THE STRESS SYSTEM OF CENTRAL RARAMURI:
ROOT PRIVILEGE, PROSODIC FAITHFULNESS AND MARKEDNESS REVERSALS

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1. INTRODUCTION.

This paper characterizes the accentual system of Central Raramuri, a typologically relevant system for two reasons: i) it is a mixed system (i.e. partially lexical, partially rhythmically assigned), and ii) it has an initial trisyllabic window, an extremely uncommon pattern that has been only reported to occur in Icua Tupi (Tupi), Terena (Tupi), Wishram and Chinook (Penutian) (Kager 1993). The interaction of these two factors yields a complex accentual system, which is theoretically relevant given the challenge it poses to prevailing accounts of mixed accent systems that rank indexed faithfulness with respect to a fixed markedness hierarchy.

Raramuri, also known as Tarahumara, is a Southern Uto-Aztecan language of the Taracahitan branch that is agglutinative and exclusively suffixing. Spoken in the northern Mexican State of Chihuahua, Central Raramuri[1] is spoken by approximately 50,000 speakers. In this paper I analyze data obtained through my field research in the community of Choguita, in the municipality of Guachochi during the summers of 2003 and 2004. My main collaborators were four native speakers from the community of Choguita, male and female of different ages that have always resided in this community (and have therefore not been exposed to other dialects of Raramuri substantially). David Brambila's grammar (1953) and dictionary (1955) were also consulted, but all data cited in this paper come from my own elicitation, unless otherwise noted.

Many lexical items in this language have lexical accent, a distinctive property demonstrated by the fact that the accentuation of non-derived words is unpredictable. When there is no information of accent present in the input, default stress is assigned. There is, however, an overarching restriction that precludes accent from being realized outside the first three syllables of the prosodic word. In other words, Central Raramuri exhibits a typologically unusual initial trisyllabic stress window.

Section 2 presents the phonological generalizations of Central Raramuri, as well as the basic phonological and distributional properties of this language. Section 3 presents the facts that show that Raramuri has a mixed stress-accent system. Section 4 motivates the initial trisyllabic window, by showing how it is actively enforced in two productive morphological environments: compound constructions, and different-sized roots under recursive affixation. In Section 5 I examine the implications of the Central Raramuri data for theories of morphologically conditioned phonology, explicitly comparing two models: Cophonologies (Orgun 1996, Antilla 1997, 2002, Inkelas 1998, Inkelas & Zoll 2004) and Root Controlled Accent (Alderete 1997, 1999, 2001). It will be shown how the former analysis is superior to the latter in delivering the correct empirical generalizations.

[1] Ethnologue (SIL 1993) reports five dialects. Dialectological studies, however, would probably reveal that there are more variants, some of which are mutually unintelligible. The extent of variation for this language has not been yet properly assessed.

2. THE DATA.

2.1. PHONOLOGICAL GENERALIZATIONS.

Although there are written materials in Raramuri, there is no standard orthography and therefore existing texts display considerable variation. For this reason, IPA symbols will be used in the remainder of this paper. The following charts illustrate the phonological inventory of Central Raramuri:

Table 1 - Phonemic Inventory of Central Raramuri

	Bilabial	**Alveolar**	**Post alveolar**	**Retroflex**	**Palatal**	**Velar**	**Glottal**
Stop	p b	t				k g	ʔ
Affricate			t͡ʃ				
Fricative		s					h
Nasal	m	n					
Trill		r					
Tap or flap				ɽ			
Approx.	(w)				j	w	

Table 2 - Monophthong vowel system

i		u
	ɛ	ɔ
	a	

Central Raramuri has no geminate consonants, and there is no contrastive vowel length. Syllables are basically CV in shape, and the only possible coda is glottal stop (CVʔ). Glottal stop in Raramuri seems to be restricted to a predictable location between the first and second syllable, either as coda to the first syllable or as onset to the second. I have found no data where a glottal stop is anywhere else in the word.[2] Heterosyllabic and

[2] There are CVʔ(C)VCV forms, where stress is in the third syllable:

i) poʔobú
ii) biʔt͡ʃiná
iii) raʔamá
iv) moʔobú

homosyllabic consonant clusters arise only through vowel syncope in morphologically derived environments. The same distribution is well-documented for Guarijio, a closely related language from the Taracahitan branch (Miller 1996, Haugen n.d). For both Raramuri and Guarijio glottal stop behaves as a glottal prosody rather than a full-fledged segment.

All plosives are underlyingly voiceless, but there are voicing alternations that are morphologically conditioned, e.g., as a mark of plural formation:[3]

1)	/mu**k**í/	'woman'	/omu**g**í/	'women'
	/ka**p**óra/	'ball'	/ka**b**óra/	'balls'
	/ka**p**írame/	'cylindrical (sg)'	/ka**b**írame/	'cylindrical (pl)'

2.2 PROPERTIES OF CENTRAL RARAMURI STRESS-ACCENT.

This paper is about Central Raramuri stress-accent system. This section describes the phonetic and distributional properties of Central Raramuri accent, confirming that it is indeed realized as stress. This language exhibits all the defining characteristics of stress languages. First, all content words have one and only one stressed syllable per word (the *obligatoriness* parameter). In addition, there are no syllables in the word with equal degree of prominence (the *culminativity* parameter). These two criteria are, of course, ambiguous between stress and pitch-accent. However, Raramuri displays phonetic properties that are unique to stress systems: increased phonetic duration of accented vowels, reduction of unaccented vowels, and augmentation of onsets in accented syllables (there is no secondary stress).

Stressed syllables in Central Raramuri are characterized by increased duration and slightly higher pitch. Spectrograms made on the Choguita data[4] show that stressed vowels (ranging between 180 to 200 msecs) tend to be approximately twice as long as unstressed vowels (80 - 100 msec).

There is post-tonic vowel reduction of all vowels to [ə], as in (2a), and also total reduction (vowel syncope), as in (2b-2c), a hallmark property of stress vs. tone.[5]

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v) raʔrat͡ʃá

These examples show that glottalization is associated with initial, as opposed to immediately pretonic, position. As Haugen (2004) has suggested for Guarijio, the glottal stop is a glottal prosody associated with the first syllable vowel. On the other hand, the absence of monosyllabic CVʔ roots is consistent with the incompatibility between stress and glottal stop.

[3] Brambila (1953) talks about epenthesis of word-initial initial vowels, stress shift and consonant mutations as separate phenomena that could independently or in conjunction form a plural stem. Valiñas (1994:45) attributes the consonant mutations to the position of stress in the word, but he ignored data like (1-3), where they are independent of the stress position.

[4] Recordings of four speakers were analyzed in Praat.

[5] I have not looked at vowel duration/length in stressed syllables which surface as closed due to syncope.

2)	a.	/awáɽ**a**mi/	“swallowed”	[awáɽəmi]
	b.	/raén**a-**tʃi/	“in the sun”	[raéntʃi]
	c.	/iyók**i-**ɽi/	“dyed”	[iyókɽi]

Another correlate of stress is related to augmentation of onset consonants in stressed syllables: voiceless plosives display slight aspiration, which is not present when they are onsets of a stressless syllable.

