Issues in Banawá Prosody: Onset Sensitivity, Minimal Words, and Syllable Integrity

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Three aspects of Banawá prosody (Buller, Buller, and Everett 1993, Everett 1996a,b) have been argued to present significant difficulties for metrical stress theory. First, Banawá stress is sensitive to the presence or absence of syllable onsets; second, Banawá tolerates monomoraic feet yet requires a bimoraic minimal word; and, third, it seems to employ mora-based footing that is free to ignore syllable boundaries. In this article, I argue that these issues are not nearly as problematic as they might first appear. The article demonstrates that Banawá's onset sensitivity can be produced by a constraint aligning the head syllables of feet with onsets, that its minimal word restriction can be produced with Nonfinality constraints, and that it can maintain syllable integrity simply by giving clash and lapse avoidance priority over other footing considerations.

Keywords: Banawá, stress, onset, minimality, clash, lapse

1 Introduction

Three issues in Banawá prosody (Buller, Buller, and Everett 1993, Everett 1996a,b) have been argued to present significant challenges for metrical stress theory. The first is that Banawá stress is sensitive to the presence or absence of syllable onsets. As Buller, Buller, and Everett (1993) and Everett (1996a,b) explain, Banawá strongly prefers that its syllables have onsets, restricting the occurrence of onsetless syllables to initial position. Even with this limited distribution, however, onsetless syllables have a significant effect on the stress pattern.

As illustrated in (1), when a form has an initial CV or CVV syllable,[1] its stress pattern is trochaic. Stress occurs on every odd-numbered mora counting from the left.

I would like to acknowledge the assistance of four anonymous reviewers. Their comments, questions, and suggestions have led to many improvements in the article.

[1] Long vowels in Banawá appear only in monosyllabic words, so VV sequences in longer forms are always heterorganic. (Buller, Buller, and Everett (1993) and Everett (1996a,b) offer some possible explanations for the few apparent exceptions.) Heterorganic VV sequences also have a limited distribution in Banawá, however, in that they do not appear word-initially on the surface. According to Buller, Buller, and Everett (1993) and Everett (1996a,b), when there is an initial VV sequence underlyingly, the first V is always realized on the surface as an onset glide.

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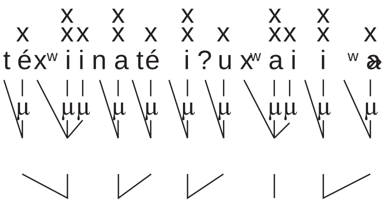
the only way to account for such forms would be to parse them from left to right with mora-based iambs that are free to ignore syllable boundaries.

(56) (t éxʷ ')(i n ˆ)(t é ")(? u xʷ ˆ)(i ") ʷ a

As demonstrated in (57), however, since Southern Paiute never has more than a single stress per syllable, it is clearly possible to produce the necessary patterns with syllable-based feet.

(57)



In the discussion that follows, we will focus on the four constraints repeated in (58). Recall that NFIN(xF, ,) requires stress to avoid the prosodic word-final mora, and that ALIGN(F-HD, R, , R) promotes rightward iambic footing. *CLASH discourages adjacent stressed moras, and HEADGAP discourages adjacent stressless moras.

(58) a. NFIN(xF, ,)
No foot-level gridmark occurs over the final mora of a prosodic word.
b. ALIGN(F-HD, R, , R)
The right edge of the head syllable of every foot is aligned with the right edge of some prosodic word.
c. *CLASH
For any two entries on level n 1 of the grid, there is an intervening entry on level n.
d. HEADGAP
For every two adjacent moras, one must be the head mora of a foot.

First, we will see how the basic Southern Paiute pattern is produced by an appropriate ranking of NFIN(xF, ,), ALIGN(F-HD, R, , R), and *CLASH. Then, we will see how adding a high-ranking HEADGAP to the ranking helps to produce the type of form that seems to support violating syllable integrity.

In ranking the constraints, an important point to keep in mind is that, unlike Banawá, Southern Paiute does not exhibit a perfect moraic alternation. In particular, Southern Paiute often tolerates clash. In forms with an even number of moras, for example, such as [ˈsa i] •coyote•, stress will fall on both the penultimate mora and the antepenultimate mora, resulting in a clash configuration. This being the case, *CLASH must be ranked low, and clash avoidance cannot play the central role in Southern Paiute that it does in Banawá. Instead, it is the ability of a high-ranking HEADGAP

Recall that the role of *Clash in the present context is to prohibit adjacent stressed moras and that the role of HeadGap is to prohibit adjacent stressless moras.[14]

The second group consists of Alignment constraints (McCarthy and Prince 1993a). In addition to Align(F-hd, L, C, L), introduced in section 1 and repeated in (19a), the analysis utilizes Align(F-hd, R, , R), given in (19b), and Align(-hd, R, , R), given in (19c).[15]

(19) a. Align(F-hd, L, C, L)
The left edge of the head syllable of every foot is aligned with the left edge of some consonant.

b. Align(F-hd, R, , R)
The right edge of the head syllable of every foot is aligned with the right edge of some prosodic word.

c. Align(-hd, R, , R)
The right edge of the head foot of every prosodic word is aligned with the right edge of some prosodic word.

