Optimality Theory and Arawan Prosodic Systems

Chapter One:
Prosodic Levels and Constraints in Banawá and Suruwahá

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Outline

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1. Introduction[1]

Most theories of grammar have included constraints of one type or another. Constraints are crucial in any theory of grammar and may in fact be the most important component of *Universal Grammar* (UG). As long ago as Chomsky (1964), linguistic research pointed to constraints as a vital component of UG. However, most theories allow two types of constraints, *violable* and *inviolable* constraints. For example, in Chomsky's (1995) *Minimalist Theory*, a violable constraint such as PROCRASTINATE (do not do anything until you have to) can be overriden by a morphological feature, e.g. the need to eliminate a "strong" morphological feature from a representation. On the other hand, an inviolable constraint such as the *Empty Category Principle* (ECP) can never be violated. When a structure arises which would violate an inviolable constraint, e.g. the ECP, that structure is prevented from appearing in the grammar - it is *ungrammatical*.

In *Optimality Theory* (Prince and Smolensky 1993), on the other hand, there are only violable constraints. This means that structures cannot be ruled out as ungrammatical in an absolute sense, but only as less *optimal* than a competing form. Only by being "less optimal" can a hypothetical structure fail to appear as an *output form* in a language. This has a number of interesting results, not least of which is the reallocation of responsibility for "ungrammatical" forms (hypothetical inputs which never surface) from the grammar proper to learnability theory. But more on this below.

The goal of this paper is twofold: first, it has the empirical objective of describing Suruwahá and Banawá prosodies (the latter in more detail than in Buller, Buller, and Everett (1993; BBE)). These are both little-studied Arawan languages of the Brazilian Amazon. Second, this paper seeks to refine and develop Optimality Theory (OT), (i) investigating the implications of hierarchical relations within Arawan for OT, (ii) by supporting the superiority of an OT account of Arawan prosodies over a derivational account, and (iii) by proposing new interpretations of previously recognized constraints, as well as some new constraints. I argue below that this paper makes at least the following contributions to phonological theory:

1. It forces a reexamination of the concept of hierarchy (Pike 1967, Selkirk 1980) or "layering" (Itô & Mester 1992) for phonological theory. In this regard, this study reaches the following conclusions: (i) Word Minimality (the minimum allowable phonological word size) cannot be derived from Foot Minimality (the minimum allowable foot size), contrary to assertions by various recent studies, since both languages allow monomoraic feet but not monomoraic words; (ii) Syllable Integrity cannot be derived from the fact that syllables are dominated hierarchically by feet; and (iii) Prosodic words "skip" the foot level to align directly with syllables.

2. It provides additional evidence for the prosodic Word Minimality constraint. It also provides evidence for a related constraint, Word Binarity, an optional constraint in Suruwahá, wherein words composed of at least two nondegenerate, bimoraic feet are preferred.

3. It provides new insight into distinctions between diphthongs of rising and falling sonority. In particular, it leads to a refinement of McCarthy's (1995) LIGHT DIPHTHONG constraint, wherein rising diphthongs are monomoraic but falling sonority diphthongs are bimoraic. As shown here, McCarthy's single constraint must be broken down into two related constraints. One, FALLDIPH, requires each vowel in a diphthongs of falling sonority to map to a single mora. The other, RISEDIPH, prohibits the less sonorant vowel of a diphthong of rising sonority to map to a mora.

4. Degenerate feet occur in both Banawá and Suruwahá (at right margins of words in Banawá and left margins of words in Suruwahá), contrary to proposals in work by Hayes (1995) and Kiparsky (1991).

5. It establishes the utility of a family of *Sonority Enhancement* constraints which accounts not only for syllable shape in Arawan, but which also enables us to derive Itô's (1989) *Onset Condition*.

6. It contributes to the data base on prosodic systems of the world's languages.

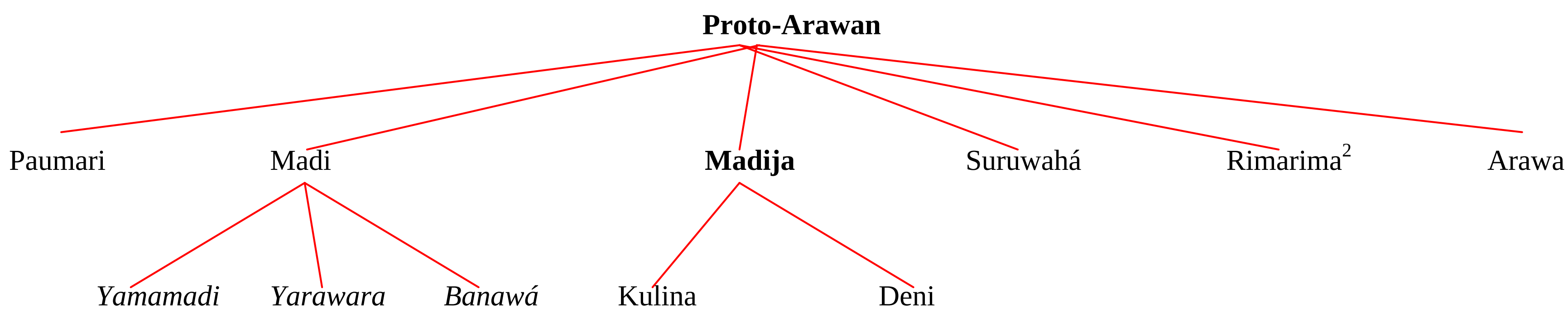
The paper is organized as follows. First, a brief review of prosodic structures in Banawá, as analyzed in BBE, is provided. This is followed by a detailed reanalysis of Banawá prosody in the OT framework. After the analysis of Banawá, Suruwahá prosody is described and analyzed. In the penultimate section I compare the two systems and consider possible scenarios of diachronic development and the lessons to be drawn from diachrony for OT. The paper concludes by reviewing the lessons learned in the course of the study. Before beginning our analysis in earnest, however, a brief discussion of the Arawan family is in order, given that these languages have been so little-studied.

2. The Arawan Family

The languages of the Arawan family have only recently come under scrutiny by linguists. The first studies were conducted by members of the Summer Institute of Linguistics (SIL) in Brazil, beginning in the 60s (Kulina and Paumari), although most languages of the family have only been studied since about 1985 or so. More recently, the present author, R.M.W. Dixon, and others have also begun to study these languages. The languages of the family that we know of are listed in the tree in (1), which shows degrees of genetic relation:

(1)

Arawan Language Family



Proto-languages are in bold-face and dialects in italics. This reconstruction work is the product of a good deal of collaboration between various linguists, but R.M.W. Dixon has done far more than any other linguist on the reconstruction of Arawan and for this (and many other insights into Arawan) I am indebted to him. Greenberg (1987) classifies Arawan as belonging to the Arawakan family. In Everett (1996a) I argue that this conclusion is unsupported by any lexical facts - there are no known cognates which support Greenberg's classification. I argued that the only similarity between Arawan and Arawakan is the fact that both families have grammatical gender. Dixon (1995) reaches the same conclusion. However, in recent work (Everett 1996c) I discovered that in 'Oro Win, a previously undocumented language of the Chapakuran family, some of the agreement pronominals and auxiliary verbs are identical in meaning and form to Arawan agreement pronominals and auxiliary verbs.[3] Since the only possible genetic connection between Arawan and Chapakuran is via Greenberg's proposed relationships as members of the Arawakan family, then either Greenberg's hypothesis has more to commend it than previously thought, the pronominals of 'Oro Win or proto-Arawan have been borrowed (which would be quite rare, but not without precedent, as Everett 1996a shows for Pirahã), or we have a rather striking coincidence.

Before concluding this section, it would be worthwhile, perhaps, to give some background on how these languages were studied and by whom. I have worked on Arawan languages since 1986, beginning with collaborative work with other linguists on descriptions of stress systems, and progressing to longer periods of field study of Banawá. I worked with Banawá informants (five men) in the Banawá village for seven weeks (three to four hours per day of informant work, seven days a week, plus five to seven additional hours per day, seven days a week, of data processing and analysis). In addition to this village time, I have spent about four weeks outside the village working with the same men, following more or less the same work regime. I have collected approximately twenty hours of transcribed texts, vocabulary items, and elicited sentences, following the *Lingua Descriptive Questionnaire* (Comrie & Smith 1977), as well as my own methodology. In addition, in conjunction with Peter Ladefoged of UCLA, I have collected systematic exemplars of vowels, consonants, and stress in isolated words from six men. The stress facts of Banawá discussed in this paper (including degenerate feet) have been confirmed instrumentally and are the subject of a study by the present author and Peter and Jenny Ladefoged (Ladefoged, Ladefoged, and Everett 1996; LLE).

Suruwahá has been studied by Márcia & Edson Suzuki and Bráulia & Reinaldo Ribeiro. The Suruwahá data in this paper were collected by these individuals. The original descriptive analysis of Suruwahá phonemes and stress is found in Suzuki (1995). Her work is thus the basis for the theoretical discussion of this discussion. However, nearly every Suruwahá example in this paper was transcribed by myself and Márcia Suzuki from the analog tapes she and her colleagues collected on various visits to the Suruwahá village. The tapes are generally of good quality and Suzuki and I agree on vowel length in all the transcriptions. Before proceeding to our analysis, a (brief) overview of leading ideas of OT is provided.

3. The OT framework

Optimality Theory (see especially Prince & Smolensky 1993 and McCarthy & Prince 1993) essentially claims that the best theory of phonology, perhaps even the best theory of grammar generally (on morphology and syntax - see, interalia, Grimshaw (1993), Legendre, Raymond, and Smolensky (1994)), should simply evaluate outputs and input-output relations, with no theoretical status accorded to the actual production of outputs, other than to recognize the function GEN(erate), which freely structures, inserts, deletes, and rearranges material in the input. By shifting the explanatory burden of phonological theory from rules to constraints on representations, OT can be seen as following the direction set by Chomsky's work in syntax over the last two and a half decades and, in a larger context, the development of linguistics in this century (Anderson 1985). On the other hand, OT differs from theories such as Chomsky's (1995) Minimalist Theory by explicitly articulating a theory of the relationship between the members of a universal set of *violable* constraints.

A central tenet of the theory is the claim that languages may not differ in the identity of their constraints, but only in the ranking between constraints available from Universal Grammar (UG). So, for example, a given language might prefer to make /i/ the nucleus of a syllable over /u/, leading to the following parses (where 'P/x' = 'preference for x to be a syllable Peak; '(A >> B = 'A outranks B'; * = 'violates constraints'; *! = 'fatally violates constraint'; and ☞ = 'optimal form'):

Language$_1$

(2) /iu/

(3) Tableau

	P/i >>	**P/u**
[yu]	*!	
☞ [iw]		*

(4) /ui/

(5) Tableau

	P/i >>	**P/u**
☞[wi]		*
[uy]	*!	

Another language might reverse the order of these constraints:

Language$_2$

(6) /iu/

(7) Tableau

	P/u >>	**P/i**
☞ [yu]		*
[iw]	*!	

(8) /ui/

(9) Tableau

	P/u >>	**P/i**
☞ [uy]		*
[wi]	*!	

Notice that both Language$_1$, in (2)-(5), and Language$_2$, in (6)-(9), have the same constraints. But the relative ranking of these constraints varies from language to language.

Moreover, it turns out that constraints in OT are constrained globally by more general considerations of learnability (Tesar & Smolensky 1993), which enforce a strict transparency relation on input-output pairings. For example, in order for the input to be related to the output in the most perspicuous manner, certain "families" of constraints are invoked. One example is the family of CORRESPONDENCE constraints. These constraints protect against gratuitous over and underparsing of the input. Overparsing results from a violation of MAX constraint (adding or "filling-in" structure) and underparsing as a DEP-violation (deleting structure).[4] Since Parse and Fill are both constraints, they can - like other constraints - be violated. But they are highly ranked constraints universally and work together to ensure that we do not derive, to take an extreme example, the output, 'banana', from the input, 'monkey', by underparsing all the segments of 'banana' and overparsing the input just to derive 'monkey'.[3]

Of course, several questions naturally arise with such an approach and these must be dealt with. An interesting issue which arises in OT is how to distinguish between the discovery of a constraint (which is legitimate) from the invention of an ad-hoc constraint to solve a local problem (illegitimate). Anyone can invent a "constraint" to solve a local problem and hail it as a discovery. To avoid such a travesty of the spirit of OT, standard metatheoretical considerations will require independent evidence to justify a constraint. This type of independent justification of constraints is similar to the requirement on independent justification of rules, assumed throughout the evolution of generative theory. There is a difference, however. Independent justification of constraints must come from other languages, whereas independent justification of rules in early generative grammars was merely required of the language in question (showing how the rule operated in other structures in a particular language). Although previous rule-based theories always welcomed crosslinguistic evidence, such evidence was not necessary in the way that it is in OT. So, while independent justification of a constraint is not sufficient to guarantee that the approach itself is not misguided, it is crucial that attention be given to such justification in any proposal of new constraints, whenever possible. In spite of potential problems for OT (and, trivially, all theories face problems), the notion of violable constraints does seem to play a crucial and interesting explanatory role in many of the Arawan prosodic facts analyzed below.

