

Moraic Onsets and WSP Partition in Pirahã*

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Pirahã onset-sensitive weight and stress are handled by means of moraic onsets discarding previous prominence-based analyses. Contrary to voiced stops, only voiceless stops are moraic. The partition of WSP into WSP(Nucleus) and WSP(Margin) is put forward to capture the primacy of nucleic over onset weight. The rarity of onset moraicity is related to the absence of (moraic) codas and lack of vowel lengthening. As a result of the proposed mini-typology of weight, additional typological issues are considered.

1 INTRODUCTION

Standard weight theories assign weight only to nuclei and codas and assume that onsets are weightless (Hayes 1989, 1995, Morén 1999). Pirahã however presents serious problems for such models given that the weight and stress system of the language is partly determined by onsets. In this paper I attempt to show that in fact utilizing moraic onsets provides a full account of the system without recourse to arbitrary prominence scales, which have been used in the past to produce the attested data (e.g. Hayes 1995). Moreover, once moraic onsets are admitted, the possibility of more complete analyses for certain problematic data as the ones in Samothraki Greek compensatory lengthening after onset deletion and Pattani Malay initial geminates is opened up.

2 BACKGROUND INFORMATION

Pirahã has a small segmental inventory that includes the consonants: *p, t, k, ʔ, b, g, s, h* and the vowels: *i, o/u, and a*. Syllables have the shape (C)V(V) and vowel length is phonemic. However, single monovocalic syllables are not permitted. There is also an absolute ban against codas, which as we will see, it will become crucial later on. The stress algorithm in the language requires that the rightmost heaviest syllable within the last three syllables of the word receives stress. Before proceeding to the exploration of heaviness, we should note that Pirahã also has tone. All syllables are either high-toned or low-toned, but tone is independent of stress (K. Everett 1998), thus we will not examine it further. The really interesting fact about Pirahã is its weight hierarchy given in (1):

- (1) PVV > BVV > VV > PV > BV
[P = voiceless stop, B = voiced stop, > = the syllable on the left of the symbol is heavier than the one on its right]

Some examples that illustrate this hierarchy are given below (stressed syllables in bold) [E = Everett 1988, E&E = Everett and Everett 1984]:

- (2) a. PVV > BVV

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	pà.hài.bí	“proper name”	[E&E: 708]
	píi.bi.gái	“deep water”	[Everett p.c.]
b. BVV > VV			
	bíi.oái.ii	“tired [literally: being without blood]”	[Everett p.c.]
	gao.ii	“proper name”	[E&E: 709]
c. VV > PV			
	pia.hao.gi.so.ai.pi	“cooking banana”	[E&E: 710]
d. PV > BV			
	?a.ba.gi	“toucan”	[E&E: 710]
	?ia.bí.ka.bi.ka.bi	“proper name”	[E: 211]
e. rightmost heaviest			
	paó.hoa.hai	“anaconda”	[E&E: 707]
	ti.po.gi	“species of bird”	[E&E: 710]

The above suggests that weight depends on three factors: I) the length of the vowel, i.e. VV attracts stress more than V, II) the presence of an onset, i.e. CV syllables attract stress more than V ones and III) the quality of an onset, i.e. PV syllables make better stress bearers than BVs¹. Next we will consider how previous analyses accounted for these facts and then we will lay out the current approach.

3 PREVIOUS ANALYSES

Roughly two main lines of thinking have been employed in order to tackle the Pirahã data. One includes the use of ternary feet (Davis 1985, Everett 1988) or combination of tree and grid theories (Everett 1988). The problem with these is that they are either rather inelegant or reach the conclusion that the models available at that time are insufficient to handle Pirahã. A more fruitful approach has been attempted through the use of prominence scales like the one suggested by Hayes (1995: 286).