In sum, these phonetic, phonological and distributional facts suggest that Raramuri has a stress accent system, rather than a tone or pitch accent system. For general discussion of the distinction between stress and pitch-accent systems, see Poser 1984, Hyman & Wilson 1991, Hyman 1977, 2001, Inkelas & Zec 1988, Alderete 2001.

3. A MIXED STRESS SYSTEM IN RARAMURI.

Assuming we are correct in interpreting Raramuri accent as stress, we now turn to the details of its distribution. While much of the accentual system is rule-governed, it is clear that to some degree stress is also lexicalized, i.e. present underlyingly for at least some morphemes.[6] Consider contrasts like the following:

3)	**/mú**ɽi/	‘basket’	/muɽ**í**/	‘turtle’
	/éka/	‘close!’	/ek**á**/	‘wind’
	/kótʃi/	‘pig’[7]	/ko**tʃí**/	‘dog’

Roots can be accented on the first, second or third syllable. All apparent cases of roots that are longer than three syllables turn out to be compounds after closer inspection. The data I collected in my field research in Choguita is organized in a database of 632 nominal and verbal roots, out of which 23 (4%) are monosyllabic, 341 (54%) are disyllabic, and 268(42%) are trisyllabic. The following table shows the statistical proportion of disyllabic (D) and trisyllabic (T) roots that were found in the data, and the accentual type for each root-type: first, second or third syllable.

[6] Vowel length is reconstructed for Proto-Uto-Aztecan. Unpredictable stress contrasts in Raramuri probably derive from an earlier distinction in vowel length. Most likely, stress became unpredictable when the vowel length distinction was lost, as in Romance languages (Hyman 1977:40).

[7] This is a loan from Mexican Spanish (from standard Spanish *cochino*, ‘pig’).

Table 3 - Stress in Roots

1st syllable stress (12%)			2nd syllable stress (69%)			3rd syllable stress (19%)		
	#	%			%		#	%
D	39	6%	D	302	48%	T	121	19%
T	11	2%	T	136	21%			
	50			242			121	

Although the position of stress is lexically governed in these and other cases, Raramuri also has emergent default stress assignment, as will be shown next.

In Raramuri, as in other Uto-Aztecan languages (e.g. Cupeño (Hill & Hill 1968, Alderete 2001)), there is a contrast between accented and unaccented roots. Accented roots retain their root stress in its original position across derivation. In unaccented roots, on the other hand, stress is free to surface on certain suffixes, under the right conditions, which will be addressed later on this paper.

The contrast between accented and unaccented roots is clear when considering a suffix like locative –tʃi. To differentiate underlying accent from stress realization for roots in isolation, I will indicate the former by underlying the accented syllable; the latter will be expressed through the acute accent symbol.

4)	/mú<u>ɾ</u>i/	'basket'	múɾi-tʃi	'in the basket'	Accented
	/ma<u>tó</u>/	'shoulder'	mató-tʃi	'on the shoulder'	Roots
	/sekᴀ́/	'hand'	seka-tʃí	'in the hand'	Unaccented
	/rapé/	'rock'	rape-tʃí	'in the rock'	Roots

The locative suffix, in addition to the conditional suffix *–sá* in the verbal paradigm in (5), are part of a set of suffixes described by Brambila (1953) as being able to "alter" the stress of the root to which they attach, if such a root does not have inherent lexical stress. These suffixes are referred to as **strong**.

5)	/be<u>né</u>/	'to learn'	bené-sa	Accented
	/ba<u>hí</u>/	'to drink'	bahí-sa	Roots
	/tʃapí/	'to grab'	tʃapi-sá	Unaccented
	/sakí/	'to roast corn'	saki-sá	Roots

A conjecture about the nature of strong suffixes is that they might have a more recent, traceable lexical origin than the ones that do not. Central Raramuri most likely grammaticized certain lexical items into formatives. [8]

[8] For example, Leopoldo Valiñas has suggested (p.c.) that the strong future suffix *–méa* has its origin in the PUA verb **méla*, 'walk, go'.

Accented roots keep stress stable under suffixation. All disyllabic words with first syllable stress show this behavior, and never displace stress to strong suffixes.[9]

			Future (strong)	Perfective (weak)
6)	/táni/	'to ask for'	táni-ma	táni-ri
	/wíɽi/	'to help'	wíɽi-ma	wíri-ri
	/pútʃi/	'to blow'	pútʃi-ma	pútʃi -ri
	/méti/	'to gee up'	méti-ma	méti-ri

Disyllabic roots with second syllable stress can also be divided between accented (7) and unaccented (8).

			Bare roots	Future (strong)	Perfective (weak)
7)	/katʃí/	'to spit'	katʃí	katʃí-ma	katʃí-ri
	/awé/	'to grill'	awé	awé-ma	awé-ri
	/riwé/	'to abandon'	riwé	riwé-ma	riwé-ri
	/napá/	'to hug'	napá	napá-ma	napá-ri
8)	/raʔɽá/	'to buy'	raʔrá	raʔɽa-méa	raʔrá-ri
	/tʃapí/	'to grab'	tʃapí	tʃapi-méa	tʃapí-ri
	/sawí/	'to grill'	sawí	sawi-méa	sawí-ri
	/tʃaʔí/	'to get stuck'	tʃaʔí	tʃaʔi-méa	tʃaʔí-ri

The future suffix displays an interesting allomorphy: *–ma*, used with accented roots, and *–méa*, used with unaccented roots. Consistently, the former is unstressed while the latter is stressed, and root stress seems to be the only parameter that plays a role in allomorph selection. I have looked at 17 suffixes, out of which 50% can bear stress with unaccented roots, while the other 50% cannot bear stress with unaccented roots. The future suffix is the only one that has two suppletive allomorphs, one stressed and one unstressed.[10]

Unaccented roots in isolation display second syllable stress (consider again the data in (8) under 'bare roots'), as well as words formed with unaccented roots and suffixes that have no independent stress properties. These properties suggest that the Raramuri mixed system has default emergent binarity, when roots lack lexical accent.

[9] These forms (and some monosyllables) probably arose from loss of initial pre-tonic syllables (e.g., *lá*, 'blood', is *elá* in other dialects and in Guarijío (Miller 1996:35).

[10] Guarijio, another Taracahitan language, does not display this allomorphy for thhume future suffix: the suffix *–ma* is used in stressed and unstressed contexts.

4. IS THERE AN INITIAL THREE-SYLLABLE WINDOW IN RARAMURI?

It was shown in the previous section that Central Raramuri has emergent binarity with disyllabic roots. Other types of roots under recursive affixation or compounding show, however, that root stress is not always kept in its original place after suffixation. Specifically, there is a strong restriction to the left edge of the prosodic word. Brambila (1953:245) noted that, without exception, stress in Raramuri cannot be placed beyond the third syllable. Miller (1996) talks about the same condition for Guarijío, a closely related Taracahitan language. For Brambila and Miller, compound constructions are used as evidence for the existence of an initial three-syllable window.[11] The following sections explore the nature of this restriction.

