THEORETICAL ASPECTS OF PANOAN METRICAL PHONOLOGY: DISYLLABIC FOOTING AND CONTEXTUAL SYLLABLE WEIGHT

by

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A Dissertation submitted to the Graduate School-New Brunswick

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Graduate Program in Linguistics

written under the direction of

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January, 2006

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ABSTRACT OF THE DISSERTATION

Theoretical Aspects of Panoan Metrical Phonology:

Disyllabic Footing and Contextual Syllable Weight

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This dissertation studies the relation between foot size and contextual syllable-weight. In particular, it focuses on the influence that foot disyllabicity has on triggering quantity adjustments of syllable weight. Within Optimality Theory (Prince and Smolensky 1993; 2004), this dissertation formally addresses the relation between foot size and syllable weight through the stringency relation between two constraints: *FOOT(σ) and *FOOT(μ). The former penalizes feet smaller than two syllables and the latter, feet smaller than two moras. In isolation, they create a scale in which disyllabic feet are more preferable than

monosyllabic feet and, in turn, bimoraic monosyllabic feet (symbolized as (H)-feet) are more preferable than monomoraic monosyllabic feet (symbolized as (L)-feet).

The existence of other conflicting constraints can, however, prevent the occurrence of disyllabic feet, which in turn causes the emergence of monosyllabic feet. Whether feet are disyllabic or monosyllabic in a given context depends on the conflict between respecting the constraints that inhibit quantity adjustments, complying with those that restrict the distribution of syllable weight and satisfying the constraints *FOOT(σ) and *FOOT(μ).

Empirically, the relation between foot disyllabicity and quantity adjustments of syllable weight is studied through the detailed examination of two Panoan languages spoken in the Peruvian Amazon: Shipibo and Capanahua. The data presented is the result of several fieldtrips carried out by the author. Although both languages are trochaic by default and distinguish heavy versus light syllables, (H)-feet are avoided in favor of disyllabic feet. In order to obtain disyllabic feet and avoid heavy syllables as heads of uneven (H.L)-trochees or in unstressed positions, Shipibo and Capanahua contextually adjust vowel length and the weight of closed syllables.

The disyllabic footing of Shipibo and Capanahua is not only supported by the distribution of heads within the Prosodic Word (PrWd) but also by a number of segmental rhythmic phenomena; for example, rhythmic allomorphy, long vowels and heavy closed syllables restricted to even syllables, inhibition of glottal coalescence in odd syllables.

DEDICATION

To Phillip, because ‘das Ding’ and ‘la Jouissance’ outrank ‘Foot Disyllabicity’

ACKNOWLEDGEMENTS

Many people have helped me during my Ph.D. studies at Rutgers and in particular in the course of this dissertation. First, I would like to thank profoundly Alan Prince for all his guidance during these last five years of my life as a graduate student. His support and insights have been critical in my research. My deepest gratitude also goes to Akinlabi Akinbiyi, Paul de Lacy, John McCarthy and Bruce Tesar for their invaluable support, guidance and feedback, which have contributed enormously to different aspects of this dissertation.

I would like to thank particularly José Camacho, Liliana Sánchez and Jane Grimshaw. They have not only guided me through my graduate studies but also have had a profound impact on me. From the beginning, Jose and Liliana have always given me their unconditional support both in my academic and personal life for which I am eternally grateful. Jane is one of the finest people I have ever met. I have not only been influenced by her way of viewing academia and by her guidance but also by her continuous energy in pursuing linguistic research and OT Syntax, in particular.

The enthusiasm and generosity of the Shipibo and Capanahua communities who warmly hosted me during the fieldtrips taught me much more than their languages. They have left me with an experience that has enormously enriched my life. My sincere appreciation goes especially to Cleber Cumapa, Laureana Rojas, Adelina Ahunari, José Silvano, Miguel Silvano, Gustavo Ramirez, Saira Solisban Chumo, Omer Pizarro Huaninchi, Celso Baquinahua Ruíz, Jobita Sachibo Rios.

The audience comments on earlier drafts of various sections of this dissertation at the Second Old World Conference in Phonology (OCP2), the 35th Conference of the North Eastern Linguistic Society (NELS 35), the 12th Manchester Phonology Meeting (12mfm), the 7th Workshop on American Indigenous Languages (WAIL-7), the 28th Penn Linguistics Colloquium, the Michigan Linguistic Society (MLS–2003) are duly and gratefully acknowledged. My deepest gratitude for their feedback, comments and support goes to Birgit Alber, Julliette Blevins, Eugene Buckley, Stuart Davis, Daniel Everett, Colleen Fitzgerald, Spike Gildea, Matthew Gordon, Harry van der Hulst, Michael Kenstowicz, Bruce Morén, Jochen Trommer, Olga Vaysman and James K. Watters.

Others who have assisted me in a multiplicity of ways, and without whom this dissertation would not have been possible include Ken Safir, Mark Baker, Veneeta Dayal, Roger Schwarzschild, Viviane Deprez, and Margo Persin. I would like to thank especially my dear friend Enrique Espinoza for his priceless help during fieldtrips to the Shipibo and Capanahua communities in Peru. I am also grateful to my family and my friends Seunghun Lee, Vita Markman, Natalia Kariaeva, Liping Chen, Joanna Stoehr, Adrian Brasoveanu, Alex Zepter, Slavica Kochovska, Xiao Li.

Table of Contents

Chapter 1: Introduction

This dissertation studies the relation between foot size and contextual syllable weight. It specifically focuses on the influence that foot disyllabicity has on triggering contextual adjustments of quantity in closed syllables as well as vowel length. Within the theoretical framework of Optimality Theory (McCarthy and Prince 1993; Prince and Smolensky 1993; 2004), it is claimed that the classical constraint FOOT BINARITY (Hayes 1985; McCarthy and Prince 1986; Prince 1980; 1990; Prince and Smolensky 1993; 2004), which penalizes feet smaller than two moras, must be complemented with a new constraint, *FOOT(σ), which penalizes the occurrence of feet smaller than two syllables. In isolation, these two constraints create a scale in which disyllabic feet are more preferable than monosyllabic feet and bimoraic monosyllabic feet (represented as (H)-feet) are more preferable than monomoraic monosyllabic feet (represented as (L)-feet).

(1) Scale of Preferability on Foot Size

(σ.σ) > (H) > (L)

However, the existence of other conflicting constraints can prevent the occurrence of disyllabic feet. Whether feet are disyllabic or monosyllabic in a given context depends on the conflict between respecting the constraints that inhibit quantity adjustments, complying with those constraints that restrict the distribution of syllable weight and satisfying the constraints *FOOT(σ) and *FOOT(μ). As a result of this approach, the foot inventory that a given grammar allows entirely depends on the interaction of constraints.

The approach proposed in this dissertation contrasts with the studies of metrical phonology (for example, Halle and Vergnaud 1987; Hayes 1980; 1995; Kager 2005; Liberman and Prince 1977; McCarthy 1993; Prince 1980; 1983; 1985) in which languages choose from a fixed set of metrical feet. For instance, in languages that group syllables into left-headed feet (i.e. trochaic languages), heavy syllables form their own (H)-feet whereas in those that lack heavy syllables, feet are disyllabic and in languages with right-headed feet (i.e. iambic languages), heavy syllables group together with preceding light syllables or otherwise they form their own (H)-feet. See examples in (2) to (4), reported by Hayes 1995:62-71. The examples are from Pintupi (Hansen and Hansen 1969; 1978; Hayes 1995:62-4; Kager 1992:124), Cairene Arabic[1] (Hayes 1995:67-71; Kenstowicz 1994:291-2; McCarthy 1979; Mitchell 1960; Prince 1990:9) and Seminole/Creek (original data[2] from Haas 1977; Jackson 1987; Tyhurst 1987 and Hayes 1995:64-7 reporting personal communication from J. Martin and P. Munro). In the data below, the PrWd main head is indicated by [ˈ] and the heads of secondary feet, by [ˌ].

(2) Pintupi: (ˈσ.σ) Syllabic Trochaic Feet

a. (ˈpa.ɳa)	‘earth’
b. (ˈtʲu.ʈa).ya	‘many’
c. (ˈma.ɭa)(ˌwa.na)	‘through from behind’
d. (ˈpu.ɭiŋ)(ˌka.la).tʲu	‘we (sat) on the hill’

[1] This includes the variety used by Egyptian news broadcasters (Harrell 1960; Hayes 1995:130-2) called Modern Standard Arabic.

[2] For metrical analysis of Seminole/Creek, see Blevins 1990; Halle and Vergnaud 1978; Hayes 1980; Jackson 1987; Prince 1983; Tyhurst 1987.

(3) Cairene Arabic: (ˈL.L) or (H) Moraic Trochaic Feet

a. (ˌʃa.ja)(ˈra.tu) ‘Tree’ (nom. sg.)

b. (ˌʃa.ja)(ˈra.tu).hu ‘His tree’

c. (ˌqaː)(ˈhi.ra) ‘Cairo’

d. (ˌʔaː)(ˈla.mu) ‘His world’

e. (ˌhaː)(ˈdaː).ni ‘These’ (m. dual) - Classical

(4) Seminole/Creek: (L.ˈσ) or (H) Iambic Feet

a. (ni.ˈhaː) ‘lard’– [from Tyhurst]

b. (co.ˈko) ‘house’ – [from Tyhurst]

c. (ˌtaː)(ʃo.ˈki).ta ‘to jump (dual subj.)’ – [from Jackson]

d. (a.ˌti)(ˌloː)(yi.ˈta) ‘to gather (pl.obj.)’ – [from Martin (p.c. reported by Hayes 1995)]

One of the most well-known inventories of feet is shown in (5) from Hayes 1995.

(5) Foot Inventory (Hayes 1995:71)

a. Syllabic Trochee (ˈσ.σ)

b. Moraic Trochee (ˈL.L) or (H)

c. Iamb (L.ˈσ) or (H)

Empirically, this dissertation focuses on the relation between foot size and syllable weight through the detailed examination of two Panoan languages: Shipibo and Capanahua. These languages do not fit into the classification given in (5).

Both languages behave as moraic-trochee languages in that they are trochaic by default and make distinctions between light and heavy syllables. However, as if they were syllabic trochee languages, they avoid the occurrence of (H)-feet. Shipibo's and Capanahua's grammars strive to obtain disyllabic feet. Furthermore, both languages impose strict restrictions on the distribution of heavy syllables: they cannot occur unstressed or as heads of trochaic (H.L)-feet. This forces heavy syllables to only occur as heads of iamb feet.

(6) Inventory of Metrical Feet in Shipibo and Capanahua

a. Trochee: (ˈL.L)

b. Iamb: (L.ˈH)

c. The (H)-foot only occurs under very restricted conditions in monosyllabic noun roots and their derived forms.

In order to comply with the restrictions on the distribution of heavy syllables, Shipibo and Capanahua adjust the weight of their syllables. Long vowels undergo rhythmic quantity-adjustments and closed syllables show contextual weight throughout the Prosodic Word (PrWd) as well as loss of codas through coalescence to meet the demands of syllable weight and the footing of syllables into disyllabic feet.

Put differently, in these languages, syllable weight adjusts to accommodate disyllabic feet and to respect weight restrictions and not the other way around as has been assumed so far in the studies of metrical phonology.

The disyllabic footing of Shipibo and Capanahua is not only supported by the distribution of heads within the Prosodic Word (PrWd) but also by a number of rhythmic phenomena[3]. Unless explicitly mentioned, the data presented in this dissertation for Shipibo and Capanahua come from several fieldtrips the author carried out in indigenous communities in Peru during 1998 to 2004.

The following sets of data illustrate a sample of the rhythmic phenomena found in Shipibo and Capanahua which will be discussed throughout the dissertation in connection with foot size and contextual syllable weight. The data from Shipibo in

(7) and (8) show that when no heavy syllable occurs in the PrWd, the footing consists in a chain of trochaic disyllabic feet. However, when heavy syllables do occur, the footing keeps being disyllabic but this time, it becomes iambic.

(7) (ˈa.ta)(ˌpa.-ʂu)(ˌku.-bu)

Hen -diminutive -plural

'Little hens'

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[3] Loos 1999 also reports that in other Panoan languages like Yaminawa (Eakin 1991; Faust and Loos 2002) and Amahuaca (Hyde 1980; Russell 1965; 1975), nasal consonants alternate with oral stops or obtain a plosive release in the onset of even open syllables. The following example comes from Amahuaca (Loos 1999): [ˈho.nᵈi] 'man' ~ [ho.ˈni-n] 'man' (ergative). Loos 1999 also provides an example for Yaminawa: [ˈa.do] 'majás (edible rodent)' ~ [a.ˈno-n] 'majás' (ergative)). Unfortunately, there is not enough data available from Yaminawa and Amahuaca to propose a serious analysis of this nasal ~ oral consonantal alternation and go beyond simply acknowledging its existence. For Huariapano, an already extinct Panoan language, Parker 1992; 1994; 1998 reports that a glottal fricative segment, [h], inserts in the coda of odd syllables counting from left to right within the PrWd (on this phenomenon, see also de Lacy 2002; Elias-Ulloa 2003; Gonzalez 2002; 2003).