(3) A. Prominence Projection: Project prominence grids as follows:

***** : PVV
 ***** : BVV
 *** : VV
 ** : PV
 * : BV

B. Apply End Rule Right within the final trisyllabic domain.

The main problem here is the arbitrariness of such scales. One could equally stipulate a scale where BVV is in fact more prominent than PVV. This problem has been noticed by Goedemans (1998) who tries to rationalise such scales by suggesting that it is not prominence generally but the prominence difference between onsets and following vowels. This is enhanced more by voiceless stops than voiced stops. A similar approach is taken up by Gordon (in prep.), which also aims at providing a fuller phonological account than Goedemans. However, this too presents flaws. For instance, it uses constraints that duplicate information, while constraint permutation yields unattested systems.

¹ Voiceless fricatives *s* and *h* pattern like voiceless stops. Although in what follows, I refer to the contrast between voiceless and voiced stops, this could in fact be extended to one between voiceless and voiced obstruents. Given though that the language lacks voiced fricatives, no conclusive claim can be made.

4 MORAIIC ONSETS

The solution proposed here instead takes advantage of an idea, which has been implicit in some previous works. Namely it suggests that onsets can be moraic. However, since moraic onsets only occur rarely, this fact is related to certain conditions such as the simultaneous absence of (moraic) codas and the lack of vowel lengthening. To show why the existence of moraic onsets is plausible consider how weight is cross-linguistically realized:

- (4) a. CVV > CVC, CV [Khalkha Mongolian]
 b. CVV, CVC > CV [Latin]

The common thing between these cases is that CVVs are uniformly treated as heavy. If we then ignore CVVs and focus on the relationship between nuclei and codas, (4) is translated into:

- (5) a. VC = V
 b. VC > V

There is however no logical reason why this should not be possible between nuclei and onsets:

- (6) a. CV = V
 b. CV > V

All of (5a), (5b) and (6a) are very well-attested. (6b) although possible, it has been ruled out by previous analyses. However, I would like to suggest that on the contrary this is attested and Pirahã is an illustration of exactly such a case.

Now consider the role of onsets. CV syllables are the first to be acquired in language acquisition. Moreover, if a language only has one type of syllables, these are the CV ones as in Hua (Levelt and Van de Vijner 1998). Being a necessary component of these very unmarked syllables, onsets seem to warrant syllable well-formedness. On the other hand, no similar role is assigned to codas. In fact codas increase syllable complexity. Nonetheless their prototypical role is to add to syllable weight (Broselow et al. 1997). If we now were to imagine a system where both codas – the default case – and onsets (as in (6b)) contributed to weight, we would have a very complex system where no single cue for stress would be available. Gordon (1999) has shown that complex weight systems are generally avoided. But what if the language lacked (moraic) codas? Then potentially a system like (6b) could arise. This is exactly what happens in Pirahã, a language where codas are completely absent.

4.1 Voiceless vs. voiced stops

As we have already seen, voiceless stops are stronger stress attractors than voiced stops. Following Everett (1988), I treat voiceless stops as geminates, and voiced ones as singletons. Good empirical evidence supports such an assertion. First, phonetically there is a tendency for voiceless obstruents to be longer than their voiced counterparts (Ohala 1983, Maddieson 1997). Some languages phonologise this property by means of an underlying contrast where voiced stops are treated as singletons and voiceless as geminates, as in Swiss German (Ham 2001, Kraehenmann 2001) or Yolngu Djapu (Morphy 1983). Very convincing is the case of a Kuna language game where the first syllable of a word moves to the end (Sherzer 1970), e.g. with a medial voiced stop: *dage* → *geda*, *obsa* → *saob*, but with a medial voiceless stop: *sapan* → *bansab* and not **pansa*, suggesting that the voiceless stop is treated as a geminate.

- (12) Pirahã
 PRESERVE- μ , NO CODA, DEPLINK- μ [v] >> *MORAIC ONSET

	$\text{?aba}^\mu\text{p}^\mu\text{a}$	PRESERVE- μ	NO CODA	DEPLINK- μ [v]	*MORAIC ONSET
a.	$\text{?a.ba}^\mu.\text{p}^\mu\text{a}$				*
b.	$\text{?a.ba}^{\mu\mu}.\text{pa}$			*!	
c.	$\text{?a.ba}^\mu\text{p}^\mu.\text{pa}$		*!		
d.	$\text{?a.ba}^\mu.\text{pa}$	*!			

