Morphologically conditioned stress assignment in Choguita Rarámuri*

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This paper investigates the morphologically conditioned stress system of a previously undocumented Uto-Aztecan language, Choguita Rarámuri (Tarahumara). Stress distribution in Choguita Rarámuri results from a complex interaction between lexically pre-specified stress, two systematic sub-patterns (second and third syllable stress), a stress rule specific to noun incorporation constructions, and an initial three-syllable window, a highly unusual typological pattern. This paper presents a Cophonology analysis that captures the full range of stress alternations in this language through the association of morphological constructions with fully general phonological subgrammars, and through the association of morphologically conditioned phonological effects to the hierarchical structure of morphologically complex words. The Cophonology analysis is contrasted with a Root Controlled Accent (RCA) analysis, an indexed constraint analysis argued for in Alderete (2001a, 2001b) to account for the stress patterns of Cupeño, a Uto-Aztecan language with stress alternations similar to those attested in Choguita Rarámuri. In an RCA analysis, stress alternations are derived through a single constraint ranking and faithfulness constraints indexed to specific morphological contexts. This paper argues that an analysis that overlooks morphological constituency and which indexes faithfulness constraints to morphological environments undergenerates in the Choguita Rarámuri case.

1. Introduction

Phonological effects that are specific to particular morphological contexts are widespread cross-linguistically and have significant consequences for developing theories of the phonology-morphology interface. Currently, there are two main competing models of language-internal phonological variation, both couched in Optimality Theory (OT; McCarthy and Prince 1993; Prince and Smolensky 1993): Indexed Constraint Theory (Hammond 1994; Pater 1995, 2000, 2007, 2009; McCarthy and Prince 1995; Smith 1997; Benua 1997a, 1997b; Itô and Mester 1999; Alderete 2001a, 2001b), where morphologically conditioned phonology is modeled through a single constraint ranking and constraints indexed lexically for specific morphological environments; and Cophonology Theory (Orgun 1996; Anttila 1997, 2002; Inkelas 1998; Yu 2000; Orgun and Inkelas 2002; Inkelas and Zoll 2005, 2007), where each morphological construction might be associated with a phonological subgrammar consisting of fully general constraints.

This paper presents a theoretically relevant case of morphologically conditioned phonology, the stress system of Choguita Rarámuri (henceforth CR), a Uto-Aztecan language. Stress assignment in this language is dependent on morphological structure and results from a complex interaction between lexically specified stress, two systematic (default) sub-patterns (second and third syllable stress), and a stress rule that favors the first syllable of the head of a morphological construction (e.g., the second element in incorporation constructions).

Furthermore, this language possesses an initial three-syllable stress window, a highly typologically unusual pattern that, to the best of my knowledge, has only been documented in four other languages to date (Kager 1993, Hualde 1998, van der Hulst 1999). I propose that the whole range of stress facts attested in CR can be captured through a Cophonology analysis, where different kinds of morphological constructions are associated with different phonological rankings, yielding a mixed binary/ternary system. I show that the existence of two default stress patterns falls naturally from the Cophonology model.

The Cophonology analysis is contrasted with an alternative monostratal, indexed faithfulness constraint analysis argued for in Alderete (2001a, 2001b), to account for the stress patterns of Cupeño, a Uto-Aztecan language with stress alternations similar to those attested in CR. I propose that this particular kind of analysis, known as Root Controlled Accent, undergenerates in the CR case, by predicting that a single default pattern will determine the stress makeup of words containing no lexically specified stress and by not taking into account the role of constituency in morphologically complex words in determining morphologically conditioned phonology.

This paper is structured as follows. In Section 2, I present the distributional properties of CR stress, including the evidence for positing an initial three-syllable stress window. In Section 3, I provide the Cophonology analysis of CR stress. An alternative Root Controlled Accent analysis is presented in Section 4. I conclude in Section 5 with a summary.

2. Choguita Rarámuri stress assignment

Rarámuri, also known as Tarahumara, is a Uto-Aztecan language of the Taracahitan branch spoken in the southwestern part of the Mexican State of Chihuahua, in the Sierra Tarahumara. This paper is concerned with the variety of Rarámuri spoken in Choguita (Guachochi municipality), which is spoken by approximately one thousand people (Casaus in prep.). CR is almost exclusively suffixing (there is no productive prefixation), highly agglutinating, with multiple valence-increasing markers, and a layered (non-templatic) hierarchical structure with different degrees of morphophonological cohesion (Caballero 2008). There is semantic, morphotactic and phonological evidence for positing the following representation of CR verbal morphology (schematized in Table 1). The suffix positions in the verbal complex are grouped into six verbal zones.[1]

Table 1: Categories expressed in the Choguita Rarámuri verb and verbal domains

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
	INCH	TR	APPL	CAUS	APPL	DESID	MOT	EV	Voice/ Aspect	TAM	TAM	SUB
Inner Stem	Derived Stem		Syntactic Stem			Aspectual Stem			Finite Verb			Subordinate Verb

The data presented in this paper comes from field research conducted by the author in Choguita between 2003 and 2009.[2]

In addition to stress, CR word prosody involves a tone system which is dependent on stress: each word obligatorily has a stressed syllable which contrasts an /H/, /L/ or /Ø/ tone. The dependence of tone on stress is further evidenced by the fact that removal of stress involves the neutralization of tonal contrasts (Caballero 2010). Given that stress assignment is not dependent on tone, tone will not be considered any further in this paper.

2.1. *Phonetic and phonological properties of stress*

CR exhibits both phonetic and phonological properties of stress systems. First, all lexical words have at least one syllable marked with the highest degree of metrical prominence, i.e., there are no lexical words that lack lexical prominence (the 'obligatoriness parameter' (Hyman 2006)). Second, there is *only one* syllable in the word with the highest degree of prominence (the 'culminativity' parameter (Hyman 1977, 1978; Beckman 1986; Hayes 1995, Hyman 2006)). These two criteria are ambiguous between stress and pitch-accent, but CR displays three further phonetic properties that are unique to stress systems: i) increased phonetic duration of stressed vowels, ii) reduction of unstressed vowels, and iii) augmentation of onsets in stressed syllables (for general discussion of the distinction between stress and pitch-accent systems, see Poser 1984; Hyman and Wilson 1991; Hyman 1977, 2001; and Inkelas and Zec 1988).

CR stressed syllables are characterized by increased duration. Impressionistically, stressed vowels in open syllables are significantly longer than unstressed vowels in open syllables.[3] The difference in articulation of stressed vs. unstressed vowels is also reflected in tendency of unstressed vowels to be more centralized (de Jong 1995; Gussenhoven 2004): unstressed vowels are often reduced to schwa (1a) – (1b), neutralized in height (1c) – (1d) or deleted altogether (1e) – (1f). Relevant vowels are underlined. The rightmost column motivates the underlying vowel quality of target vowels (vowel reduction and deletion is blocked in word final position (Caballero 2008)).

(1)	a.	[t͡ʃipó-rə̱-ma]	/t͡ʃipó-ri̱-ma/	'bounce-CAUS-FUT.SG'[4]	[t͡ʃipó-ri̱]
	b.	[pórə̱-ki]	/póri̱-ki/	'cover-PST.1'	[póri̱]
	c.	[t͡ʃihá-ni̱-ri]	/t͡ʃiha-na̱-li/	'scatter-TR-PST'	[t͡ʃihá-na̱]
	d.	[tijópi̱-t͡ʃi]	/tijopa̱-t͡ʃi/	'church-LOC'	[tiyópa̱]
	e.	[ná:r-ki=ni]	/nári-ki=ni/	'ask-PST.1=1SG.NOM'	[nári̱]
	f.	[to-ná:l-t͡ʃin-]	/to-nále̱-t͡ʃane-/	'take-DESID-EV-EP'	[to-nále̱]

The forms in (1) exemplify reduction and syncope of the immediately posttonic vowel.[5] Although there is a process of mid front vowel height neutralization that targets both pretonic and posttonic vowels, unstressed vowel reduction and deletion are processes most frequently attested in posttonic vowels, i.e., a wider arrange of vocalic contrasts are licensed pretonically than posttonically (see Caballero 2008 for more details on vowel reduction and deletion). In addition, there is no auditory or phonological evidence for secondary stress.

Another correlate of stress is augmentation of onset consonants in stressed syllables. In CR, voiceless plosives onsets of stressed syllables display slight aspiration (2a) – (2d), a phenomenon that does not affect the onsets of stressless syllables (2e) – (2g). The degree of aspiration is greater in word-initial position, but is attested word-medially as well (relevant onsets are bold-faced).[6]

(2)	a.	[**p**^{h}á]	'throw'	[BFL 05 1:112/el]
	b.	[**t**^{h}óo-ru]	'bury-PST.PASS'	[SFH 07 el417/el]
	c.	[na**p**^{h}á]	'hug'	[BFL VDB/el]
	d.	[su**p**^{h}ániri]	'adobe'	[SFH 03 VM03/el]

	e.	[**t**it͡ʃí]	'comb'	[RF 03 1:116/el]
	f.	[**p**ot͡ʃí]	'jump'	[SFH 05 1:140/el]
	g.	[sa**p**ará]	'fatten'	[BFL 05 1:171/el]

There are phonological and morphological sources for derived vowel length in CR, including compensatory lengthening, semi-vowel monophthongization, and minimal word size restrictions. These derived long vowels, however, do not play any role in determining stress location. There is in fact no single general phonological process that models stress location in CR. The distributional properties of CR stress are addressed next.

2.2. *Distributional properties of stress*

Assuming we are correct in interpreting CR word prominence as stress, we now turn to the details of its distribution.

2.2.1. *Alignment.* As exemplified in the morphologically complex words below, words can be stressed on the first (3a) – (3c), second (3d) – (3f) or third syllable (3g) – (3j) (stressed vowels are bold-faced).[7]

(3)	a.	/h**ú**misi-li/	'take.off.PL-PST'	[SFH 05 1:101/el]
	b.	/**é**ri-simi/	'close-MOT'	[SFH 08 1:142/el]
	c.	/k**é**t͡ʃi-si-nale/	'chew-MOT-DESID'	[SFH 08 1:146/el]
	d.	/pot͡ʃ**í**-po/	'jump-FUT.PL'	[SFH 05 1:69/el]
	e.	/pot͡ʃ**í**-ti-si-ma/	'jump-CAUS-MOT-FUT.SG'	[SFH 08 1:72/el]
	f.	/at**í**si-t͡ʃa-nale/	'sneeze-EV-DESID'	[SFH 07 1:73/el]
	g.	/amat͡ʃ**í**-a/	'pray-PRS'	[SFH 04 1:133/el]
	h.	/amat͡ʃ**í**-si-ma/	'pray-MOT-FUT.SG'	[SFH 08 1:142/el]
	i.	/basar**ó**wa-na-ma/	'stroll-DESID-FUT.SG'	[SFH 07 1:150/el]
	j.	/kot͡ʃi-n**á**le-si-li/	'sleep-DESID-MOT-PST'	[SFH 08 1:71/el]

While the forms in (4a), (4c), and (4e) below could be ambiguous between second and third syllable stress and penultimate and antepenultimate stress, embedding these forms in further morphology reveals that the correct generalization about stress assignment can only be made with respect to the left edge of the prosodic word. In each pair of morphologically related words in (4), stress is constantly on the second or third syllable.