Recall that Align(F-hd, L, C, L) is responsible for producing onset sensitivity. It aligns the left edge of head syllables with a consonant.

The second Alignment constraint, Align(F-hd, R, , R), aligns head syllables with the right edge of a prosodic word. As illustrated in tableau (20), this type of constraint can establish both foot type and footing directionality.

[14] Because it only prevents the head moras of feet from occurring more than one mora apart, HeadGap does not exclude lapse configurations that arise because a head syllable has been left stressless. For example, it does not exclude the lapse configuration created when overlapping feet occur at the left edge of an iambic form.

(i)
```
   x     x  x
 x x x x x x x
```


As illustrated in (i), when an iambic foot follows the stressless head syllable of two overlapping feet, the result is a lapse, even though the head moras never occur more than one mora apart. As tableau (20) will show, however, rightward foot-head alignment excludes such configurations in iambic forms by positioning overlapping feet, when they occur, at the right edge of the prosodic word. Since the possibility of positioning overlapping configurations somewhere other than the right edge of the prosodic word is of limited interest here, for the sake of simplicity I will assume throughout the article that HeadGap excludes both types of lapse configurations. See Hyde 2002, however, for additional discussion of the adopted framework•s ability to control clash and lapse.

[15] As is customary with Alignment constraints referring to prosodic categories, violations of Align(F-hd, R, , R) and Align(-hd, R, , R) will be measured in terms of intervening syllables. Since Align(F-hd, L, C, L) has a reference to segments and requires finer measurements, its violations will be measured in terms of intervening segments.

(28) illustrates, vowel-initial forms always leave their initial syllable stressless, exhibiting an iambic pattern where stress occurs on every even-numbered mora counting from the left.

If we were to analyze the situation in terms of prominence, we might say that syllables with onsets are prominent enough to bear stress but syllables without onsets are not. Because onsets do not play a role in the standard types of weight-based processes (Hyman 1985, 1990, McCarthy and Prince 1986, Hayes 1989), however, it has long been assumed that they do not contribute to mora count, the conventional measure of syllable prominence. The problem presented by Banawá and similar cases, then, is to produce onset sensitivity without relying on the mediation of moras.

To avoid the mediation of moras, the proposed approach posits a direct alignment relationship between head syllables and consonants, a relationship established by ALIGN(F-HD, L, C, L), repeated in (29).

(29) ALIGN(F-HD, L, C, L)
The left edge of the head syllable of every foot is aligned with the left edge of some consonant.

Because it requires the left edges of head syllables to coincide with a consonant, and because stress must always occur over a head syllable, a high-ranking ALIGN(F-HD, L, C, L) ensures that stressed syllables always have onsets. The discussion proceeds as follows. Section 3.1 shows how ALIGN(F-HD, L, C, L) helps to produce the basic Banawá stress patterns. Section 3.2 examines some of the more recent alternatives to the proposed account.

3.1 The Proposed Account

The issue of onset sensitivity arises in Banawá in the context of a shift from a trochaic pattern to an iambic pattern. When the initial syllable has an onset, it can be stressed, and the form exhibits the default trochaic pattern. When the initial syllable does not have an onset, it cannot be stressed, so the trochaic pattern must be avoided. An iambic pattern, which leaves the initial syllable stressless, emerges instead.

Schematically, to establish the trochaic pattern as the default pattern, constraints that prefer trochaic footing must dominate constraints that prefer iambic footing. Given such a ranking, a trochaic pattern will always emerge, unless a more important consideration requires that it be avoided. In Banawá, of course, a more important consideration is that stress avoid onsetless syllables, and this makes it necessary to rank ALIGN(F-HD, L, C, L) above the constraints that prefer trochaic footing.

(30) ALIGN(F-HD, L, C, L) trochaic constraints iambic constraints

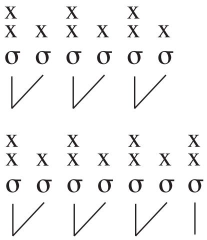
Given such a ranking, ALIGN(F-HD, L, C, L) will negate the preferences of the trochaic constraints in those contexts where trochaic footing would position stress on an onsetless syllable. Since onsetless syllables are restricted to initial position, and the trochaic pattern always stresses the initial syllable, ALIGN(F-HD, L, C, L) will require an iambic pattern in vowel-initial forms.

In the adopted framework, a constraint that produces iambic footing is ALIGN(F-HD, R, , R), repeated in (31a), which aligns head syllables with the right edge of the prosodic word. A

(16) a. *Conventional structures* b. *Proposed structures*

(σ́σ)(σ́σ)(σ́σ)

(σ́σ)(σ́σ)(σ́σ)(σ́)



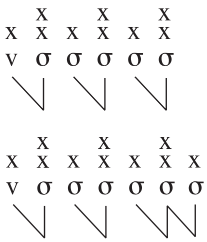
As illustrated in (16), both approaches would parse every syllable into feet, and there would be no improperly bracketed prosodic categories.