(8) (yu.ˈmɨː)(tsu.-ˌriː)(ba.-ˌwɨː)

steal -again -imperative

'Steal (it) again'

It is worth mentioning that heavy syllables with long vowels that would occur in odd positions undergo vowel shortening. In general, PrWds do not contain (H.L) or (H) feet[4]. This ban is schematically shown in (9).

(9) a. *(ˈH)…

b. *(ˈH.L)…

The data in (10) from Shipibo shows that only closed syllables in even positions are heavy (they attract the stress). The example in (10.a) offers a point of comparison between even syllables with long vowels and even closed syllables. As in the case of long vowels that are shortened in odd syllables, odd closed syllables are forced to be light.

(10) a. (ka.ˈpɨː) 'crocodile'

b. (wi.ˈtaʂ̩) 'leg'

c. (tʃun.ˈkɨʂ̩) '(sp. of) bird'

d. (mis.ˈpan).mis 'tamale seller'

[4] As mentioned, the (H)-foot only occurs in Shipibo and Capanahua in the case of monosyllabic roots with long vowels and their derived forms (see chapter 2 and 3 for more information).

Besides the rhythmic distribution of its syllable heads within the prosodic structure, Shipibo also presents segmental rhythmic phenomena. As an example, the data in (11) to (14) present instances of the realization of the morpheme ‘again’, which has two allomorphs /-ribiː/ and /-riːba/. The rhythmic alternation of the suffix ‘again’ was originally reportated by Lauriault 1948; Loriot, Lauriault et al. 1993 (see also de Lacy 2002; Elias-Ulloa 2000; 2003; Faust 1973; García-Rivera 1994; Gonzalez 2002; 2003). The alternation is conditioned in that the long vowel always occur as the head of an iambic feet. In the data below, the realizations of the suffix ‘again’ appear underlined.

(11) (pi.-ˈ<u>riː)(ba</u>.-kɨ)

Eat -again -past

‘(He) ate (it) again’

(12) (ˈpu.ta)(-<u>ri.ˌbiː)</u>-kɨ

Throw -again -past

‘(He) threw (it) again’

(13) (ˈpu.ta)(-ma.-ˌ<u>riː)(ba</u>.-kɨ)

Throw -causative -again -past_tense

‘(He) made (him) throw (it) again’

(14) (ˈpu.ta)(-ˌya.ma)(-ˌri.biː)-kɨ

Throw -negation -again -past

'(He) did not throw (it) again'

The ergative suffix both in Shipibo and Capanahua shows a rhythmic behavior, as well. The suffix alternates between /-n/ and /-nin/ so it ends up parsed into a disyllabic feet. See data in (15) and (16).

(15) a. (ˈba.kɨ) 'Child'

b. (ba.ˈkɨ-n) 'Child (ergative)'

(16) a. (ˈa.ta).pa 'Hen'

b. (ˈa.ta)(pa.-nin) 'Hen (ergative)'

Capanahua, in addition to the rhythmic phenomena just shown for Shipibo, also has a phenomenon of glottal coalescence, which is metrically conditioned. This rhythmic phenomenon was originally reported by Loos 1969; 1999. Glottal coalescence in Capanahua only affects glottal stops, [ʔ], that would otherwise occur in the coda of unstressed syllables. Glottal coalescence is inhibited in stressed syllables. See data in (17) and (18). In this dissertation, Capanahua's glottal coalescence is analyzed as another way that Panoan languages resort in order to adjust the weight of their syllables to the metrical context in which they occur while respecting the disyllabic size of their feet.

(17) /toʔko -raʔ -taʔ -ki/ → (ˈtoʔ.ko)(-ˌraʔ.-ta̰) -ki

Frog -probably -evidential –declarative

‘It’s probably a frog’

(18) /ʔotʃiti -raʔ -taʔ -ki/ → (ˈʔo.tʃi)(ˌti.-ra̰)(-ˌtaʔ.-ki)

Dog -probably -evidential –declarative

‘It’s probably a dog’

The dissertation is organized as follows: chapter 2 presents an overview of Shipibo phonology. This overview provides data and descriptive generalizations of Shipibo segmental and stress system. This overview is done in neutral terms with regard to theoretical frameworks. Chapter 3 lays a set of theoretical assumptions on which the formal analyses proposed for Shipibo and Capanahua will rely. Chapter 4 and 5 accounts for the interaction of foot size and contextual syllable weight in Shipibo. Chapter 4 focuses on the metrical adjustments that vowel length undergoes. Chapter 5 discusses and accounts for the contextual weight of closed syllables. Central to the account presented in these chapters is the proposal of a new constraint, *FOOT(σ) ‘do not have feet smaller than two syllables’. The interaction of *FOOT(σ) with the classical constraint FOOT BINARITY and with the constraints that govern syllable weight regulates foot size and the trigger or inhibition of quantity adjustments.

Chapter 6 studies metrically conditioned glottal coalescence in Capanahua. In addition to show the key parallels between Shipibo and Capanahua segmental and metrical systems, this chapter focuses on the role that the interaction of *FOOT(σ), faithfulness constraints and the constraints in charge of syllable weight plays in creating glottal coalescence in Capanahua as a way to comply with the requirements of footing and the distributional restrictions on the weight of closed syllables. Chapter 7 explores the consequences of incorporating the constraint *FOOT(σ) for other grammars with regard to foot size and contextual syllable weight.

Chapter 2: Overview of Shipibo Phonology

1 Introduction

The main aim of this chapter is to present an overview, as descriptive as possible, of Shipibo[1] segmental inventory, syllable structure, stress patterns and asymmetries between odd and even syllables with regard to vowel-length distribution, vowel reduction, vowel devoicing and high-tone attraction.

This chapter is organized as follows: section §2 shows the Shipibo segmental inventory as well as its syllabic structure. Section §3 provides information about the metrical system of the language; in particular, main-stress assignment and high-tone attraction as well as distribution of long vowels and behavior of closed syllables. Section §4 presents information on the long vowels of monosyllabic roots. Finally, section §5 presents a summary of the main generalizations obtained in this chapter.

[1] The data presented in this chapter come from my own fieldwork (Peru, 1997-2004). Other data sources can be found in Faust 1973; García-Rivera 1994; Lauriault 1948; Loriot, Lauriault et al. 1993; Steinen 1904.

2 Basics of Shipibo

2.1 Segmental Inventory

Shipibo has fifteen consonantal segments. The glottal stop [ʔ] occurs optionally at the beginning of words that otherwise would begin with a vowel. The voiced bilabial is always fricative. In this dissertation is represented by [b]. The symbol [ʂ] represents a voiceless retroflex sibilant.

(1) Consonants of Shipibo

p	t			k	(ʔ)
b					
	s	ʃ	ʂ		h
	ts	tʃ			
	r				
m	n				
w		y			

Shipibo has four vowels: [i, u, a, ɨ]. Each vowel has a long counterpart. See (2). In this dissertation, the symbol [u] represents a high back slightly-rounded vowel and the symbol [ɨ], a high central unrounded vowel.

(2) Vowels of Shipibo

i / iː   ɨ / ɨː   u / uː

a / aː

Vowels in Shipibo are generally reduced and phonetically shortened as they occur away from the PrWd right edge. In the case of vowel reduction, vowels tend to be centralized and lax. The further to the right a vowel occurs, the stronger the effects of reduction and shortening are. Section §3 gives more information about vowels and their relation with the metrical system.

2.2 Phonotactics within the Syllable

In Shipibo, codas are restricted to the segments [s, ʃ, ʂ, n]. See (3). Syllable nuclei cannot host diphthongs. Codas and onsets are optional. Complex onsets and complex codas are disallowed. Possible syllables have one of the following forms: (C)V(C) or (C)Vː.

(3) a. [ˈba.kɨ] ‘child’

b. [kuʃ.ˈpan] ‘double chin, jowl’

c. [tʃi.ˈpɨʂ.ku] ‘iliac bone’

d. [ˈtsis.tɨ] ‘coal’

e. [ˈta.ɨ] ‘foot’

f. [i.ˈsaː] ~ [ʔi.ˈsaː] ‘bird’

Although Shipibo tolerates onsetless syllables, it imposes certain restrictions on their distribution: the third syllable of a word must have an onset (e.g. [ˈʔa.ta.pa] ‘hen’, [ˈʂun.ta.ku] ‘young woman’). Thus, words whose third syllable lacks an onset (i.e. *CV.CV.V) are ill-formed[2].

Vowels followed by a nasal coda are strongly nasalized. The nasalization can spread to other syllables if the surrounding segments are sonorant or voiced segments.

(4) a. / binun / → [bĩ.ˈnũn] ‘Aguaje (Sp. of palm tree/fruit)’

b. / kubin -kɨ / → [kũ.ˈbĩŋ.-kɨ] ‘(he) boiled (it)’

c. / tʃumpɨ / → [ˈtʃũm.pɨ] ‘(Sp.of) wood rattan’

d. / rantunku / → [rãn.ˈtũŋ.ku] ‘knee joint’

Words that begin with a vowel can optionally appear with a glottal stop. See (5). Morpheme-internally, glottal stops cannot occur. See examples in (6).

(5) Onsetless Initial Syllables

a. [ˈi.bu] ~ [ˈʔi.bu] ‘owner’

b. [ˈa.ta.pa] ~ [ˈʔa.ta.pa] ‘hen’

c. [i.ˈsaː] ~ [ʔi.ˈsaː] ‘bird’

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[2] I am only aware of two words with an onsetless third syllable: [ma.ˈsuː.i.-ti] ‘to swell up one’s head’ and [tʃi.ˈtuː.a.-ti] ‘shrink’. In both cases, the second syllable has a long vowel and bears the main stress. In chapter 6, a similar restriction will be addressed for Capanahua.

(6) Onsetless Second Syllables

a. [ˈka.u] ‘(sp. of) bird’

b. [ˈpɨ.u.ta] ‘(type of) shelter’

c. [a.ˈin.bu] ‘woman’

Shipibo roots are overwhelmingly disyllabic, although there are also monosyllabic and trisyllabic roots. Words that seem greater than three syllables can be analyzed as compounds or roots with suffixes. See data in (7) to (8).

(7) <u>*Compound (Loriot, Lauriault et al. 1993)*</u>

a. [ˈmu.ru.tɨ.u] ‘(type of) collar for women’

b. [ˈmu.ru] ‘beads’

c. [ˈtɨ.u] ‘necklace’

(8) <u>*Root and Suffix (Loriot, Lauriault et al. 1993)*</u>

a. [ˈʂɨ.ta.u.ma] ‘toothless’

b. [ˈʂɨ.ta] ‘tooth’

c. / -oma / ‘without’

The only monomorphemic roots bigger than three syllables of which I am aware are loanwords. See examples in (9).

(9) *Loanwords (Loriot, Lauriault et al. 1993)*

a. [ˈru.ku.tu.ru] ‘doctor’ (from Spanish [dok.ˈtor] – doctor)

b. [ki.ˈriː.ni.ka] ‘clinic’ (from Spanish [ˈkli.ni.ka] – clínica)

c. [ˈma.ra.ti.tʃu] ‘hammer’ (from Spanish [mar.ˈti.yo] – martillo)

3 Shipibo Metrical System

3.1 Main Stress

Syllables bearing main stress in Shipibo are characterized, in the case of short and long vowels, by their resistance to becoming lax, undergoing devoicing and their attraction of high tones. In addition, long vowels in main-stressed syllables do not shorten.

(10) Main-stressed syllables in Shipibo are characterized by having (i) vowels that do not become lax and resist devoicing, (ii) long vowels that do not shorten and by (iii) their attraction of high tones.

The data presented in (11) and (12) give examples of short and long vowels bearing main stress. The symbol [ˈ] indicates a syllable bearing main stress and [́] high tone.

