A Note on the Relationship between Grid Structure and Metrical Structure in Banawá

Violeta Martínez-Paricio
Universitat de València
René Kager
Utrecht University

1 Introduction and Theoretical Background

The stress system of Banawá, an endangered Arawan language spoken in the Brazilian Amazon, constitutes a puzzling case study for metrical phonology. It has been claimed that its metrical representations violate the Syllable Integrity Principle (1) (Buller, Buller, and Everett (BBE) 1993, Everett 1996, 1997), one of the core universal principles in standard metrical theory, which bans representations where a foot *dissects* a heavy syllable (e.g., *(CV.CV́)(V.CV́), *(CV́.CV)(V́.CV), where periods indicate syllable boundaries and parentheses, foot edges).

(1) *Syllable Integrity Principle (SIP)*
A foot cannot directly dominate one but not all morae of a syllable. (adapted from Prince 1976, 1980, Rice 1988, 1992, Hayes 1995)

The underlying assumption of this principle is that syllables, and not morae, are the only possible stress-bearing units (Hayes 1995). An important prediction that arises from the alleged inviolable nature of (1) is that no language may display a contrast between identical heavy syllables with stress on the first mora (e.g., CV́V) and stress on the second mora (e.g., CVV́) (Hayes 1995:49–50). Interestingly enough, both types of syllables have been attested in Banawá (BBE 1993, Everett 1996, 1997, Ladefoged, Ladefoged, and Everett 1997). (In the following examples, heavy syllables are underlined.)

(2) *Stress on the 1st mora of a heavy syllable*
a. ká.ra.bùa 'blowgun'
b. tìa.sía.nì 'acquire'

(3) *Stress on the 2nd mora of a heavy syllable*
a. kè.re.wé.duà.ma 'turn end over end'
b. sú.kià 'dark'

BBE and Everett (1996, 1997) propose that these specific stress patterns result from the construction of left-to-right trochaic bimoraic feet, which occasionally leads to violations of the SIP (underlined in (4)). In forms with an odd number of morae, a final monomoraic foot is built over the last mora (4b,d). In order to account for the unstressed nature of the first vowel in vowel-initial forms with more than two morae (4e–f), these authors assume that the initial vowel is extrapro-

We would like to thank three anonymous reviewers, the Squibs and Discussion editors, Jeroen Breteler, and participants at the Sound Circle Seminar at the Meertens Institute (Amsterdam, March 2017) for their helpful comments and feedback. The first author's research was financially supported by the Spanish State Research Agency (AEI) (postdoctoral grant FJCI-2015-24202 and project FFI2016-76245-C3-3-P), FEDER, and the Valencian Government (APOSTD/2016/A/120). The second author's research was supported by the Netherlands Organisation for Scientific Research (NWO) in the framework of the project "Parsing and Metrical Structure: Where Phonology Meets Processing" (360-89-030).

Linguistic Inquiry, Volume 51, Number 1, Winter 2020
168–183

https://doi.org/10.1162/ling_a_00334

sodic. The extraprosodicity requirement must be “relaxed” to account for the stress patterns in vowel-initial forms with two vowels, since these place stress on the first vowel (4g–h).

(4) *Metrical representations in BBE 1993 and Everett 1996, 1997*

a. (ká.ra).(bùa)
b. (tìa).(sía).(nì)
c. (kè.re).(wé.du)(à.ma)
d. (sú.ki)(à)
e. u.(déi).(bù.na)
f. a.(tì.ke)(í.ɟa).(rì.ne)
g. (á.ba)
h. (ú.wi)

The SIP could be claimed to be respected in Banawá if vocalic sequences were posited to be heterosyllabic rather than tautosyllabic. However, this contradicts all previous phonetic studies on the language, which characterize all adjacent vowels in Banawá as tautosyllabic. The phonetic study by Ladefoged, Ladefoged, and Everett (1997: 106) concludes that in Banawá, “VV denotes a vowel sequence of two morae within a single syllable.” Additionally, Everett (1996, 1997) provides language-internal evidence in favor of the tautosyllabic parsings based on a process of hypocoristic formation.[1] Given these facts and descriptions, we will assume the syllabic parsings adopted in the original sources.

To maintain the universality of syllable integrity, Hyde (2007a) develops an alternative to BBE’s and Everett’s analysis in which Banawá’s metrical representations do not incur violations of the SIP. However, he does so at the cost of compromising another commonly accepted condition on metrical representations: his representations formally separate prosodic prominence (gridmarks) and metrical prominence (foot heads). In this squib, we will demonstrate that this move entails an underdetermination of foot structure with respect to the overt stress pattern: whereas Hyde’s analysis of Banawá can correctly derive the grid structure, it cannot always determine the corresponding metrical structures.