The structures assigned to vowel-initial words, however, would exhibit a slight difference in odd-parity forms. (In (17), a lowercase *v* represents an onsetless syllable.)

(17) a. *Conventional structures*[11] b. *Proposed structures*

(vσ́)(σσ́)(σσ́)

(vσ́)(σσ́)(σσ́)σ



In the final three syllables of an odd-parity form, conventional OT frameworks would foot the first two syllables and leave the third syllable unfooted. The adopted framework would parse all three syllables using two overlapping feet. The two feet share the middle syllable and the foot-level gridmark that occurs above it.

Without going into unnecessary detail, I will note here that the occurrence of overlapping feet is sharply restricted in the adopted framework, since alignment constraints typically confine them to one edge or the other of an odd-parity form. For present purposes, the best way to think of these structures is that they are simply the adopted framework's substitute for sequences involving a foot and an unfooted syllable, and they will arise in similar contexts.

The second difference is that the adopted framework distinguishes between *prosodic head* and *gridmark*,[12] while more conventional OT frameworks tend either to conflate these notions

[11] As we will see in section 3.2, approaches rooted in more conventional frameworks actually tend to use trochaic footing for vowel-initial forms. The iambic footing illustrated in (17a), however, is the structure typically used for this type of pattern when onset sensitivity is not an issue. I use iambic footing in this particular example only to highlight the differences in structural assumptions between the adopted framework and more conventional frameworks.

[12] In other words, the adopted framework maintains a distinction between prosodic prominence and metrical prominence. In this respect, the approach is similar in spirit, if not in actual execution, to the original proposals of Liberman (1975) and Liberman and Prince (1977).

The purpose of this section, then, is to demonstrate that we can allow for Banawá•s syllable-internal stress distinctions while maintaining syllable integrity. This is possible if we assume (as in Prince 1983, Kager 1993, 1995, Hyde 2001) that the grid•s base level corresponds to moras rather than syllables. Since heavy syllables will have two mora-level gridmarks, there will be two possible locations for the foot-level gridmark when a heavy syllable is stressed. By focusing on clash and lapse avoidance, we can then produce the appropriate stress patterns with syllable-based feet.

Although the position of stress within a heavy syllable will necessarily vary, I will assume that the default is for stress to fall on a syllable•s initial mora. This seems likely, since most languages associate initial moras with the most sonorous segments, at least in those cases where sonority distinctions can be made. For the purposes of illustration, I will implement this preference in the analysis below with the formulation in (46).

(46) FIRSTMORA
In a stressed syllable, the foot-level gridmark occurs over the leftmost mora.

When a syllable is stressed, FIRSTMORA simply requires that the stress occur over the syllable•s initial mora.

The discussion proceeds as follows. Section 4.1 shows how the proposed account produces the Banawá stress pattern using syllable-based feet. Section 4.2 briefly discusses the alternative account that utilizes mora-based feet. We will see that there are considerations within Banawá itself, as well as the more general considerations mentioned above, that prevent us from abandoning syllable integrity. Finally, section 4.3 briefly examines the case of Southern Paiute, which has also been argued to exhibit mora-based footing. We will see that we can preserve syllable-based footing in Southern Paiute, as well, using principles similar to those involved in the analysis of Banawá.

4.1 Heavy Syllables

The issue of syllable integrity arises in the Banawá stress patterns because they exhibit a perfectly binary moraic alternation, even in forms that contain heavy syllables. When heavy syllables are present, they fail to perturb the basic patterns.

(47) a. LLH kárabùa •blowgun•
b. HHL tšásánš •acquire•
c. LLLH tškadámuè •you forget•
d. HLLL kèiyárinè •happy•
e. LHLL bàduébirš •species of deer•
f. LLLHL kèrewéduàma •turn end over end•

stress is associated with a particular portion of the syllable in the formal structure, syllable integrity ensures that there is never more than one stress per syllable. It should not be surprising, then, that stress is typically perceived as stress on a syllable, especially in languages where the phonetic correlates of stress are present throughout the syllable.

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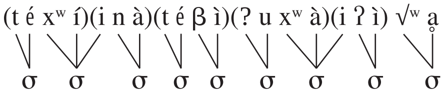
(56) 

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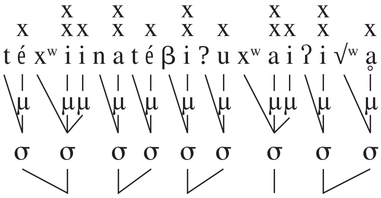
(57) 

In the discussion that follows, we will focus on the four constraints repeated in (58). Recall that NFIN(x_F, μ, ω) requires stress to avoid the prosodic word-final mora, and that ALIGN(F-HD, R, ω, R) promotes rightward iambic footing. *CLASH discourages adjacent stressed moras, and HEADGAP discourages adjacent stressless moras.

