words, as argued in chapter 5, then, they must be properly headed containing at least a single instantiation of foot, syllable, nuclear-mora, and mora.
[18]The undominated status of will be established further in the discussion of minimality restrictions in chapeter 5.

One plausible candidate predicted by the ranking in (52) is one containing a sequence of unparsed nuclear-moras. Such forms are predicted to be well-formed because the absence of syllable results in the vacuous satisfaction of ONS. Thus, it should be possible for a form like /òru/ to surface as */ òu/ given the productive process of [r] deletion which applies in the language to forms that occur in the appropriate environment for deletion is satisfied. The repeated examples in (56) illustrate this process.[19]

(55)		Full form	[r] deletion		Gloss
	a.	òrùlé	òòlé		roof
	b.	orórì	oórì	*oóì	mausoleum
	c.	òru	*òu		midnight

Akinlabi (1993) proposes that [r] is susceptible to deletion because it is unspecified for CORONAL,[20, 21] Under this proposal the special (defective) property of [r] is structurally encoded into its underlying representation. Given the assumption that constraints do not hold of underlying

[19]In general, the rightmost syllable in a noun is retained in deletion. This property is captured by Word Right Edge Syllable Alignment constraint Ọla (1995).

[20]Among coronals, only [r] is argued to be unspecified underlyingly. The coronal node is thus assumed to be activated underlyingly for obstruents in Standard Yoruba. That is, obstruents are linked to the CORONAL node in the lexical entry. The claim that CORONAL is the default value in Yoruba raises a question on the epenthetic status of [h] in loans: why is [r] not the epenthetic consonant in loan syllabification if it is truly unspecified for place features? I would like to suggest two plausible answers to this question. Firstly, Nigeria was a British Colony and most of the loans are borrowed from British English, R.P., a variety of English in which a glottal stop [ʔ] may appear before vowel-initial words. When such words are borrowed, the glottal stop surfaces as a glottal fricative [h] since Yoruba does not have a glottal stop. In this respect, the [h] insertion reported for loans in (5) may be a property of direct borrowing from English. Lillooet (a Salish language) also inserts [h] in the same context as pointed out by Henry Davis. Secondly, assuming that we adopt the proposal that both [r] and [h] are unspecified for place features as advanced in Akinlabi (1991) and (1993) respectively, there is still a significant specification difference between these segments. If we compare the specification of glottal [h] with that of [r], the former *lacks* an oral place-node (both in the underlying and surface representations); hence, vacuously satisfies FILLPLACE since it has no Place node to be filled. The latter, on the other hand, *acquires* an oral place-node by default. This property seems to suggest that [h] is considered less specified than the [r].

[21]The second argument (and perharps the stronger one) for claiming that [r] is unspecified comes from the transparency of [r] to V-spreading in loans. See Akinlabi (1993) for details.

representations in OT, the proposed underspecified representation cannot be imposed on [r]. Thus, the condition governing [r] deletion is formulated along the same lines as the segmental sonority constraints motivated in chapter 2, the *Peak, *Margin constraints of P& S (1993):

(56) *M/COR[r]: [r] is not a good margin consonant

This constraint is obeyed in examples such as (56a,b) but is violated in words like (56c) where [r] surfaces. However, as shown earlier, the condition that a CV must be present in every word in Standard Yoruba overrides the process of deletion. Thus the deletion of [r] is not tolerated in the domain of minimality. This minimal condition is defined as Properheadedness (PROP-HEAD Itô & Mester 1992, Ọla 1995). This constraint will be discussed in detail in chapter 5.

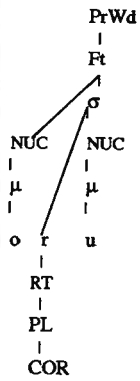
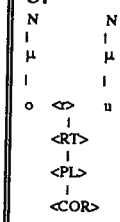
(57) PROP-HEAD: Every Prosodic Word contains a foot
Every foot contains a syllable
Every syllable contains a nucelus
Every nucleus contains a mora

*M/COR[r] is violated in the domain of minimality, that is, PROP-HEAD. This constitute an evidence that PROP-HEAD outranks *M/COR[r].

(58) PROP-HEAD, ONS NO-CODA >> PARSENUC, *M/COR[r]

The tableau in (59) demonstrates the effect of the ranking in (58).

(59) CV Minimality (Properheadedness) induced *M/COR[r]violation

Candidates	PROPHEAD	ONS	NO-CODA	PARSENUC	*M/COR[r]
✓a. 				*	*
b. 	*!			**	

In (59), a domain illustrating the implementation of PROP-HEAD, i.e. the CV minimality condition, candidate (a) incurs a violation of *M/COR[r]. This enables the satisfaction of PROP-HEAD. However, candidate (b) is non-optimal because it violates undominated PROP-HEAD to satisfy lowly ranked *M/COR[r].

Let us summarize the crucial points of the analysis. First, syllabification in Standard Yoruba requires the presence of an onset consonant and a syllable nucleus. The high ranking of ONS forces the violation of *M/COR[r] and LEXRT to guarantee the presence of Onsets for purposes of syllabification in templatically-conditioned and/or minimality-conditioned contexts. Second, it has been claimed that syllabification is non-exhaustive; in other words, not all segments are syllabically affiliated. For example, onsetless moras (nuclear or non-nuclear) are not parsed into the syllable node, but are licensed by the mora. This effect is derived by the low ranking of PARSENUCμ. The distributives provide evidence that PARSENUCμ is violable: only unparsed

nuclei are allowed at the left edge of the base and the reduplicant. Finally, as previously argued, the explicit assumption made about the interaction of PARSENUCμ and ONS is that an onsetless V violates only PARSENUCμ, not ONS. ONS is vacuously satisfied in this configuration since a PARSENUCμ violation entails that syllable structure is not erected. The story would be different if PARSENUCμ were undominated as would be the case in an exhaustive parsing system. In a system where all vowels must syllabify, PARSENUCμ must outrank ONS. This ranking would enforce Vs to syllabify whether or not they have onsets. This is what happens in Ondo as we will see in the next section.

3.7. Syllable structure in Ondo Yoruba

When syllable processes in Ondo (an Eastern Yoruba dialect) are considered, the syllabic asymmetries observed between CVs and Vs in the Standard dialect are neutralized. In particular, the loss of [r] in this dialect (Adetunji 1988) gives rise to the violation of a whole range of conditions that obligatorily hold of the Standard dialect. For example, [r]-less Ondo violates the CV minimality condition in lexical items which obligatorily contain [r] in Standard Yoruba, the three morphemic conditions are disrespected in words where [r] is lost, and the distributive reduplicant, a Ft, is expressed as VCV or VV.

3.7.1. Minimal Word Condition & the loss of [r]

As demonstrated in the preceding section, minimality conditions require the presence of a CV syllable in every word in Standard Yoruba. This requirement is shown to block the deletion of [r] in contexts where this segment would have otherwise deleted. Adetunji (1988) observes the complete loss of [r] in Ondo Yoruba and shows that words which have [r] in the Standard dialect do not surface with [r] in Ondo. This observation is made explicit by comparing the following cognates in Standard Yoruba and Ondo Yoruba.

(60)	Standard Yoruba	Ondo Yoruba	Gloss
	rí	í	see
	rà	à	buy
	rìn	ẹn [ɛ̃]	walk
	rù	ù	carry

(61)	Standard Yoruba		Ondo Yoruba	Gloss
	orí	*oɪ	oɪgho	head
	ọ̀rọ̀	*ọ̀ọ̀	ọ̀ọ̀	word
	ara	*aa	aa	body
	ẹ̀rɪn	*ẹɪn	ẹ̀ɪn [ɛ̃ĩ]	four

The loss of [r] in Ondo, as exemplifed above in (60,61) gives rise to sequences of Vs; consequently, words are either expressed as CV or V in this dialect, contra the scenario witnessed in the Standard dialect.

3.7.2. Word-initial Morpheme Condition: H-tone V, Nasal-V, H-back V

Consider next, the effect of the loss of [r] on the spellout of the three morpheme structure conditions in word-initial position. First, High tone words may either be C-initial or V-initial in Ondo. Because of the loss of [r], High toned intial vowels are quite common in this dialect. Cases involving monomorphemic words are given in (62), while those involving prefixation are shown in (62) below.

(62) High toned vowels freely occur word initially in Ondo

	Standard Yoruba	Ondo Yoruba	Gloss
a.	wúrà	wúà	gold
	nípọn	nípọn	thick
b.	réré	éé	far; deep
	rógódó	ógódó	small and round

(63) Prefixation: a high tone prefix may either be C-initial or V-initial in Ondo

	Standard Yoruba	Ondo Yoruba	Gloss
a.	ì-lọ	ù-lọ	going
	ì-jẹ	ù-jẹ	eating
	ì-rìn	ù-ẹ̀n [ù-ɛ̃]	walking
	ì-rẹjẹ	ù-ẹ́jẹ [ù-ɛ́dʒɛ]	cheating

b.	Standard Yoruba		Ondo Yoruba	Gloss
	lí-lọ	*í-lọ	lílọ	going
	jíjẹ	*í-jẹ	jíjẹ	eating
	rí-rìn	*í-rìn	í-ẹ̀n [í-ɛ̃]	walking
	rí-rẹ́jẹ	*í-rẹ́jẹ	í-ẹ́jẹ [í-ɛ́dʒɛ]	cheating

Observe in (63a), where the prefix bears a low tone, that the copying of the initial consonant of the base is neither triggered in the Standard variety nor Ondo dialect.[22] In contrast, in (63b), high tone

[22]Actually, the data in (63a) also illustrate another point of divergence between Standard Yoruba and Ondo Yoruba, as the former allows [u] to occur word-initially only if the word is C-initial (Also, see data in 65).

V prefixation is obligatorily accompanied by base consonantal copying in the Standard dialect. Consonantal copying in the standard forms is ensured because all verbal roots are consonant-initial. If a verb root is consonant-initial in Ondo a violation of this condition is avoided; but if a verb root is vowel-initial, as is the case with [r]-less roots, the high toned prefix is attached to the left edge of the root in violation of the (*#v́) constraint. Notice the attempt to avoid High tone initial words even in Ondo, as shown by the fact of C-copying in (63b). Thus lọ 'go' is rendered as lí-lọ 'going', not as *í-lọ as one might expect. This data may be accounted for if we assume that the prefix is a syllable which must be maximally filled. By the principle of syllable maximization, the syllable prefix in C-initial verbs is realized as CV, while in V-initial forms the prefix simply surfaces as V. Additionally, through C-copying the prefix is expressed as an unmarked syllable.

Given the observed variation in the treatment of syllabic constituents in these two dialects, specific questions arise for any account that characterizes syllabification as a uniform universal algorithm. Why are Vs characterized differently from CVs in the Standard dialect? Why does Standard Yoruba require the presence of onsets for syllabification? On the other hand, why are onsetless vowels permitted to group together with CV syllables in Ondo as illustrated in (60-63)? With these questions in mind, let us examine other phenomena that further illustrate the symmetrical behavior of CVs and Vs in Ondo.

Consider the characterization of other morphemic conditions that were earlier advanced as evidence showing that CVs and Vs are phonologically asymmetric in Standard Yoruba. Contrary to what obtains in the Standard, onsetless nasalised vowels and onsetless high back vowels may occur word-initially in Ondo. The examples in (64) show that initial nasalized vowels may either be C-initial or V-initial.

(64) Word-initial nasalised vowels may either be C-initial or V-initial in Ondo:

Standard Yoruba		Ondo Yoruba		Gloss
ìrù	[ɪru]	ùnùn	[ũũ]	tail
oúnjẹ	[oũdʒɛ]	unjíjẹ	[ũdʒídʒɛ]	food
rìn	[rĩ]	ẹ̀n	[ɛ̃]	walk
fọ́nrọ́n	[fɔ̃rɔ̃]	fọ́nọ́n	[fɔ̃ɔ̃]	strand

The examples in (65) show that word initial [u] may occur with or without a preceding onset consonant:

(65) Word-initial [u] may either be C-initial or V-initial in Ondo

Standard Yoruba	Ondo Yoruba	Gloss
ìdí	ùdí	buttock
ilé	ulí	house
rù	ù	carry
kú	kú	die
kùtà	kùtà	unsuccessful
burú	buú	wicked, bad

3.7.3. Distributive Reduplication

Recall that in order to form distributives in Standard Yoruba, prefixal reduplication targets the initial VCV in the word; word-initial unidentical VVs do not reduplicate as demonstrated in the repeated data given below:

(66) Distributive Reduplication in Standard Yoruba

a. VCV-initial noun

Base	Reduplicated Form	Gloss	Distributive
òru	òrò-òru	midnight	every midnight
ìrọ̀lẹ́	ìrì-ìrọ̀lẹ́	evening	every evening

b. VV-initial noun: does not reduplicate

owúrọ̀	òwò-òwúrọ̀	morning	every morning
òúrọ̀	*òò-òúrọ *òrò-òúrọ	morning	every morning

However, in forming distributives in Ondo, the impossible scenario noted for Standard Yoruba is indeed licit: VV nouns reduplicate in exactly the same manner as VCV nouns. The relevant data appear in (67).[23]

(67) Distributive Reduplication in Ondo Yoruba

VCV- and VV initial nouns reduplicate in Ondo

Base	Reduplicated Form	Gloss	Distributive
ewé	ewe-ewé	leaf	every leaf
ìla	ìlì-ìlà	line	every line
òu	òò-òu	midnight	every midnight
ìọ̀lẹ́	ìì-ìọ̀lẹ́	'evening	every evening

[23]In Ondo (OD), Monomorphemic CVCV nouns are not reduplicatable as distributives. One possible explanation for this gap is the observation that C-initial nouns are rare in Ondo. The few forms are possibly borrowings from the Standard (SY) variety. One piece of evidence that supports this suggestion is that consonant-initial monomorphemic nouns in Ondo also have alternative vowel-initial forms: fílà (SY) = àkòó (OD) 'cap', yàrá (SY) = oúpò (OD) 'room', baba (SY) = iba (OD) 'father' or bàbá = bài 'father', fèrèsé (SY) = uwólí (OD) 'window'.

The reduplication pattern in (67) suggests that there is no phonological contrast between onset-ful (CV) and onset-less (V) syllables. If this is so, then it is not surprising that the reduplicant foot prefix is realised as VV or VCV.

3.7.4. Vowel Hiatus Resolution

Finally, let us establish that onsetless syllables in Ondo do not begin with covert onsets, as is the case in languages such as French (h-aspiré) where covert consonants block the deletion of vowels in expected environments. The evidence is offered by vowel hiatus resolution in Ondo Yoruba. As is the case in Standard Yoruba, when two vowels occur at morpheme junctures, a hiatus context arises. In cases involving verb-noun collocations, vowel deletion is triggered to eliminate the hiatus.[24] As shown by the data in (68), deletion does not apply when the noun is consonant-initial. However, when the noun begins with an initial vowel, one of the vowels deletes.[25] The following data illustrates this point:

(68) Vowel Hiatus Resolution: vowel deletion (Data from Adetunji 1988)[26]

Verb + C-initial Noun	Gloss		Verb + C-initial Noun			Gloss
í bàtà	see the shoe	vs.	í aṣọ	→	áṣọ	see the dress
tà kòkó	sell cocoa	vs.	tà ewé	→	tewé	sell leaves
sè kókò	cook cocoyam	vs.	se ọbẹ̀	→	sọbẹ̀	cook meat
pa Dàda	kill Dada	vs.	pa uọ́	→	puọ́	kill a lie (to lie)

[24]Other strategies for resolving vowel hiatus in Standard Yoruba include vowel assimilation and coalescence. See Pulleyblank (1988) and the references cited therein for a detailed account of various vocalic processes which result from hiatus contexts.
[25]Like Standard Yoruba, the vowel of the verb tends to delete in the general pattern. However, at times, it is the vowel of the noun that deletes. See Adetunji (1988) for details.
[26]Also confirmed in my findings on Ondo.

The data in (68) where (a) vowel deletion is blocked in C-initial nouns and (b) one of the vowels in conjunction is deleted in V-initial nouns, show that there are no covert consonants in Ondo. If a covert consonant is present in the vowel-initial nouns, deletion ought to be blocked. The deletion process also suggests that the language creates CV syllables where possible, a fact that supports the claim that syllables are optimally CV in the unmarked case.

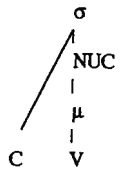
3.7.5. Summary and Interim Analysis

In summary, we have seen that Vs, with or without preceding onsets, behave as phonological syllables in the morpho-phonemics of Ondo. In Ondo, unlike in Standard Yoruba, CV and V do not contrast phonologically. So, how do we account for syllabification in Ondo? Clearly, CVs syllabify in this dialect; this must be the case under any analysis of syllabification. What about onsetless Vs? Are they also syllabified as CVs with covert onsets or do they remain unsyllabified as Vs do in the Standard dialect?

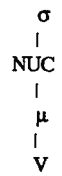
The first proposal which entails rendering Vs phonologically unsyllabified is a non-starter. This is because the data presented obviously show that the two dialects diverge in terms of how onsetless Vs are treated. The assumption that Vs do not syllabify in Standard Yoruba accounts for why they contrast with CVs in the phonology. But this analysis fails in Ondo, where there are no contrasts between CVs and Vs. However, if exhaustive parsing is adopted, Vs without onsets will parse into syllables in exactly the same manner as CVs, and the observed similarities between CVs and Vs will follow logically. The second proposal, which entails an analysis where onsetless syllables are treated as Vs with covert onsets, also fails because the facts of vowel deletion discussed in the previous section show that onsetless Vs are not syllabified with covert onsets. The structural representation, of syllables in Ondo are given below:

(69) Vowels are syllabified with or without onsets

a. Onset-ful syllable



b. Onset-less syllable



3.7.6. An Optimality account of Syllabification in Ondo Yoruba

As shown in the preceeding discussion, adherence to the Onset Principle is not obligatory in Ondo Yoruba. Thus, it is possible to have phonological syllables without onsets. Recall that the factors that converge to enforce this requirement are (a) the loss of [r], (b) the absence of [h] epenthesis. What this means in Optimality terms is that the constraints *M/COR[r] and LEXRT are undominated. Therefore, these constraints can never be violated to generate the presence of onsets for syllabification in Ondo dialect. The undominated ranking of these constraints in Ondo contrasts with their low ranking in the Standard dialect, a ranking that enforces the presence of onsets for syllabification in minimality-conditioned or templatically-conditioned environments. The obligatory satisfaction of higher-ranked *M/COR[r] and LEXRT gives rise to V-only words in Ondo.[27]

(70)

Standard Yoruba			Ondo Yoruba		
rí	[rɪ]		í	[ɪ]	'see'
rà	[ra]		à	[a]	'buy'
ara	[ra]	*aa	aa	[aa]	'body'
ẹrin	[ɛrĩ]	*ẹin	ẹin	[ɛĩ]	'four'

[27]Placeless nodes, specified or unspecified, are generally not tolerated in Ondo. This implies that FILLPLACE is also inviolable in Ondo. For instance, in addition to the loss of [r], Ondo has no words containing [h]. Words with [h] in the Standard (SY) surface in Ondo (OD) as a glide corresponding in backness to a flanking vowel: ihò 'SY, hole' vs. uwò 'OD, hole'; hó 'SY, boil' vs. wó 'OD, boil'.

The data in (70) exhibits one of the major points of divergence between Ondo and the Standard dialect. Standard Yoruba, as shown, never allows V-only words: a phonological syllable is required in every word by properheadedness. Syllabification is achieved in Standard Yoruba if only there is an onset and a nucleus in the syllable; thus, only a CV can satisfy properheadedness. Because Ondo permits V-only words and allows Vs to count for syllabic processes (morphemic constraints and reduplication), one is led to conclude that CVs and Vs are licit phonological syllables in this dialect. The facts of Ondo are straightforwardly analyzed as resulting from the high ranking of PARSENUCμ, NO-CODA, *M/COR[r], and LEXRT, and the low ranking of ONS:

(71) Exhaustive Syllabification: High ranking of PARSENUCμ

PARSENUCμ, NO-CODA, *M/COR[r], LEXRT >> ONS

The tableau in (72) depicts the effect of ranking PARSENUCμ and *M/COR[r] above ONS.[28] (NO-CODA is undominated in Ondo. It is omitted in tableau (72) because it is not crucial for the point of focus.)

[28]LEXRT is not included in the the tableau because it is a general constraint that holds throughout the grammar in Ondo. This claim is evidenced by the fact that there are no words with [h] either in the lexical entry or in derived contexts in the dialect (see note 27). This makes a prediction that speakers of Ondo will not epenthesize [h] prevocalically in V-initial loans. I have to check this prediction with speakers.

(72)[29] PARSENUCμ is undominated in Ondo

Input /òru/	PARSENUCμ	*M/COR[r]	LEXRT	ONS
✓a. σ σ, N N, μ μ, o <r> u				**
b. σ σ, N N, μ μ, o C u, RT			*!	
c. σ σ, N N, μ μ, o r u, RT, PL, COR		*!		
d. N N, μ μ, o <r> u	*!			

The candidate in (72a) satisfies the high ranking constraints: PARSENUCμ, NO-CODA, *M/COR[r]; it violates ONS which is a lower-ranked constraint twice; nonetheless, this candidate incurs a minimal penality. It is in fact the optimal output. By contrast, the candidates in (72b,c&d) are impossible surface forms because they (fatally) violate one high ranking constraint or the other; (72b) violates LEXRT, (72c) violates *M/COR[r], and (72d) violates PARSENUCμ.

[29]Whether or not [r] is part of the underlying structure in Ondo, the ranking established will prevent it from appearing on the surface. In other words, the absence of [r] is a lexical property of the grammar, not an idosyncratic property of lexical items.

Under the assumption that Vs (with or without onsets) exhaustively parse into syllables by higher-ranked and inviolable PARSENUCμ, the distributive reduplication pattern attested in Ondo follows logically (67, repeated below as 73).

(73) Distributive Reduplication

<u>VCV- and VV initial nouns reduplicate in Ondo</u>

ewé	→	ewe-ewé	'leaf'	→	'every leaf'
ìọ̀lẹ́	→	ìì-ìọ̀lẹ́	'evening'	→	'every evening'

The reduplicant here is simply stated as a disyllabic foot prefix which may be spelt out as either VV or VCV by the syllabification algorithm of the dialect.

3.8. Interdialectal variation in syllabification through constraint rankings

Thus far, phonological syllabification has been analyzed as either exhaustive (Ondo) or non-exhaustive (Gokana, Ọwọn-Afa, Standard Yoruba). Recognizing the viability of both approaches raises the question of how to characterize this diversity. In particular, how do we express this typological variation in formal terms without resorting to ad hoc rules and/or filters? It is not immediately obvious how this problem would be handled in standard phonological theory. However it is tackled, this typological variation can at best be captured in terms of descriptive statements augmented with specific rules and/or filters such as the Onset Principle (40, Avoid σ[V). A plausible standard account of the interdialectal diversity in syllabification is given below:

(74) a. <u>Non-exhaustive Parsing</u>:

In Standard Yoruba, the Onset Principle is *strongly* invoked for syllabification (Itô 1989). Thus, only CVs are syllabified. Onsetless Vs violate this condition and

consequently remain unsyllabified in the phonology. The mora, being a valid prosodic licenser, guarantees the phonetic interpretation of onsetless Vs (Bagemihl 1991, etc).

b. Exhaustive Parsing:

In Ondo Yoruba, the Onset Principle is *weakened*, thus, both CVs and Onsetless Vs are syllabically affiliated.

In Parameterized-based approaches, this difference could be formalized as follows (YES means parameter turned "on" NO means parameter turned "off"):

(75)

Yoruba	ONSET
a. Standard	YES
b. Ondo	NO

Even with statements such as given in (74), or the Yes/No parameter setting proposed in (75), questions still arise for such accounts. Why is the Onset principle strongly invoked in one dialect of a language and not in the other? What drives the obligatory satisfaction of the Onset principle in one dialect and not in the other? What does it mean to be *strongly* invoked vs. *weakened* in formal terms? Why should a parameter be totally activated in one dialect of a language? Why on the other hand should the same parameter be totally inert in another dialect of the same language? These questions cannot be easily answered in standard phonological theory. For example, under a standard analysis, the syllabification algorithm of Standard Yoruba (74a) and Ondo (74b) would simply be treated as different. There is no formal mechanism within standard accounts for integrating this distinction into an analysis. Parameter-based approaches also face problems in accounting for why some syllables have onsets in the dialect where ONSET is supposedly turned "off". As observed, even in Ondo, syllables must have onsets if they can without violating either LEXRT or *M/r. A formal analysis is offered by Optimality Theory which

states that typological differences follow from the variable ranking of the constraints made available by Universal Grammar.