(11) Short Vowels with Main Stress

a. [ˈtí.tɐ] ‘mother’

b. [ˈpú.tʊ] ‘dust’

c. [ˈkɨ́.nɪ] ‘moustache’

d. [ˈrá.mɐ] ‘now’

e. [ˈʃɨ́.pɐ] ‘green’

(12) Long Vowels with Main Stress

a. [pa.ˈbíː.kɪ] ‘ear’

b. [tʃi.ˈkúː.rʊ] (type of demon)

d. [ka.ˈpɨ́ː] ‘crocodile’

e. [ka.ˈwaː.tɪ] ‘bridge’

f. [ˈtʃíː.-kɪ] ‘in the fire’ (/tʃiː/ ‘fire’, /-ki/ locative suffix)

Closed syllables ((C)VC), syllables with long vowels ((C)Vː) and open syllables with short vowels ((C)V) can bear main stress. However, main stress cannot occur beyond the two initial syllables of the PrWd counting from left to right. Furthermore, the assignment of main stress is quantity-sensitive. It occurs on the second syllable if it is heavy (i.e. bimoraic); otherwise, it occurs on the initial syllable.

(13) Shipibo Main Stress

> “Main stress is restricted to occur on one of the two initial syllables of a PrWd. Stress the second syllable if it has a long vowel or it is a closed syllable. Otherwise stress the initial one. Monosyllabic roots with long vowels are always stressed.”

The data in (14) shows that when the second syllable of a prosodic word has a long vowel, the main stress is attracted to it[3].

(14) Main Stress on the Second Syllable

a. [ka.ˈpɨː]	‘crocodile’
b. [pɨ.ˈkɨː]	‘sore’
c. [haʂ.ˈkaː]	‘(a bunch of) bananas’
d. [is.ˈpiː.ku]	‘mirror’ (from the Spanish [es.ˈpe.xo] - *espejo*)
e. [pa.ˈbiː.ki]	‘ear’
f. [ha.ˈmaː.-kɨ]	‘(he) stepped (on it)’
g. [yu.ˈmɨː.tsu-kɨ]	‘(he) stole (it)’

If the second syllable is closed, the main stress is also attracted to it. See (15).

(15) Main Stress on the Second Syllable

a. [wi.ˈtaʂ]	‘leg’
b. [ma.ˈsɨn]	‘pumpkin’
c. [rɨ.ˈpin.ti]	‘port’

Initial closed syllable cannot attract the main stress when competing with a following closed syllable or a syllable with a long vowel. See the data in (16) and (17).

[3] Putting aside the case of monosyllables (see section §4), in Shipibo long vowels only occur in even syllables counting from left to right. Furthermore, the occurrence of long vowels is not predictable. Compare the data in (14) and (18). See section §3.2.1 for more information on the distribution of long vowels in Shipibo.

The words in (16) have two closed syllables competing for the main stress. What is interesting about these words is that the main stress falls on the even closed syllable, not on the odd one.

Thus, the words in (16.a) and (16.b) have two closed syllables. The main stress falls on the second syllable and not on the initial one. This is unexpected since both syllables are closed. We would expect the main stress to show the default pattern (namely, main stress on initial syllable) but it does not. The trisyllabic words in (16.c) and (16.d) follow the same pattern. They have three closed syllables but only their second closed syllable is able to attract the main stress.

(16) *<u>Main Stress on the Second Syllable</u>*

a. [tʃun.ˈkɨʂ̩] ‘(sp. of) bird’

b. [tsis.ˈpin] ‘sting’

c. [mis.ˈpan.mis] ‘tamale seller’

d. [run.ˈtan.his] ‘(a type of) medicine’

The data in (17) show that initial closed syllables cannot defeat syllables with long vowels when competing for main stress.

(17) a. [kɨʂ̩.ˈbuː] ‘corn chaff’

b. [nin.ˈkɨː] ‘long’

c. [maʂ̩.ˈkaː.-kɨ] ‘(he) lacked (it)’

The data in (18) show the default case for main stress. When syllable heaviness is not at play, main stress appears on the initial syllable of the PrWd. In all those cases, the second syllable is open and has a short vowel.

(18) *Main Stress on the Initial Syllable*

a. [ˈba.kɨ] ‘child’

b. [ˈmis.ku] ‘cramp’

c. [ˈsa.pi.tun] ‘(sp. of) fish’

The data in (19), from Loriot, Lauriault et al. 1993, show that the generalization for the main stress assignment presented in (13) is quite regular. Compare (18.a) and (19.a). When the ergative suffix, /-n/, is added, the second syllable of [ˈba.kɨ] ‘child’ becomes closed: [ba.ˈkɨ-n]. The main stress now is assigned onto the closed syllable. Similarly, the main head falls on the second syllable of the word for ‘cramp’ when it becomes closed. Compare (18.b) and (19.b): [ˈmis.ku] but [mis.ˈku-n].

Now compare (15.a) to (19.c). In (15.a), the main stress is assigned to the second syllable of the word [wi.ˈtas̺] ‘leg’ since it is closed. When the ergative suffix is added, the final consonant is syllabified as the onset of the following syllable. Since the second syllable is now open, the main stress returns to the initial one: [ˈwi.ta.s̺-ɨn]. A similar pattern is shown in (15.b) and (19.d). The main stress falls on the second syllable when closed, but once it is open, it falls on the initial one: [tʃun.ˈkɨʂ], [ˈtʃun.kɨ.ʂɨn].

(19) a. [ba.ˈkɨn] ‘child-ergative’

b. [mis.ˈkun] ‘cramp-ergative’

c. [ˈwi.ta.ʂɨn] ‘leg-ergative’

d. [ˈtʃun.kɨ.ʂɨn] ‘(sp. of) bird-ergative’

In sum, in Shipibo main stress appears on the initial syllable when the second is open, but it is attracted to the second syllable if it is closed or has a long vowel. Closed syllables in Shipibo show two different behaviors with regard to their ability to attract main stress. Initial closed syllables, when competing with an even closed syllable or an even syllable with a long vowel, always fail to bear the main stress. In contrast, second closed syllables pattern with syllables with long vowels. In that position, they always attract the main stress. This is schematically shown in (20).

(20) [ˈba.kɨ], [ˈmis.ku] → ˈσ. σ

[ka.ˈpɨː], [kɨʂ.ˈbuː], [wi.ˈtaʂ], [tʃun.ˈkɨʂ] → σ.ˈσ

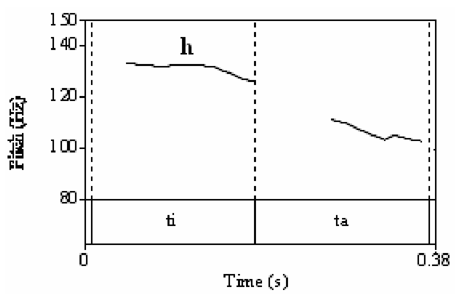
3.1.1 High Tones and Main Stress

Putting aside the resistance of short vowels to becoming lax or devoiced and long vowels' avoidance of shortening when they occur main-stressed, the syllable bearing the main stress in Shipibo always occurs associated with a high tone.

(21) Main-stressed syllables are associated with high tones.

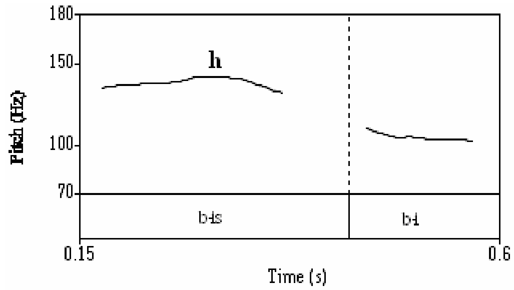
The pitch contours in (22) to (26) show this through the words [ˈtɪ́.ta] 'mother', [ˈbɨ́s.bɨ] '(Sp. of) wasp', [wi.ˈtá̧ʂ] 'leg', [tʃun.ˈkɨ́ʂ̧] '(sp. of) bird' and [pu.ˈtúː] 'full'. The high tone is indicated in the graphs by the letter '**h**'[4] and an acute diacritic [́] is used in the transcriptions.

(22) Pitch Contour for the Word [ˈtɪ́.ta] 'mother'

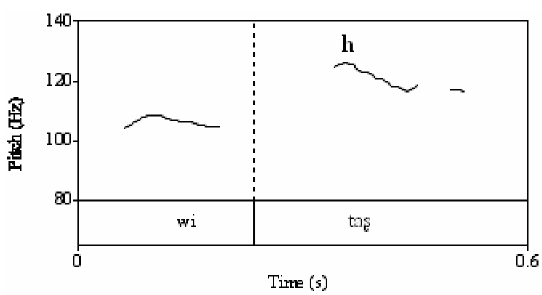


[4] The pitch contours were extracted using the PRAAT software (Boersma 1999; Boersma and Weenink 2005; Wood 2005).

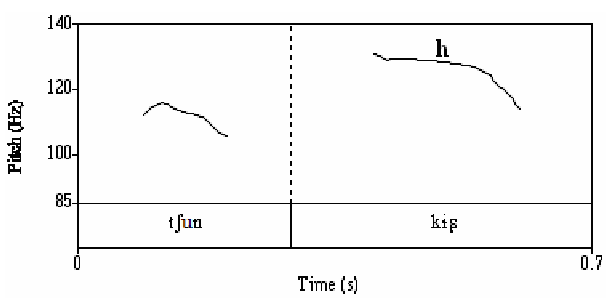
(23) Pitch Contour for the Word [ˈbɨ́s.bɨ]



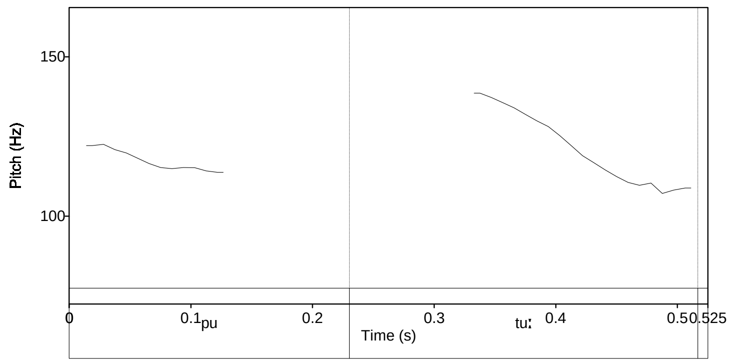
(24) Pitch Contour for the Word [wi.ˈtá̤s]



(25) Pitch Contour for the Word [tʃun.ˈkɨ́s]



(26) Pitch Contour for the Word [pu.ˈtúː]



3.2 Secondary Stresses

Secondary stresses in Shipibo are identifiable through the following phonological phenomena: resistance to vowel reduction and high-tone attraction in the case of long vowels, and resistance to vowel devoicing in the case of short vowels.

(27) Phonological indicators of secondary stresses: (i) resistance to vowel reduction and (ii) high-tone attraction in the case of long vowels and (iii) resistance to vowel devoicing in the case of short vowels.

3.2.1 Secondary Stress and Long Vowels

Long vowels in Shipibo always occur stressed and in even syllables (with the exception of monosyllabic roots with long vowels, which are the only source of long vowels in odd syllables in the language– see section §4 for more information).

Although, phonetically, long vowels with secondary stress can be realized shorter than their main-stressed counterparts, their phonological behavior is similar to main-stressed long vowels: they do not become lax or devoiced and they have the ability to attract a high tone. This dissertation takes this behavior to point out their 'stressed' status.

Before presenting the distribution of syllables with long vowels with secondary stress, it is important to describe their phonetic realization. In general, the further to the right a long vowel occurs in a PrWd, the shorter it becomes. However, this shortening is not categorical. The grammar treats them as long. There is considerably variation in the degree of phonetic shortening a long vowel can undergo.

The table (28) shows the different gradation observed in the length of long vowels with secondary stresses. The symbol [ˑ] indicates a long vowel that is phonetically shorter than a main-stressed long vowel but still long when compared to short vowels.

(28) Long Vowels in Even Syllables Beyond the Main Stress

/ɨː/ → [ɨː] ~ [ɨˑ] ~ [ɨ]	/aː/ → [aː] ~ [aˑ]~ [a]
/iː/ → [iː] ~ [iˑ]~ [i]	/uː/ → [uː] ~ [uˑ] ~ [u]

The data in (29) and (30) present examples of the phonetic implementation of length in syllables with long vowels bearing secondary stresses. The examples contain the imperative suffix, /-wɨː/, and one of the allomorphs of the suffix 'again', /-riːba/. The phonetic length of the long vowel depends on how far away it occurs from the right edge of the PrWd. The further to the right a long vowel occurs, the shorter it becomes: /-riːba/ → [-riː.bɐ], [-riˑ.bɐ] or [-ri.bɐ] and /-wɨː/ → [-wɨː], [-wɨˑ] or [-wɨ].

The symbol [ˌ] indicates a syllable with a phonological long vowel bearing secondary stress. The syllable containing the long vowel appears underlined.

