The Stress Window in Pirahã: A Reanalysis of Rhythm in Optimality Theory[1]

Thomas Green

MIT, January 27, 1995

1 Introduction

In this paper we provide an analysis of the location of main stress in Pirahã, from the perspective of Optimality Theory (OT) (Prince and Smolensky 1993, McCarthy and Prince 1993a,b). The three-syllable window for possible stress placement, coupled with quantity-sensitivity and default finality have to our knowledge defied convincing explanation within current phonological theory. We will show that, given a recent suggestion for explaining ternary metrical parsing in OT (the PARSE-2 constraint of Kager 1994), the solution is rather straightforward, although it implies the existence in the phonology of metrical peaks that are not realized in the phonetic output.

We then turn to take a closer look at the nature of the rather *ad hoc* PARSE-2 constraint. We will argue that PARSE-2 is in fact a subpart of a larger generalization, and that this new constraint, LAPSE, provides the basis for all boundedness in metrical structure. That is, binarity and ternarity are a unified phenomenon, expressed differently depending upon the rankings of other constraints such as PARSE. Moreover, the reanalysis of rhythm in terms of LAPSE invites the isolation of a new separate constraint, MIN2, formerly part of the single constraint which yielded strictly binary constituents. Evidence from Passamaquoddy shows that this factoring is independently necessary, since only through this particular bifurcation can the theory accomodate the possibility of degenerate feet in otherwise strictly binary languages.

2 The three-syllable window in Pirahã

2.1 The data

The location of word stress in Pirahã (as described in Everett and Everett 1984, and Everett 1988) is a prime example of a word-final three-syllable window effect. In

[1]I would like to thank Michael Kenstowicz for extensive discussion and collaboration at every stage in the development of this paper. I am also grateful to the participants in the MIT Phonology Circle for comments on an early version of this paper.

this language, the stress seeks out the heaviest of the last three syllables. In the event of a tie, stress occurs on the rightmost of the heaviest syllable type. If the window contains only light syllables, then again the rightmost receives the stress. In order to concentrate solely on issues related to the window phenomenon, (but without affecting the integrity of the analysis) we collapse the multi-valued syllable quantity distinction found in Pirahã into a simple binary heavy/light (H/L) distinction. For our purposes, the data in (1) are sufficient to show the window effect in "Simplified" Pirahã.[2]

(1)	a.	ʔò.gà.bà.**gàí**	(LLLH́)	'want'
	b.	ʔí.bò.**bìì**.hì	(LLH́L)	'ant'
	c.	ʔí.**tìì**.ʔì.sì	(LH́LL)	'fish'
	d.	káò.bìì.gá.**bàì**	(HLLĹ)	'almost falling'

As mentioned above, we ignore here the full splendor of the complex syllable quantity generalization in Pirahã, and so, for instance, the (HLLĹ) notation for the example [káò.bìì.gá.**bàì**] in (1d) may be slightly confusing. While the final syllable [bàì] is certainly heavier (by virtue of its VV rime structure) than most other syllable types in the language, what is crucial is that the initial syllable, [káò], is in fact *heavier* than [bàì] according to the Pirahã rules of syllable weight, since a voiceless onset consonant imparts greater weight to a syllable than a voiced onset. Therefore, what is important about [káò.bìì.gá.**bàì**] is that it cannot be *[**káò**.bìì.gá.bàì] with initial stress, because the initial syllable, while the heaviest of the word, is preantepenultimate, and thus outside the three-syllable window of possible stress location. The interaction of the stress-to-weight generalization with the window effect is summarized abstractly in (2):

(2)	a.	... σ L L H́	
	b.	... σ L H́ L	
	c.	... σ H́ L L	
	d.	$*$... H́ L L L	(actual output ... H L L Ĺ)

The remaining generalization which comes into play in the location of Pirahã word stress is the preference for finality when all else is equal. This is indicated in (1d), but is shown more clearly by the examples in (3). Each form in (3) ends in three syllables of equal weight, and in each case the stress is located on the final syllable.

[2] Vowels marked with grave and acute accents in the Pirahã transcriptions show low and high tone and are not relevant to the stress data or the determination of syllable quantity; stressed syllables are marked in bold-faced type.

(3)	a.	gí.gò.**gí**	'what about you'
	b.	kò.ʔò.**pà**	'stomach'
	c.	ʔò.hò.áà.áà.**áà**	'searching intensely'
	d.	pàó.hòà.**hàì**	'anaconda'

2.2 Toward a solution

To begin to see the solution to simplified Pirahã stress placement we factor the pattern into three general requirements, which are ranked in the OT sense as in (4).

(4) 3-σ window (word-final) $\gg$ MAIN-H (main-stress $\rightarrow$ heavy) $\gg$ EDGE(R) (finality)

The MAIN-H and EDGE(R) constraints are straightforward. The former is clearly related to PK-PROM (Prince and Smolensky 1993; 39), and the latter may be considered part of the ALIGN family (McCarthy and Prince 1993b). They are described in (5):

(5) MAIN-H: Main stress falls on a heavy syllable.[3]

EDGE(R): The main stress is located on the **Rightmost** syllable (gradient).

Taken in isolation, MAIN-H and EDGE(R) in this relative ranking would characterize a language in which the rightmost (no matter where it may be in the word) heavy syllable receives main stress. Since EDGE(R) is dominated by MAIN-H, it is violated in order to place stress on a heavy syllable that does not happen to be word-final. However, because EDGE(R) is evaluated in a *gradient* fashion (the further the stressed syllable is from the right edge, the greater the violation) the stress is retracted from the right edge just enough to be located on the rightmost heavy syllable. A word containing no heavy syllables would exhibit final stress in this hypothetical language,[4] since MAIN-H could not be satisfied in any case in such a word.

Pirahã is like the above hypothetical language except that it adds an additional restriction that overrules MAIN-H, not permitting stress to be retracted more than

[3]MAIN-H is basically PK-PROM tuned only to the main word stress rather than to all foot heads. The latter type of prominence constraint (referring to all foot heads) must also exist in all languages, but only MAIN-H makes its presence visible in our analysis of simplified Pirahã. Again, use of this constraint is an oversimplification, since quantity-sensitivity in Pirahã is actually more complex.

[4]This type of stress generalization is not unprecedented. It is a paradigm case of what Prince (1985) refers to as a "default-to-same-side" language. Such a pattern is reportedly exemplified by Aguacatec Mayan (Hayes 1980; 107, citing McArthur and McArthur 1956).

three syllables from the right edge. This window constraint must dominate MAIN-H because it is not violated under any circumstances—crucially, while /...HLL/ is realized with antepenultimate stress, /...HLLL/ has final stress because the heavy syllable lies outside the trisyllabic window. MAIN-H must in turn outrank EDGE(R), since /...HLL/ receives antepenultimate stress in Pirahã instead of final stress.