In Optimality Framework, the crucial constraints at issue are PARSENUCμ and ONS.[30] ONS is inviolable for syllabification in Standard Yoruba, hence, undominated in the ranking hierarchy. However, PARSENUCμ ranks relatively low since onsetless Vs are never parsed into syllables. In Ondo, the reverse holds in terms of ranking: PARSENUCμ is inviolable whereas ONS is violable. This ranking enables vowels to syllabify even if they do not have onsets. The relevant rankings are given in (76) below:

(76) Interdialectal Syllable Structure Typology

Dialect	Exhaustivity of parsing (syllabification)	Constraint Rankings
a. Standard Yoruba	Only vowels with onsets syllabify (non-exhaustive syllabification)	ONS >> PARSENUCμ
b. Ondo Yoruba	Vowels, with or without onsets syllabify (exhaustive syllabification)	PARSENUCμ >> ONS

This analysis shows that typological variations in syllabification, both interdialectal and crosslinguistic, can be reduced to a difference in constraint ranking. Through the principles of violability and ranking, the seemingly conflicting syllabification hypotheses (exhaustive vs. non-exhaustive accounts) in moraic theory, which could not be intergrated into an analysis in standard account receive a straightforward analysis in Optimality Theory.

3.9. Syllable structure in Ẹmai

The last case to be presented is Ẹmai, an Ẹdoid language of Nigeria. Like Ondo Yoruba, Ẹmai does not differentiate the syllabicity of vowels based on the presence or absence of onsets: vowels in Ẹmai behave as syllables even if they do not have onsets. First, evidence from the shape

[30]As demonstrated in this chapter (3.3 and 3.4), a language specific constraint, *M/COR[r] is also crucial for syllabification. I set aside these specific constraints here, focussing instead on constraints which are more general in scope for any analysis of syllabification.

of verbal roots and reduplication is presented to back up this claim. Second, the ranking established for Ondo Yoruba is adopted in accounting for syllabification in Ẹmai since both languages exhibit the same syllable pattern.

3.9.1. Syllable types in Ẹmai

Ẹmai has verbal roots which may be consonant-initial or vowel-initial as shown below (data from Egbokhare 1990):

(77) Verbal root

a.	tà	say
	gbè	beat
	dà	betray
b.	è	eat
	ɔ̃	drink
	ù	die

In incorporating emphasis (which indicates that the speaker's intension, expectation or belief has been violated) into verbs, a syllable prefix is attached to the verbal root. The vowel of this prefix is consistently realised as a high toned [i]. The shape of the prefix is dependent upon whether or not the root is consonant-initial. If the verb is consonant-initial, such as the forms in (77a), the prefix copies the initial consonant and surfaces as [Ci]. If, on the other hand, the verbal root is vowel-initial, the prefix is realised as a high toned [i].

(78)	Base	Derived form	Gloss
a.	tà	tí - tà	say; still say
	gbè	gbí - gbè	beat; still beat
	dà	dí - dà	betray; still betray
b.	è	í - è	eat; still eat
	ɔ̃	í - ɔ̃	drink; still drink
	ù	í - ù	die; still die

From the prefixation pattern presented above, Ẹmai seems to allow syllables with or without onsets. In this regard, it behaves like Ondo Yoruba, which was presented in the previous section.

Reduplication presents futher evidence illustrating the symmetric characteristics of CV and V syllables. In marking aggregation in nouns and numerals, either a VCV or VV is prefixed to the base, as illustrated in these examples.[31]

(79)	Base		Reduplicant	Gloss
	ìkpòsò	(ìkpì - ìkpòso)	ìkpì - kpòsò	women; all women
	ímɔ̀hè	(ímí - ìmɔ̀he)	ímí - mɔ̀hè	men; all men
	èvá	(èvè - èvá)	èvè - va	two; both
	èéà	(èè - èéà)	èè - éà	three; all three

This pattern again is familiar from Ondo Yoruba where foot reduplication is freely spelt either as VCV or VV. The above two properties, (a: minimally, words may be CV or V, and b: syllable and foot reduplicative templates are either CV or V and VCV or VV respectively) argue that vowels are syllabified in Ẹmai regardless of whether they have onsets or not.

[31]In (79), a process of deletion deletes one of the adjacent vowels in the reduplicated form. It is not clear which mora deletes, that of the base or the reduplicant.

3.9.2. Ẹmai syllable structure: an OT account

Since Ondo Yoruba and Ẹmai allow vowels to syllabify with or without onsets, it is expected that the same constraint ranking is applicable to both languages. For example, by ranking PARSENUCμ highly, all vowels are require to syllabify. By ranking ONS lowly, the fact that some syllables surface without onsets is accounted for. This ranking, previously established for Ondo Yoruba, predicts the symmetric characterization of onset-less Vs and onset-ful syllables (CVs).

(80) Exhaustive Syllabification in Ẹmai: PARSENUCμ outranks ONS

PARSENUCμ, NO-CODA, LEXRT >> ONS

To illustrate the validity of this ranking, consider how it accounts for the syllable reduplication data in (79) where the reduplicative prefix is either realised as CV or V, depending on whether the base begins with a consonant or vowel.

(81) RED = σ, PARSENUC, LEXRT >> ONS

Base: ta	RED = σ	PARSENUC	LEXRT	ONS
RED: ✓ a̤. tɪ - ta				
b. ɪ - ta				*!
c. hɪ-ta			*!	

In (81), the difference between candidate (a) and candidate (b) lies in the satisfaction of ONS since both satisfy all other contraints. By violating ONS, albeit a lower-ranked constraint, candidate (b) loses in the competition. The grammar selects (a) as the winner because it satisfies ONS, a property which makes it a better syllable. Candidate (c) is presented to show that LEXRT is not a possible option for satisfying ONS.

Compare this situation with a case involving an onsetless syllable base:

(82) RED = σ, PARSENUC, LEXRT >> ONS

Base: /e/	RED = σ	PARSENUC	LEXRT	ONS
RED:✓ a. ɪ - e				*
b. hɪ - e			*!	
c. ɪ - he			*!	
d. hɪ - he			*!*	

Note that candidate (a), the optimal form, is chosen as the winner even though it does not have an onset, affirming the low-ranked status of this constraint. The failure of (b, c, d) show that it is better to violate ONS, a lower-ranked constraint than it is to violate LEXRT in Ẹmai.

3. Summary of typological rankings

This chapter has examined syllabification in five languages focussing on the properties of onsetless Vs. Two types of patterns are attested. First, there is a scenario (illustrated in languages such as Gokana, Ọwọn-Afa and Standard Yoruba) where vowels act as syllables only when they have onsets. The ranking established for this class of languages is one where ONS crucially outranks PARSENUCμ. The second situation, demonstrated by Ondo Yoruba and Ẹmai, involves cases where vowels behave as syllables, with or without onsets. This system is shown to derive from the opposite ranking, PARSENUCμ dominates ONS. These constraints interact with faithfulness constraints such as LEXRT and LEXNUCμ. The ranking of LEX constraints, as demonstrated in the languages discussed either induce or prevent augmentation of a phonological constituent to a desired shape. A summary of the attested rankings appears in (83).

(83) Variable ranking of ONS and PARSENUCμ and Faithfulness Constraints

Language	Ranking
Gokana	ONS, LEXNUCμ >> PARSENUCμ, LEXRT
Ọwọn-Afa	ONS, LEXRT >> PARSENUCμ, LEXNUCμ
Standard Yoruba	ONS, LEXNUCμ >> LEXRT >> PARSENUCμ
Ondo Yoruba	PARSENUCμ, LEXRT, LEXNUCμ >> ONS
Ẹmai	PARSENUCμ, LEXRT, LEXNUCμ >> ONS

Chapter 4

Footing and Headedness in non-stress systems

4. 1. Introduction

One of the fundamental arguments motivating foot structure is the observation that in stress systems, stress is assigned to groupings of syllables; groupings which may either be in twos or in an unbounded shape form (Liberman 1975, Prince & Liberman 1977, Hayes 1981, to mention a few). In formal terms, the first foot type, which is the focus of interest in this chapter, is referred to as a binary foot. A binary foot selects any two members of the prosodic constituent below the foot level (mora, nuclear-mora or syllable), one of which is usually the strong member or the head. There is also a weak member which occupies the non-head position. In metrical phonology, stress is always assigned to the strong member, which occupies the head position within the foot.

Foot structure is also present in non-stress systems. In tone languages, where tone rather than stress is used for lexical contrast, evidence for foot structure usually comes from the empirical domain of prosodic morphology such as reduplication and truncation. Featural processes may also select the foot rather than morphological constituents as domain. This chapter documents evidence of this type from non-metrical systems in Benue-Congo languages.

The claim that non-stress systems make use of foot structure raises a number of theoretical issues. These issues concern the nature and properties of foot structure: issues relating to binarity, headedness, and the issue of whether or not there is a distinction between metrical and morphological feet. Views on these issues vary in the phonological literature. Let us begin by establishing the two major points of agreement.

First, foot structure is assumed to be the organizing node for groupings of moras and syllables. The main significant argument for this proposal comes from the observation that certain

processes such as stress and reduplication apply within a domain which is larger than the mora or syllable and smaller than the word. The formal implementation of this observation is the proposal that the foot is the organizing node or constituent under which moras and syllables are grouped to form the domain for the application of processes like stress assignment and reduplication. The question then is: how many tokens of the mora or syllable are permitted to group together under the foot?

This question leads us to the second point of agreement: the notion of binarity. The general pattern in assigning bounded stress to metrical constituents is to group moras or syllables together in twos. This property serves as the basis for the proposal that, in the unmarked case, foot well-formedness is determined by the principle of binarity: a foot is maximally binary either at the moraic or syllabic level (Hayes 1980, Hammond 1990, Prince 1991, M&P 1993a).

Beyond this point, opinions differ on other issues: Are there degenerate feet? Do ternary feet occur in languages? Is there a distinction between metrical and morphological feet? Are all feet headed? As regards the first two questions (on degenerate and ternary feet), there are two opinions in the literature. According to one view, although languages prefer binary branching feet, the existence of degenerate and ternary feet cannot be denied (Everett and Everett 1984, Levin 1988a, Rice 1991, Crowhurst 1991, Hayes 1995, to mention a few). According to the other view, degenerate and ternary feet are impossible and thus banned by UG as possible foot types in languages (Hayes 1991, Kager 1989).

The last two questions (on metrical vs. morphological distinction and headedness) are of particular interest in this chapter for the following reason. The languages to be examined here are non-stress, yet they utilize foot structure for prosodic morphology. The critical question to be answered regarding the property of foot structure in these languages is this: is the foot structure in a non-metrical system metrical or morphological? To answer this question, the notion of headedness in footing is quite significant. Again two views are expressed on headedness and foot structure in phonological literature. In M&P (1986, 1990), all foot types, metrical or morphological, are headed. Crowhurst (1991) takes the opposite view and argues based on the

notion of headedness that there is a distinction between metrical and morphological feet: metrical feet have heads whereas morphological feet lack heads.

These two views make different predictions on the phonological relationship of foot constituents. The first view, where a head is an obligatory component of foot structure, predicts asymmetry between the two prosodic units (mora, syllable) contained within the foot: the head is assigned a special status while the non-head is not. Under the second view, however, since a morphological foot lacks a head, neither of the two prosodic members of the foot is more special than the other, predicting the absence of complete asymmetry. The choice of either view is dependent on empirical justification. The cases to be presented here from non-metrical systems provide support for the proposal that feet are headed.

The remaining discussion is organized as follows. Section 4.1. presents evidence for foot structure from the empirical domain of reduplication in Standard Yoruba, Ọwọn-Afa and Ibibio. Three types of asymmetries provide evidence for headedness in these languages. First, in Ibibio and Ọwọn-Afa, heads of feet are bimoraic. This requirement induces the lenghtening of short vowels, leftmost vowel lenghtening Ibibio (left-headedness, trochaic foot) and rightmost vowel lenghtening in Ọwọn-Afa (rightheadedness, iambic foot). Second, in Ibibio CVCV words, obstruents are tolerated in the initial syllable while they are disallowed as onsets in the second syllable; this constraint induces weakening of obstruents to fricatives and [r]. Third, in Yoruba, the rightmost syllable in a VCV sequence is accorded a special status in the phonology. Section 4.2. turns to the prosodic domain of truncation and demonstrates with facts from Yoruba that foot structure plays a crucial role in capturing the process of shortening. The overall analysis will be presented within OT. Much work on prosodic morphology within OT has focussed on reduplication, while truncation has received very little attention (though see Hewitt 1994, Ọla 1995). This chapter will touch on the issue of how to formalize the similarities and contrasts between reduplication and truncation within OT. Specifically, the status of PARSE - SEG is examined with respect to the input-output relation of the base and the reduplicant and the base and the truncative. M&P (1994) argue that sub-total reduplication entails violations of MAX but not

violations of PARSE because the base is present in the output of reduplication. In truncation, however, the base is never present in its entirety in the output, a factor that suggests that PARSE violations are incurred. Section 4.3. discusses the theoretical implications of this work and section 4.4. summarizes the chapter.

4.2. Non-metrical Foot: Evidence from Reduplication

In this section, I will present evidence for foot structure from the empirical domain of reduplication. Data will be presented from Yoruba, Ọwọn-Afa and Ibibio showing that the foot is binary and headed in these languages. In Standard Yoruba, headedness is determined on the basis of syllabification (only vowels with onsets are potential heads, vowels without onsets occupy the non-head position). In Ọwọn-Afa and Ibibio, the notion of headedness is motivated by the bimoraic requirement imposed on the head, a factor which triggers vowel lengthening when the head contains an open light syllable. In another process in Ibibio, syllables in CVCV words exhibit asymmetries with respect to the tolerance of obstruents: the first syllable tolerates obstruents while obstruents are generally weakened in the second syllable. This is treated as a case involving asymmetries between the head and non-head position within the foot.

4.2.1. Foot Structure in Yoruba

Four types of phonological phenomena are given as evidence for foot structure in Yoruba: (a) Ideophone Reduplication signifying disorderliness, (b) Agentive reduplication, (c) Numeral Distributive, (d) Back Harmony. Each process is discussed in the following sub-sections.

4.2.1.1. Ideophone Reduplication

Awoyale (1974, 1989) documents a copious number of reduplicative processes involving ideophones in Yoruba. These processes exhibit interesting patterns which are significant for the theory of prosodic morphology. Two basic patterns are observed: the non-templatically governed and the templatically constrained. Let us examine the first pattern. Virtually all ideophones undergo total reduplication of both the segmental and tonal melody and the resulting meaning is "even intensity". Representative data appear in (1). The meaning of the base form appears in the gloss, to this is added the meaning "even intensity" after reduplication.

(1) Ideophone Reduplication signifying "even intensity": total reduplication

Base	Reduplicated Form	Gloss
ràkọ̀	ràkọ̀-ràkọ̀	dull (appearance or color)
ròdò	ródò-ròdò	bright
róbótó	róbótó-róbótó	small and round (object)
gbàgìdì	gbàgìdì-gbàgìdì	bulky
fẹ́rẹ́gẹ́dẹ́	fẹ́rẹ́gẹ́dẹ́-fẹ́rẹ́gẹ́dẹ́	large and wide
gbàràgàdà	gbàràgàdà-gbàràgàdà	falling

From the viewpoint of prosodic morphology, the above process involving total reduplication is not prosodically governed, a situation in which morphology takes precedence over prosody. In OT (M&P 1993, 1994), total reduplication is governed by the following undominated constraint.

(2) Constraint governing total reduplication in OT

MAX : The reduplicant is identical to the base

With this constraint, we can account for the data in (1) as follows

(3) MAX is undominated

BASE:	MAX
REDUP: ✓a. fẹrẹgẹdẹ - fẹrẹgẹdẹ	
× b. fẹrẹgẹdẹ - gẹdẹ	*!***
× c. fẹrẹgẹdẹ - rẹgẹdẹ	*!*
× d. fẹrẹgẹdẹ - fẹrẹgẹ	*!*

In (3), the last three candidates are rejected because they violate the undominated constraint: reduplication is partial, not total, in these forms. The first candidate which reduplicates in its entirety, in contrast obeys MAX and is selected as the optimal form.

Let us turn to the templatically governed type of reduplication. In expressing "disorderliness", only a subset of ideophones are selected for reduplication. Consider the data in (4) below.

(4) Ideophone Reduplication signifying "disorderliness"

Base	Reduplicated Form	Gloss
jàlà	jála-jàla	moving shabbily
bàlù	bálu-bàlu	unsteady movement
yẹ̀lẹ̀	yẹ́lẹ-yẹ̀lẹ	carelessly
wùrù	wúru-wùru	disorderly
ràdà	ráda-ràda	sluggish
bòrò	bóro-bòro	open and drippy

As shown by the data in (4), the base of reduplication is always two syllables long and it reduplicates totally. The tonal melody expressing "disorderliness", HMLM, maps on to the vowels of the reduplicant from left-to-right, displacing whatever tone the base originally had. By merely

looking at the data in (4), one could hypothesize that this is yet another instantiation of total reduplication, as shown for example in the data in (1). However, a difference emerges when longer bases are considered: reduplication fails to apply. Relevant examples appear below.

(5) Unattested Forms:

Base	Reduplicated Forms	Gloss
rẹ̀pẹ̀tẹ̀	*rẹ́pẹtẹ-rẹ̀pẹtẹ	bulky (soft)
gbàràgàdà	*gbárágáda-gbàràgada	falling

The contrast in the reduplication process in (4) and (5) is accounted for if we assume, following Downing (1994), that prosodic restrictions may be imposed on the base of reduplication, in this case the prosodic requirement that the base of reduplication must be a foot. Formalized within OT, the prosodic conditions governing the reduplication pattern in (4) is defined as follows:

(6) Prosodic Constraints governing the shape of the base and the reduplicant:

a. BASE = Foot

b. RED = Foot

Both constraints are undominated, as evident from a comparison of the following two tableaux.

(7) BASE = Ft, RED = Ft

BASE: /bàlù/	BASE = Ft	RED = Ft
✓a. bálu - bàlu		
b. bálu - bà		*!

The second candidate in (7) is sub-optimal because the reduplicant is not a binary foot, a factor that prevents the tonal specification of this reduplicative process (HMLM) from being fully realised. The option of linking the two tonal melodies - LM - to a single vowel or tone-bearing unit

(μ) is unavailable in Yoruba because of the one-to-one linking constraint between mora and tone in the phonology. Candidate (7b) therefore emerges as the winner, since the base and the reduplicant are binary footed.

Now, consider tableau (8).

(8) BASE = Ft, RED = Ft

BASE: /rẹ̀pẹ̀tẹ̀/	BASE = Ft	RED = Ft
✗ a. rẹ́pẹtẹ-rẹ̀pẹ	*!	
✗ b. rẹ́pẹtẹ-rẹ̀pẹtẹ	*!	*

Tableau (8) involves a situation where the base violates the binary foot condition imposed on it by the grammar. This accounts for why both candidates are rejected. Notice that (8a) is still ill-formed in spite of the fact that the reduplicant obeys RED = Ft, a fact that shows that BASE = Ft is equally undominated. Both constraints must be satisfied for the output to be well-formed, as demonstrated by the licitness of (7b: bálu - bàlu). The optimal situation for longer forms is a Null Parse (M&P 1993a: 112), defined as follows

(9) M-PARSE

Morphemes are parsed into morphological constituents

Although this constraint was originally formulated to capture the failure of morphological parsing in cases where illicit outputs would result (e.g. {think, ation} which never surfaces in English), it may be applied to prosodically constrained processes such as the data forms in (5). If BASE = Ft and RED = Ft outrank M-PARSE, the optimal output is the one which does not reduplicate.

(10) BASE = Ft, RED = Ft >> M-PARSE

BASE: /rẹ̀pẹ̀tẹ̀/	BASE = Ft	RED = Ft	M-PARSE
a. rẹ́pẹtẹ-rẹ̀pẹ	*!		
b. rẹ́pẹtẹ-rẹ̀pẹtẹ	*!	*	
✓ c. rẹ̀pẹ̀tẹ			*

The proposal that this process is foot-constrained provides a straightforward explanation for the well-formedness of the forms in (4): the base of reduplication is a foot and meets the prosodic condition imposed on the base. The failure of reduplication in (5) is also explained because the base of reduplication is longer than a foot.

4.2.1.2. Agentive Reduplication

A second argument for foot structure is provided by agentive reduplication (Pulleyblank & Akinlabi 1988). Reduplicated agentives are productively formed when the following conditions are satisfied: (a) a CVCV verb phrase (comprising a CV verb and a VCV object reduced to CVCV by vowel deletion) is the base of reduplication, (b) the CVCV is reduplicated in its entirety. The following data show this process.

(11) Agentive Reduplication

Base	Reduplicated Form	Gloss
kólé	kólé-kólé	invade a house; thief
jẹ̀dí	jẹ̀dí-jẹ̀dí	eat anus; pile
yínrùn	yínrùn-yínrùn	twist neck; meningitis
lámı	lámı-lámı	lick water; a type of water insect
náwó	náwó-náwó	spend money; extravagant person
jayé	jayé-jayé	enjoy life; lover of pleasure

Again, the pattern of reduplication in (11) is accounted for if we assume that there is a Foot limit prosodic restriction on the base and the reduplicant. The same constraints required for the ideophone-type reduplication (bálu - bàlu *versus* rẹ́pẹtẹ-rẹ̀pẹtẹ) are also needed in this case (6 is repeated for ease of reference):

(12) Prosodic Constraints governing the shape of the base and the reduplicant:

a. BASE = Foot

b. RED = Foot

The following tableau demonstrates the relevance of these constraints.

(13) BASE = Ft, RED = Ft

BASE: /kólé/	BASE = Ft	RED = Ft
✓a. kólé - kólé		
✗ b. kólé-kó		*!

Candidate (13a) does not fully satisfy the constraint requirement: it obeys BASE = Ft, but fails RED = Ft and is thus considered ill-formed. Candidate (b), on the other hand, satisfies both constraints and surfaces as the winner.

Pulleyblank & Akinlabi (1988), however document some examples which do not conform to the general pattern described and analysed above:

(14)	Base	Reduplicated Form	Gloss
	ṣòdodo	ṣòdodo-ṣòdodo	truthful person (ṣe 'do' òdodo 'truth')
	ṣèbàjẹ́	ṣèbàjẹ́-ṣèbàjẹ́	evil-doer (ṣe 'do' ìbàjẹ́ 'badness')
	yánıláṣọ	yánıláṣọ-yánıláṣọ	cloth-lender (yá 'lend' ẹnı 'person' ní 'syntactic case marker', aṣọ 'cloth')
	fẹ́nılọ́mọ	fẹ́nılọ́mọ-fẹ́nılọ́mọ	somebody who takes peoples' daughters and marries them (fẹ́ 'marry' ẹnı 'person' ní 'syntactic case marker' ọmọ 'child')

The data in (14) have two exceptional properties which distinguish them from the data in (11). First, unlike the forms in (11), each of the forms in (14) have another agentive variant which is derived by attaching /a/ -prefix to the verb phrase.

(15)	Base	Prefixed Form	Gloss
	ṣòdodo	a-ṣòdodo	truthful person (ṣe 'do' òdodo 'truth')
	ṣèbàjẹ́	a-ṣèbàjẹ́	evil-doer (ṣe 'do' ìbàjẹ́ 'badness')
	yánıláṣọ	a-yánıláṣọ	cloth-lender (yá 'lend' ẹnı 'person' ní 'syntactic case marker', aṣọ 'cloth')
	fẹ́nılọ́mọ	a-fẹ́nılọ́mọ	somebody who takes peoples' daughters and marries them (fẹ́ 'marry' ẹnı 'person' ní 'syntactic case marker' ọmọ 'child')

But it is impossible to have the same process apply to the forms in (11):

(16)	Base	Reduplicated Form		Gloss
	kólé	kólé-kólé	*a-kólé	invade a house; thief
	jẹ̀dí	jẹ̀dí-jẹ̀dí	*a-jẹ̀dí	eat anus; pile
	yínrùn	yínrùn-yínrùn	*a-yínrùn	twist neck; meningitis
	lámı	lámı-lámı	*a-lámı to	lick water; a type of water insect
	náwó	náwó-náwó	*a-náwó	to spend money; extravagant person

Second, unlike the forms in (11, repeated in 16) which are accepted by all speakers, there is a split judgement among speakers with respect to the acceptability of (14). For some, they are marked but possible forms (A. Akinlabi, personal communication); for others, they are simply impossible. For the latter type of speaker the forms in (15) are the only acceptable forms for agentives whose verbal bases exceed two syllables.

The exceptional properties of (14) are explained if, as proposed, there is a foot limit restriction on the base and the reduplicant. In (14), both the base and the reduplicant are larger than a foot and are predicted to be marked, as they turn out to be.

4.2.1.3. Numeral Distributive

A third argument for foot structure in Yoruba comes from distributive numerals which are productively derived by reduplicating the leftmost VCV in the base: If the base is a VCV, as in (17a), total reduplication applies, if on the other hand the base is longer as in the forms in (17b), the leftmost VCV is reduplicated. Consider the following examples.