Our goal in this squib is to suggest that no possible metrical analysis of Banawá stress complies with *both* representational assumptions of standard metrical theory: specific analyses must either permit violations of the SIP (Prince 1976, 1980), as pursued in the original

[1] In Banawá, names can be truncated to create hypocoristics, which must satisfy a bisyllabic template: for example, *Hóbetò* > *Bé.to*, *Sábatào* > *Bá.taò*, *Téresìna* > *Sí.na* (Everett 1997:sec. 2.3). If the adjacent vowels in the last syllable of a form like *Sábatào* were heterosyllabic, the form **Táo* would be a possible hypocoristic for this name; *Bátaò* would be ruled out because it would contain three syllables rather than two. However, this is not the case: the hypocoristic of *Sábatào* is *Bátaò* (see Everett 1997 for additional data and details on this process).

analyses of the language (BBE 1993, Everett 1996, 1997), or else complicate the transparent relation between grid structure and metrical structure (Hyde 2007a). Faced with this dilemma, we will argue that (occasionally) obscuring the SIP is less problematic than leaving metrical structure underdetermined, and we develop a reanalysis of the language in accordance with this view. Our reappraisal is in line with ideas put forward in BBE's and Everett's original analysis, while slightly amending it in two minor aspects by positing word-initial moraic onsets (e.g., Topintzi 2010, Ryan 2014). First, while our analysis also assumes moraic feet and allows violations of the SIP, it improves over BBE's in that it does not need to stipulate that some word-initial vowels are extraprosodic (see (4e–f)). Second, our analysis does not need to include degenerate feet in Banawá metrical representations (4b,d), offering a more principled account of word minimality.

2 Banawá Stress Data

Banawá displays quantity-insensitive rhythmic stress on alternating vowels. In the presence of more than one stress, the penultimate stress is realized as primary. In consonant-initial (C-initial) words, stress falls on alternating vowels, starting from the first one. In the following examples, we adopt the syllabifications provided by BBE and Everett (1996, 1997):

(5) *Stress patterns in C-initial words*

a.	fúa	'manioc'
b.	fáa	'water'
c.	té.me	'foot'
d.	má.ka.rì	'cloth'
e.	tìa.sía.nì	'acquire'
f.	bá.bu.rù.ru	'cockroach'
g.	kèi.ɟá.ri.nè	'happy'
h.	bà.dué.bi.rì	'species of deer'
i.	kè.re.wé.duà.ma	'turn end over end'
j.	kái.ɟà.ra	'to take pride in oneself'

In vowel-initial (V-initial) words with three or more vowels, stress falls on alternating vowels, but in this case the first vowel to be stressed is the second one. In V-initial words with two vowels, stress falls on the first vowel (*á.ba* 'fish', *ú.wi* 'cry').

(6) *Stress patterns in V-initial words with three or more vowels*

a.	u.wía	'go out (as a fire)'
b.	a.bé.bi.rì	'gnat'
c.	u.déi.bù.na	'I fish-spear'
d.	e.né.ki	'middle'
e.	a.tì.keí.ɟa.rì.ne	'happy'
f.	u.wá.rià	'one'

A few additional properties related to the prosody of Banawá are relevant for any reanalysis of its stress patterns. First, given that there are no CV words and that long vowels are largely restricted to monosyllabic forms (*bíi* 'fan', *háa* 'also'), long vowels are considered to be underlyingly short (BBE 1993). Second, all syllables must contain at least a simple onset and a simple vowel (i.e., CV), except in word-initial position, where onsetless syllables are permitted.[2] Third, the maximal size of the syllable is CVV, although CVV*i* can occur in word-final position as long as the final [i] corresponds to the masculine suffix (e.g., *ká.wiè-i* 'to grate (masc. obj.)', *ká.wa.rìe-i* 'to cook (masc. obj.)').[3]

3 A Metrical Reanalysis

3.1 Iambic Feet and Word-Initial Moraic Onsets

Although onsets have generally been considered to be irrelevant for stress assignment, the data in section 2 suggest that word-initial onsets play a central role in Banawá stress. Banawá is not alone in this respect, as languages from different linguistic families have been found to exhibit stress patterns that are sensitive to the presence or absence of onsets and/or their particular size (e.g., Davis 1988, Goedemans 1996, Downing 1998, Topintzi 2008, 2010, Ryan 2014). We propose that