We now discuss how to account for the window itself. What constraint or constraints would be equally satisfied by stress in any of the final three syllables, but violated by a candidate placing main stress outside this window? The fact that the constraint clearly dominates MAIN-H and EDGE(R), yet does not in any way govern the precise localization of stress within the window indicates that the window constraint must be *equally* satisfied by a stress on any window-internal syllable. If the window constraint were to itself embody a preference for a particular syllable within the trisyllabic window, this preference would *always* override the MAIN-H and EDGE(R) constraints and main stress would simply have a fixed location, unaffected by lower constraints.

We will claim that an explanatory account of this window effect requires us to assume that the the entire word is parsed into feet, regardless of the fact that only one overt stress is detectable. Just as in Halle's (1990) analysis of Cairene Arabic, it proves necessary to assign secondary metrical structure, not in order to realize phonetic prominence of the heads of this structure, but rather to ensure indirectly the correct placement of the constituent which will receive primary prominence. Pirahã will turn out, like Cairene, to be a rather ordinary rhythmically metrified language, in which only the head of the final foot is marked phonetically prominent, as bearer of main stress.[5] The necessity of assuming full metrification of the word is a direct consequence of the analysis, and will be discussed in section 3. For now, we simply keep in mind that it is the *final* foot of the word which realizes the stress, and thus it is the head of this foot that must be contained in the final trisyllabic window. Furthermore, let us assume that all feet are bisyllabic by virtue of a top-ranked FT-BIN-like constraint:[6]

---

[5]The isolation of the final metrical foot is achieved by a superordinate constraint MAIN-LAST, having the effect of the End Rule(R) of Prince (1983), built on feet. This is another EDGEMOST constraint of Prince and Smolensky (1993), evaluated on the primary stress with respect to feet (instead of syllables as is the case with the EDGE(R) constraint in (5) above).

[6]BIN is the same as FT-BIN if we ignore the moraic level of representation mentioned in the commonly-assumed disjunction in its formulation:

FT-BIN: (McCarthy and Prince 1993; p. 10)
Feet must be binary under syllabic or moraic analysis.

(6) BIN: A foot contains exactly two syllables.

The key aspect of the BIN constraint is that it prohibits feet containing more than two syllables, such as ($\acute{\sigma}\sigma\sigma$). This will be absolutely necessary to the analysis. The constraint also happens to rule out "degenerate" or monosyllabic feet. That is, a single syllable, *even if bimoraic*, is still not a valid foot type.[7]

Since degenerate feet are thus prohibited, in order to achieve final stress the language must at least permit output forms incorporating a right-headed foot:

(7) ...($\sigma\acute{\sigma}$)#

On the other hand, left-headed feet must also exist given our binarity assumptions, since in words of three or fewer syllables the stressed syllable may also happen to be word-initial:

(8) a. **bìí**.sì (H́L) 'red'
b. ʔ**à**.bà.gì (H́L)L 'toucan'

Therefore, the constraint which determines directional headedness of feet (whether left- or right-) must be violable in Pirahã. We assume for concreteness that feet are preferably left-headed in Pirahã, according to a relatively low-ranking HEAD(L) constraint:

(9) HEAD(L): Metrical feet are left-headed.

Now, the trisyllabic window effect can be recast as the problem of allowing only the three foot structures in (10a-c) while disallowing (10d):

(10) a. ... (σ $\acute{\sigma}$) #
b. ... ($\acute{\sigma}$ σ) #
c. ... ($\acute{\sigma}$ σ) σ #
d. ... ($\acute{\sigma}$ σ) σ σ #

See Hewitt (1994), among others, for evidence that the syllabic/moraic disjunction in the formulation of FT-BIN must be factored out into separate constraints (so in addition to BIN for syllables we would have BIN-μas well).

[7]The feature of this constraint that prohibits degenerate feet is, on the other hand, not necessary to the analysis, but it narrows down the sets of candidates that must be discussed in the exposition. Incidentally, we could not find evidence in the data for the existence of monosyllabic words in Pirahã.

That is, we seek a constraint which unifies (10a-c) as starkly contrasting with (10d).[8]

PARSE will not do, since this constraint makes the division between (10a-b) on the one hand versus the relatively less harmonic (c) and (d) candidates (in effect, yielding a *two*-syllable window). What is required is something similar to PARSE, but slightly weaker. Kager (1994) proposes exactly such a constraint, which he refers to as PARSE-2:

(11) PARSE-2: One of two adjacent stress units must be parsed by a foot. (Kager 1994; 9)

PARSE-2 is to be interpreted as requiring that *at least one* (and possibly both) of two adjacent stress units be parsed. Thus $\sigma)\sigma\#$ and $\sigma)\sigma(\sigma$ are allowed by PARSE-2, while $\sigma)\sigma\sigma\#$ and $\sigma)\sigma\sigma(\sigma$ both violate the constraint. It is this constraint which yields Hayes' (1991) so-called "Mininum Prosodic Distance", and, straightforwardly, languages with highly-ranked PARSE-2 and relatively low PARSE turn out to exhibit ternary rhythmic patterns when combined with strict foot binarity and any constraint which prefers fewer feet in a word.[9]

Returning to (10), PARSE-2 yields exactly the desired contrast to account for the window in Pirahã, since (10a-c) all satisfy PARSE-2 whereas in (10d) the final two syllables are unparsed, violating the constraint. Crucially, (10c), although it does contain a single unparsed syllable, does not violate PARSE-2.

Summarizing informally, the key to the trisyllabic window is that BIN and PARSE-2 (but *not* PARSE) are ranked so highly as to remain unviolated in the language.[10] Final stress is preferred (by EDGE(R)), except that this consideration is overruled by MAIN-H in case there is a non-final syllable of greater weight than the final. The core constraint ranking is thus that shown in (12):

(12) $\left\{ \begin{array}{c} \text{PARSE-2} \\ \text{BIN} \end{array} \right\} \gg \text{MAIN-H} \gg \text{EDGE(R)}$

[8]Recall that the BIN constraint forbids an analysis with feet larger than binary. Thus we do not consider possibilities such as $(\acute{\sigma}\sigma\sigma)\sigma\#$ and $(\acute{\sigma}\sigma\sigma\sigma)\#$ to realize preantepenultimate stress.

[9]This is because in such a language PARSE is not active and therefore the active constraint discouraging foot creation is brought into check only by PARSE-2, and PARSE-2 is minimally satisfied if there is a single unparsed syllable between each pair of binary feet. Thus the repeating unit consists of a binary foot plus an unparsed syllable, a total of three syllables (or stress units in Kager's words). The reader is referred to Kager (1994) for fuller discussion.

[10]Recall that BIN is still required in order to prevent forms such as [... $(\acute{\sigma}\ \sigma\ \sigma)\ \sigma$] and [... $(\acute{\sigma}\ \sigma\ \sigma\ \sigma)$], which are not ruled out by PARSE-2.

Remember, however, that PARSE-2 (exactly like PARSE and all other constraints) is evaluated with respect to an entire candidate string (not simply to the final portion). This means that in a longer word, we cannot merely ignore what happens with the pretonic portion of the string. A candidate like that in (13), while correctly locating stress within the final trisyllabic window (because leaving the single final syllable unparsed still satisfies PARSE-2), nevertheless violates PARSE-2 (twice, in fact) in the pretonic string.