4.1 COMPOUND STRESS.

Compounding provides a unique opportunity to test the behavior of stress in longer words in Central Raramuri, given that most roots are maximally trisyllabic. Compounding shows that there is in fact a formal limitation on how far right from the left edge of the prosodic word can stress fall.

Raramuri has N-V constructions that are restricted to nouns referring to body parts and bodily fluids. These constructions display the following features: [12]

a) The noun root is fully integrated with the verb morphologically.
b) The noun is referentially active.
c) Both the noun root and the verb root can be used independently.

These properties are prototypical of 'body part incorporation', a restricted kind of noun incorporation, which is common in languages of the Americas, including the Uto-Aztecan family (Baker 1998). I will, however, keep Brambila's terminology and refer to these constructions as compounds, given that an in-depth analysis of the syntactic properties of these constructions in Raramuri is still missing.[13]

In compounds whose first member is disyllabic and whose 2nd member is initially stressed, stress surfaces on the first syllable of the second member.

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[11] Window systems are defined as stress systems where "stress falls within a disyllabic or trisyllabic sequence of syllables from the edge of the domain, but is unpredictable within that window" (Kager 1993:1).

[12] A few verbs have a suppletive form that attaches productively to all other verbs. These constructions convey modal (*bené-simi* 'go around learning'), evidential (*bené-ʧani* 'to sound like learning is happening'), desidertaive (*bené-niri* 'to want to learn'), and causative (*bené-nura* 'to force someone to learn') meanings. These verbs all exist independently, but have a different phonological make-up when combined with other verbs, which places them in a level between V-V compounds and derivational suffixes.

[13] Raramuri has also a more fully lexicalized type of incorporation, the derivational use of instrumental prefixes, reconstructed for Proto-Uto-Aztecan (Langacker 1976) and attested in many Uto-Aztecan languages.

9)	/moʔó + répu/	'head + to cut off'	moʔo-répu	'to head-cut'
	/tʃumá + hó/	'beak + to dig'	tʃuma-hó	'to dig with beak'
	/ropá + hí/	'belly + to tie'	ropa-hí	'to saddle a horse'
	/lá + póru/	'blood + to harden'	la-póru	'to coagulate (blood-harden)'
	/lá+répu/	'blood + to cut'	la-répu	'to cut the veins'

Is this retraction stress a result of an active 3-syllable window, as Brambila and Miller suggest, or is it in fact an epiphenomenon of another active principle in the grammar? Note that in the examples in (9) all the nouns are underlyingly accented. This could simply indicate that accent is deleted from the first member in compounding but preserved in the second member in the same location that it would surface in when the second member is used in isolation.

Consideration of other compounds suggests that the placement of stress with these forms is definitely being actively constrained by the grammar. Stress retracts to the previous syllable, the compound's third syllable, if the compound head has second syllable stress in isolation and if the first member is two syllables long. Note also that all possible interactions of accented and unaccented roots are attested in these forms: unaccented noun plus unaccented verb (10a), accented noun plus unaccented verb (10b), unaccented noun plus accented verb (10c), and accented noun plus accented verb (10d). Regardless of the underlying accentual information the compounded roots might carry, stress is assigned in the first syllable of the head.

10) a.	/busí+kasí/ 'eye + to break'	busi-kási	'to become blind' (lit. 'to eye-break')
b.	/ropá+kasí/ 'stomach + to break'	ropa-kási	'to have a miscarriage' (lit. 'to stomach-break')
c.	/busí+botá/ 'eye + to come out'	busi-bóta	'to eye-come out'
d.	/kawá+botá/ 'egg + to come out'	kawa-bóta	'to come out eggs'
e.	/kutá+biʔrí/ 'neck + to twist'	kuta-bíri	'to twist neck (intr)'
f.	/tʃomá+biʔwá/ 'mucus + to clean'	tʃoma-bíwa	'to clean mocus'
g.	/tʃerewáka+biʔwá/ 'sweat + to clean'	tʃere-bíwa	'to clean sweat'

The stress retraction phenomenon involves actual deletion of lexical inherent root stress from the head of the compound. The root *biʔwá*, 'to clean', for example, is an accented root: under affixation of accented suffixes, its root stress remains unaltered: *biʔwá-ma, biʔwá-sa, biʔwá-bo*, etc. Compound stress, then, involves both stress deletion and stress-reassignment.

As already mentioned, Brambila (1953) and Miller (1996) interpret comparable stress re-assignment facts for the Tarachaitan languages as evidence for a three-syllable window for stress. Fourth syllable stress, which would result in (10a-f) if stress deletion in the first member were the only effect of compounding, would fall outside this window, and is therefore retracted one syllable to the left. However, compound forms that involve

monosyllabic nouns suggest a different explanation for the window-like effect. Consider the following forms:

11)	/lá+biʔwá/	‘blood + to clean’	la-bíwa ‘to clean blood’	not */labiwá/
	/lá+rusí/	‘blood + to fall’	la-rúsi ‘to blood-fall’	not */larusí/

The head verbs in (11) have second syllable stress in isolation. Unexpectedly, the outcome is a compound with stress on the second syllable. In these cases, a hypothetical ternary initial window would not be challenged by the original place of the compound’s head stress on the second syllable, since it would yield forms with three-syllable stress. In other words, the ternary initial window would not rule out the unattested forms noted in the right of each example (e.g. **labiwá*). These forms show the need to posit a compound stress rule that assigns stress in the first syllable of the head of the compound.

But even if the morphological compound stress rule is kept, there are other test grounds for the window hypothesis, which could in principle exist in addition to the compound rule. Trisyllabic nouns in compounding are crucial in this regard. But Raramuri, as other Uto-Aztecan languages (e.g. Southern Paiute (Sapir 1931) and Kawaiisu (Zigmond *et al*. 1991)), tends to shorten its trisyllabic nouns to a disyllabic form in compounding:

12)	/tʃaméka + répu/	‘tongue + to cut’	tʃame-répu	‘to tongue-cut’
	/kutatʃí + répu/	‘neck + to cut’	kuta-répu	‘to neck-cut’

I was able to assess, however, that non-truncated versions of (12) are possible. Consider the forms in (13):

13) a.	tʃameká-repu		‘to tongue-cut’	Stress in 3rd
	kutatʃí-repu		‘to neck-cut’	Stress in 3rd
b.	*tʃameka-répu		‘to tongue-cut’	Stress in 4th
	*kutatʃi-répu		‘to neck-cut’	Stress in 4th

The forms in (13a), with stress in the third syllable, were odd, but acceptable. These forms were preferred over equivalent forms with stress in the fourth syllable, which were completely rejected (13b). The compound rule is violated in the acceptable cases (13a). This suggests that there is a trisyllabic window in the language after all. The truncation effect in these compound forms reinforces the hypothesis that arises with the forms in (11) (monosyllabic nouns plus disyllabic verbs that retract stress), where there seems to be a relationship between the compound stress rule and the three-syllable window. In this case, truncation could be said to arise both from the need to satisfy the three-syllable window restriction AND the need to satisfy the compound stress rule.