[2] An anonymous reviewer points out that an adequate phonological analysis of Banawá should be able to account for yet another generalization: the absence of word-initial VV syllables. However, if one reexamines the data in the original sources, it becomes clear that sequences of vowels do in fact occur in Banawá, but exceptionally (e.g., *áaba* 'spoil', *éene* 'sore'; BBE 1993:286), given that long vowels are generally restricted to monosyllabic forms. BBE state (p. 286) that these word-initial vowel sequences involve identical vowels that are either polymorphemic or "belong to a morpheme which has undergone the vowel-spreading rule induced by minimality" in CV forms. In any case, these forms are not phonologically repaired and, therefore, we believe their scarcity is a matter of the (root) lexicon, not the surface phonology. Furthermore, in addition to these forms, Ladefoged, Ladefoged, and Everett (1997) suggest that in words like *wárabù* 'ear' and *wánakùri* 'spider' the initial glide [w] could be analyzed as an underlying high vowel that has undergone strengthening. If this is correct, we have another set of examples of word-initial VV syllables.

Finally, additional data from a closely related dialect mutually intelligible with Banawá, Jarawara, seems to confirm the existence of VV-initial words: like Banawá, Jarawara has a small group of V-initial forms ("about 14 per cent of words [in Jarawara] begin with V as against 86 per cent with CV"; Dixon 2004:24), among which a few start with a sequence of vowels and yet are not repaired (e.g., the 1st person object pronoun can be pronounced as either *oa* or *owa*; words like *ohi* 'cry, mourn' can undergo optional *h* deletion (*ohi* → *oi*; Dixon 2004:21). (We thank Varun de Castro-Arrazola for directing us to the Jarawara data.)

On the basis of these facts, our analysis will not rule out the existence of VV-initial forms.

[3] As BBE note (1993:285), "it turns out . . . that word-final /i/ is never stressed when preceded by another vowel" even if secondary stress is allowed on word-final morae (e.g., *súkià* 'dark') and on other word-final instances of *-i* (e.g., *tìasíanì* 'acquire'). On this point, we follow these authors and assume that every final [i] following a vowel is unfooted.

in Banawá, only a subset of onsets (those in word-initial position) is relevant for stress assignment. Moreover, on the basis of Topintzi's (2008, 2010) hypothesis that singleton initial onsets can be moraic in some languages, we propose that word-initial consonants display coerced weight in Banawá in order to strengthen this phonological position. A vast body of phonetic, phonological, and psycholinguistic research (e.g., Beckman 1998, Smith 2005) has demonstrated that the initial position of the prosodic word (e.g., the first segment, the first syllable) is more prominent than other phonological positions. As a result, several phonetic and phonological strengthening phenomena apply at the left edge of this domain in a scenario that *makes the strong stronger.*

In line with this research, we propose that word-initial consonants in Banawá project their own mora as a way of phonologically enhancing the left edge of the prosodic word. Under these assumptions, a unified metrical analysis of Banawá emerges without the need to stipulate the extrametrical nature of some initial vowels. In our proposal, C- and V-initial words display identical metrical structures: they both exhibit left-to-right *moraic iambs* (Kager 1993).

(7) *Schematic metrical representations in Banawá*

a.		*Even-parity forms*	*C-initial words*	*V-initial words*
	4-μ	(μμ́) (μμ̀)	(má).(ka.rì)	(u.wá).(rià)
	6-μ[4]	(μμ̀) (μμ́) (μμ̀)	(bà).(dué).(bi.rì)	____
b.		*Odd-parity forms*	*C-initial words*	*V-initial words*
	3-μ	(μμ́) μ	(té).me	(u.wí) a
	5-μ	(μμ́) (μμ̀) μ	(bá).(bu.rù).ru	(u.dé)(i.bù).na
	7-μ	(μμ̀) (μμ́) (μμ̀) μ	(kè).(re.wé).(duà).ma	(a.tì).(keí).(ɟa.rì).ne

As anticipated in section 1, this analysis is quite similar to BBE's and Everett's in that both proposals assume moraic feet and allow violations of the SIP. However, our analysis has two advantages over previous ones due to our proposal that C-initial word onsets are moraic. First, our analysis can avoid the use of vowel-initial extrametricality, a device for which there is no independent evidence beyond its ability to predict stress (see Hyde 2007a:260–262 for critical discussion). Second, our representations do not include monomoraic feet (note that all feet in (7) are bimoraic). While unary feet are not problematic per se, their alleged presence in longer forms (4b,d) is incompatible with the minimality condition in Banawá posited by BBE, which is claimed to force vowel lengthening in CV forms (see section 2 for details). If minimality conditions are to be derived from a language's minimal foot size, it is not clear why Banawá bans words consisting of a monomoraic foot, yet allows monomoraic feet in longer forms (4b,d). It is important to highlight that the reason why CV words are ruled out in