(13) L L L (H́ L) L #

The following form (14) does satisfy PARSE-2 while still correctly locating main stress:

(14) (L̀ L) L (H́ L) L #

Thus, the power of PARSE-2 in explaining the trisyllabic window requires that the entire word be subject to metrification. Pirahã, we claim, is essentially an "ordinary" ternary language with an added constraint (MAIN-H) governing the quantity of the main-stressed syllable. A superordinate constraint ("MAIN-LAST") ensures that it is the *final* foot that receives main word stress. Since only a single stress is actually perceived in a Pirahã word, a further necessary assumption (discussed in section 3) dictates that secondary metrical peaks be suppressed in the phonetic output. PARSE and HEAD(L), if active at all, are ranked quite low on the hierarchy.

2.3 The analysis

Consider first a four-syllable word containing only light syllables:

(15) **Simplified Pirahã:** [LLLĹ]

	/LLLL/	PARSE-2	BIN	MAIN-H	EDGE(R)	HEAD(L)
a. ♡	(L̀L)(LĹ)	-	-	*	-	*
b.	(LL̀)(LĹ)	-	-	*	-	**
c.	(L̀L)(ĹL)	-	-	*	*	-
d.	L̀(LĹ)L	-	-	*	*	*
e.	LL(LĹ)	*	-	*	-	*
f.	LLLL	***	-	-	-	-

Highly ranked Parse-2 eliminates LL(LĹ), which contains just a single foot, as well as the completely unparsed candidate in (15f), which is the only candidate that does not violate Main-H.[11] In a string of light syllables, any metrification whatsoever will produce a violation of Main-H, since the last foot will (by the undominated Main-Last) be the main stress foot, and the head of this foot (by Main-H) must in turn be heavy. The Edge(R) constraint singles out the (L̀L)(LĹ) candidate as the winner since it locates the main stress on the final syllable (even though this causes the lower-ranked Head(L) to be violated). If the headedness constraint were Head(R) instead of Head(L), the only consequence for the analysis would be that form (15b) would win out. In general, since the headedness constraint is ranked below the constraints that locate the main stress, its orientation (right or left) will only have an effect on the placement of the boundaries (but not the peak) of the primary foot, and on the nonovert headedness of the (pretonic) secondary metrification. This contrast, though not directly visible, could conceivably have indirect effects in other areas of Pirahã phonology.

Selection of the output form is even more clear-cut if the final syllable of the input form happens to be heavy, as shown in tableaux (16) and (17).

(16) **Simplified Pirahã:** [LLLH́]

	/LLLH/	Parse-2	Bin	Main-H	Edge(R)	Head(L)
a. ♡	(L̀L)(LH́)	-	-	-	-	*
b.	(LL̀)(LH́)	-	-	-	-	**
c.	LLLH	***	-	-	-	-

In (16) as in (17) below, none of the four top-ranking constraints is violated under final stress. Violation of Head(L) to create a binary foot whose head is final is of no consequence, since the only way we could satisfy Head(L) (by making the final constituent unary in violation of Bin, or binary left-headed, forcing penultimate stress in violation of Edge(R) and possibly Main-H) would entail violating higher-ranked constraints.

[11]Recall that Main-H requires the main stressed syllable to be heavy. This constraint applies vacuously to candidate (15f), since this form has no main stress in the first place.

(17) **Simplified Pirahã:** [LHHH́]

/LHHH/		Parse-2	Bin	Main-H	Edge(R)	Head(L)
a. ♡	(L̀H)(HH́)	-	-	-	-	*
b.	(LH̀)(HH́)	-	-	-	-	**
c.	(L̀H)(H́H)	-	-	-	*	-
d.	LHHH	***	-	-	-	-

Main stress recedes from final position only if lured by a heavier non-final syllable. If Edge(R) were to dominate Main-H, then such a migration would not be tolerated. Thus in words of the form LLH́L (see tableau (18)) the main stress is located on the penult only because Main-H ≫ Edge(R)—the former constraint rejects (18d) in favor of (18a):

(18) **Simplified Pirahã:** [LLH́L]

/LLHL/		Parse-2	Bin	Main-H	Edge(R)	Head(L)
a. ♡	(L̀L)(H́L)	-	-	-	*	-
b.	(LL̀)(H́L)	-	-	-	*	*
c.	L(LH́)L	-	-	-	*	*
d.	(L̀L)(HĹ)	-	-	*	-	*
e.	LL(H́L)	*	-	-	*	-
f.	LLHL	***	-	-	-	-

Consider now the role of Parse-2 ≫ Main-H in distinguishing LH́LL from HLLĹ, the crucial contrast in the three-syllable window generalization. First, LH́LL is essentially like the penultimate-stress case in (18), except that the antepenultimate positioning of main stress is achieved at the expense of *two* Edge(R) violations rather than only one. Again, this is permitted in order to satisfy the dominating Main-H, and crucially only because the overarching Parse-2 constraint is still not violated. The final two syllables are not stressed, but Parse-2 is satisfied because one of them is parsed into a foot.

(19) **Simplified Pirahã:** [LH́LL]

	/LHLL/	Parse-2	Bin	Main-H	Edge(R)	Head(L)
a. ♡	L(H́L)L	-	-	-	**	-
b.	(LH̀)(LĹ)	-	-	*	-	**
c.	L(H́LL)	-	*	-	**	-
d.	LHLL	***	-	-	-	-

However, although antepenultimate stress is allowed, the main stress may not recede to the preantepenult without violating either Bin (20d) or Parse-2 (20e). Again, the undominated Main-Last constraint ensures that the final foot is the main stress foot (thus we do not even consider in the tableau candidate forms such as (H́L)(L̀L)).

(20) **Simplified Pirahã:** [HLLĹ]

	/HLLL/	Parse-2	Bin	Main-H	Edge(R)	Head(L)
a. ♡	(H̀L)(LĹ)	-	-	*	-	*
b.	(HL̀)(LĹ)	-	-	*	-	**
c.	(H̀L)(ĹL)	-	-	*	*	-
d.	(H́LL)L	-	*	-	***	-
e.	(H́L)LL	*	-	-	***	-
f.	HLLL	***	-	-	-	-

In our solution we have made use of the constraint hierarchy in (21). The trisyllabic window effect arises due to the placement of Parse-2 and Bin high enough in the hierarchy so as to remain unviolated at the expense of the constraints which more finely locate the main stress.