This stress pattern in compounds could be analyzed as a grammaticalized pattern that arose from the initial ternary window restriction, although it is also conceivable that the window effect is an epiphenomenona of the compound stress rule.

The next section explores what recursive affixation with different-sized roots might contribute to this issue.

4.2 ROOT CLASSES (ACCENT- AND SIZE-WISE) AND RECURSIVE AFFIXATION.

The contrast that roots exhibit as accented or unaccented was illustrated in previous section. Suffixes too can be classified into two groups, according to their properties regarding stress assignment. Specifically, suffixes can be characterized as being **strong** or **weak**, with stress-perturbing and stress-neutral properties, respectively. The following table shows the strong and weak suffixes of Central Raramuri.

Table 3 – Strong and weak suffixes

Weak Suffixes	Strong Suffixes
-ɾi Perfective	*-méa* Future
-ɾu Past Passive	*-bó* Future plural
-si Imperative inclusive	*-sá* Conditional
-ba Future Passive	*-bá* Inchoative
-ke Perfective/Evidential	*-ná* Transitivizer
-ti Causative	*-bú* Derivational (to undo)
-ki Applicative	*-tʃí* Locative
-raɾe Locative	*-rá* Possesive
-a Progressive	

A strong suffix emerges with the word's stress when the root is not inherently accented, and when the root is disyllabic (14b). The same unaccented root, however, will emerge with second syllable stress when used in isolation, and when a weak suffix (like perfective *–ri*) is attached (second column in (14b)).

			Strong Suffix Conditional	Weak Suffix Perfective	
14) a.	/katʃ́i/	'to spit'	katʃí-sa	katʃí-ri	Accented
	/riwé/	'to abandon'	riwé-sa	riwé-ri	Roots
b.	/tʃapí/	'to grab'	tʃapi-sá	tʃapí-ri	Unaccented
	/tʃaʔí/	'to get stuck'	tʃaʔi-sá	tʃaʔí-ri	Roots

What happens with roots of different sizes? The following sections introduce trisyllabic and monosyllabic roots under affixation to answer this question.

4.2.2 TRISYLLABIC ROOTS.

Trisyllabic roots are about 40% of the database. Many of these roots (53%) have second syllable stress:

			Future (strong)	Perfective (weak)
15)	/natéti/	'to pay'	natéti-ma	natéti-ri
	/naháta/	'to follow'	naháti-ma	naháti-ri
	/sebári/	'to complete'	sebári-ma	sebári-ri
	/otʃópi/	'to hit with fist'	otʃópi-ma	otʃópi-ri

Notice how stress remains in its original position across derivation. The same is true for many other trisyllabic roots that have third syllable stress instead:

			Future (strong)	Perfective (weak)
16)	/binihí/	'to acuse'	/binihí-ma/	/binihí-ri/
	/bahuré/	'to invite'	/bahuré-ma/	/bahuré-ri/
	/sukutʃú/	'to scratch'	/sukutʃú-ma/	/sukutʃú-ri/
	/wikará/	'to sing'	/wikará-ma/	/wikará-ri/

Stress can be argued to be lexical in these forms. But there are also instances of trisyllabic roots with **variable stress** under affixation. Consider the following forms:

17) a.	/a**ná**t͡ʃa-ri/	PST	'to endure'	
	/a**ná**t͡ʃa-ki/	PST.EV		
	/a**ná**t͡ʃa-ti/	CAUS		Weak suffixes
b.	/ana**t͡ʃá**-ma/	FUT		Strong suffixes
	/ana**t͡ʃá**-ba/	FUT.PASS		
	/ana**t͡ʃá**-sa/	COND		

Variation in stress placement within these roots is not random. The verb *anat͡ʃa* has second syllable stress when weak suffixes are added, but third syllable stress when strong suffixes are added. Further examples of this phenomenon are given in (18-20):

18) a.	/nasówa-ri/	PST	'to mix'	
	/nasówa-ki/	PST.EV		
	/nasówa-a/	PRES		Weak suffixes
b.	/nasowá-ma/	FUT		Strong suffixes
	/nasowá-sa/	COND		
	/nasowá-bo/	FUT.PL		

19) a.	/raʔáma-ri/	PST	‘to demand’	
	/raʔáma-a/	PRES		
	/raʔáma-ki/	PST.EV		Weak suffixes
b.	/raʔamá-ma/	FUT		Strong suffixes
	/raʔamá-sa/	COND		
20) a.	/raít͡ʃa-ri/	PST	‘to speak’	
	/raít͡ʃa-a/	PRES		
	/raít͡ʃa-ki/	PST.EV		Weak suffixes
b.	/rait͡ʃá-ma/	FUT		Strong suffixes
	/rait͡ʃá-bo/	FUT.PL		
	/rait͡ʃá-sa/	COND		

First, these cases show how weak suffixes are not pre-stressing, as could have been assumed to be the case with disyllabic roots. Specifically, if weak suffixes were pre-stressing, we would expect three-syllable stress with trisyllabic unaccented roots (18a, 19a, 20a), immediately preceding the suffixes, instead of the attested second syllable stress. Variable stress assignment with weak and strong suffixes with these roots could be conceived as an instance of dominance, given that the suffixes are immediately adjacent to the root. However, this variation in stress placement also takes place even when the strong suffixes are not adjacent to the root.

21)	/anat͡ʃá-ti-bo/	CAUS-FUT.PL
	/anat͡ʃá-ti-sa/	CAUS-COND
	/rait͡ʃá-ti-bo/	CAUS+FUT.PL

In these forms, stress is still pulled to the third syllable under the effect of a strong suffix, despite of it not being adjacent to the root, clearly showing the window effect.

In sum, it has been shown so far that there is evidence for the window hypothesis after all, despite the compound stress rule that places stress in the first syllable of the head of the compound. This evidence is clearly appreciated in the following two phenomena:

a) Stress and truncation properties of N-V compounds where the noun is three syllables long.
b) Variable stress assignment with trisyllabic roots under recursive affixation.

4.2.1 MONOSYLLABLES.

Monosyllabic roots are also important to consider, since the same suffix interactions that would challenge the stress window with disyllabic or trisyllabic roots would have a different outcome with monosyllabic forms. Some of the monosyllabic forms are shown in (22):

			Future (strong)
22)	/sú/	'to sow'	sú-ma
	/tú/	'to bring'	tú-ma
	/wé/	'to raise'	wé-ma
	/wá/	'to be strong'	wá-ma
	/mó/	'to climb (sg subj)'	mó-ma
	/ɸá/	'to throw'	pá-ma

With one exception, all monosyllabic roots are accented, and keep stress fixed under recursive affixation.[14] Only one situation has been found where a monosyllabic root shifts stress to strong suffixes (future and conditional). This root keeps stress in the root with weak suffixes (past evidential, and past):[15]

23)	a.	/ru-méa/	FUT	Strong	'to speak'
	b.	/ru-sá/	COND	Strong	
	c.	/rú-ki/	PST.EV	Weak	
	d.	/rú-ɽi/	PST	Weak	

These forms are interesting since they show that weak suffixes are not only stress-neutral, but also that they are never stressed. Since it has been shown that second syllable stress is the default emergent pattern, it would be expected that the forms in (23c) and (23d), with weak suffixes, would have second syllable stress, the unattested **rukí* and **ruɽí*, but we instead find forms with first syllable stress. This lone case of monosyllabic unaccented root shows that the default second syllable stress must also meet the condition of being assigned *within* the stem. This issue will be addressed again below, where more relevant data is considered.