With respect to constraint relations more generally, I will argue below that ranking is not the only possible relationship one might imagine between constraints. For example, another possible relation, but one which has attracted little attention to this point, is that of taxonomic hierarchical relations among constraints. It is possible to imagine a version of the OT model in which some constraints are broken down into more finely grained constraints. The higher ranked constraints in essence give the *raison d'etre* of the lower constraints, providing a global or unmarked ranking. This matter is taken up in 3.2.2. below in our discussion of sonority constraints and syllable structure in Arawan, but the idea can be summarized as in (10):

(10) Y (COARSE CONSTRAINT)

A B C (FINE GRAINED CONSTRAINTS)

In (10), A, B, and C are subtypes of Y, meaning that they are constrained by Y. By 'activates at level Y', I mean that the lower constraints are ranked exclusively by the higher constraints. By 'activate at level A, B, C', I mean that these constraints can be locally ordered in ways that violate the higher-level constraints which dominate them.

Having provided a brief introduction to some elementary OT assumptions and how I plan to address them, we are now ready to proceed to analyses of the data.

4. Banawá

4.1. Introduction

Although Banawá prosody is discussed in BBE, there are at least three reasons to reconsider it here. First, the analysis of BBE is incomplete in crucial respects. BBE's conclusion (quite important if correct) that *syllable integrity* may be violated (i.e. foot boundaries may fall within syllables, not merely at syllable boundaries) is based on incomplete argumentation. I want to strengthen this claim here by filling in important parts of the necessary argumentation. Another reason to reconsider Banawá here is that an OT analysis provides a clearer picture of the relationship between stress, syllable size, word-shape, and sonority (or "segment quality"; see below and LLE) for a reconsideration of the use of sonority in phonological analysis).

4.2. The Minimal Word in Banawá

As argued in BBE (p290ff), Banawá prohibits words less than two moras in length. This is restated here as the constraint in (11):

(11) Word Minimality (WDMIN): Words are minimally bimoraic (WD ≥ μμ).

There are various facts which support this claim, many of which are discussed in later sections. But the main evidence can be summarized here. There are three main arguments for (11). The first is negative. As BBE observe, Banawá lacks monomoraic words (*=unattested):[5]

(12) *bi, *ka, *mu, etc.

According to BBE, positive evidence is most clearly seen in two facts: (i) the restriction of geminate or long vowels to bimoraic words and (ii) the fact that the prohibition against stressing word-initial vowels is systematically violated in bimoraic words:

(13) fáa 'water'; dáa 'the'; bíi 'fan'; búu 'beat'; háa 'also'. (cf. *faaha; *baadi; etc.)[6]

(14) ába 'fish'; áwa 'wood'; údei 'I spear'[7] (cf. udéibúna 'I fish-spear' vs. *údeíbuna).

A third kind of evidence for word-minimality is seen in verb types. Verb roots to which inflectional morphology can attach directly can be monomoraic (since they will never surface in this way, given that some inflection is obligatory). However, verbs which take an auxiliary must be at least bimoraic, since inflection must appear on the auxiliary, not the verb directly. This means that the verb root will correspond to an independent phonological word and so will need to satisfy WDMIN. Moreover, long vowels are only found in these latter verbs, i.e. those which take an auxiliary, and only in bimoraic, aux-taking verbs:

(15) soo 'lay'; saa 'let go of'; sii 'dip out'; etc.

As I show below, although feet in Banawá are normally bimoraic, we cannot derive WDMIN from minimum foot size, because Banawá allows monomoraic, degenerate feet, yet prohibits monomoraic words.

4.3. Syllable structure

4.3.1. Syllable maximality

BBE established that Banawá has CV and CVV syllables (see LLE for phonetic evidence). The absence of V-syllables is discussed directly. First, however, let us address the absence of syllables larger than CVV (e.g. CVVV, CVVVV, etc.). I will assume that syllables larger than two moras in length are ruled out by the constraint in (16):

(16) Syllabic Maximality (SYL ≤ μμ): Banawá syllables are maximally bimoraic.

Thus, (17a)-(17c) would be allowed by this constraint, while (17d) and (17e) would violate it:

```
(17) a. CV      b. CVV     c. CV:     d. *CVVV  e. *CV V:
         |          ||         /\          |||        | /\
         μ          μμ        μ   μ        μμμ        μ  μ  μ
```

Every vowel in an output form must be linked to a mora (although as we will see, there are different ways to satisfy this constraint), as stated in (18):

(18) Max Vμ: [-cons] segments *correspond* to moras.

This requires all output vowels to map to moras. Input vowels mapped to output onsets are interpreted as [+cons], as per BBE. As we will see, this has the effect in OT of rendering high vowels underspecified for [cons] (to avoid an *Identity*-correspondence violation).

OT allows any constraint to be violated just in case a more highly ranked constraint conflicts with it. Thus it is predicted that constraints will be violated. A case in point is syllable maximality in (16) above. It turns out that CVVV syllables *do* arise at the right margins of words from the suffixation of the gender suffix, ***-i***. This gender suffix not only produces violations of syllable maximality, it violates footing constraints (see below) in that it is not stressed, even where it would otherwise be in a head position in a foot. However, as expected in OT, this constraint violation is provoked by a higher-ranked constraint, as is argued in section 4.4.6. below.

4.3.2. Sonority and syllable shape
4.3.2.1. Sonority basics

Sonority-based accounts of syllable structure are well-known and commonly appealed to by phonologists (Zec 1988; Blevins 1995; and others). However, the concept of sonority itself is not without problems. For example, not only are there obvious and crosslinguistically recurrent violations of sonority-based generalizations within specific languages, it is often not clear whether or not sonority is intended to be a phonetic entity or phonological construct. I want to argue for a *phonological* interpretation of sonority for Arawan languages. This means that most, *but not all*, of my sonority-based claims will be phonetically motivated. I will discuss an alternative, nonsonority-based account of vowel-sequencing which, although perhaps better motivated phonetically and functionally, is nevertheless less desirable than the formal, sonority-based account.

Among other advantages I wish to claim for a sonority-based account of Banawá (and Suruwahá) syllable structure is the fact that such an analysis allows us to dispense with more stipulative proposals on syllabic organization. For example, it allows us to derive Itô's (1989) *Onset Condition*, according to which syllables require onsets in most cases. But to begin our analysis in earnest, I consider the *Sonority Sequencing Constraint* (SSC) in (19) (first version); see, interalia, Kenstowicz (1994, 254ff) for discussion of a version of this principle):

(19) Sonority Sequencing Constraint (SSC): Segments increase in sonority up to the syllable nucleus and decrease following the nucleus.

Although constraints are universal according to OT, interactions between language-specific and language-universal properties can lead to slightly different interpretations of this principle in different languages. For example, segments can fall into different sonority groupings in different languages. If this is true, then phonetics can be said to underdetermine sonority. This will be discussed in detail below. For now, it is important to record the sonority values of Banawá segments, in order to understand the exact effects of (). These values are given in Table One:

TABLE ONE

Banawá Sonority Values

Consonants	i	u	a	e	
+			-	-	[consonantal]
-	-		+	+	[low]
0	0/2	0/2/3	3	3	

As per Zec (1988, 96ff), I count [-consonantal] as adding to sonority. I also list /i/ and /u/ as underspecified for [consonantal] and /u/ as additionally underspecified for [low]. In other words, /i/ and /u/ can be either '+' or '-' for the features they are underspecified for. Values for underspecified features are determined locally, i.e. in a context-sensitive fashion. Missing features are filled in so as to produce optimal forms (i.e. forms which violate the fewest or lowest ranked constraints relative to other forms with which they are compared in a Tableau). To allow for syllables containing a Consonant-/i/ sequence, i.e. one which does not violate the SSC, /i/ must be of greater sonority than an immediately preceding consonant. At the same time, since /i/ is allowed to stand adjacent to any vowel (other than itself), it must have a sonority value less than that of other vowels. Yet /i/'s lesser sonority value is not small enough for /i/ to function as an onset (except when it is interpreted as [+consonantal], cf. 4.3.2.3. below and BBE, p285.). I will account for these different sequencing facts by assigning consonants zero sonority, low vowels a sonority value of three, and other vowels (/i/ and /u/ in certain contexts) a sonority value between zero and three, depending on context. The reader might legitimately ask at this point what I mean by sonority and how seriously I intend for numeric sonority values to be taken.

Sonority is the language-particular ranking of universal constraints which restrict particular segments to syllable margins or syllable peaks. I interpret sonority in terms of values assigned to segments which are restricted in their appearance by principles of SONORITY ENHANCEMENT, whose goal it is to see to it that sonority is properly dispersed and distributed throughout the syllable, so as to *enhance* the sonority of the nucleus.

To see how this differs (a better word would perhaps by 'complements'), for example, from proposals by Prince & Smolensky (1993, 129ff), consider some of the constraints they propose for Tashlhiyt Berber:

(20) M/t/, *P/t/, *M/a/, P/a/

These constraints state that /t/ should not be a syllable peak (i.e. nucleus) but, rather, that it should be a syllable margin. They also say that /a/ ought not surface in a syllable-margin position, but that it is quite happy to be the peak (nucleus) of a syllable. Prince & Smolensky (1993) rank these constraints separately, allowing them to be ranked relative to one another. If we adopted this view, we could perhaps reformulate the values of Table One in terms of these segmental constraints, obviating the need for the use of numerical values.

However, the problem of individual constraints of the type suggested by Prince & Smolensky is that they do not express what I take to be the essence of the generalization, namely, that sonority is a property of the syllable as a whole (functioning as a decrescendo/crescendo effect). It is important for the real generalization to emerge from our theory, i.e. it is important for our constraints to be sonority constraints rather than segmental constraints (which are in fact ultimately related to sonority but which do not express this relationship directly). One thing that explicit acknowledgement of sonority buys us is that it predicts, correctly, that the segmental constraints expressed by Prince & Smolensky (1993) will never appear in any language in inverse order (e.g. valuing /a/ as a margin over /t/). This is so because recognizing sonority as the principal organizing principle of the syllable relegates segmental sequencing to secondary status. There could be no inverse segmental ordering because, properly defined, there could be no inverse sonority enhancement. Prince & Smolensky (p129ff) recognize that the hierarchy cannot be reversed. They account for this by making the dominance hierarchy universal. However, while I agree that at least parts of this hierarchy are universal, their solution is simply brute force. The ENHANCEMENT constraints of section 4.3.2.3. *predict* rather than stipulate this. Therefore, I submit that Prince & Smolensky's segmental constraints need to be supplemented by the higher-level *sonority enhancement* constraints to be developed in 4.3.2.3.

If we assume the sonority values along the lines of Table One, we are better prepared to understand constraints on syllable structure in Banawá. The basic idea to be pursued is simple and familiar (see, interalia, Fujimura (1990) and Clements (1990)), namely, that syllables begin with a sharp sonority crescendo and end with an abrupt sonority decrescendo. The proposal here differs from the previous uses of sonority in defining the notion of enhancement and allowing it to organize lowel-level constraints, as well as derive the Onset Condition. Moreover, no adjacent segments in the word may have identical sonority values, i.e. crescendo to and descrendo from the syllable peak is constant. However, before we can proceed to evaluate this proposal, it is necessary to enter into a brief discussion of sonority, to better understand the nature and plausibility of this notion.

4.3.2.2. The phonological basis of sonority

The Sonority Sequencing Constraint (SSC) in (19) above accounts for the absence of sequences of identical vowels, consonant clusters, complex onsets, and ***ea/ae*** sequences throughout Banawá (and, in fact, throughout the entire Arawan family). But, again, the constraint is only intelligible if sonority is understood as a *phonological* principle, i.e. phonetically underdetermined. If sonority is conceived of exclusively in phonetic terms, then the account here is subject to the criticisms of sonority raised in LLE. That work points out that there are at least two objections one might raise against any sonority-based analysis in Banawá:

> "Firstly, there is no objective data to support such a definition of sonority, which is a weak and poorly quantified notion at the best of times. Secondly, it provides little in the way of an explanation of the observed facts. Why should a difference in sonority (whatever that is) be required for a sequence of vowels?"