(29) Phonetic Shortening of Long Vowels as They Approach to the PrWd Right Edge

a. [pi -ˈwɨː] ‘eat (it)!’

b. [ˈsa.wɨ.mɐ -ˌwɨˑ] ‘wear (it)!’

c. [ˈsa.wɨ.mɐ -yɐ.mɐ -ˌwɨ] ‘do not wear (it)!’

(30) Phonetic Shortening of Long Vowels as They Approach to the PrWd Right Edge

a. [pi -ˈriː.bɐ -kɨ] ‘(he) ate again’

b. [ˈyú.nʊ -mɐ -ˌriˑ.bɐ -kɨ] ‘(he) made (him) command (it) again’

c. [ˈsá.wɨ.mɐ -yɐ.mɐ -ˌri.bɐ -kɨ] ‘(he) didn’t wear (it) again’

Importantly, in (30), the long vowel could become phonetically shorter but it does not develop into a lax vowel.

(31) Long vowels bearing secondary stress do not become lax (e.g. /iː/ → *[ɪ], /uː/ → *[ʊ], /aː/ → *[ɐ], *[ə]).

Thus, as shown in (32), the long vowel in /-riːba/ in the examples in (30) do not develop into a lax *[ɪ]-vowel.

(32) a. *[pi -ˈr̲ɪ̲.bɐ -kɨ]

b. *[ˈyú.nʊ -mɐ -ˌr̲ɪ̲.bɐ -kɨ]

c. *[ˈsá.wɨ.mɐ -yɐ.mɐ -ˌr̲ɪ̲.bɐ -kɨ]

With regard to their distribution, long vowels in Shipibo, which always are stressed, can only be hosted by even syllables if the initial syllable has a short vowel.

(33) Syllables with long vowels bearing secondary stress occur in even syllables counting from the left edge of the PrWd, except if the initial syllable is a monosyllabic root that has a long vowel. In that case, stressed long vowels, if present, occur in odd syllables.

Since generally roots are maximally trisyllabic, the sources of long vowels with secondary stress are suffixes. The suffix meaning 'again' has two allomorphs[5]: /-ribiː/ and /-riːba/[6,7]. Each allomorph has a long vowel that always occurs stressed. The

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[5] Lauriault 1948 mentions the existence of five suffixes that show similar alternations but unfortunately he does not mention which those suffixes are. Furthermore, the allomorphy /-ribiː/ and /-riːba/ is mostly observed in older speakers of Shipibo. For younger speakers, the alternance is: [-rɪ.biː] and [-riː.bɪ].

[6] Diachronically, the possible origin of the long vowels present in the suffix 'again' might be due to the loss of consonants in the coda of both syllables. See Gonzalez 2002; 2003; Loos 1969; Loos and Loos 1998 who suggest that the initial syllable of the suffix comes from the proto-form *ritʃ 'yet'. The second syllable might come from *bi 'emphatic'. This latter proto-form has a short vowel, though.

[7] Chapter 4 (section §3.4) presents the arguments justifying why this suffix is analyzed as having two phonological representations.

alternation is governed by the condition that the long vowel must occur in an even syllable.

Descriptively, the allomorph /-ribiː/ appears when the suffix is attached either to an even number of syllables and the initial syllable has a short vowel (see (34) and (35)). In this case, the long vowel of /-ribiː/ appears stressed and in an even syllable.

(34) [ˈyu.nʊ.-rɪ.ˌbiː.-kɨ]

command -again -past_tense

‘(he) commanded (it) again’

(35) [ˈyu.nʊ.-yɐ.mɐ.-rɪ.ˌbiː.-kɨ]

command -negation -again -past_tense

‘(he) did not command (it) again’

Significantly, when the initial syllable has a short vowel, odd syllables cannot host long vowels. This is shown by the impossibility of having the allomorph /-riːba/ occurring instead of /-ribiː/ in (34) to (35), as shown by the ungrammatical forms in (36), which have in common that the long vowel would occur in an odd syllable.

(36) a. *[ˈyu.nʊ.-ˌriː.bɐ.-kɨ]

b. *[ˈyu.nʊ.-yɐ.mɐ.-ˌriː.bɐ.-kɨ]

In contrast, if the initial syllable of a PrWd is a monosyllabic root with a long vowel, stressed syllables with long vowels can occur in odd syllables. Thus, the long vowel of /-ribiː/ appears stressed but, this time, in an odd syllable (see (37) and (38)).

(37) [ˈtɨː.-rɪ.ˌbiː.-kɨ]

work -again -past_tense

'(he) worked again'

(38) [ˈtɨː.-yɐ.mɐ.-rɪ.ˌbiː.-kɨ]

work -negation -again -past_tense

'(he) did not work again'

Again, in this case, the allomorph /-riːba/ cannot occur instead of /-ribiː/ in (37) and (38). Since the initial syllable has a long vowel, other long vowels in the PrWd can only be hosted by odd syllables, not by the even ones.

(39) a. *[ˈtɨː.-riː.bɐ.-kɨ]

b. *[ˈtɨː.-yɐ.mɐ.-riː.bɐ.-kɨ]

Unlike /-ribiː/, the allomorph /-riːba/ appears when the suffix is attached to an odd number of syllables and the initial syllable has a short vowel (see data in (40) to (42)). In this case, its long vowel appears stressed in an even syllable.

(40) [pi -ˈriː.bɐ.-kɨ]

eat -again -past_tense

‘(he) ate (it) again’

(41) [yu.ˈmɨː.tsʊ.-ˌriː.bɐ.-kɨ]

steal -again -past_tense

‘(he) stole (it) again’

(42) [ˈyu.nʊ.-mɐ.-ˌriː.bɐ.-kɨ]

command -causative -again -past_tense

‘(he) made (him) command (it) again’

However, if the initial syllable is a monosyllabic root with a long vowel, the long vowel of /-riːba/ occurs stressed but in an odd syllable (see data in (43))

(43) [ˈtɨː.-mɐ.-ˌriː.bɐ.-kɨ]

work -causative -again -past_tense

‘(he) made (him) work again’

As shown by the ungrammatical forms in (44), the allomorph /-ribiː/ cannot occur instead of /-riːba/ because the long vowel of the suffix 'again' would occur in an odd syllable (when the initial syllable has a short vowel; see (44.a-c)) or in an even syllable (when the initial syllable is a monosyllabic root with a long vowel; see (44.d)). Compare them to the data in (40) to (43).

(44) a. *[ˈpi -rɪ.ˌbiː.-kɨ]

b. *[yu.ˈmɨː.tsʊ.-rɪ.ˌbiː.-kɨ]

c. *[ˈyu.nʊ.-mɐ.-rɪ.ˌbiː.-kɨ]

d. *[ˈtɨː.-mɐ.-rɪ.ˌbiː.-kɨ]

So far the allomorphy /-ribiː/ and /-riːba/ is being used to illustrate the distribution of long vowels in Shipibo. At this point, it is worth mentioning that it is possible to find two different groups of speakers with regard to how the suffix 'again' is realized. The description given so far corresponds to the group of older speakers. This pattern has been well known among Panoan researchers since Lauriault 1948 described it for the first time.

However, there is a second group, formed mostly for young speakers of Shipibo, who have a high level of competence in Spanish. For this second group, the suffix ‘again’ is realized as [-riː.bɪ] and [-rɪ.biː][8]. See data in (45).

(45)	a. [ˈyu.nʊ.-<u>rɪ.biː</u>.-kɨ]	‘(he) commanded (it) again’
	b. [ˈyu.nʊ.-mɐ.-<u>riː.bɪ</u>.-kɨ]	‘(he) made (him) command (it) again’
	c. [ˈtɨː.-<u>rɪ.biː</u>.-kɨ]	‘(he) worked again’
	d. [ˈtɨː.-mɐ.-<u>riː.bɪ</u>.-kɨ]	‘(he) made (him) work again’

The existence of this second group of Shipibo speakers does not contradict the pattern described so far for the distribution of long vowels. On the contrary, it supports it. In both cases, the form [-rɪ.biː] as well as [-riː.bɐ] (older speakers) or [-riː.bɪ] (young speakers) occur in the same contexts.

Thus, putting aside the cases of monosyllabic roots with long vowels, in Shipibo long vowels are banned from occurring in odd syllables within the PrWd. Moreover, this generalization is also supported by the lack of polysyllabic words with long vowels in odd syllables. This is schematically represented in (46).

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[8] Interestingly, both old and young speakers only accept /-riːba/ in forms like [pi -<u>riː.bɐ</u>.-kɨ] as in (44.a). I will leave this issue for future research.

(46) Long Vowels banned in Odd Syllables

a. ✓CV.ˈCVː (e.g. [ka.ˈpɨː], [kɨʂ.ˈbuː], etc.)

b. *ˈCVː.CV

c. ✓CV.ˈCVː.CV (e.g. [yu.ˈmɨː.tsu.kɨ], [pa.ˈbiː.ki], etc.)

d. *ˈCVː.CV.CV

e. *ˈCV.CV.CVː

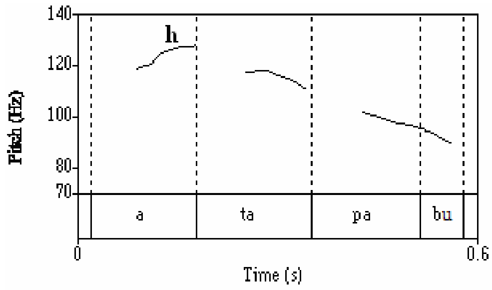
3.2.1.1 Secondary Stress, Long Vowels and High Tone Attraction

High tone attraction by long vowels also corroborates their status as ‘stressed’: in careful speech, syllables with long vowels occur associated with high tones.

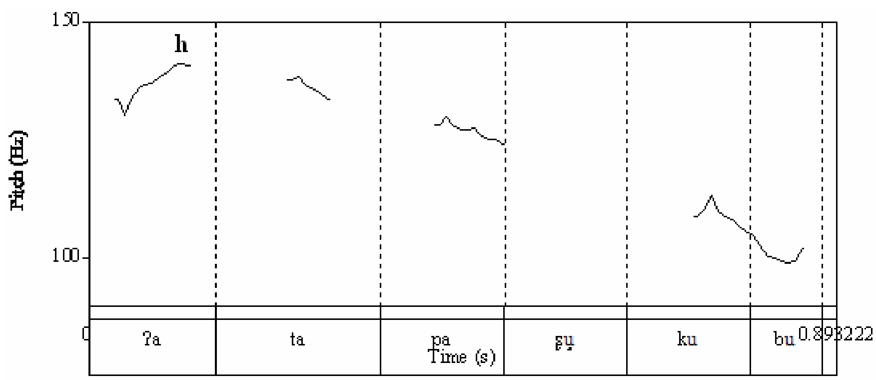
(47) In careful speech, long vowels bearing secondary stress attract high tones.

As a point for comparison, before presenting the attraction of high tones by long vowels, it is worth describing the behavior of the word pitch when there are no long vowels. As shown in section §3.1.1, the syllable bearing main stress is always associated with a high tone. After that syllable, the word pitch steadily falls until it reaches the end of the word. See graphs in (48) and (49). The ***h*** indicates where the high tone occurs.

(48) Word Falling-Pitch: [ˈá.tɐ.pɐ.bʊ]



(49) Word Falling-Pitch: [ˈá.tɐ.pɐ.ʂ̬ʊ.kʊ.bʊ]



The behavior of pitch in words like [ˈá.tɐ.pɐ.bʊ] ‘hens’ and [ˈá.tɐ.pɐ.ʂ̬ʊ.kʊ.bʊ] ‘little hens’ is important since it indicates that when a PrWd does not have long vowels, the pitch steadily falls after the syllable bearing main stress.

In contrast to the cases shown in (48) and (49), in careful speech, long vowels beyond the main stress do have high tones. As an example, let us examine the PrWd [ˈká.mɐ.rɪ.bíː.kɨ] ‘(he) made (him) go again’. Phonetically, the long vowel of the allomorph /-ribiː/ ‘again’ in this PrWd could be implemented as a long [iː]-vowel, as a shorter [iˑ]-vowel or as a short [i]-vowel. Importantly, the vowel does not develop into a lax vowel. As shown in the transcriptions in (50.c), even if the long vowel is phonetically implemented as a short one, it obtains a high tone.

(50) a. [ˈká.mɐ.rɪ.bɪ́ː.kɨ]

b. [ˈká.mɐ.rɪ.bɪ́ˑ.kɨ]

c. [ˈká.mɐ.rɪ.bɪ́.kɨ]

Compare the behavior of the long vowel of /-ribiː/ in (50) to the short vowels of /a.ta.pa -s̥uku -bu/. Except for the short vowel in the syllable bearing the main stress, short vowels never obtain a high tone, not even in careful speech. See (51) and also the pitch contour in (49).