[4] In the original sources (BBE 1993, Everett 1996, 1997, Ladefoged, Ladefoged, and Everett 1997), we have not found a concrete example for a vowel-initial word with six morae, but our model predicts that a form of this kind would be parsed with three moraic iambs.

our analysis is related not to their degenerate status (recall that in our proposal, CV forms would consist of a bimoraic iamb due to the moraic status of C-initial onsets), but to an independent fact. Note that contrary to the iambic stress patterns reported in (7), bimoraic V-initial forms surface with trochaic rhythm (e.g., *ába* 'fish', *úwi* 'cry'). Given that final rhythmic reversals are well-attested in other iambic languages (Hayes 1995), these patterns do not conflict with our iambic analysis, which indirectly explains why CV forms are unattested. In Banawá, primary stress never falls on the final mora; hence, the underlying motivation of the foot type reversal in forms like *ába* can be claimed to be the avoidance of primary stress on final morae (Hung 1994, McGarrity 2003, Hyde 2007a:252). The prohibition of primary stress on word-final morae hence independently accounts for three additional phenomena: (a) the absence of CV words (in our analysis, these forms would be parsed with a moraic iamb, but since this would place stress on the word-final mora, CV forms are ruled out); (b) the specific distribution of long vowels (a potential rhythmic reversal from a moraic iamb to a trochee in CV forms is not possible since this would place stress on the word-initial consonant, a nonnuclear segment incapable of carrying stress; hence, the only way to avoid final stress is to lengthen the vowel); and (c) the absence of (C)VV́ words, with stress on the final mora.

3.2 Syllable Integrity Violations

The proposed analysis, which postulates strictly bimoraic feet, inevitably causes syllable integrity violations (underlined in the examples).

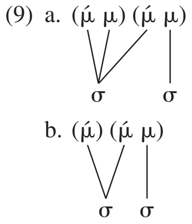
(8) a. (kè)(i.ɟá.)(ri.nè)
 b. (tì)(a.sí)(a.nì)
 c. (u.wí)a

Even though such representations have traditionally been claimed to be universally ill-formed (Hayes 1995), in the case of Banawá, it is evident that the binary rhythmic alternation of unstressed and stressed morae disregards syllable boundaries. Accepting the violable nature of the SIP makes the correct prediction with respect to the stress patterns of heavy syllables, which may display stress on the first or second mora, depending on the specific number of morae preceding the heavy syllable (see (2)–(3)).

Note that violations of syllable integrity are straightforwardly cued by the *overt* data, which display a cue to *hidden* structure (metrical bracketing): contrasts between **CV́V** and **CVV́** syllables provide positive evidence that the CVV syllable is not an inviolable unit for metrical bracketing.

4 Hyde's (2007a) Criticism of Representations with SIP Violations

According to Hyde (2007a:241), abandoning the SIP is problematic because "it opens the door to syllable-internal stress distinctions that are not actually attested” like the ones illustrated in (9), in which a multimoraic syllable surfaces with more than one stress.



The question is whether these structures should be universally ruled out by inviolate principles or whether in fact they are just highly unlikely structures—that is, whether they constitute *unattested* but *attestable* structures (Hale and Reiss 2008).

Let us first examine the two structures in greater detail. Representation (9a) corresponds to a trimoraic syllable with stress on its first and third mora, followed by a monomoraic syllable (e.g., *páaá.pa*). This structure could only possibly emerge in a system that (a) allows trimoraic syllables (which are crosslinguistically rare), (b) builds strictly moraic feet, and (c) allows such feet to violate syllable integrity. That is, typologically infrequent metrical properties (a) and (c) would have to coexist in a particular system for a metrical parsing such as (9a) to arise.

Representation (9b) is slightly different. To us, it is not clear why this structure should be at all problematic: note that, phonetically, it simply corresponds to a stressed bimoraic syllable, with stress equally realized on both morae, followed by a monomoraic unstressed syllable (e.g., *páá.pa*).

To summarize, we believe that the strength of positive evidence for SIP violations emerging from the stress pattern of Banawá suffices to outweigh any counterarguments based on the absence of multistressed syllables. But even if it could be proven that structures similar to (9a–b) are absolutely ill-formed—hence, would never surface even in systems that allow SIP violations—their ill-formedness need not be attributed to the SIP; it could be due to their failure to respect the inviolable Proper Headedness principle, according to which a prosodic category like the syllable cannot contain more than one designated mora as its head (Zec 2003:126, Itô and Mester 2003:37).[5] Note that the initial syllables in (9a–b) each contain two designated morae as their heads.