(17) Distributive Numerals

	Base	Reduplicated Form	Gloss
a.	ọ̀kan	ọ̀kọ̀-ọ̀kan	one
	èjì	èjè-èjì	two
	ẹ̀ta	ẹ̀tẹ̀-ẹ̀ta	three
	àrún	àrà-àrún	five
b.	ogojì	ogo-ogójì	forty
	ọgọ́ta	ọgọ-ọgọ́ta	sixty
	ọgọ́rin	ọgọ-ọgọ́rin	eighty
	ọgọ́rùn-ún	ọgọ-ọgọ́rùn-ún	hundred

An explanation of the distributive numeral formatives again is obtained in prosodic terms if we assume that the reduplicant is a foot prefix. However, the data in (16) differ from the two sets of data examined previously in that the foot prosodic limit is imposed on the reduplicant only, unlike in the previous cases where the base and the reduplicant are prosodically constrained. Thus, we see in (17) that the base may contain materials which are longer than the foot: VCV or VCVCV.

Under the assumption that the reduplicant is a foot, we derive a straightforward explanation for why the reduplicant is systematically expressed as VCV rather than VCVCV.

In Optimality framework, the requirement that the reduplicant be a foot is accounted for by the constraint in (18a), while the prefixal position of the reduplicant can be accounted for by the alignment constraint in (18b).

(18) Constraints governing the formation of numeral distributives

a. RED = Foot: The left and right edges of RED must coincide with the left and right edges of a binary foot

b. ALIGN RED (RED, Left, Stem, Left)

The left-to-right mapping of the base to the reduplicant is accounted for by the following undominated constraints:

(19) a. ANCH-L

b. CONTIGUITY

Finally, MAX, the constraint that requires identity between the base and the reduplicant, is violable because in cases where the base is longer than a foot reduplication is not total: the reduplicant is identical only to the leftmost foot of the base. The ranking and tableau that obtain this effect are shown in (18, undominated ANCH and CONTIGUITY are not included).

(20) RED = Ft, ALIGN-RED >> MAX

BASE: /ọgọta/	RED = Ft	ALIGN-RED	MAX
× a. ọgọ́ta-ọgọ́ta	*!		
× b. ọgọ́ta-ata		*!	**
✓c. ọgọ-ọgọ́ta			**

The tableau in (18) depicts the effects of the ranking established for the numeral distributives: candidate (a) fails because the reduplicant is larger than a foot, candidate (b) is rejected because it disobeys higher-ranked ALIGN-RED which requires that the reduplicant be expressed at the left edge of the word, and candidate (c) is the optimal form because it respects the highly ranked constraints that the two candidates violate; MAX, a lowly ranked constraint is violated by (c), but does not prohibit the well-formedness of the candidate.

4.2.1.4. Back Harmony

The fourth argument for foot structure comes from a rounding harmony involving two affixes: /kí/ infixation and /onɪ/ prefixation. First, let us consider /kí/ infixation. There is a robust descriptive literature on /kí/ infixation, a morphological process in which /kí/ is inserted between two identical nominals. The meaning expressed by the derived forms is "any NP or bad NP" (Owolabi 1976, 1981, 1985, Awobuluyi 1983, Bamgbose 1987). Examples illustrating this process are given below:

(21) /kí/ infixation signifying "any NP or bad NP"

a. Consonant-initial nouns

Noun	/kí/	Noun	Output	Gloss
fìlà	kí	fìlà	fìlàkífìla	any type of cap
dùrù	kí	dùrù	dùrùkídùrù	any type of piano
pátákó	kí	pátákó	pátákókípátákó	any type of wood
jàgùda	kí	jàgùdà	jàgùdàkíjàgùdà	any thief
jàǹdùkú	kí	jàǹdùkù	jàǹdùkúkíjàǹdùkú	any dubious person
sọ̀wédowó	kí	sọ̀wédowó	sọ̀wédowókísọ̀wédowó	any check

b. Vowel-initial nouns

Noun	/kí/	Noun	Output	Gloss
ọmọ	kí	ọmọ	ọmọkọ́mọ	any child
ıṣẹ́	kí	ıṣẹ́	ıṣẹ́kíṣẹ́	any job
eré	kí	eré	erékéré	any play
olorì	kí	olorì	olorìkólorì	any queen
akẹ́kọ̀ọ́	kí	akẹ́kọ̀ọ́	akẹ́kọ̀ọ́kákẹ́kọ̀ọ́	any student
alákọ̀wé	kí	alákọ̀wé	alákọ̀wékálákọ̀wé	any educated person

Notice in the examples in (21) that the surface realisation of /kí/ varies depending on whether the following noun is C-initial or V-initial. When the noun is C-initial, /kí/ remains unchanged. However, when the noun following the infix is V-initial, a hiatus context is created between the final vowel of /kı/ and the initial vowel of the second noun. To resolve the hiatus, /i/ is deleted before other vowels because it is the least specified vowel in the language (Pulleyblank 1987, 1988); its high tone, however, is realised in the surface form (see Akinlabi 1985, Pulleyblank 1986 for discussions on tonal specification in Yoruba). The vowel deletion process applies regardless of the prosodic shape of the noun as demonstrated in (21b).

The scenario changes when we consider hiatus resolution in cases involving deverbal nouns derived productively by prefixing a low toned /ì/ to verbal bases. Consider the following set of data.

(22) Vowel hiatus resolution in deverbal nouns: surviving high vowel is rounded:

Base	Infixation and Reduplication	Gloss
ìwò	ìwòkuwò	looking; bad look
ìṣe	ìṣekúṣe	doing; bad conduct
ìjẹ	ìjẹkújẹ	eating; bad eating
ìtà	ìtàkutà	selling; bad selling
ɪmọ̀	ɪmọ̀kumọ̀	knowledge; bad knowledge
ìyí	ɪyíkúyìí	turning; bad turning

Notice in (22) that all the verbal bases have one property in common: all are monosyllabic. Observe also that the hiatus resolution not only deletes one of the vowels as expected, but the rounding or backness property of the surviving vowel is also different: the surviving vowel is [u], not [ɪ] as one might expect. This process applies exceptionlessly in Standard Yoruba and is a subject of lively debate in the phonological literature of the language: it is variously characterized as (a) coalescence (Awobuluyi 1983, 1987), (b) a relic of dialectal influence in Standard Yoruba (Bamgbose 1987), and (c) back harmony between the velar stop /k/ and the vowel /ɪ/ (Pulleyblank 1988). Whatever the correct analysis of this fact, the critical point for the discussion here is the domain of the application of this process. If the process were a purely segmental phenomena which is presumably driven by the syllabification well-formedness requirement (as argued in chapter 3), one would expect it to apply across the board to all deverbal nouns. This expectation is not fulfilled: when /ì/ is prefixed to bases longer that CV verbs, the output of vowel hiatus resolution is /ɪ/ not /u/, as attested to by the following data.

(23) High vowel Rounding is blocked in longer forms:

Base	Infixation and Reduplication	Gloss
ìmọ̀ràn	ìmọ̀ràn kí mọ̀ràn *ìmọ̀ràn kú mọ̀ràn	advice, bad advice
ɪdúró	ìdúró kí dùúró *ɪdúró kú dúro	standing; bad standing
ìyẹ́sí	ìyẹ́sí kí yẹ́sí *ìyẹ́sí kú yẹ́sí	respect; bad respect
ìjókòó	ìjókòó kí jókòó *ìjókòó kú jókòo	sitting, bad sitting
ìdájọ́	ìdájọ́ kí dàájọ́ *ìdájọ́ kú dàájọ	judgement, bad judgement
ìyípadà	ìyípadà kí yípadà *ìyípadà kú yípada	change; bad change

The difference in resolving vowel hiatus in (22 &23) suggests that the rounding harmony is sensitive to something else. I propose that the additional factor needed to capture the rounding process is the notion of foot structure. Specifically, I propose that the rounding harmony which turns the low toned [ɪ] deverbal prefix into [u] applies within the domain of the *rightmost foot* in the word. Once we delimit the domain of [ɪ] rounding to the rightmost foot, the constraints required to capture the facts can now be stated as follows.

(24) Constraints deriving the rounding harmony

a. Foot-Bin: Foot is binary at the moraic or syllabic analysis.

b. ALIGN-FOOT (WD, R; Ft, R): The right edge of the word must coincide with the right edge of a foot.

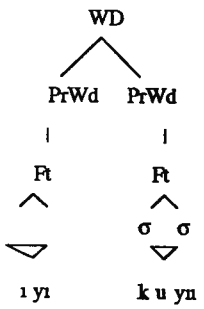
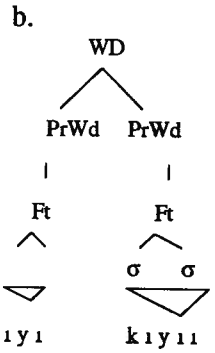
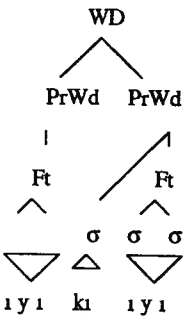
c. NO-HIATUS: Vowel Hiatus is prohibited across morpheme boundary

d. [[ì]-ROUNDING]$_{FOOT}$: If low toned [ì] is contained within the rightmost foot in deverbal construction, then it is rounded.

Constraint (24d) is stipulated to capture the tone-vowel interaction rounding phenomenon which appears to be triggered by the presence of the low tone on the high vowel. It is unclear at present why a low tone would induce back harmony. All other constraints are familiar from other

processes discussed previously. I will motivate the ranking of each of these constraints as each case is presented. Consider a case involving vowel hiatus resolution between /kí/ and a deverbal V-CV noun as shown in the following tableau.

(25) Ft-Bin, ALIGN-Ft, [[ì]-ROUNDING]$_{FOOT}$, NO-HIATUS

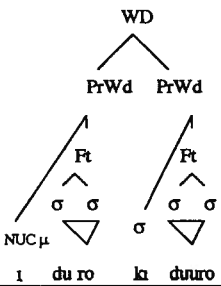
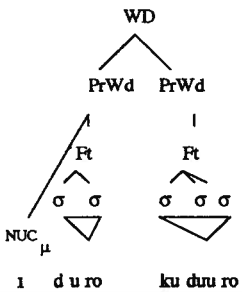
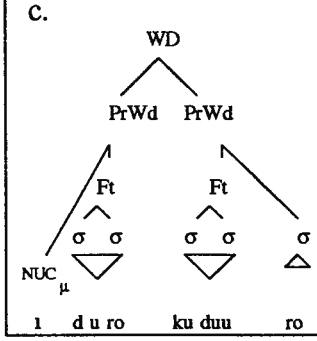
INPUT: ìyí - kí ìyí	Ft-Bin	ALIGN-Ft	[[ì]-ROUNDING]$_{FOOT}$	NO-HIATUS
✓a. 				
b. 			*!	
c. 				*!

In (25), all three candidates respect Ft-Bin and ALIGN-Ft. However, candidate (b), in which the rightmost foot is ternary, is sub-optimal because it violates [[ì]-ROUNDING]$_{FOOT}$, candidate (c) is

ill-formed because it does not obey NO-HIATUS. The illicitness of these two forms shows that [[ì]-ROUNDING]$_{FOOT}$ and NO-HIATUS must be respected when there respective structural requirements are satisfied. The first candidate is chosen as the optimal form: it respects NO-HIATUS and vacuously satisfies [[ì]-ROUNDING]$_{FOOT}$ because the structural condition for the rounding process is not satisfied as [ki] does not constitute part of the rightmost foot.

To further motivate the constraints given in (26) and the relevant rankings, consider a case of /ki/ infixation with a V-CVCV deverbal base where the surviving vowel is an unrounded high vowel. Ft-Bin and ALIGN-Ft are the relevant constraints for evaluation here.

(26) Ft-Bin, ALIGN-Ft, [[ì]-ROUNDING]$_{FOOT}$, NO-HIATUS

INPUT: ìdúró- kí - ìdúró	Ft-Bin	ALIGN-Ft	[[ì]-ROUNDING]$_{FOOT}$	NO-HIATUS
✓a. 			vacuously satisfied	
b. 	*!			
c. 		*!		

The rightmost foot in candidate (b) is ternary branching and it thus incurs a fatal violation of Ft-Bin, and candidate (c) is rejected because it fails to obey ALIGN-Ft, as the rightmost binary foot this form is not expressed at the right edge of the word. In contrast, candidate (a) surfaces as the optimal form because it obeys the undominated constraints. Note in particular that the failure to foot /kí/ in the rightmost foot enables it to satisfy the rounding constraint in a vacuous fashion.

The second construction in which high vowel rounding occurs involves the prefixation of /onɪ/ to deverbal nominals.[1]

(27)	Base	Prefixation	Output		Gloss
	ì-fẹ́	onɪ-ìfẹ́	olùfẹ́	*onìfẹ́	owner-love; lover
	ì-ṣọ́	onɪ-ìṣọ́	olùṣọ́	*onìṣọ́	owner-watching; one who keeps watch
	ì-kọ́	onɪ-ìkọ́	olùkọ́	*onɪkọ́	owner-teaching; teacher
	ì-bùkún	onɪ-ìbùkún	olùbùkún	*onìbùkún	owner-blessing; one who blesses
	ì-gbàlà	onɪ-ìgbàlà	olùgbàlà	*onìgbàlà	owner-saving; savior
	ì-wòran	onɪ-ìwòran	olùwòran	*onìwòran	owner-gazing; spectator

In (25), the prefixation of /onɪ/ to a vowel initial deverbal nominal creates a hiatus environment. This causes one of the high vowels to delete. Following deletion and a denasalization process which changes /n/ to /l/ before other vowels apart from /ɪ/ (Oyelaran 1970, Pulleyblank 1988), the

[1]To derive the meaning "owner or possessor of NP" in Yoruba, two nominalizing prefixes, /oní/ and /onɪ/ are prefixed to nouns (see Bamgbose 1987 for details). These prefixes appear to be somewhat complementary in distribution: the former /oní/ is typically prefixed to any nominal (oní + òṣì : olóṣì 'owner of poverty, poor person'; oní + ìgbàgbọ́: onígbàgbọ́ 'owner of believe, christian'), while deverbal nominals exclusively select the the latter prefix /onɪ, e.g. onɪ + ìṣe: olùṣe *onìṣe*onísẹ, 'owner of action, doer'/. Certain nominals which are clearly non-deverbal forms are also nominalized by /onɪ/, for example, onɪ + ọ̀tẹ̀: ọlọ̀tẹ̀ 'owner of conspiracy, rebel'; onɪ + àáyè: alàáyè. Notice however, that these forms are strikingly low-tone initial, an important trade-mark of the deverbal nominals under discussion. Prefixation to non deverbal forms only trigger vowel deletion whereas prefixation to deverbal forms trigger both vowel deletion and high vowel rounding as discussed in this chapter.

surviving high vowel surfaces as a high rounded vowel [u], in exactly the same fashion as witnessed for /ki/ infixation in (22). The analysis of this data requires the following OT constraints, one of which was motivated earlier.

(28) Constraints deriving the /onɪ/ rounding harmony

a. ALIGN- onɪ (onɪ, L; WD, L):

The left edge of /onɪ/ must coincide with the left edge of the word.

b. NO-HIATUS: Vowel Hiatus is prohibited across morpheme boundary

c. /onɪ/-ROUNDING: /ɪ/ is is rounded in the leftmost foot when prefixed to deverbal nouns.

d. ALIGN-FOOT (onɪ, L; Ft, L):

The left edge of /onɪ/ must coincide with the left edge of a foot.

The constraints in (28) are proposed to account for the facts in (20) as follows: (28a) accounts for the fact that /onɪ/ is a prefix which occurs at the left edge of the word, (28b) accounts for the deletion effect, (28c) accounts for the high vowel rounding effect. These constraints are inviolable as depicted in the following tableau, where the optimal candidate is the one in which all the constraints are satisfied.

(29) ALIGN- onɪ, NO-HIATUS, /onɪ/-ROUND

INPUT: /onɪ-ìgbàlà/	ALIGN- onɪ	NO-HIATUS	/onɪ/-ROUND
a. ìgbàlà-onu	*!	*	
b. ìgbàlà-nu	*!		
c. onɪ-ìgbàlà		*!	*
d. onìgbàlà			*!
e. olùgbàlà			

4.2.1.5. Footing and Headedness in Standard Yoruba: evidence from deletion

Until now, we have presented evidence demonstrating the presence and vitality of foot structure in Yoruba, but have not touched on the issue of whether or not footing requires the presence of a head. To briefly show that heads are required for footing, consider once more the process of intervocalic [r] deletion which was presented in the discussion on syllabification in chapter 3 (the structural description for this process requires either (a) total identity of the vowels flanking [r], or (b) one of the vowels is [+high]).

(30) <u>[r] deletion</u>

a.		erùpẹ̀	~	eèpẹ̀		'sand'
		òrìṣà	~	òòṣà		'god'
		oríkı	~	oókì		'praise name'
		orórì	~	oórì	*oóì	'mausoleum'
	b.	orí	~	*oı		'head'
		àrá	~	*aa		'thunder'
		oró	~	*oó		'pain'
		ọrọ̀	~	*ọọ̀		'wealth'

The structural description for [r] deletion is satisfied in all the data in (30), yet [r] deletion is possible in (30a) but impossible in (30b). In (30) there is a crucial difference between the input forms in (a) and (b): the former contains two CV syllables in the input form whereas the latter has only one CV in the input. What is the relevance of this description to the different deletion patterns illustrated in (30)? In the output of deletion in (a), a CV is still present in the word; in contrast in (b), the result of deletion yields a sequence of two vowels which in prosodic terms qualifies as a binary foot. Why then is this form illicit even though it satisfies foot binarity?

The difference in the deletion process is explained if we assume that a syllable is the head of a foot. As argued in chapter 3 for Standard Yoruba, only vowels with onsets are syllables, and consequently, only CVs qualify as heads of a foot. The foot in (30b) would not be headed if [r] deletion were to apply; the obligatoriness of heads in foot structure, then, correctly predicts the absence of [r] deletion in these forms. The data in (30a) also offer some information on the location of a head within a foot in Yoruba: the syllable head is expressed at the right edge of the foot as evident from a form such as (orórì ~ oórì *oóì,*oróì) where the two [r]s are potentially deletable since both meet the structural condition for deletion; but in fact, only the initial [r] can be deleted, the rightmost never deletes. To account for this requirement, I propose the following constraint (these constraints will be further motivated in the discussion of truncation in Yoruba in section 4.2. and in the discussion of prosodic minimality in chapter 5):

(31) Foot headedness constraints in Yoruba

a. Head of Foot = σ

b. ALIGN-HEAD-R (Ft, R; Head, R):

The right edge of a foot corresponds to the right edge of a syllable

To account for the asymmetric behavior of [r] in the data in (30), three assumptions regarding the structural representation of [r], high vowels and identical vowels are crucial. Formally, following Akinlabi (1993), I assume that underspecifed [r] is represented as a root node whose place features are not parsed because of *M/COR [r]. Also, assuming following Pulleyblank (1988) that [i] is unspecified for place features in Yoruba, I assume that the formal characterization of this segment is just a bare nuclear-mora. Third, I assume that the general OCP prohibition against having identical X at the melodic level forces the representation of identical (long) vowels as a single root node linked to two nuclear-moras. These structures are illustrated below:

(32) Structural represetation of [r], high vowels and identical (long) vowels[2]

a. [r]

```
[r]
 |
RT
<COR>
```

b. High vowels

```
[I]
 |
RT
<HI>
```

c. Long vowels

```
NUC   NUC
 |     |
 μ     μ
  \   /
   RT
    |
   PL
```

Given the structural representations in (32), the structural configurations that emerges when [r] is flanked either by identical vowels or when one of its flanking vowels is high are the following:

(33) [r] flanked by identical vowels: *OCP PLACE

```
NUC     NUC
 |       |
 μ       μ
 |  [r]  |
RT RT   RT
 |       |
PL      PL
  <COR>
```

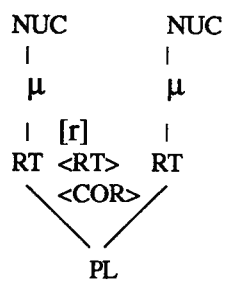
(34) one of the vowels flanking [r] is high: *PLACELESS NUCμ

```
NUC     NUC
 |       |
 μ       μ
 |  [r]  |
RT RT   RT
 |
PL
  <COR><HI>
```

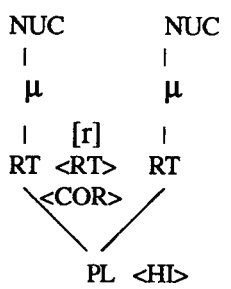
[2]By Containment (P&S 1993), the specification in angled brackets are assumed to be present in the representation.

In (33), an OCP Place violation context is created, while (34) has two bare root nodes. I propose that the pressure to avoid an OCP Place violation causes the underparsing of [r]'s root node; this causes [r] to be phonetically unrealised as shown in (35). Further, in (36), the spreading of the place feature of the initial nuclear-mora to the rightmost nuclear-mora is triggered by its lack of place feature (*PLACELESS NUCμ: a nuclear-moraic position is specified for Place feature).

(35) <u>Surface representation of [r] in deletion contexts involving identical vowels</u>



(36) <u>Surface representation of [r] in deletion contexts involving a high vowel</u>



Notice the striking resemblance between the two configurations in (35&36): the satisfaction of *OCP PLACE and *PLACELESS NUCμ both result in the underparsing of [r]. In Optimality Theory, this is interpreted as a situation where *OCP PLACE and *PLACELESS NUCμ outrank *M/COR[r] and *P/HI. Together with the undominated constraints governing headedness (Head = σ and ALIGN-HEAD-R), the ranking that derives the facts of [r] deletion in words such as (oríkı ~

óókì 'praise name' and orórì ~ óórì *óóì ' mausoleum') is depicted in the following tableaux (I assume that the satisfaction of PARSECOR[r] and PARSEHI is militated against by *M/COR[r], *P/HI. The two violable constraints are not considered in the tableaux) :

(37) Head = σ, ALIGN-HEAD-R, *OCP PLACE, *PLACELESS NUCμ >>*M/COR[r], *P/HI

/oríkì/	Head = σ	ALIGNR	*OCP PLACE	*PLACELESS	*M/COR[r]	*P/HI
a. oríkì					*!	*
b. oíkì						*!
c. óókì						

In (37), candidate (c) incurs no violation of the ranked set of constraints and is favoured over the other two candidates that either violate one lowly constraint or the other. However, the selection of an optimal form is not always dependent on total satisfaction of all the constraints, as depicted in (38), (C indicates a placeless root node, and V stands for a placeless nuclear-mora).

(38) Head = σ, ALIGN-HEAD-R, *OCP PLACE, *PLACELESS NUCμ >>*M/COR[r], *P/HI

/orórì/	Head = σ	ALIGNR	*OCP PLACE	*PLACELESS	*M/COR[r]	*P/HI
a. orórì					**!	*
b. oróì		*!				*
c. oróò		*!				
d. oCóɪ			*!		*	*
e. oróV				*!		
f. óóo	*!					
g. óóɪ					*	*

In (38), the pressure to satisfy undominated Head = σ, and ALIGN-HEAD-R forces the optimal candidate to violate lower ranked *M/COR[r], and *P/HI. Other candidates are rejected because they violate one higher ranked constraint or the other. Candidate (g)'s major competitor is candidate (a), but (g) wins because its competitor incurs more violations of *M/COR[r].

4.2.2. Foot Structure in Ibibio

Ibibio is another Benue-Congo language which provides evidence for foot structure from prosodic processes. Like Yoruba, Ibibio is a non-stress system, but foot structure plays a crucial role in defining the domain of certain phonological processes (Akinlabi & Urua 1992). I present two of the foot-constrained processes documented in Akinlabi & Urua: negated verbs and consonantal weakening.

4.2.2.1. Negated Verbs

In deriving the negative form of verbs, a monosyllabic suffix /kv́/ (whose vowel is always identical to the final vowel of the verb) is attached to a verbal root. No matter what the underlying shape of the verb is, on the surface, the verb is either CVV or CVC. Thus, when a verb root is underlyingly CV, it surfaces as CVV, when it is CVVC, it shortens to CVC on the surface and when it is CVC, it remains unchanged in the output. The following data illustrate the generalizations.

(39) Negated Verbs (data from Akinlabi & Urua 1992)

a.

CV Root	Gloss	Negated Form	Gloss
sé	look	séé-ɣé	not looking
nɔ̀	give	nɔ̀ɔ̀-ɣɔ́	not giving
dá	stand	dáá-ɣá	not standing
kpù	be in vain	kpùù-ɣá	not be in vain

b. CVVC Root

fáák	wedge between two objects	fák-ká	remove wedge object
kɔ́ɔ́ŋ	hang on hook	kɔ́ŋ-ŋɔ́	remove from hook

c.