(51) a. [ˈá.tɐ.pɐ.s̥ʊ.kʊ.bʊ]

b. *[ˈá.tɐ.pá.s̥ʊ.kú.bʊ]

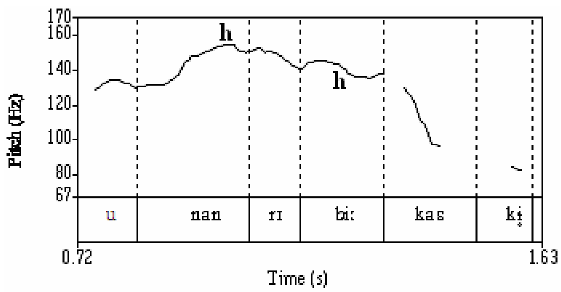
c. *[ˈá.tɐ.pɐ.s̥ú.kʊ.bú]

In (52) and (53), the words [ˈká.mɐ.rɪ.bíː.kɨ] ‘(he) made (him) go again’ and [u.ˈnán.rɪ.bíː.kɐs.kɨ] ‘(he) wanted to know (about him) again’ are shown. Each has two high tones: one associated with the main stress and the other with a long vowel.

As observed in (52), the leftmost high pitch appears associated with the syllable bearing the main stress. In this case, this is the second syllable of the PrWd since it is closed. Interestingly, the syllable with the long vowel also ‘attracts’ a high tone. This long vowel occurs in an even syllable.

In the graph, observe how the syllable containing the long vowel in [-rɪbiː] ‘again’ not only briefly stops the falling of the pitch but also creates a slight pitch raising. After this syllable, the pitch quickly falls again until it reaches the end of the PrWd[9].

(52) Pitch Contour and Foot Headiness: [u.ˈnán.rɪ.bíː.kɐs.kɨ]



Similarly, in (53), the syllable with the long vowel in [-rɪ.biː], an even syllable, slightly stops the pitch falling. Thus, the long vowel in [-rɪ.biː] disrupts the word-pitch contour by requiring its own high tone.

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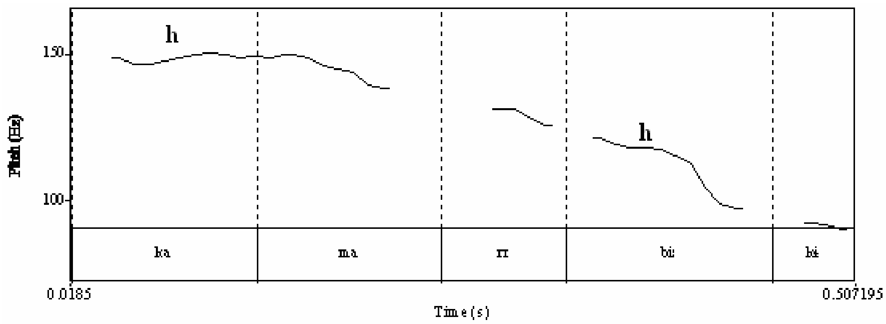
[9] The final vowel is almost completely devoiced.

(53) Pitch Contour and Foot Headiness: [ˈká.mɐ.rɪ.bíː.kɨ]



In sum, in Shipibo, long vowels bearing secondary stress are identified by their length, resistance to becoming lax and additionally, in careful speech, by their attraction of high tones.

3.2.2 Secondary Stress and Short Vowels

In contrast to long vowels, short vowels beyond the syllable bearing main stress become lax and do not have the ability to attract high tones but in spite of this, Shipibo offers evidence, although very limited, for determining their stressed or unstressed status.

(54) Beyond the syllable bearing main stress, short vowels in any position in the PrWd become lax and they do not attract high tones.

The table in (55) shows the different degrees of reduction that a short vowel could display. The point of articulation of the surrounding segments might affect them.[10]

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[10] See also García-Rivera 1994 for a similar observation.

(55) Short Vowel Reduction Beyond the Main Stress

/ɨ/ → [ɨ] ~ [ə]	/a/ → [a] ~ [ɐ]~ [ə]
/i/ → [i] ~ [ɪ]	/u/ → [u] ~ [ʊ]~ [ʉ]

The Shipibo words in (56), as well as those previously presented, have examples of short lax vowels that occur beyond the syllable bearing main stress.

(56) a. / wɨʂati / → [ˈwɨ.ʂɐ.tɪ] ‘ushate (sp. of knife)’

b. / atapa / → [ˈʔa.tɐ.pɐ] ~ [ˈʔa.tɐ.pə] ‘hen’

c. / ʂuntaku / → [ˈʂun.tɐ.kʊ] ~ [ˈʂun.tɐ.kʉ] ‘young woman’

Short vowels that occur in unstressed initial syllables do not become lax. See examples in (58).

(57) Vowels in unstressed initial syllables do not become lax.

(58) Vowels in Unstressed Initial Syllables

a. [pa.ˈbiː.kɪ] ‘ear’

b. [pu.ˈtuː] ‘full’

c. [tʃi.ˈkuː.rʊ] (type of demon)

Although very restricted, Shipibo does provide phonological evidence for syllables with short vowels bearing secondary stress. This is the resistance to vowel devoicing. In this language, short vowels are vulnerable to becoming voiceless between voiceless fricative and stop consonants or they acquire breathy voice.

(59) Short vowels in even syllables optionally devoice when they occur between a voiceless fricative and a stop.

However, Shipibo shows an interesting asymmetry between short vowels in even versus odd syllables when they appear between a voiceless fricative and a stop. In that context, short vowels optionally devoice if in addition they occur in an even syllable and the initial syllable of the PrWd has a stressed short vowel. See data in (60).

(60)	a. / wɨʂ̻ati /	→ [ˈwɨ.ʂ̻ɐ.tɪ] ~ [ˈwɨ.ʂ̻ɐ̥.tɪ]	‘ushate (sp. of knife)’
	b. / atapa -ʂ̻uku /	→ [ˈʔa.tɐ.pɐ -ʂ̻ʊ.kʊ] ~ [ˈʔa.tɐ.pɐ.-ʂ̻ʊ̥.kʊ]	‘little hen’

In contrast, vowel devoicing cannot take place if the short lax vowel occurs in an odd syllable and the main stress is on the initial syllable of PrWd. See (61). The star ‘*’ next to *[ˈbu.nɐ.-ʂ̻ʊ̥.kʊ], *[ˈya.mɪ.-ˌʂ̻ʊ̥.kʊ] and *[ˈma.rɐ.ˌtɪ.tʃʊ.-ˌʂ̻ʉ̥.kʊ.-bʊ] indicates that this form is not acceptable. Similarly, vowel devoicing is blocked when the short lax vowel appears in an even syllable. See (61.b-c).

(61) a. / buna -ʂ̬uku / → [ˈbu.nɐ.-ˌʂ̬ʊ.kʊ] ~ *[ˈbu.nɐ.-ˌʂ̬ʊ̥.kʊ] ‘little bee’

b. / yami -ʂ̬uku / → [ˈya.mɪ.-ˌʂ̬ʊ.kʊ] ~ *[ˈya.mɪ.-ˌʂ̬ʊ̥.kʊ] ‘little axe’

c. / maratitʃu -ʂ̬uku -bu/ → [ˈma.rɐ.ˌtɪ.tʃʊ.-ˌʂ̬ʊ.kʊ.-bʊ] ‘little hammers’

~ *[ˈma.rɐ.ˌtɪ.tʃʊ.-ˌʂ̬ʉ̥.kʊ.-bʊ]

This dissertation takes the impossibility of having vowel devoicing as an indicator of the ‘stressed’ status of odd syllables with short vowels in words as in (61). In contrast, the possibility of vowel devoicing indicates the ‘unstressed’ status of even syllables with short vowels in (60). From a phonological point of view, the odd short vowels in (61) occupy a prominent position, which protects them from undergoing vowel devoicing. In contrast, the even short vowels in (60) do not occupy a prominent position so that they are vulnerable to vowel devoicing.

3.2.3 Phonological Vowel Shortening

Put aside the cases created by monosyllabic roots with long vowels, the lack of long vowels in odd syllables within the PrWd in Shipibo points out the existence of phonological vowel shortening.

(62) Input long vowels mapped onto odd syllables undergo phonological shortening.

Remember that whereas long vowels in even syllables tend to be realized shorter as they approach the right edge of the PrWd, phonologically they still behave as long vowels; that is, they resist becoming lax or devoiced, and attract high tones. In contrast, this never occurs in odd syllables (except for the cases of monosyllabic roots with long vowels). In odd syllables, vowels are short, lax and, beyond the main stress, they do not attract high tones. Thus, hypothetical input long vowels that are mapped onto odd syllables do shorten. The grammar treats them as short vowels. This is schematically presented in (63).

(63) a. /CVː CVː / → [CV.ˈCVː]

*[ˈCVː.CV]

b. /CV CV CVː / → [ˈCV.CV.CV]

*[ˈCV.CV.ˌCVː]

As an example, the long vowel of the imperative suffix, /-wɨː/, keeps its length in even syllables but in odd syllables, it behaves phonologically as a short vowel. See data in (64) to (69). In (64), (66) and (68), the suffix occurs in an even syllable and it has a long vowel bearing secondary stress. In contrast, in (65), (67) and (69), the suffix occurs in an odd syllable. In this position, the suffix vowel is phonologically short: it never attracts a high tone.

(64) [pi.-ˈwɨ́ː]

eat -imperative

‘eat (it)!’

(65) [ˈpɪ́.-mɐ.-<u>wɨ</u>]

eat -causative -imperative

‘make (him) eat (it)!’

(66) [pi.-ˈrɪ́ː.bɐ.-<u>wɨ́ː</u>]

eat -again -imperative

‘eat (it) again!’

(67) [ˈyú.nʊ-<u>wɨ</u>]

command -imperative

‘command (it)!’

(68) [ˈyú.nʊ.-mɐ.-rɪ́ː.bɐ.-<u>wɨ́ː</u>]

command -causative -again -imperative

‘make (him) command (it) again!’

(69) [ˈyú.nʊ.-rɪ.bɪ́ː.-<u>wɨ</u>]

command -again -imperative

‘command (it) again!’

3.3 The Behavior of Closed Syllables beyond the Main-Stress Window

In Shipibo, closed syllables pattern with syllables with long vowels when they are in even positions, but with syllables with short vowels when they are in odd positions. This section presents the evidence for this asymmetric behavior.

In odd positions, closed syllables behave as open syllables with short vowels. Here the allomorphic alternation of the suffix ‘again’, /-ribiː/ ~ /-riːba/, can be used as evidence. As a point for comparison the example in (70) shows what happens with the alternation of the suffix ‘again’ when an initial syllable, a monosyllabic root, has a long vowel. In this case, the surfacing allomorph is: [-riː.bɐ], not [-rɪ.biː]. In general, an initial syllable with a long vowel amounts to two syllables with short vowels (compare (70) to (71) with regard to the choice of allomorph for the suffix ‘again’).

(70) [ˈ**tɨː**.-mɐ.-riː.bɐ.-kɨ]

*[ˈ**tɨː**.-mɐ.-rɪ.biː.-kɨ]

work -causative -again -past_tense

‘(he) made (him) work again’

(71) [ˈ**pu.tɐ**.-mɐ.-riː.bɐ.-kɨ]

*[ˈ**pu.tɐ**.-mɐ.-rɪ.biː.-kɨ]

throw -causative -again -past_tense

‘(he) made (him) throw (it) again’

Now, observe that both (70) and (72) have almost the same segmental makeup, except for the initial syllable. In (70), the initial syllable has a long vowel and in (72), the initial syllable is closed. If the initial closed syllable in (72) patterned with the initial syllable with the long vowel in (70), then the suffix 'again' would surface as [-riː.bɐ]. But it surfaces as [-rɪ.biː]. Furthermore, compare (72) to (71). The initial closed syllable in (72) is not equivalent to the two initial syllables with short vowels in (71).

(72) [ˈ**his**.mɐ.-<u>rɪ.biː</u>.-kɨ]

*[**his**.mɐ.-<u>riː.bɐ</u>.-kɨ]

show-again -past_tense

'(he) showed (it) again'

In (73), the third syllable is closed. Again, an odd closed syllable is not equivalent to two open syllables with short vowels. If it did, then the suffix 'again' would surface as [-rɪ.biː] in (73) instead of [-riː.bɐ]. This is also supported in (74), in which the beneficial suffix /-s̥un/ has been replaced by the negation suffix /-yama/, which has two syllables. In this case, the suffix 'again' appears as [-ribiː].