In conclusion, the alleged unattested status of structures (9a–b) does not constitute a real argument against allowing occasional SIP violations. Having argued that abandoning the SIP will not undermine

[5] Proper Headedness is independent of the SIP; hence, in a framework without the SIP but with Proper Headedness, feet can still “dissect” syllables as long as all but one of the involved morae are parsed as dependents. Thanks to an anonymous reviewer for pointing this out.

the theoretical restrictiveness of stress representations, we now assess how a specific proposal that maintains the SIP (Hyde 2007a) fares with regard to the same criterion.

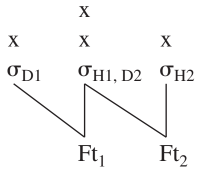
5 Hyde's (2007a) Alternative Representations

To account for Banawá stress without incurring SIP violations, Hyde (2007a) needs to rely on two nonstandard representational assumptions. First, unlike the standard theory, which assumes a transparent relation between foot and grid (or segmental) structure, Hyde's representations dissociate prosodic heads and gridmarks. As a result, the relationship between grid and foot structure in his model is not always straightforward; in turn, the correlation between overt structure (stress and metrically conditioned phenomena such as segmental strengthening and weakening) and hidden metrical structure (foot structure) is less transparent than in standard metrical theory, where stress is always the manifestation of a foot head.[6] A second divergence with respect to standard metrical theory, which also renders the relation between overt and hidden structure less transparent, has to do with the inclusion of *ambipodal syllables* in Hyde's metrical representations—that is, syllables that are dominated by two different (intersected) feet and are simultaneously the head of one foot and the dependent of another foot. (Vertical lines indicate a foot head, and an *x* above the prosodic structure indicates a gridmark entry. Two gridmarks indicate that the syllable carries stress. Subscripts attached to each syllable indicate whether they constitute a foot head (H) or a dependent (D) of one foot or another.)

[6] Following a suggestion by an anonymous reviewer, we should make an important clarification here. It is true that in standard theory (and in our proposal) the presence of stress always entails the presence of a foot head. It is in that sense that the relationship between grid structure and metrical structure is direct and more transparent than in Hyde's proposal. However, it should be highlighted that in standard theory, stress is not the only possible way to overtly realize the greater prominence of a foot head, yet this typological variation is not incompatible with the transparent relationship between foot structure and its segmental or suprasegmental manifestation. Most stress languages choose stress to be the single realization of a foot head. But in a few languages, foot heads can be manifested via a segmental strengthening process: for example, (a) lengthening or diphthongization of the vocalic nucleus of the foot head, (b) epenthesis of a consonant in the onset/coda of a foot head, or (c) emergence of a fortis allophone in the onset of the foot head (e.g., aspiration).

Importantly, despite this crosslinguistic variation, under the traditional approach defended here there is always a direct and overt segmental or suprasegmental realization of the foot head, a restriction lost under Hyde's proposal. In the standard approach, the only specific case in which a foot head can exceptionally be realized without greater phonetic prominence is restricted to a small subset of languages in which the construction of secondary feet without overt realization is needed to locate the primary foot in a word, which carries main stress. Even in these particular cases, the "counting" nature of primary stress will serve as an indirect cue for secondary feet. For discussion of stressless feet, see Buckley 2009 and Bennett 2012, among others.

(10) *Intersected feet with an ambipodal syllable* (Hyde 2007a:247)

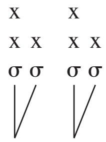


In Hyde's model, being a foot head, like the third syllable in (10), does not necessarily entail carrying stress (or being segmentally strengthened)—nor does being a dependent, like the second syllable in (10), entail a lack of stress. This nontransparent relationship between grid structure and prosodic structure allows for pervasive ambiguity of metrical structure; for example, the grid structure in (10) can be bracketed with or without intersected feet in several ways, as we will demonstrate below with a concrete example.

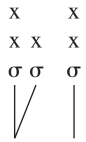
To illustrate these points for Banawá, let us now turn to analyzing the specific representations that Hyde (2007a) proposes for the language. We start with words that contain only CV syllables. C-initial words are analyzed with left-to-right trochaic feet. The leftover syllable at the right edge in odd-parity forms constitutes a degenerate foot.

(11) *C-initial words with CV syllables* (Hyde 2007a:247)

a. Even-parity forms: (bá.bu).(rù.ru)



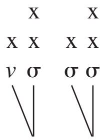
b. Odd-parity forms: (má.ka).(rì)



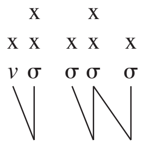
V-initial words, in contrast, are analyzed with iambic feet. In odd-parity forms, the final light syllable, rather than projecting its own foot as in C-initial words (12b), becomes part of an intersected foot (*v* represents an onsetless syllable).