CVC Root	Gloss	Negated Form	Gloss
kɔ̀p	hear	kɔ̀p-pɔ́	not hearing
yét	wash	yét-té	not washing
kɔ̀k	talk	kɔ̀k-kɔ́	not talking
dɔ́m	bite	dɔ́m-mɔ́	not biting

An insightful analysis of this data is given in Akinlabi & Urua (1992). They propose that the negated verb (verb root plus suffix = stem) constitutes a trochaic foot. If the foot is a trochee, then the various lengthening (39a) and shortening (39b) processes observed above follow straigthforwardly The requirement that the leftmost syllable must be heavy follows from the general property of moraic trochees: the trochee is left headed. In (39a), the material in the input base is insufficient to satisfy the weight requirement imposed on the head, hence the need for augmentation by vowel lengthening. In (39b), on the other hand, the material in the input is too much, for if syllabified into the same syllable, it would yield a marked ternary branching syllable. To get around the problem of the erection of a marked representation, the vowel shortens and we end up with a CVC, and the final consonant provides the onset for the negative suffix.

4.1.2.2. Consonantal Weakening

The second process which is best explained by making reference to foot structure is a process of consonant weaking which changes intervocalic stops to fricatives and [r] in CVCV

forms. Relevant data appear below from the suffixation process which expresses the reflexive or agentless passive forms of verbs.

(40)	Root	Gloss	Suffixation	Gloss
	yàt	wear a hat	yàrá	wear a hat on oneself
	dòt	place on top of	dòró	place on top of oneself
	kɔ̀p	lock	kɔ̀β́ɔ	be locked
	wèt	write	wèré	be written

As in the former case involving the negated verbal forms, Akinlabi & Urua (1992) propose that the consonantal weakening process is prosodically controlled and can only be explained if we assume that the domain of weakening is the trochaic foot.[3] However, they do not explain why the second consonant is always targeted for weakening.[4] I propose that the leftmost syllable being the head of the trochee, must satisfy Best Onset (P&S 1993); that is, it must have an onset which is not high in sonority value. In contrast, the rightmost syllable, which occupies the non-head position in the trochee, need not satisfy best onset, hence the weakening tendency.

The class of segments that best satisfy Best Onset is the set containing stop consonants. If following Shaw (1991a for Athapaskan and 1993b, 1995 for Nisgha) and LaCharité (1993 for Setswana), we assume that stops are specified as for continuancy as [-cont], then we can invoke an alignment constraint which restricts the well-formedness of this feature the left edge of a trochaic foot:

(41) ALIGN-L[-cont]: ALIGN-L ([-cont], Ft)

[3]According to these authors, this weakening process is blocked between prefixes and roots, and they attribute it to extraprosodicity. The present work abstracts away from a discussion of this class of data.
[4]Hyman (1990), citing Cook (1985), reports the same process in Efik and analyses the weakening process as a syllable conditioned process which changes stops to fricatives in coda position. An alternative account of this fact is the one presented here where trochaic headedness rather than syllable well-formedness acts as the trigger for weakening.

Assuming that ALIGN-L[-cont] is not outranked within the domain of the trocahic foot, it will force the appearance of the least sonorous consonant in the leftmost syllable in a trochee. In a situation whereby the rightmost syllable contains a stop, weakening is triggered to avoid violations of ALIGN-L[-cont]. Weakening entails the underparsing of [-cont], a PARSE-F violation. This shows that ALIGN-L[-cont] is ranked above PARSE-F. The data in (40) is accounted for as in tableau (42).

(42) ALIGN-L[-cont] Ft >> PARSE-F

INPUT: /kɔpɔ/	ALIGN-L[-cont]Ft	PARSE-F
a. kɔpɔ	*!	
b. ɣɔβɔ		**!
✓ c. kɔβɔ		*

Tableau (42) demonstrates that it is more optimal to obey ALIGN-L[-cont] Ft than to violate it. As evident from the well-formedness of the optimal candidate (c), a minimal PARSE-F violation is permitted as long as it is enforced by the need to satisfy any of the high ranking constraints.

4.2.3. Foot Structure in Ọwọn-Afa

Like Yoruba and Ibibio, Ọwọn-Afa, another non-metrical system utilizes foot structure in reduplication. Two reduplicative processes are presented as evidence for this claim. The first is numeral reduplication indicating "Number by Number". Examples are given below.

(43) Numeral Reduplication

Base	Gloss	Reduplicated form	Gloss
ɪkãã	one	ɪkɪ - ɪkãã	one by one
ìjí	two	ìjì - ìjí	two by two
ɪda	three	ɪdɪ - ɪda	three by three
ídʒè	ten	ídʒí - ídʒè	ten by ten
orĩtã̃	1hundred	oro - orĩtã̃	1 hundred by 1 hundred
ígbórɔ	2 hundred	ígbí - ígbórɔ	2 hundred by 2 hundred

As the data in (43) show, the reduplicant is always identical to the initial VCV in the base. Following M&P (1986, and subsequent works), we assume that reduplicative forms are best captured as prosodic templates rather than segmental entities; then, the reduplication process described above can only be defined as a foot. The reduplicant is also a prefix because it is realised at the left edge of the word. The constraints that account for this process in OT are the following:

(44) a. RED = Foot: The left and right edges of RED must coincide with the left and right edges of a binary foot

b. ALIGN RED (RED, Left, Root, Left)

(45) RED = Ft, ALIGN-RED >> MAX

BASE: /ígbórɔ/	RED = Ft	ALIGN-RED	MAX
a. ígbórɔ-ígbórɔ	*!		
b. ígbórɔ-ɔrɔ		*!	**
✓c. ɪgbɪ-ígbórɔ			**

The tableau in (45) depicts the effects of the ranking established for the numeral distributives: candidate (a) fails because the reduplicant is larger than a foot, candidate (b) is rejected because it

disobeys higher-ranked ALIGN-RED which requires that the reduplicant be expressed at the left edge of the word, and candidate (c) is the optimal form because it respects the highly ranked constraints that the two candidates violate; MAX, a lowly ranked constraint is violated by (c), but does not prohibit the well-formedness of the candidate.

The second process that depicts the effect of foot structure in Ọwọn-Afa is a verbal reduplication process denoting "action done anyhow". Relevant examples appear below:

(46)	Base	Gloss	Reduplicated form	Gloss
	dʒu	eat	dʒì - dʒúú	eat anyhow
	kpɛ́	dig	kpì - kpɛ́ɛ́	dig anyhow
	kò	sing	kì - kóó	sing anyhow
	ja	pull	jì - jaa	pull anyhow
	gɔ́	gather	gì - gɔ́ɔ́	gather anyhow
	nu	carry	nì - núú	carry anyhow

The above data reveal the following generalizations. First, about the base: observe that the verbal base is consistently monosyllabic, the canonical shape of verbs in the language. Second, the reduplicant exhibits the following characteristics: (i) it is expressed as CV-CVV, (ii) the initial (leftmost) vowel of the reduplicant is the default vowel in the language, (iii) the vowel of the base systematically lengthens changing the original CV shape of the base to CVV.

The above generalizations are straightforwardly explained in prosodic terms as an instantiation of the iambic foot: the iamb consists a of light-heavy syllable sequence. The weight requirement imposed on the rightmost syllable is a consequence of headedness: the iambic foot is right headed. The following Optimality Theoretic constraints account for the reduplicative process. First the prosodic condition imposed on "any action verbs " is defined as follows:

(47) Any type of Action Verb = Iambic Foot:

The left and the right edges of "any action verb" correspond to the left and right edges of an iambic foot.

Second, since input monosyllabic verbs surface as bimoraic forms, this shows that LEX-μ is violated: a mora that was not in the input surfaces in the output:

(48) LEX-NUCμ: a mora that is present in the input must also be present in the output

Third, the fact that the leftmost vowel in the output is not a copy of the vowel of the verbal base must be accounted for. Recall that this vowel is expressed as [ɪ] - the default vowel. This fact suggests that there is a segmental markedness factor involved. Drawing on the proposal advanced for Nisgha in Shaw (1995) that the prosodic domain of reduplication may induce the reduction of segmental markedness, I propose that the presence of the default vowel in the nucleus of the leftmost syllable an instantiation of the reduction of segmental markedness. Thus, what we have then is complete asymmetry between the prosodic and featural specification of the head and non-head syllable of the iambic foot. Compared with the syllable at the right edge of the foot, the leftmost syllable, which is the non-head position, is reduced both in weight (because it is monomoraic) and in segmental features (because only the default vowel may occur in the nuclear position). The rightmost syllable in contrast, exhibits no such reduction: it is bimoraic (as evident from the lengthening effect) and the featural properties of the nucleus of the base are fully retained in it.

In order to explain the presence of the default vowel in the leftmost syllable of the iambic foot, I adopt the following analysis (based on Shaw 1995). First, I assume that the constraint governing the copying of the segmental properties of the nucleus is MAX/NUC, a subconstraint of the MAX family of constraints which enforces a full copy of the BASE NUC. Second, I assume that the melodic simplification which selects the default vowel as the vowel of the leftmost nucleus

of the iambic foot may be captured by *NUC/[f] ([f] stands for any feature), an analog of *STRUC constraint which prohibits any featural representation in the nucleus of the non-head syllable nucleus.

Finally, given the asymmetry between the featural specification and the weight property of the head and non-head syllables of the iambic foot in Owon-Afa, the shape of the prosodic structure of "any type of action" already given in (47) needs to be properly spelled out:

(49) Undominated Constraints: "Any Type of Action Verb"

a. Any Action = iambic Foot

b. Head is a bimoraic syllable: σNUCμμ

c. Non-Head is a monomoraic syllable: σNUCμ

d. ALIGN-HEAD: (HEAD, Right, Ft, Right): The right edge of the head corresponds with the right edge of the foot

e. ALIGN-NON-HEAD: (NON-HEAD, Left, Ft, Left): The left edge of the head corresponds with the left edge of the foot

The following constraint ranking is established and demonstrated in tableau (50) for the iambic process (The alignment constraints and Any ACTION = IAMBIC Ft are excluded in the tableau).

(50) HEAD = σNUCμμ, NON-HEAD = σNUCμ, *NUC/[f] NON-HD, MAX/NUC-HD >> LEXμ

BASE: /pẹ/	HDNUCμμ	NON-HDNUCμ	*NUC/[f]NON-HD	MAX/NUC-HD	LEXμ
a. pì-píí				*!	*
b. pẹ̀-pẹ́ẹ́			*!		*
c. pìì-pẹ́ẹ́		*!			**
d. pì-pẹ́	*!				
✓e. pì-pẹ́ẹ́					*

Tableau (50) reveals the interaction of the constraint ranking. Form (a) surfaces with a default vowel in the head position and fails because of the requirement that the featural specification of the

base should be maximized (MAX/NUC-HD violation). Form (b), on the other hand, is sub-optimal because the non-head nucleus fails *NUC/[f] NON-HD, a constraint that disallows any featural representation in the non-head nuclear position. Even though form (c) is rejected because it is not a proper iamb (it has two heavy syllables), the major reason for its failure results from a violation of NON-HEAD = σNUCμ, a constraint that prohibits a heavy syllable from occupying the non-head position. Like (c), candidate (d) is not an iambic foot: it is monomoraic, hence, does not satisfy the bimoraic weight requirement imposed on the head of the foot. Candidate (e) satisfies all the constraints violated by the other candidates considered earlier and emerges as the winner. This candidate is able to satisfy the weight requirement of the head by violating LEXμ, but receives a minimal penalty because of the low ranking status of this constraint.

To sum up this section, evidence has been presented from the domain of reduplication to show that foot structure is actively utilized in non-stress systems. Footing, as demonstrated, is identical to the type found in metrical systems in that foot structure is optimally binary (moraic or syllabic) and headed. In the next section, more evidence is documented from truncation to show the vitality of foot structure in a non-stress system: Yoruba.

4.3. Foot Structure: Evidence from Truncation

This section provides further evidence for foot structure from the productive process of name truncation in Yoruba. The process is then formalized in Optimality Theory as a foot dependent prosodic process which maps sufficient segmental material from the base to foot to satisfy the templatic requirement. The remaining materials which are left unmapped remain unparsed: in OT, this is expressed as PARSE-seg violation. This is the dividing line between reduplication and truncation. Reduplication, as argued by M&P (1994) does not entail violations of PARSE-seg because the base is always present in the output. The opposite holds of truncation because the base is only partially realised in the output form.

4.3.1. Yoruba Name Shortening

Oduyoye (1972) gives a detailed documentation of Yoruba names. According to Oduyoye, a name in Yoruba may be formed from a combination of two nouns (as in 51), a sentence comprising a noun and a verb phrase (comprising a *verb* plus *noun* and sometimes additionally, a *prepositional phrase* as in 52) or a verb phrase (comprising a *verb* plus *noun* and *verb* as in 53). Phrasal boundaries are indicated with a dash (-).

(51) Noun plus Noun name formatives

Noun	Noun	Output	Gloss
ọlá	olúwa	ọláolúwa	the high estate of God
ìfẹ́	olúwa	ìfẹ́olúwa	the love of God
akın	ọlá	akınọlá	the valor of high status
wúrà	ọlá	wúràọlá	Gold of honor
ayọ̀	adé	ayọ̀adé	the joy of a crown
ọ̀kẹ́	owó	ọ̀kẹ́owó	bag of money

(52) Sentential name formatives

Noun	Verb Phrase	Output	Gloss
adé	doyın	adé-doyın	the crown becomes honey
ọmọ	nıyì	ọmọ-nıyì	children are the glory
oyè	ṣínà	oyèé-ṣínà	a tittle opens the way
ọlá	jùmọ̀-kẹ́	ọlá-jùmọ̀-kẹ́	fame gathers to pet this child
olúwa	fúnmı-láyọ̀	olúwa-fúnmı-láyọ̀	God gave me joy
olúwa	dámı-lọ́lá	olúwa-dámı-lọ́lá	God gave me honor

(53) Predicate (verb phrase) name formatives

Verb Phrase	Gloss
fọlá-mí	breathe with honor
kóre-dé	gather good things in
gbọ́lá-hàn	exhibit honor
kọ́lá-wọlé	bring honor into the house
fọlá-ṣadé	make a crown out of honor
bámı-jókòó	sit with me

In Yoruba, the output forms of the names list above are traditionally used when a person is being addressed seriously or when invoking incantations or blessings on someone. Recently, it is also used in formal contexts such as in formal school registration and formal documentation such as registration of birth and announcement of death. To signify "familiarity" with a peer or younger person, however, names are shortened to either VCV, CVCV CVCVCV or CVCVCVCV forms (surnames are in general not subject to this process). Examples appear below.

(54) Shortened names:

NounNoun Base	Output	Gloss
ọláolúwa	ọlá *or* olú	the high estate of God
ìfẹ́olúwa	ìfẹ́ *or* olú	the love of God
akınọlá	akın *or* ọlá	the valor of high status
wúràọlá	wúrà *or* ọlá	Gold of honor
ayọ̀adé	ayọ̀ *or* adé	the joy of a crown
ọ̀kẹ́owó	ọ̀kẹ́ *or* owó	bag of money

(55) Shortened names:

	Noun *plus* Verb Phrase Base	Truncated Forms	Gloss
a.	adé-doyın	adé *or* doyın	the crown becomes honey
	ọmọ-nıyì	ọmọ *or* nıyì	children are the glory
	oyè-ṣínà	oyè *or* ṣínà	a title opens the way
b.	ọlá-jùmọ̀-kẹ́	ọlá *or* jùmọ̀kẹ́ *or* jùmọ̀	fame gathers to pet this child
	olúwa-fúnmı-láyọ̀	olú *or* fúnmıláyọ *or* fúnmı *or* láyọ	God gave me joy
	olúwa-dámı-lọ́lá	olú *or* dámılọ́lá *or* dámı *or* lọ́lá	God gave me honor

(56) Shortened names:

	Verb Phrase	Truncated Form(s)	Gloss
a.	fọlá-mí	fọlá *lámí *mí	breathe with honor
	kóre-dé	kóre *redé *dé	gather good things in
	gbọ́lá-hàn	gbọ́lá *láhàn *hàn	exhibit honor
b.	kọ́lá-wọlé	kọ́lá *or* wọlé	bring honor into the house
	fọlá-ṣadé	fọlá *or* ṣadé	make a crown out of honor
	bámı-jókòó	bámı *or* jókòó	sit with me

Name shortening is analyzed in Oduyoye (1972: 26) as involving two patterns: shortening may either select the (a) subject or (b) predicate. This analysis captures cases in (54) where noun-noun compounds are shortened to the first or second noun. It also explains why in (55b) a form like olúwafúnmıláyọ̀ is shortened to olú *or* fúnmıláyọ. However, the possiblity of truncating to shorter forms like fúnmı *or* láyọ is not explicitly predicted by this account. To capture the diverse shortening patterns, we need to look into the prosodic structure of these forms in addition to the morphemic information prescribed by Oduyoye. Observe from the data that the smallest and most

regularly shortened form is either VCV or CVCV, a binary foot (bimoraic or disyllabic) in prosodic terms.

In addition to the prosodic requirement, another observation which must be accounted for is the fact that shortened names always correspond to the leftmost segmental materials of the morpheme. For example, a name such as kọ́lá-wọlé may be shortened to either kọ́lá *or* wọlé, while a name like fọlá-mí may only have one shortened form, namely, fọlá other forms such as *lámí or *mí are impossible. The latter illicit form is independently ruled out by the foot-based prosodic restriction proposed earlier. But why is *lámı, a binary footed name illicit? I propose that truncation is thus constrained because the TRUNCATIVE FOOT (TRUNC) is a prefix. Prefixes, obviously occur at the left edge of the word, so this property explains why the segmental properties of the truncated forms are identical to the leftmost segments in the base. The question that still remains, though, is why a verb phrase comprising two verb phrases (kọ́lá-wọle: kọ́lá *or* wọle) or one verb phrase plus a prepositional phrase (fúnmıláyọ: fúnmı *or* láyọ) may have two truncated variants. To answer this question, I propose that truncation targets the leftmost materials in the morpheme. The templatic and leftmostness requirements are formalized in Optimality Theory as follows.

(57) a. TRUNC = Foot: The left and right edges of TRUNC must coincide with the left and right edges of a binary foot.

b. ALIGN TRUNC (TRUNC,L;Morpheme, L):
the left edge of the truncative must be aligned with the left edge of a morpheme

Since truncation entails mapping of segmental materials from the base to the truncative foot, ANCHORING and CONTIGUITY, two Optimality Theoretic constraints that were already motivated in our analysis of reduplication are also relevant for the truncation analysis to be presented shortly. I propose that these two constraints must be respected because segments are

mapped from left-to-right with no form of skipping in the truncated forms. As a result of the constraints motivated so far, the truncated forms are realised as a single binary foot whose segmental materials is identical to that of the leftmost foot in the morpheme.

One salient issue remains to be addressed: the status of segments which do not surface in the truncative. Are they parsed or not? M&P (1994) discuss the status of PARSE-seg in reduplication, and argue that what the non-total templatically constrained reduplicant disobeys is MAX because the segmental content of the base is not fully realised in the copy. Under this view, reduplication does not entail violations of PARSE-seg because the base is always present in the output. Clearly the opposite holds of truncation, because the base is only partially realised in the output form, a property that suggests that PARSE-seg violations are incurred. If PARSE-seg violations are possible in truncatives, then the constraint is ranked below the undominated constraints motivated earlier. The following tableau demonstrates this fact.

(58) TRUNC = Foot, ALIGN TRUNC, ANCHORING, CONTIGUITY >> PARSE-Seg

BASE: /olúwa-fúnmɪ-láyọ̀/	TRUNC =Foot	ALIGNTRUNC	ANCHOR	CONT	PARSE
× a. olúwa	*!				********
× b. lúwa		*!	*		*********
× c. owa				**!	**********
✓d. olú					**********
✓e. fúnmɪ					*********
✓f. láyọ̀					*********

For tableau (58) TRUNC = Foot rules out candidate (a). The second candidate, (b) fails because it disobeys ALIGN-TRUNC and ANCHOR. Candidate (c) is ruled out by CONT violation: the segments in the truncated form are not realised in a contiguous string. Candidates (d-f) are optimal because they satisfy all the undominated constraints. The fact that they all violate PARSE-Seg is not critical for evaluation because that constraint is low-ranking. As long as the prosodic requirements are satisfied, PARSE-Seg are not treated as fatal.

The constraint ranking is further demonstrated in the following tableau.

(59) TRUNC = FOOT, ALIGN TRUNC, ANCHORING, CONTIGUITY >> PARSE-Seg

BASE: /fọlá-mí/	TRUNC = Foot	ALIGN TRUNC	ANCHOR	CONT	PARSE
× a. lámí		*!	*		**
× b. mí	*!				****
× c. fọmí				**!	**
✓d. fọlá					**

In (59), even though candidate (a) obeys TRUNC is a Foot, it is still sub-optimal because it violates ALIGN-TRUNC and ANCHOR. Candidate (b), a syllable, is ruled out by TRUNC is a Foot, and candidate (c) fails by violating CONT. Candidate (d) is the winner: it satisfies higher ranked constraints and is not penalized for violating lower-ranked PARSE.

Arabic loan names provide further support for the prosodic template proposed for shortened names in Yoruba. Consider the following data.

(60) Loan Name truncation:

Base	Truncated form	
gàníyátù	gàní	*yatu
làtífátù	làtí	*fatu
wúlèmọ́tù	wúlè	*mọ́tù
mọ̀dínátù	mọ̀dí	*nátù
afúsátù	afú	*satu
àbúbákà	àbú	*baka

The generalization that we see is that the truncated form is either the leftmost VCV or CVCV in the word, a familiar pattern from the native forms considered previously. To account for this pattern, the constraints motivated for the native forms are adopted. The tableau illustrating the analysis of the loan names is given below.

(61) TRUNC = Foot, ALIGN TRUNC, ANCHORING, CONTIGUITY >> PARSE-Seg

BASE: /múrítàlá/	TRUNC = Foot	ALIGN TRUNC	ANCHOR	CONT	PARSE
a. tàlá		*!	*		****
b. múlá				****!	****
c. mú	*!				******
d. múrí					****

In tableau (54), candidate (a) is rejected because it violate ALIGN-TRUNC: the left edge of the truncative does not match the left edge of the morpheme, as evident from the segmental materials contained in this candidate. Unlike native words where names are formed by word and morpheme concantenation, loan names are treated as one single morpheme, even if they are derived in the source language. Thus, the truncative treats loans as one word and must therefore target the left edge of the morpheme in mapping segments to the truncative foot. Candidate (b) is illicit because it incurs violation of CONT. Candidate (c) is ill-formed because it is a syllable, not a foot as required by the prosodic restrictions governing truncated names. Candidate (d) surfaces as the optimal form because it obeys the higher-ranked constraints.

Consider now the following additional set of data, cases involving tone-bearing nasals which appear to violate the bimoraic Foot templatic requirement:

(62)

Base	Truncated form(s)	Gloss
Adé-bá-n-ḳẹ́	Ade, bá-n-ḳẹ́, *bá-n,*n-ḳẹ́	crown helps me pet
Olúwa-gbé-n-ró	Olu, gbé-n-ro, *gbé-n, *n-ró	God sustains me
Ọlá-ró-n-ḳẹ́	Ọlá, ró-n-ḳẹ́, *ró-n, *n-ḳẹ́	wealth has something to pet
Oyè-ń-pè-mí	Oyè, pè-mí, *ń-pè	chieftaincy beckons to me

The above data reveal two major generalizations. First, the shape of the truncated form is VCV, CVCV or CVNCV. Second, the truncated form is never expressed as NCV or CVN, a fact that

suggests that there is something special about the property of the tone-bearing nasal. These generalizations will be accounted for in turn.

To begin with the latter: what is special about the tone-bearing nasal in Yoruba? As argued in chapter 2, the tone-bearing nasal is a mora in Yoruba. Evidence from prosodic morphology was adduced to show that the nasal is never syllabified by itself: the nasal never reduplicates as a syllable. If the nasal is not a syllable, and if only a syllable (CV) constitutes a potential head of the foot in Standard Yoruba, then a nasal is ruled out from occurring at the right edge of the foot by ALIGN-HEAD-R, the constraint that requires the presence of a head at the right edge of the foot. As regards why NCV names are not attested, this follows from the fact that the alignment constraint states that the left edge of the truncative must be aligned with the left edge of the prosodic word, but no lexical item begins with a nasal in Standard Yoruba. Minimally, a noun (name) is expressed as VCV or CVCV which is characterized as a binuclear-mora foot or bisyllabic foot. The tone-bearing nasal is neither a nuclear-mora nor a syllable, and is thus independently ruled out on these grounds.

Both CONTIGUITY (NO-SKIPPING) and ALIGN-HEAD-R, (a non-violable constraint) conspire to ensure the well-formedness of CVNCV shortened forms as shown in tableau (63) (the leftmost name /adé/ is not considered in the tableau).

(63) TRUNC = Foot, ALIGN TRUNC, ANCHORING, CONTIGUITY, ALIGN-HEAD >> PARSE-Seg

BASE: /adé-bá-n-ḱẹ́/	TRUNC: Foot	ALIGN TRUNC	ANCHOR	CONT	ALIGN-HEAD	PARSE
× a. bán					*!	*****
× b. nḱẹ́		*!	**			*****
× c. bá	*!					******
× d. báḱẹ́				*!		****
✓e. bá-n-ḱẹ́						***

As is obvious from (63), the undominated status of ALIGN-TRUNC, CONT and ALIGN-HEAD forces the optimal form (candidate e) to surface as CVNCV. This candidate violates binarity at the

moraic level because it contains three moras, but this is the best the grammar could do given the high ranking status of CONT. Foot Binarity is however maintained in this form at the nuclear and syllabic levels. Other candidates are rejected for violating one higher-ranked constraint or the other: candidate (a) fails ALIGN-HEAD, candidate (b) fails ALIGN-TRUNC, candidate (c) fails TRUNC is Foot and candidate (d) fails CONT.