LLE go on to suggest an alternative *functional* analysis of vowel-sequences in terms of vowel quality. The idea is that vowels which are too similar in quality cannot appear in the same position in otherwise identical diphthongs because this would make it too difficult to detect contrast between them, e.g. it would be difficult to distinguish ***e*** from ***i*** following ***a.*** Clearly, this is a plausible, phonetically well-grounded proposal. This account rules out the existence of ***ae, ea*** for paradigmatic reasons.The existence of ***ai, ae***, ***ea***, and ***ia*** in the same language would make it hard to distinguish all tokens of ***i*** from all tokens of ***e*** and vice-versa. Moreover, these same sequences are *also* ruled out because *as sequences* they are insufficiently contrastive with other sequences. That is, by this hypothesis, ***ae*** is hard to distinguish from ***ai*** and so is less desirable.[8] Thus, we have two functional problems which conspire to eliminate the unattested vowel sequences, neither of which relies on sonority: lack of contrast with other diphthongs (syntagmatic) and lack of contrast between like vowels in otherwise identical environments (paradigmatic). We could state both functional considerations as separate constraints but this would violate the principle of parsimony, since one is sufficient. In other words, the nonsonority-based functional account will capture a single fact by two functions. It usually turns out, though, that having two similar solutions for the same problem generally means that something is amiss - a deeper generalization is being overlooked.

The sonority-based account, on the other hand, avoids the problem of redundancy in solution, by offering a single constraint based on *syllabic* requirements. But this account only avoids the criticisms in the earlier quote from LLE if we assume a phonological notion of sonority. The SSC in (19) above can be thought of as a grammaticization of the functional needs for contrast discussed by LLE. By insuring that adjacent, tautosyllabic segments differ in sonority, we immediately ensure that both paradigmatic and syntagmatic contrastiveness will be maintained. The only rub is that we must allow an individual language's calibration of segmental sonority to be underdetermined by phonetics (not to contradict phonetics, but to make finer or grosser distinctions than strictly warranted by the phonetics). Just as distinct semantic categories may be fused into a single syntactic category in a specific language (e.g. "oblique" case), so it should not be too surprising that grammars also elaborate on phonetic distinctions. This is an important assumption for the analysis which follows.

Having settled for now the usefulness of a phonological definition of sonority, we can nevertheless see pretty quickly that it is inadequate to account for Banawá phonotactics by itself. For example, (19) has nothing to say about the absence of a number of vowel sequences. So, if ***ia, ui, iu, ai, ie, ei, ue,*** and ***eu*** are possible sequences, what is to prevent sequences like ***uei, iaiu, uiai,*** etc.? (Such sequences are prohibited throughout the Arawan family.) Part of the solution to the problem these hypothetical sequences raise is to interpret SYLLMAX above to be a parsing constraint, relating inputs to outputs. Assuming that every vowels is mapped to a mora, these sequences would violate SYLLMAX if parsed as a single syllable. However, there is another type of parse available that would allow these as possible sequences.

One could, for example, parse each vowel as a separate syllable or pairs of tautosyllabic vowels, as in (21):

(21) Tableau

	SYLLMAX

☞u.i.a.i.
  | | | |
  µ µ µ µ
  | | | |
  σ σ σ σ
	✓✓✓✓

☞ui. ai.
  |/ |/
  µ   µ
  | |
  σ   σ
	✓✓

uia.i. ||| | µµµ µ |// | σ σ	*!

☞u.i.   a.i.
  | | | |
  µ µ   µ µ
  |/ |/
  σ   σ
	✓✓

What prevents these parses? The answer cannot be that they are ungrammatical for some other reasons, since the notion of *ungrammaticality* has no status in OT. The only answer allowed by OT is that there must be more optimal parses available. And these more optimal parses must be able to derive well-formed outputs from ill-formed inputs. This is an important point, but it is relatively subtle, so it will take space to tease apart the relevant issues. This excursus is justified, however, because it provides a clearer understanding of OT on the one hand and Banawá and Suruwahá prosody on the other.

4.3.2.3. Enhancement

In order to better understand syllabification in Banawá (and, indeed, in UG), we need to avail ourselves of the concept of *Sonority Dispersion* developed by Clements (1990). The notion of Sonority Dispersion expresses the fact that sonority is distributed differentially across distinct positions within the syllable. I want to argue that it is useful to fine-tune Sonority Dispersion in terms of a family of *Sonority Enhancement* constraints. Sonority Enhancement is defined in (22):

(22) Sonority Enhancement (SonEnh): The sonority of the syllable nucleus is optimally enhanced.

(23) ***Enhancement***: The sonority of ***S***, a segment, is *enhanced* just in case it surpasses the sonority of tautosyllabic segments (enhancement is gradient and relative; i.e., the larger S's sonority superiority over surrounding segments, the more S is enhanced).

Enhancement is implemented by the following constraints:

(24) Harmonic Nucleus (HNuc): The most sonorous segment of the syllable is the nucleus.

(25) Sonority Increase (SonInc): The sonority of the nuclear segment exceeds the sonority of the initial syllabic segment by at least two values.

These constraints are ranked as in (26), which includes constraint (19) above:

(26) Ssc >> SonInc >> HNuc

Now let us reconsider sequences along the lines of those in Tableau (20) above, now compared with an additional parse involving assignment of [-consonantal] to segments underspecified for this feature:

(27) Tableau

	SSC >>	SonInc >>	HNuc

`*ua.ia`
` |/ |/`
` μ  μ`
` |  |`
` σ  σ`
		*!	

☞`wa.ya`
`  |  |`
`  μ  μ`
`  σ  σ`			

Although /ua/ and /ia/ violate SONINC when /u/ and /i/ are interpreted as [-cons], they satisfy it when the offending segments are interpreted as [+cons], i.e. as [w] and [y], respectively (see Table One). Therefore, the parses in (27) better satisfy the Enhancement constraints in (22)-(25). But now contrast the parses in (27) with the words in (28)-(31) (` = secondary stress; ´ = primary stress):

```
(28) fúa 'manioc'
(29) súkià 'dark'
(30) réukàna (auxiliary plus main verb; single prosodic word)
(31) fáa   fùi 'directly to the water'
     water direct
```

In examples (28)-(31), we see that tautosyllabic nonhigh-vowel sequences are allowed, so long as their syllable begins with a consonant. Compare the parses in Table Two to see how the constraints developed to this point predict this:

(32) Tableau

	SSC >>	SONINC >>	HNUC
ua		*!	
ia		*!	
☞fua 'manioc'			
☞tia 'you'			

Since the first segment of the syllable of ***tia*** is [-cons], and thus of ∅-relative sonority, the nuclear segment, a vowel, exceeds it in sonority by two values, as required. It is important to appreciate exactly what the SONINC constraint, one of the family of Enhancement constraints, does here. Not only does it account for the fact that high vowel/nonhigh vowel sequences are only possible syllable internally, never syllable initially, but it also derives Itô's (1989) *Onset Condition*. Rather than view the presence of onsets as simply a stipulation, SONINC allows us to derive the need for onsets from the need to properly disperse sonority throughout the syllable and enhance the sonority of the syllable nucleus.

There is yet the more subtle issue of how to handle inputs like those in (33)-(35) in OT:

(33) aaa
(34) aea
(35) eae

Sequences of nonhigh vowels cannot be salvaged by simply interpreting some of the vowels as onsets. Low vowels differ from high vowels crosslinguistically by their inability to serve as syllable onsets. So how would OT deal with the fact that such sequences are missing? To better appreciate the problem, consider the Tableau in (36):

(36) Tableau

	SSC >>	SONINC >>	HNUC
☞aa || μμ || σσ	**	**	
☞aa || μμ \/ σ	**	**	

Both parses violate the SSC and SONINC. But neither produces a fatal violation because there are no better parses. Therefore, one of these sequences ought to appear. Yet neither does. In previous models of phonology, this fact is accounted for by inviolable constraints or rules. Thus if, say, SONINC were inviolable, then both sequences would be ruled out for violating it. But in OT any constraint may be violated. This means that constraints only select the better of two parses, they do not eliminate parses which have no competition. Therefore, in order to rule out hypothetical input sequences like those in (33)-(35), which never surface, I will have to assume that it is less costly to insert onsets than to allow words without onsets to appear. This involves the families of *Correspondence Constraints* in OT. To repeat from an earlier section, these constraints include families of constraints relating to the input-output relations of nonreduplicative and reduplicate forms. Since reduplication does not enter into our discussion here, I will take up only the former constraints here. These are:

(37) Maximum Input-Output Constraint (MAX IO): Every segment of the input has a correspondent in the output (i.e. no deletion is allowed).

(38) Dependent Input-Output Constraint (DEP IO): Every segment of the output has a correspondent in the input (no insertion).

Let us assume that SONINC outranks DEP IO. Then we have an account for the absence of the forms in (33)-(35) above (aaa, aea, etc.), as shown in the Tableau below:

(39) Tableau

<table>
<tr><th></th><th>SSC >></th><th>SONINC >></th><th>HNUC >></th><th>DEPIO</th></tr>
<tr><td>aa
| |
μμ
| |
σσ</td><td>**!</td><td></td><td></td><td></td></tr>
<tr><td>CaCa
| |
μ μ
σ σ</td><td></td><td></td><td></td><td>**!</td></tr>
<tr><td>☞Caa
| |
μμ
σ</td><td></td><td></td><td></td><td>*</td></tr>
</table>

The last form ***Caa***, with an epenthetic onset, is preferred, since it only violates the lowest ranking constraint in the Tableau.[9] If Correspondence constraints could not be ranked relative to other constraints in this fashion we would be unable to account for the absence of the sequences in (33)-(35) above. I conclude, therefore, based on Sonority Enhancement constraints and the absence of polysyllabic V-sequences in Banawá, that Banawá does not have V-syllables.

There are problems remaining for the current analysis, however. Consider the contrast in (40):

(40) a. kèiyárinè 'happy'
b. * kèyiárinè

Whenever there is a sequence of high vowels surrounded by other vowels, syllabification is ambiguous, given the discussion to this point. Since only (40a) is allowed, what we need is a way to ensure that syllabification is oriented from right-to-left in Banawá. I propose the following ALIGN constraint:

(41) ALIGN σ (σ, L, PRWD, R)

This alignment constraint is to be interpreted as requiring the left boundary of each syllable to be as close to the right boundary of the prosodic word as possible. Closeness here is defined in terms of the number of segments which separates the syllable boundary from the prosodic word boundary. This constraint will evaluate the two parses in (40a)and (40b) as in (42):

(42) Tableau

	ALIGN (σ, L, PRWD, R)
A. ☞ke i y a r i n e |/ \/ \/ \/ σ_1 σ_2 σ_3 σ_4	
B. ke yia ri n e | |/ \/ \/ σ_1 σ_2 σ_3 σ_4	*!

The syllable boundary of σ_2 in (42A) is farther from the right boundary of the PRWD than σ_2 in (42B). σ_1 is irrelevant to the parse, since there is no way to move it closer to the right edge of the prosodic word. In other words, this constraint most highly values the parse in which each left syllable boundary is as close to the right margin of the word as possible. Since it is dominated by SYLLABIFY V and LXWD≈PRWD, it cannot force nonparsing of syllables to the left of the rightmost syllable. This completes the analysis of Banawá syllables: (i) there are two types CV and CVV and (ii) there are no V syllables.

Let me summarize the arguments against V-syllables:

(43) Against V-syllables:

a. There are no vowel sequences greater than two moras in length (this is guaranteed iff adjacent vowels are tautosyllabic).

b. High vowels always syllabify as onsets intervocalically, nor may they be stressed in this position. (These related gaps in the distribution of high vowels are predicted by SONINC which has the effect of syllabifying intervocalic high vowels as onsets).

c. As interpreted here, the SSC prohibits sequences of vowels with like sonority only if they are tautosyllabic, since sonority is here seen as a function of Sonority Dispersion within syllables.

The following arguments against V-syllables will be added to the list in (43) in the course of this paper:

d. No word-initial, two-vowel sequences. An onset will always be inserted between these vowels in word-initial position.

e. Word-initial vowels are never footed (and thus never stressed; because the prosodic word must align with a syllable and feet must align with the left-boundary of the prosodic word).

f. Proto-Arawan syllable maximality appears to have reduced from two moras (as in Banawá) to one mora in Suruwahá (cf. section 5.4. below), to avoid violations of syllable integrity. This change only makes sense if there are no V-syllables in Banawá, Proto-Arawan, or Suruwahá.

g. Word-final, post-vocalic high vowels never bear stress (because they are adjoined to a mora on their left and can never be a syllable on their own).

h. Name Truncation shortens names to two syllables, but CVV is never an allowable output of this process. This is expected if CVV is a single syllable, but not if V is a syllable.

We have established that Banawá has two syllable types, CV and CVV (also LLE for phonetic evidence). There are two apparent counterexamples to this claim, however - word-initial vowels and word-final CVVV sequences. These are illustrated in (44) and (45), respectively:

(44) a. enémedè 'child
b. enéki 'middle'
c. éye 'to accompany'
d. abébirì 'gnat'
e. abárikò 'moon'
f. ukúmu 'parasite'
g. uwáribìsei 'one more (masc. adj)'

(45) a. káwiè-i 'to grate (masc. obj.)'
grate-masc.
b. kíe-i 'to have (masc. obj.)' (cf. *kíe-ì)
have-masc.
c. káwarìe-i 'to cook (masc. obj.)' (cf. kàwarìe-í)
cook-masc.