(12) *V-initial words with CV syllables* (Hyde 2007a:247)

a. Even-parity forms: (a.bé).(bi.rì)

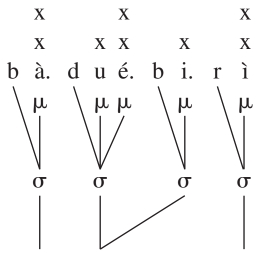


b. Odd-parity forms: $(\text{u.dé})(_1\text{i.}(_2\text{bù})_1\text{.na})_2$

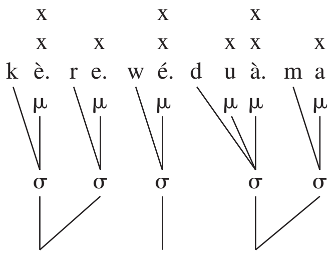


The lack of transparency between stress (gridmarks) and foot heads in Hyde's theory of metrical representations is obvious from these examples: note, for instance, that the final syllable in V-initial odd-parity forms (12b), which is unstressed, constitutes the head of the final foot, whereas in C-initial even-parity forms (11a), the final syllable, which is also unstressed, constitutes a dependent. The picture grows more complicated when we examine Hyde's representations for words containing at least one bimoraic syllable (CVV). Compare the metrical structure of the words *bàduébirì* (LHLL) (13a), *kèrewéduàma* (LLLHL) (13b), *atìkeíɾarìne* (LLHLLL) (13c), and *káiɾàra* (13d).

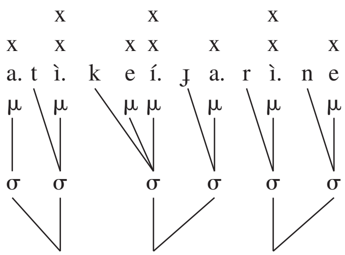
(13) a.



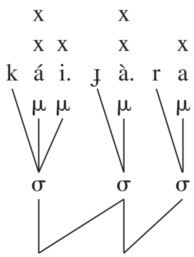
b.



c.



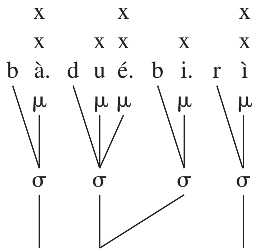
d.



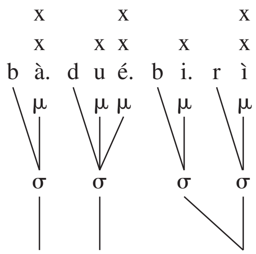
Contrary to standard metrical theory, where the distribution of degenerate feet is restricted in both number and location (these only occur at a particular word edge) and metrical parsings tend to be uniform, Hyde's representations are nonuniform in the sense that unary feet may arise at different locations and all types of feet (trochees, iambs, binary, unary, intersected, nonintersected) may cooccur in a single word. For example, in (13a) there are two degenerate feet (one word-initial, one word-final) with an HL bisyllabic trochee in between. In (13b), the degenerate foot arises word-medially instead, between an LL trochee and an HL trochee. In (13c), there are no degenerate feet; the word starts with an iamb, like other V-initial forms, but then the two following feet are trochaic. Finally, (13d) exhibits a foot intersection.

The nontransparent relationship between grid structure and prosodic structure may even lead to underdeterminacy of metrical structures, as can be illustrated by the form in (13a). Apart from (13a), repeated in (14a), which is the metrical structure Hyde (2007a:263) proposes, we can posit an alternative structure, (14b), that has the same grid structure but instead groups the final two light syllables into an iambic foot.

(14) a.



b.



Given the grammar Hyde proposes, the two structures are actually indistinguishable. In Banawá, grid structure is determined by higher-ranked rhythmic constraints, while foot type is regulated by constraints that align foot heads with respect to word edges; on this criterion, (14a) and (14b) are identical. The iambic foot in (14b) is a licit structure that occurs in other forms of the language (e.g., (13c)). Constraints never directly target foot type; beyond the constraints used in the analysis of Banawá, no other constraint from Hyde's metrical theory (Hyde 2001, 2002, 2007a,b, 2012a,b) regulates foot type directly—which is a principled omission (Hyde 2002:319: "[A]lignment constraints referring to foot-heads are responsible for determining both foot type and footing directionality"). The tableau in (16) for *bàduébirì* 'species of deer', adapted from Hyde 2007a:266, illustrates the underdetermination of foot structure. To distinguish the forms (14a) and (14b), FOOT-BINARITY might be invoked (although Hyde (2012a) argues that this constraint is not essential to his theory), but this would only favor (14b) over (14a), given that the syllable (dué) is parsed as a bimoraic foot in (14b), thus satisfying the binary foot requirement. Hyde's definitions of the relevant constraints are given in (15).