4.4. Theoretical Implications

In this section, I examine two theoretical implications which follow from the empirical facts presented in this chapter. The first concerns the debate on whether or not there is a distinction between metrical foot and morphological foot. The second concerns the status of PARSE-seg in the formalization of reduplicative and truncative processes in Optimality Theory.

4.4.1. Metrical Foot *versus* Morphological Foot: Foot structure in non-stress systems

Foot structure is present in non-stress systems. This is demonstrated by the facts of reduplication and truncation presented in this chapter. The implicit question that has not yet been answered concerns the nature of the foot type utilized by the non-stress languages presented: what kind of foot is present in these languages, a metrical foot or a morphological foot?

There is no straightforward answer to this question. Clearly, if the metrical vs. morphological distinction is based on whether or not a language is stress-based, foot structure in the languages under examination cannot pass as metrical. On the other hand, if, as argued in Crowhurst (1991), the presence or absence of heads is the crucial parameter for distinguishing a metrical foot from a morphological foot, then foot structure must be of the metrical type in the languages considered here: the foot is binary and headed in Yoruba, Ibibio and Ọwọn-Afa. The data presented in this chapter, therefore does not support the proposal that metrical foot is different from morphological foot (Poser 1990, Inkelas 1989, Crowhurst 1991, Bagemihl 1993).

4.4.2. Reduplication and Truncation in Optimality Theory: the Status of PARSE

Reduplication and truncation share two characteristics. First, there is usually an input-output relation between a given base and the reduplicant or truncative. Second, the two processes may be prosodically conditioned, as demonstrated in this chapter. Even though the two processes are alike in these respects, they differ on two other counts. These differences again are related to the input-output relation and the output shape of the reduplicant or truncative. First, in reduplication, the base is almost always present in the output, and the reduplicant is attached to the base as additional morphological component which is partially or totally identical to the base. The reverse is true of truncation. Truncation entails the reduction of a given base; thus, the base is only partially realised in the output form. This leads to the second point of divergence which concerns the shape of the templatic forms: reduplicants and truncatives. Reduplicants may either be prosodically constrained or not. In cases where the reduplicant is prosodically governed, reduplication could be partial, while reduplication which is morphologically conditioned is complete or total in nature. Truncation on the other hand, can only be partial or prosodically governed; nothing like total truncation (a case comparable to total reduplication) has been encountered in phonology.

The theory of Prosodic Morphology, couched within an Optimality Theoretic framework (M&P 1993, 1994) formalizes the process of reduplication by the variable ranking of prosodic constituents (if reduplication is proosdically governed) and MAX. For example, if prosody is ranked above MAX, the result is partial reduplication; on the other hand, if MAX dominates prosody, the result is total reduplication. M&P (1994) particularly discuss the status of PARSE-seg for the account of reduplication, and argue that what the non-total templatically (that is prosodically constrained reduplication) constrained reduplicant disobeys is MAX. MAX is violated because the segmental content of the base is not fully realised in the copy. Under this view, reduplication does not entail violations of PARSE-seg, because the base is always present in the output.

Clearly, the opposite holds of truncation: the base is only partially realised in the output form. Segmental materials which cannot fit into the prosodic template are not realised phonetically. This property suggests that PARSE-seg violations are incurred in truncation. In effect, the formal characterization of truncation, unlike that of reduplication, shows that PARSE-seg interacts with other constraints governing the process of truncation. In particular, the prosodic truncative must outrank PARSE-seg, such that only the materials which are needed to fill the template will be parsed; left-over segments will remain unparsed in the phonology.

4.5. Summary

In this chapter, I have presented evidence for foot structure in non-stress systems and have shown that the foot in the languages examined are binary and headed. Both trochaic and iambic foot types are attested. Evidence for this is provided either by (a) syllable well-formedness requirement (as in Standard Yoruba where only CVs are potential heads), (b) weight restrictions (as in Ibibio and Ọwọn-Afa where heavy syllables (CVV) are potential heads) or (c) sonority constraints (as in Ibibio where the head versus non-head distinction is sometimes determined by sonority restriction on segments within the foot). These properties are summarized in the table shown below:

(64) Summary of Foot Structure Properties in the languages examined:

Language	Generalization	Binarity	Head	Constraint	Foot Type
Standard Yoruba	Syllables (CV) are potential heads	Yes	Right	HEAD = σ ALIGN-HEAD-R	Iamb
Ibibio	1. Heavy syllables are potential heads 2. The first stop consonant in a CVCV word is never weakened to a fricative but the second stop consonant is always weakened	Yes	Left	1. HEAD = σμμ ALIGN-HEAD-L 2. HEAD = σ ALIGN-L ([-cont], Ft), PARSE-F	Trochee
Ọwọn-Afa	Heavy Syllables are potential heads	Yes	Right	HEAD = σμμ ALIGN-HEAD-R	Iamb

CHAPTER 5

The Prosodic Word in Benue-Congo: Minimality and Maximality Effects

5. 1. Introduction

The prosodic word plays a central role in prosodic morphology (McCarthy & Prince, 1986, 1993a M&P hereafter) in that it defines the domain of several phenomena in phonology and morphology. Standardly, the unmarked minimal prosodic word (PrWd) is characterized as a binary foot. This is so since the PrWd immediately dominates the foot in the prosodic hierarchy, and as has been extensively argued, foot structure markedness requires that every foot be binary either at the moraic or syllabic level (Prince 1980, M&P 1986, Hayes 1991, Hewitt 1994). Within the last decade, a significant body of research has been documented as evidence illustrating the importance of the minimal prosodic word. Some of these processes are reduplication, truncation, prominence assignment, tonal processes, augmentative epenthesis, blockage of deletion, defining the prosodic shape of morphological constituents such as roots, stems, and derived vs. underived words.

While this view of minimality has explained a lot of facts cross-linguistically, two empirical domains still remain unexplained. First, in most languages of Benue-Congo, minimality requires the presence of a syllable in every lexical item. Foot binarity effects are attested, but are usually restricted to the constituency of nouns or verbal stems. Second, it has been noted in language acquisition literature that children's early words are systematically truncated to a single syllable and that binary footed words emerge at later stages of acquisition (Demuth 1994, 1995, Fikkert 1994, Ingram 1978, Ingram & Fee 1982, Fee, in press). Within a conventional approach where the well-formedness of a minimal prosodic word is dependent upon foot binarity, the prosodic shape of nouns and verbal stems would easily be explained as an instantiation of foot

binarity, while the forms which obey the minimal syllable requirement would be treated as lexically marked exceptions (Itô 1990). In the same fashion, one of the standard ways of explaining why CV words are salient at the onset of word production in children's early words is to assume that this stage is the default stage, a stage which does not require the setting of the binary foot parameter (Fikkert 1994). Fikkert, for example, assumes that phonological words surface in child language only when binary footed words emerge. Under this approach, the early stage where CV words are productively produced is discounted as a phonological one. What this approach fails to explain is why children do not generate a "wild grammar" in the production of words at this stage. That is, if the early stage is not phonologically governed, why do children not simply randomly produce any kind of structure instead of the consistently produced CV forms? The CV stage further challenges the uniqueness of the assumption that the minimal word is always binary footed: if Universal Grammar uniquely supplies foot binarity as the sole constraint governing the expression of the minimal word, why do children not produce binary footed words at the early stage of acquisition?

Instead of treating CV words either as lexical exceptions or prephonological words in the case of early children's words, these forms are explained if we assume that the wellformedness of a minimal word follows from the interaction of two universal constraints: *properheadedness* and *foot binarity* (Ọla 1995). Following Itô and Mester (1992), the principle of properheadedness requires that every word must contain at least one foot, every foot at least one syllable, every syllable at least one nucleus, every nucleus at least one mora (given the moraic model adopted here). On the other hand, the markedness principle on foot structure requires every foot to be binary, either at the moraic or syllabic level (Prince 1980). This view of minimality allows for two instantiations of prosodic words. In one pattern, minimal words are expressed as a single syllable, i.e. a monosyllabic foot by properheadedness. In the other pattern, minimality is expressed via foot binarity, in which case, words must contain two moras or two syllables.

In Optimality Theory, the variable ranking of these two constraints yield four types of grammar : 1, where Ft-Bin and PROP-HEAD are undominated, the minimal word is properly headed

and binary footed (Axininca-Campa, Gokana, Idoma); 2, where PROP-HEAD outranks Ft-Bin, the minimal word surfaces as a sub-binary properly headed foot (Yoruba, Ebira); 3, where Ft-Bin outranks PROP-HEAD, the prosodic shape of the minimal word is a head-less binary foot (Japanese); 4, where Ft-Bin and PROP-HEAD are crucially dominated by PARSE, the minimal word would neither be governed by Ft-Bin nor PROP-HEAD. The principal factor in such a case would be the satisfaction of prosodic licensing which requires the parsing of phonological constituents into higher prosodic structure. Such cases, although predicted to be possible grammars by the theory, have not been reported in the literature. The relative ranking of faithfulness constraints such as LEX (RT, NUCμ, μ) and PARSE (for cases involving child language) with Ft-Bin and PROP-HEAD determines the surface realisation of minimal words. The relative ranking of PARSE and LEX may either block or trigger augmentation to satisfy Ft-Bin or PROP-HEAD or both.

I also explore the hypothesis that there is a maximal prosodic word. The existence of a maximal prosodic word is proposed to account for the upper limit restriction placed on morphemes: no morpheme in Bella Coola or Yoruba may exceed four moras or two feet (Bagemihl 1993, Ọla 1995). The hypothesis that the two feet restriction is prosodically conditioned is supported by several templatically conditioned processes which are stated as two feet: Japanese hypocoristics (Poser 1990), mimetics (Itô & Mester 1989, Poser 1990), loanword abbreviations (Ito 1990), secret language forms (Tateishi 1989, Poser 1990); Ponapean reduplication (M&P 1986: 28); English Echo words (M&P 1986: 63); Dyirbal ergative suffixation (M&P 1990:237); Yoruba hypocoristics (Ọla 1995).

By implication, then, the prosodic word is either minimally expressed as a single foot or maximally instantiated as two bipodic foot. This chapter presents empirical evidence from Benue-Congo languages illustrating both minimality and maximality effects at the level of the prosodic word. I begin by briefly reviewing the evidence for the proposal that a minimal word is a binary foot and present empirical evidence from Gokana and Idoma in support of this view. Next, evidence is presented from Yoruba and Ebira to show that the crucial minimal condition is that a syllable be present in every word, foot binarity is only required for nouns. These data are

accounted for by the variable ranking of Properheadedness and Foot binarity in Optimality Theory (P&S 1993, M&P 1993). In light of the findings from these languages, early children's words which are systematically expressed as CV cross-linguistically even in languages where adult words are minimally binary footed are revisited, and are explained as the phonological expression of Properheadedness. The discussion then shifts to the maximal prosodic word which is expressed as two feet. Two types of evidence are presented. First, morphological evidence is presented from the maximum size of roots across languages. Second, templatic evidence is presented from prefixation, hypocoristics and clefted nouns in Yoruba.

5.2. The Minimal Prosodic Word: the interaction of properheadedness and foot binarity

In this section, I wish to establish three points. First, minimality is a consequence of two universal constraints: Properheadedness and Foot binarity. Across the languages to be examined, the minimal word is either a monosyllabic foot (in Yoruba and Ebira) or a binary foot (in Idoma and Gokana). Second, the early word stage where children productively produce CV words, that is, the so-called "sub-minimal word" stage, is analyzed as a stage where the satisfaction of Properheadedness is exhibited. Third, the cross-linguistic expression of the minimal word follows from the variable ranking of Properheadedness and Foot binarity in Optimality Theory.

5.2.1. The minimal Prosodic word: Evidence in favour of foot binarity

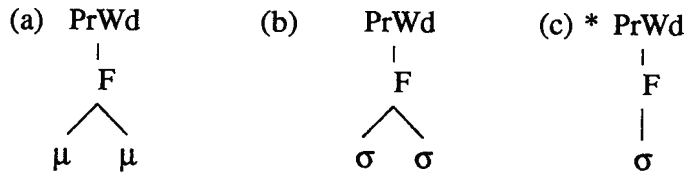
Consider the standard definition of the minimal word (M&P 1986, 1993a).

(1) The minimal word hypothesis M&P (1993a: 44):

The *prosodic hierarchy* and *foot binarity*, taken together, derive the notion *minimal word*... any instance of the category prosodic word (PrWd) must contain at least one foot. By *foot binarity*,

every foot must be *bimoraic* or *disyllabic*.

(2)



By the hypothesis in (1), the PrWds in (2a&2b) are well-formed, whereas the one in (2c) is ill-formed. A range of phonological processes provide evidence for the importance of the binary footed minimal word cross-linguistically. Some are given below in (3):

(3) The function of the minimal word in prosodic phonology and morphology:

a. defines the prosodic shape of a reduplicant (as in Diyari, Yidin, M&P 1993a,1994)

b. defines the domain of prominence assignment (as in Diyari M&P 1993a, 1994).

c. defines the prosodic shape of a truncative (as in Japanese Itô 1990).

d. defines the prosodic shape of morphological categories, viz. root, stem. (as in Lardil M&P 1993a, etc).

e. triggers augmentative epenthesis (as in Axininca Campa, Lardil, M&P 1993a).

f. blocks deletion if the output would be a subminimal form (Lardil M&P 1993a, Swahili Park 1995).

To show how the minimal word hypothesis in (1) conditions one of the processes in (3), consider Axininca Campa augmentative epenthesis (M&P 1993a).

(4) Axininca Campa (M&P 1993a, epenthetic materials are bolded)

a. Bare Root	Augmented form	Gloss
p	**pAA**	feed
na	**naTA**	carry

b. Root + infinitive suffix	Non-augmented form
p - aanc^{h}i	p - aanc^{h}i
na - aanc^{h}i	na - T aanc^{h}i

According to (M&P 1993a), C and CV roots are always augmented to CAA and CVTA (4a) in Axininca Campa. However, when a suffix is present as in (4b), nothing happens. Their analysis of these facts appeals to the notion of minimality given in (1): a minimal word must be bimoraic or bisyllabic. The input forms in (4a) are deviant because they fall below this minimal size requirement, hence, the obligatoriness of augmentation.

A similar pattern is found in Gokana, a Benue-Congo language of Nigeria. In Gokana, Arekamhe (1972) observes that CV and V morphemes are realised with epenthetic glottal stops morpheme-initially before a V, and in morpheme-final position after phonetically short vowels. Representational examples appear in (5).

(5) Glottal epenthesis in Gokana (from Arekamhe 1972)

a. CV Morphemes		Gloss	b. V Morphemes		Gloss
ké	[keʔ]	egg	ú	[ʔúʔ]	death
zɔ́	[zɔ́ʔ]	fetish	ɔ̀	[ʔɔ̀ʔ]	carve
dù	[dùʔ]	come	ɛ̃	[ʔɛ̃ʔ]	moon
bá	[báʔ]	hand	ù	[ʔùʔ]	die
gù	[gùʔ]	mountain	ɔ̃	[ʔɔ̃ʔ]	drink
tà	[tàʔ]	finish	à	[ʔàʔ]	he

In contrast, neither CVV nor CVC morphemes require glottal epenthesis as illustrated below.

(6)

a. CVV Morphemes	Gloss	b. CVC Morphemes	Gloss
gíá	hair	zɪb	steal
láo	cow	lɔ̃m	animal
gbèì	sunshine	pɔ̀b	big
kóò	friend	víl	grass
píɪ	penis	zób	dance
vòò	five	tup	twenty

At first glance, one may be tempted to attribute the augmentation of CV and V words in (5) to CVC by proposing that the glottal epenthesis is constrained by syllable structure requirements in Gokana. As argued, in chapter 3 following Hyman (1990), however, only the ONSET is required for syllabification in Gokana, coda consonants are not, as evidenced by syllable (CV) reduplication reported in chapter 3. If the unmarked syllable in Gokana is a CV, what then is the motivation for the insertion of an epenthetic glottal consonant? Why would a language create a marked syllable structure? I propose that the epenthesis of the moraic coda [ʔ] is motivated by the minimal binary foot condition. So, Gokana, like Axininca Campa places a requirement on words that every word be expressed minimally as bimoraic. CV and V morphemes do not meet this requirement and are thus forced to augment to a binary foot (CVC) by glottal epenthesis.

Park (1995) documents a lot of evidence in favour of the minimal word hypothesis in (1) in Swahili, a Bantu language. One representative argument is presented below. In Swahili declarative and imperative sentences, monosyllabic verbs require the presence of the infinitive marker [ku] even when an infinitival meaning is not intended. Disyllabic or longer verbal stems, on the other hand, have no such requirement:

(7)	Declarative	Imperative
a.	Ni-na - [ku la]	[ku la] Chakula!
	I am eating	Eat food!
	*Ni-na - [la]	*[la] Chakula!
b.	Ni-na - [kaa]	[Soma] Kitabu!
	I am sitting	Read the book!
	*Ni-na - [ku kaa]	*[ku soma] kitabu!
c.	Ni-na - [Andika] bama	[Andika] bama!
	I am writing a letter	Write a letter!
	*Ni-na - [ku andika]	*[ku andika] bama!

The difference between the behavior of monosyllabic verbs (7a) and longer verbal stems (7b,c) is explained if the hypothesis is adopted that a word is minimally expressed as binary foot. Monosyllabic verbs do not satisfy this condition, hence need supporting morphemes to meet the well-formedness requirement. This assumption accounts for why the monosyllabic infinitive marker [ku] is required to augment the subminimal monosyllabic verbs in (7a) to disyllabic forms to satisfy foot binarity. Disyllabic or longer verbal stem do not require [ku] because they already satisfy the minimal condition, and thus constitute prosodic constituents of their own.

In Idoma,[1] as in Swahili, monosyllabic verbs never occur in isolation. Thus, they obligatorily take the infinitive prefix [o] in the declarative forms as illustrated below:

(8) Idoma Monosyllabic Verbs: infinitive prefix is required

	Underlying form	Surface form	Gloss
a.	lí	ó- lí	to eat
b.	wà	ɔ̀-wà	to come
c.	jɔ̃	ɔ̀-jɔ̃	to go
d.	hè	ɔ̀-hè	to shoot

[1]The Idoma forms cited here were kindly provided by Mathias Ogo Abata.

The tonal and harmonic realization of the prefix as can be seen in (data 8) is dependent upon the tone and harmonic value of the root: if the root has a high tone the prefix also bears the same tone (8a), if on the other hand, the root bears a low tone, the prefix also surfaces with a low tone (8b-d). In terms of the harmonic representation, if the harmonic value of the root is advanced, the prefix is also advanced (8a), if retracted, the prefix is also retracted (8b-d). These properties suggest that the root and prefix form a harmonic domain prosodically defined as a binary foot.

This prefix, however is no longer required when the imperative marker [mɛ̃] is suffixed to the verb. As shown in (9), after suffixation, the prefix is optional.

(9) Imperative form: infinitive prefix is optional

Underlying form	Imperative form	Gloss
lí	(ò) lí - mɛ̃	eat!
wà	(ɔ̀) wà - mɛ̃	come!
jɔ̃	(ɔ̀) jɔ̃ - mɛ̃	go!
hɛ̀	(ɔ̀) hɛ̀ - mɛ̃	shoot!

These two observations suggest that there is a bimoraic minimality requirement on words in Idoma. The prefix is required in (8) because it allows the verb to satisfy foot binarity. On the other hand, in (9), the presence of the prefix is no longer required since the verb and the suffix together make a prosodic bimoraic word. The notion of minimality thus enables us to explain why the prefix is required in one context and optional in another context.

So far, evidence has been presented from Benue-Congo in support of the minimal word hypothesis which states that words are well-formed if they contain two syllables or two moras. However, in several other languages, monosyllabic words occur in abundance and are not augmented to two syllables or two moras as one might expect given the minimal word hypothesis in (1). Two examples of such languages, Yoruba and Ebira, are presented in the following section.

5.2.2. The minimal Prosodic Word: Evidence in favour of properheadedness

5.2.2.1. Standard Yoruba

The syllable type CV in Standard Yoruba is productively utilized in a variety of ways. For example, (i) the smallest root is a CV, the canonical verbal form, (ii) polysyllabic loan verbs truncate to the initial CV and the resulting form signifies action carried out secretly (iii) CV, but neither V nor a tone-bearing nasal reduplicates with a prosodic template that is expressed as a syllable, and (iv) consonantal deletion is possible in a word if and only if there is at least one CV remaining in it. Within standard Prosodic Morphology (McCarthy and Prince 1986, 1993a, M&P hereafter), the behavior of the CV in Yoruba would be explained as resulting from minimality constraints. However, this explanation is problematic for the theory of minimality: universally, a minimal word has been proposed to be a binary foot (bimoraic or bisyllabic as defined in 1). According to this proposal, every word of Yoruba ought to obey *categorial binarity*, a requirement that would rule out the CV patterns described above. These processes are described in the subsections below.

5.2.2.1.1. Intransitive imperatives

The first argument for the minimal CV requirement in Yoruba comes from the structural representation of verbs. In general, verbs in Yoruba are canonically CV and intransitives function as imperatives without any form of augmentation:

(10)	Verb	Imperative		Gloss
	bɪ	bì	*bɪɪ	vomit, vomit!
	ba	ba	*baa	hide, hide!
	lọ	lọ	*lọọ	go, go!
	ṣu	ṣu	*ṣuu	defecate, defecate!

Since a CV is standardly assumed to be subminimal, one might expect the CV imperatives to augment to a bimoraic or bisyllabic foot as is the case in Axininca Campa, Gokana, Swahili and Idoma. That is what one might naturally expect for Yoruba given its epenthetic vowel [ɪ] (Pulleyblank 1988) which is productively used in loan word restructuring as the following data shows:

(11) English Loan Restructuring in Yoruba

English	Yoruba	Gloss
kəum	kóòmù	Comb
pəlɪ:s	polîsɪ	Police
skuːl	súkúùlù	School
sleɪt	sílèètì	Slate

But as the forms in (8) show, imperatives are not increased by [ɪ] epenthesis to CVV or VCV to satisfy foot binarity.[2]

Igala, a close relative of Yoruba patterns differently on this count: all words, vebs and nouns, are minimally VCV. Thus Yoruba cognate or near-cognate verbs in Igala surface with an initial dummy infinitive marker [é], enabling monosyllabic verbs to augment to VCV as illustrated

[2]Verbs could be emphasized by the suffixation of the following emphatic morphemes: *kẹẹ̀*, mid-toned *o* or a low tone. In cases involving low tone suffixation, the final vowel of the verb is lengthened to provide an anchor for tonal linking. For example, lọ → lọ kẹẹ̀/ lọ o/ lọ-ọ̀ 'go' → 'go!'. This process is not conditioned by minimality effects however since longer forms and sentences are emphatically expressed similarly: sáré wá nîbí → sáré wá nîbí kẹẹ̀/ sáré wá nîbí-o/ sáré wá nîbí-ì '→ 'come here quickly!'.

in the following data (Armstrong 1965):

(12)	Yoruba		Igala	Gloss
	dʒɛ	*ɪ-dʒɛ *dʒɛ-ɪ	é-dʒɛ	eat
	mu	*ɪ-mu *mu-ɪ	é-mɔ	drink
	ʃe	*ɪ-ʃe *ʃe-ɪ	é-ce	do
	lɔ	*ɪ-lɔ *lɔ-ɪ	é-ló	go

By comparing the two languages, we see that Yoruba, unlike Igala, disallows any form of incrementation in the data in (12). Yet, these words are licit. Given the well-formedness of CV verbs in Yoruba, I conclude that monomoraic syllable imperatives function as independent words in Yoruba just as the bimoraic forms function as independent words in Igala.[3]

5.2.2.1.2. Loan verb truncation

The productive truncation pattern in the loan vocabulary presented in chapter 3 provides the second argument for the requirement that a word be minimally monosyllabic. As a reminder, the shortening process reduces polysyllabic consonant-initial English loan verbs to the leftmost CV and truncates vowel-initial loans to the leftmost V. This process applies in conjunction with [h] epenthesis, in the case of vowel-initial loans to allow the V to augment to the minimal CV.[4]

[3]Armstrong does not discuss sychronic alternations involving these forms.

[4]As shown in the starred examples in (13) there are segmental materials which could satisfy the templatic requirement in the base/input of truncation, e.g., *gì / *li. However, these forms are ruled out by other dominant constraints such as the left alignment which requires that the leftmost materials of the input be contained in the output of truncation. A candidate output such as *gi is disallowed by the no-skipping over constraint (Contiguity, M&P 1993a). See Ọla (1995c) for a detailed analysis of truncation in Yoruba.