(73) [ˈpu.tɐ.-**ʂ̺ʊn**.-riː.bɐ.-kɨ]

*[ˈpu.tɐ.-**ʂ̺ʊn**.-rɪ.biː.-kɨ]

throw-beneficial-again-past

‘(he) threw (it for him) again’

(74) [ˈpu.tɐ.-**yɐ**.**mɐ.**-rɪ.biː.-kɨ]

*[ˈpu.tɐ.-**yɐ**.**mɐ.**-riː.bɐ.-kɨ]

throw -negation -again -past

‘(he) did not throw (it) again’

In contrast, closed syllables in even positions within the PrWd do pattern with syllables with long vowels. As shown in the previous section, within the main-stress window, both even closed syllables and even syllables with long vowels attract the main stress away from the initial syllable. See (75).

(75) a. [pu.ˈ**túː**] ‘full’

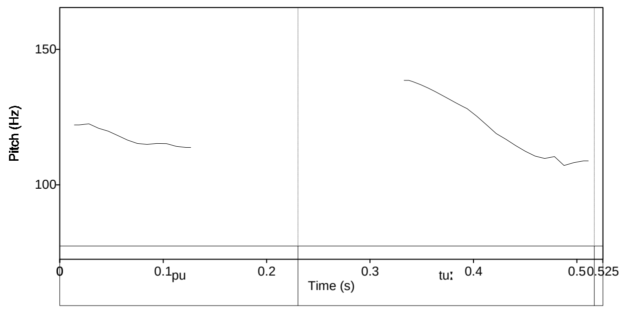
b. [wi.ˈ**táʂ̺**] ‘leg’

c. [tʃun.ˈ**kɨ́ʂ̺**] ‘(sp. of) bird’

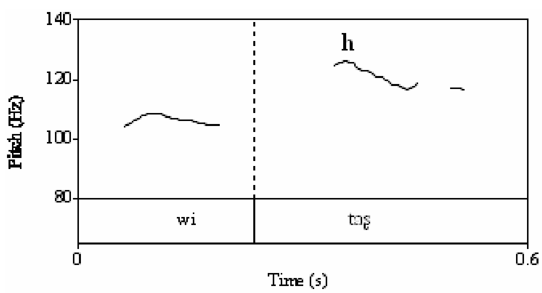
d. [mis.ˈ**pán**.mis] ‘tamale seller’

The pitch contours of the words in (75) are given in (76) to (79).

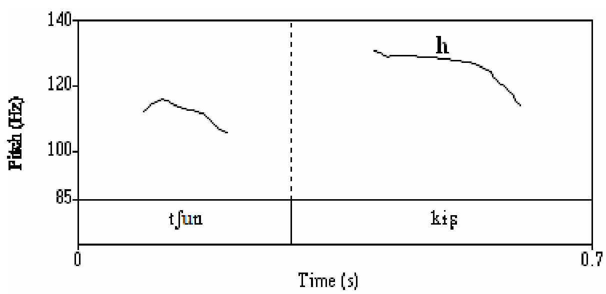
(76) Pitch Contour for the Word [pu.ˈ**túː**]



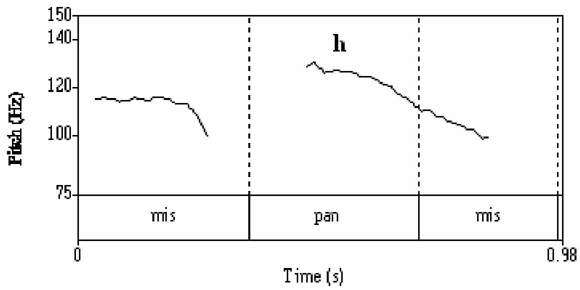
(77) Pitch Contour for the Word [wi.ˈ**táʂ**]



(78) Pitch Contour for the Word [tʃun.ˈ**kɨ́ʂ**]



(79) Pitch Contour for the Word [mis.ˈ**pán**.mis]

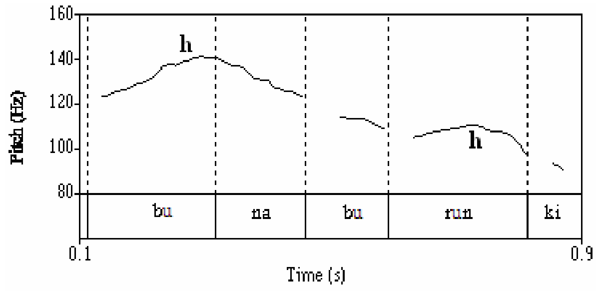


It is worth noting that in (78) and (79), the closed syllable bearing main stress is competing against an initial closed syllable; however, as the pitch shows, this initial closed syllable is treated as if it were an open syllable with short vowels in (76) and (77).

Furthermore, it is also important to observe that the word in (79) has three closed syllables. However, only the even closed syllable manages to attract the main stress. The other two odd closed syllables behave as open syllables with short vowels.

Beyond the main-stress window, even closed syllables also behave as syllables with long vowels. In (80), we have the word [ˈbú.na.-bu.-**rún**.ki] '(sp. of) bee' (-plural -reportative). The initial syllable bears the main stress. Importantly, the fourth syllable of this word is closed and it behaves as it were a syllable with a long vowel in attracting a high tone. As observed in (80), the high tone of this syllable briefly stops the falling of the pitch creating a slight pitch raising.

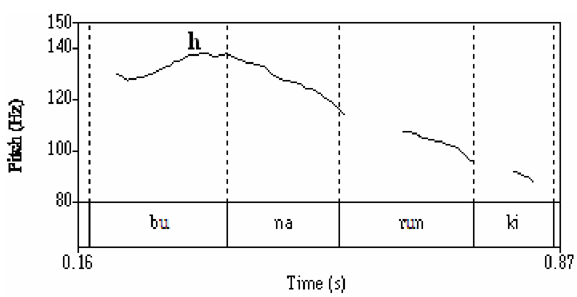
(80) Pitch Contour and Foot Headiness: [ˈbú.na.bu.**rún**.ki]



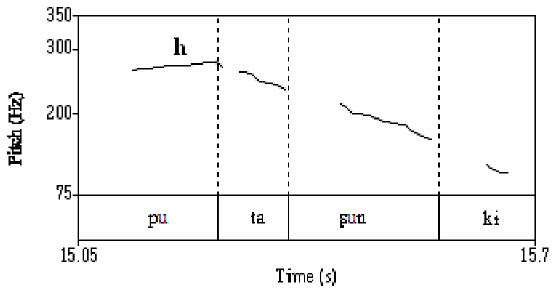
In (81) and (82), the words [ˈbú.na.-**run**.ki] '(sp. of) bee' (-reportative) and [ˈpú.ta.-**şun**.-kɨ] '(he) threw (it for you)' have the main stress on the initial syllable. However, unlike the previous example, their closed syllables occur in an odd position beyond the main stress. In both cases, it is the third syllable.

This time, in contrast to the closed syllable in (80), neither of the closed syllables in (81) and (82) causes a disruption of the falling of the word pitch nor a raising of pitch. They behave as they were open syllables with short vowels.

(81) Pitch Contour and Foot Headiness: [ˈbú.na.**run**.ki]

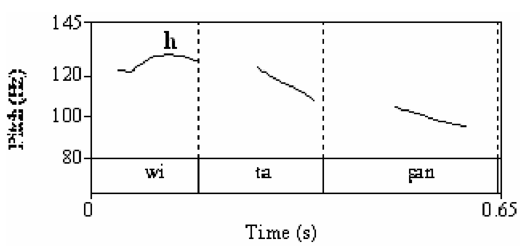


(82) Pitch Contour for the Word [ˈpú.ta.**ʂun**.kɨ]

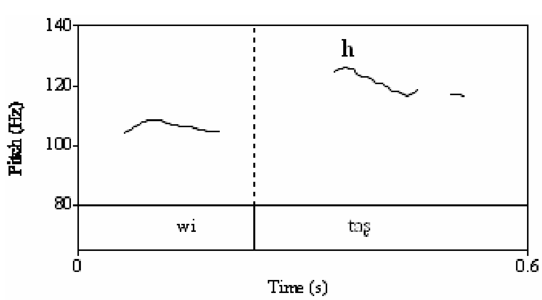


The graph in (83) shows the pitch contour of a Shipibo word with a closed syllable in an odd final position, which does not obtain its own high tone. Compare (83) to (85), which has an even final closed syllable that does have a high tone.

(83) Pitch Contour for the Word [ˈwí.ta.**ʂan**] 'leg (ergative)'



(84) Pitch Contour for the Word [wi.ˈ**táʂ**] 'leg'



In sum, this section concludes that in Shipibo even closed syllables within the PrWd pattern with syllables with long vowels but odd closed syllables pattern with open syllables with short vowel. In order to identify these patterns, this section has resorted to the vowel-length distribution, vowel reduction and high-tone attraction.

4 Vowel-Length in Monosyllables

This section describes the behavior of vowel length in monosyllabic roots in Shipibo since these roots are the only source of odd syllables with long vowels in the language.

4.1 Long Vowels of Monosyllabic Roots

The restrictions that long vowels follow in monosyllabic roots are different than in polysyllabic ones. Some monosyllabic *verb* roots have long vowels and some have short vowels. See data in (85).

(85) Long and Short Vowels in Monosyllabic Verb Roots

a. (ˈ**tɨː**)-kɨ ‘(he) worked’

b. (ˈ**his**.-kɨ) ‘(he) saw’

c. (ˈ**pi**.-kɨ) ‘(he) ate’

In contrast, all monosyllabic *noun* roots obligatorily surface with long vowels. They must have a long vowel even when they appear suffixed. See (86).

(86) Long Vowels in Monosyllabic Noun Roots

a. (ˈ**tʃiː**) ‘fire’

b. (ˈ**tʃiː**)-ki ‘fire’ (locative)

c. (ˈ**tʃiː**)-rɨs ‘only the fire’

4.2 Bare Nouns and Suffixed Verbs

Furthermore, in contrast to noun roots, verb roots in Shipibo cannot occur bare. They need at least one suffix to be able to surface. See examples in (87) to (89).

(87) Monosyllabic Root Verbs with Short Vowels

a. (ˈpi.-ti) ‘to eat’ (/-ti/ infinitive)

b. (ˈpi.-kɨ) ‘(he) ate (it)’ (/-kɨ/ past tense)

c. (pi.-ˈnon) ‘(he) ate (it)’ (/-non/ switch reference)

d. *(pi) (verb *eat*)

(88) Monosyllabic Root Verbs with Long Vowels

a. (ˈtɨː)-ti ‘to work’ (/-ti/ infinitive)

b. (ˈtɨː).-kɨ ‘(he) worked’ (/-kɨ/ past tense)

c. (ˈtɨː).-non ‘(he) worked’ (/-non/ switch reference)

d. *(ˈtɨː) (verb *work*)

(89) Polysyllabic Root Verbs

a. (ˈba.na)-ti ‘to plant’ (/-ti/ infinitive)

b. (ˈba.na).-kɨ ‘(he) planted’ (/-kɨ/ past tense)

c. (ˈba.na).-non ‘(he) planted’ (/-non/ switch reference)

d. *(ba.na) (verb ‘*to plant’*)

The data in (90) shows that monosyllabic noun roots, which always surface with long vowels, can occur bare.

(90) Monosyllabic Noun Roots

a. (ˈtɨː) ‘work’ (noun)

b. (ˈboː) ‘healed skin’ (noun)

c. (ˈtsaː) ‘splinter’ (noun)

4.3 The Long Vowels of Monosyllabic Verb Roots

Monosyllabic verb roots that exhibit long vowels are always denominalized verbs. They have a noun counterpart which is semantically related and which can occur as a bare root. See the examples in (91) and (93).

(91) a. (ˈ**tɨː**)-ti ‘to work’ (/-ti/ infinitive)

b. (ˈ**tɨː**)-kɨ ‘(he) worked’ (/-kɨ/ past tense)

c. (ˈ**tɨː**) ‘work’ (*noun*)

(92) a. (ˈ**tsaː**)-ti ‘to splinter’ (/-ti/ infinitive)

b. (ˈ**tsaː**)-kɨ ‘(it) splintered’ (/-kɨ/ past tense)

c. (ˈ**tsaː**) ‘splinter’ (*noun*)

(93) a. (ˈ**boː**)-ti ‘to heal’ (/-ti/ infinitive)

b. (ˈ**boː**)-kɨ ‘(it) healed’ (/-kɨ/ past tense)

c. (ˈ**boː**) ‘healed skin’ (*noun*)

In contrast, monosyllabic verb roots with short vowels do not have a noun counterpart that can occur bare. In order for a verb root of this type to function as a noun, the nominalizer suffix /-ti/ must be added. See (94) and (95).