(15) a. *Rhythmic constraints* (Hyde 2007a:257)

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

HEADGAP: For every two adjacent morae, one must be the head mora of a foot.

b. *Alignment constraints that regulate the position of stress and foot heads within the word* (Hyde 2007a:255, 264; 2002:319)

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

IGRID(x_F, μ, ω): A foot-level gridmark occurs over the initial mora of a prosodic word.

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.

ALIGN(F-HD, L, ω, L): The left edge of the head syllable of every foot is aligned with the left edge of some prosodic word.

(16)

ba.due.bi.ri	*Clash	IGrid (x_F, μ,ω)	First Mora	Align(F-hd, R, ω, R)	Align(F-hd, L, ω, L)
☞ a. x x x x x x x x bà. d u é. b i. r ì μ μ μ μ μ σ σ σ σ			*	*** **	* ***
☞ b. x x x x x x x x bà. d u é. b i. r ì μ μ μ μ μ σ σ σ σ			*	*** **	* ***
c. x x x x x x x ba. d ú e. b ì. r i μ μ μ μ μ σ σ σ σ		*!		** *	* **
d. x x x x x x x x bà. d ú e. b ì. r i μ μ μ μ μ σ σ σ σ	*!			*** ** *	* **

A similar example of metrical indeterminacy can be found in (13b). The proposed foot bracketing (Hyde 2007a:263) is (kè.re).(wé).(duà.ma), which contains a unary foot in medial position. However, nothing rules out an alternative structure, (kè).(re.wé).(duà.ma), rhythmically identical but with the unary foot occurring in initial position. Furthermore, in this case a constraint like Foot-Binarity would not be able to select between these two candidates.

The general point is that in grammars where grid structure is fixed by inviolable rhythmic constraints, foot head alignment constraints come to play a modest role in determining metrical structure, which may lead to substantial indeterminacy of metrical structures. Whereas the underdetermination of foot structure might not be problematic in a language like Banawá, where there are no segmental metrically conditioned processes, we think that it may be problematic in languages where a particular foot structure is crucial to account for a particular foot-conditioned process—for instance, foot-initial strengthening or foot-dependent weakening. In such cases, it would probably be crucial that a given grid structure match one, and only one, particular metrical structure. It is precisely for these languages that nonuniform parsings characterized by (a) the presence of opposite-dominance feet within a single form, (b) an unprincipled distribution of degenerate feet, and (c) the extensive emergence of tied candidates might run into problems. Future research may attempt to identify foot-conditioned processes in languages in which grid structure is fixed by inviolable rhythmic constraints, in order to test whether the underdetermination of foot structure is empirically problematic.

6 Conclusion

In this squib, we have shown that there is no possible metrical analysis of Banawá stress patterns that complies with all traditional representational assumptions of standard metrical theory: specific analyses must either permit violations of the SIP (Prince 1976, 1980) or abandon transparent grid-to-foot-head mappings. The purpose of this squib has been to argue that, despite traditional criticism of the possibility of abandoning the SIP, admitting occasional violations of this principle in Banawá could be less problematic than obscuring the transparent mapping between gridmarks and foot heads. On the one hand, given the robust phonetic cues for syllable boundaries and stress beats in Banawá, and given the overt contrast between syllables with stress on their first mora (e.g., CV́V) and syllables with stress on their second mora (e.g., CVV́) (Ladefoged, Ladefoged, and Everett 1997), SIP violations are robustly cued, and the corresponding metrical structures are transparent. On the other hand, retaining the SIP in favor of nontransparent metrical representations in Banawá (Hyde 2007a) has the direct consequence of underdetermining the metrical structures that correspond to observed grid structures as well as generating representations with an unprincipled positioning of degenerate feet. Such a weakening of the transparency of metrical representations seems unwarranted outside Banawá, as far as we are aware.

To conclude, this squib has suggested that a modest revision of standard metrical theory, which occasionally allows syllable integrity violations and moraic onsets, permits a more consistent analysis of Banawá stress patterns. It is a question for future research whether such an approach holds up well when compared with Hyde's framework.

References

Beckman, Jill. 1998. Positional faithfulness. Doctoral dissertation, University of Massachusetts, Amherst.

Bennett, Ryan. 2012. Foot-conditioned phonotactics and prosodic constituency. Doctoral dissertation, University of California, Santa Cruz.

Buckley, Eugene. 2009. Locality in metrical typology. *Phonology* 26: 389–435.