(4)	a.	/pot͡ʃ**í**-po/	'jump-FUT.PL'	[SFH 05 1:69/el]
	b.	/pot͡ʃ**í**-ti-si-ma/	'jump-CAUS-MOT-FUT.SG'	[SFH 08 1:72/el]
	c.	/at**í**si-ma/	'sneeze-FUT.SG'	[BFL 05 1:111/el]
	d.	/at**í**si-t͡ʃa-nale/	'sneeze-EV-DESID'	[SFH 07 1:73/el]
	e.	/basar**ó**wi-ki/	'stroll-PST.1'	[BFL 05 1:162/el]
	f.	/basar**ó**wi-ni-ma/	'stroll-DESID-FUT.SG'	[SFH 07 1:150/el]

The next section describes how stress assignment in CR is dependent on the stress properties of roots and morphological constructions.

2.2.2. *Root types and stress properties of morphological constructions.* Stress is part of the underlying representation of at least some morphemes. The examples in (5) illustrate stress minimal pairs.

(5)	a.	*sáwa* 'smell'	[BFL 05 1:113/el]	b. *sawá* 'leaf'	[SFH 05 1:72/el]
	c.	*kót͡ʃi* 'pig'	[BFL 06 tx48/tx]	d. *kot͡ʃí* 'dog'	[LEL 06 tx84/tx]
	e.	*kóri* 'visit'	[BFL 05 1:111/el]	f. *korí* 'chile peper'	[GFM el741/el]
	g.	*mísa* 'mass'[8]	[BFL 08 1:65/el]	h. *misá* 'crush'	[JHF 05 1:2/el]
	i.	*nówi* 'have son'	[SFH 04 1:114/el]	j. *nowí* 'maggot'	[LEL 06 5:68/el]

Although the position of stress is lexically governed in some words, CR has words that receive default stress assignment. Roots in this language fall into two classes: stressed and unstressed. Stressed roots retain stress in a fixed syllable in morphologically complex constructions throughout derivation. The position of stress in these cases is unpredictable in terms of phonological grounds (Hyman 1977; Hayes 1995). In words containing unstressed roots, on the other hand, location of stress depends on particular morphological contexts. I assume that stressed roots are lexically pre-specified with a diacritic mark that is phonetically realized as stress in output forms, and that unstressed roots are not lexically pre-specified for stress and receive stress by default.[9] The contrast between stressed and unstressed roots becomes apparent when considering the different stress patterns of verbal roots that add the conditional suffix *-sa* (6).[10] Lexical stress is represented through underlining in underlying representations.

(6)		UR	Gloss	Bare stem[11]	Conditional	
	a.	/ku̲t͡ʃi/	'have child'	*kút͡ʃi*	*kút͡ʃi-sa*	[FLP in63(115)/tx]]
	b.	/la̲ni/	'bleed'	*láni*	*láni-sa*	[BFL 04 1:89/el]
	c.	/bure̲/	'tie'	*buré*	*buré-sa*	[SFH 05 1:93/el]
	d.	/reʔe̲/	'play'	*reʔé*	*reʔé-sa*	[BFL 04 1:75/el]
	e.	/t͡ʃapi/	'grab'	*t͡ʃapí*	*t͡ʃapi-sá*	[SFH 05 1:102/el]
	f.	/mat͡ʃi/	'toast corn'	*mat͡ʃí*	*mat͡ʃi-sá*	[SFH 05 1:79/el]
	g.	/osa/	'read/write'	*osá*	*osi-sá*	[JHF 04 1:5/el]
	h.	/kot͡ʃi/	'sleep'	*kot͡ʃí*	*kot͡ʃi-sá*	[SFH 04 1:97/el]

Stressed roots have fixed stress in the first (6a) – (6b) or second (6c) – (6d) syllable, whether bare or suffixed with the Conditional *-sa* suffix. In words containing unstressed roots (6e) – (6h), on the other hand, stress falls on different positions across the paradigm, the second syllable in bare stems or the third syllable when inflected with the Conditional suffix.

The Conditional suffix is part of a class of suffixes that may bear stress when attaching to unstressed roots. I will refer to this class of suffixes as *stress-shifting*. These stress-shifting suffixes contrast with another class of suffixes that do not perturb the stress makeup of the roots to which they attach, *stress-neutral suffixes*. The forms in (7) illustrate the behavior of stress-neutral suffixes (the roots in these examples are the same as in (6)).

(7)	UR	Gloss	Bare stem	Past	
a.	/kut͡ʃi/	'have child'	*kút͡ʃi*	*kút͡ʃi-li*	[SFH 05 1:83/el]
b.	/lani/	'bleed'	*láni*	*láni-li*	[RF 04 1:82/el]
c.	/bure/	'tie'	*buré*	*buré-li*	[SFH 05 1:93/el]
d.	/reʔe/	'play'	*reʔé*	*reʔé-li*	[BFL 04 1:75/el]
e.	/t͡ʃapi/	'grab'	*t͡ʃapí*	*t͡ʃapí-li*	[JHF 05 1:102/el]
f.	/mat͡ʃi/	'toast corn'	*mat͡ʃi*	*mat͡ʃi-li*	[SFH 05 1:79/el]
g.	/osa/	'read/write'	*osá*	*osá-li*	[SFH 05 1:78/el]
h.	/kot͡ʃi/	'sleep'	*kot͡ʃi*	*kot͡ʃi-li*	[LEL tx5(52)/tx]

In (7), both stressed and unstressed roots keep stress in the same position across the paradigm, whether they are bear stems or attaching a stress neutral suffix.

A non-exhaustive list of the two types of suffixes (exemplified with the unstressed root *sukú* 'to scratch') is provided in Table 2.

Table 2: Stress-neutral and stress-shifting verbal suffixes

Stress-neutral		Stress-shifting	
Causative *–ti*	*suk**ú**-ti*	Desiderative *–nale*	*suku-n**á**le*
Ass. Motion *-simi*	*suk**ú**-simi*	Future Passive *-pa*	*suku-p**á***
Evidential *-t͡ʃane*	*suk**ú**-t͡ʃane*	Habitual passive *-wa*	*suku-w**á***
Past Passive *-ru*	*suk**ú**-ru*	Cond. Passive *-suwa*	*suku-s**ú**wa*
Past *-li*	*suk**ú**-li*	Future Singular *-mea*	*suku-m**é**a*
Imperative *-ri*	*suk**ú**-ri*	Future Plural *-bo*	*suku-b**ó***
Reportative *–ra*	*suk**ú**-ra*	Conditional *–sa*	*suku-s**á***

The next section addresses the stress alternations attested in roots of different types.

2.2.3. *Stress alternations by root type.* Disyllabic roots can be underlyingly stressed (8a) – (8d) or unstressed (8e) – (8f). All disyllabic roots with first syllable stress are lexically stressed.

(8)	UR	Gloss	Bare	Shifting FUT.SG	Neutral PST	
a.	/pút͡ʃi/	'blow'	*pút͡ʃi*	*pút͡ʃi-ma*	*pút͡ʃi-li*	[BFL 04 1:112/el]
b.	/éri/	'lock, close'	*éri*	*éri-ma*	*éri-li*	[SFH 05 1:68/el]
c.	/bené/	'learn'	*bené*	*bené-ma*	*bené-li*	[RF 04 1:9/el]
d.	/semé/	'play violin'	*semé*	*semé-ma*	*semé-li*	[SFH 04 1:85/el]
e.	/uku/	'rain'	*ukú*	*uku-méa*[12]	*ukú-li*	[BFL 04 1:92/el]
f.	/rono/	'boil'	*ronó*	*rono-méa*	*ronó-li*	[SFH 04 1:81/el]

There are also stressed trisyllabic roots, with fixed first syllable stress (9a), second syllable stress (9b) – (9d) or fixed third syllable stress (9e) – (9g):

(9)		UR	Gloss	Bare	Shifting FUT.SG	Neutral PST	
	a.	/humisi/	‘take off, pl’	*húmisi*	*húmisi-ma*	*húmisi-li*	[SFH 05 1:101/el]
	b.	/nateti/	‘pay’	*natéti*	*natéti-ma*	*natéti-li*	[SFH 07 2:66/el]
	c.	/nahata/	‘follow’	*naháta*	*naháti-ma*	*naháti-li*	[SFH 05 1:181/el]
	d.	/ot͡ʃopi/	‘stick’	*ot͡ʃópi*	*ot͡ʃópi-ma*	*ot͡ʃópi-li*	[BFL 04 1:113/el]
	e.	/binihi/	‘acuse’	*binihí*	*binihí-ma*	*binihí-li*	[LEL 07 VDB/el]
	f.	/bahure/	‘invite’	*bahuré*	*bahuré-ma*	*bahuré-li*	[BFL 05 1:134/el]
	g.	/sukut͡ʃu/	‘scratch’	*sukut͡ʃú*	*sukut͡ʃú-ma*	*sukut͡ʃú-li*	[LEL 06 tx32/tx]

Unstressed trisyllabic roots have second syllable stress (10a) – (10c) or third syllable stress (10d) – (10f) across paradigms. Trisyllabic roots with first syllable stress, like disyllabic roots with first syllable stress, are all lexically stressed.

(10)		Form	Gloss	Stress position	
	a.	*anát͡ʃa-li*	‘endure-PST’	2nd syllable	[RF 04 1:123/el]
	b.	*anát͡ʃa-ti*	‘endure-CAUS’	2nd syllable	[RF 04 1:123/el]
	c.	*anát͡ʃa-i*	‘endure-IMPF’	2nd syllable	[RF 04 1:123/el]
	d.	*anat͡ʃá-ma*	‘endure-FUT.SG’	3rd syllable	[RF 04 1:123/el]
	e.	*anat͡ʃá-ba*	‘endure-FUT.PASS’	3rd syllable	[RF 04 1:123/el]
	f.	*anat͡ʃá-nale*	‘endure-DESID’	3rd syllable	[RF 04 1:123/el]

The stress shifts that the verbal root *anát͡ʃa* undergoes in (10) parallels those of unstressed disyllabic roots (e.g., in (6e) – (6h) and (8e) – (8f) above): the position of stress shifts across derivation depending on the type of the suffix added (second syllable when inflected with stress-neutral suffixes (10a) – (10c), and third syllable when inflected with stress-shifting suffixes (10d) – (10f)).