Both of these exceptions are important not only for a fuller understanding of Banawá prosodic constraints, but also for the theory of constraints in OT. I will ignore them for the present, however, and proceed to a discussion of foot structure. I do this because a complete understanding of these exceptions requires a knowledge of foot structure constraints in Banawá.

4.4. Foot structure
4.4.1. Constraining foot structure

As originally described in BBE, Banawá stresses every other mora from left-to-right within the word, skipping word-initial vowels in words with more than two syllables. The words in (46) illustrate the basic stress rule:

(46) a. súirì 'penis'
b. wárabù 'ear'
c. wánakàri 'spider'
d. yífuyà 'fire'
e. uwárià 'one'
f. úwi 'cry'
g. uwía 'go out (as a fire)'
h. káwarìse-i 'rafter (masc.)'
rafter -masc.
i. dábikàri 'bee'

As pointed out in BBE, at first glance Banawá foot structure seems to be just another straightforward trochaic system, with the slight aberration presented by its word-initial vowels. As I will show, however, Banawá's prosodic system is much more complex than first impressions might indicate. On the other hand, its basic stress pattern is indeed a common left-to-right moraic trochaic system. The constraints which guarantee this basic stress pattern are given in (47) and (48):

(47) Foot Binarity (FTBIN): Feet are binary (on moras).
(48) ALIGN FT: (FT, L, PRWD, L)

Constraint (48) tells us that the left boundary of the foot must align with the left boundary of the word. Constraint (49) tells us that feet are left-headed:

(49) ALIGN HD: (FT HD, L, FT, L)

This constraint requires the head of the foot to appear at the left boundary of the foot, i.e. it produces left-headed, or trochaic, feet. The next constraint is crucial, accounting for the failure of word-initial vowels to bear stress:

(50) ALIGN PRWD (σ, L, PRWD, L)

This constraint, vital to the comprehension of Banawá and other Arawan stress systems, requires the left boundary of the foot to align with the left boundary of a syllable. The next constraint requires exhaustive footing of moras:

(51) FOOT μ: All moras are parsed into feet.
(52) PRWD ≈ LXWD

Let's look at the interaction of (51) and (52):

(53) wánakàri 'spider'

	PRWD ≈ LXWD >>	**FOOT μ >>**	**ALIGN FT >>**	**FTBIN**
(wana)kari		**!		
(wa)na(kari)		*!		*
wa(naka)(ri)	*!	*	*	*
(wana)(ka)(ri)				*!
☞(wana)(kari)				

The alternative ranking of ALIGN FT and FOOT μ produces the wrong results:

(54) Tableau

	ALIGN FT >>	FOOT μ
(wana)(kari)	*!	
☞(wana)kari		*

Therefore, since stress is found on every other syllable throughout the word and not simply on the first syllable, FOOT μ must outrank ALIGN FT, just as it is in Tableau (54).

Now let us look at vowel-initial words. By hypothesis, vowels are licensed by moras, but syllables are only licensed by onsets, due to the action of SONINC. Therefore, a vowel not preceded by an onset is left unsyllabified. Constraint (50), which requires the prosodic word to align with a syllable boundary will therefore skip word-initial vowels, if we assume that ALIGN (FT, L, PRWD, L) outranks FOOT μ. Consider the Tableau in (56) ([] = PRWD boundaries; () = foot boundaries; || = LXWD boundaries):

(55) enémedè 'child

(56) Tableau

	ALIGN FT >>	FOOT μ
☞|e[(neme)(de)]|		*
|(e[ne)(mede)]|	*!	

Leaving a word-initial mora unparsed raises the question of how the vowel associated with the mora is pronounced (i.e. licensed). I must assume that Correspondence constraints prevent a nonfooted mora from deleting (this is the equivalent of "stray adjunction", as opposed to "stray deletion"). The relevant constraints are illustrated in (57):

(57) ufábonè 'I will drink'

(58) Tableau

	ALIGN PRWD>>	LXWD≈PRWD >>	SONINC >>	FOOT μ >>	FT BIN >>
|[(u.fa.)(bu.ne)]|	*!				
☞|u[(fa.bu) (ne)]|		*	*	*	*

ALIGN PRWD thus forces word-initial vowels to fall outside of the prosodic word. The ALIGN FT constraint will place a foot edge at the PRWD boundary, omitting the word-initial vowel from foot structure. PARSE µ will not force a Ft boundary to fall to the left of the PRWD boundary because it is outranked by LXWD≈PRWD. Putting a foot boundary between [,| or |,] separates the LXWD and PRWD further, producing additional violations of LXWD≈PRWD.

(59) ufábonè 'I will drink'

(60) Tableau

	LXWD≈PRWD
|(u[fa) (bune)]|	**!
☞|u[(fabu) (ne)]|	*

In a recent ms. Downing (1996, 27ff) claims (referring to an earlier version of the present paper) that this analysis of word-initial vowels is problematic:

> "If vowels are licensed only be being linked to a mora, then ... we would expect unsyllabified vowels to occur in longer strings and in word-medial, as well as peripheral, positions in Banawá."

This argument does not go through, however. Its answer is implicit in the discussion above. Nevertheless, it is worth our effort to make this answer explicit, since in so doing we deepen our understanding of OT.

Downing's objection is that the analysis above appears to allow output structures like the hypothetical examples in (61):

```
(61) aaaa
     ||||
     µµµµ
```

This structure ought to be allowed if the constraints proposed to this point are the only means available to us for parsing words. The structure would presumably be unstressed, since no moras are footable, yet the structure would nonetheless be allowed since the vowels are licensed by moras. But no such words are found in Banawá, therefore, my analysis must be wrong. However, as we have already seen in our discussion of Correspondence, this objection does not follow.

Part of the confusion expressed in Downing's objection rests, I think, with the vestiges of inviolable constraint theories in phonologists' assumptions regarding unattested forms and ungrammaticality. So, for example, ruling out nonexistent forms like (61) is easy in a theory with inviolable constraints (e.g. Chomsky's (1995) Minimalist Theory, which has both inviolable and violable constraints). One simply shows that the nonattested form(s) violates an inviolable constraint and the form(s) is prohibited, thus is unattested. But in OT, even a form that violates the highest-ranking constraint in a grammar or in Universal Grammar, must be allowed if it is the best parse available. The task with unattested forms is always to show that they are not found in the output due to a better parse.

Now, an output like (61) would most liekly arise from an identical input form (i.e. **aaaa**). How can OT rule out such bad input forms? The answer is that the burden for such forms actually falls on learnability theory, rather than phonology per se, unlike theories with inviolable constraints, which would make ruling out such inputs the responsibility of the grammar proper. And the crucial question is how to prevent inputs like **aaaa** from occurring, i.e. not just unattested outputs but the inputs which underly them.

Assume that (61) is an input.Then, because there is no corresponding output identical to it, OT is forced to assert that a constraint must exist which outranks the relevant Correspondence constraint (DEP IO), forcing () to result in an optimal output of a radically different shape from the input. Consider the following Tableau (where ***C*** = epenthetic consonant):

(62) **aaaa**

(63) Tableau

	LXWD≈PRWD >>	**SONINC >>**	**DEP IO**
aaaa		****!	
Ca***C***a***C***a***C***a	***!**		****
☞a***C***a***C***a***C***a			***

Inserting onsets before each vowel will violate Dep IO but will respect SONINC. Assume that this is correct. Then the language learner is faced with outputs **CVCV**, etc. which correspond to very opaque inputs **aaaa**, etc. The learner, as argued by Tesar & Smolensky (1993), Smolensky (1996), and Pulleyblank & Turkel (1995), will simply assume that the input is **CVCV** *not* **aaaa**. So **aaaa** sequences will not arise if we rank SONINC over DEP IO. They will not appear in the output, nor even in the input (via learnability). Learnability, not phonology proper, thus prevents most absolute neutralizations that would result from Correspondence violations.

At the same time, this approach predicts that Banawá will allow onsetless, unsyllabified vowels in word-initial position. The reason is that the constraints ALIGN FT and LXWD≈PRWD outrank SONINC, just as seen in Tableaus (58) and (63). Thus, Downing's objections are answered.

The only question which remains with regard to vowel-initial words is why unsyllabified vowels are not simply deleted (i.e. why "stray deletion" does not apply). The answer is that some Correspondence constraint must be ranked so as to prevent this deletion. Previously we discussed the effects of DEP IO, the constraint that prohibits adding to or additing to the output. However, recent work in OT theory (McCarthy and Prince 1995) argues that output Correspondence constraints are independent from (and thus may be ranked differently than) Correspondence constraints on the input. The relevant constraints are repeated:

(64) MAX IO: Every segment of the input has a correspondent in the output.

(65) DEP IO: Every segment of the output has a correspondent in the input.

Consider the Tableau in (67) and the treatment of word-initial, unsyllabified vowels (where <> = deleted):

(66) ufábonè 'I will drink.'

(67) Tableau

	MAX IO>>	ALIGN FT >>	FOOT µ >>	DEP IO
|<u>[(fabo)(ne)]|	*!			
☞|u[(fabo)(ne)]|			*	

Therefore, any deletion rule will fatally violate MAX IO, effectively barring deletion for word-initial vowels.

This accounts as well for the absence of examples like those in (68):

(68) *aidaha, *aadaha, *audaha, etc.

The absence of such words was interpreted by BBE as strong evidence in favor of a rule of Extrametricality. Since Extrametricality is inviolable and can only affect peripheral *constituents*, these forms are eliminated because the two vowels do not form a constituent. Therefore, the noninitial vowels are not part of a peripheral constituent and so cannot be marked extrametrical. Thus they cannot be syllabified. However, in the present account these hypothetical words are accounted for without need for special comment, by the SONINC >> DEP IO constraint ranking, as shown. We now turn to consider an important theoretical implication of the above analysis, namely, the existence of degenerate feet.

4.4.2. Implication 1 - Degenerate feet

Feet are bimoraic in Banawá with the exception of word-final, monomoraic feet in words of odd-numbered moras (omitting word-initial vowels). These degenerate, monomoraic feet are illustrated in (69):

```
(69) a. súki  à 'dark'
         | |  |
        (µ µ)(µ)
         o    o
         |/   |
```

```
b. túwi à  'to not allow to accompany'
    | |  |
   (µ µ)(µ)
    o    o
    |/   |

c. afí ya mà 'species of bird'
     |  |  |
    (µ  µ)(µ)
     o     o
     |/    |

d. fúa nà 'lost'
    ||  |
   (µµ)(µ)
    o   o
    |/  |

e. máka rì 'cloth'
    | |  |
   (µ µ)(µ)
    o    o
    |/   |
```

Monomoraic feet are not problematic for the analysis presented above because they occur exactly where they are predicted to occur. However, they do violate predictions of some theories of prosody, especially Hayes (1995). According to Hayes (1995, 87), degenerate feet are constrained severely, per (70):

(70) Prohibitions on Degenerate Feet

Foot parsing may form degenerate feet under the following conditions:

a. Strong prohibition - absolutely disallowed.

b. Weak prohibition - allowed only in strong position, i.e. when dominated by another grid mark.

Hayes suggests that (70) might be supplemented by (71), but does not argue that it *must* be:

(71) Non-prohibition - Degenerate feet are freely allowed.

Hayes is concerned with the distribution of degenerate feet for various reasons. Especially important is the perceived correlation between foot size and word size, apparently enabling the latter to be derived from the former (p88):

> "... a ban on degenerate feet makes predictions about possible word shapes. In particular, assuming that every phonological word must contain at least one foot, and that there are no degenerate feet, then there can be no degenerate-size words."

In this quote, Hayes is in effect proposing the implicational universal in (72):

(72) Not degenerate feet → Not degenerate words
(or: Degenerate words → Degenerate feet)

This implication seems correct, so long as it is restricted to prosodic words, as Hayes intends. However, later in the text (p95), Hayes makes it clear that he in fact has a stronger implicational relationship in mind, namely:

> "... degenerate feet will only occur in strong position, only at the (right/left) edge of the word where footing is (left-to-right/right-to-left), *and only in languages that allow degenerate-size monosyllables*." (emphasis mine, DLE)

The emphasized portion of this quote is incorrect, if the analysis above is right. Banawá lacks degenerate words (cf. the discussion of word-minimality in 4.2. above), but it allows degenerate feet. Moreover, its degenerate feet are neither restricted to "strong position", i.e. to where primary stress falls (see (69) above), nor are they completely unrestricted; i.e. they do not fall under *Nonprohibition* in (71) above. The Banawá data thus strongly support a distinction between the minimal word and the minimal foot, namely, that the former is not derived from the latter. This in turn leads to a reformulation of the constraint on foot size, Prince & Smolensky's (1993, 47) FOOT BINarity:

(73) FTBIN: Feet are binary at some level of analysis (where the levels of analysis are μ or σ).