(58) a. *NFIN(x_F, μ, ω)*
No foot-level gridmark occurs over the final mora of a prosodic word.

b. *ALIGN(F-HD, R, ω, R)*
The right edge of the head syllable of every foot is aligned with the right edge of some prosodic word.

c. **CLASH*
For any two entries on level $n+1$ of the grid, there is an intervening entry on level n.

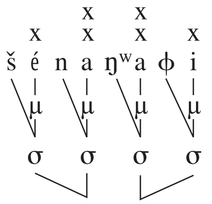
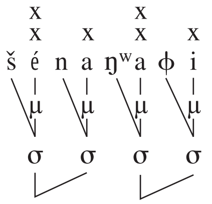
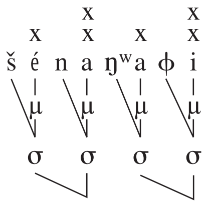
d. *HEADGAP*
For every two adjacent moras, one must be the head mora of a foot.

First, we will see how the basic Southern Paiute pattern is produced by an appropriate ranking of NFIN(x_F, μ, ω), ALIGN(F-HD, R, ω, R), and *CLASH. Then, we will see how adding a high-ranking HEADGAP to the ranking helps to produce the type of form that seems to support violating syllable integrity.

In ranking the constraints, an important point to keep in mind is that, unlike Banawá, Southern Paiute does not exhibit a perfect moraic alternation. In particular, Southern Paiute often tolerates clash. In forms with an even number of moras, for example, such as [šɨnáŋʷàɸi̥] 'coyote', stress will fall on both the penultimate mora and the antepenultimate mora, resulting in a clash configuration. This being the case, *CLASH must be ranked low, and clash avoidance cannot play the central role in Southern Paiute that it does in Banawá. Instead, it is the ability of a high-ranking HEADGAP to avoid lapse at the expense of ALIGN(F-HD, R, ω, R) that creates a limited moraic alternation and the illusion of mora-based footing.[29]

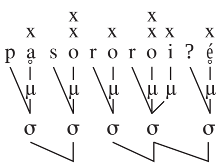
To produce the basic Southern Paiute pattern, NFIN(x_F, μ, ω) must dominate ALIGN(F-HD, R, ω, R), and ALIGN(F-HD, R, ω, R) must dominate *CLASH.

(59) [šénáŋʷàɸi̥] ‘coyote’

šé.na.ŋʷa.ɸi	NFIN (x_F, μ, ω)	ALIGN (F-HD, R, ω, R)	*CLASH
☞ a. 		* **	*
b. 		* ***!	
c. 	*!	**	

[29] There is a particular context where lapse can occur in Southern Paiute. When the penult is a stressed heavy syllable (see footnote 28), and the ultima is a stressless light syllable, the result is two adjacent stressless moras at the right edge of the prosodic word. This is the case, for example, in [pḁsórorȍiči̥] ‘waterfall’. While this may seem problematic at first, the difficulty disappears when we consider the appropriate structure.

(i)



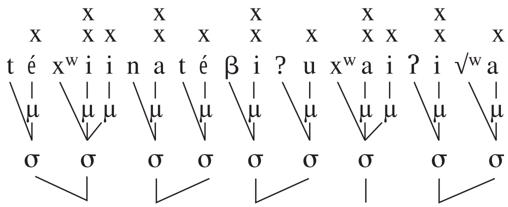
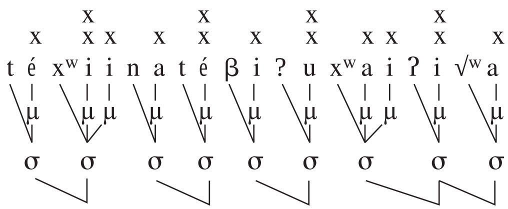
Since there are two overlapping iambic feet at the right edge of the prosodic word, the final mora is a head mora (even though it is not associated with a foot-level gridmark), and it is only one mora removed from the previous head mora. Since HEADGAP is defined in terms of head moras, rather than grid entries, the structure would not actually violate the constraint. This is one case, then, where the distinction between heads and gridmarks is crucial (see section 2.1).

As tableau (59) demonstrates, in forms with an even number of moras, ranking NFIN(x_F, μ, ω) above ALIGN(F-HD, R, ω, R) ensures that the final stress retracts to the penultimate mora. Stress cannot occur over the final mora, as in candidate (59c), in an effort to promote better rightward alignment of head syllables. In turn, ranking ALIGN(F-HD, R, ω, R) above *CLASH ensures that nonfinal feet will be iambic. Nonfinal feet cannot be trochaic, as in candidate (59b), to avoid a clash configuration. Candidate (59a), where stress occurs on the penultimate mora and every even-numbered mora preceding the penultimate mora, correctly emerges as the winner.

Although I omit the additional tableau, it should be clear that the ranking also produces the correct result for forms with an odd number of moras, such as [u̥túšuŋʷɨ̀ʔi] 'to cause to go to sleep'. Optimal rightward alignment would position two overlapping feet at the prosodic word's right edge, much as it does in Banawá's iambic pattern. Since only the shared syllable of the overlapping feet would be stressed, the form would avoid stress on its final mora while also avoiding a clash configuration.