(13)	Full Form	Truncated Form	Gloss
	páàsì	pá	to pass
	pọ́m̀bù	pọ́	to pump
	ẹ́ńfı	hẹ́ *ẹ́/ *ẹ́ń/ *f́ı	to envy
	ọ́gìlì	họ́ / *ọ́ / *gì / *lì	to be ugly

The loan verb truncation facts provide strong evidence for the minimal CV size requirement. On the assumption that minimality favours either a bimoraic or bisyllabic word over a CV word, a language should not productively create words that violate the standard minimal size. Assuming that the occurrence of CV words is prosodically motivated, the suggestion is that a CV is a licit word in Standard Yoruba.

5.2.2.1.3. Ideophone reduplication

Awoyale (1974, 1989) describes a reduplication process in Yoruba which copies the final CV in ideophones giving the reduplicated form the meaning "light intensity (of shape or action)". Representative data appear in (14):[5]

[5]Reduplication patterns involving ideophones are interesting given the accompanying tonal effects. For example, in expressing 'even intensity' the forms in (14) undergo total reduplication of tone and melody: ròǫ̀dò-ròǫ̀dọ̀, gbẹ̀m̀-gbẹ̀m̀, gbàyàù-gbàyàù. In contrast, when reduplication denotes uneveness of shape, sound or action, only the melody is totally copied, tone is not. In this case, the reduplicant receives mid tone by default (Akinlabi 1985, Pulleyblank 1986): ròǫ̀dò-rogodo, gbẹ̀m̀-gbẹm, gbàyàù-gbayau.

(14)		Base	Reduplicated form		
	a.	rògòdò	rògòdò-dò		'round and big' → int.
	b.	gbẹ̀m̀	gbẹ̀m̀-gbẹ	*gbẹ̀m̀-m̀	'heavy and soft' → int
			*gbẹ̀m̀-ẹ̀m	*gbẹ̀m̀-gbm̀	
	c.	gbàyàù	*gbàyàù-ù *gbàyàù-àù *gbàyàù-yu		'open and loose'
			*gbàyàù-hu *gbàyàù-yà *gbàyàù-yàù		

Notice in (14) that only a CV reduplicates; neither a vowel nor a tone-bearing nasal does. An explanation for the reduplication pattern is obtained under the assumption that the reduplicant is a suffixal minimal word: σ. On this view, the well-formedness of reduplication in (14a,b) could then be explained since the reduplicant is a licit minimum. On the other hand, reduplication fails in (14c) for various reasons: in *gbàyàù-ù, the reduplicant is V, a subminimal form; *gbàyàù-hù which contains an epenthetic [h] is ruled out because epenthesis is only enforced in a word which does not contain a σ (as shown in loan verb truncation in (13)). However, since the base of reduplication already contains a σ, V is not augmented to CV by epenthesis in the reduplicant.[6] This process provides the third source of evidence for the minimal prosodic word.

5.2.2.1.4. Consonantal deletion

The fourth argument for the CV minimal requirement comes from consonant deletion. Two basic types are used as illustration: (i) sonorant deletion (Akinlabi 1991), and (ii) deletion by identity (Oyelaran 1971, Pulleyblank 1988). Each deletion is triggered intervocalically. Consider these processess below.

[6]A form like *gbàyàù-yù is rendered illicit by the no-skipping over constraint (CONTIGUITY, M&P 1993a), while *gbàyàù-yà is unacceptable because the rightmost vowel of the base /u/ is not contained in the reduplicant (an ANCHORING violation).

5.2.2.1.4.1. Optional intervocalic sonorant deletion

Akinlabi (1991) discusses an optional intervocalic sonorant deletion process. As seen in (15), deletion targets glides and [r].

(15)	Full Form	Glide deletion	Deletion of [r]		Gloss
a.	ewúrẹ́	eúrẹ́	ewúẹ́	*eúẹ́	goat
	àwúre	àúre	àwúe	*àúe	luck charm
	òrúwọ	òrúọ	òówọ	*òóọ	brimstone tree
b.	orí		orí	*oí	head
	erùpẹ̀		eèpẹ̀		sand
	ìrágberí		àágberı *or* àágbeé		name of a city

Notice in these examples that deletion is permitted subject to the availability of at least one CV in the word. Thus, in (15a) either one of the two consonants may delete optionally, one at a time. Both cannot delete at the same time. If they do as in the starred forms, the resulting output is ungrammatical. The last example in (15b: ìrágberı → àágbeé) shows that it is simply not the case that two sonorants cannot delete at the same time: they do if there is a CV left in the word. Again, this is explained if we assume that the minimal size condition in Standard Yoruba requires the presence of a syllable (CV) in every word. Thus, even though the standard bimoraic minimum requirement is satisfied in the illicit output of deletion in (15), such forms are still unacceptable. A licit word is obtained only if it contains at least a CV.

5.2.2.1.4.2. Consonantal deletion by identity

Consider the forms in (16) where the first of two identical consonants in the word deletes intervocalically (Oyelaran 1971, Pulleyblank 1988):[7]

(16)	Full Form	Truncated Form			Gloss
	agogo	aago	*aao	*agoo	bell
	èsúsú	èésú	*èéú	*èsúú	traditional form of banking
	egungun	eegun	*eeun	*egunun	bone
	òtútù	òótù	*òóù	*òtúù	chill
	orìrùn	oòrùn	*oìùn	*orìùn	sun

In the forms resulting from identical consonant deletion, the output of deletion is wellformed because it contains a CV. The second and rightmost consonant is never deleted because of the CV minimality restriction.[8]

In sum, the data presented above provide strong arguments for the claim that a CV is required in every word to satisfy the minimal size requirement. Neither V nor VV can fulfill this condition. Obligatorily, a word must contain one CV in Standard Yoruba. The question that arises is whether the minimal binary foot size condition of M&P (1986, 1993a) holds of every language. If so, how does a CV satisfy foot binarity given that binarity is expected to hold of prosodic categories?

One way of ensuring that a CV obeys categorial binarity is to assume that an onset is a valid prosodic constituent (Davis 1985, etc). From this perspective, it could then be argued that

---

[7]Following deletion, the leftmost vowel spreads rightwards to the adjacent vowel resulting in a long vowel. See Pulleyblank (1988) for details.

[8]In general, the CV is preferably expressed at the right edge of the foot. This property as analyzed in chapter 4, follows from ALIGN-HEAD-R. More on the interaction of the minimum condition and the right-edge alignment condition later in this section.

both the onset and the nuclear-mora together satisfy the binary foot condition. This assumption makes a prediction that the onset should function freely as a prosodic constituent just like moras. However, this prediction is not borne out for Yoruba. Apart from syllabification in which an onset is obligatorily required (Ọla 1993), it plays no independent role elsewhere in the language. In contrast, moras (nuclear and non-nuclear) function independently as prosodic units, tone-bearing units and weight-bearing units (Ọla 1994b). Yoruba thus provides evidence for the standard assumption within moraic theory that the onset is not a prosodic constituent; if it were, it should exhibit independent characteristics usually associated with authentic constituents. The position taken here is this: since the onset is not required independently of syllabification, it would be ad hoc to accord it the same independent prosodic status accorded to moras just to make a CV conform to the standard minimal binary foot requirement.

Quite apart from the moraic theoretic considerations that rule out the onset as a prosodic constituent, Ondo, a dialect of Yoruba poses a problem for the assumption that the onset and the nuclear-mora are possible prosodic constituents which foot binarity requirement may select: as argued in chapter 3, onsets are not required for syllabification in Ondo, thus, a minimal word is expressed either as CV or V:

(17)	Standard Yoruba	Ondo Yoruba	Gloss
	rí	í	see
	rìn	ẹn [ɛ̃]	walk
	lọ	lọ	go
	fò	fò	jump

Under an approach where the onset is treated as prosodic constituent, only CV words would satisfy categorial binarity in Ondo, onsetless syllable words would not and the well-formedness of both forms is unexplained.

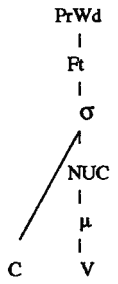
To get around the problem that confronts a proposal that accords an onset consonant the status of a prosodic constituent, one could adopt a deconstructionist approach to foot binarity (Hewitt 1994). Hewitt proposes that Foot Binarity may be viewed in Optimality Theory as a family of constraints which can be decomposed into three different constraints holding at various levels within the foot: Foot-Binμ, Foot-BinNμ and Foot-Binσ. Although Hewitt does not treat the root node as a prosodic constituent, one could extend his analysis to capture foot binarity at the level of the root node, just to preserve the standard assumption that a word must contain two phonological units below the foot: after all, the root node (though not "prosodic") is considered to be a phonological unit. This assumption would enable a CV to satisfy foot binarity (Ft-Bin Rt). This would incur four difficulties, however. First, it makes a prediction that any two root nodes - CV, VC, CC, or VV should suffice to satisfy foot binarity. This prediction is not borne out in Yoruba: only a CV is an acceptable minimum, other forms *VC, *CC, *VV are unacceptable. The second problem which this account faces is the cross-linguistic evidence that binary foot templates are preferably stated in terms of moras, nucleus or syllable, never in terms of root nodes. This is a systematic gap which is completely unexpected under the assumption that foot binarity is extendable to the root node in this specific case. Third, it predicts that two root nodes are required to fulfill the binary condition imposed on the minimal word at the expense of other well-formedness constraints. One such constraint is the Obligatory Contour Principle (OCP, Leben 1973, McCarthy 1986, Odden 1986, Yip 1988). For example, Ft-Bin Rt requires the projection of two distinct root nodes in a CV containing a glide + high vowel sequence. On the assumption that glides and their corresponding high vowels differ structurally but not featurally (Guerssel 1986, among others), the two root node requirement would yield an OCP violation in this configuration. Such a condition would be surprising given cross-linguistic evidence that languages prefer to obey the OCP rather than violate it.[9] Fourth, this analysis cannot explain why Ondo allows words either with one or two root nodes (V or CV) to be well-formed.

[9]McCarthy (1986) and Yip (1988) presents the OCP as a principle which languages *must* respect, a non-violable constraint in Optimality Theoretic terms. In Odden (1986), languages *prefer* to obey the OCP but may violate it if need be. By this latter view, the OCP is a rankable constraint which in essence is violable.

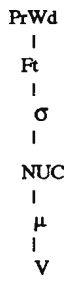
A more promising explanation for the CV minimal condition is offered by the properheadedness constraint of Itô and Mester (1992). Properheadedness requires that every word must contain at least one foot, every foot at least one syllable, every syllable at least one mora. In Japanese, for example, the interaction of *properheadedness* and *foot binarity* derives the minimum bimoraic word (Itô 1990). Adapted to Yoruba, the obligatoriness of a CV in every word is proposed to follow from properheadedness. By properheadedness, at least a syllable must be present in every word.[10] The expression of properheadedness is dependent upon the syllable structure of a given language. If ONS is required for syllabification as is the case in Standard Yoruba (Ọla 1993), properheadedness would be expressed as a CV (18a). However, if ONS is outranked and violable a minimal word is properly headed if it contains either a CV or V (18a,b; as is the case in Ondo Yoruba). The structure assumed for properheadedness is given below:

(18) Yoruba minimal size condition: Properheadedness

a



b.



The notions of ranking and violability are crucial for the analysis of Yoruba. Prior to OT, a language such as Yoruba which allows CV minimal size condition is predicted to be non-existent: the universal minimal word condition requires at least two moras. OT, however, predicts the

[10]The possibility of a Catalexis analysis (Kiparsky 1991, etc) was raised by Alan Prince. Under this view, one would have to assume that there is an empty prosodic constituent (μ, NUC or σ) at the edge of a monosyllabic word which enables it to conform to the standard bimoraic or bisyllabic minimum:
Two arguments militate against such a view. First, if the above representation were the correct one for Yoruba, the empty prosodic position ought to be filled with epenthetic materials; /h/ in onset position and /i/ in the moraic position. Thus, a form like lọ should surface as *lọ-hi. But in fact, no such thing occurs. Second, a catalexis analysis cannot account for why lọ is well-formed while V-only words are not as shown by the facts of consonant deletion (òwúrọ̀ ~ òúrọ̀ ~ òwúọ̀ *òúọ̀).

existence of Yoruba: phonological and templatic constraints are in principle violable, the minimal bimoraic constraint inclusive. For Yoruba, the basic constraint is Properheadedness (Itô and Mester 1992):

(19) PROP-HEAD: Every prosodic word must contain one foot
Every foot must contain one syllable
Every syllable must contain one nucleus
Every nucleus must contain one mora

Because CV words are never augmented to a binary foot, the faithfulness constraints which prohibits the insertion of phonological consitutents, LEX-μ (LEXμ),[11] and LEX-NUCμ are crucially ranked higher that Ft-Bin. Here is the ranking which derives the CV minimal size:

(20) PROP-HEAD, LEX-NUCμ >> Ft-Bin.

Given the constraint ranking in (20), any output candidate that satisfies the undominated and highly ranked constraints is evaluated as optimal even if it violates lowly ranked Ft-Bin.[12] Thus, this ranking predicts that given a CV input, the optimal output would be a CV. This output would satisfy properheadedness and augmentation to Ft-Bin would be prohibited by REC-NUC which is more highly ranked than Ft-Bin. Tableau (20) demonstrates this:

[11]For simplicity, violations of LEXμ and LEX-NUCμ are represented as LEX-NUCμ violation.
[12]Ft-Bin will be expressed either as Ft-BinNUCμ or Ft-Binσ, **not** as Ft-Binμ which if allowed would be realized as a word consisting of two nasals, a prohibited configuration in Yoruba. If we adopt the hypothesis that nasals are moraic, not syllabic as argued in chapter 2 and in Qla (1994b), then the observed asymmetry between licit CV words and unattested *N-only words are explained

(21)	PROP-HEAD	LEX-NUCμ	Ft-Bin
✓a. wá			*
b. w áa		*!	

The optimal candidate in (a) obeys all the top-ranking constraints though it violates lowly-ranked Ft-Bin. Candidate (b) does not emerge as the winner despite the fact that it respects PROP-HEAD and Ft-Bin. In particular, (b) is ruled out because it obeys Ft-Bin at the expense of violating top-ranked LEX-NUCμ.

Assuming that PROP-HEAD is undominated in Yoruba, one can now account for why sonorant deletion does not apply across the board to yield vowel-only words in binary footed (or larger forms) words in Standard Yoruba. Before dealing with the overall process of sonorant deletion such as (ewúrẹ́ ~ eúrẹ́ ~ ewúẹ́ *eúẹ), let us review the analysis of [r] deletion proposed in chapter 4. Recall from our previous discussion that the constraints governing intervocalic [r] deletion are *OCP-PLACE and *PLACELESS. *OCP-PLACE prevents vowels with identical features from flanking underspecifed [r], while *PLACELESS forces the spreading of place features from moras of vowels whose features are specified to those of vowels which are unspecified for place features. This process as earlier mentioned, applies only when there is another consonant in the word as illustrated by comparing the following forms (àrágberí → àágbeé, orórì → oórì *oóı vs. orí → *oí). As demonstrated earlier, this shows that the Properheadedness constraint dominates *OCP PLACE, *PLACELESS NUCμ >> *M/COR[r], *P/HI

(22) PROP-HEAD >> *OCP PLACE, *PLACELESS NUCμ >>*M/COR[r], *P/HI, Ft-Bin

Tableau (22) demonstrates the interaction of the ranked constraints.

(23) /orí/	PROP-HEAD	*OCP PLACE	*PLACELESS	M/COR[r]	*P/HI	Ft-Bin
a. oí	*!					
✓b. orí				*	*	

In (a), the drive to satisfy the highly-ranked PROP-HEAD forces the optimal candidate to violate lowly-ranked *M/COR[r] and *P/HI. Even though candidate (b) satisfies these two constraints and Ft-Bin, it is still less optimal because it violates top-ranked PROP-HEAD. Compare the illicitness of the VV form in (22) with the well-formedness of /àrágberí/ which surfaces as /àágbeé/:

(24) /àragberí/	PROP-HEAD	*OCP PLACE	*PLACELESS	M/COR[r]	*P/HI	Ft-Bin
a. àrágberí		*		**	*	
b. àágberí				*	*	
c. àrágbeí				*	*	
d. àagbeé						

All the forms in (24) are possible.[13] But the interesting form that I wish to consider here is (24d), a form that fully satisfies *COR/r. Why is (23a: *oí) an impossible output? Why is (24b: àagbeé) well-formed? The answer to this question is found by simply considering evaluating the candidates based on the established ranking of PROP-HEAD and other lowly ranked constraints. In (23a), undominated PROP-HEAD propels the violation of *M/COR[r] whereas in (24d), the obedience of *M/COR[r] is possible because of the presence of a syllable in the word, PROP-HEAD is thus respected in the output.

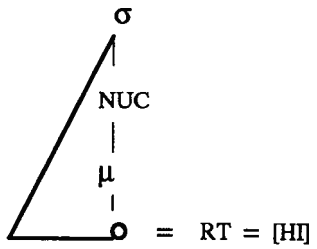
Now, let us turn to the analysis of alternating forms which either appear with [r] or a glide corresponding in featural properties to the following high vowel (ewúrẹ́ ~ eúrẹ́ ~ ewúẹ́ *eúẹ). In a form where [r] is present, glide formation is not required, in a form where [r] is deleted on the other hand, glide formation is obligatory: a syllable must be present in the word. I propose that glide formation is triggered by the need to satisfy PROP-HEAD. So, just as *M/COR[r] is dominated by PROP-HEAD, the constraint governing glide formation is obviously dominated by PROP-HEAD.

Assuming following Guerssel (1986) that high vowels and glides differ only in terms of

[13]Optionality in OT has been characterized as effects following from (a) constraints which are crucially unranked (Blake 1993), (b) the effect of having different input forms for the same process (Grimshaw 1994).

their structural characterization, and given the OCP restrictions on identity and adjacency of melodic representation, I assume that the glide-high vowel sequence in (ewúrẹ́ ~ eúrẹ́ ~ ewúẹ́ *eúẹ) is represented as one root node which is linked to two different syllable positions, the onset (root node as defined by the ALIGN-L constraint) and the nuclear-mora. As an onset consonant, this root node links directly to the syllable node, whereas as a vowel, the root node is dominated by a nuclear-mora:

(25) <u>Representation of identical glide-vowel sequence</u>



When the path between a feature and a prosodic anchor is not a lexical property, a LEX-PATH-F violation is incured. The creation of a path between a high vowel and a glide in the alternating forms in Yoruba violates LEX-PATH-Ft (he constraint governing the well-formedness of association lines between features and prosodic anchors, Archangeli & Pulleyblank 1994, Itô, Mester & Padgett 1993).

(26) LEX-PATH-F: For any path between an F-element α, and some anchor β, if α is associated to β in the output, then, α is associated to β in the input.

The ranking and tableau that implement this analysis are given below.

(27) PROP-HEAD >> *M/COR[r], LEX-PATHF

Full form: /ewúrẹ́/	PROP-HEAD	*M/COR[r]	LEX-PATHF
a. eúẹ́	*!		
b. eúrẹ		*	
c. ewúẹ			*

The optimal candidates in (27) are forms where PROP-HEAD is obeyed. Candidate (a) fails because it violates PROP-HEAD, a high-ranking constraint.

The claim in OT that a lowly ranked constraint is functional in a grammar is supported by noun canonicity. Canonical nouns are expressed as VCV as shown by the representative data given below:

(28)

Noun	Gloss
aṣọ	cloth
oṣù	month
ọmọ	child
alẹ́	night

This shows that foot binarity is respected within some domain, namely the domain of the noun:

(29) Nouns are minimally binary footed

The robust expression of nouns in Standard Yoruba is VCV. The question is why are nouns so expressed? Why can't they be freely realised as either VV, CVV or VCV? The fact that a CV is obligatorily present in every word is proposed to follow from Properheadedness. Why is the CV required at the right edge of the word?

It is well-known that heads of words in languages prefer to occur at a particular edge. As shown for Japanese, heads occur at the left edge of the word (Itô and Mester 1992). In Yoruba, the

situation is reversed: heads occur at the right-edge of the word. CV words maximally satisfy this requirement. They contain one head and are properly aligned. Now if we adopt the hypothesis that the head of a word prefers to occur at the right-edge, then a simple explanation emerges as to why nouns are realised as VCV not as CVV. Formalized within Generalized Alignment (M&P 1993b), this condition as defined earlier in chapter 4 and repeated below for referential convenience:

(30) ALIGNHEAD (HEAD, R; Ft, R):

the head of a foot must be aligned with the right edge of a foot

However, as shown in (27), a few VV nouns exist. In all, they are thirteen in number. Apart from the fact that this set is not as robust as the VCV-type nouns, they are also special because the rightmost V is always [high]. In addition, this class exhibits a unique property in that they are freely realised as VV or VCV.[14] Whenever they are expressed as VCV, the onset can either be a glide corresponding featurally to the rightmost high vowel or a [h] if the high vowel is specified for [nasal].[15]

(31)

VV Form	Glide Formation	Forms with [h]	Gloss
aun	awun	ahun	tortoise/miser
ẹ̀in	ẹyìn	ẹhìn	palmnuts
ìín	ìyín	ìhín	here
òú	òwú	*òhú	cotton

The question is, how does one account for this alternation? There are two possible ways of explaining it. First, it could be argued to be a deletion process by which either (i) the place node of

[14]Judgements vary among speakers on the VV realisation of the forms in (31). In general, the VCV forms are highly preferred by most speakers of Standard Yoruba. In fact, some speakers do not use the VV variants at all. Speakers of Ọyọ dialect, a dialect which permits a pervasive rule of deletion, both consonantal and vocalic (Awobuluyi 1981), however, tend to lean towards the free VV~VCV variation. For Standard Yoruba, I propose following Awobuluyi (1981) that only the VCV forms are permitted.

[15]A sonorant which is tautosyllabic to a nasalized vowel becomes nasalized e.g., /yún/ → [ỹũ] 'to be pregnant' (Oyelaran 1971, Pulleyblank 1988).

the glide or (ii) its root node delinks intervocalically when the right flanking vowel is a homorganic [high] vowel. When the place node is deleted, the root node remains and is interpreted as voiceless fricative [h]. When deletion targets the root node on the other hand, the glide is removed from the representation resulting in a VV output. Call this the Deletion Hypothesis. Second, the alternation could be analysed as a leftward high vowel spread triggered in a VV sequence. This creates an onset glide to meet the Properheadedness requirement. Alternatively, an epenthetic [h] could surface in the onset position if a nasal specification is present in the syllable containing the epenthetic consonant.[16,17] Call this the Spreading/Epenthesis Hypothesis.

In analysing these glide vowel alternations, these two hypotheses were considered in Akinlabi (1991).[18] He argued for the deletion hypothesis. However, the evidence adduced from other consonantal deletion processes in Standard Yoruba points in the other direction: Cs are immune to deletion if it would yield a violation of Properheadedness (as shown by the deletion pattern in (a) optional sonorant deletion, and (b) consonant deletion by identity. Hence, evidence from the language suggests that the spreading hypothesis is the more plausible of the two hypotheses since that would enable the satisfaction of Properheadedness. Further, since [h] epenthesis is independently attested elsewhere in the language (loan verb truncation), it seems plausible to assume that this is an available option for respecting Properheadedness.

Assuming that glide formation follows from ranking PROP-HEAD above LEXPATHF, cases in which the VV forms are realised as VGV (aun ~ awun 'tortoise', òú ~ òwú 'cotton') are straightfowardly accounted for by invoking this ranking as depicted in these two tableaux where the optimal forms obey PROP-HEAD by violating LEX-PATHF.

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[16]The fact that nasality conditions /h/ epenthesis seems plausible in view of the fact that nasalized vowels in the language prefer to occur in a σ, i.e., a CV configuration. Hence, although it is impossible to find native words begining with a nasalized vowel *ṽcv, c-initial words may contain nasalized vowels, e.g. rán 'sew/send', tuntun 'new'. Note that /h/ epenthesis is further motivated by Properheadedness.

[17]The interaction of nasality and aspiration is also attested in some Igbo dialects. The motivation for this interaction is unclear at present.

[18]The second hypothesis suggested here, i.e., spreading/epenthetic is slightly different from the one offered by Akinlabi (1991). In the original version, /h/ is specified as underlying while the glides are derived by spreading the root nodes of the high vowels to the underlying /h/.