(94) a. (ˈ**pi**-ti) ‘to eat’ (/-ti/ infinitive)

b. (ˈ**pi**-kɨ) ‘(he) ate (it)’ (/-kɨ/ past tense)

c. (ˈ**pi**-ti) ‘food’ (/-ti/ nominalizer)

d. *(**pi**) ‘food’ (*noun*)

(95) a. (ˈ**his**-ti) ‘to see’ (/-ti/ infinitive)

b. (ˈ**his**-kɨ) ‘(he) saw (it)’ (/-kɨ/ past tense)

c. (ˈ**his**-ti) ‘sight’ (/-ti/ nominalizer)

d. *(**his**) ‘sight’ (*noun*)

5 Summary

This chapter presented an overview of Shipibo phonology with regard to its segmental inventory and main phonotactic patterns. Particular attention was payed to the asymmetric behavior of even and odd closed syllables as well as on the restriction of long vowels to occur in even syllables, with the exception of monosyllabic roots with long vowels, which are the only source of long vowels occurring in odd syllables in Shipibo. The following shows a summary of the main descriptive generalizations found in this chapter.

(96) *Generalizations on Syllable Structure*

a. Complex onsets and complex codas are banned.

b. Diphthongs do not occur.

c. In coda position, only the segments [s, ʃ, s̺, n] can occur.

(97) *Generalizations on Main Stress*

a. Main stress can only occur within the first two initial syllables of the PrWd.

b. Main stress occurs on the second syllable if it has a long vowel or it is a closed syllable. Otherwise main stress occurs on the initial one. Monosyllabic roots with long vowels are always stressed.

c. Main-stressed syllables in Shipibo are characterized by having (i) vowels that do not become lax and resist devoicing, (ii) long vowels that do not shorten and by (iii) their attraction of high tones.

(98) *<u>Generalizations on Secondary Stresses</u>*

a. The assignment of secondary stresses follows the generalization made for main stress. In a grouping of two syllables, the second one appears stressed if it has a long vowel or a closed syllable. Otherwise, it is the initial syllable of the grouping that appears stressed.

b. Secondary-stressed syllables in Shipibo are characterized by (i) resistance to vowel reduction, (ii) high-tone attraction in the case of long vowels and (iii) resistance to vowel devoicing in the case of short vowels.

(99) *<u>Generalizations on Syllables with Long Vowels and Closed Sylalbles</u>*

a. Putting aside the case of monosyllabic roots with long vowels, syllables with long vowels only occur in even syllables counting from left to right within the PrWd.

b. Even closed syllables behave as syllables with long vowels but odd closed syllables behave as syllables with short vowels.

c. Monosyllabic roots with long vowels and their derived forms are the only cases of odd long-voweled syllables.

Chapter 3: Theoretical Assumptions

1 General Assumptions

The subsequent sections provide the reader with the basic theoretical assumptions on which the formal analyses proposed in the following chapters for the Panoan languages Shipibo and Capanahua will depend.

1.1 Optimality Theory

This dissertation assumes the theoretical framework of Optimality Theory (henceforth OT) as proposed by Prince and Smolensky 1993a; 2004 and also McCarthy and Prince 1993. OT conceives the grammar of a language as the result of the interaction of a set of universal constraints hierarchically ranked. The universal set of constraints forms the CON component of language. The GEN function generates an infinite set of linguistic candidates, which compete against each other to be selected as the output mapping of an input form. The EVAL function is in charge of choosing among the set of infinite candidates a winning candidate according to the specific ranking of constraints a given language has.

Since OT is currently the mainstream theory in phonological research, this dissertation will assume the acquaintance of the reader with this theoretical framework. For additional literature on OT, see de Lacy to appear 2005a; Dekkers, Leeuw et al. 2000; Kager 1999; Legendre, Grimshaw et al. 2001; McCarthy 2002; 2004b, among other important works. An important and ever growing online resource of articles written about OT can be found at the *Rutgers Optimality Archive* (ROA - http://roa.rutgers.edu).

1.2 Metrical Phonology

With regard to representations, this dissertation assumes *Metrical Phonology* (de Lacy 1997; 2002; Gussenhoven 2005; Halle and Vergnaud 1987; Hayes 1980; 1995; Kager 2005; Liberman and Prince 1977; McCarthy 1993; Prince 1980; 1983; 1985, among many others).

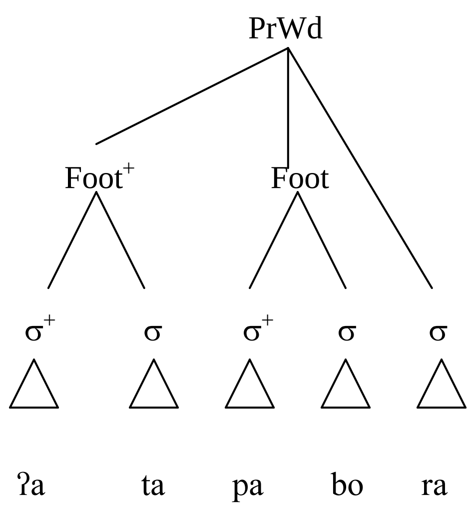
In Metrical Phonology, ‘stress’ is represented through structure, that is, as a structure hierarchically organized that groups prosodic units into higher constituents. Thus, for example, syllables (σ) group into metrical feet, metrical feet into Prosodic Words (PrWd), etc (McCarthy and Prince 1986; Nespor and Vogel 1986; Selkirk 1982).

Every constituent in the metrical structure has a head element. When syllables group into a metrical foot, one of them is selected as the *head syllable*. The other syllables are *non-head syllables*. Informally, head syllables are usually referred to in the literature as ‘stressed syllables’ and non-head syllables as ‘unstressed syllables’. In the dissertation, I use the terms ‘stressed’ and ‘unstressed’ as a simplified and informal way to refer to head and non-head positions in the metrical structure.

When feet group to form a PrWd, the head of the grouping is usually called *main foot* and the other feet, *secondary feet* (for metrical grouping beyond the PrWd see Gussenhoven and Rietveld 1992; Jun 1993; Kubozono 1993; O'Connor and Arnold 1973).

In (1), head syllables are indicated by a superscript [$^{+}$] symbol next to the relevant syllable (e.g. [σ^{+}]). The main foot is indicated by [Foot^{+}]. This example represents the metrical structure of the Shipibo word [ʔa.ta.pa.bo.ra] ‘hens’ (evidential).

(1) Metrical Representation of the Shipibo Word [ʔa.ta.pa.bo.ra] ‘hens’ (evidential)



For practical purposes, the metrical structure of the Shipibo word in (1) can be represented as in (2). Brackets are used to represent the grouping of syllables into metrical feet. The head syllable of the main foot (informally, the syllable with the word main stress) is indicated by a superscript vertical line [ˈ].

Head syllables of secondary feet (informally, syllables with secondary stresses) are indicated by a subscript vertical line [ˌ]. Customarily, non-head syllables are left unmarked. Unless stated otherwise, this dissertation employs transcriptions as in (2) to represent the metrical structure depicted in the graph in (1).

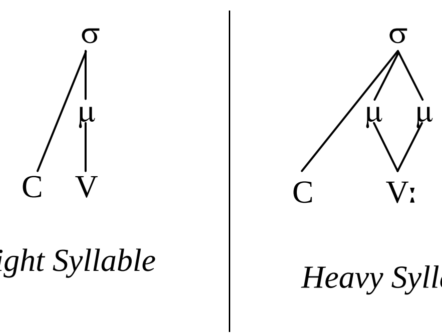
(2) (ˈʔa.ta)(ˌpa.bo).ra ‘hens (evidential)’

The phonetic transcriptions employed in this dissertation follow the conventions established in 1996 by the International Phonetic Association (IPA: http://www.arts.gla.ac.uk/ipa/ipa.html).

1.3 Moraic Theory

Furthermore, in order to represent syllable weight, this dissertation assumes Moraic Theory (Davis 1995; Hayes 1989; 1994; 1995; Hyman 1985; Ito 1989; McCarthy and Prince 1986; McCawley 1968; Prince 1976; 1983; Zec 1988, among others). Under this theory, open syllables with a short vowel are monomoraic (also called ‘light’ syllables) and syllables with a long vowel are bimoraic (also called ‘heavy’ syllables). See the representation in (3).

(3) Moraic Representation of Vowel Length[1]



Light Syllable *Heavy Syllable*

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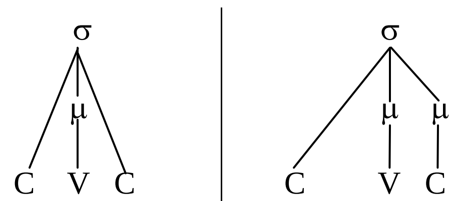
[1] For the purposes of this dissertation, nothing hinges on whether non-moraic segments are associated with the syllable node or whether they are adjoined to the mora of another segment. See de Lacy 1997 for further discussion on this issue.

In the case of closed syllables, they can also be light or heavy[2]. Their moraic representation is shown in (4).

(4) Moraic Representation of Syllable Weight for Closed Syllables



Light Closed Syllable | *Heavy Closed Syllable*

Moreover, light (i.e. monomoraic) closed syllables are represented as [CVC] whereas heavy (i.e. bimoraic) closed syllables as [CVC_{μ}].

[2] Since this dissertation does not deal with geminates; it assumes, for the purposes of analysis, that input consonants do not have moras.

2 Contextual Syllable Weight

As is well known, metrical environments and syllable weight can influence each other. The contexts targeted by grammars are the different positions in the metrical structure. Following Beckman 1995; 1997; 1998; Buckley 1998; Davis 1999; Davis and Cho 2003; de Lacy 2002; 2004; to appear 2005a; b; Hyman 1998; Kenstowicz 1996; Nelson 1998; 2003; Prince and Smolensky 1993b; Zoll 1996; 1997; 1998; 2004a; b, among many others, those metrical contexts can be grouped into two categories prominent/privilege and non-prominent/non-privilege positions.

Examples of prominent/privilege metrical positions are: main head of the PrWd, main heads of feet, initial syllables, initial feet, etc. Examples of non-prominent/non-privilege metrical positions are: non-head syllables (i.e. ‘unstressed’ syllables), non-initial syllables, non-initial feet, etc.

Thus, for example, heavy syllables can insist on occurring in head-positions and head-positions can demand the occurrence of heavy syllables. The result of that interaction determines the distribution of heavy and light syllables in a given language.

Heavy syllables may not only be allowed to occur as heads of prosodic constituents (that is, in ‘stressed’ positions) but also they can be restricted to occur only in initial positions (e.g. initial syllable, initial foot). But heavy syllables are not the only ones that endure restrictions on their distribution. Light syllables do as well. In some grammars, light syllables are banned from occurring as heads of prosodic constituents. The most common restriction found on light syllables is the avoidance of having them forming their own foot.

As for vowel length, the influence that the metrical structure has on it is well known (Hayes 1995; Prince 1990; Prince and Smolensky 1993a). Vowels may be shortened or lengthened in order to fit the metrical context in which they occur. The demands that impose metrical contexts on vowel length function as restrictions on their distribution.

However, despite the common acceptance that metrical context and vowel length can influence each other, somehow that acceptance has not yet extended to the treatment of the weight of closed syllables. As will be apparent in the subsequent chapters, the influence between the metrical environment and the weight of closed syllables is crucial to understanding languages like Shipibo and Capanahua.

In other words, this dissertation emphasizes the position that just as vowel length can be modified to fit the metrical environment in which it occurs, closed syllables can also modify their weight influenced by the metrical context.

- *The Weight of Closed Syllables*

Determining the weight of closed syllables has always been a complex issue, not only because they do not show structural changes like vowels do when they undergo quantity adjustments, but also because sometimes they pattern with light syllables and other times with heavy syllables. Thus, in contrast to syllables with long or short vowels, which are universally heavy or light respectively, closed syllables can be light or heavy.

Traditionally, this variation is assumed to occur from one language to another. Thus, in a given language, all closed syllables could be heavy or all light but they could not vary their weight in the same language. In this view, if, in a given language, some evidence is found that closed syllables pattern with long vowels, all closed syllables in that language are considered heavy. If, in contrast, closed syllables pattern with open syllables with short vowels, then they are all considered light.

There are two main problems with this position. First, whereas it is well known that the moraic content of vowels can be influenced by the metrical context; this position implicitly assumes that closed syllables are completely blind to the metrical environment that hosts them. Somehow, in this view, weight restrictors like GROUPING HARMONY, WEIGHT-TO-STRESS PRINCIPLE and STRESS-TO-WEIGHT PRINCIPLE always fail to have any effect on the weight of closed syllables.

The second problem is empirical: the existence of cases in which closed syllables show variable weight. McCarthy 1979's work on Arabic is the first to entertain the idea that closed syllables may contextually vary their weight. Other works that have reported closed syllables with variable weight within the same language include Broselow, Chen et al. 1997; Hayes 1994; Kager 1989; Moren 1999; 2000; 2001; Rosenthall and van der Hulst 1999, among others.