The ranking demonstrated in tableau (59), then, is adequate for producing the basic Southern Paiute pattern, but we must also consider the effects of the HEADGAP constraint if we intend to account for those forms that seem to support mora-based footing. To produce a form like [tɨxʷíinàtɨβìčuxʷàiʔìŋʷḁ] 'go and ask him to tell a story', HEADGAP must dominate ALIGN(F-HD, R, ω, R), so that alignment cannot draw head moras so far apart that they create a lapse configuration. As tableau (60) demonstrates, restricting lapse configurations helps to position stress within syllable-based feet in such a way that the desired pattern emerges.

(60) [tə́xʷíinàtə́βìʔuxʷàiʔì√ʷḁ] 'go and ask him to tell a story'

tə́.xʷii.na.tə́.βi.ʔu.xʷai.ʔi.√ʷa	HEADGAP	ALIGN (F-HD, R, ω, R)
☞ a. 		* ** **** ***** ******* (20)
b. 	*!*	* *** ***** ******* (16)

In tableau (60), although candidate (60b) exhibits better rightward alignment, it is excluded by HEADGAP, because some of the head moras have been pulled more than one mora apart. The candidate contains two pairs of adjacent moras where neither is the head mora of a foot. The first pair consists of the third and fourth moras, and the second pair consists of the eighth and ninth moras. Although candidate (60a) has additional violations of ALIGN(F-HD, R, ω, R), its head moras are close enough together to avoid lapse. Since it satisfies the higher-ranked HEADGAP, candidate (60a) correctly emerges as the winner.

Although we have not examined Southern Paiute in great detail, it should be clear at this point that we can maintain syllable integrity in this case, as well, simply by using principles that we have already seen at work in the analysis of Banawá. While it is true that clash avoidance does not play as significant a role in Southern Paiute, the combination of lapse avoidance and alignment is sufficient to correctly position stress using syllable-based feet.

Next, we turn to the final issue in our examination of Banawá prosody: Banawá's bimoraic minimal word.

5 Primary Stress and the Minimal Word

Having seen how the proposal produces the correct distribution for secondary stress in Banawá, without violating syllable integrity, we turn now to issues involving primary stress. To present a complete picture, I will address both the position of primary stress in longer forms and the role of primary stress in producing Banawá's bimoraic minimal word. Discussion of the pattern in longer forms provides an example of a foot extrametricality effect, an effect that McCarthy (2003) claims may be unattested.[30] It should be noted, however, that Buller, Buller, and Everett (1993) mention that there are a number of unexplained exceptions to this description, so Banawá does not present a completely compelling counterexample at this point. Banawá's minimal word is significant because it cannot be obtained through a minimal foot restriction, the mechanism that theories like those of McCarthy and Prince (1986) and Hayes (1995) typically use to produce minimal words.

5.1 Positioning Primary Stress

As (61) illustrates, the location of primary stress in Banawá provides an example of a foot extrametricality effect.

(61) a. téme 'foot'
b. enéki 'middle'
c. báburùru 'cockroach'
d. abárikò 'moon'
e. mètuwásimà 'find them'
f. tìnarífabùne 'you are going to work'

[30] Examples of foot extrametricality effects are problematic for the Categoricality Hypothesis. When a head foot cannot be the final foot (due to Nonfinality, for example), categorical Alignment constraints cannot ensure that the head foot will then be the penultimate foot. If they are blocked from achieving exact alignment with the right edge of the prosodic word, they cannot persuade the head foot to occur in penultimate position, rather than initial position or some other nonfinal position. See section 2.2 and footnote 16 for additional discussion.

In forms long enough to contain two or more stressed moras, the primary stress is the penultimate stress, indicating that primary stress prefers to occur over the penultimate foot, rather than the final foot.

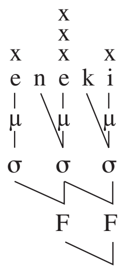
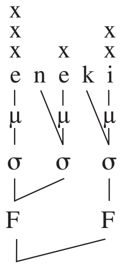
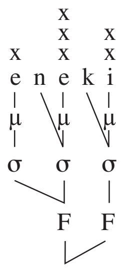
Beyond the constraints utilized in sections 3 and 4 to produce the correct distribution for secondary stress, two additional constraints are needed to produce the foot extrametricality effect for primary stress. The two constraints are ALIGN(ω-HD, R, ω, R), repeated in (62a), which aligns the head foot with the right edge of the prosodic word, and NFIN(x_{ω}, F, ω), repeated in (62b), which prohibits primary stress from occurring over the prosodic word-final foot.

(62) a. *ALIGN(ω-HD, R, ω, R)*
The right edge of the head foot of every prosodic word is aligned with the right edge of some prosodic word.
b. *NFIN(x_{ω}, F, ω)*
No prosodic word-level gridmark occurs over the final foot of a prosodic word.