Buller, Barbara, Ernest Buller, and Daniel L. Everett. 1993. Stress placement, syllable structure, and minimality in Banawá. *International Journal of American Linguistics* 59:280–293.

Davis, Stuart. 1988. Syllable onsets as a factor in stress rules. *Phonology* 5:1–19.

Dixon, R. M. W. 2004. *The Jarawara language of southern Amazonia.* Oxford: Oxford University Press.

Downing, Laura J. 1998. On the prosodic misalignment of onsetless syllables. *Natural Language and Linguistic Theory* 16:1–52.

Everett, Daniel L. 1996. Prosodic levels and constraints in Banawá and Suruwahá. Ms., University of Pittsburgh, Pittsburgh, PA. http://roa.rutgers.edu/article/view/132.

Everett, Daniel L. 1997. Syllable Integrity. In *WCCFL 16: Proceedings of the 16th West Coast Conference on Formal Linguistics*, ed. by Emily Curtis, James Lyle, and Gabriel Webster, 177–190. Stanford, CA: CSLI Publications.

Goedemans, Rob. 1996. An optimality account of onset-sensitive stress in quantity-insensitive languages. *The Linguistic Review* 13: 33–47.

Hale, Mark, and Charles Reiss. 2008. *The phonological enterprise.* Oxford: Oxford University Press.

Hayes, Bruce. 1995. *Metrical stress theory: Principles and case studies.* Chicago: University of Chicago Press.

Hung, Henrietta J. 1994. The rhythmic and prosodic organization of edge constituents. Doctoral dissertation, Brandeis University, Waltham, MA.

Hyde, Brett. 2001. Metrical and prosodic structure in Optimality Theory. Doctoral dissertation, Rutgers University, New Brunswick, NJ. http://roa.rutgers.edu/article/view/486.

Hyde, Brett. 2002. A restrictive theory of metrical stress. *Phonology* 19:313–339.

Hyde, Brett. 2007a. Issues in Banawá prosody: Onset sensitivity, minimal words, and syllable integrity. *Linguistic Inquiry* 38: 239–285.

Hyde, Brett. 2007b. Non-finality and weight-sensitivity. *Phonology* 24:287–334.

Hyde, Brett. 2012a. Alignment constraints. *Natural Language and Linguistic Theory* 30:789–836.

Hyde, Brett. 2012b. The odd-parity input problem in metrical stress theory. *Phonology* 29:383–431.

Itô, Junko, and Armin Mester. 2003. Weak layering and word binarity. In *A new century of phonology and phonological theory: A festschrift for Professor Shosuke Haraguchi on the occasion of his sixtieth birthday*, ed. by Takeru Honma, Masao Okazaki, Toshiyuki Tabata, and Shinichi Tanaka, 26–65. Tokyo: Kaitakusha. Originally published in 1992 as Linguistic Research

Center Working Paper LRC-92-09, University of California, Santa Cruz.

Kager, René. 1993. Alternatives to the iambic-trochaic law. *Natural Language and Linguistic Theory* 11:381–432.

Ladefoged, Peter, Jenny Ladefoged, and Daniel L. Everett. 1997. Phonetic structures of Banawá, an endangered language. *Phonetica* 54:94–111.

McGarrity, Laura W. 2003. Constraints on patterns of primary and secondary stress. Doctoral dissertation, Indiana University, Bloomington.

Prince, Alan. 1976. Applying stress. Ms., University of Massachusetts, Amherst.

Prince, Alan. 1980. A metrical theory for Estonian quantity. *Linguistic Inquiry* 11:511–562.

Rice, Curt. 1988. Stress assignment in the Chugach dialect of Alutiiq. In *Papers from the 24th Annual Regional Meeting of the Chicago Linguistic Society*, ed. by Lynn MacLeod, Gary Larson, and Diane Brentari, 304–315. Chicago: University of Chicago, Chicago Linguistic Society.

Rice, Curt. 1992. Binarity and ternarity in metrical theory: Parametric extensions. Doctoral dissertation, University of Texas, Austin.

Ryan, Kevin. 2014. Onsets contribute to syllable weight: Statistical evidence from stress and meter. *Language* 90:309–341.

Smith, Jennifer L. 2005. *Phonological augmentation in prominent positions.* New York: Routledge.

Topintzi, Nina. 2008. On the existence of moraic onset geminates. *Natural Language and Linguistic Theory* 26:147–184.

Topintzi, Nina. 2010. *Onsets: Suprasegmental and prosodic behaviour.* Cambridge: Cambridge University Press.

Zec, Draga. 2003. Prosodic weight. In *The syllable in Optimality Theory*, ed. by Caroline Féry and Ruben van de Vijver, 123–143. Cambridge: Cambridge University Press.