The reason (73) must be reformulated is that when it is outranked by another constraint its effects are ambiguous. Let us consider, for example, two hypothetical cases, in which FOOT μ outranks FTBIN:

(74) Tableau

	FOOT μ >>	FTBIN
(σσ) σ	* !	
☞ (σσσ)		*

(75) Tableau

	FOOT μ >>	FTBIN
(σσ) σ	* !	
☞ (σσ) (σ)		*

These Tableaus compare the adjunction response to FTBIN with the degenerate foot solution. Since FTBIN is violated equally by both, yet both equally satisfy FOOT μ, we must conclude that FTBIN is unable to distinguish between them. Now, Banawá exemplifies the latter strategy positing degenerate feet.. Therefore, if the adjunction strategy is also found in natural languages, FTBIN must be rejected, since it cannot account for how languages choose one strategy over another. And in fact Hayes (1995, 308ff) provides several examples of the adjunction strategy. Therefore, I suggest that FTBIN be broken down into the two constraints in (76) and (77):[10]

(76) FTMAX (Foot Maximality): Feet are no larger than binary (unit of measure = μ or σ).

(77) FTMIN (Foot Minimality): Feet are no smaller than binary (unit of measure = μ or σ).

Consider a trisyllabic sequence, in which FOOT μ, FTMAX, and FTMIN are ranked highly enough to be relevant:

(78) Tableau

	FOOT μ >>	**FTMIN >>**	**FTMAX**
(μμ) μ	* !		
(μμ) (μ)		* !	
☞ (μμμ)			*

(79) Tableau

	FOOT μ >>	**FTMAX >>**	**FTMIN**
(μμ) μ	* !		
☞ (μμ) (μ)			*
(μμμ)		* !	

As we see, by breaking FTBIN down into FTMAX and FTMIN, OT is able to express the two different kinds of odd-footing resolution strategies - empirically essential.

Banawá (and Suruwahá, as we see in section 5.2.3.) ranks FTMAX over FTMIN, producing degenerate feet. Assume that this is correct. Then is there any relationship at all between word-minimality (WDMIN) and foot size?

If FTMIN>>FOOT μ, then degenerate feet will never surface. If there were such a language, then presumably it would also lack degenerate (i.e. subminimal) words. Or if FTMIN>>FTMAX, the language would presumably lack both degenerate feet and degenerate words. In a language like Banawá, however, the two constraints WDMIN and FTMIN are independent.

4.4.3. Alternative accounts of Banawá feet

Before proceeding we must consider two alternatives to the analysis above, Hayes' (1995, 86ff) lengthening hypothesis and Kiparsky's *Catalexis* strategy. Both of these will be shown to be unable to account for the Banawá data.

4.4.3.1. Lengthening

Hayes (1995, 100) argues that apparent cases of degenerate feet in weak positions are in reality due to phonetic final lengthening. His claim would be that in a word, e.g. ***màkarí*** 'cloth', the final /i/ is lengthened by a word-final phonetic process, in effect producing a binary foot in word-final position, as in (80):

```
(80) máka rìi 'cloth'
      | |   ||
     (μ μ)(μμ)
      o     o
      |/    |
```

Or this lengthening could produce no stress at all, but simply result in a perceptually confusing (for the linguist) case of length: (máka)(rì)***i***. However, this hypothesis does not work in Banawá. In instrumental studies of Banawá words, including words with degenerate feet, LLE found no final lengthening. This means that the Banawá data present a solid counterexample to Hayes' proposal on degenerate feet.

4.4.3.2. Catalexis

Kiparsky (1991) and Kager (1995a) propose a different, quite ingenious, account of degenerate feet, based on a notion Kiparsky labels *Catalexis*. According to Kager (1995b, p447), Catalexis is based on the idea that final stresses on so-called degenerate feet are under "grammatical control" and not merely phonetic facts, as in Hayes' account. Kager (1995n, 447) claims that this allows him and Kiparsky to capture the fact that "... in rightward trochaic systems, the presence of degenerate-size words correlates with the presence of final stresses in odd-numbered words."

Catalexis claims in effect that there are no degenerate feet, period, and that where there appear to be degenerate feet, there is in reality a "segmentally empty metrical position at the right edge of the word, i.e. essentially the logical counterpart of extrametricality." (Kager 1995b,447).

In words with odd-numbers of moras, the catalectic mora is footed. It is left unfooted, however, in words of even numbers of moras. It makes the prediction in (81):

(81) Catalexis: Degenerate words → Final stress in odd-numbered words.

Although this correlation is irrelevant in Banawá, Catalexis might nonetheless still be argued to hold. Aside from the "gimmicky" feel of the Catalexis approach and the question of its compatibility with OT, it fails empirically in Banawá. It fails because of another implication that Kager (1995,447) draws from it, namely, that it is "... predicted that catalectic languages have no word minimum." However, we have seen from lengthening and overriding of ALIGN by WDMIN in Banawá, that these processes can only be accounted for if there is a bimoraic minimal word constraint in Banawá, violating the Catalexis model.

Having established that Banawá does allow degenerate feet, we now turn to consider a class of cases in which degenerate feet are systematically barred. These cases involve degenerate feet which violate syllable integrity. However, as we will see, only an extremely narrow subset of syllable integrity violations is barred. We first establish that syllable integrity may be violated in Banawá. We then consider the cases in which it is barred.

4.4.4. Implication 2 - Syllable integrity and foot structure

A second major implication of the present analysis for phonological theory is that syllable integrity is violated by foot structure. In BBE it is argued that foot boundaries may fall between syllable boundaries, violating syllable integrity.[11] This fact violates a number of proposals on the so-called "prosodic hierarchy" (Pike 1967; Selkirk 1980; and Itô & Mester 1992; Hayes 1995, 122). Examples of such violations are given in (82)-(85):

```
(82) a. sáyièi 'sound out'
     b. (sa yi)(ei)
          \/ \\/
          σ   σ

(83) a. kèrewéduàma 'turn end over end'
     b. (ke re) (wedu)(a ma)
          \/\/   \/\/   \/
          σ σ     σ σ    σ

(84) a. tìkadámuèi 'you forget'
     b. (ti ka)(da mu)(uei)
          \/\/  \/ \/
          σ σ    σ σ
(85) a. díhiài 'to catch'
     b. (di hi)(ai)
         \/ \/
          σ σ
```

There are no morpheme boundaries at the relevant syllable boundaries, so we cannot escape the implications of these examples by saying that the "violated" syllables are heteromorphemic. The conclusion such violations of syllable integrity force on us is that syllable integrity is not an inviolable universal. e.g. built into OT's GENerate function or deriving from "strict layering" (Itô & Mester 1992), but rather that syllable integrity is a violable constraint, outranked by FOOT μ in Banawá:

(86) Tableau

	FOOT µ >>	SYLLINT
☞(ke r e) (we **d u)(a** m a) \/ \/ \/ \/ / \/ σ σ σ σ σ		*
(ke r e) (we)**du a**(ma) \/\/ \/ \/ / \/ σ σ σ σ σ	**!	

There are other constraints which might also outrank SYLLINT (e.g. CORRESPOND V-µ; see below) but I omit them here since they add nothing to this portion of the discussion.

Before concluding this side discussion of syllable integrity (i.e. the lack thereof) in Banawá, two plausible alternatives must be considered. The first is that Banawá lacks syllables altogether. The second is, following Hayes (1995, 122ff), that CVV sequences are underlyingly bisyllabic (CV+V) and "fused" subsequent to stressing. We will first review the evidence for syllables.

Phonotactics

If Banawá has no syllables, then it becomes very difficult to account for the constraints on CV alternations and VV sequences analyzed above in terms of syllable maximality, sonority sequencing, and sonority enhancement. For example, we lose any account for why words like (87) are unattested:

(87) *aaaa

One could simply offer a stipulation along the lines of (88):

(88) No more than two Vs are adjacent.

But this stipulation explains nothing. It simply restates the problem. On the other hand, if Banawá does have syllables the observation in (88) is accounted for by SYLLABLE MAXIMALITY and SONORITY INCREASE.

Word-Initial Vowels

Another argument for the syllable in Banawá is the lack of stress on word-initial vowels. If prosodic words align with their leftmost syllable and if feet align with prosodic words, then the fact that word-initial vwels are unstressed is predicted. Without syllables it is difficult to understand why word-initial vowels in Banawá are unstressed.

The final argument on behalf of syllables in Banawá to be presented here comes from hypocoristic formation, a phenomenon heretofore undescribed for Arawan languages, which I will call Name Truncation.

Name Truncation

Banawá personal names, as used in direct address, are almost always bisyllabic oxytones. When names have forms longer than two syllables, they are shortened. Consider first personal names that are always bisyllabic (i.e. they have no longer forms):

	Vocative vs.	*Nonvocative*
(89)	a. Bidú vs.	b. Bídu
(90)	a. Badá vs.	b. Báda
(91)	a. Ifé vs.	b. Ífe
(92)	a. Ritá vs.	b. Ríta

The a. forms show the words with iambic, Vocative Stress. This pattern, which I refer to as Vocative Stress, is used for direct address, single-word replies to questions about the bearers of the relevant names, and some other uses of proper names in isolation. The b. forms show the words with (otherwise expected) trochaic stress, as they appear in texts (outside of direct quotes using them vocatively). Without a notion of the syllable, one could argue that these names are bimoraic. This would follow from the WDMIN constraint. However, things are not so simple. Consider the names in (93)-(96). The a. forms give the full form, the b. forms the truncated forms:

	Long Form	Truncated Form with Vocative Stress
(93)	a. Sabatau [sábatàu] vs.	b. Batau [batáu] (long form from Portuguese Sabatão)[12]
(94)	a. Hobetu [hóbetù] vs.	b. Betu [betú] (long form from Portuguese Roberto)
(95)	a. Tideke [tídekè] vs.	b. Deka [deká] (I do not know why there is an [a] in the shortened form)
(96)	a. Solimau [sólimàu] vs.	b. Rimau [rimáu] (long form from Portuguese Solimão)

The crucial observation in these examples is that the names of Banawá are truncated to two *syllables*, not two moras. Thus, the name ***Sabatau*** does not shorten to ****Tao***. There is nothing ill-formed about a name of this form, however. For example, (97) is an actual Banawá name:

(97) Nao 'woman's name'

Rather, ****Tau*** is not a possible output of Name Truncation, which targets syllables rather than moras. The forms in (93)-(96) are also interesting because they illustrate that a CVV sequence is monosyllabic rather than bisyllabic. If there were V syllables, we would once again be at a loss to account for the failure of ***Sabatau*** to shorten to ***Batau***, rather than ***Tau*** (syllabified as ta.u).

So the rule cannot be to reduce the name to two moras. It is, rather, a reduction to two syllables. Therefore, Name Truncation supports both (i) the necessity of the syllable in analyzing Banawá prosody and (ii) the CV/CVV analysis proposed above, as opposed to the alternative V/CV analysis.

CV+V Fusion

Hayes (1995, 121) argues (contra the above) that "the syllable is universally the stress-bearing unit." He considers two potential cases from the literature that constitute apparent violations of his claim, Southern Paiute (Sapir 1930; Harms 1966) and Winnebago (Hale & White Eagle 1980). If Hayes is correct in this claim, then, obviously, the analysis developed above cannot be correct. Thus it is necessary to discuss Hayes' arguments. Consider first what he says about Southern Paiute. His discussion centers on words like those in (98), in which I have numbered feet and syllables for clarity of exposition:

```
       σ1     σ2     σ3   σ4   σ5    σ6   σ7     σ8  σ9
       /\    /|\    /\   /\  /\    /\  /| \   /\  /\
(98)  tɨ. xʷi   i.na tɨ.βi.  cu.xʷa  i.?i.nʷa
        |     |    |   |   |   |     |   |   |   |    |
       (μ    μ)1(μ  μ)2(μ  μ)3 (μ  μ)4(μ  μ)5<μ>6
```

'go and ask him to tell a story'

In (98), <>$_6$ is Extrametical. The boundary between feet 1 and 2 falls within σ_2. Hayes (p122) states that mora-stressing in Southern Paiute is "not a surface phenomenon, since the sequences /'VV/ versus /V'V/ derived by the stress rule in different contexts are not distinct from one another phonetically."