(21) Constraint hierarchy for Simplified Pirahã:

$$\left\{ \begin{array}{c} \textsc{Parse-2} \\ \textsc{Bin} \end{array} \right\} \gg \textsc{Main-H} \gg \textsc{Edge(R)} \gg \textsc{Head(L)}$$

The relative rankings are justified as follows: both Bin and Parse-2 must dominate Main-H because otherwise stress could be attracted *outside* the final three syllables by a syllable heavier than those found inside the window. Concretely, if MAIN-H outranked BIN, then candidate (20d) would be incorrectly chosen over (20a), while if MAIN-H were to dominate PARSE-2, another preantepenultimately stressed candidate, (20e), would win.[12] MAIN-H must in turn dominate EDGE(R), as can be seen in (18). If the opposite relative ranking were to obtain, then candidate (18d) would be the expected output, and final stress would be preferred over even the slightest leftward shift. MAIN-H would be rendered invisible and the language would have uniform final stress (as this would in any case always satisfy PARSE-2 and BIN as well). The final ranking, EDGE(R) $\gg$ HEAD(L) must not be reversed, because if so, in the simplest case, the language would default to penultimate, rather than final, stress. This is shown in (15) and (17); that is, in cases in which the final two syllables are equally heavy. If HEAD(L) outranked EDGE(R), then (15c) and (17c) would be chosen over (15a) and (17a) (respectively), incorrectly yielding in penultimate stress.[13]

3 Full metrification examined

In section 2.2 we stated that in order to correctly place the single overt stress within the final three syllables of a Pirahã word, it is crucial that the *entire* string be metrified with headed constituents, even if only one such constituent is registered in the phonetic form. There may be several feet in a Pirahã word; however, the main stress (the only phonetically detectable one) must fall on the last foot. This explanatory power of this proposal is evident from the fact that it does not require explicit mention of the trisyllabic window, and in fact traces the phenomenon to the crucial presence of ordinary binary constituents. In order to locate the stress directly on the correct syllable without making use of metrical constituent groupings would require a brute force statement of the window constraint, such as that in (22):

(22) WINDOW-3: Stress is located among the final three syllables in a word.

This type of solution contrasts with our proposal in terms of PARSE-2 and BIN, which have been shown elsewhere to have independent cross-linguistic motivation as plausible members of the set of universal constraints.

[12] Since both BIN and PARSE-2 remain unviolated in all output forms, there can be no evidence from this data set as to their relative ranking.

[13] We point out, however, that the ultimate success of the analysis would not be altered by substituting HEAD(R) for HEAD(L). The two languages would differ only in the head placement in the pretonic and phonetically null feet. Therefore, our choice of HEAD(L) is arbitrary.

Another possible strategy would be to propose that the stress of a Pirahã word requires only the creation of a single foot constituent (after all, only one stress is actually heard on the surface). Our analysis is inconsistent with this approach as well, simply because there is no principled way in which we could alter PARSE-2 so as to target only the final part of a word. The trisyllabic effect comes from *absolute* avoidance of PARSE-2 and BIN violations, and **Eval** of course judges the entire candidate, not merely the last few syllables. Thus, just as candidate (20e) is crucially eliminated due to its pair of final unparsed syllables (producing a PARSE-2 violation), so must the apparently innocuous (18e) be ruled out on the same grounds, even though it is phonetically indistinguishible from the winning candidate (18a) which is fully metrified. In fact, if we were to somehow force the presence of one and only one foot per word,[14] then the current analysis would incorrectly yield a grouping of [σ (σ σ) σ] for *any* four-syllable word, since this is the only such parse that fails to violate the highly-ranked PARSE-2 and BIN.[15] Words with final stress, which would require a [σ σ (σ $\acute{\sigma}$)] structure under the "one foot only" theory, would not be allowed under any circumstances.[16]

Therefore, the analysis proposed in this paper is viable only insofar as it caters to the requirements of PARSE-2 over the *entire output string*, yielding for example the fully-parsed [(L̀ L) (L Ĺ)] instead of [L L (L Ĺ)]. This theory-internal motivation for positing the presence of otherwise invisible metrification parallels Halle's (1990) argument against the [±iter] parameter, showing that full metrification is necessary in a word of Cairene Arabic, although only a single stress is realized. In other recent OT work, Cabré and Kenstowicz (1994) provide an analysis of Catalan hypocoristics which also requires full metrification of a string in order to correctly pick out a final constituent.

---

[14] This could be done by appealing to a higher-ranked constraint *STRUC, which discourages positing any foot structure whatsoever, combined with a superordinate LEX≈PR requiring there to be at least one foot in order to project into a prosodic word. Inkelas (1994) provides an example of such a proposal.

[15] Recall that these constraints are necessarily dominant over MAIN-H and EDGE(R) in order to achieve the window effect in the first place.

[16] It has lately come to our attention that Inkelas (1994) takes quite a different approach to a similar window restriction in Turkish. Although full discussion of her analysis is not possible here, there appears to be no straightforward way to extend or modify it to fit Pirahã, given the default *final* stress in this language. On the other hand, the present proposal for Pirahã extends quite naturally to handle the Turkish "Sezer" stress paradigm Inkelas discusses; all that is required is to move HEAD(L) up in the hierarchy so that it dominates MAIN-H and EDGE(R). This has the effect of preventing final stress by outlawing right-headed feet. The Turkish pattern is then predicted: stress a heavy antepenult if the penult is light, otherwise stress the penult.

Nespor and Vogel (1986; 89) explicitly consider the option of simply ignoring subsidiary foot structure in their discussion of Khalkha Mongolian: "...we could account for this with a language-specific phonetic interpretation convention to the effect that the only strong node that is actually perceived as such is the one that corresponds to the primary word stress". However, they leave the issue unresolved, and instead cast doubt on the precision of the data, suggesting that "more detailed studies of languages like Khalkha Mongolian" will reveal finer-grained stress systems after all (p. 90). The latter point is well-taken. If it turns out that Pirahã, Cairene, Catalan, and languages of this sort do in fact have phonetically detectable secondary stress, then certainly the issue of mapping failure becomes much less pressing. However, it seems to me that the implication that there could not be a language "like Khalkha Mongolian" (in the sense of having phonetically uninterpreted foot structure) is unnecessarily strong. It is, we think, equally conceivable that the pattern of stress placement is best thought of as an imperfect window on the actual structure of a phonological utterance. After all, other prosodic structure, such as syllable peak and constituency must somehow be phonogically active but phonetically inert.

Hayes (1980), grappling with the problem of the relation between metrical structure and the phonetics of stress, argues as follows:

> Lehiste (1970) suggests that at least for certain secondary stresses, there are no phonetic cues for stress at all, and that native speakers perceive stress according to what the phonological rules of their language predict in the more perspicuous environments. If the reader wonders, then, just what phonetic reality the trees in this thesis represent, the answer is essentially none: the trees depict a mental representation of the relative prominence of syllables and words in an utterance. (Hayes 1980; 32)

The reference to Lehiste's work underscores the need for studies of stress done by native speakers—perhaps a native Pirahã linguist would identify secondary metrical structure that Everett and Everett do not, and could not in principle, perceive.

Given that we accept the existence of phonetically undetectable metrical feet, there are various ways in which this could be implemented in theory. Possible strategies would include an overt operation of **conflation** (Halle and Vergnaud 1987, Halle 1990), a later OT level whose constraints require only a single foot, and a simple provision for a "mapping failure" between phonological and phonetic structure. Discussion of these alternatives is beside the point of this paper. What is crucial here is that the analysis proposed requires some such strategy for suppressing the pretonic metrical peaks that are predicted to exist in Pirahã.