These forms also show that stress-neutral suffixes are not pre-stressing, as could have been assumed from the stress pattern of unstressed disyllabic roots. If stress-neutral suffixes were pre-stressing, we would expect third-syllable stress with trisyllabic unstressed roots, immediately preceding the suffixes, instead of the attested second syllable stress. Hypothetical, unattested forms illustrate this in the last column in (11).

(11)					
	a.	*nasówa-li*	‘mix-PST’	[RF 04 1:123/el]	**nasowá-li*
	b.	*nasówa-a*	‘mix-PRS’	[RF 04 1:123/el]	**nasowá-a*
	c.	*raʔáma-li*	‘give.advice-PST’	[RF 04 1:64/el]	**raʔamá-li*
	d.	*raʔáma-ki*	‘give.advice-PST.1’	[RF 04 1:64/el]	**raʔamá-ki*

In addition to not being pre-stressing, stress-neutral suffixes are never stressed. Following the pattern of unstressed trisyllabic roots, we would expect unstressed disyllabic roots adding a stress-neutral suffix (like Causative *-ri*) and a stress-shifting suffix (like Future Singular *–ma*) to have third syllable stress (since unstressed trisyllabic roots (e.g. (10)) have third-syllable stress when attaching a stress-shifting suffix). These verbs, however, have second-syllable stress. This is shown in (12).

(12)	a.	*awí-ti-sa*	**awi-tí-sa*	'dance-CAUS-COND'	[SFH 08 1:112/el]
	b.	*rarí-si-ma*	**rari-sí-ma*	'buy-MOT-FUT.SG'	[AH 05 1:130/el]
	c.	*osí-si-ma*	**osi-sí-ma*	'read-MOT-FUT.SG'	[SFH 05 1:78/el]
	d.	*t͡ʃoní-ki-ma*	**t͡ʃoni-kí-ma*	'fist.fight-APPL-FUT.SG'	[SFH 05 1:67/el]

The unstressability of stress-neutral suffixes is further evidenced by the stress properties of unstressed monosyllabic roots. These roots shift stress to stress-shifting suffixes, as shown in (13d) – (13f).

(13)	a.	*rú-ki*	'say-PST.1'	**ru-kí*	[JH 04 1:27/el]
	b.	*rú-li*	'say-PST'	**ru-lí*	[JH 04 1:27/el]
	c.	*rú-simi*	'say-MOT'	**ru-sími*	[RF 04 1:102/el]
	d.	*ru-méa*	'say-FUT.SG'		[JH 04 1:27/el]
	e.	*ru-sá*	'say-COND'		[RF 04 1:102/el]
	f.	*ru-bó*	'say-FUT.PL'		[JH 04 1:27/el]

Finally, following the pattern of disyllabic and trisyllabic unstressed roots, it could have been expected that the forms in (13a) – (13d) would have second syllable stress when adding stress-neutral suffixes. Instead, stress in these words is in the first syllable, the root. Thus, the stress pattern associated with stress-neutral suffixes must meet the condition of being assigned within the root (i.e., stress-neutral suffixes are not part of the stress domain).

So far it has been shown that, as long as stress is assigned within a stressable domain, unstressed roots receive stress through two regular sub-patterns, second syllable stress and third syllable stress, specific to two sets of morphological constructions (with stress-neutral and stress-shifting suffixes, respectively). Bare stems of unstressed verbs have second syllable stress. The prominence of second syllable stress (a pattern reconstructed for Proto-Uto-Aztecan (Munro 1977)) suggests that CR has a left-aligned iambic system.

There is only a small set of verbs that does not fit this generalization: a few disyllabic roots that have first syllable stress when adding stress-neutral suffixes and second syllable stress when adding stress-shifting suffixes, instead of the expected second and third syllable patterns, respectively. From a corpus of 700 verbal roots, eight roots exhibit this behavior. An exhaustive list is given in (14):

(14)		UR	Gloss	Shifting FUT.SG	Neutral PST	
	a.	/uba/	'bathe'	*ubá-ma*	*úbi-li*	[RF 04 1:102/el]
	b.	/not͡ʃa/	'work'	*not͡ʃá-ma*	*nót͡ʃi-li*	[SFH 05 1:97/el]
	c.	/seba/	'reach'	*sebá-ma*	*sébi-li*	[BFL 05 1:171/el]
	d.	/t͡ʃuta/	'sharpen'	*t͡ʃutá-ma*	*t͡ʃúti-li*	[RF 04 1:122/el]
	e.	/pewa/	'smoke'	*pewá-ma*	*péwi-li*	[RF 04 1:122/el]

f.	/t͡ʃota/	‘begin’	*t͡ʃotá-ma*	*t͡ʃóti-li*	[LEL 06 5:36/El]
g.	/soma/	‘wash head’	*somá-ma*	*sómi-li*	[BFL 06 FN4-23/el]
i.	/nata/	‘think’	*natá-ma*	*náti-li*	[SFH 04 1:67/el]

I will analyze these roots as having lexically specified stress and stress alternations.[13]

In sum, I have shown so far that CR roots are either stressed or unstressed and that suffixes are either stress-shifting (i.e., stress perturbing) or stress-neutral. While stress-shifting suffixes are part of the stressable domain, stress-neutral suffixes are never stressed. Stressed roots have fixed stress across morphological contexts and unstressed roots display systematic sub-patterns: second-syllable stress when attaching stress-neutral suffixes and third-syllable stress when attaching stress-shifting suffixes.

Table 3 summarizes the stress patterns attested in CR according to root type (in terms of size and stress properties), and suffix type (stress-shifting and stress-neutral). Only words with one layer of affixation are exemplified. Stress in roots is marked through underlining; stress-shifting suffixes are marked with bold-face.

Table 3: CR stress patterns by root and suffix type

Monosyllables	/σ̲ + **σ**/	First syllable stress	*s̲ú̲-**sa***	‘sew-COND’
	/σ̲ + σ/	First syllable stress	*s̲ú̲-li*	‘sew-PST’
	/σ + **σ**/	Second syllable stress	*ru-**sá***	‘say-COND’
	/σ + σ/	First syllable stress	*rú-li*	‘say-PST’
Disyllables	/σ̲ σ + **σ**/	First syllable stress	*t̲á̲ni-**sa***	‘borrow-COND’
	/σ̲ σ + σ/	First syllable stress	*t̲á̲ni-li*	‘borrow-PST’
	/σ σ̲ + **σ**/	Second syllable stress	*kat̲͡ʃ̲i̲-**sa***	‘spit-COND’
	/σ σ̲ + σ/	Second syllable stress	*kat̲͡ʃ̲i̲-li*	‘spit-PST’
	/σ σ + **σ**/	Third syllable stress	*awi-**sá***	‘dance-COND’
	/σ σ + σ/	Second syllable stress	*awí-li*	‘dance-PST’
Trisyllables	/σ̲ σ σ + **σ**/	First syllable stress	*h̲ú̲misi-**sa***	‘take.off-COND’
	/σ̲ σ σ + σ/	First syllable stress	*h̲ú̲misi-li*	‘take.off-PST’
	/σ σ̲ σ + **σ**/	Second syllable stress	*nat̲é̲ti-**sa***	‘pay-COND’
	/σ σ̲ σ + σ/	Second syllable stress	*nat̲é̲ti-li*	‘pay-PST’
	/σ σ σ̲ + **σ**/	Third syllable stress	*binih̲í̲-**sa***	‘acuse-COND’
	/σ σ σ̲ + σ/	Third syllable stress	*binih̲í̲-li*	‘acuse-PST’
	/σ σ σ + **σ**/	Third syllable	*anat͡ʃá-**sa***	‘endure-COND’
	/σ σ σ + σ/	Second syllable	*anát͡ʃa-li*	‘endure-PST’

The next section is concerned with how stress assignment in CR is dependent on the stress properties of the first layer of morphology in derived environments.

2.2.4. *Morphological constituency and stress assignment.* A crucial property in this language is that stress assignment is dependent on morphological constituency: in words containing unstressed roots and multiple suffixes with different stress properties, word-level stress is defined in the first layer of affixation. Words containing an unstressed disyllabic root will have third syllable stress when the first suffix is stress shifting (15a) – (15d), and second syllable stress when the first suffix is stress neutral (15e) – (15h), regardless of the stress type of outer suffixes.

(15)	a.	/suku-nále-sa/	'scratch-DESID-COND'	V+ shifting + shifting
	b.	/suku-bó-si/	'scratch-FUT.PL-IMP.PL'	V+ shifting + shifting
	c.	/suku-nále-ki/	'scratch-DESID-PST.1'	V + shifting + neutral
	d.	/suku-wá-i/	'scratch-MPASS-IMPF'	V + shifting + neutral
	e.	/sukú-si-ma/	'scratch-MOT-FUT.SG'	V + neutral + shifting
	f.	/sukú-ki-ma/	'scratch-APPL-FUT.SG'	V + neutral + shifting
	g.	/sukú-ri-li/	'scratch-CAUS-PST'	V + neutral + neutral
	h.	/sukú-ri-ki/	'scratch-CAUS-PST.1'	V + neutral + neutral

Since stress-neutral suffixes are outside the stressable domain, the key forms to consider are the words where stress-neutral suffixes are ordered last. If the stress makeup of words would depend on the stress properties of the last suffix added, then we would expect the verbs in (15c) – (15d) to have second syllable stress from the last stress-neutral suffix added (**su**kú**-nari-ki* and **su**kú**-wa-i*, respectively). In morphologically complex word containing more than one suffix with different stress properties that are reversible in their order, stress assignment is also determined by the suffix attached first.[14] Example (16) includes pairs of words that have the same root and suffixes with different stress properties (the stress-shifting Desiderative *–nale* suffix, and the stress-neutral Causative *–ri*, Associated Motion *–si* and Progressive *–a* suffixes); different suffix order entails a different stress makeup with words containing unstressed roots:

(16)	a.	/awi-nále-ri/	'dance-DESID-CAUS'	[BFL 06 5:138/el]
	b.	/awí-ri-nale/	'dance-CAUS-DESID'	[SFH 07 1:94/el]
	c.	/koʔa-nále-si-a/	'eat-DESID-MOT-PROG'	[SFH 08 1:71/el]
	d.	/koʔá-si-nale/	'eat-MOT-DESID'	[SFH 07 2:72-73/el]
	e.	/kot͡ʃi-nále-si/	'sleep-DESID-MOT'	[SFH 07 2:72/el]
	f.	/kot͡ʃí-ri-nale/	'sleep-CAUS-DESID'	[JHF 04 1:2/el]

As with (15) above, the crucial forms in (16) are the verbs with stress-neutral suffixes ordered last ((16a), (16c) and (16e)): if stress assignment were dependent on the final suffix, we would have expected forms with second syllable stress (*/a**wí**-nale-ti/, */ko**ʔá**-nale-si-a/, and */ko**t͡ʃí**-nale-si/), instead of the attested forms with third syllable stress. Irrespective of the stress type of the suffixes added, the stress makeup of unstressed roots is dependent on the prosodic makeup of the root and the first layer of affixation.