Hayes seems to be talking about long/geminate vowels in this quote. If he is, then their failure to be distinguished phonetically could follow from the constraint proposed in section four on geminate vowels (GEM), namely, that all geminate vowels are stressed on their leftmost mora. So $V_\alpha V_\alpha$ would always surface as 'VV, not *V'V, unless a higher-ranking constraint forces a GEM violation. Hayes goes on to argue that Southern Paiute CVV syllables are represented "at an earlier stage of the phonology" as CV+V. His evidence for this claim is that "certain allophonic rules of Southern Paiute apply to one 'half' of a VV sequence."

However, there is no such evidence in Banawá. Moreover, there *are* phonetic differences (LLE) between (nongeminate) C'VV and CV'V sequences in Banawá. The absence of any rules treating CVV as bisyllabic or divisible (other than stress) and the phonetic distrinction between C'VV and CV'V (modulo GEM), means that Hayes' reanalysis os Southern Paiute cannot carry over to Banawá.

Hayes (p123) raises another problem for mora-based analyses of stress, however, in his reconsideration of Hale & White Eagle's (1980) analysis of Winnebago. Specifically, Hayes claims that

> "... there is a more direct argument against the view that metrical structure can split syllables. Were this possible, we would logically expect to find it in languages where (unlike in Southern Paiute) CVC counts as heavy."

He argues that a CVC syllable ought also to be divisible by feet just like CVV syllables, i.e. that the mora projected by the coda C ought to be dominated directly by the foot. He claims that such cases "... appear to be unattested". It could be that Cs are never stressed for independent phonetic reasons, so that his argument is not particularly strong if it indicts such analyses for the failure of coda Cs to bear stress. But there is a weaker version of his objection which is more plausible (which he does not state, but which I infer), namely that coda moras never get directly dominated by feet nor enter into the geometry of foot construction. However, in Everett (1990), I argue that in fact exactly this case obtains in Kamã, a Makuan language of Northern Brazil. Consider the following examples (as per Everett 1990, 27ff, left-headed feet are constructed left-to-right in the word in Kamã; see also Martins 1994 for additional data and a different analysis):

```
(99) a. tâwâât 'generic term for bird'
     b. tâwâ  ât
         | |   ||
        (µ µ)(µµ)
         o    o
         |/   |/

(100)a. paspuug 'boa constrictor'
     b. pas puug
         ||  ||
        (µµ)(µµ)
         o   o
         |/  |/
```

In these examples, we see that voiceless codas are assigned moras but voiced codas are not. Moreover, we see also that foot construction takes place on moras regardless of whether that mora is ultimately anchored to a consonant or a vowel.

Thus there seems to be evidence of exactly the right kind to weaken Hayes' second objection against building feet on moras. The upshot of this section is this: there is no evidence for analysing CVV sequences in Banawá as bisyllabic. But there *is* evidence for treating CVV as monosyllabic and there is evidence that coda moras (in Kamã) count for foot construction. Therefore, I reject Hayes' proposal that feet are built exclusively on syllables. This conclusion, in conjunction with independent evidence for syllables from phonotactics, word-initial vowel behavior, and Name Truncation, establishes that (i) Banawá has syllables; (ii) feet are built on moras, not syllables; (iii) feet may violate syllable integrity. On the other hand, in section 5 below, I will suggest that Suruwahá has developed diachronically such that feet are built directly on syllables in this language, avoiding syllable integrity violations. I argue that this suggests that violations of syllable integrity are marked and that pressure is exerted on the grammar to rank SYLINT high.

4.4.5. Conclusion:

Let's sum up the discussion of this section.The most important point is that the relationship between prosodic "levels" is not as direct as we might have expected. This is illustrated by three distinct phenomena of Banawá: (i) minimal word size cannot be derived from minimal foot size (since there are degenerate feet but no degenerate words); (ii) syllable integrity can be violated by foot boundaries; (iii) prosodic words are aligned with syllables, i.e. their relationship is not as we might have expected - it does not follow a strict hierarchical account in the normal sense wherein units higher on the hierarchy are composed of or manifested by units lower on the hierarchy. We will see as the paper progresses that these findings receive support from other aspects of Banawá and Suruwahá prosody. Before moving on to a discussion of Suruwahá prosody, I would like to complete tthe discussion of Banawá by showing that morphological constraints on stress exist. Morphological contraints are shown by the footing restrictions on certain suffixes and the interaction of these suffixes with WDMIN.

4.4.6. A morpheme-specific constraint: ***-i***

First, let us consider the interaction of the masculine gender suffix ***-i*** with stress.

```
(101)     a. káwiè-i 'to grate (masc. obj.)'
             grate-masc.
          b. kíe-i 'to have (masc. obj.)' (cf. *kíe-ì)
             have-masc.
          c. káwarìe-i 'to cook (masc. obj.)' (cf. kàwarìe-í)
             cook-masc.
```

These examples illustrate the fact that this suffix is never stressed, i.e. it can never form a degenerate foot on its own. However, because Banawá allows both degenerate feet and SYLLINT violations, we cannot account for ***-i***'s behavior simply by saying that it cannot be stressed because it would violate these constraints. There must be another reason.

I will assume that ***-i*** is not stressed because it is lexically constrainedso as to avoid heading a foot. This constraint is given in (102):

(102) AVOID ***-i***: The masculine gender suffix, ***-i*** does not map to a mora.

I will further assume that this constraint is implemented indirectly by allowing ***-i*** to violate CORRESPOND V μ.[13]

(103) CORRESPOND V μ: Vowels map to moras.

This constraint outranks ALIGN PRWD, as shown in (104)-(106):

(104) údei

(105) a. *udéi
b. *udeí

(106) Tableau

<table>
<tr><th></th><th>WdMin >></th><th>Avoid -i >></th><th>Align PrWd >></th><th>Correspond Vμ</th></tr>
<tr><td>u dei
| ||
μ|[(μμ)]|
o
|/</td><td></td><td>*!</td><td></td><td></td></tr>
<tr><td>☞ udei
| \/
|[(μ μ)]|
o
|/</td><td></td><td></td><td>*</td><td>*</td></tr>
<tr><td>udei
\/
μ
o
|</td><td>*!</td><td></td><td>*</td><td>*</td></tr>
<tr><td>udei
||
(μμ)
o
|/</td><td></td><td>*!</td><td>*</td><td>*</td></tr>
</table>

On the other hand, examples like (107) illustrate further the fact that Avoid ***-i*** is outranked by WdMin:

(107) Tableau

	WDMIN >>	**AVOID -*i***
mai 'sun' \/ μ	*!	
☞mai || (μμ)		*

Having completed our discussion of Banawá, we are ready to move on to Suruwahá. This language provides interesting insights on further constraints, as well as the relevance of variable constraint rankings to understanding differences between the prosodic systems of these two languages.

5. Suruwahá
5.1. Syllable structure

Suruwahá syllable structure is very similar to Banawá syllable structure, but with two differences. The first is relatively minor - according to Suzuki (1995), Suruwahá has a high-central vowel, /ɨ/, not found in Banawá (or any other Arawan language), adding to the sonority table. Otherwise, Suruwahá segmental sonority values are identical to those for Banawá. The second difference is that Suruwahá syllables are maximally monomoraic. Thus, whereas Banawá diphthongs are all bimoraic, Suruwahá has only light, monomoraic diphthongs (with a few exceptions forced by minimality constraints). This result is achieved, as we see below, by the two constraints in (108) and (109):

(108) SYLL = μ (Syllable maximality)
(109) CORrespond V-μ (vowels map to moras)

(110) SYLL = μ >> COR V-μ

The sonority relations for Suruwahá are given in Table Two:

Table Two
Suruwahá **Segmental Sonority Values**

Consonants	i	ɨ	u*	a	e	
+						[+consonantal]
-						[+low]
∅	∅/2	2	∅/2/3	3	3	

Consider how SYLL=μ and sonority constraints syllabify the input sequence in (111):

(111) iaiauai 'woman's name'

(112) Tableau

<table>
<tr><th></th><th>SONINC >></th><th>SYLL=μ >></th><th>COR V-μ</th></tr>
<tr><td>iayauai
| | ||
μ μ μμ
| | |/
σ σ σ</td><td>**!</td><td></td><td></td></tr>
<tr><td>yayawai
| | ||
μ μ μμ
| | |/
σ σ σ</td><td></td><td>*!</td><td></td></tr>
<tr><td>yayawai
| | ||
μ μ μμ
| | ||
σ σ σσ</td><td>*!</td><td></td><td></td></tr>
<tr><td>☞yayawai
| | |/
μ μ μ
| | |
σ σ σ</td><td></td><td></td><td>*</td></tr>
</table>

Assuming the constraints just given, as well as the identical ENHANCEMENT constraints proposed earlier for Banawá, ranked as shown, we pick out the correct form as optimal. Other examples are:

(113) a. bàtohá 'to fight' → a'. .bà.to.há .
b. zàmarí 'generous' → b' .zà.ma.rí.
c. baxìhuuú 'sp. of fruit' → c'. .ba.xì.hu.wú.
d. bìhauùhurá 'to fly' → d'. .bì.ha.wù.hu.rá.
e. dadú 'hole' → e'. .da.dú.
f. haí 'to exit' →f'. .haí
g. mosá 'owl' → g'. .mo.sá.

Again, as was the case with Banawá, high vowels /i/ and /u/ are underspecified for the feature [consonantal], their output value determined by ENHANCEMENT above.[14]

Recall that in Banawá syllable size (SYL ≤ μμ), COR V-μ, and sonority enhancement constraints guaranteed that syllables could contain no more than two vowels. However, in Suruwahá, since COR V-μ is outranked by SYLL=μ, the maximum vowel sequence is not determined by limitations on number of moras per syllable. The question then arises why syllables like those in (114) are not found in Suruwahá (*=unattested):

```
(114)     *piai, *piua, *paiu, etc.
            \|/    \|/    \|/
             μ      μ      μ
             |      |      |
             σ      σ      σ
```

These sequences can only be ruled out if we rank constraints as in (115):

(115) COMPLEX$_1$>>DEP IO>> SYLL=μ >>COR V-μ>>COMPLEX$_2$

The COMPLEX constraints are defined in (116) and (117):

(116) COMPLEX$_1$: Mappings between levels greater than two-to-one are prohibited.
(117) COMPLEX$_2$: Mappings between levels greater than one-to-one are prohibited.

COMPLEX$_2$ prohibits diphthongs (i.e. two-to-one mappings between Vs and μs). COMPLEX$_1$ prohibits triphthongs and larger sequences.

This point is not crucial to the major thrust of the present paper. But it is raised to make explicit the inference that SYL=μ cannot guarantee that Suruwahá will have no nuclei larger than dipthongs. This was unnecessary in Banawá, due to the higher ranking of COR V μ.

One cannot help but notice that a crucial difference between Suruwahá and Banawá is that Suruwahá's SYL=μ constraint, ranked above COR V μ, will prevent feet from violating SYLINT. I'll return to this later, but for now, let us say that Suruwahá likely represents the more natural constraint ranking and hence a development away from the less natural proto-Arawan form. Before we can evaluate this claim, however, we need to understand how footing works in Suruwahá.

5.2. Foot structure and alignment
5.2.1. Basics

Suruwahá feet are right-headed (iambic) and are oriented from right-to-left. These alignment constraints are stated in (118) and (119):

(118) ALIGN FT (FT, R, PRWD, R)
(119) ALIGN HD (HD, FT R)

Consider the examples in (120) and their parses in (121):

```
(121)     a. dakùhurú    'to put in the fire'
          b. tàburí      'vestige/track'
          c. dànazú      'difficult/dumb'
```

```
          d. hàbanùhurú  'to get away'

(122)     a. daku huru
              | |  | |
             (μ μ)(μ μ)
               o    o
              \|   \|

          b. ta  bori
              |   | |
             (μ) (μ μ)
              o     o
              |    \|

          c. da nazu
              |  | |
             (μ)(μ μ)
              o    o
              |   \|

     d. ha banu huro
         |  | |  | |
        (μ)(μ μ)(μ μ)
         o    o    o
         |   \|   \|
```

Suruwahá thus has syllabic iambs, whereas Banawá has moraic trochees. Interestingly, it is Suruwahá's iambic system which has lost the distinction between light and heavy syllables. This distinction has been maintained in the moraic, trochaic systems in Banawá. This is not what we would have otherwise expected. However, it can be understood, I think, as a result of the fact that SYLLINT is violated in Banawá foot construction (and probably, therefore, in proto-Arawan foot construction as well), which Suruwahá has avoided. But this avoidance produces a somewhat marked system, in which proto-Arawan heavy syllables and trochaic feet are changed to light iambs in Suruwahá.

Hayes (1995, 80ff) proposes the Iambic/Trochaic law in (122):

(122) "a. Elements contrasting in intensity naturally form groupings with initial prominence.
b. Elements contrasting in duration naturally form groupings with final prominence."