4 Where does Parse-2 come from?

In Kager (1994), Parse-2 is presented as a somewhat eccentric member of the Faithfulness family of constraints—like a watered-down Parse constraint. Kager aims to give Parse-2 greater intuitive appeal by claiming that it is the natural "mirror-image" counterpart of Ft-Bin. He notes that "apparently constraints which relate (prosodic?) units x, y come in pairs. One has the shape '$\forall x, \exists y\ p(x, y)$', and the other '$\forall y, \exists x\ p(y, x)$'." (p. 10) The formulation of the two constraints in (23) (Kager's (25)) is meant to make the special relationship clear.

(23) a. Ft-Bin: 'Every foot parses some pair of stress units'.

b. Parse-2: 'Every pair of stress units is parsed by some foot'.

Suggestive though this juxtaposition may be, the alleged mirror relationship does not hold up under scrutiny. In (23a) the required interpretation of 'parse' is such that 'parse some pair' means that *both* members of a pair are parsed, whereas in (23b) the term must only imply that *one* of a pair is parsed. The true mirror image of Ft-Bin, under this formulation,[17] would be a constraint requiring for each pair of stress units in a string that *both* be parsed, and in fact parsed by the *same* foot—that is, even the representation ...$(\sigma\sigma)(\sigma\sigma)$... would violate the constraint, because the middle pair of syllables, while both parsed, are parsed by different feet. This constraint, quite unlike Parse-2, would insist that every utterance be parsed into one giant foot.

We conclude that, although the existence of a constraint equivalent to Parse-2 is necessary for an explanatory account of the trisyllabic window in Pirahã, and of ternarity phenomena in general, its conceptual status as part of a taxonomy of constraint types is questionable. It is a constraint whose sole purpose is to account for ternary patterns; it is not related, save in the most informal way, to those constraints which account for binary alternation.

In this section, we explore an alternative perspective on the grammatical basis for the Parse-2 generalization. We will argue that, while necessary for analyses of ternarity and the trisyllabic window in Pirahã stress, Parse-2 is not a separate constraint in UG. Rather, it follows as a subcase of a more general constraint, whose consequences are far-reaching, and which is in fact at the heart of all rhythmic alternation in phonology.

[17] Maintaining Kager's tacit assumption that the predicate 'P' stands for 'parse' (23a) and 'is parsed by' in (23b).

We propose the following LAPSE constraint, stated informally in (24):[18]

(24) LAPSE: Adjacent unstressed (= metrically weak) syllables are separated by a foot boundary.

The formulation of LAPSE in (24) provides a key contrast between the three candidate configurations shown in tableau (25).

(25) **Patterns of LAPSE**

	/... $\sigma\sigma\sigma$/	LAPSE
a.	... $\acute{\sigma}\underline{\sigma\sigma}$)	*
b.	... $\acute{\sigma}\sigma)\sigma$	-
c.	... $\acute{\sigma})\underline{\sigma\sigma}$	*

Tableau (25) illustrates two significant facts about LAPSE. On the one hand, LAPSE prevents metrical feet from being too *big* (like the candidate in (25a)), and on the other hand it discourages feet from being too *far apart* (as in (25c)). The latter restriction is exactly the feature of PARSE-2 which we appealed to in order to derive the Pirahã stress window. It prohibits an adjacent pair of unparsed syllables, while a single unparsed syllable in (25b) is allowed. LAPSE thus subsumes PARSE-2 for our purposes.[19]

Now let us return to row (25a). The contrast between (25a) and (25b) means that an ordinary binary foot ($\acute{\sigma}\sigma$) would satisfy LAPSE whereas a dactyl ($\acute{\sigma}\sigma\sigma$) or anapest ($\sigma\sigma\acute{\sigma}$) would not. Each of these ternary feet violates LAPSE because it contains an adjacent pair of weak stress units, which are not separated by a foot boundary. This is an important part of the generalization we have referred to as BIN, which is similar to FT-BIN,[20] generally assumed to be a primitive; that is, it is not held to follow from the interaction of simpler constraints. The BIN constraint

[18]The name of this constraint goes back at least as far as the filter of the same name in Selkirk (1984; 49).

[19]Actually, Kager's formulation of PARSE-2 would apply to unparsed *stressed* stress units as well. If we assume that only foot heads are stressed then all will be parsed anyway, and therefore never relevant to the constraint. Also, note that PARSE-2 contains the same disjunction as FT-BIN regarding syllables and moras; in this sense is still has a slightly different character from LAPSE, since we would propose to split the disjunction into two constraints, LAPSE and LAPSE-μ.

[20]See note 6 above.

straightforwardly selects from among the set of conceivable foot types as shown in the following "abridged" tableau:[21]

(26) BIN **as a primitive constraint**

	...$\sigma\sigma\sigma\sigma$...	BIN
a.	...($\acute{\sigma}$)...	*
b. ♡	...($\acute{\sigma}\sigma$)...	-
c. ♡	...($\sigma\acute{\sigma}$)...	-
d.	...($\acute{\sigma}\sigma\sigma$)...	*
e.	...($\sigma\acute{\sigma}\sigma$)...	*
f.	...($\sigma\sigma\acute{\sigma}$)...	*
g.	...($\acute{\sigma}\sigma\sigma\sigma$)...	*

Referring back to the LAPSE constraint proposed at the outset of this section, we see that LAPSE would rule out any foot containing adjacent unstressed syllables (such as ($\acute{\sigma}\sigma\sigma$) and ($\sigma\sigma\acute{\sigma}$) as well as, of course, any larger foot, which would contain additional pairs of unstressed syllables and yield *multiple* LAPSE violations). That is, LAPSE duplicates the work of BIN in rows (d), (f) and (g) of tableau (26), as well as in any other row "beyond" (26g) that we might imagine.[22] This comparison is displayed in tableau (27):

[21]Tableaux of this sort should be interpreted as follows: imagine an input form large enough to contain all the sequences shown in the candidate set; the cells of the tableau show only the violations contributed by the *visible* portion of each listed candidate; the ultimate tableau for this input will be quite different from this one, since it will include the constraint violations yielded by the entire string of each candidate (for each constraint in the universal set **Con**, no less).

[22]With respect to foot-internal material, LAPSE duplicates exactly the BOUNDED parameter in the theory of Halle and Vergnaud (1987). It prevents the head of a foot from being more than one unit away from either edge.