2.3. *Stress in incorporation constructions and initial three-syllable stress window*

In addition to the morphologically conditioned stress alternations noted above, there are stress alternations in CR that follow both from a noun incorporation stress rule, and from an initial three-syllable stress window. Window stress systems have been defined as 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). There are, however, languages with predictable stress within a window: in Pirahã, for example, stress is assigned to the heaviest syllable within the last three syllables of the word (Everett 1988; Green and Kenstowicz 1995). Regardless of the predictability of stress within the two- or three-syllable margin, the key characteristic of window systems is the presence of alternations that maintain binarity or ternarity (e.g., in constructions with multiple affixation, reduplication, compounding, etc.).

Other Rarámuri varieties (Norogachi Rarámuri; Brambila 1953:245) and closely related languages (River Guarijío; Miller 1996:49–50) have been documented to possess left-aligned stress systems where stress is never placed beyond the third syllable, with alternations in compounding maintaining this three-syllable restriction. CR also displays stress alternations specific to Noun Incorporation constructions. Noun incorporation in CR is restricted to nouns referring to body parts and bodily fluids, and is the only type of construction in this language where two roots may potentially be mapped into their own prosodic word and carry their own stress.[15] In CR incorporation, however, the two roots are mapped into a single prosodic word with a single main surface stress. Stress in these N-V constructions is actively constrained by the grammar: if the head of the construction, the incorporated verb, has second syllable stress in isolation and if the first member, the body-part noun, is two syllables long, stress retracts to the verb's first syllable, the construction's third syllable.[16] This is exemplified in (17).

(17)		Underlying	Gloss	Bare V	Incorporated V	
	a.	/busi+kasi/	'eye+break'	*kasí*	*busi+kási*	[BFL 07 1:163/el]
	b.	/ropa+kasi/	'stomach+break'	*kasí*	*ropa+kási*	[BFL 07 1:47/el]
	c.	/siwa+bota/	'tripe+come.out'	*botá*	*siwa+bóta*	[SFH 07 1:186/el]
	d.	/kuta+biʔri/	'neck+twist'	*biʔrí*	*kuta+bíri*	[BFL 07 1:163/el]
	e.	/wita+biʔwa/	'excrement+clean'	*biʔwá*	*wita+bíwa*	[SFH 07 1:187/el]
	f.	/kawa+bota/	'egg+come out'	*botá*	*kawa+bóta*	[RF 04 CDB/el]

All possible interactions of stressed and unstressed roots are exemplified in these forms: unstressed noun plus unstressed verb (17a), stressed noun plus unstressed verb (17b), unstressed noun plus stressed verb (17c) – (17e), and stressed noun plus stressed verb (17f). Regardless of the underlying stress information the roots of the construction might carry, stress is assigned in the first syllable of the head of the construction, the verbal root.[17] Stress retraction in these cases involves actual deletion of lexical root stress from the head of the construction. For instance, the verbal root *biʔwá* 'to clean' (17e) is a stressed root (with fixed stress when adding stress-shifting suffixes, e.g. *biʔwá-ma* 'clean-FUT.SG', *biʔwá-sa* 'clean-COND', *biʔwá-nale* 'clean-DESID'). In incorporation, however, this verbal root undergoes a stress shift one syllable to the left (e.g., *wita+bíwa* (17e)). Thus, stress in incorporated verbs involves both stress deletion and stress-reassignment.[18]

These stress alternations are ambiguously the product of either a three-syllable stress window or a stress rule specific to noun incorporation constructions. In the case of a three-syllable window, fourth syllable stress, which would result in the incorporated forms in (17a) – (17f), would fall outside this window, therefore causing retraction of stress one syllable to the left. On the other hand, a stress rule that would require stress to be assigned in the first syllable of the head of the incorporated construction could also cause stress retraction in these forms. This rule is defined in (18):

(18) Incorporated verb stress rule: the head of the incorporation construction, the verbal root, must bear stress in the first syllable

This rule predicts that incorporated verbs with monosyllabic nouns will bear stress in the second syllable, the verb's first syllable. This prediction is hard to test, since incorporation constructions in CR are restricted to nouns referring to body parts and bodily fluids, and I have only documented one monosyllabic noun of this type, *lá* 'blood'. Brambila (1953) cites the form *la+bíwa*, 'blood+clean', as a compound in Norogachi Rarámuri. There does not seem to be any synchronically productive form in CR where this noun gets incorporated, but speakers accept the prompted <la+bíwa> (/lá+biʔwá/), with second syllable stress, as an interpretable form meaning 'to clean blood'. In contrast, all speakers reject a prompted form with third syllable stress, **la+biwá*, a form which would preserve stress in the original place of the head verb without challenging an initial three-syllable stress window. This suggests that CR does indeed possess an incorporation-specific stress rule as defined in (18).

The behavior of trisyllabic nouns in incorporation is important in determining if this language does in fact possess a stress window, in addition to an incorporation stress rule. CR, like other Uto-Aztecan languages (e.g. Southern Paiute (Sapir 1930) and Kawaiisu (Zigmond et al. 1991)), shortens its trisyllabic nouns to a disyllabic form when incorporated, as shown in (19).

(19)		Incorporation	Gloss	Bare N	
	a.	*t͡ʃere+bíwa*	'sweat+clean'	*t͡ʃere**wá***	[SFH 07 1:187/el]
	b.	*t͡ʃame+répu*	'tongue+cut'	*t͡ʃamé**ka***	[SFH 07 1:187/el]

Truncation of tetrasyllabic nouns in the incorporated forms in (19) is also ambiguously triggered by an initial three-syllable stress window or by the morphological incorporation stress rule defined in (18). However, while non-truncated versions of the forms in (19) are not spontaneously produced, for some speakers such forms are in fact interpretable. Angled brackets indicate that these forms, shown in (20), are abstract (i.e., potential but not actually attested).

(20)		Form	Gloss	Stress position	
	a.	<t͡ʃameká+repu>	'tongue+cut'	Third syllable	[BFL 07 1:48/el]
	b.	<kutat͡ʃí+repu>	'neck+cut'	Third syllable	[BFL 07 1:48/el]

The acceptable non-truncated forms in (20) have third syllable stress (the root's final syllable). In contrast, equivalent non-truncated forms with stress in the fourth syllable (shown in (21)) are completely rejected, and their intended meaning cannot be recovered.[19]

(21)		Form	Gloss	Stress position	
	a.	**t͡ʃameka+répu*	'tongue+cut'	Fourth syllable	[BFL 07 1:48/el]
	b.	**kutat͡ʃi+répu*	'neck+cut'	Fourth syllable	[BFL 07 1:48/el]

What (20) and (21) suggest is that there is indeed an overarching restriction that limits stress assignment to the first three syllables of the word in CR: the incorporation stress rule is violated in the interpretable cases in (20), but an initial three-syllable stress window is violated in the completely rejected forms in (21). There is in fact no single form in the CR corpus that has stress outside this three-syllable range.

As mentioned above, CR is not the only Uto-Aztecan language that displays stress alternations maintaining ternarity. In River Guarijío, these alternations are also attested in prefixing reduplication constructions (Miller 1996). While reduplicated forms of base verbs with second syllable stress do not shift stress in reduplication (22a) – (22b), verbs with stress in the third syllable in unreduplicated constructions shift stress in reduplication to maintain a three-syllable stress window (22c) – (22e):

(22) River Guarijío stress shifts, pluractional reduplication (Miller 1996:48–49)

	Unreduplicated		Reduplicated	Unattested
a.	*saé-na*	'smell-PRS'	*sa-saé-na*	
b.	*isí-na*	'go-PRS'	*i-isí-na*	
c.	*yawi-**ná***	'dance-PRS'	*ya-yaw**í**-na*	**ya-yawi-**ná***
d.	*osa-**ní***	'write-PRS'	*o-os**á**-ni*	**o-osa-**ní***
e.	*nete-**ná***	'make-PRS'	*ne-net**é**-na*	**ne-nete-**ná***

While languages with a final ternary stress window - permitting only final, penultimate, or antepenultimate stress - are not uncommon (e.g. Imbabura Quechua, Macedonian, Greek, Hebrew, Spanish, Polish, Zoque, Italian), initial three-syllable stress windows have been rarely documented (Hyman 1977; Kager 1993). To the best of my knowledge, these have been described only in four other languages to date: in Icua Tupi (Tupi), Terena (Tupi), Wishram Chinook (Chinookan) (Kager 1993), and Azkoitia Basque (Hualde 1998). Assuming that we are correct in interpreting the stress and truncation alternations of CR and River Guarijío, we can add two more cases to this reduced list.

2.4. *Summary*

The descriptive generalizations of the CR stress system are summarized in (23):

(23) CR stress properties

a. Each prosodic word has a single main stress (Section 2.1).
b. There is no secondary stress (i.e. this is a non-iterative system) (Section 2.1).
c. Iambic feet are built from the left edge of the prosodic word (Section 2.2.1).
d. Roots can be lexically stressed or unstressed (Section 2.2.2).
e. All roots with first syllable stress are lexically stressed (Section 2.2.2).
f. Suffixes are either stress-shifting or stress-neutral, meaning that they can perturb the root's stress or be neutral regarding stress assignment, respectively (Section 2.2.2).
g. Stress-shifting suffixes are part of the stressable domain, while stress-neutral suffixes are outside the stressable domain and never stressed (Section 2.2.3).
h. In words containing unstressed disyllabic or unstressed trisyllabic roots and stress-neutral suffixes, stress falls in the second syllable of the word (Section 2.2.3).
i. In words containing unstressed disyllabic or unstressed trisyllabic roots and stress-shifting suffixes, stress falls in the third syllable of the word (Section 2.2.3).

j. Lexical stress in roots blocks morphologically conditioned second and third syllable stress (Section 2.2.2).

k. The stress properties of roots and the first layer of affixation determine the stress makeup of words (i.e., the stress properties of any subsequent suffixes is irrelevant for stress assignment) (Section 2.2.4).

l. There is a stress rule specific to noun incorporation constructions (Section 2.3).

m. There is an initial three-syllable stress window (Section 2.3).