In other words, iambic systems are more likely than trochaic systems (even in the weak version of (122)) to have long syllables. However, in Arawan we see a contrast between heavy vs. light syllables in Banawá's trochaic system, but not in Suruwahá's iambic system. This raises interesting diachronic and synchronic questions regardless of which of the two systems is hypothesized as the protoform. It would seem that the most transparent account of the development is to assume that Banawá's system is closest to that of the protosystem (since development to a system like Banawá's from a system like Suruwahá would be harder to understand) and that the system developed to eliminate a moraic basis for foot construction to avoid violations of SYLINT.

5.2.2. Word-initial vowels

In this section we discuss data which shows the superiority of OT alignment constraints over a serial approach based on extrametricality. Both Banawá and Suruwahá allow word-initial vowels in spite of the fact that onsets are required word-internally. I will assume that these are allowed in Suruwahá for the same reasons they are allowed in Banawá, as discussed in section 4.3. and 4.4. above, so I will not repeat that discussion here.

However, there is a striking difference in the behavior of word-initial vowels in Suruwahá and Banawá. In Banawá word -initial vowels can only be stressed to avoid a violation of WDMIN. But in Suruwahá, word-initial vowels are always stressed in words of odd-numbered moras, i.e. when they head a foot. I take this to mean that Suruwahá stress is built on moras, not syllables, since I still want to claim that these word-initial vowels are not syllabified (arguments against V-syllables in Suruwahá are roughly the same as for Banawá).

This ability of word-initial Vs in Suruwahá to bear stress routinely means that they cannot be analyzed by a *rule* rendering them extraprosodic. So we could not in principle appeal to extrametricality to account for the fact that they are only allowed at the left margin of the word. Alignment, on the other hand, accounts for their behavior straightforwardly. Consider ALIGN FT again, repeated below as (123):

(123) ALIGN (FT, R, PRWD, R)

Alignment with the right edge of the word will be blind to the presence of onsets. Since there is no need for any constraint for alignment of feet at the left margin of the PRWD, the onsetless word-initial vowels will be footed routinely. They will, however, just as in Banawá, be allowed only at the left margin of the word, because only there would an epenthetic onset violate LXWD≈PRWD. Epenthetic onsets would, in principle, be allowed word-interannly, if, as in Banawá LXWD≈PRWD >> SONINC >> DEP IO. We expect no onsetless vowels except at the left-margin of the word. Other examples of vowel-initial words in Suruwahá include the following:

```
(124)     a. ubùniú      'man's name'
          b. abá         'fish'
          c. ìnahá       's/he takes a bath'
          d. àdamí       'hill'
          e. adá         'reddened'
          f. abú         'tongue'
          g. idú         'that one'
          h. ìgamú       'chest'
          i. ìnamìzarú   'man's name'
          j. itènizá 'to cut'
```

5.2.3. Degenerate feet

Like Banawá, Suruwahá also has degenerate feet. Since the foot aligns with the right margin of the word in Suruwahá, these degenerate feet will surface at the left-margin of the word. The existence of these feet is predicted by the same constraint ranking we observed in Banawá:

```
(125) ìnahá 's/he takes a bath'
```

(126) Tableau

	FtMax >>	**Foot μ** >>	**FtMin**
☞ inaha | | | (μ)(μ μ) o o			*
in aha | | | (μ μ μ) o o	*!		
in aha | | | μ (μ μ) o		*![15]	

Other examples of degenerate feet include:

```
(127)  (ma)(kasio)' truth'
         |    | |/
         μ    μ μ

(128)  (ma)(jowa)(kari) 'passion fruit'
         |    | |    | |
         μ    μ μ    μ μ
```

```
(129)  (to)(karu)(huro)  'to push'
         |    | |    | |
         μ    μ μ    μ μ
```

5.3. Word Binarity and Word Minimality

5.3.1. Word minimality

Suruwahá rigidly enforces a bimoraic word minimum, just as Banawá does. As in Banawá, the evidence for WDMIN in Suruwahá is both negative and positive. Negatively, there are no words in the corpus (including about 1000 isolated words) collected to date smaller than two moras (*=unattested):

(130) *ba, *ri, *nu, etc.

Positively, there are two arguments: (i) word-final postvocalic high vowels are stressed only in bimoraic words and (ii) sequences of identical vowels are only found in such words (violating the SSC) and in fact must be found in such words if a short vowel would result in a monomoraic form. Consider first postvocalic high vowels:

(131) a. baí 'thunder'
b. naí 'mother (vocative)'
c. haí 'vine'

As we have seen previously, postvocalic, word-final high vowels are normally parsed as part of the preceding mora and are not stressable. However, analyzing the final [i] of these words in the same way would produce a monomoraic representation of these words, in violation of WDMIN. If we assume that word-minimality outranks syllable maximality, then bimoraic representations are optimal, as shown is the following tableau:

(132) Tableau

	WDMIN>>	**SYL=μ**
bai \/ μ	*!	
☞bai || μμ		*

The occurrence of word final geminate vowels in Suruwahá, as in Banawá, results from ranking WDMIN over the SSC, COMPLEX, and SYLMAX. However, the lengthening pattern in Suruwahá raises an interesting issue concerning diphthongs. So, for example, consider the constrasts in (133) and (134):

```
(133)     a. hiáa 'here'[16]
          b. *hiia
          c. *hia

(134)     a. baí 'thunder'
          b. *baii
          c. *baai
```

In monosyllabic words with diphthongs that rise in sonority, as in (133), the most sonorous vowel must lenghten to satisfy WDMIN. However, in monosyllables with diphthongs of falling sonority, as in (134), no long vowels are allowed. Rather the final high vowel receives a single mora and is parsed as the head of its foot. This would be very difficult to capture in a serial, multilinear representation. For example, assume that the underlying representations in a serial model are (135) and (136), respectively:

```
(135) hia
       \/
       µ

(136) bai
       \/
       µ
```

If a mora is added to satisfy WDMIN, with the stipulation that only minimal reconfiguring of the tree is allowed (along the lines of Chomsky's *economy principle*), then the representations in (137)-(140) equally valued by the grammar:

```
(137)     hia + → b. hi a (=hiaa)
           \/ |        \|\
           µ  µ         µ µ

(138)     bai + → ba i (=*baii)
           \/ |     \|\
           µ  µ      µ µ
```

OR

```
(139)     hia + → hi a (=*hiia)
           \/   |   /\/
            μ   μ   μ   μ

(140)     bai + → ba i (=*baai)
           \/ |     /\/
           μ   μ    μ   μ
```

To correctly derive ***hiaa*** in such a model, we incorrectly predict *__*baii.*__* On the other hand, if we revise our analysis to involve delinking and relinking of vowels to moras, then we correctly derive ***bai*** but incorrectly predict *__*hia*__*.

```
          UF          Add mora for WdMin
(141)     bai         →    bai
                            ||
           μ               μμ

          UF          Add mora for WdMin

(142)     hia         →    *hia
                             ||
           μ                μμ
```

A serial account of this contrast would have to be fairly complex. However, in an OT analysis, concerned with outputs rather than the processes which produce them, we can account for these contrasts by the constraints in (143) and (144):

(143) FALLing DIPHthong: Each vowel may map to a mora in a sonority-falling diphthong.

(144) RISing DIPHthong: First vowel is not moraic (i.e. does not map to a mora one-to-one).

These two constraints, reflecting universal properties of diphthongs, in conjunction with COMPLEX$_2$ predict all and only the correct forms:

(145) Tableau

<table>
<tr><th></th><th>WDMIN >></th><th>RISDIPH >></th><th>COMPLEX$_2$</th></tr>
<tr><td>hia
 \/
 μ</td><td>*!</td><td></td><td></td></tr>
<tr><td>hia
 ||
 μμ</td><td></td><td>*!</td><td></td></tr>
<tr><td>☞hia
  \|\
   μ μ</td><td></td><td></td><td>*</td></tr>
</table>

(146) Tableau

<table>
<tr><th></th><th>WDMIN >></th><th>RISDIPH>></th><th>COMPLEX$_2$</th></tr>
<tr><td>bai
 \/
 μ</td><td>*!</td><td></td><td></td></tr>
<tr><td>ba i
 /\/
 μ μ</td><td></td><td>*!</td><td></td></tr>
<tr><td>☞bai
  ||
  μμ</td><td></td><td></td><td>*</td></tr>
</table>

These constraints seem valid universally (McCarthy 1995,14ff). They are related to, but not identical to, McCarthy's (1995, 8ff) LIGHT DIPHTHONG constraint ("Diphthongs of rising sonority are monomoraic"). Once again, OT has provided a simpler analysis with fewer ancillary hypotheses than would be required by a serial-based model, concerned with processes rather than outputs. Before concluding this discuss of Suruwahá diphthongs, however, there is another interesting phenomenon in Suruwahá which shows that stress likes to be placed on syllables rather than moras. Consider the examples in (147), which seem to be in free variation:

(147)	a. baí vs	a.' ba?í 'thunder'
	b. haí vs.	b.' ha?í 'vine'
	c. aú vs.	c.' a?ú 'woman's name'

Stress in bimoraic words appears on the right half of a falling diphthong. The structures on the left are stressed by placing stress on a mora. Moreover, they violate FALLDIPH. In the structures on the right, however, all constraints, except MAX IO, are respected. Since the structures are optional it may be that MAX IO is freely ranked with regard to FALLDIPH.

5.3.2. Word Binarity

In this section, I argue that Suruwahá enforces an additional constraint not found in other Arawan languages, to my knowledge, namely, that words should have two feet each. I will call this the WORD BINARITY CONSTRAINT (WDBIN). WDBIN is unlike WDMIN in that it appears to be optional, which I will express as being freely ordered with respect to the constraint SYL=μ. Words are brought into conformity with WDBIN and WDMIN by GEN, which produces a range of moraic-melodic mappings which are pruned down by constraints to just the optimal outputs. Wherever additional moras involve many-one mappings from melodic to moraic levels, syllable maximality will be violated. Therefore, such representations will only survive in the output if forced by a higher-level constraint. To WDBIN we must add the constraint on melody-mora mappings, discussed earlier, BIM, which rules out vowels greater than two moras - which prevents WDBIN from 'iterating'. These two constraints are given in (148) and (149):

(148) Word Binarity (WDBIN): Words are composed of two minimal (i.e. nondegenerate) feet.
(149) Bimoraicity (BIM): Vowels are maximally bimoraic.

Crucially, BIM outranks WDBIN. Consider first the words in (150):

```
(150)     a. hamau
              | |/
              μ μ

          b.  h ama u
                /\ \/
               μ μ  μ

          c.  *hamau
                | ||
                μ μμ

          d.  *hama  u
                | | /\
                μ μ μμ

          e.  *ha m au
                /\  ||
               μ  μ μμ
```

```
(151)     a.  bai
               ||
              (μμ)

          b.  b a  i
                /\ |
              (μ)(μμ)

          c.  *ba  i
                /\ /\
               μ  μμ μ

          d.  *ba  i
                | /|\
                μ μμμ

          e.  *b a  i
                /|\ |
               μ μ μμ
```

What we see from such examples is that bimoraic words may be alternatively represented with vowel length, as trimoraic size, but additional length is not allowed; i.e. vowels may not be larger than bimoraic (other forms will be ruled out by FTMIN, HNUC, or other constraints). Consider the Tableau below:

(152) Tableau

<table>
<tr><th></th><th>WDMIN >></th><th>ALIGN µ >></th><th>BIM >></th><th>WDBIN >></th><th>HNUC[22] >></th><th>SYLLMAX</th></tr>
<tr><td>bai
\/
µ</td><td>*!</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>bai
||
(µµ)
o</td><td></td><td></td><td></td><td>*!</td><td>*</td><td>*</td></tr>
<tr><td>☞ba i
|\ |
(µ)(µµ)
o o</td><td></td><td></td><td></td><td></td><td></td><td>**</td></tr>
<tr><td>ba i
|\ |\
(µµ) (µµ)
o o</td><td></td><td></td><td></td><td></td><td>*!</td><td>**</td></tr>
<tr><td>b a i
/| \ |\
(µµ)(µ µ)
o o</td><td></td><td></td><td>*!</td><td></td><td></td><td></td></tr>
<tr><td>b a i
/| \ |\
µ(µ)(µ µ)
o o</td><td></td><td>*!</td><td></td><td></td><td></td><td></td></tr>
<tr><td>b a i
/| \ |\
(µµ)(µ µ)
o o</td><td></td><td></td><td>*!</td><td></td><td>**!</td><td>***</td></tr>
</table>

As stated earlier, however, WDBIN is optional, accounted for in my analysis by freely ordering WDBIN with regard to SYLLMAX (i.e. allowing either one to outrank the other). The derivation of the nonbipedal form in the following Tableau:

(153) Tableau

<table>
<tr><th></th><th>WdMin >></th><th>Align μ >></th><th>Bim >></th><th>SyllMax >></th><th>HNuc >></th><th>WdBin</th></tr>
<tr><td>☞bai
||
(μμ)
o
\|</td><td></td><td></td><td></td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>b a i
/\ |
(μ) (μμ)
o o
| \|</td><td></td><td></td><td></td><td>**!</td><td>*</td><td></td></tr>
</table>

Multiple cases of bimoraic vowels will always be eliminated by SYLMAX in these kinds of examples, since the additional violations of SYLMAX are not offset by conformity to any higher-level constraint.