4.2.3 RECURSIVE AFFIXATION.

Multiply affixed roots are also relevant in exploring the stress properties of weak and strong suffixes. It was already shown in the previous section how weak suffixes are unstressable, and keep stress in the root. The following example of an unaccented

[14] One assumption is that these forms were disyllabic with initial accent that lost their post-tonic syllables. Revision of Uto-Aztecan cognate sets (Miller), however, does not confirm this hypothesis, although it should be noted that only two cognate forms were found, and these forms are monosyllabic.

[15] The cognate of this verb in Guarijio is *tui* with a variant *tu*. It might be the case that this form was a disyllabic form that lost a syllable, yielding a monosyllabic form.

disyllabic root under recursive affixation reinforces the observation made about the unstressability of weak affixes. When a strong suffix is not immediately adjacent to an unaccented root, stress will be assigned to the second syllable, and no the third syllable, as in (24):

24)	/awí-ti-sa/	dance-CAUS-COND	not **awitísa*
	/rará-ti-ma/	buy-CAUS-FUT	not **raratíma*

Here, the root is immediately followed by the causative, a weak suffix (the third syllable), which is in turn followed by a strong suffix.

These cases call back our attention to the prominent role of the stem in default stress assignment. This leads us to assume that weak affixes and strong affixes have a different status, the former apparently being part of the stem for stress purposes, meaning that they induce cyclic stress assignment. It is possible to interpret that the assymetrical stress behavior between weak and strong suffixes owes its origin to diachronic processes: strong suffixes most likely have a more recent history of grammaticalization, still retaining their root-like properties for stress purposes.

5. ANALYSIS.

The following table summarizes the types of roots (classified in terms of size and their nature as unaccented/accented) and the possible interactions with strong and weak suffixes (accent in roots is marked through underlining and strong suffixes are marked with bold-face).

Table 4 – Interactions between roots and affixes

Monosyllables	/σ̲ + **σ**/	First syllable stress	**/sú**-sa/
	/σ̲ + σ/	First syllable stress	**/sú**-ri/
	/σ + **σ**/	Second syllable stress	/ru-**sá**/
	/σ + σ/	First syllable stress	**/rú**-ri/
Disyllables	/σ̲ σ + **σ**/	First syllable stress	**/tá**ni-sa/
	/σ̲ σ + σ/	First syllable stress	**/tá**ni-ri/
	/σ σ̲ + **σ**/	Second syllable stress	/ka**tʃí**-sa/
	/σ σ̲ + σ/	Second syllable stress	/ka**tʃí**-ri/
	/σ σ + **σ**/	**Third syllable stress**	/awi-**sá**/
	/σ σ + σ/	**Second syllable stress**	/a**wí**-ri/
	/σ σ + σ + **σ**/	**Second syllable stress**	/a**wí**-ti-sa/
Trisyllables	/**σ̲** σ σ + **σ**/	First syllable stress	**/hú**misi-sa/
	/**σ̲** σ σ + σ/	First syllable stress	**/hú**misi-ri/
	/σ **σ̲** σ + **σ**/	Second syllable stress	/na**té**ti-sa/
	/σ **σ̲** σ + σ/	Second syllable stress	/na**té**ti-ri/
	/σ σ **σ̲** + **σ**/	Third syllable stress	/bini**hí**-sa/
	/σ σ **σ̲** + σ/	Third syllable stress	/bini**hí**-ri/
	/σ σ σ + **σ**/	**Third syllable**	/ana**t͡ʃá**-sa/
	/σ σ σ + σ/	**Second syllable**	/a**ná**t͡ʃa-ri/

Up until now, the descriptive generalizations of the Raramuri stress system are:

a) Each prosodic word has a single stress.
b) Roots can be accented or unaccented.
c) Affixes can be strong or weak, meaning that they can perturb the root's stress or be neutral regarding stress assignment, respectively.
d) In words containing no accented roots or strong suffixes, stress falls by default in the second syllable of the stem.
e) In words containing an unaccented root and a strong affix, stress falls in the third syllable of the word, the immediately adjacent strong suffix with disyllabic roots, the final root syllable of three-syllable roots.
f) Lexical accent in roots blocks default second and third syllable stress.
g) Compounding constructions display an accentual pattern of dominance that deletes inherent accent on the members of the compound. This is an instance of morphologically sensitive phonological dominance.
h) There is an initial three-syllable window.

The default second-syllable is the reconstructed pattern for Proto-Uto-Aztecan (Munro 1977).[16] The numerous instances of third syllable stress are explained through either lexical accent of roots or by the effect of strong suffixes. The window restricts stress from falling in these strong suffixes when the root is itself three syllables long. Violations to the window are not being resolved through the established second syllable default. Instead, stress falls as close as possible to the strong suffix within the stress window, as long as within the stem. It can be argued, then, that there are two default stress patterns: second syllable base stress with weak suffixes, and third syllable stress with strong suffixes.

This set of factors clearly shows that the Raramuri stress system is governed by morphological structure, rather than directionality principles alone. Phonological effects that are specific to particular morphological environments are widespread crosslinguistically and have significant consequences for theories of the phonology-morphology interface. In one of these developing frameworks, the Indexed Constraint approach, intra-linguistic variation is handled through a single ranking of markedness constraints and indexed faithfulness constraints to individual morphological contexts. Inscribed in this framework is the Root Controlled Accent (RCA) Hypothesis (Alderete 1997, 1999, 2001), in which morphologically conditioned accent resolution is handled with morpheme-specific indexed faithfulness constraints.

A cophonology account, on the other hand, handles such phenomena with construction-specific phonological mappings, or morphologically blind phonological sub-grammars (Orgun 1996, Antilla 1997, 2002, Inkelas 1998, Inkelas & Zoll 2004). While in the RCA faithfulness constraints are indexed to roots and affixes, and a single markedness hierarchy is kept, in the cophonology approach constraints are fully general, but multiple rankings are allowed. These two approaches yield substantially different empirical predictions. The next section presents a cophonology analysis of the Raramuri data and contrasts its predictions to that of an indexed constraint analysis, the RCA.

5.1 A COPHONOLOGY ANALYSIS.

In the previous section it was shown how Raramuri has two grammatical stress patterns: second syllable stress and third syllable stress. Words composed of unaccented roots and weak suffixes trigger the second syllable default pattern, while words composed of unaccented roots and strong suffixes trigger the third syllable pattern. The second syllable pattern, in addition, restricts stress to be assigned on the bare, monomorphemic root. Both default patterns are blocked by lexical root stress. Above all, there is an over-arching restriction that keeps stress in the first three syllables of the word. Compound forms and roots under recursive affixation show the effects of this over-arching restriction.