Surface stress in CR is thus the product of a complex interplay of lexical, morphological and purely prosodic factors. Crucially, default stress patterns in this language are governed by morphological structure, rather than directionality principles alone. In the next section, I provide a Cophonology analysis of this system.

3. Analysis

Before introducing a formal account of CR stress assignment, I first provide a background on Cophonology theory and the morphological grammar assumed for the analysis.

3.1. *Cophonology theory and constructions in morphology*

Cophonology theory (first developed in Orgun (1996) and Anttila (1997) and developed subsequently in Inkelas (1998), Yu (2000), Orgun and Inkelas (2002), Inkelas and Zoll (2005, 2007), among others), is a model that builds on Lexical Phonology and Morphology (Kiparsky 1982, Mohanan 1986, inter alia) where intra-linguistic variation is handled with construction-specific phonological mappings, or morphologically blind phonological sub-grammars. In this theory, the morphological grammar of a language consists of a set of constructions (affixation, compounding, reduplication, etc.) that are sequentially ordered. These morphological constructions are morphological processes that combine two sisters into a single constituent to form a complex word (Inkelas and Zoll 2005:12); they involve a meaning function (an inflectional feature or derivational category) and a form function, the 'cophonology' or set of ranked phonological constraints. Phonological rules or constraints are fully general, since it is entire rankings of constraints that are associated to specific morphological contexts. When cophonologies differ across morphological constructions, morphologically conditioned phonology obtains.

The association of cophonologies with morphological constructions may be formalized as follows:[20] the phonological function of a mother node (the "output") arises from the phonological functions of the daughter nodes (the "inputs"). Figure 1 exemplifies an affixation construction from CR, where the mother node is a causative verb with two daughters – a non-causative verb and the suffix /-ri/:

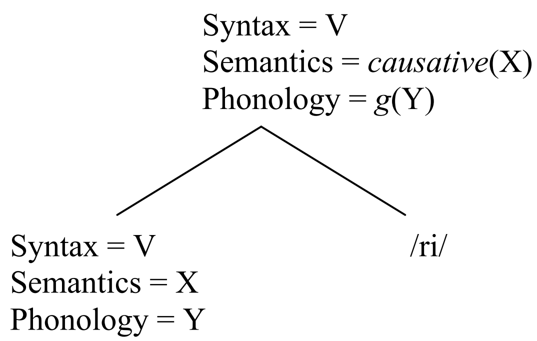

Figure 1: Affixation construction in CR[21]

The architecture of Cophonology theory derives the fact that the phonological makeup of morphologically complex words is dependent on the phonological properties of their morphological subconstituents. Each of the branching nodes (stem levels) in the structure in Figure 2 is the phonological output of the input-output mapping between daughters and mother node.

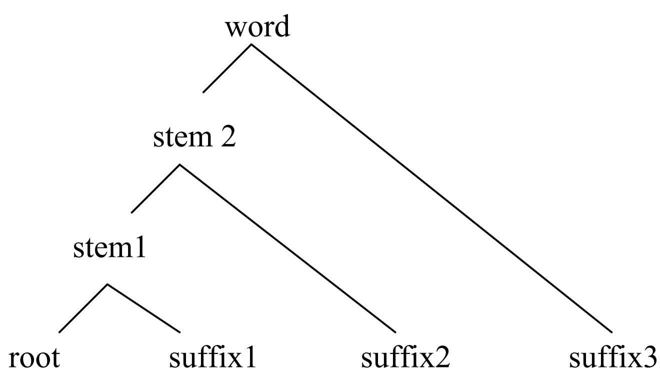

Figure 2: Branching structure of morphologically complex word

The phonological makeup of a structure like the one depicted in Figure 2 is dependent on its hierarchical structure: the phonological effects of a given morphological construction will only affect the stem created by that construction, i.e. each cophonology affects only its daughters (e.g., the scope of stem 1 is the root plus suffix1) (Inkelas and Zoll 2007:145). It is thus the hierarchical structure of complex words that determines the domain of application of each cophonology to each subpart of the word.

Finally, while the cophonologies of a language are able in principle to display a completely different ranking, the potential phonological divergence within a single grammar is constrained in this theory by assuming that every cophonology in a language conforms to a 'Master Ranking', a partial ranking of constraints (Anttila 1997, 2002; Inkelas and Zoll 2005, 2007).[22] While each cophonology specifies the relative ranking of some constraints, all cophonologies share a core set of phonological properties, reflected in a set of constraints which are fully specified in their ranking. Figure 3 schematizes an abstract grammar lattice that relates two cophonologies in a superordinate node:

Master Ranking
A >> {B, C}

Cophonology A
A >> B >> C

Cophonology B
A >> C >> B

Figure 3: Grammar lattice

In this schema, constraint A is undominated, but the ranking of constraints B and C is undetermined in the master ranking; each cophonology then specifies the relative ranking of B and C (Cophonology A ranks B >> C, while Cophonology B ranks C >> B).
The cophonologies in this case are formalized in OT. Each cophonology consists of a phonological sub-grammar spelled out as a hierarchy of fully general ranked and violable markedness, faithfulness and alignment constraints.

3.2. *CR stress cophonologies*
Some of the relevant constraints for CR stress assignment are presented in (24):

(24) Footing constraints for CR stress assignment

ALL-FT-L:	Every foot stands at the left edge of the prosodic word (PrWd).
PARSE-σ:	Syllables must be parsed into feet.
RHTYPE=I(AMB):	Feet have final prominence.
RHTYPE=T(ROCHEE):	Feet have initial prominence.
FT-BIN:	Feet must be binary under moraic or syllabic analysis

Recall that stress is aligned to the left of the prosodic word (Section 2.2.1) and that there is no phonetic or phonological evidence for secondary stress assignment (Section 2.1). We can thus posit that ALL-FT-L, a constraint that forces feet to the left edge of the prosodic word, is undominated; its ranking above PARSE-σ derives a non-iterating stress pattern. We can also posit that the ranking RHTYPE=I >> RHTYPE=T, together with ALL-FT-L, derives second syllable stress in the absence of lexical stress (Section 2.2.1).[23] High-ranked FT-BIN ensures that iambs are binary.

The realization of lexically specified stress in its original position in every cophonology can be modeled with Prosodic Faithfulness (PROS-FAITH) constraints (McCarthy 1997, Alderete 2001b).[24] These constraints are defined in (25).

(25) Prosodic Faithfulness (PROS-FAITH) Constraints (Alderete 2001b:24)
MAX-PROM: Every prominence in the input must have a correspondent in the output.
DEP- PROM: Every prominence in the output must have a correspondent in the input.
NO-FLOP-PROM: Corresponding prominences must have corresponding sponsors and links.

High ranked faithfulness constraints ensure that default stress assignment is blocked when a root is lexically pre-specified for stress. These constraints are not, however, undominated, since stress is without exception limited to appear within the initial three-syllable window. This over-arching window restriction can also be attributed to the high ranking of ALL-FT-L.

Third-syllable stress needs an additional component. To formalize third syllable stress in constructions involving stress-shifting suffixes and in incorporated constructions, I resort to a ternary constituent, a foot with a single (left-) adjoined syllable (Zoll 2004, following others who have proposed similar types of constituents, including: Selkirk 1980; Dresher and Lahiri 1991; Rice 1992; Itô and Mester 1992; Blevins and Harrison 1999, inter alia).[25] This ternary constituent is schematized in Figure 4.

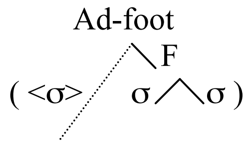

Figure 4: Ternary constituent with single adjoined syllable (Zoll 2004)

This representation crucially groups three syllables into a constituent. The adjoined syllable violates a markedness constraint STRICT (Zoll 2004), which assigns violations to candidates with non-strict layering (Selkirk 1981, 1984). Specifically, the ternary constituent violates the non-recursivity constraint on prosodic domination, a constraint that requires that no category C^i dominates a category C^j, where j = i, e.g. "No Ft dominates a Ft" (Selkirk 1995).

The relative ranking of STRICT is different in the cophonologies associated with different morphological constructions. Stress-shifting suffixes and stress-neutral suffixes are two different sets of morphological constructions, each associated with a particular stress pattern. To describe the split between the two types of affixal constructions it is necessary to posit two cophonologies, each with its own specified ranking of the constraint STRICT. The rankings associated with each cophonology are provided in (26):

(26) Two stress cophonologies of CR affixal constructions

a.	*Cophonology Neutral:*	**STRICT** >> RHTYPE=I, PARSE-σ	2nd syllable stress
b.	*Cophonology Shifting:*	RHTYPE=I, PARSE-σ >> **STRICT**	3rd syllable stress

In the next section, I show how these affixal stress cophonologies work.

3.2.1. *Affixal stress cophonologies.* In Cophonology Neutral, STRICT is highly ranked, enforcing second syllable stress. In Cophonology Shifting, STRICT is ranked below PARSE-σ, allowing for ternary constituents (i.e., third syllable stress). Both of these stress patterns are default patterns, since they emerge when there is no lexically pre-specified stress information in the root of a morphologically complex word.

The unstressability of stress-neutral suffixes is captured through a positional markedness constraint, STEMSTRESS (defined in (27)), which favors roots and stress-shifting suffixes (the stressable Stem domain) over stress neutral affixes for stress assignment:

(27) Positional markedness constraint (Smith 1998)
STEMSTRESS: Every Stem has a stress

While stress-neutral suffixes are not part of the stressable domain, stress-shifting suffixes are (i.e., stress-shifting suffixes do not incur in violations of STEMSTRESS when bearing stress). Stress-shifting suffixes form a tight phonological unit with their host root, and are part of the stem for stress purposes, inducing stress assignment. Stress-neutral suffixes, on the other hand, are not part of the stressable domain. Stress-shifting and stress-neutral suffixes may thus be characterized as *cohering* and *non-cohering*, respectively. Cohering suffixes are suffixes that form one prosodic word with the preceding stem (evidenced by their phonological behavior as identical to morphologically simple words) (Booij 2002). For general discussion about cohering and non-cohering affixes, see Dixon (1977), and Booij (1977, 1995, 2002).

The ranking in (28) is fixed in every cophonology.

(28) Fixed constraints in CR stress
ALL-FT-L >> STEMSTRESS, PROS-FAITH >> RHTYPE=I >> PARSE-σ

As discussed above, each cophonology differs in the relative ranking of STRICT. Cophonology Neutral ranks STRICT above RHTYPE=I and PARSE-σ. The total ranking of this cophonology is given in (29).

(29) Cophonology Neutral ranking
ALL-FT-L >> STEMSTRESS, STRICT, PROS-FAITH >> RHTYPE=I >> PARSE-σ

The high ranked STRICT, ALL-FT-L and RHTYPE=I generate second syllable stress in words containing disyllabic (Tableau (30)) and trisyllabic (Tableau (31)) unstressed roots and stress-neutral suffixes (underlyingly stressed roots are indicated by underlining and stress-shifting suffixes are bold-faced in the underlying representation in the input of each Tableaux).