When NFIN(x_{ω}, F, ω) dominates ALIGN(ω-HD, R, ω, R), as demonstrated in tableau (63), Alignment draws the head foot as far to the right as possible, but Nonfinality prevents it from drawing the head foot into final position. Since a head foot in final position would mean that primary stress had to occur over the final foot, the best that Alignment can do is to make the penultimate foot the head foot. In tableau (63), NFIN(x_{ω}, F, ω) excludes candidate (63c). Because its final foot is the head foot, its prosodic word-level gridmark occurs over the final foot. Candidates (63a) and (63b) both satisfy NFIN(x_{ω}, F, ω), but ALIGN(ω-HD, R, ω, R) excludes candidate (63b), because its head foot occurs further to the left than necessary. Candidate (63a)—where the head foot is the penultimate foot and the primary stress the penultimate stress—correctly emerges as the winner.

The ranking in tableau (63) correctly positions stress in forms with two or more stressed moras. More should be said, however, about shorter forms with only a single stressed mora. In such forms, stress always occurs over the final foot, violating NFIN(x_{ω}, F, ω).

(64) [enéki] 'middle'

e.ne.ki	*CLASH	ALIGN (F-HD, L, C, L)	NFIN (x_ω, F, ω)
☞ a. 			*
b. 		*!	
c. 	*!		

In tableau (64), candidates (64b) and (64c) both satisfy NFIN(x_ω, F, ω), but the optimal candidate (64a) does not. *CLASH excludes candidate (64c), where a monosyllabic foot follows an iamb, because it has a clash configuration at the word's right edge. ALIGN(F-HD, L, C, L) excludes candidate (64b), where a monosyllabic foot follows a trochee, because its leftmost head syllable is not aligned with a consonant. The improperly bracketed structure of candidate (64a), which avoids both a clash configuration and a stressed onsetless syllable, correctly emerges as the winner.

Although I omit the additional tableau, ranking *CLASH above NFIN(x_ω, F, ω) also avoids the possibility of parsing light disyllabic forms with two monomoraic feet. Primary stress would be able to avoid the final foot with such a configuration, but the adjacent degenerate feet would result in clash.

We have seen, then, that the proposed account uses a Nonfinality constraint, NFIN(x_ω, F, ω), to produce Banawá's foot extrametricality effect in longer forms. We also saw that the effect can be suspended in shorter forms by ranking NFIN(x_ω, F, ω) below the constraints that determine the basic stress patterns. These are the desired results. Next, we examine the role of primary stress in producing Banawá's bimoraic minimal word.

5.2 *Producing the Minimal Word*

Two phenomena help to demonstrate the nature of Banawá's minimal word. First, as (65) illustrates, long vowels occur only in monosyllabic forms. This suggests that they are derived to support a bimoraic minimality requirement, rather than being specified underlyingly.

(65) a. fáa 'water'
b. bíi 'fan'
c. búu 'beat'

Second, as (66) illustrates, vowel-initial forms consisting of two light syllables exhibit a trochaic pattern, rather than the iambic pattern of their longer counterparts. Banawá not only requires that its minimal words be bimoraic, it also requires that they have a strong-weak contour.

(66) a. ába 'fish'
b. áwa 'wood'
c. áwi 'tapir'

In theories like those of McCarthy and Prince (1986) and Hayes (1995), minimal word restrictions are typically derived from minimal foot restrictions. If feet are minimally bimoraic, and words must contain at least one foot, then words must be minimally bimoraic, as well. In the Banawá case, however, such an analysis is impossible. Banawá utilizes monomoraic feet to produce final stress in odd-parity consonant-initial forms, such as [mákarì] 'cloth' and [mètuwásimà] 'find them'. Since Banawá does not have an active minimal foot restriction, foot minimality cannot be responsible for the bimoraic minimal word.

The inability of a minimal foot restriction to account for the Banawá minimal word does not indicate, however, as Everett (1996a,b) suggests, that a separate stipulation concerning word minimality is necessary. Nonfinality constraints are obvious candidates for producing the necessary strong-weak contours, and they are also effective mechanisms for establishing minimal words. Although final positions often have some degree of stress in Banawá, the crucial observation is that primary stress, in particular, never occurs on a final mora.[31] If primary stress cannot occur on the final mora, then a word must be at least bimoraic to have a primary stress.

[31] The vocative stress pattern, mentioned in section 4.2, always positions primary stress on the final syllable, even if it means placing it on the final mora. This does not constitute a counterexample to the Nonfinality analysis presented here, however, because there is no need to enforce a word minimality requirement for forms with the vocative pattern directly. If we consider forms with the vocative pattern to be derived from forms with the regular patterns (see footnote 27), then Nonfinality can establish a minimal word in the original forms, and its effects can be transferred to the derived forms through Transderivational Faithfulness (see Benua 1997). Since the original forms will always be at least bimoraic, because of Nonfinality, and since truncated forms copy as much material as possible, up to a maximal foot, the derived vocative forms will always be at least bimoraic. Also because of Transderivational Faithfulness, derived forms with the vocative pattern would fail to exhibit the lengthening effects found in monosyllabic forms with the regular pattern.