In the cophonology approach this set of co-existing stress patterns is naturally captured. The different cophonologies of a language share a partial ranking of constraints to which the cophonologies must conform to a 'Master Ranking' (Antilla 2002, Inkelas & Zoll 2004). This Master Ranking contains the undominated requirement that stress must be in the first three syllables of the prosodic word, and the lower ranked constraint that enforces the realization of input prosodic information. Each cophonology further

[16] Second-syllable and second-mora stress is kept in Hopi and the Numic and Taracahitan branches (Munro 1977).

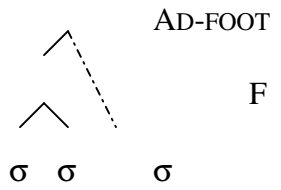
specifies its own default pattern, but is related to each other in a grammar lattice (Antilla 2002).

The compound stress rule, plus the two default stress patterns in regular affixation, are accounted for through three cophonologies. Raramuri roots would still be classified into two different classes, depending on presence or absence of lexical stress. The asymmetry between weak and strong suffixes is characterized through indexing of constructions, rather than specific morphemes. The constructions in Cophonology A would have second syllable stress, while the constructions in Cophonology B would have third syllable stress.

Table 5 – Two types of constructions.

COPHONOLOGY A	COPHONOLOGY B
'Perfective'	'Future'
'Past Passive'	'Future plural'
'Imperative inclusive'	'Conditional'
'Future Passive'	'Inchoative'
'Perfective/Evidential'	'Stative'
'Causative'	'Transitivizer'
'Applicative'	'Derivational (to undo)'
'Participle'	'Locative' *(-tʃi)*
'Locative' (*-rare*)	'Possesive'
'Progressive'	'Imperative'

The distinction between weak and strong affixes is replaced with different cophonologies, and the previously unexplained emergence of third syllable stress with strong affixes falls out naturally from a cophonology analysis. The only general prosodic faithfulness constraint that is enforced in every cophonology is MAX-PROM. The over-arching window restriction can be attributed to a high ranked constraint that forces feet to the left edge of the prosodic word, ALL-FT-LEFT. ALL-FT-LEFT gives second syllable stress. Third syllable needs an additional component. To formalize third syllable stress in Cophonology B, I follow Zoll (2004), and resort to a ternary constituent, a foot with a single adjoined syllable:



This representation crucially groups three syllables into a constituent. The adjoined syllable violates the markedness constraint violated by non-strict layering (Selkirk (1984)), which Zoll labels "Strict". The ranking of this constraint is undetermined in the Master Ranking, and each cophonology specifies its relative ranking. In Cophonology A, STRICT is highly ranked, enforcing second syllable stress, while in

Cophonology B, it is ranked below PARSE-σ, allowing for ternary constituents with third syllable stress.

Since Raramuri has a non-iterating stress system ALL-FT-LEFT is ranked above PARSE-σ. Feet are iambic. The unstressability of certain affixes which precludes stress to the root is captured through a pattern of *positional markedness* attested in other languages (e.g. Tuyuca (Barnes 1996, Smith 1998)), where there is a default preference for stem stress with a Markedness constraint that is indexed to stems (as opposed to affixes):

25) STEMSTRESS 'Every stem has a stress'

The following ranking is inherited from the Master Ranking to each sub-grammar:

26) ALLFT-L >> STEMSTRESS, MAX-PROM >> IAMB >> PARSE-SYL

Cophonology A has the following ranking:

COPHONOLOGY A
ALL-FT-LEFT >> STEMSTRESS, **STRICT,** MAX-PROM >> IAMB >> PARSE-σ

The high ranked STRICT, ALL-FT-LEFT and IAMB generate second syllable stress in both disyllabic (Table 6) and trisyllabic (Table 7) unaccented roots.

Table 6 – 2nd syllable stress, disyllabic unaccented root

	/t͡ʃapi+ri/	ALL-FT-LEFT	STRICT	IAMB	PARSE-σ
a.	(t͡ʃápi)ri			*!	*
b.	t͡ʃa(píri)	*!*			*
c.	t͡ʃa(pirí)	*!*			*
☞ d.	(t͡ʃapí)ri				*
e.	(<t͡ʃa>pirí)		*!		

Table 7 – 2nd syllable stress, trisyllabic unaccented root

	/rait͡ʃa+ri/	ALL-FT-LEFT	STRICT	IAMB	PARSE-σ
a.	(raí)(t͡ʃarí)	*!**			
b.	rai(t͡ʃári)	*!**		*	**
c.	(rái)t͡ʃari			*!	**
☞ d.	(raí)t͡ʃari				**
e.	(<ra>it͡ʃá)ri		*!		*

The role of STEMSTRESS can be appreciated in the case of a monosyllabic unaccented root, where a degenerate foot is preferred over an iamb that assigns stress outside the stem (recall example (61)).

Table 8 – Monosyllabic unaccented root

	/ru+ri/	STEMSTRESS	IAMB	PARSE-σ
a.	(rurí)	*!		
b.	(rú)ri		*	*

In Cophonology B, on the other hand, the ban on ternary feet is low ranked:

COPHONOLOGY B
ALL-FT-LEFT >> STEMSTRESS, MAX-PROM >> IAMB >> PARSE-σ >> **STRICT**

The effect of this ranking is to prefer a ternary constituent (e), the winning candidate, over an unparsed syllable (c).

Table 9 – 3rd syllable stress , disyllabic unaccented root

	/tʃapi+sa/	ALL-FT-LEFT	IAMB	PARSE-σ	STRICT
a.	(tʃápi)sa		*!	*	
b.	tʃa(písa)	*!*	*	*	
c.	(tʃapí)sa			*!	
d.	tʃa(pisá)	*!*		*	
☞ e.	(<tʃa>pisá)				*

This ranking also correctly yields third syllable stress with an unaccented trisyllabic root.

Table 10 – 3rd syllable stress, trisyllabic unaccented root

	/raitʃ͡a+sa/	ALL-FT-LEFT	IAMB	PARSE-σ	STRICT
a.	(rái)tʃ͡asa		*!	**	
b.	rai(tʃ͡ásа)	*!*	*	**	
c.	(raí)tʃ͡asa			*!*	
d.	ra(itʃ͡á)sa	*!		**	
☞ e.	(<ra>Itʃ͡á)sa			*	*

The effect of STEMSTRESS is also felt in this cophonology. It crucially prevents that a disyllabic unaccented root gets third syllable stress in an "unstressable" affix

(Table11), while allowing third syllable stress with a trisyllabic root under the same string of affixes (Table 12).