(30) Second-syllable stress, disyllabic unstressed root plus stress-neutral suffix

	/t͡ʃapi-li/ ‘grab-‘PST’	ALL-FT-L	STRICT	RHTYPE=I	PARSE-σ
a.	(t͡ʃá.pi).li			*!	*
b.	t͡ʃa.(pí.li)	*!		*	*
c.	t͡ʃa.(pi.lí)	*!			*
☞ d.	(t͡ʃa.pí).li				*
e.	(<t͡ʃa>.pi.lí)		*!		

(31) Second-syllable stress, trisyllabic unstressed root plus stress-neutral suffix

	/raʔit͡ʃa-li/ ‘speak-PST’	ALL-FT-L	STRICT	RHTYPE=I	PARSE-σ
a.	(ra.ʔí)(t͡ʃa.lí)	*!*			
b.	ra.ʔi(t͡ʃá.li)	*!*		*	**
c.	(rá.ʔi)t͡ʃa.li			*!	**
☞ d.	(ra.ʔí)t͡ʃa.li				**
e.	(<ra>.ʔi.t͡ʃá).li		*!		*

In both cases, candidates with a ternary constituent ((30e) and (31e)) are eliminated due to a fatal violation of the high ranked STRICT.

The role of STEMSTRESS can be appreciated in the case of monosyllabic unstressed roots, where a trochaic foot is preferred over an iamb where stress falls in a stress-neutral suffix instead of the stem (32).

(32) Monosyllabic unstressed root plus stress-neutral suffix

	/ru-li/ 'say-PST'	STEMSTRESS	RHTYPE=I	FT-BIN	PARSE-σ
a.	(ru.-lí)	*!			
b.	(rú).-li		*	*!	*
☞ c.	(rú.-li)		*		

In Cophonology Shifting, on the other hand, the ban on ternary feet is low ranked, since STRICT is ranked below PARSE-σ and RHTYPE=I. The Cophonology Shifting ranking is given in (33).

(33) Cophonology Shifting
ALL-FT-L >> STEMSTRESS, PROS-FAITH >> RHTYPE=I >> PARSE-σ >> STRICT

The effect of this ranking is illustrated in Tableau (34), with an evaluation of a disyllabic unstressed root plus a stress-shifting suffix. A word with a ternary constituent (34e) is preferred over a form with an unparsed syllable (34c).

(34) Third-syllable stress, disyllabic unstressed root plus stress-shifting suffix

	/t͡ʃapi-**sa**/ 'grab-COND'	ALL-FT-L	RHTYPE=I	PARSE-σ	STRICT
a.	(t͡ʃá.pi).-sa		*!	*	
b.	t͡ʃa.(pí.-sa)	*!	*	*	
c.	(t͡ʃa.pí).-sa			*!	
d.	t͡ʃa.(pi.-sá)	*!		*	
☞ e.	(<t͡ʃa>.pi.-sá)				*

This ranking also correctly yields third syllable stress with an unstressed trisyllabic root and a stress-shifting suffix, as shown in (35) below.

(35) Third-syllable stress, trisyllabic unstressed root plus stress-shifting suffix

	/raʔit͡ʃa-**sa**/ ‘speak-COND’	All-Ft-L	RhType=I	Parse-σ	Strict
a.	(rá.ʔi)t͡ʃa.sa		*!	**	
b.	ra.ʔi(t͡ʃá.sa)	*!*	*	**	
c.	(ra.ʔí).t͡ʃa.sa			*!*	
d.	ra.(ʔi.t͡ʃá).sa	*!		**	
☞ e.	(<ra>.ʔi.t͡ʃá).sa			*	*

The examples considered so far have all involved only one layer of affixation. Recall from the examples shown in (16), repeated as (36) below, that stress is assigned in the level consisting of the root plus first layer of morphology.

(36)	a.	/awi-nále-ri/	‘dance-DESID-CAUS’	[BFL 06 5:138/el]
	b.	/awí-ri-nale/	‘dance-CAUS-DESID’	[SFH 07 1:94/el]
	c.	/koʔa-nále-si-a/	‘eat-DESID-MOT-PROG’	[SFH 08 1:71/el]
	d.	/koʔá-si-nale/	‘eat-MOT-DESID’	[SFH 07 2:72-73/el]
	e.	/kot͡ʃi-nále-si/	‘sleep-DESID-MOT’	[SFH 07 2:72/el]
	f.	/kot͡ʃí-ri-nale/	‘sleep-CAUS-DESID’	[JHF 04 1:2/el]

As shown above, the stress properties of suffixes added after the first layer do not determine the stress makeup of the word. That is, it is the stress properties of the root plus first morphological construction which percolate up to the Word level. The branching morphological structure of CR is depicted in Figure 5.

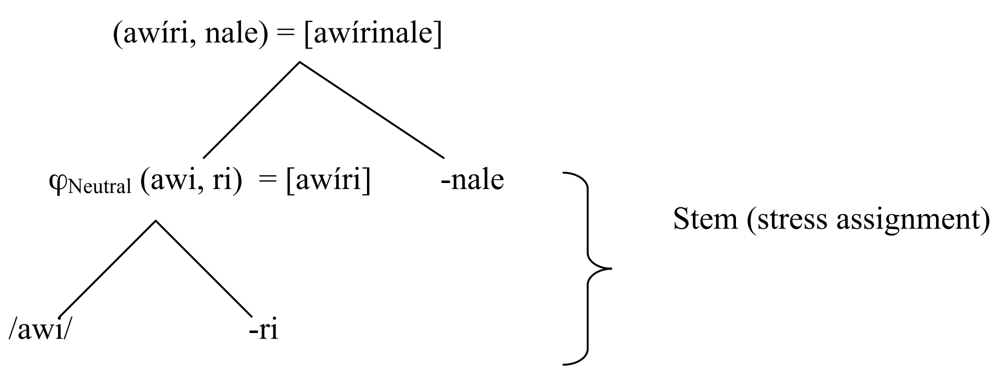

Figure 5: CR branching morphological structure (/awi-ri-nale/, ‘dance-CAUS-DESID’)

Thus, a word with two suffixes with conflicting phonological properties will be evaluated by the cophonology associated with the first suffix. In Tableau (37) below, the root /awi/ 'dance' plus stress-neutral Causative suffix and stress-shifting Desiderative suffix is evaluated through

Cophonology Neutral, the cophonology associated with the inner Causative suffix: the cophonology of the first layer of affixation takes precedence over the outer morphological material.

(37) Cophonology neutral evaluation

	[[awi-ri] $_{CAUS}$ **-nale**] $_{DESID}$	STRICT	RHTYPE=I	PARSE-σ
☞ a.	(a.wí).-ri.-na.le			***
b.	(<a>.wi.-rí).-na.le	*!		**

If, on the other hand, the constructions are reversed in their order, with an inner stress shifting construction ordered before an outer stress neutral construction, the cophonology associated with the stress shifting construction will determine the stress makeup of the word. This is shown in Tableaux (38).

(38) Cophonology shifting evaluation

	[[awi-**nale**] $_{DESID}$ -ri] $_{CAUS}$	RHTYPE=I	PARSE-σ	STRICT
a.	(a.wí).-na.le-ri		**!*	
☞ b.	(<a>.wi.-ná).le-ri		**	*

In (38), the low-ranked STRICT favors the selection of the candidate with a ternary foot, correctly predicting third syllable stress.

The stress properties of the word in CR thus depend intrinsically on the hierarchical structure of the word, as predicted by Cophonology theory.

3.2.2 *Incorporation stress cophonology.* Finally, the morphological stress rule which maps two roots of incorporated constructions into a single prosodic word is given in (39), a high ranking constraint that requires the preservation of the stress of construction head, the second member. This constraint also requires the assignment of stress to the first syllable of the construction head.

(39) Incorporation construction stress rule
ACC-TO-HEAD(σ_1): The head of an incorporation construction must have a stress in the first syllable.

This constraint is ranked below ALL-FT-L but above PROS-FAITH, to ensure the deletion of any underlying stress of both nouns and verbs in incorporated constructions. Incorporated constructions have the phonological ranking of Cophonology Shifting, where STRICT is parsed below PARSE-σ, allowing third syllable stress. The ranking operating in these constructions is shown in (40), and is exemplified in Tableau (41).

(40) ALL-FT-L >> ACC-TO-HEAD(σ_1) >> PROS-FAITH, MAX-IO, STEMSTRESS >> RHTYPE=I >> PARSE-σ >> STRICT

(41) Body-part incorporation stress

	/siwa+botá/ ‘tripe+come.out’	ALL-FT-L	ACC-TO-HEAD(σ_1)	PROS-FAITH	STRICT
a.	(siwá)+bota		*!	*	
b.	(siwá)(+botá)	*!*	*		
c.	siwa(+botá)	*!*	*		
d.	si(wa+bó)ta	*!		*	
☞ e.	(<si>wa+bó)ta			*	*

The ranking ACC-TO-HEAD(σ_1) >> PROS-FAITH eliminates candidate (41b), with faithful stress to underlying noun and verb prominences. This constraint also eliminates the candidate with stress in the second syllable of the head verb (41c).

This constraint ranking also yields the truncation effect of trisyllabic nouns in incorporation (shown in (19), above): ACC-TO-HEAD(σ_1) dominates MAX-IO, a constraint banning deletion of input segments in output forms. This effect is shown in Tableau (42).

(42) Truncation in body-part incorporation

	/t͡ʃerewa+biʔwá/ ‘sweat+clean’	ALL-FT-L	ACC-TO-HEAD(σ_1)	PROS-FAITH	MAX-IO	STRICT
a.	(t͡ʃeré)wa+biwa		*!	*		
b.	(t͡ʃeré)(wa+bí)wa	*!*		*		
c.	t͡ʃere(wa+bí)wa	*!*		*		
d.	(<t͡ʃe>rewá)+biwa		*!	*		*
☞ e.	(<t͡ʃe>re+bí)wa			*	**	*

In Tableau (42), the window effect is achieved by the ranking ALL-FT-L >> PROS-FAITH.

The ranking MAX-IO >> STRICT (fixed in Cophonology Shifting) predicts that the pressure to build ternary feet will never induce truncation of roots in the shifting morphological constructions, but only in incorporated constructions under the effect of the high ranked ACC-TO-HEAD(σ_1). This prediction is borne out in the CR data.