(32) PROP-HEAD >> LEXPATH-F

Full form: /òwú/	PROP-HEAD	LEX-PATHF
a. òú	*!	
✓b. òwú		*

(33 PROP-HEAD >> LEXPATH-F

Full form: /awuń/	PROP-HEAD	LEX-PATHF
a. aun	*!	
✓b. awun		*

As mentioned in the previous discussion, VV forms, whose rightmost high vowels are nasalized exhibit a unique property which their non-nasalized counterparts do not have: if the rightmost high vowel is specified for [nasal], an epenthetic [h] may appear in the onset position so that the vowel can syllabify to satisfy PROP-HEAD, [h] epenthesis is probited when nasality is absent (aun ~ awun ~ ahun 'tortoise', òú ~ òwú *òhú 'cotton'). In other words, the presence of nasality correlates with the presence of aspiration and vice versa, a nasal aspiration co-occurrence restriction. For the present purposes, the informally characterization of this phenomenon which I shall adopt here is stated as follows:[19]

(34) Nasal/Aspiration: If [+glottis], then [nasal]

Since this condition applies in the domain of the syllable created to satisfy PROP-HEAD, it is stated as [Nas/Asp]σ. For [Nas/Asp]σ to be satisfied, a root node [h] which was not present in the input surfaces in the output, a LEX-RT violation. This shows that PROP-HEAD and [Nas/Asp]σ dominate LEX-RT.

[19]A detailed examination of this process is a major topic, which is outside the scope of the present work.

(35) PROP-HEAD, [Nas/Asp]σ >> LEXPATH-F, LEX-RT

/òwú/	PROP-HEAD	[Nas/Asp]σ	LEX-PATHF	LEX-RT
✓ a. òwú			*	
b. òhú		*!		*

In (35), the optimal candidate is the form that violates lowly-ranked LEX-PATHF, the candidate that violates lower-ranked LEX-RT, in contrast, is rejected because it does not meet the structural description for the insertion of [h]: the nuclear-mora of this syllable is non-nasalized. A violation of the same constaint, LEX-RT is permited if the appropriate structural context is satisfied as the following tableau shows:

(36 PROP-HEAD, [Nas/Asp]σ >> LEXPATH-F, LEX-RT

Full form: /awuń/	PROP-HEAD	[Nas/Asp]σ	LEX-PATHF	LEX-RT
✓a. ahun				*
✓b. awun			*	

In (36), [h] epenthesis is licit in candidate (a) because the syllable containing this segment is nasalized, while candidate (b), a form that disobeys LEX-PATHF is also a possible optimal form because the constraint is lower-ranked. The critical constraint for the well-formedness of these forms is the satisfaction of higher-ranked PROP-HEAD.

The findings presented above may be summarized as follows. Yoruba imposes a unique minimal size condition on every word: each word must contain a CV, regardless of its number of Vs. This well-formedness condition follows from Properheadedness. Since a head (i.e., σ) is commonly realised at the right edge of the word, I have proposed the Right-headedness constraint. Evidence for this proposal was adduced from the canonical shape of nouns and distributives. Placed within the standard notion of minimality which requires that minimal words be binary footed, Yoruba is clearly deviant. The basic requirement is the CV minimal size condition which cuts across all categories: verbs, nouns and ideophones. All other conditions then follow. Thus, the condition that nouns be obligatorily binary footed is optimal if only the CV condition is also

satisfied.

The obligatoriness of PROP-HEAD is obtained in OT by ranking: PROP-HEAD is undominated in Yoruba. Other constraints such as *M/COR[r], LEX-RT, LEXPATHF are lower ranked and may be violated under pressure to satisfy PROP-HEAD as evident from the following processes: (i) [h] is epenthesized to augment a V initial polysyllabic loan verb to CV, (ii) the rightmost high vowel in a VV sequence spreads to the prenuclear position creating a glide onset; alternatively, when the rightmost V is nasalized, [h] is epenthesized into the onset position, (iii) [r] deletion is prohibited in a context where it would otherwise be expected to apply. Compared with Properheadedness, Ft-Bin is lowly-ranked. This is so since CV words are not compelled to augment to Ft-Bin in Yoruba, as is reported for languages such as Axininca Campa, Gokana, Swahili and Idoma for example.

5.2.2.2. Ebira

Like Yoruba, verbs in Ebira (Standard Ebira: Adive 1989, Jatto 1994 and Igara: Adigun 1970) have a canonical CV shape and function as imperatives with no form of augmentation:

(37) Ebira imperatives (from Jatto 1994:61)

Verb	Gloss
rí	eat, eat!
pà	beg, beg!
tè	hide, hide!
ŋʊ	enter, enter!

Notice that the lack of incrementation to VCV (as we saw in Igala 9) or to CVV or CVC (as demonstrated in Axininca Campa 4a and Gokana) is not prevented by the absence of an epenthetic vowel in the language: like Yoruba, Ebira has an epenthetic vowel [ɪ] which features prominently

in the loan vocabulary for word restructuring. The following examples attest to this fact (Adive 1989, Jatto 1994; epenthetic vowels are underlined; as in Yoruba and Ọwọn-Afa, epenthetic vowels surface as [i] or [u] depending on the back value of adjacent segments):

(38) Ebira loan restructuring (from Adive 1989, Jatto 1994)

English	Ebira	Gloss
kəum	ɪkóòmù	Comb
pəlɪ:s	ɪporîsɪ	Police
sku:l	ɪsíkúrù	School
sleɪt	ɪsíréètì	Slate

In (38), epenthesis is constrained by phonology and morphology. The phonology of Ebira disfavors consonant clusters as well as closed syllables. Thus, when words having such structures are borrowed from English, they are restructured by epenthesis to fit into the canonical CV syllable structure of Ebira. Ebira has another morphological property which is quite pervasive in the Benue-Congo family: the requirement that nouns begin with a vowel. This property propels the insertion of epenthetic [ɪ] in the word-initial position as evident from the data in (38). If epenthesis results from the requirements of prosody (Itô 1989), the epenthetic process in (38) must be prosodically governed. The prosodic constituent that is filled up with vocalic features in (38) is the nuclear-mora which is syllabified with a preceding consonant, if any. Otherwise, the mora, being a prosodic licenser (Zec 1988, etc.) guarantees the phonetic interpretation of unsyllabified onsetless Vs. The loan word restructing facts provide evidence that FILL (syllable (or prosodic) positions must be filled with an underlying segment) is violable in Ebira when an empty prosodic position is present in the lexical entry.

Thus, we see from the loan phonology that an epenthetic vowel exists in Ebira. But as seen from the monomoraic imperatives in (37), they never augment to CVV by vowel epenthesis or even by vowel lengthening because there is no prosodic motivation for such incrementation. Given that

the CV verbs in (37) are well-formed in spite of the fact that they do not augment to a binary foot, one is led to conclude that they are licit words in Ebira. The Ebira data is explained if we adopt the view that Properheadedness plays a role in defining the minimal size of words. Once this view is adopted, the fact that monosyllabic verbs function as imperative without incrementation follows logically. The ranking that accounts for this data is exactly like that established for Yoruba:

(39) PROP-HEAD, LEXNUCμ >> Ft-Bin

Candidates	PROP-HEAD	LEX-NUCμ	Ft-Bin
✓ a. π			*
b. πι		*!	

In (b), the candidate is rejected because it violates higher ranked LEX-NUCμ to satisfy lower-ranked Ft-Bin, while the form in (a) spares the same violation by violating Ft-Bin. Having obeyed higher ranked PROP-HEAD, it emerges as the optimal form.

As argued in M&P (1986), patterns of truncation provide insightful evidence for the notion of minimal word. Specifically, truncation applies to forms that would not yield words which are below the minimal size, but is blocked in cases which would result in subminimal words. For example, in Lardil, an Australian language, truncation applies to three or more moras (40a) whereas the same process is prevented from applying in disyllabic words (40b):

(40) Lardil Truncation (from M&P 1993a)

	Inflected	Uninflected		Gloss
a.	mayara-n	mayar		rainbow
	karikari-n	karikar		butter-fish
b.	mela-n	mela	*mel	sea
	wite-n	wite	*wit	interior

This set of data is explained in M&P (1996, 1993a) as an instantiation of word minimality which

requires the presence of at least two moras in ever word in Lardil. The non-application of truncation in (40b), then, is accounted for since deletion in this case would yield subminimal words.

Let us test this hypothesis in Ebira. In Ebira, when two vowels occur at morpheme boundary, a hiatus environment is formed. If the two vowels are non-high, the first vowel is either deleted or assimilated to the second vowel to resolve the hiatus. However, if the first vowel is high, it does not delete, instead, it loses its tone and surfaces as a glide on the preceeding consonant. Consider these processes in the following examples involving a sequence of a CV verb and a following VCV nominal object:

(41) Vowel Hiatus resolution in Ebira

a. Deletion:

Vowel hiatus context			Output (after vowel deletion)	Gloss
dɔ́	+	ozí	dózí	get the child
tò	+	ɔhá	tɔhá	arrange the spears
ré	+	ɛvó	rɛ́vó	see a goat
ná	+	òbó	nóbó	sell a rope

b. Glide formation:

Vowel hiatus context			Output (glide formation)	Gloss
hì	+	ècè	hʲècè	buy wine
hí	+	ozí	hʲózí	call child
tú	+	ɛvó	tʷɛ́vó	beat goat
dʊ	+	àzà	dʷàzà	chase goat

In (41), the resolution of vowel hiatus either by vowel deletion or glide formation is naturally expected since the output forms conform to the standard bimoraic minimal size. However, if the

bimoraic/bisyllabic minimal condition is operative in Ebira, one would expect glide formation to be blocked in morpheme sequences consisting of two vowels. This expectation is not fulfilled: the same process applies between a CV verb and the third person singular pronoun object, a V, as shown below:

(42)	Vowel hiatus context			Output (glide formation)	Gloss
	nĩ	+	ɔ	nʲɔ	skin it
	vu	+	ɔ	vʷɔ	mould it
	hì	+	ɔ	hʲɔ	buy it
	tú	+	ɔ	tʷɔ́	beat it

In (42), the CV-V input yields a CGV output. The high vowel which was originally moraic, as is obviously the case because it bears tone (Hyman 1985, Pulleyblank 1994), loses its tone and mora and surfaces as a glide. This results in a subminimal form by the standard definition of minimal word (1): words are minimally bimoraic or bisyllabic. However, these words are well-formed and so it seems safe to conclude that they are licit prosodic constituents of their own as was demonstrated for Yoruba in the previous section.

Again, once we say that Properheadedness is the crucial condition for meeting minimality in Ebira, the fact that glide formation applies to polysyllabic as well as bisyllabic words follow nicely: in all of these forms, Properheadedness is satisfied fully. Since the output forms in (42) are CGV not CVV, this shows that PROP-HEAD outranks Ft-Bin. To account for the vowel hiatus resolution data involving glide formation, I assume the following: 1, I assume following Rosenthall (1994) that glide formation in CGV sequence (where the second consonant is secondarily articulated as a glide) entails the obedience of PARSE-HI (PLACE), but results in a violation of PARSEROOT since the high vowel no longer surfaces as an independent segment in the output form constraints; and, 2, that NVH prevents vowel hiatus across morpheme sequences:

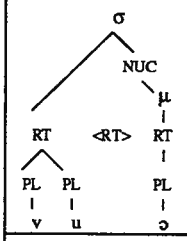
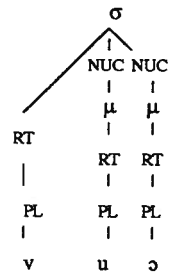
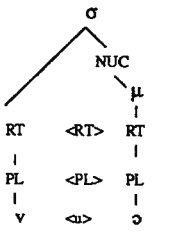
(43) a. NVH: Vowel Hiatus (sequences of unidentical vowels) is prohibited

b. PARSE-HI (PLACE): HI-Place Features must be parsed

c. PARSE-ROOT: Roots must be parsed

These constraints are ranked with PROP-HEAD and Ft-Bin as follows:

(44) PROP-HEAD, NVH, PARSE-HI >> PARSE-ROOT, Ft-Bin

Candidates	PROP-HEAD	NVH	PARSE-HI	PARSE-RT	Ft-Bin
✓a. v^wɔ: 				*	*
b. vuɔ: 		*!			
c. vɔ: 			*!		

The form in (b) satisfies lower-ranked Ft-Bin, PARSE-RT and PARSE-HI at the expense of higher ranked NVH and is rejected for that reason. Candidate (c) is rejected because it violates PARSE-HI, a highly ranked constraint. Candidate (a) avoids violations of the same constraints by

disobeying Ft-Bin and PARSE-RT and surfaces as the winner; its well-formedness is taken care of by undominated PROP-HEAD which it obeys.

One should ask if foot binarity plays a role in Ebira. Like Yoruba nouns, Ebira nouns are minimally VCV. Shorter nouns are not found in the language. Examples are given below:

(45) Ebira Nouns:

Noun	Gloss
àdá	Father
òtá	Friend
òkà	Food of yam flour
àmù	Cap

The minimal requirement on nouns is explained if we assume that the constraint NounFt-Bin is operative in Ebira. This constraint ensures that no noun falls below the minimal two mora requirement. It is worth asking if the sole requirement for noun minimality is the binary foot condition or whether the satisfaction of PROP-HEAD is additionally required. As recorded by Adigun (1970) a few VV nouns are attested in Ebira, but they generally alternate as VCV:

(46) VV ~ VCV alternation in Ebira and Igara

VV form	VCV form	Gloss
aí	ají	Heart
éí	éjí	Hair
èó	èwó	Ten
ɔɪ	ɔjɪ	Thread

Observe in (46) that the rightmost vowel is always a high vowel and note too that the consonant in the VCV form is a glide corresponding in featural properties to the high vowel. The alternating

forms are accounted for if as claimed earlier, PROP-HEAD is undominated in this language: a syllable must be present in every word. What the above data suggests is that the preferred shape of a syllable in Ebira, as in Standard Yoruba, is CV. Thus, we can extend the Standard Yoruba type analysis to the data above to account for the alternating pairs. The required constraint ranking is: PROP-HEAD >> LEXPATH-F

(47) PROP-HEAD >> LEXPATH-F

/aí/ 'heart'	PROP-HEAD	LEXPATH-F
a. aí	*!	
✓b. ajɪ		*

In the following subsection, I extend the analysis of the minimal CV condition in Yoruba and Ebira to account for the very first stage in word acquisition, a hitherto recalcitrant data for the standard analysis of prosodic minimality.

5.2.2.3. Markedness and the acquisition of the prosodic word

It is well-established in the language acquisition literature that children's early words are truncated in form. Such words are systematically expressed as CV, the unmarked form of syllables. In English, for example, four stages of production are identified as follows (No data is cited in Demuth 1995).

(48) Stages of language acquisition in English (Demuth 1994, Ingram 1978)

Stage 1: Core syllables -CV- are produced (No vowel distinctions)

Stage 2: disyllabic forms - binary feet- appear

Stage 3: words larger than disyllabic forms appear

Stage 4: the target form emerges

In Dutch too, children also produce the unmarked form of syllables, that is CV, at the

onset of language acquisition. Thus, a word containing two or more vowels in the adult form is shortened to a CV in child language:

(49) Stage I (Dutch, data from Demuth 1995)

	Child	Adult Target
a.	[ka:], [kɒ]	/kla:r/
b.	[da:], [dɒ]	/da:r/
c.	[tɪ:], [tɪ]	/dɪt/

Fikkert (1994) classifies this as the default stage which does not require the setting of the binary foot parameter. For Fikkert, CV words are not phonological words because they do not satisfy foot binarity.

In Yoruba, children's early words appear to be predominantly CV: canonical CV verbs remain unchanged, canonical VCV nouns and larger nouns are truncated to the rightmost CV in the word (Data based on my own research):

(50) Stage 1 - CV: verbs and nouns

Child	Adult target	Gloss
wá	wá	come (LD at 1.3-1.4)
yɔ	lɔ	go
ỹí	eỹí	teeth
mĩ	omĩ	water
ta	òkuta	stone
tè	ɔ̀gèdè	banana/plantain

From the above, it is plausible that the cross-linguistic characterization of the unmarked minimal word in child language is a core syllable CV. How is this stage to be accounted for?

There are two proposals in the literature. The first approach is that of Fikkert (1994) who does not regard the CV stage as a phonological one. She treats it as a default stage, a stage where the child is still unsure of how to set the binary foot parameter. For Fikkert, phonological words emerge when bimoraic and bisyllabic words appear in child language. Essentially, then, the CV stage is dismissed as a stage which is not phonologically constrained. Some questions arise for this analysis. Why are the words produced by children at the earliest stages consistently and predominantly expressed as CV? Why do children not make errors in producing such forms? Specifically, if word production is not phonologically constrained at the CV stage, why can't children generate "wild grammars" at the onset of word production? Assuming that Universal Grammar supplies the language learner with the unmarked values even without exposure to data, why is it that children learning English and Dutch do not begin word production at the (C)VCV stage even after exposure to the adult grammar in which words are minimally binary footed (Ito 1990, Fee to appear, Fikkert 1994)? The child data in Yoruba is equally startling: why are nouns truncated to a CV in Yoruba in spite of the fact that nouns are minimally VCV in the adult grammar? There is no straightforward explanation for these questions in an approach that disregards the CV stage as phonological: the CV stage is just a default stage which is not constrained by any principle of UG.

The second explanation is offered by Demuth (1995). Demuth proposes that the CV stage is governed by the phonological principles. Indeed, this is a natural conclusion since words are not randomly produced at this stage. This is not a novel idea; it just confirms the view proposed by Jackobson (1968) and Ingram (1978, 1989b) that the child's first words is a product of phonology. Specifically Demuth appeals to the principles of syllabification in accounting for the expression of words at this stage: early children's grammars allow for the emergence of unmarked syllables. Even though the CV stage is an instantiation of phonological principles in Demuth's account, she calls it a "sub-minimal" stage. Like Fikkert, she assumes that minimal words are produced when (C)VCV words surface, an attempt to preserve the standard definition of the minimal word. She offers three possible explanations for the existence of the "sub-minimal" stage. The three analyses

are summarized below:

(51) Possible accounts of the CV stage (Demuth 1995):

a. Avoiding the problem of setting binary foot parameter (trochaic or iambic)

b. Avoiding a violation of syllable markedness constraint such as NO-CODA (e.g. in languages with closed syllables where the coda consonant counts as moraic for minimality)

c. Prosodic word is left unspecified for foot binarity (Prosodic Word immediately dominates syllable in violation of exhaustivity)

These three proposals incur difficulties, each of a different nature. First, of the two types of foot structures attested in natural languages, the trochaic foot is standardly assumed to be the default type (Hayes 1985, 1991) and should be available to Universal Grammar. If so, the trochaic foot should be available to children at the early stage of acquisition making it possible for the early emergence of binary footed words. Second, the obedience of the NO-CODA constraint proposal neither explains why children acquiring a language like Yoruba which does not have coda consonants truncates VCV or VCVCV nouns to a CV nor why vowel length is not retained in children's words in languages with length distinction (in English and Dutch). Third, the binary foot underspecification account does not work either because if the unmarked foot is binary, it should be salient in the production of children's words rather than be underspecified.

The above problems are particularly avoided if we assume that PROP-HEAD is a constraint governing minimality: CV words are the phonological expression of Properheadedness. If PROP-HEAD and Foot Binarity are available to Universal Grammar for the spellout of word well-formedness, then children have an option of expressing the minimal word as a syllable by PROP-HEAD or a binary foot by Foot Binarity. Evidence from child data so far show that children prefer to launch into the phonological world of word production through PROP-HEAD, foot binarity is utilized at a later stage. At the PROP-HEAD stage, PARSE-seg violations are incurred

since the adult full form which constitutes the input for the child's phonology is not present in the output. Further, the fact that there is no pressure to augment CV words either to CVV, VCV or CVC, this constitutes evidence that LEX-NUCμ, LEXμ and LEX-RT outrank Ft-Bin. In Optimality Theory framework, this is expressed by ranking PROP-HEAD above Ft-Bin and PARSE-seg:

(52) The CV Stage: PROP-HEAD, LEX-NUCμ, LEXμ and LEX-RT are undominated

PROP-HEAD, LEX-NUCμ, LEXμ, LEX-RT >> Ft-Bin, PARSE-seg

In languages where Foot Binarity plays a role in minimality, the ranking shifts over time as the child attains further stages of acquisition to promote Ft-Bin to a higher level in the ranking hierarchy. In English and Dutch, Foot Binarity and PROP-HEAD become equally ranked as in the adult grammar, while in Yoruba, Foot Binarity become relevant only for nouns.

5.2.2. 4. Typological Rankings: Properheadedness and Foot Binarity

Assuming that PROP-HEAD and Foot Binarity are the two constraints required for the phonological characterization of the minimal word, four logical language typologies are obtained via ranking. First, in a situation where both constraints are undominated, the minimal word must contain a syllable as well as two tokens of either the mora or syllable (PROP-HEAD, Ft-Bin: e.g. Gokana, Idoma and Igala). Second, if Properheadedness outranks Foot Binarity, the minimal word will be spelt out as a monosyllabic syllable (PROP-HEAD >> Ft-Bin: e.g. Yoruba, Ebira, the unmarked minimal word in child language). Third, if Foot Binarity outranks Properheadedness, then the minimal word surfaces as a binary footed word with no crucial reference to syllable structure (Ft-Bin >> PROP-HEAD: e.g. Japanese). The fourth typology entails a scenario where a faithfulness constraint, such as PARSE-Seg for example, outranks Properheadedness and Foot Binarity, then, the minimal word may not be prosodically conditioned by either PROP-HEAD or Ft-Bin. To my knowledge, such languages have not been discussed in the literature. The various

typologies documented in this chapter are illustrated in the following table.

(53) Typological Ranking of Properheadedness and Foot Binarity

Language	Minimal Word	Constraint Ranking
a. Gokana	Binary foot (CVC or CVV)	PROP-HEAD, Ft-Bin are undominated. Both constraints outrank LEXRT
b. Idoma	Binary foot (VCV or CVCV)	PROP-HEAD, Ft-Bin are undominated
c. Yoruba	Monosyllabic Foot (CV)	PROP-HEAD, LEXNUCμ >> LEXRT >> LEXPATH-F, Ft-Bin
d. Ebira	Monosyllabic Foot (CV)	PROP-HEAD, LEXNUCμ >> LEXPATH-F, Ft-Bin
e. Child language: the unmarked word in the first stage of acquisition	Monosyllabic Foot (CV)	PROP-HEAD LEX-NUCμ, LEXμ and LEX-RT >> Ft-Bin, PARSE-seg
f. Not attested	No fixed prosodic shape	PARSE-Seg >> PROP-HEAD Ft-Bin

5.3. Maximal Prosodic Word and Binarity

In this section, the hypothesis is explored that there is a maximal restriction imposed on the prosodic shape of a prosodic word (Bagemihl 1993, Itô & Mester 1992). Three observations are presented as evidence in support of this proposal. First, in many languages of Benue-Congo (Kakanda, Ebira, Yoruba, Idoma), the size of roots is somewhat limited: a root cannot exceed four syllables. Second, in Yoruba, the number of prefixes which can be attached to a root is restricted to four syllables. Third, dimunitives and clefted nouns are productively formed in Yoruba by reduplicating words consisting of two syllables. The above facts are accounted for if we assume that the quadrisyllabic maximal restriction imposed on roots in Benue-Congo is prosodically constrained: it is a maximal prosodic word defined in prosodic terms as two bipodic feet.

5.3.1. Maximal Prosodic Word effects across Benue-Congo

The idea that binarity operates at the level of Word was first proposed in Itô and Mester (1992) where it was shown that word binarity in Japanese is computed at two prosodic levels: the syllable and the foot. According to this hypothesis, the minimal binary word is a bisyllabic foot and the maximal is two feet.[20] A series of processes are shown to utilize this template: hypocoristics (Poser 1990), mimetics (Itô and Mester 1990), loanword abbreviation (Itô 1990, Itô and Mester 1992), and secret language forms (Tateishi 1989, Poser 1990). Other languages which are reported to utilize a two feet template for various processes include Ponapean and English (M&P 1986).

Bagemihl (1993) also reports that in Bella Coola, a Salish language, the shape of roots is constrained both minimally and maximally. Descriptively, in Bella Coola, roots are minimally CV or CC and are maximally CVCVCVC or CVCCVCV:

(54) Bella Coola (data from Bagemihl 1993)

a. Minimal root: CV or CC *C *V

Word	Gloss
ʎɪ	fast
ʎ'p	to cut with scissors
c'm̩	index finger
χm̩	to bite

[20]In Japanese, minimal word binarity is computed differently from Word binarity. The former requires a bimoraic Ftμμ (Itô 1990), and the latter, a minimal Ftσσ and a maximal FF template (Itô & Mester 1992).

b. Maximal root: CVCCVCV or CVCVCVC *CCVCCVCV

Word	Gloss
ɬ'aqʷakıla	a man's name
sıta:χsu	catfish
k'anawıł	bow of boat
stapıtm̩	bat (animal)

Bagemihl accounts for the restriction described above within prosodic morphology by appealing to the notion of prosodic minimality and maximality. For Bagemihl, in Bella Coola, the minimal word is a binary foot while the maximal word is a bipodic foot. The assumption that a maximal prosodic constraint governs the shape of underived roots correctly accounts for why the largest form of roots cannot exceed four moras.

Word binarity restrictions are also attested in languages of Benue-Congo. Across many languages of Benue-Congo, there is a maximum limit on the size of roots: no morpheme exceeds four syllables. For example, Oyebade (1988: 149) observes that in Kakanda, the shape of underived lexical items ranges from mono- to quari-syllabic forms:

> Most lexical items in Kakanda are either *monosyllabic* or *disyllabic*...
> there are a few *trisyllabic* and *quadrisyllabic* lexical items in the language
> which are seemingly neither derived nor compound words..