(27) BIN **vs.** LAPSE

...σσσσ...		BIN	LAPSE
a. ◯	...($\acute{\sigma}$)...	*	-
b. ♡	...($\acute{\sigma}\sigma$)...	-	-
c. ♡	...($\sigma\acute{\sigma}$)...	-	-
d.	...($\acute{\sigma}\sigma\sigma$)...	*	*
e. ◯	...($\sigma\acute{\sigma}\sigma$)...	*	-
f.	...($\sigma\sigma\acute{\sigma}$)...	*	*
g.	...($\acute{\sigma}\sigma\sigma\sigma$)...	*	**

The '◯' symbols in (27) indicate the two rows, (a) and (e), in which BIN and LAPSE actually evaluate the candidates differently. First, as (27a) shows, LAPSE says nothing about unary, or "degenerate" feet, although this foot type is prohibited under strict binarism. To account for this portion of the BIN generalization, we propose a new constraint, MIN2, which simply rules out such unary feet, providing the necessary violation in row (26a).

(28) MIN2: A foot must contain *at least* two syllables. (= *UNARY)

MIN2 corresponds to Everett's (1994) FT-MIN.[23] We believe that MIN2 has its origin as a member of the same family as PK-PROM—just as PK-PROM requires that a foot head be supported by a syllable that is "heavy enough" (e.g. by containing two moras), MIN2 dictates that a foot itself must contain two syllables to support its own head. Minimal size, rather than strict binarism, is the key for the PK-PROM family, and, accordingly, MIN2 requires there to be *at least* two rather than *exactly* two syllables in a foot.[24]

To completely duplicate the effects of BIN, only the "amphibrach" foot type ($\sigma\acute{\sigma}\sigma$), shown in row (26e) must be ruled out. This is straightforward, given the

[23]Although Everett gives an independent empirical argument that FT-BIN must be broken down into independent constraints, and we agree on the nature of the constraint which rules out degenerate feet, his FT-MAX constraint (simply prohibiting feet larger than binary) does not also encapsulate the PARSE-2 generalization as does LAPSE.

[24]We would also of course presume the existence of a moraic counterpart, MIN2-μ, which requires a foot to be minimally bimoraic.

existence of separate and independently motivated constraints governing the edge-orientation (left or right) of the foot head. If we assume, for instance, that some languages have highly-ranked HEAD(L) while in others HEAD(R) is superordinate,[25] then the amphibrach (as well as all larger foot types with non-peripheral heads) stands out as the only foot type which would be prohibited in both language types. In other words, we make no effort to advance a new constraint to prohibit the amphibrach; this job is already performed by the dominant headedness constraint in a language.

The tableau in (29) summarizes how the three constraint types outlined here converge to duplicate the effects of BIN:[26]

(29) BIN **as the sum of independent constraints**

	...$\sigma\sigma\sigma\sigma$...	LAPSE	MIN2	HEAD(L/R)
a.	...($\acute{\sigma}$)...	-	*	-
b. ♡	...($\acute{\sigma}\sigma$)...	-	-	-
c. ♡	...($\sigma\acute{\sigma}$)...	-	-	-
d.	...($\acute{\sigma}\sigma\sigma$)...	*	-	-
e.	...($\sigma\acute{\sigma}\sigma$)...	-	-	*
f.	...($\sigma\sigma\acute{\sigma}$)...	*	-	-
g.	...($\acute{\sigma}\sigma\sigma\sigma$)...	**	-	-

Since MIN2 prohibits ($\acute{\sigma}$), and because amphibrachs and larger non-head-terminal feet are prohibited by either HEAD(L) or HEAD(R), and since LAPSE rules out all head-terminal ternary and larger feet, we can see that this set of constraints converges to accept only the binary feet ($\acute{\sigma}\sigma$) and ($\sigma\acute{\sigma}$). We thus propose to eliminate BIN from the universal constraint set **Con**.[27]

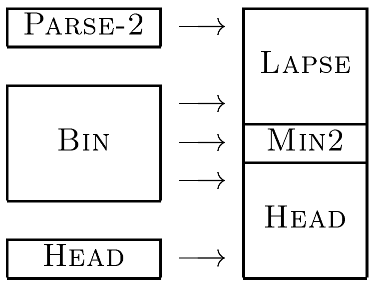
[25]The reader may substitute TROCHAIC, IAMBIC, RHTYPE=T/I, etc., according to taste.

[26]The column labelled 'HEAD(L/R)' should be interpreted as follows. A violation mark in this column signifies that *neither* HEAD(L) nor HEAD(R) would be satisfied by the candidate in question. Inversely, the lack of a violation mark in this column means only that a given candidate satisfies one or the other HEAD constraint, but not necessarily both.

[27]Breaking a high-level constraint down into lower-level components does not yield exactly equivalent predictions in OT, however, since the resulting set of constraints may be ranked arbitrarily with respect to each other and to the other constraints in the grammar. Under this scheme, for instance, a given language might rank *both* HEAD constraints at the bottom of its constraint hierarchy, while placing LAPSE and MIN2 in an extremely high, undominated position. Such a grammar would quite freely allow both left- and right-headed binary feet as well as the ternary amphibrach, but would strictly forbid degenerate feet as well as all peripherally-headed ternary and larger feet. Therefore

To summarize, then, in this section we have taken the Parse-2 and Bin constraints and recast them in terms of Lapse and Min2, with the Head constraints now playing a slightly greater roll in the determination of the licit foot types in a language. The relationships between the original and proposed new constraints are summarized in the diagram in (30):

(30)



5 Implications in Pirahã and beyond

5.1 Pirahã revisited

We now must briefly consider whether this reanalysis of basic constraints is consistent with, or has any significant consequences for, our analysis of Pirahã stress. Recall the constraint hierarchy (21) that was motivated for Pirahã (repeated below) :

(31) Constraint hierarchy for Simplified Pirahã:

$$\left\{ \begin{array}{c} \text{Parse-2} \\ \text{Bin} \end{array} \right\} \gg \text{Main-H} \gg \text{Edge(R)} \gg \text{Head(L)}$$

The key aspect of this hierarchy is that Parse-2 and Bin are *not crucially ranked* with respect to one another. Recall that the particular aspect of Bin that was needed for the analysis was its requirement that feet be no *larger* than binary (to rule out candidates like *[. . .(H́LLL)]). This is precisely the component of Bin that was unified with Parse-2 to form Lapse. Therefore, if these two constraints could be shown to have a crucial relative ranking, then this would show that the two requirements must be kept as separate constraints, a fatal argument against Lapse. Conversely, the fact that we could not determine a relative ordering for Bin and Parse-2 is a heartening bit of circumstantial evidence for the reanalysis proposed here. The other

the conclusion of this section makes fewer restrictions on the range of possible languages than a theory which contains only Bin. See section 5.2 for more discussion of the typological implications of this proposal.

components of the defunct BIN, corresponding to the rows in tableau (29) which are starred by the MIN2 and HEAD constraints, are independent from LAPSE in theory, and in fact we ranked HEAD at the bottom of the hierarchy, while only assuming a highly-ranked anti-unary constraint because it came bundled inside BIN. If, under the new arrangement of constraints, we were to rank MIN2 at the bottom of the hierarchy, the only consequence would be that final stress could be achieved at no cost to HEAD(L) in examples (15), (16), (17) and (20), since the final foot could then be unary instead of binary right-headed. We have therefore no evidence from these data to support any particular ranking of MIN2. The new constraint hierarchy for Pirahã stress is then:

(32) Constraint hierarchy for Simplified Pirahã: (REANALYZED)
LAPSE ≫ MAIN-H ≫ EDGE(R) ≫ HEAD(L)

5.2 Typological implications

As we have seen, our reanalysis of BIN in terms of LAPSE and MIN2 means that minimal foot size is no longer enforced by the same constraint which guarantees that a foot does not grow unboundedly. The two new constraints, when considered in isolation, yield four different types of tendencies which languages may exhibit:

(33) LAPSE **and** MIN2 **Typology:**

Type	Ranking of LAPSE, MIN2	Expected foot types
I	LAPSE, MIN2 both high	Strictly binary[28]
II	LAPSE ≫ ... ≫ MIN2	Maximally binary,[28] unary possible
III	MIN2 ≫ ... ≫ LAPSE	Unbounded, minimally binary
IV	LAPSE, MIN2 both low	No restrictions on foot size

A theory which relies on the single constraint BIN, however, can directly accomodate only types I and IV from table (33). Type III is not much of a problem for a BIN-only theory, however, since it is difficult to detect foot boundaries, and "unbounded" systems have been quite successfully modelled by parsing only binary feet and leaving many syllables unparsed or subject to stray adjunction (as proposed by Prince 1985).

The most interesting category in table (33) is that of the type II languages. Kiparsky (1993) discusses many such cases and argues that these are not counterex-

[28]Actually, (sSs) amphibrachs would still be possible in such a language if neither HEAD(L/R) constraint is sufficiently highly ranked to disallow them (see footnote 27 above).

amples to strict binarity, but rather they are evidence for **catalexis**, which allows an invisible weak element to be added to the end of a word to act as the second half of a perfectly binary trochee. Without this assumption, languages like Maranungku (Hayes 1980, citing Tryon 1970), cannot be reconciled with strict binarity:

(34) Maranungku stress pattern (Hayes 1980; pp. 86–87)

a.	*σ́σ*	tíralk	'saliva'
b.	*σ́σσ̀*	mérepèt	'beard'
c.	*σ́σσ̀σ*	yángarmàta	'the Pleiades'
d.	*σ́σσ̀σσ̀*	lángkaràtetì	'prawn'
e.	*σ́σσ̀σσ̀σ*	wélepènemànta	'kind of duck'

Catalexis makes it possible to have both initial and final stress in a Maranungku word like *lángkaràtetì* (34d) without resorting to a degenerate foot. Instead, the parse looks something like that in (35), with a defective element completing the final binary foot:

(35) (σ́ σ) (σ̀ σ) (σ̀ [σ])
l á n g k a r à t e t ì

In our theory neither the degenerate foot, nor in fact any size or shape of foot, is disallowed in principle. In Maranungku a degenerate foot is created in odd-syllabled words because Lapse, Parse and Head(L) dominate Min2, and therefore when an extra syllable is left over after all binary groupings have been made, it is preferable to parse it into a unary constituent than to (a) leave it unparsed (violating Parse) or (b) absorb the syllable into a binary foot to create an amphibrach (violating Head(L)) or dactyl (violating Lapse). The relevant tableau is given in (36), with the constraint hierarchy that in (37):

(36) **Maranungku:** [lángkaràtetì]

	/σσσσσ/	HEAD(L)	PARSE-σ	LAPSE	MIN2	ALIGN-R
a. ♡	$(\acute{\sigma}\sigma)(\grave{\sigma}\sigma)(\grave{\sigma})$	-	-	-	*	3+1
b.	$(\acute{\sigma}\sigma)(\grave{\sigma})(\grave{\sigma}\sigma)$	-	-	-	*	3+2
c.	$(\acute{\sigma})(\grave{\sigma}\sigma)(\grave{\sigma}\sigma)$	-	-	-	*	4+2
d.	$(\acute{\sigma}\sigma\sigma)(\grave{\sigma}\sigma)$	-	-	*	-	2
e.	$(\acute{\sigma}\sigma\sigma\sigma\sigma)$	-	-	***	-	-
f.	$\sigma(\acute{\sigma}\sigma)(\grave{\sigma}\sigma)$	-	*	-	-	2

(37) Constraint hierarchy for Maranungku:

$$\left\{\begin{array}{c}\textsc{Head(L)}\\ \textsc{Parse}\\ \textsc{Lapse}\end{array}\right\} \gg \left\{\begin{array}{c}\textsc{Min2}\\ \textsc{Align-R}\end{array}\right\}$$

The ALIGN-R constraint (see McCarthy and Prince 1993b for extensive discussion) takes care of the actual placement of the degenerate foot by penalizing each foot for every syllable which intervenes between its right boundary and the right edge of the word (the numbers in the ALIGN-R column of tableau (36) count the violations for each foot).

In Pintupi (Hansen and Hansen 1969), on the other hand, a stray syllable in an odd parse does not receive stress. In Kiparsky's terms, Pintupi does not allow catalexis, so the orphan syllable is simply left unparsed. Without going into a detailed analysis, we account for this with a constraint hierarchy minimally different from that of Maranungku. Whereas in Maranungku MIN2 is subordinate, Pintupi has MIN2 ≫ PARSE, so to parse the leftover syllable as a unary foot (violating MIN2) is not allowed. Leaving it unparsed only violates the lower-ranking PARSE.[29]

However, the catalexis solution is only applicable in cases like Maranungku, where the need for a degenerate foot occurs only in word-final position in a trochaic parse, and all the languages Kiparsky considers are of this type. But the stress pattern

[29] Another possible solution to Pintupi would be to move LAPSE below the other three constraints, yielding a dactylic $(\acute{\sigma}\sigma\sigma)$ in place of $(\acute{\sigma}\sigma)\sigma$. As long as LAPSE still dominates other relavant constraints which would prefer fewer feet, the non-binary foot will only occur as a last resort to absorb a single stray syllable.

of Passamaquoddy (LeSourd 1993, Hagstrom 1995) appears to be a real problem for strict binarity, even when augmented with the device of catalexis.

(38) Basic Passamaquoddy stress pattern
(from Hagstrom 1995, citing LeSourd 1993)

a.	$\acute{\sigma}\sigma$	wás-is	'child'
b.	$\acute{\sigma}\acute{\sigma}\sigma$	l-éwésto	'he speaks'
c.	$\acute{\sigma}\sigma\acute{\sigma}\sigma$	wík-ewésto	'he likes to talk'
d.	$\acute{\sigma}\acute{\sigma}\sigma\acute{\sigma}\sigma$	séhtáy-ewésto	'he speaks while walking backwards'

As can be seen in the data sample in (38), Passamaquoddy words of odd syllable count are stressed on both the initial and peninitial syllables.