WDBIN is a bit more complex than merely saying that words like to have two feet, however. There are two complications. First, as per the definition of WDBIN, words like to have not just two feet but, where possible, two minimal (i.e. bimoraic), rather than degenerate, feet. Second, lengthening cannot "iterate". That is, a vowel can be bimoraic to respect WDBIN, but cannot be trimoraic (or larger). These two facts follow partly from the constraints given, if BIM outranks WDBIN. To this we add a crosslinguistically common constraint, not discussed to this point, because it is ranked very low in the Arawan constraint hierarchy, ALIGN_{FT} (Ft L, s L).

Consider the words in (120) as illustration of the first point:

(154) a. hàmedí 'child between 5 and 8 years of age'
b. hàamedí
c. *haaamedi
d. *haameedi
e. *hamedii

As shown in the Tableau below, the constraints already introduced are able to account for these facts (the form in (150a) is omitted since we have already dealt with this - such forms arise when SYLLMAX outranks WDMIN, a possibility that arises since these two constraints are freely ordered with respect to one another).

(155) Tableau

	BIM >>	**WDBIN >>**	**ALIGN_{FT}**
☞haamedi			
hameedi			*!
haaamedi	*!		

The form in (154d) is interesting because it forces us to ask why a mora can only be added at the *left* boundary of the word. The (154a) form arises when WDBIN is ranked below SYLMAX. The (154b) form results when WDBIN is ranked above SYLMAX. But how are we to avoid the forms in (154c-e)? We could add another constraint:

(156) ALIGN μ: All moras align with the leftmost PRWD boundary.

If we assume that vowels are mapped one-to-one with moras *in the input*, the ALIGN μ constraint can only add moras to the left.[17] The μs of the input form which violate (156) are allowed if PARSE μ and CORRESPOND V μ outrank ALIGN μ (M=output mora not found in input):

(157) Tableau

	PARSE μ, CORRESPOND Vμ >>	ALIGN μ
ham edi | /\ | μ Mμ μμ		*!

☞hamedi
  /\\| |
  Mμμ μ		

hamedi | | /\ μ μ μ M		*!
hamedi | | μ μ	*!	
hakubi | μ	**!	

If moras are indeed part of the input, then GEN's ability to add moras is properly constrained to the left margin of the word. But now let us reconsider the ***hia/hiaa*** alternation from (158) above:

(158) a. hia
b. hiaa
c. *hiia

The unattested form obeys ALIGN μ, but the attested form does not. This apparent problem in fact follows if ALIGN μ is outranked by RISDIPH.

These constraints then account for all the relevant facts: (i) length occurs on the left; (ii) length only creates bimoraic, never trimoraic or longer vowels; (iii) length only occurs in bimoraic or trimoraic forms.

As evidence of the claim in (iii) consider the words below. It is crucial to illustrate the absence of bimoraic vowels in words larger than three moras in length, in order to establish that (i) the effect here really is WDBIN and that (ii) it cannot be reanalyzed in terms of cola. So, consider the following words:

(159) a. hàrikàdawùhurú 'to turn so as not to burn is a fire'
b. *haarikadawuhuru

(160) a. akàbuzàhurú 'to remove'
b. *aakabuzahuru

(161) a. bànuzùnarí 'to make a circle on the ground for dancing'
b. *baanuzunari

(162) a. azòwaní 'vomit' (noun)
b. *aazowani

Words like (159a) are rare, but they make an important point - WDBIN cannot be reframed in terms of cola (well-formed cola are groups of four moras/syllables). If it were, we would expect lengthening on the leftmost vowel to make a well-formed cola.[18,19]

5.4. Diachronic syllable shortening and alignment in Suruwahá

In Everett (1995), I argued that proto-Arawan stress was a left-to-right trochaic system and that its syllables were maximally bimoraic. In Suruwahá syllables are maximally monomoraic (except to satisfy WDBIN or WDMIN); feet are aligned with the right of the PRWD and is iambic. What might have caused these innovations in Suruwahá? Let us recall that there are two relatively unusual features of Banawá prosody (which are argued in Everett (1995) to be found in proto-Arawan as well), namely that word-initial vowels fall outside the prosodic word and that foot boundaries violate syllable integrity. Whatever one's beliefs about diachronic prosody, one thing is clear: Suruwahá's monomoraic syllables and iambic, right-aligned stress pattern avoid violations of syllable integrity and avoid the violation of LXWD≈PRWD resulting from word-initial vowels falling outside the PRWD.

Let us speculate that violations of syllable integrity and failure of segments to align with the prosodic word are marked. This seems uncontroversial. If so, then constraint markedness might be eventually derived from some deeper principle. I will not look for this deeper principle here, however, but will stipulate the following unmarked constraint hierarchy:

(163) Unmarked Constraint Hierarchy: SYLLABLE INTEGRITY >> LXWD≈PRWD >> ALIGN S[20]

6. Conclusion

This paper explored prosodic structures in Banawá and Suruwahá in considerable detail. In addition to its empirical objective of documenting and describing these prosodic systems, this paper has also established that hierarchical relations between prosodic levels do not themselves exhaust the range of possible inter-level relations. There can be, for example, separate constraints on closely related structures in different levels (FTMIN vs. WDMIN); levels can be skewed (e.g. when foot boundaries fall within syllables); levels can have connections that skip intermediate, adjacent levels (prosodic words in these languages align with the syllable rather than the foot); and similar constraints can target distinct entities at nearly the same positionon the heirarchy of prosodic relations, e.g. in Suruwahá's bisyllabic requirement on hypocoristic formation vs. it bimoraic requirement on word minimality).

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Notes

[1] Some general background: this research is based on fieldwork by the author (Banawá informant work in and out of the main village, along the Banawá river, a tributary of the Purus; transcription of Suruwahá recordings) and Márcia Suzuki (informant work in Suruwahá villages). Arawan languages are endangered by most definitions of that term - they are all spoken by small communities (most have less than 200 speakers total) and are threatened by the encroachment of Western civilization. Data collection is always a challenge in the Amazon, but the case of the Suruwahá merits special mention. Access to these people is extremely difficult - a two-hour flight in a single-engine aircraft, a one-day canoe trip, and a two-day hike, in that order. Moreover, the Suruwahá are monolingual in Suruwahá. Márcia Suzuki's sacrifice and hard work in collecting and analyzing the Suruwahá data is thus very admirable and should be greatly appreciated by the linguistics community. Speakers of Banawá are relatively fluent in Portuguese, although they speak Portuguese only with foreigners or reporting the speech of foreigners. There are approximately 80 speakers of each language.

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[2] Rimarimá has not even been contacted by Europeans yet. It listed here because the Banawá and Suruwahá claim to have spoken to such a group of people and it seems that there language is Arawan. But this is not at all clear.

[3] For example, the examples in (i) and (ii) are from 'Oro Win and the (iii) and (iv) examples are from Banawá:

'Oro Win:

```
(i) kambira 0-na  ciprain pana
    fall    3-aux leaf    stick
    'Three leaves fell.'
(ii) watapee o-na namakan
     sit     1-aux ground
    'I sit on the ground.'
```

Banawá:

```
(iii) isiri dza tee 0-na
      basket in put 3-aux
    'S/he put it in the basket.'

(iv) yati o-na-ke
     live 1-aux-declarative
    'I am alive.'
```

[4] These constraint types are discussed more fully below.

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[5] I use *unattested*, rather than ungrammatical, because I wish to avoid the impression that constraints are inviolable.

[6] There are exceptions to this generalization. Some of these exceptions (about a dozen words in all) are interjections, e.g. ***eee***, an agreement particle. Others are the result of consonant deletion in morphophonemic combinations. But one or two appear to have no synchronic explanation at all. The most obvious example is ***baama*** 'catfish'. This derives historically from ***bahama*** (and in fact still has this form in most other Arawan languages). That is, the intervocalic ***h*** has been dropped. But since the word is morphologically simple, so far as I can tell, it should have been shortened to ***bama***. Indeed some speakers alternate between ***baama*** and ***bama*** in their pronunciation. However, at this point I have no satisfying account of this word.

[7] See below for an explanation of why the word-final ***-i*** in forms like ***udei*** 'I spear' are not stressed nor help resolve WDMIN violations.

[8] Of course, this account fails to tell us why it is **ae** which is lacking, rather than **ai**, a rather serious problem it would seem.

[9] However, as we see directly, epenthesis can only salvage a syllable in word-internal position. In word-initial position it would violate LXWD ≈ PRWD and so is less optimal. In word-initial position, the optimal form would be a**C**a.

[10] Other researchers (Downing 1995; Green 1995) have suggested similar proposals, but the first proposal along these lines I am aware of (and cited by these others) was an earlier version of this paper.

[11] We noted also that only the stress theory of Halle & Vergnaud (1987) predicts such a possibility.

[12] Word final high vowels in Banawá and Suruwahá are parsed as light diphthongs with a preceding adjacent vowel. See below and footnote 14.

[13] This constraint exists in Suruwahá as well but, like in Banawá it is violated by WDMIN. The AVOID ***-i*** constraint is like constraints on numerous Arawan suffixes. It is common in these languages (as in English, etc.) for different suffixes to impose their own constraints on stress in the word. There is an alternative analysis, however, which requires no special reference to ***-i***. We could rank the constraints in (i) as in (ii):

(i) a. ALIGN LXWD/PRWD LEFT: The left edge of the lexical word aligns with the left edge of the PRWD.
b. ALIGN LXWD/PRWD RIGHT: The right edge of the lexical word aligns with the right edge of the PRWD.

ALIGN LXWD/PRWD RIGHT >> SYLINT >> ALIGN LXWD/PRWD LEFT

This would predict the behavior of word-final /i/s. They would be omitted from the prosodic word since their inclusion would lead to a violation of ALIGN LXWD/PRWD RIGHT. (Presumably, they would be included in the syllable to their left, though, violating SYLINT since the prosodic word boundary would divide the syllable.) This ranking predicts that prefixes will behave differently than suffixes. But the analysis in the text seems simpler and so is preferred here in the absence of evidence to the contrary.

[14] The vowel /ɨ/ patterns like neither /i/ nor /u/, somewhat contrary to expectations given that it too is a high vowel. Moreover, it is not found in other Arawan languages. There may be some reason, therefore, to pursue the hypothesis that this vowel is in fact not part of the input inventory of Suruwahá.

[15] Below we consider an alternative analysis whereby feet in Suruwahá are built on syllables rather than moras. It turns out that this a priori plausible alternative must be rejected because it cannot explain stress shift in bimoraic words, forced by WDMIN.

[16] Consider too examples like (i) and (ii):
(i) híi 'there'
(ii) táa 'you'

These words violate the iambic stress pattern of Suruwahá. However, they are predicted if GEM outranks ALIGN HD. Therefore, I assume the ranking GEM >> ALIGN HD.

[17] This could force revisions in the earlier claim that high vowels are unspecified for [+cons]. However, we could assume that high vowels are not associated with moras in the input, but that the moras are added in the output. Alternatively, we could assume that /y/ and /w/ are found in the input in Arawan languages.

[18] I owe the suggestion of the cola alternative to Colleen Fitzgerald (pc).

[19] Before concluding this section, it would be worthwhile to note that WDBIN offers further support for the constraints ALIGN µ and GENSTR:

(i)
a. ìkizí 'man's name'
b. àzuwí 'cashew'
c. hamáu 'stop (verb)'
d. hàkubí 'mortar & pestle'

(ii)
a. ìikizí
b. àazuwí
c. hàamáu
d. hàakubí

The crucial observation here is of course the stress on the first vowels of the words in (i). Without BIM, this stress pattern would leave an unaccounted for gap between stresses, since it violates our normal stress rule, which should have otherwise stressed the antepenultimate vowel in each of the lengthened forms in (ii). The words in (iii), on the other hand, illustrate that BIM alone is not enough to guarantee the correct stress patterns of geminate vowels. It must be supplemented by the higher ranking ALIGN µ constraint, as discussed above.

(iii)
a. híi 'there'
b. táa 'you (sg.)'
c. hiáa 'here'
d. ?íi 'jungle fruit'

[20] Alternatively, we could replace SYLLABLE INTEGRITY in (163) with LAYERING. This constraint (see Ito & Mester 1992) prohibits "skipping" levels of the prosodic hierarchy (i.e. syllables will be dominated by feet, and feet by words; syllables are not dominated directly by words). If this analysis is correct, then Suruwahá has changed from marked (proto-Arawan) to its currently less marked system.