Examples are given below:

(55) Kakanda (data from Oyebade 1988)

a.	Monosyllabic words	Gloss
	bé	come
	fù	fly
	kɪ	see
b.	Disyllabic words	
	alé	rain
	éwu	sun
	àró	tongue
c.	Trisyllabic words	Gloss
	èkòkpɪ	heart
	atúvà	ear
	rúkótsí	big
d.	Quadrisyllabic words	
	abútònĩ	claw
	egbíkíí	penis
	egĩnũ	God

A similar restriction is observed to hold of Ebira. According to Adive (1989:13), most words consists of one to four syllables as shown in the following data.

(56) Ebira (data from Adive 1989)

a.	Monosyllabic	Gloss
	ré	see
	sì	look for
	hɔ̀	ask

b. Disyllabic

ʊ̀bà	vulture
ɛdɔ	antelope
ɔkʊ́	firewood

c. Trisyllabic

éhepo	a kind of yam
árʊsà	walnut
ɪrehí	house

d. Quadrisyllabic

àtàáhʊ̀	ankle
etéèsù	floor
ìhìhìnè	ants

. The same restriction is found in Yoruba: monomorphemic words are minimally monosyllabic (CV) and maximally quadrisyllabic (C (VCV)) (CVCV):

(57) Yoruba

a. CV words

	Gloss
wá	come
dʒɛ	eat
tɔ̀	urinate

b. VCV words

ɪlé	house
ɔba	king
egbò	wound

c. (C)VCVCV

èrèké	cheek
ɔ̀gèdè	banana/plantain
gbàgede	open yard

d. (C)VCVCVCV words

ɔ̀furufú	sky *or* space
àgbálùmọ́	a type of fruit
gbaragada	wide and open

Also, in Idoma, underived lexical items are minimally VCV and maximally CVCVCVCV. Representative data are given below:

(58) Idoma

a.

VCV	Gloss
ó- lí	to eat
ò-wà	to come
èwò	ashes
úbù	locust bean basket

b. V(C)VCV

àjınṹ	tooth
ɔ̀dɔ̀lé	well
àdàba	shoe
òogbà	vomit

c. V(C)VCVCV

èıkípú	stomach
íkínábɔ	tortoise
òkróbìà	friend

The data presented in (55-58) can be summarized as follows: in many languages of Benue-Congo (Kakanda, Ebira, Yoruba, Idoma), the largest underived morpheme is represented as four syllables.

This observation raises two questions: 1, why should there be a restriction on the largest morpheme in a language? 2, why is the maximum size expressed as four syllables instead of three or five syllables?. As regards the first question, given that there is such a thing as a minimum prosodic restriction, by logical extension, a maximal prosodic restriction could exist. Thus, a maximum limit is a natural phenomenon which natural languages should exhibit. The second question concerning the expression of the maximal word as four syllables can be tackled in two different ways. First, one can stipulate that the maximal word is just a sequence of four syllables. Apart from the fact that this description does not explain anything, it is difficult to see the connection between the phonological expression of the maximal word as four syllables and any principle of phonology: no phonological process relies on the number *four* for application. Second and alternatively, if we appeal to the principle of binarity (an important principle in linguistic theory), we can group the four syllables in twos into foot structure. This grouping gives us a sequence of two feet. As a result, the maximal word can be formulated in prosodic terms as follows: a maximal prosodic word is a bipodic foot (following Bagemihl 1993).

The second phenomenon which utilizes the two feet template is hypocoristic forms. A HHML tonal melody comes with this template and hypocorated names are expressed with it. In forming hypocoristics in Yoruba,[21] first, a shortened VCV or CVCV name is reduplicated. Second, the tonal melody links to the vowels of the reduplicated name. As shown by the starred forms, larger hypocoristics are illicit:

[21]Hypocoristics are generally used as pet names, but may also be used satirically (Bamgbọṣe 1986).

(59)	Base	Hypocoristics	
	Ọlá-níkẹ̀	ọ́lá-ọlà *or* níkẹ́-nıkẹ̀	*ọ́lániké-ọlanıkẹ̀
	Ayọ̀-bámı	áyọ́-ayọ̀ *or* bámí-bamì	*áyọ́bámí-ayọbamì
	Olú-délé	ólú-olù *or* délé -delè	*ólúdélé-oludelè
	Oyè-báyọ̀	óyé-oyè *or* báyọ́-bayọ̀	*óyébáyọ́-oyebayọ̀

Hypocoristic formation is also observed in Personal Praise names. First, some background information. Personal Praise names are formed by prefixing a low-toned *à* (sometimes *ì*) to a collocation of two monosyllabic verbs (Oyetade 1991):

(60) Yoruba personal praise names: prf-v-v

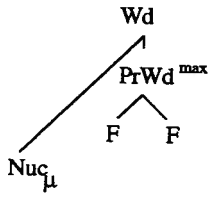
à-ṣàbí	'prf + ṣà 'to select' - bí 'give birth'
	one whose birth was carefully selected'
à-kànbí	'prf +ḳaǹ 'to select' - bí 'give birth'
	'one that is purposefully given birth to'
à-jọ-kẹ́	'prf + collective + to pet"
	'one who is collectively petted'
à-bí-kẹ́	'prf + give birth + to pet'
	'one who is born to be petted'

To derive hypocoristics from Praise names, the rightmost foot reduplicates to satisfy the two foot maximal condition. The HHML tonal melody then maps strictly to the vowels contained in the two feet. Crucially, the initial vowel of the name must be excluded. The illicitness of the forms where the initial V is incorporated into the template shows that the maximal restriction cannot be violated:

(61)	Base	Hypocoristics	
	à-ṣàbí	à-ṣábí ṣabì	*á-ṣábí - ṣabì
	à-kànbí	à-kánbí kanbì	*á-kánbí - kanbì
	à-jọ-kẹ́	à-jọ́kẹ́ jọkẹ̀	*á-jọ́kẹ́ jọkẹ̀
	à-bí-kẹ́	à-bíkẹ́ bıkẹ̀	*á-bíkẹ́ bıkẹ̀

The restriction placed on the hypocoristic tonal melody suggests that the rightmost two feet, which excludes the prefix, form a seperate domain from the one which includes the prefix. I propose that the domain of hypocoristics is a *prosodic domain*, while the entire word which includes the prefix, consitutes a *morphological domain*, hence, not prosodically governed:

(62) Hypocorated Personal Praise Name[22]



The fact that binarity holds at the level of the Prosodic word accords with Hewitt's (1994) idea that binarity is decomposable into units. Hewitt demonstrates this idea with foot binarity. He proposes that binarity is established at different levels contained within the foot: Ft-Binμ, Ft-BinNUC and Ft-Binσ. If we extend this to the Prosodic Word level, the following inventory emerges:

[22]This structure assumes the weak layering hypothesis of Itô and Mester (1992) which allows the direct parsing of unfooted prosodic constituents to PrWd. In Optimality Theory, unsyllabified and unfooted constituents violate PARSENUCμ and PARSEσ.

(63) Categorial Binarity

PrWd-Bin Ft $^{min, max}$ (FF)

Ft-Binσ $^{min, max}$ ($\sigma\sigma$)

Ft-BinNUC $^{min, max}$ (NUC NUC)

Ft-Binμ $^{min, max}$ ($\mu\mu$)

A more formal expression of the categorial binarity constraint is given below:

(64) Categorial Binarity (Bin-Cat)

α is strictly binary at level β iff[23]:

(i) $\beta \in \{\mu, N, \sigma, Ft, PrWd\}$

(ii) α contains two uniform units of β

(iii) α is minimally two

(iv) α is maximally two

By strict layering (Selkirk 1984), a constituent selects two members of each unit which it immediately dominates. For example, PrWd-Bin Ft $^{min, max}$ will select two feet (FF) to satisfy binarity. By weak layering (Itô and Mester (992), on the other hand, PrWd-Bin Ft $^{min, max}$ may either be stated as two feet (FF) or a Foot and a syllable.

However, categorial binarity as expressed in (63) and (64) does not explain the puzzle posed by the realization of binarity of the maximal prosodic word. Categorial binarity imposes the condition of two uniform categories on a prosodic constituent such that the expression of binarity at the Prosodic Word level is pegged down to two feet. But why can any smaller category such as μ, NUC or σ **not** be added to the two feet? In particular, what permits the grouping of Ft-σ as a

[23]One might ask if binarity at α is ever expressed at β when β is a μ. The answer to this question is not straightforward. For instance, if light diphthongs are represented as two root nodes linked to a single mora, then that might constitute some evidence for binarity at the moraic level. But, if by *COMPLEX, monothongs are preferred over diphthongs, then, binarity below the mora will always be preferentially violable.

constituent under PrWd? Why is the same grouping unacceptable with FFσ? The answer to this question is provided by Itô and Mester (1992). They argue that the addition of extra categories albeit smaller than the foot in size is illicit because such a configuration would give rise to a ternary branching structure. In other words, binarity holds of prosodic word branchingness as well. Thus, in the unmarked case, the most harmonic branching structure is binary branching. This explains why binarity at the word level in both Japanese and Yoruba strictly requires a binary branching structure. A formal expression of structural binarity is stated below:

(65) <u>Structural Binarity (Bin-Br)</u>

α is strictly binary at level β iff:

(i) $\beta \in \{\mu, N, \sigma, Ft, Wd\}$

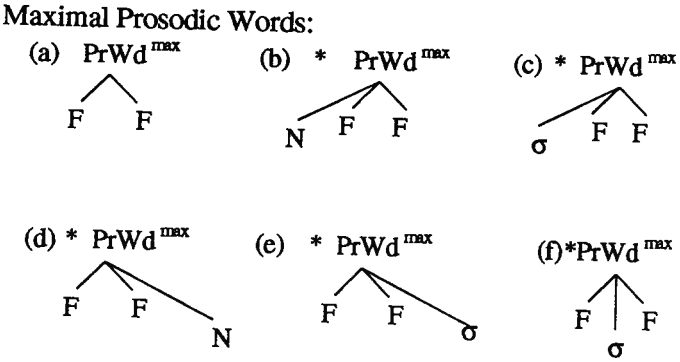
(ii) α immediately dominates two of β

(iii) α's branching node is minimally two

(iv) α's branching node is maximally two

By (65), the maximal prosodic word in (66a) is well-formed since it immediately dominates two feet whereas the forms in (66b-66e) are unacceptable because prosodic word immediately dominates three constituents.

(66) Illicit Maximal Prosodic Words:



The next tableau to be considered presents the analysis of hypocoristic names. First, the

alignment constraints which regulate the proper alignment of the maximal word.

(67) Maximal Word Alignment Constraints: undominated and unviolable

(a) Hypocoristic template = PrWd-Bin Ft^{max} (FF)

(b) ALIGN ($PrWd^{max}$, L, Ft, L):

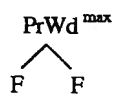
The left-edge of a maximal PrWd corresponds with a foot's left edge

(c) ALIGN ($PrWd^{max}$, R, Ft, R):

The right-edge of a maximal PrWd corresponds with a foot's right-edge

By the constraints in (67), the optimal $PrWd^{max}$ is this:

(68) Maximal Prosodic Word



Following Pulleyblank's (1994) proposal that tonal spreading is an alignment based process, the realisation of the HHML tonal melody associated with the hypocoristics template may be accounted for by the following Alignment constraints:

(69) Hypocoristics Tonal Alignment Constraints

a. ALIGN-H-LEFT (H, L; PrWdmax, L): The left edge of a high tone is aligned with the left edge of a maximal prosodic word

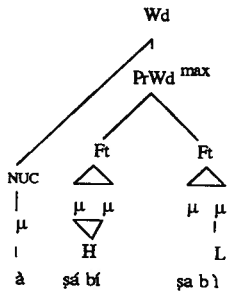
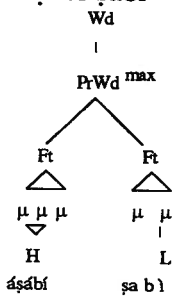
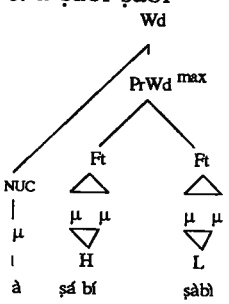
b. ALIGN-H-RIGHT (H,R;Ft,R): The right edge of a high tone is aligned with the right edge of a binary foot

c. ALIGN-L-RIGHT (L,R;PrWdmax,R): The right edge of a high tone is aligned with the right edge of a maximal prosodic word

d.	LEX-PATH-F:	For any path between an F-element α, and some anchor β, if a is associated to β in the output, then, α is associated to β in the input.
e.	Ft-Bin:	a foot is binary at the moraic or syllabic level

The alignment constraints must be obeyed by a well-formed hypocoristic form. This means that these alignment constraints are undominated. In contrast LEX-PATH-F is lowly ranked, this guarantees the appearance of tonal spreading. Consider (70).

ALIGN-H-L, ALIGN-H-R, ALIGN-L-R, Ft-Bin >> LEX-P

(70)	ALIGN-H-L	ALIGN-H-R	ALIGN-L-R	Ft-Bin	LEX-P
✓a. à-ṣábí-ṣabı 					***
b. á-ṣábí-ṣabì 				*!	***
c. à-ṣábí-ṣàbì 					****!

Representation (a), is selected as the optimal form because it fully satisfies all the higher ranked constraints. It violates LEX-PATH under pressure from the dominating constraints, so it incurs minimal penality. In contrast, (b) whose prefixal vowel is parsed into the hypocoristic template (by virtue of the fact that the H-tone of the template is realised on it) violates Ft-Bin, an undominated constraint and is immediately ejected. Sub-optimal (c) is rejected because it fatally violates LEX-

PATH. I assume that the intial mora of the right-most foot receives a mid tone by default (Akinlabi 1985, Pulleyblank 1986).

Another argument for the two feet maximal prosodic word comes from clefted nouns in negated sentences in Yoruba. In this structure, a clefted noun can only be reduplicated if it maximally has two syllables, otherwise reduplication does not apply. Consider these examples:

(71) Clefted Nouns (the unreduplicated base is underlined in the underlying form):

	Reduplicated Form	Unclefted Form	Gloss
a.	aya-aya (rèé, Olú kò fẹ́)	Olú kò fẹ́ aya	It is wife that Olu refused to marry
b.	ọmọ-ọmọ (rèé, Olú kò bí)	Olú kò bí omọ	It is a child that Olu refused to give birth to
c.	ìwé-ìwé (rèé, Olú kò kà)	Olú kò ka ìwé	It is a book that Olu refused to read
d.	ıyán-ıyán (rèé, Olú kò gún)	Olú kò gún ıyán	It is pounded yam that Olu refused to pound
e.	kókò-kókò (rèé, Olú kò jẹ)	Olú kò jẹ kókò	It is coco-yam that Olu refused to eat
f.	filà-filà (rèé, Olú kò dé)	Olú kò dé filà	It is a cap that Olu refused to wear

Nouns that are larger than two syllables do not reduplicate:

(72)	Unreduplicated Clefted Form	Unclefted Form	Gloss
a.	ìyàwó (rèé, Olú kò fẹ́) *ìyàwó-ìyàwó (rèé, Olú kò fẹ́)	Olú kò fé ìyawó	It is a wife that Olu did refused to marry
b.	àgbàdo (rèé, Olú kò jẹ) *àgbàdo-àgbàdó (rèé, Olú kò jẹ)	Olú kò jẹ àgbàdo	It is corn that Olu did refused to eat

The interesting forms to compare in (71) and (72) are the (a) forms, aya and ìyàwó, both forms translate into 'wife'. In (71), we see that aya is reduplicated whereas in (72) ìyàwo does not reduplicate: why? Obviously, this asymmetry cannot be a consequence of semantics because both forms have the same meaning - 'wife'. However, if we take a closer look at the prosodic shape of both nouns, a difference emerges: aya has two moras, while ìyàwo has three moras. When these forms reduplicate, aya-aya yields four moras while the moras in * ìyàwo-ìyàwó totals up to six. If we assume that this process is constrained by the maximal prosodic word requirement, then the observation follows straightforwardly: aya-aya conforms to the two feet maximal prosodic word shape while the two feet limitation isolates * ìyàwo-ìyàwó as a possible form.

The final argument for the maximal prosodic word comes from prefixation: in Yoruba, prefixes never exceed four syllables. At this point, some background information about the morphology of the language is required. Yoruba is a highly prefixing language. Except for some cases involving suffixal reduplication (cf. Awoyale 1974, 1989, Akinlabi 1986), words are productively derived by prefixation. A lot of discussion exists in the literature on prefixation, word formation and the different constraints that govern the order in which prefixes attach to roots (see Awoyale 1974, Akinlabi and Oyebade 1986, Akinlabi 1986, Oyelaran 1987, Pulleyblank and Akinlabi 1988, Owolabi 1995 among others).[24] The interesting fact observed for prefixation (modulo the strata ordering constraints in Akinlabi and Oyebade 1986, Akinlabi 1986) in Yoruba is the following: an *X*-number of prefixes is allowed to attach to root *Y* as long as the overall output string of prefixes is not more than four syllables, i.e., CVCVCVCV. Consider the derived forms given below (Rt = root, prf = prefix, prefixes are underlined in the output).[25]

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[24]Prefixes differ with respect to the selection of syntactic base. For example, /o-ní/ the possessor prefix selects a nominal base while the agentive prefixes /a, ò/ɔ̀/ select either a verb or a verb phrase depending on the subcategorizational properties of the predicate. See Pulleyblank and Akinlabi (1988) for discussion.
[25]The analysis of the morphological composition of the prefix /oní/ "owner or possesor of *x*" varies in the literature. In Akinlabi and Oyebade (1986) and Akinlabi (1986), it is treated as two morphemes /o-ní/ which is decomposed into "Pronoun + Verb". In Oyelaran (1987), it is treated as a single morpheme. I assume the former analysis without attempting to provide any justification. Note however that even if the latter is assumed, the point made regarding the constraint on the output of prefixation still holds. A further point to note is that when /o-ní/ is prefixed to a noun with a non-high vowel initial, the processes of vowel deletion and assimilation are triggered. First, the final (nasalized) vowel of /o-ní/ deletes and /n/ is denasalized as soon as it is adjacent to the initial (non-high) oral vowel of the noun surfacing as /l/. Second,

(73)	kọ̀wé	Rt	'to write/ to write a book'	
a.	a - kọ̀wé	(1prf-Rt)	→	akọ̀wé
				'one who writes'
b.	o - ní - a -kọ̀wé	(3 prf-Rt)	→	alá-kọ̀wé
				'educated person'
c.	o - ní - o - ní - a - kọ̀wé	(6 prf-Rt)	→	alálá-kọ̀wé
				'that of the educated'
d.	ti - o - ní - o - ní - a - kọ̀wé	(6 prf-Rt)	→	találá-kọ̀wé
				'that of the educated'
e.	o - ní - ti - o - ni - a - kọ̀wé	(6 prf-Rt)	→	onítalá-kọ̀wé
				'that of the educated'
f.	ti - o - ní - ti - o - ní - a - kọ̀wé	(7prf-Rt)	→	tonítalá-kọ̀wé
				'that of the educated'
g.	*o - ní - ti - o - ní - ti - o - ní - a - kọ̀wé		→	onítonítalá-kọ̀wé

In the well-formed output of prefixation, observe that the shape of prefixes ranges from one vowel (V) to four syllables (CVCVCVCV).[26] The ill-formed output, in contrast exceed the four syllable limit. Given the classic assumption in morphology that morphological processes are expressed in purely morphological terms (for example, prefix the agentive marker to the verb), the maximal four syllable restriction is surprising.

Ọlasope Oyelaran (personal communication) suggests that the markedness or unacceptability of (73h) follows from two things. First, the extension of prefixation in these forms

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following the n → l denasalization, the initial vowel of /o-ní/ assimilates to the initial vowel of the noun: o-ní akọ̀wè → o l akọ̀wé → alákọ̀wé. For a detailed discussion of this phenomenon see Oyelaran (1971) and Pulleyblank (1988).

[26]When two vowels are in hiatus in Yoruba, the process of vowel deletion may be triggered to resolve the hiatus. This process applies in prefixation to reduce the input vowels in the output. The reader is refered to the existing robust literature on Yoruba vowel deletion (see for example, Ward 1952, Rowlands 1954, Abraham 1958, Siertsema 1959, Bamgbose 1966, 1989, Courtenay 1968, Oyelaran 1971, Akinlabi and Oyebade 1987, Pulleyblank 1988, Ọla 1991, among others) for a full discussion of this process.

does not add any meaning to the word. So, it is redundant to continue extending the number of prefixes attached to the root. Second, is the factor of processing: the longer the string of prefixes, the longer the word. As the word becomes larger, the task of processing becomes more difficult for the speaker. Consequently, it is natural to expect a restriction to hold of derived forms. With respect to the first point, notice that there is no distinct difference in meaning in the forms in (73c-g). The only difference being that the referent of nominalization becomes more indefinite as the prefixation is expanded. The interesting question though is why such redundancy should be acceptable up to a maximum of four syllables (two feet)?

In prosodic morphology, the four syllable upper limit is captured in prosodic terms as a sequence of two feet, the maximal prosodic word as suggested in this chapter. This assumption explains why the forms with four syllable string of prefixes are well-formed (73a-f) and why the form that contains more than four syllables unacceptable (73g).[27]

To summarize: In this section, I have proposed that there is a prosodic category - the maximal prosodic word which is expressed as a bipodic feet. This assumption explains why certain restrictions hold of morphological categories and certain phonological processes in Benue-Congo: the maximal upper limit restriction on the shape of roots (Kakanda, Ebira, Yoruba, Idoma), the maximal upper limit on the size of prefixes (Yoruba) hypocoristic formatives and clefted nouns (Yoruba).

[27]Given that the maximal prosodic limit is imposed on roots and prefixes, an interesting question arises on the representation of the output of prefixation: when the maximal prefixal shape is combined with the maximal root, does the output form a phonological or morphological domain? In the interim, I suggest that the output forms a morphological domain. To assume the alternative answer, (i.e., the assumption that the output of prefixation is phonologically constrained) amounts to motivating a prosodic constituent above the prosodic word. Since the focus of this work is limited to the prosodic word, such an inquiry is reserved for further research.

5.4. Summary of typological rankings

In this chapter, I have presented evidence from Benue-Congo languages illustrating various minimality and maximality effects at the level of the prosodic word. I have shown that minimality is not uniquely instantiated by foot binarity, properheadedness, as argued is another constraint which governs the phonological realisation of the minimal word. This proposal, couched within Optimality Theory framework, is shown to account for the cross-linguistic variation in the characterization of the minimal word: in Gokana and Idoma, foot binarity and properheadedness are undominated, whereas in Yoruba and Ebira, properheadedness outranks foot binarity since the presence of a monosyllabic foot is required in every word. The notion of properheadedness has also been used to account for the CV stage in child language: if properheadedness is a constraint available to Universal Grammar, children should be able to exploit it actively in word production.

I also explored the hypothesis that natural languages impose a maximal limit on the size of the prosodic word. The maximal prosodic word realised as two bipodic feet has been shown to play a crucial role in a number of phenomena in Benue-Congo: the maximal size of roots, the maximal size of affixes, hypocoristics and clefted nouns all rely fundamentally on this prosodic shape.

The constraints motivated in this chapter, along with the empirical domain which they cover are summarized in the following tableau

(74) Constraints govering the minimal and maximal realisation of the prosodic word

a. Prosodic Word (minimality)

Language	Generalization	Constraints and Rankings 1, *Prosodic requirement*: Properheadedness Foot Binarity 2. *Faithfulness*: LEX-NUCμ,LEXμ LEX-RT, PARSE-seg
Gokana	A word minimally contains two moras ans a syllable	PROP-HEAD, FOOT-BIN >> LEX-RT
Idoma	A word minimally contains two moras and a syllable	PROP-HEAD, FOOT-BIN
Yoruba	A syllable must be present in every word	PROP-HEAD, LEX-NUCμ >> LEX-RT >> FOOT-BIN, LEX-PATH-F
Ebira	A syllable must be present in every word	PROP-HEAD,LEX-NUCμ >> FOOT-BIN LEX-PATH-F
Child language	Every word shortened to a syllable	PROP-HEAD LEX-NUCμ, LEXμ LEX-RT >> FOOT-BIN PARSE-seg
Not attested	No fixed prosodic shape	PARSE-seg >> PROP-HEAD, FOOT-BIN

b. Prosodic Word (maximality)

Language	Generalization	Constraint and Ranking: PrWd-Bin-Ft
Kakanda	A root is maximally quadrisyllabic	Undominated
Ebira	A root is maximally quadrisyllabic	Undominated
Idoma	A root is maximally quadrisyllabic	Undominated
Yoruba	a. A root is maximally quadrisyllabic b. Dimunitives are quadrisyllabic c. Clefted Nouns are quadrisyllabic d. Prefixes are maximally qadrisyllabic	Undominated

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