3.3. *CR stress grammar lattice*

The phonological sub-grammars of CR are partially ordered with respect to a Master Ranking in a grammar lattice. The Master Ranking of CR stress contains the undominated requirement that stress must be located in the first three syllables of the prosodic word, as well as the lower ranked constraint that enforces the realization of input prosodic information. These pressures are invariant within the grammar, and each cophonology further specifies its own unmarked, emergent pattern. Figure 6 shows the relevant section of the grammar lattice in CR for stress assignment.

Stress Master Ranking

ALLFT-L >> STEMSTRESS >> {STRICT, PROS-FAITH , RHTYPE=I, PARSE- σ}

Cophonology Neutral (2nd syllable stress)

STRICT >> RHTYPE=I >> PARSE-σ

Cophonology Shifting (3rd syllable stress)

RHTYPE=I >> PARSE-σ >> STRICT

Cophonology Incorporation

ALLFT-L >> ACC-TO-HEAD(σ_1) >> PROS-FAITH >> STRICT

Figure 6: Grammar lattice for stress assignment in CR

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 undominated in the Master Ranking. The different cophonologies must specify their ranking of STRICT, allowing or disallowing ternary feet. Cophonology Incorporation also includes ACC-TO-HEAD(σ_1), a constraint that assigns stress to the first syllable of the head of the construction. Every cophonology is related to each other in this grammar lattice, since each cophonology inherits the invariably ranked constraints from the Master Ranking. In addition, this schema relates the two cophonologies that allow ternary feet, Cophonology Shifting and Cophonology Incorporation, where the ranking ALLFT-L >> PARSE-σ favors larger feet (see Elenbaas and Kager 1999).[26]

4. Root Controlled Accent analysis

This section presents an alternative to the Cophonology analysis, a Root Controlled Stress (RCA) analysis, a stress-specific version of indexed-constraint theory (Alderete 2001a, 2001b) which has been employed to analyze morphologically conditioned stress assignment in another Uto-Aztecan language, Cupeño (Takic; Alderete 2001a, 2001b). RCA assumes the Morphologically-Dispersed Faithfulness meta-constraint ROOT FAITH >> AFFIX FAITH (McCarthy and Prince 1995). Given the culminative nature of stress, competing lexical stress in a word lead to a stress resolution that favors the root. This hypothesis is defined in (43).

(43) Root Controlled Stress Hypothesis (Alderete 2001b:43)
In lexical-to-surface mappings of a word with more than one inherent stress, if stress is deleted, stress in the root is realized over stress elsewhere in the word.[27]

Under this approach, highly ranked Prosodic Faithfulness constraints (as defined in (25) above) enforce the realization of underlying stress in its original position. Prosodic Faithfulness constraints distinguish between faithfulness to the prosodic prominence of roots vs. affixes, with MAX-PROM$_{ROOT}$ and MAX-PROM$_{AFFIX}$, respectively. The former outranks the latter in stress resolution, following the Root Faith >> Affix Faith metaconstraint. When Prosodic Faithfulness does not determine the output –that is, when the input lacks lexically pres-specified stress information-, the invariant, lower ranked markedness constraints yield default stress assignment.

The properties of the CR stress system are easily translatable into an RCA analysis: underlying stress of roots prevails in numerous morphological contexts where stress-shifting suffixes derive their properties from underlying, lexical stress. Affixal stress is only realized in words with unstressed roots. Roots are strong positions, and indexing prosodic faithfulness constraints to roots and affixes takes care of the asymmetry between strong and weak positions.

In an RCA analysis of CR, prosodic faithfulness must be ranked above the markedness constraints that yield the default stress pattern, second syllable stress (RHTYPE=I and PARSE-σ). Prosodic faithfulness cannot, however, be undominated: the stress window strictly confines input stress information to the first three syllables of the prosodic word. Within this theory, CR instantiates a 'hybrid stress' system, i.e., a system in which stress is contrastive in some contexts, but where over-arching constraints limit the distribution of the stress contrast (Alderete 2001b). This kind of system is modeled through the interleaving of indexed Prosodic Faithfulness constraints and general markedness constraints, yielding the limitations on contrastive stress to, for instance, a stress window.

It is possible to model both second syllable stress and third syllable stress in an RCA analysis through the interaction of root stress vs. affix stress. The ranking ALL-FT-L >> MAX-PROM$_{\text{AFFIX}}$ prevents trisyllabic unstressed roots from having stress on a stressed suffix (the fourth syllable). The single ranking of CR is given in (44).

(44) Single ranking of CR stress in RCA
ALL-FT-L >> MAX-PROM$_{\text{Root}}$ >> RHTYPE=I >> MAX-PROM$_{\text{Affix}}$ >> STRICT >> PARSE-σ

This ranking predicts that words containing morphemes with no lexical stress will have second syllables stress. This prediction is borne out in the case of disyllabic unstressed roots plus unstressed (stress-neutral) suffixes (Tableau (45)), and trisyllabic unstressed roots plus unstressed suffixes (Tableau (46)).[28]

(45) Second-syllable stress, disyllabic unstressed root plus unstressed suffix

	/t͡ʃapi-li/ 'grab-PST'	ALL-FT-L	RHTYPE=I	STRICT	PARSE-σ
a.	(t͡ʃá.pi).li		*!		*
b.	t͡ʃa.(pí.li)	*!	*		*
c.	t͡ʃa.(pi.lí)	*!			*
☞ d.	(t͡ʃa.pí).li				*
e.	(<t͡ʃa>.pi.lí)			*!	

(46) Trisyllabic unstressed root plus unstressed (stress-neutral) affix

	/anat͡ʃa-ki/ ‘endure-PST.1’	ALL-FT-L	RHTYPE=I	STRICT	PARSE-σ
a.	(a.ná)(. t͡ʃa.kí)	*!*			
b.	(a.na)(. t͡ʃá.ki)	*!*	*		
c.	a.na(.t͡ʃa.kí)	*!*			**
☞ d.	(a.ná).t͡ʃa.ki				**
e.	(<a>.na.t͡ʃá).ki			*!	*

The ranking STRICT >> PARSE-σ eliminates the candidates with a ternary constituent and third-syllable stress ((46e) and (46b), respectively).

This ranking, however, yields the wrong result in an evaluation involving a trisyllabic unstressed root plus a stressed (stress-shifting) suffix. Consider Tableu (47).

(47) Trisyllabic unstressed root plus stressed (stress-shifting) suffix

	/anat͡ʃa-sá/ ‘endure-COND’	ALL-FT-L	MAX-PROM$_{\text{Affix}}$	STRICT	PARSE-σ
a.	(a.ná)(t͡ʃasá)	*!*			
b.	a.na(t͡ʃasá)	*!*			**
(☞) c.	(a.ná).t͡ʃa.sa		*		****
💣 d.	(<a>.na.t͡ʃá).sa		*	*!	**

ALL-FT-L is violated by the candidates that are faithful to the lexical prominence of the suffix (47a) – (47b). The remaining candidates violate faithfulness to the affixal prominence. The ranking STRICT >> PARSE-σ favors the form with second syllable stress (47c), and not the attested third syllable stress form (47d). As shown in (48), ranking PARSE-σ >> STRICT yields the correct result in this case.

(48) Trisyllabic unstressed root and stressed (stress-shifting) affix with ranking PARSE-σ >> STRICT

	/anat͡ʃa-sá/ ‘endure-COND’	ALL-FT-L	MAX-PROM$_{\text{Affix}}$	PARSE-σ	STRICT
a.	(a.ná)(.t͡ʃa.sá)	*!*			
b.	a.na(.t͡ʃa.sá)	*!*		**	
c.	(a.ná).t͡ʃa.sa		*	*!*	
☞ d.	(<a>.na. t͡ʃá).sa		*	*	*
e.	a(.na.t͡ʃá).sa	*!	*	**	

However, this ranking predicts third syllable stress when the same root would take an unstressed (stress-neutral) affix. The attested form, however, has second syllable stress. This is shown in Tableau (49).

(49) Trisyllabic unstressed root and unstressed (stress-neutral) affix with ranking PARSE-σ >> STRICT

	/anat͡ʃa-li/ 'endure-PST'	ALL-FT-L	MAX-PROM$_{Affix}$	PARSE-σ	STRICT
a.	(a.ná)(.t͡ʃa.lí)	*!*			
b.	a.na(.t͡ʃa.lí)	*!*		*	
💣 c.	(a.ná).t͡ʃa.li			*!*	
☞ d.	(<a>.na. t͡ʃá).li			*	*
e.	a.(na.t͡ʃá).li	*!		**	

Thus, attempting to model the attested stress patterns of CR under a single ranking generates a *ranking paradox*. An alternation where an unstressed root has second syllable stress with an unstressed (stress-neutral) suffix (i.e., *anát͡ʃa-ri*), but third syllable stress with a stressed (stress-shifting) one (i.e., *anat͡ʃá-sa*) is left unexplained under the single ranking approach. The prediction is that when the undominated alignment constraint prevents lexical stress from surfacing in its original position, a uniform default pattern (e.g., default second syllable stress) must be assigned instead.[29] It is thus impossible to model variation in stress assignment in these cases, since there are two predictable patterns dependent on two sets of morphological constructions. The CR case contributes further evidence that languages do in fact exhibit markedness reversals (Inkelas and Zoll 2007) and that accounts such as the RCA undergenerate in modeling language-internal variation.

Finally, the CR case is also relevant for indexed constraint theories in general, whether only faithfulness constraints are specified for morphological environments (Itô and Mester 1999) or both faithfulness and markedness constraints are indexed (Pater 2007, 2009). The latter kind of approach is more powerful than the former and can also express markedness reversals (Pater 2009), approaching closely Cophonology theory. However, Cophonology theory and any version of Indexed Constraint theory can be differentiated in terms of the predictions made with respect to morphologically complex words with multiple constructions with distinctive phonology. In Cophonology Theory, phonological patterns are associated to word-formation constructions, but in Indexed Constraint theory, it is the highest ranked indexed constraint which determines the output, not the hierarchical structure of the word. Recall, however, how CR stress is determined by the properties of the first layer of morphology. Crucially, we have seen that a change in order of attachment of constructions with distinct stress properties will produce different outcomes of stress location ((16a) – (16b) above, repeated as (50)):

(50) a. /awi-nále-ri/ 'dance-DESID-CAUS' [BFL 06 5:138/el]
b. /awí-ri-nale/ 'dance-CAUS-DESID' [SFH 07 1:94/el]

This kind of pattern is problematic in an Indexed Constraint analysis, since the indexed markedness constraints for each type of suffix would still be in a fixed ranking. That is, every time two (or more) conflicting constraints are involved in an evaluation, it will be the highest ranked which determines the output, regardless of morphological constituency. Cases like CR stress are thus hard to model in any version of Indexed Constraint theory.