To implement the appropriate restriction, the proposed account uses NFin(x_ω, μ, ω), repeated in (67), which prohibits prosodic word-level gridmarks from occupying a prosodic word-final mora.

(67) *NFin(x_ω, μ, ω)*
No prosodic word-level gridmark occurs over the final mora of a prosodic word.

Different types of forms react in different ways to a high-ranking NFin(x_ω, μ, ω). In longer forms, the constraint has no discernible effect. Since primary stress prefers to avoid the final foot, there is no danger that it will occupy the final mora. The reaction in shorter forms, however, where there is a danger that primary stress might occupy the final mora, is largely determined by the ranking of the Faithfulness constraint that prohibits vowel lengthening.

In this context, the role of Dep-μ, given in (68), is simply to prohibit vowels that are monomoraic in the input from being bimoraic in the output.

(68) *Dep-μ*
All moras present in the output are present in the input.

An underlyingly monomoraic form, like [fáa] 'water', reacts to a high-ranking NFin(x_ω, μ, ω) by violating Dep-μ and lengthening its vowel. A vowel-initial disyllabic form, however, like [ába] 'fish', avoids violating Dep-μ. Instead, it reacts by shifting its stress to its initial onsetless syllable, violating the onset-sensitive Align(F-hd, L, C, L). The ranking required to produce these results is given in (69).

(69) NFin(x_ω, μ, ω) ≫ Dep-μ ≫ Align(F-hd, L, C, L)

NFin(x_ω, μ, ω) must dominate Dep-μ, and Dep-μ, in turn, must dominate Align(F-hd, L, C, L).

To illustrate, to produce the surface long vowels in underlyingly monomoraic words, NFin(x_ω, μ, ω) must dominate Dep-μ. Given this ranking, a mora can be added to an underlyingly monomoraic vowel, so that primary stress can avoid the final mora of the prosodic word. Tableau (70) demonstrates the crucial interaction.

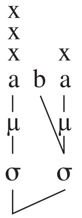
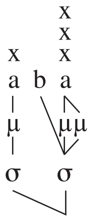
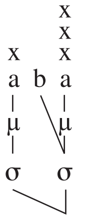
(70) [fáa] 'water'

fa	NFin(x_ω, μ, ω)	Dep-μ
☞ a. x x x x μ μ f a		*
b. x x x μ f a	*!	

In tableau (70), NFIN(x_{ω}, μ, ω) excludes candidate (70b). Positioning primary stress over a final short vowel also positions it over a final mora. Although the optimal candidate (70a) violates DEP-μ, lengthening its vowel allows primary stress to avoid the final mora, satisfying the higher-ranked NFIN(x_{ω}, μ, ω). This is the desired result.

To produce the strong-weak contours in vowel-initial disyllabic forms, DEP-μ and NFIN(x_{ω}, μ, ω) must both dominate ALIGN(F-HD, L, C, L). Ranking DEP-μ above ALIGN(F-HD, L, C, L) ensures that light disyllabic forms will prefer to retract primary stress to their initial syllable, rather than lengthening their final vowel, even if the initial syllable does not have an onset.

(71) [ába] 'fish'

a.ba	NFIN (x_{ω}, μ, ω)	DEP-μ	ALIGN (F-HD, L, C, L)
☞ a. 			*
b. 		*!	
c. 	*!		

In tableau (71), NFIN(x_{ω}, μ, ω) excludes candidate (71c), because its primary stress occurs over the prosodic word-final mora. DEP-μ excludes candidate (71b), because it lengthens its rightmost vowel. In candidate (71a), the onsetless initial syllable is a foot head, violating ALIGN(F-HD, L, C, L). Stressing the initial syllable, however, allows (71a) to satisfy the higher-ranked DEP-μ and NFIN(x_{ω}, μ, ω) simultaneously, so (71a) emerges as the winner.

Whether one assumes the framework pursued by Everett (1996a,b) or the framework adopted here, Banawá's bimoraic minimal word cannot be explained by a minimal foot restriction. This does not mean, however, that the Banawá minimal word is especially challenging or problematic. Nor does it mean that a special word minimality condition must be stipulated. We can achieve the desired result simply by using an appropriate constraint drawn from a general and independently motivated Nonfinality framework.

5.3 Nonfinality and Extrametricality

The significance of the Banawá minimal word extends beyond its resistance to explanation in terms of a minimal foot restriction. It is also significant because it provides a case for distinguishing between Nonfinality formulations and Extrametricality formulations. While Nonfinality and its predecessor, Extrametricality, have both been used on a limited basis to produce minimal words (see, e.g., Hayes 1995, Kenstowicz 1995, Itô, Kitagawa, and Mester 1996, Hyde 2003), an Extrametricality formulation could not have produced the particular type of minimal word that is required for Banawá. Since Nonfinality and Extrametricality are often conflated, this may be a reason why a Nonfinality analysis might not have been as obvious in this particular situation.