4.2 Mora amount and weight

Having established the existence of moraic onsets in Pirahã, let us now explore the weight and stress system of the language more fully. (13) shows how moras are shared among the segments of the syllables given the approach put forward here.

- (13) Weight hierarchy: PVV > BVV > VV > PV > BV
- | | Total mora amount | Onset | Mora composition |
|-------|-------------------|-------|------------------------------------|
| PVV = | 3 μ | YES | (2 μ -nucleic, 1 μ -onset) |
| BVV = | 2 μ | YES | (2 μ -nucleic) |
| VV = | 2 μ | NO | (2 μ -nucleic) |
| PV = | 2 μ | YES | (1 μ -nucleic, 1 μ -onset) |
| BV = | 1 μ | YES | (1 μ -nucleic) |

Obviously PVV is the heaviest of all, while BV is the lightest. The problem arises with BVV, VV and PV, because although all three are bimoraic, they are not treated equally in terms of stress attraction as one might anticipate, but instead a clearly defined hierarchy is formed where BVV > VV > PV.

How are we to account for this? The answer lies in examining the syllables involved in greater depth. Let us first take the BVV > VV relationship. Both syllables are bimoraic, but only BVV has an onset. Apparently, the presence of an onset makes BVV a better candidate for stress than VV. To capture this I use the constraint in (14) which requires the left edge of the stressed syllable to begin with a consonant, i.e. an onset:

- (14) **Align σ** : Align-L (σ , C) [A variant of Goedemans' (1998) AlignFtO]

This constraint has been previously used for languages like Alyawarra and Western Aranda where the first onsetful syllable gets stress. Now it finds a natural extension in Pirahã. This deals with BVV > VV. But how about VV > PV? In fact in the light of the constraint above, one might expect the scale to be PV > VV, since PV has an onset that VV lacks. Crucially however, VV includes two moras both coming from the nucleus, whereas PV comprises only one mora from the nucleus; the second originates from the onset. This suggests that nucleic weight has a priority over onset weight. I claim that such a preference can be captured by partitioning the Weight-to-Stress Principle (WSP) into the WSP(Nucleus) and WSP(Margin) as defined below:

- (15) **WSP**: Heavy syllables are stressed
 (16) **WSP(NUCLEUS)**: Heavy syllables due to nucleic moras are stressed
 (17) **WSP(MARGIN)**: Heavy syllables due to marginal moras are stressed

Ranking WSP(N) over WSP(M) captures the aforementioned primacy. To achieve the full picture of Pirahã weight and stress, two more ingredients are required.

- (18) **Align-Head-Right:** Align the head syllable of a prosodic word to the right edge of the prosodic word [McCarthy and Prince (1993)]
- (19) ***Extended Lapse Right:** Sequences of more than two consecutive stressless syllables at the right edge of the word are banned [Elenbaas and Kager (1999), Gordon (in prep.)]

(18) accounts for the rightmost effect as described in (2e) and (19) captures the trisyllabic window arising at the right edge of the word. The latter is never violated, therefore this constraint has to be undominated and will not be included in the tableaux that follow. Having said that, the ranking I would like to propose for Pirahã is:

- (20) **WSP(N) >> Align^óO, WSP(M) >> Align-Hd-R**

This can be established by a number of ranking arguments as depicted in (21)-(23), where in each case final stress is not applicable since a higher-ranked constraint causes assignment of stress to the penult.

- (21) WSP(N) >> Align-Hd-R
 PVV.PV: **paá.si** “species of jungle fruit” [Everett p.c.]

	$p^{\mu}a^{\mu\mu}s^{\mu}i^{\mu}$	WSP(N)	Align-Hd-R
☞ a.	paá.si		*
b.	paá. si	*!	

- (22) Align^óO >> Align-Hd-R
 BVV.VV: **gao.ii** “proper name” [E&E: 709]

	$ga^{\mu}o^{\mu}i^{\mu\mu}$	Align ^ó O	Align-Hd-R
☞ a.	gao.ii		*
b.	gao. ii	*!	