Table 11 – disyllabic unaccented root under recursive affixation

	/awi+ti+sa/	STEMSTRESS	PARSE-σ	STRICT
☞ a.	(awí)tisa		**	
b.	(<a>wití)sa	*!	*	*

Table 12 – trisyllabic unaccented root under recursive affixation

	/rait͡ʃa+ti+sa/	STEMSTRESS	PARSE-σ	STRICT
a.	(raí)t͡ʃatisa		*****!*	
☞ b.	(<ra>it͡ʃá)tisa		****	*

Again, at this point it could only be stipulated that the affixes in Cophonology B, are not affected by this positional markedness constraint. It is this privilege of roots over affixes, plus the standard size of roots in the language (disyllabic and trisyllabic, but not longer) that most likely yields the trisyllabic window effect.

The compound stress rule is given by yet a third cophonology, in which a constraint would enforce faithfulness to the first syllable of the morphological heads.

27) ACCENT-TO-HEAD(σ_1)
The head of the compound must have an accent in the first syllable.

This constraint would be ranked below ALL-FT-LEFT but above MAX-PROM, to ensure the deletion of accent of both nouns and verbs in compound constructions. The compound construction receives stress in the first syllable of the head.

COPHONOLOGY C
ALL-FT-LEFT >> ACCENT-TO-HEAD(σ_1) >> MAX-PROM, STEMSTRESS >> STRICT

Table 13 – Compound stress

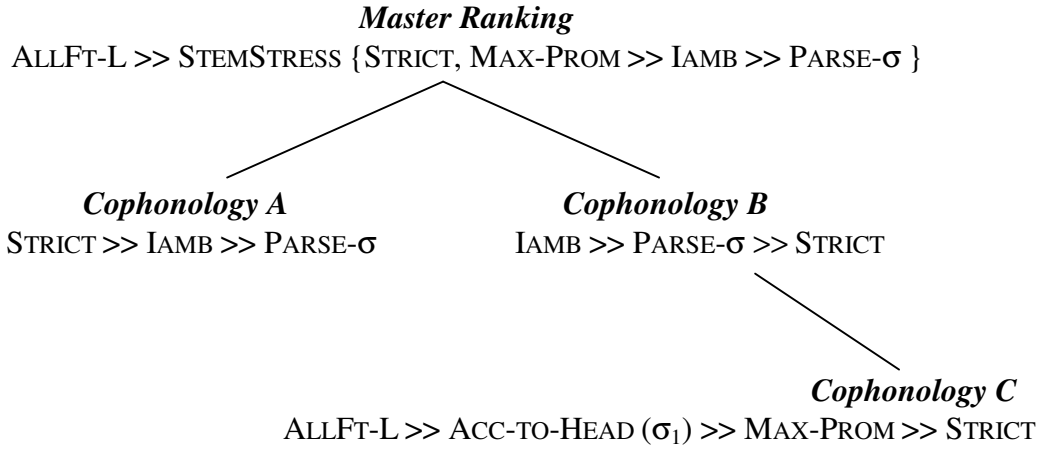
	/kawá+botá/	ALL-FT-LEFT	ACCENT-TO-HEAD(σ_1)	MAX-PROM	STRICT
a.	(kawá)-bota		*!	*	
b.	(kawá)(-botá)	*!***	*		
c.	Kawa(-botá)	*!***		*	
d.	Ka(wa-bó)ta	*!*		*	
☞e.	(<ka>wa-bó)ta			*	*

This constraint ranking also yields the truncation effect in compounds with trisyllabic nouns:

Table 14 – Truncation in Compounding

	/tʃaméka+répu/	ALL-FT-LEFT	ACCENT-TO-HEAD (σ_1)	MAX-PROM	STRICT
a.	(tʃamé)ka-repu		*!	*	
b.	(tʃamé)(ka-ré)pu	*!***	*		
c.	Tʃame(ka-ré)pu	*!***			
d.	(<tʃa>meká)-repu		*!	*	*
☞e.	(<tʃa>me-ré)pu				*

The following schema shows the relevant section of the grammar lattice in Raramuri for stress assignment. The requirement of feet to be built at the left edge of the prosodic word and the requirement to keep stress in the stem are undiminated in the Master Ranking. The different cophonologies must specify where do they rank STRICT, allowing or disallowing ternary feet. Cophonology C, the compound cophonology, must also include a constraint that assigns stress to the first syllable of the head.



Notice how Cophonology B and Cophonology C both allow the building of ternary feet. The argument so far for considering that the affixes in Cophonology B are not affected by the constraint StemStress relies on the assumption that diachronically, these suffixes have a more recent history of grammaticalization. This reduction process started after a regular compounding process. For example, the suffix *–bu*, a strong suffix, is a derivational suffix that has the meaning of "reversing" an action ('to untie' from 'tie', for example). This suffix is still used as a free-standing verb in other Raramuri dialects, as well as Guarijio. The connection between Cophonology B and Cophonology C is not random, and is probably from this preference for stem and the head of a construction in compounding that the window phenomenon arose.

In sum, it is proposed that there are three stress cophonologies in Raramuri, which determine the three detected grammatical stress patterns in this language:

a) Cophonology A: default second syllable stress.
b) Cophonology B: default third syllable stress.
c) Cophonology C: compound stress.

The next section contrasts the predictions of this analysis with one that handles the present empirical generalizations with a single ranking, through indexing faithfulness constraints to roots and affixes.

5.2 A ROOT CONTROLLED ACCENT ANALYSIS OF RARAMURI.

In the previous section, I showed how a cophonology analysis accounts for two default stress patterns plus a morphological compound stress rule in the Raramuri stress system. In this section, I will consider an alternative analysis in which the Raramuri facts would be explained through a single ranking, without appealing to any phonological sub-grammar.

The Root Controlled Accent (RCA) hypothesis (Alderete 1997, 1999, 2001) follows the Morphologically-Dispersed Faithfulness meta-constraint (McCarthy & Prince 1995) (Root Faith >> Affix Faith), and treats accent resolution as another case of root-privilege. Given the culminative nature of accent, competing lexical accents in a word lead to an accent resolution that favors the root:

(Alderete 1999:33)

28) Root Controlled Accent Hypothesis:
If one accent is deleted in mappings from lexical level to surface level in a word with more than one inherent accent, then root accent will be realized over any other accent in the word.

Under this approach, a set of highly ranked Prosodic Faithfulness constraints (MAX-PROM, DEP-PROM, NOFLOP-PROM) enforces the realization of underlying accent in its original position. When prosodic faithfulness is indecisive (i.e., when the input lacks accentual information), the invariant, lower ranked markedness constraints yield default stress assignment.

The properties of the Raramuri stress system are easily translatable into an RCA analysis: underlying accent of roots prevails in numerous morphological contexts where affixes, the ones I have labeled 'strong', are arguably so because they are lexically accented. Affixal accent would only be realized in words with unaccented roots. Roots are 'strong' positions, and indexing prosodic faithfulness constraints to roots and affixes takes care of the asymmetry between the strong and weak positions.

In an RCA analysis, prosodic faithfulness must be ranked above the markedness constraints that give second syllable stress (IAMB and PARSE-σ). Prosodic faithfulness cannot, however, be undominated: the stress window strictly confines input accentual information to the first three syllables. Raramuri is a 'hybrid accent' system, i.e., a system in which accent is contrastive in some contexts, but over-arching constraints limit the distribution of the accentual contrast (Alderete 2001:21). In an approach like the

RCA, the hybrid system is modeled through interleaving of Prosodic Faithfulness between markedness constraints, yielding the limitations on contrastive accent to, for instance, a stress window.