While the Passamaquoddy pattern would seem quite challenging to strict binarity, and therefore to a theory of **Con** which relied solely on BIN to account for patterns of binarity, we are able to state a solution that is essentially identical to that for Maranungku above. The only difference is that in Passamaquoddy it is ALIGN-L which is active, shifting the feet as far to the *left* as possible. The constraint hierarchy for Passamaquoddy is thus shown in (39), and a sample tableau given in (40):

(39) Constraint hierarchy for Passamaquoddy:

$$\left\{ \begin{array}{c} \text{HEAD(L)} \\ \text{PARSE} \\ \text{LAPSE} \end{array} \right\} \gg \left\{ \begin{array}{c} \text{MIN2} \\ \text{ALIGN-L} \end{array} \right\}$$

(40) **Passamaquoddy:** [séhtáy-ewésto]

	/σσσσσ/	HEAD(L)	PARSE-σ	LAPSE	MIN2	ALIGN-L
a. ♡	$(\acute{\sigma})(\acute{\sigma}\sigma)(\acute{\sigma}\sigma)$	-	-	-	*	1+3
b.	$(\acute{\sigma}\sigma)(\acute{\sigma})(\acute{\sigma}\sigma)$	-	-	-	*	2+3
c.	$(\acute{\sigma}\sigma)(\acute{\sigma}\sigma)(\acute{\sigma})$	-	-	-	*	2+4
d.	$(\acute{\sigma}\sigma)(\acute{\sigma}\sigma\sigma)$	-	-	*	-	2
e.	$(\acute{\sigma}\sigma\sigma\sigma\sigma)$	-	-	***	-	-
f.	$(\acute{\sigma}\sigma)(\acute{\sigma}\sigma)\sigma$	-	*	-	-	2
g.	$\sigma(\acute{\sigma}\sigma)(\acute{\sigma}\sigma)$	-	*	-	-	1+3

Again, splitting Bin into Lapse and Min2 allows the minimal and maximal aspects of binarity to be ranked separately, and this is crucial to understanding an overall binary parsing pattern which nevertheless allows a degenerate foot if absolutely necessary. In Passamaquoddy, as in Maranungku above, the "absolutely necessary" criterion is provided by ranking Parse above Min2, and thus (40a) is preferred over (40f-g)

6 Summary

We began this paper by demonstrating that the Parse-2 constraint of Kager (1994) provides, perhaps unexpectedly, a key insight into the theoretically recalcitrant stress pattern of Pirahã. But since Parse-2 was introduced by Kager solely to provide an OT constraint to deal with specific ternary rhythmic phenomena, and since the trisyllabic window in Pirahã is another ternary effect, it appeared that Parse-2 is simply a "ternarity" constraint, active in the few ternary languages, and inactive in the rest. We then showed that Parse-2 could be derived from a more generally-applicable constraint, Lapse, which in turn largely obviates the need for the separate binarity constraint Bin. Lapse simultaneously governs the amount of material inside a foot as well as the amount outside, and in this way, it is the origin of *all* rhythmic alternation, whether binary or ternary. The relative rankings of the other constraints, especially Parse, determine whether a language surfaces with binary or ternary parsing tendencies. Not only does Lapse unify Parse-2 with part of the Bin generalization, but this unification leaves a residue from Bin unaccounted for, the component that prohibits degenerate feet. However, we provide an empirical argument from Passamaquoddy that this component, Min2, must in fact be a separate constraint anyway, since Passamaquoddy is a language with definite binary rhythm, yet allows degenerate feet which could not be explained even under catalexis. In other words, the solution to this language would require the crucial ranking of one subpart of the Bin constraint over over the other. These subparts correspond nicely to Lapse and Min2. We propose, therefore, that the universal set of constraints contains Lapse and Min2, which take the place of Parse-2 and Bin and provide us with greater insight into the nature of rhythmic stress alternation.

REFERENCES

Cabré, Teresa and Michael Kenstowicz (1994) "Prosodic Trapping in Catalan," ms., UAB and MIT. [ROA-32]

Everett, Daniel (1988) "On Metrical Constituent Structure in Pirahã Phonology," *Natural Language and Linguistic Theory* 6, 207–246.

Everett, Daniel (1994) "Quantity, Sonority, and Alignment Constraints in Arawan Prosody," talk given at MIT, November 9.

Everett, Daniel and Keren Everett (1984) "On the Relevance of Syllable Onsets to Stress Placement," *Linguistic Inquiry* 15, 705–711.

Hagstrom, Paul (1995) "When a Passamaquoddy Unstressable Schwa, That's a Mora," ms., MIT, Cambridge, MA.

Halle, Morris (1990) "Respecting Metrical Structure," *Natural Language and Linguistic Theory* 8, 149–176.

Halle, Morris and Jean-Roger Vergnaud (1987) *An Essay on Stress*, MIT Press, Cambridge, MA.

Hansen, K. and L. Hansen (1969) "Pintupi Phonology," *Oceanic Linguistics* 8, 153–170.

Hayes, Bruce (1980) *A Metrical Theory of Stress Rules*, PhD dissertation, MIT, Cambridge, MA.

Hayes, Bruce (1991) *Metrical Stress Theory: Principles and Case Studies*, ms., UCLA.

Hewitt, Mark (1994) "Deconstructing Foot Binarity in Koniag Alutiiq," ms., University of British Columbia, Vancouver. [ROA-12]

Inkelas, Sharon (1994) "Exceptional Stress-attracting Suffixes in Turkish: Representations vs. the Grammar," presented at Workshop on Prosodic Morphology, Utrecht. [ROA-39]

Kager, René (1994) "Ternary Rhythm in Alignment Theory," ms., Research Institute for Language and Speech, Utrecht University. [ROA-35]

Kiparsky, Paul (1991) "Catalexis," ms., Stanford University and Wissenschaftskolleg zu Berlin.

Lehiste, Ilse (1970) *Suprasegmentals*, MIT Press, Cambridge, MA.

LeSourd, Phil (1993) *Accent and Syllable Structure in Passamaquoddy*, Garland Press, New York.

McArthur, H., and L. McArthur (1956) "Aguacatec (Mayan) Phonemes in the Stress Group," *International Journal of American Linguistics* 22, 72–76.

McCarthy, John and Alan Prince (1993a) *Prosodic Morphology I: Constraint Interaction and Satisfaction*, ms., University of Massachusetts, Amherst, and Rutgers University.

McCarthy, John and Alan Prince (1993b) "Generalized Alignment," ms., University of Massachusetts, Amherst, and Rutgers University.

Nespor, Marina and Irene Vogel (1986) *Prosodic Phonology*, Foris, Dordrecht.

Prince, Alan (1985) "Improving Tree Theory," *BLS* 11, 471–490.

Prince, Alan and Paul Smolensky (1993) *Optimality Theory: Constraint Interaction in Generative Grammar*, ms., Rutgers University and University of Colorado at Boulder.

Selkirk, Elizabeth (1984) '*Phonology and Syntax: The Relation between Sound and Structure*, MIT Press, Cambridge, MA.

Tryon, D. T. (1970) *An Introduction to Maranungku*, Pacific Linguistics Monographs, Series B, No. 14, Australian National University, Canberra.

Department of Linguistics and Philosophy
MIT 20E-225
Cambridge, MA 02139
`tmgreen@mit.edu`