- (23) WSP(M) >> Align-Hd-R
 PVV.BVV: **toi.bai** “woman’s name” [Everett p.c.]

	$t^{\mu}o^{\mu}i^{\mu}ba^{\mu}i^{\mu}$	WSP(M)	Align-Hd-R
☞ a.	toi.bai		*
b.	toi. bai	*!	

The ranking achieved so far is WSP(N), Align^óO, WSP(M) >> Align-Hd-R, but a more finely-grained ranking is possible as the ranking arguments below reveal:

- (24) WSP(N) >> Align^óO [words in Pirahã must begin with consonants (Everett p.c.), so no disyllabic word available]
 PV.VV.PV: ho.**ai.pi** “type of fish” [E&E: 710]

	$h^{\mu}o^{\mu}a^{\mu}i^{\mu}p^{\mu}i^{\mu}$	WSP(N)	Align ^ó O
☞ a.	ho. ai.pi		*
b.	ho. ai.pi	*!	

- (25) WSP(N) >> WSP(M)
 BVV.PV: **bií**.si ‘blood’ [Everett p.c.]

	$bi^{[M]}s^{[M]}i^{[M]}$	WSP(N)	WSP(M)
a.	bií .si		*
b.	bií. si	*!	

All these lead us to the final ranking of (20) repeated in (26):

- (26) Final ranking: **WSP(N) >> Align σ O, WSP(M) >> Align-Hd-R**

For completeness, (27) illustrates the rightmost effect, namely that when the higher-ranked constraints are no longer relevant, Align-Hd-R determines the final outcome by pulling stress to the rightmost heaviest syllable.

- (27) Align-Hd-R seen in action
 PV.PV.PV: ko.ʔo.**pa** ‘stomach’ [E: 239]

	$k^{[M]}o^{[M]}ʔ^{[M]}o^{[M]}p^{[M]}a^{[M]}$	WSP(N)	Align σ O	WSP(M)	Align-Hd-R
a.	ko .ʔo.pa			**	**!
b.	ko. ʔo .pa			**	*!
c.	ko.ʔo. pa			**	

4.3 Typological issues

Before we conclude, we can turn our attention to some typological considerations. The first relates to the apparent fixed ranking of WSP(N) >> WSP(M), implying that WSP(M) >> WSP(N) looks impossible. The WSP partition itself finds additional support. As noted, WSP(M) refers to margins, but margins come into two flavours: onsets and codas. Here, we have examined WSP(M) in relation to onsets, but we could do the same for codas. In this case and by keeping the ranking WSP(N) >> WSP(M), we derive languages like Kashmiri, Klamath and Chickasaw where the hierarchy CVV > CVC > CV holds. Of course, CVV, CVC > CV, as in Latin or Votic can be produced by employing WSP uniformly in the usual fashion.

Moreover and as already mentioned, Align σ O is independently motivated in other languages. The most significant finding however is that there is increasing evidence that moraic onsets exist in languages other than Pirahã. For instance Pattani Malay initial geminates have been recently analysed in terms of moraic onsets (Hajek and Goedemans 2003) and generally moraic onsets emerge as a possible representation of initial geminates (Muller 2001). Further, other approaches make reference to onset weight (Gordon to appear) - although stated in terms of timing slots rather than moras - whereas Samothraki Greek compensatory lengthening after onset loss (Davis 1985, Hayes 1989), or Damin word minimality (Hale and Nash 1997) may find more straightforward analyses within a framework where moraic onsets are permitted.

5 CONCLUSION

In this paper the existence of moraic onsets constrained by conditions such as the absence of (moraic) codas and vowel lengthening has been proposed. This forms a more symmetric mini weight-typology where apart from the well-accepted VC > V, VC = V and CV = V, CV > V is now also attested. Pirahã serves as an illustration of such a system, where, corroborating cross-linguistic tendencies, voiceless stops behave as geminates, whereas voiced stops behave as

singletons. Pirahã also presents itself as another case where Align_{PO} is in action and strongly supports the partition of the WSP.

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