Extrametricality produces its effect by excluding a final element from a higher level of prosodic structure. In particular, in Hayes 1995, Extrametricality is a collection of three rules. Consonant Extrametricality prohibits final consonants from being moraic, Syllable Extrametricality prevents final syllables from being footed, and Foot Extrametricality prevents final feet from being included in the prosodic word. In his account, however, Hayes excludes the possibility of Mora Extrametricality, the type that would be needed to produce Banawá's minimal word, and it is important to understand why.

For Mora Extrametricality to achieve its desired effect, it would have to be possible to uniquely exclude a final mora from some higher level of prosodic structure. As Hayes observes, however, if the final syllable is bimoraic—exactly the case where mora extrametricality can be distinguished from syllable extrametricality—it would have to be possible for higher prosodic structure to split the final syllable; otherwise, it could not uniquely exclude the final mora. In Banawá, since the final mora often has a secondary stress and clearly could not be invisible to foot structure, the prosodic word would have to be able to split the final syllable and, often, the final foot as well.

A Nonfinality formulation does not encounter this difficulty. Since Nonfinality focuses on the location of stress peaks rather than the parsability of final elements (Prince and Smolensky 1993), it need not exclude a final element from higher prosodic structure to achieve its effect. Requiring a prosodic word-level gridmark to avoid the final mora does not require that the final mora be excluded from a foot or prosodic word, so there is no need to allow higher prosodic structure to split a syllable.

6 Conclusion

In this article, I examined three phenomena in Banawá that have previously been argued to present significant difficulties for metrical stress theory. First, onset sensitivity challenges theories of syllable weight that exclude onsets from the types of elements that can have moraic status. Second, the distribution of stress in forms containing heavy syllables challenges theories that require syllable integrity. Finally, the coexistence of degenerate feet and a bimoraic minimal word challenges the connection between minimal foot restrictions and minimal word restrictions.

In section 1, I introduced each of these issues, as well as the constraints that form the core of the proposed analyses. ALIGN(F-HD, L, C, L), which aligns the left edges of head syllables with consonants, produces onset sensitivity without the mediation of moras. The clash and lapse avoidance constraints, *CLASH and HEADGAP, are responsible for producing Banawá's moraic alternations without sacrificing syllable integrity. NFIN(x_ω, μ, ω), which prohibits primary stress from occupying a prosodic word-final mora, produces Banawá's bimoraic minimal word in the absence of an active foot minimality restriction.

To illustrate the analyses in fuller detail, I briefly outlined the most relevant assumptions of Hyde 2001, 2002, and I demonstrated how the proposal might be implemented in this particular framework. The ranking summarized in (72) and (73) accounts for the problematic Banawá phenomena.

(72) *CLASH, HEADGAP, ALIGN(F-HD, L, C, L) $\gg$ IGRID(x_F, μ, ω) $\gg$ ALIGN(F-HD, R, ω, R), FIRSTMORA

(73) *CLASH, NFIN(x_ω, μ, ω) $\gg$ DEP-μ $\gg$ ALIGN(F-HD, L, C, L) $\gg$ NFIN(x_ω, F, ω) $\gg$ ALIGN(ω-HD, R, ω, R)

The portion of the ranking in (72) is responsible for the distribution of stress in general, and the portion of the ranking in (73) deals with phenomena connected to primary stress in particular.

In section 3, I examined onset sensitivity. I showed that the high-ranking *CLASH and HEADGAP constraints limit the candidates available for consideration by other constraints to those that conform to the Perfect Grid. Given this situation, the proposal can produce Banawá's two basic stress patterns simply by ranking the onset-sensitive ALIGN(F-HD, L, C, L) above the trochee-producing IGRID(x_F, μ, ω). In consonant-initial forms, IGRID(x_F, μ, ω) can position a stress on an initial mora, without violating ALIGN(F-HD, L, C, L), and the result is a trochaic Perfect Grid pattern. In vowel-initial forms, however, ALIGN(F-HD, L, C, L) prevents initial moras from bearing stress, and the result is an iambic Perfect Grid pattern. Adopting this approach allows the theory to maintain the nonmoraic status of onsets, while avoiding the difficulties encountered by alternatives that rely on underparsing.

In section 4, I examined the issue of syllable integrity. I showed that the ranking used in section 3 for forms containing only light syllables can also produce the Banawá patterns in forms containing heavy syllables and that it can do so with syllable-based footing. There were two steps to the analysis. The first was to assume that the grid's base level corresponds to moras rather than syllables. This makes it possible to have moraic alternations without requiring feet to be mora-based. The second step was to give clash and lapse avoidance priority over other footing considerations, so that the resulting patterns always conform to the Perfect Grid. The foot-level gridmarks are always able to fall at a location within the syllable-based feet that preserve the moraic alternations. In no case is it necessary for a foot to split a syllable.

Finally, in section 5, I examined the difficulties presented by Banawá's bimoraic minimal word. While it is true that the minimal word cannot be derived from a minimal foot restriction,

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