5. Conclusions

This paper presented the empirical generalizations of CR stress, a mixed stress system with two default stress patterns, second and third syllable stress. These two coexisting default stress patterns were formalized through a mixed binary-ternary iambic system. In addition, I showed how CR has a dominance pattern, the incorporated construction stress rule, which deletes any input lexical stress, and assigns stress to the first syllable of the head of the construction. I have also demonstrated that this language possesses an over-arching restriction that limits stress to the first three syllables of the word, a typologically marked initial three-syllable window.

I proposed that these descriptive facts are captured through three cophonologies. Third syllable stress is present in two of these co-phonologies. The existence of two default patterns plus a dominance pattern with the incorporated construction fall out naturally from a Cophonology analysis, in which morphologically conditioned phonology is sensitive to internal morphological constituency and handled through general phonological constraints and multiple rankings.

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[1] Each example cited provides an IPA transcription, gloss, and source. Stress is indicated with an acute accent, instead of the IPA symbol for primary stress. Source information includes contributor, year, hard copy or electronic document identifier and type of document (El = Elicitation or Tx = Text). The following abbreviations are used in the paper: 1 = first person; 2 = second person; 3 = third person; ACC = Accusative; APPL = Applicative; CAUS = Causative; COND = Conditional; DESID = Desiderative; EP = Epistemic; EV = Evidential; FUT = Future; IMP = Imperative; IMPF = Imperfective; INCH = Inchoative; INTR = Intransitive; LOC = Locative; MOT = Associated Motion; MPASS = Medio-Passive; NOM = Nominative; PASS = Passive; PL = Plural; PRS = Present; PST = Past; PST.1 = Past 1st person; SG = Singular; SUB = Subordinator; TAM = Tense/Aspect/Mode; TR = Transitive.

[2] The phonological inventory of CR is: /p, b, t, k, ʔ, t͡ʃ, n, m, r [ɾ], l [ɽ], s, h, w, j, i, u, e [ɛ], o [ɔ], a/. /l/ represents a lateral flap, a sound that auditorily resembles both a lateral approximant and an alveolar (slightly retroflexed) flap.

[3] A preliminary examination of the duration of stressed and unstressed vowels in open syllables shows that stressed vowels range between 130 to 170 ms, while unstressed vowels range between 70 to 110 ms (Caballero 2008).

[4] The Causative suffix has two lexically conditioned allomorphs, *-ti* and *–ri*. Allomorphy is also phonologically determined in some cases (voiced/lenis consonants devoice after another consonant after post-tonic vowel deletion) (Caballero 2008).

[5] Stressed vowels may undergo compensatory lengthening, after a post-tonic vowel has been deleted (Caballero 2008).

[6] A preliminary look at spectrograms of voiceless stops as onsets of stressed and unstressed syllables reveals that there is a voice onset time (VOT) of stressed syllable onsets of about 22-24 ms, versus about 14-15ms for the duration from the burst stop to the beginning of the following vowel in unstressed syllables (speech samples compared came from careful (elicitation) speech pronunciation).

[7] While most of these examples involve stressed roots, note that suffixes may also be stressed (e.g., (3j)). More examples of words where stress falls on a suffix are provided in the rest of the paper.

[8] A loanword from Spanish [mísa].

[9] Lexically pre-specified stress does not necessarily have to be represented as a diacritic mark (e.g., see Revithiadou (2007) for an analysis of lexically pre-specified stress as an autosegmental representation).

[10] This contrast is also found with nominal roots. In this paper I will only consider verbal stress patterns.

[11] Present tense or imperative singular can be marked through the bare stem.

[12] The future singular suffix displays an interesting allomorphy: *–ma*, used with stressed roots, and *–méa*, used with unstressed 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. The future singular suffix is the only suffix that displays this stress-conditioned suppletive allomorphy.

[13] Comparison of these roots with their cognates in Guarijío (Miller 1996), a closely related Taracahitan language, reveals that this set of roots is exceptional: the Guarijío cognates all have *three* syllables, suggesting that CR has innovated initial syllable truncation with these forms:

CR		Guarijío		Gloss
a. *uba*	[SFH 05 1:86]	*uʔupá*	[M402]	'bathe'
b. *not͡ʃa*	[RF 04 1:129]	*inót͡ʃa*	[M340]	'work'
c. *seba*	[RF 04 1:109]	*ahséba*	[M323]	'reach'

d. *t͡ʃota*	[LEL 06 5:36]	*iht͡ʃotá*	[M337]	'begin'
e. *soma*	[LEL 06 FN]	*moʔso-má*	[M360]	'wash head/hair'
f. *nata*	[JH 04 1:2]	*uʔnatá*	[M401]	'think'

It is not the case that all of the CR roots are one syllable shorter than their Guarijío counterparts (e.g. CR *raʔít͡ʃa* – Guarijío *taʔít͡ʃa* (M391), 'speak'; CR *rosówa* – Guarijío *tohsoá* (M396), 'cough'). The forms in (14) are thus derived from trisyllabic roots through a recent diachronic development. Based on this comparative evidence, I contend that these exceptional forms originally patterned with unstressed trisyllabic roots, and that first and second syllable stress in these roots corresponds to the regular second and third syllable stress patterns identified above. The synchronically motivated stress shifts of these verbal roots must have then been lexicalized after truncation of the first syllable of these roots took place.

[14] Suffix order in CR may be determined by several factors, including semantic scope (Caballero 2010)).

[15] Rarámuri varieties also have a fully lexicalized type of incorporation, the derivational use of instrumental prefixes. Instrumental prefixes, which indicate the instrument with which a transitive activity is done or the manner in which the activity is carried out, are reconstructed for Proto-Uto-Aztecan (Dayley 1989) and still found as a synchronically productive process in the Numic and Tepiman branches of Uto-Aztecan (Langacker 1977).

[16] The verbal roots in (17e) – (17g) have an underlying glottal stop that is deleted in surface forms in incorporation constructions. Glottals must emerge between the first and second syllable of the prosodic word if the root to which they are associated is aligned to the left edge of the prosodic word (Caballero 2008; see also Miller 1996 and Haugen n.d. for a similar restriction in River Guarijío).

[17] Similar compound-specific stress rules have been documented for other languages (e.g., Greek (Nespor 1999) and Romance languages (Roca 1999)).

[18] Incorporated verbs may undergo suffixation; the stress makeup of these forms is the same as their unsuffixed counterparts, e.g. *t͡ʃuʔu+**répu*** 'beak+cut' - *t͡ʃuʔu+**ré**pu-t-ame* 'beak+cut-P.NMLZ-PTCP' [LEL 09 4:65/el].

[19] Only body-part nouns can incorporate, which limits the amount of incorporated forms possible in the language. The forms in (21) involve the only tetrasyllabic body-part nouns in the corpus.

[20] This formalism comes from Sign-Based Morphology (Orgun 1996), but this framework is not indispensable for the analysis.

[21] This notation assumes a item-based view of morphology, but this is merely done for clarity of exposition. Please note that this schema is also amenable to a realizational representation.

[22] Discussion of the role of 'master rankings' in Cophonology theory can be found in Benua (1997a), Alderete (2001c), Itô and Mester (1999), Anttila (2002), and Inkelas and Zoll (2007).

[23] An anonymous reviewer points out that without tetrasyllabic roots, this system could be analyzed as trochaic with high ranked foot-binarity. However, it would be hard to reconcilliate a left-aligned trochaic system with disyllabic words with second syllable stress (which are well represented in the CR corpus). As discussed in Graf and Ussishkin (2003), this kind of analysis would have the undesirable consequence of having to handle these forms through a structure with an initial unparsed syllable and a degenerate foot, a highly marked structure.

[24] The distinction between the two classes of suffixes in CR could be treated as inherently stressed or unstressed, just as roots, as a reviewer suggests. That is, the phonological properties of a heterogeneous set of affixes can be 'unpacked' as diacritic marks for each individual affix. In a Cophonology analysis, however, phonological properties of affixes are treated as properties of morphological constructions, not as diacritically marked individual morphemes (see Inkelas 1998 for discussion). See, however, how the diacritic marking of affixes as stressed or unstressed is compatible with Indexed Constraint approaches (and see the implementation in these terms in Section 4).

[25] An anonymous reviewer suggests that is preferable to analyze ternary stress in CR without ternary constituents, but instead using (initial) extrametricality (Hayes 1995; Hammond 1990a, 1990b) or another device that is not ternary-specific (e.g., edge marking (Idsardi 1992), constraints on lapse (Green and Kenstowicz 1995, Elenbaas and Kager 1999) or edge avoiding constraints (Beasley and Crosswhite 2003), etc.). An analysis of CR stress employing initial extrametricality could be implemented in OT terms through a NONINITIALITY constraint, as in Hualde's (1998) analysis of an initial three-syllable window in Azkoitia Basque. Note, however, that modeling ternary stress with initial extrametricality may lead to a ranking conflict if initial extrametricality has to be reversed in the presence of lexical stress. Specifically, as Hyde (2008) notes, any constraint ensuring the preservation of lexically

pre-specified stress (such as PROS-FAITH) must outrank NONINITIALITY in the cases of roots with irregular first syllable stress (recall (8a) – (8b) and (9a) in Section 2.2.3). However, the opposite ranking would be necessary in order to model window effects, i.e., the generalization that the overarching restriction of having stress be confined to the first three syllables cannot be overridden by faithfulness to lexical stress. While it would be perhaps possible to save an initial-extrametricality analysis (or another alternative framework) for CR, I leave the adequacy of such analyses for future research.

[26] We might speculate about the nature of the relationship between the two cophonologies with third syllable stress. On the one hand, morphological heads in incorporation are prosodically prominent. On the other hand, second syllable stress roots are the most frequent root type in the CR corpus. These two factors could have led to the reanalysis of the morphologically conditioned third syllable stress as a ternary initial window system. That is, if stress-shifting suffixes have a more recent history of grammaticalization than stress-neutral suffixes, there is a link between the constructions with stress-shifting suffixes and incorporation constructions. The diachronic source of the stress window will remain a topic for future research.

[27] This generalization stems from 'Accent Resolution', which involves the deletion of accent of a morpheme in a word containing more than one inherently accented morpheme in competition for the single accent in the prosodic word level. Accent resolution is regulated by the PROS-FAITH constraints defined in (25), a set of constraints regulating input-output mappings.

[28] These Tableaux do not include prosodic faithfulness constraints, since the morphemes evaluated do not carry any lexically specified prosodic information.

[29] RCA correctly emphasizes the asymmetry between roots and affixes in the resolution of competing stresses, but it incorrectly predicts that this asymmetry is only possible when stress is present in the input. That is, only through positional faithfulness are roots conferred a privileged role over affixes. The CR case suggests, however, that roots also prevail in default stress assignment, an important generalization that the RCA is not able to capture.