The RCA correctly predicts second syllable stress and third syllable stress through the interaction of root accent vs. affix accent. The ranking ALL-FT-L >> PROS-FAITHaffix prevents trisyllabic unaccented roots from having stress on an accented suffix (the 4th syllable). The single ranking would be:

ALL-FT-L >> P-FAITHroot >> IAMB >> P-FAITHaffix >> STRICT >> PARSE-σ

This ranking yields the right results, except for trisyllabic unaccented roots plus accented affixes. In these cases, ALL-FT-L is violated by the candidates that are faithful to the affix ((a) and (b)). The remaining candidates ((c) and (d)) violate faithfulness to the affix. The ranking STRICT >> PARSE-σ, however, yields the *wrong result*: the wining candidate is the form with second syllable stress, and not the attested third syllable stress form. Consider Table (9).

Table 9 – Trisyllabic unaccented root plus accented affix

		/anat͡ʃa+sá/	ALL-FT-L	P-FAITHaffix	STRICT	PARSE-σ
	a.	(aná)(t͡ʃasá)	*!**			
	b.	<a>na(t͡ʃasá)	*!*			**
(☞)	c.	(aná)t͡ʃasa		*		****
💣	d.	(<a>nat͡ʃá)sa		*	*!	**

If we were to rank PARSE-σ above STRICT, we would have the right result with this case, but the wrong result when the same root would take a weak/unaccented affix, yielding third syllable stress when the attested form has second syllable stress. In other words, under the current ranking, these forms generate a ranking paradox.

All trisyllabic roots with third syllable stress would have to be assumed to be accented. An alternation like the one depicted in (18), where an unaccented root has second syllable stress with an "unaccented" suffix (a**ná**t͡ʃa-ri), but third syllable stress with an "accented" one (anat**͡ʃá**-sa), is left unexplained under the single ranking approach. The prediction is that when the undominated alignment constraint restricts lexical accent from surfacing in its original position, it is expected that the established default second syllable stress be assigned instead. It is impossible to model third syllable stress in these cases. Not only second syllable stress, but also third syllable stress is a default pattern.

An RCA account, in addition, fails to account for the compound stress pattern, a dominance pattern, plus the existence of two default stress patterns, that privilege roots over affixes through positional markedness. The existence of multiple default patterns challenges the core assumption of this kind of approach, in which Markedness constraints remain unaltered in a single ranking in a given language, thus precluding any markedness

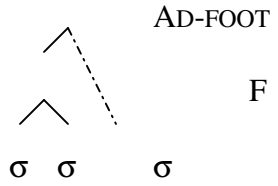
reversals. It seems, however, that the only way of modeling the Central Raramuri pattern with the RCA assumptions is precisely through a markedness reversal.

Finally, the RCA correctly emphasizes the asymmetry between roots and affixes in the resolution of accent, but it wrongly implies that this asymmetry is only possible when accent is present in the input. That is, only through positional faithfulness are roots conferred a privileged role over affixes. But roots also prevail in default stress assignment, an important generalization that the RCA is not able to capture.

6. A FEW REMARKS ON INITIAL THREE-SYLLABLE STRESS WINDOWS.

The main focus of this paper is the challenge that the mixed nature of Central Raramuri stress poses to theories of morphologically conditioned phonology. But this system is also typologically and theoretically relevant for its initial three-syllable window. While antepenultimate stress is not infrequent, third-syllable stress is a pattern that is highly marked cross-linguistically (Hyman 1977, Kager 1993).

In the previous section, I represented third syllable stress through a ternary constituent, a foot with a single adjoined syllable, which violates a low ranking STRICT constraint (Zoll 2004).[17]



There are, however, alternative ways to handle ternary stress systems. Some of them are:

a) Final exclusion –(Extrametricality (Hayes 1995))
b) Lapse (Elenbaas & Kager 1999)
c) Edge marking and edge avoidance (Idsardi 1992, Beasley & Crosswhite 2003).

These approaches differ in their factorial typologies, predicting different possible ternary systems. Not all are capable of predicting ternary window effects. According to Zoll (2004), window effects cannot be modeled with Final Exclusion (invisibility of final constituent from metrical structure). This is because IO-Faithfulness must outrank whatever constraint that bans metrical structure on a final constituent (e.g., No-Foot-on-Final), in order to preserve lexical stress. But this constraint does not restrict how far left

[17] Others who have argued for a similar constituent include Prince (1980), Selkirk (1980), McCarthy (1982), Ito and Mester (1992(2003)), Blevins and Harrison (1999), among others (cited in Zoll 2004).

can stress be, incorrectly generating forms that do not maintain antepenultimacy (Beasley & Crosswhite 2003, Zoll 2004).[18]

The Lapse constraint was devised to solve this problem, by allowing a sequence of two unstressed syllables, but banning a sequence of three unstressed syllables (*LAPSE = "Every weak beat must be adjacent to a strong beat or the word edge" (Elenbaas & Kager 1999)). But LAPSE does not ban unlimited *pretonic* lapses (Zoll 2004), falling into the same problem as the Final Exclusion approach - a failure to capture alternations that maintain a ternary window.

Edge marking, on the other hand, is an alternative to extrametricality that resorts to pre-assigned foot brackets (Idsardi 1992, Beasley & Crosswhite 2003). In this rule-based approach, a constituent boundary is inserted next to a word edge before other metrical rules apply. In order to model antepenultimate stress, for example, a boundary is inserted to the left of the rightmost syllable, which results in the final syllable being excluded: xxx)x#. A point made by Beasley & Crosswhite (2003) is that it is possible to generate a single ternary constituent at the left edge with Idsardi's edge marking rules, through successive insertion of edge marks (Edge: LRL) and posterior Iterative Constituent Construction from left to right (ICC: L → R). Edge marking thus seems to be equally well suited as the ternary constituent Ad-Foot to represent Central Raramuri's initial three-syllable window.

7. CONCLUSIONS.

This paper presented the empirical generalizations of Central Raramuri stress, a mixed stress system, which includes two defaults, second and third syllable stress, when no lexical information for accent is present in the input. In addition, Raramuri has a dominance pattern, the compound stress rule, which deletes any input lexical accent, and assigns stress to the first syllable of the head of the construction.

I propose that these descriptive facts are captured through three cophonologies relevant for stress in Central Raramuri. Third syllable stress is present in two of these cophonologies. Third syllable stress was represented through a ternary constituent. The existence of two default patterns plus a dominance pattern with the compound construction fall out naturally from a cophonology analysis, in which morphologically conditioned phonology is handled through general phonological constraints and multiple rankings.

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[18] And, of course, ternarity would be restricted to the right edge, given that extrametricality is handled as *final* invisibility or unstressability (although there are well-known cases of *initial* extrametricality (e.g. Kashaya (Buckley 1994)).

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