The position that dissertation takes is that a closed syllable behaving heavy in certain metrical contexts does not necessarily imply that closed syllables in other metrical contexts are also heavy. Parallel to the case of quantity-adjustments in vowel length, closed syllables can contextually adjust their weight influenced by the metrical structure.

The weight of closed syllables needs to be determined context by context in comparison with the behavior of syllables with short and long vowels and its effect on footing. Thus, in contrast to current practices, it is not enough to determine that closed syllables pattern with syllables with long vowels or syllables with short vowels in a given environment to claim that all closed syllables are heavy or light in a language. The test for patterning[3] needs to be carried out in all metrical environments in which closed syllables occur.

[3] See Elias-Ulloa 2003; 2004; Moren 2000; Rosenthall and van der Hulst 1999 for examples of conflicting patterns as tests for variable weight in closed syllables. See also Broselow, Chen et al. 1997's work which reports that the moraic content of closed syllables can have a reflex on the duration of the syllable rhyme: the rhyme of heavy closed syllables is longer than the rhyme of light closed syllables.

Chapter 4: Foot Disyllabicity and Quantity-Adjustments in Shipibo

1 Introduction

This chapter focuses on the formal account of the Shipibo metrical system. It shows that Shipibo is crucial to the study of footing and syllable weight because the language has a QI-footing but is sensitive to syllable weight, two properties currently thought to be mutually excluding.

Contrary to most known cases, Shipibo does not accommodate the size of feet to quantity but adjusts quantity to fit disyllabic feet. In this language, long vowels shorten to comply with the restrictions imposed on their distribution. They cannot occur in ‘unstressed’ syllables or as heads of uneven trochees. Shipibo’s quantity-sensitivity arises as a consequence of the distributional restrictions that heavy syllables endure. Shipibo allows heavy syllables to occur as heads of iamb feet, a context in which weight-restrictors (WT-restrictors) do not have influence. The rise of quantity-sensitivity in Shipibo reverses the default trochaic rhythm of the language.

Shipibo also makes clear the different status of ‘preferability’ between disyllabic feet and the (H)-foot. The (H)-foot is overwhelmingly disfavored. Shipibo strives for disyllabic feet, even in cases where the occurrence of (H)-feet would obtain better results in terms of parsing of syllables and respect for vowel length.

Although, Shipibo prefers disyllabic feet, QS-footing (that is, the (H)-foot) does occur, but only under very special conditions: when output-to-output faithfulness demands respect for long vowels of monosyllables. This OO-faithfulness effect together with the general avoidance of uneven trochees shrinks the disyllabic size of Shipibo's feet and allows the (H)-foot to emerge, as the closest deviation from foot-disyllabicity.

The current study of the case of Shipibo has theoretical value in shedding light on the importance of foot-disyllabicity and its role in quantity adjustments as well as demonstrating how the interaction of foot-disyllabicity with syllable weight derives QS and QI footing.

The study also provides new and detailed data from an understudied language from the Peruvian Amazon. The data presented from Shipibo in this dissertation were collected during fieldwork in Peru between 1997 and 2004. This empirical component adds to the ever-growing field of metrical phonology.

The chapter is organized as follows: section §2 presents evidence for Shipibo's iterative QI-footing, foot headiness and states the restrictions that Shipibo imposes on heavy syllables in terms of positions in the prosodic struture. Section §3 presents the formal analysis of foot size and its relation with the quantity adjustments that long vowels undergo in Shipibo. This section justifies the need for the constraint *FOOT(σ). Finally, section §4 presents the conclusions.

2 Shipibo: QI-Footing and Syllable Weight

Shipibo is a language that imposes a QI-footing but the distribution of heads within the prosodic structure is sensitive to syllable weight.

(1) Shipibo: a language with a QI-footing in a metrical system that is sensitive to syllable weight.

In order to reconcile a QI-footing with a QS metrical-system, Shipibo resorts to a number of quantity adjustments which result in heavy syllables enduring strict restrictions on their occurrence. In this language, heavy syllables do not form their own foot[1]: although the language is trochaic by default, they can never occur in unstressed positions and they cannot appear as heads of uneven trochaic (HL)-feet.

(2) Distributional Restrictions on Heavy Syllables:

(i) In spite of the system being trochaic by default, heavy syllables cannot form their own foot.

(ii) Heavy syllables cannot form part of (HL)-trochaic feet.

(iii) Heavy syllables cannot occur in unstressed positions in the prosodic structure.

[1] The only exception to this generalization is monosyllabic roots with long vowels – see §3.5.2 for more information.

Descriptively, these distributional restrictions result in heavy syllables occurring in even positions counting from left to right (see chapter §2). The data in (3)[2] show examples of words containing heavy syllables in even positions. In all the examples, the syllables containing long vowels bear either main stress or secondary stress.

(3)	a. (ka.ˈpɨː)	‘crocodile’
	b. (pa.ˈbiː).ki	‘ear’
	c. (ˈba.na)(-ri.ˌbiː)-kɨ	‘(he) planted (it) again’
	d. (yu.ˈmɨː)(tsu.-ˌriː)(ba-ˌwɨː)	‘steal (it) again!’ (imperative)

In contrast to the examples in (3), when long vowels do not occur in even syllables, head syllables occur in odd positions[3]. See data in (4).

(4)	a. (ˈba.kɨ)	‘child’
	b. (ˈʔa.ta).pa	‘hen’
	c. (ˈba.na)(-ˌya.ma).-kɨ	‘(he) did not plant (it)’
	d. (ˈba.na)(-ˌya.ma)(-ˌniʃ.kɨ)	‘(he) did not plant (it)’ (remote past)

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[2] In this chapter, phonetic vowel shortening, reduction and devoicing are not transcribed unless it becomes crucial to the discussion at hand. In (3.c), the root is /bana/ ‘to plant’, and in (3.d), /yumɨːtsu/ ‘to steal’. The suffix /-kɨ/ marks past tense and /-wɨː/ the imperative. The allomorph /-ribiː/ of the suffix ‘again’ appears in (3.c) and /-riːba/, in (3.d). In (4), the suffix /-yama/ marks the negation and /-niʃkɨ/ marks the ‘remote past’ tense.

[3] Shipibo is not the only language to display this type of mixed rhythmic pattern. A very well known case is the Australian language Yidinʸ (Crowhurst and Hewitt 1995b; Dixon 1977; Hayes 1982; 1995; Nash 1979; Poser 1986). Other Panoan languages with similar patterns are Capanahua (Elias-Ulloa 2003; 2004) and Matses (Fleck 2003).

2.1 Evidence for the Iterative QI-Footing

The iterative footing shown in (3) and (4) is also supported by segmental rhythmic phenomena. The allomorphy of the ergative suffix and the suffix meaning ‘again’ depends on the presence of a chain of disyllabic feet running from left to right throughout the PrWd. Let us first present the allomorphy of the suffix ‘again’: /-ribiː/ and /-riːba/[4].

The driving force governing the allomorphy of the suffix ‘again’ is that the long vowel, either of /-ribiː/ or /-riːba/, should occupy a head syllable of a disyllabic foot within the prosodic structure without creating an (HL)-foot. Put differently, the long vowel must always be part of an iambic (LH)-foot.

Thus, the suffix surfaces as [-ri.biː] when both syllables form a single foot. In contrast, the suffix surfaces as [-riː.ba] when its syllables are split between two feet. In this case, the initial syllable occurs as the head of an iambic foot. See data in (5) to (8).

(5) (pi.-ˈriː)(ba.-kɨ)

eat -again -past_tense

‘(he) ate again’

(6) (ˈyu.nu)(-ri.ˌbiː)-kɨ

command -again -past_tense

‘(he) commanded (it) again’

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[4] Section §3.4 discusses why this suffix is analyzed as having two phonological representations (/-ribiː/ and /-riːba/), instead of just one.

(7) (ˈyu.nu)(-ma.-<u>ˌriː)(ba</u>.-kɨ)

command -causative -again -past_tense

‘(he) made (him) command (it) again’

(8) (ˈyu.nu)(-ˌya.ma)(-<u>ri.ˌbi</u>ː)-kɨ

command -negation -again -past_tense

‘(he) did not command (it) again’

Importantly, the occurrence of the correct allomorph entirely depends on the grouping of syllables in pairs (namely, QI-footing) and the avoidance of uneven trochaic (HL)-feet.

The evidence for the QI-footing is important since, as described in chapter §2, secondary stresses are not necessarily audible in Shipibo. For instance, in the example in (8), the head of second foot does not obtain a high tone and the vowels of both syllables become lax. In a narrower transcription, the example in (8) would look like: [ˈyú.nʊ.<u>yɐ.mɐ</u>.rɪ.bɪ́ː-kɨ]. The test of vowel devoicing cannot be applied since the context in which it occurs is not present: none of the vowels of the second foot occurs between a voiceless fricative and a stop.

In spite of this, the grammar gives evidence that the syllables [ya] and [ma] in (8) are grouped together so that the correct allomorph of the suffix ‘again’ can be selected. Since both syllables [ya] and [ma] form the second foot of the PrWd, the two syllables of the suffix ‘again’ do not have other alternative than to form the following foot; that is, the iambic (LH)-foot: […(-<u>ri.ˌbiː</u>)…].

One could argue that the Shipibo grammar allows the skipping of syllables in its footing and that the suffix ‘again’ has a prosodic requirement that warranties footing. Under this alternative analysis, the grammar does not foot the syllables [ya] and [ma] in (8). This is shown in (9). However, if the grammar skips only one syllable, the wrong allomorph is chosen. See the ungrammatical form in (9.a).

(9) a. *(ˈyu.nu)-ya.(ma.-ˌ<u>riː)(ba</u>.-kɨ)

b. *(ˈyu.nu)-ya.ma.(-<u>ri.ˌbiː</u>)-kɨ

If the grammar skips two syllables (see (9.b)), the right allomorph for the suffix ‘again’ is selected but there is independent evidence that this non-iterative footing is incorrect. If non-iterative footing were allowed by Shipibo, the only allomorph the suffix ‘again’ had would be /-ribiː/. The prosodic context that selects /-riːba/ would never occur since this allomorph only appears when the syllables of the suffix are split between two metrical feet. For example, if the third syllable in (7) were skipped, the ungrammatical form in (10.b) would be selected instead of the occurring form in (10.a).

(10) a. (ˈyu.nu)(-ma.-ˌ<u>riː)(ba</u>.-kɨ)

b. *(ˈyu.nu)-ma.(-<u>ri.ˌbiː</u>)-kɨ

The ergative suffix provides additional evidence of the pressure that the Shipibo[5] grammar exerts in order to obtain disyllabic feet. This suffix avoids being left unparsed (Elias-Ulloa 2000; Faust 1973; Loriot, Lauriault et al. 1993). The suffix surfaces as a single nasal, [-n], when attached to the second syllable of a disyllabic foot. Descriptively, this occurs when the suffix is added to a stem with an even number of syllables. See data in (11) (Loriot, Lauriault et al. 1993).

In (11.a), the noun [ˈba.kɨ] 'child' has two syllables. When the ergative suffix is added, it appears as a single nasal attached as the coda of the final syllable of [ˈba.kɨ]. See (11.b). If the suffix had taken the form [-nin], as shown in (11.c-d), it would have been left unparsed or it would have formed its own foot. Both possibilities are ruled out by Shipibo grammar.

(11) a. (ba.kɨ) 'child'

b. (ba.kɨ-n) 'child (ergative)'

c. *(ba.kɨ)-nin

d. *(ba.kɨ)(-nin)

In contrast, the ergative suffix surfaces as [-nin], when attached to a syllable that otherwise would have left unparsed. Descriptively, this occurs when the suffix is added to a stem with an odd number of syllables. The allomorph [-nin] supplements the syllable

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[5] A similar alternation is observed for the ergative suffix in Capanahua (see Loos 1978:159-61).

necessary to form a disyllabic foot. In (12.a), the noun [ˈa.ta.pa] 'hen' has three syllables. When the ergative suffix is added, in (12.b), it surfaces as [-nin]. As shown in (12.c-d), Shipibo grammar rules out both leaving unparsed the syllable bearing the ergative suffix and allowing the occurrence of metrical foot smaller than two syllables.

(12) a. (a.ta.)pa 'hen'

b. (a.ta)(pa.-nin) 'hen (ergative)'

c. *(a.ta)pa-n

d. *(a.ta)(pa-n)

2.2 Evidence for Headiness in (CV.CV) Feet

Whereas in main feet of structured out of two open syllables with short vowels, there is plenty of evidence concerning which syllable occupies the head of the foot (that is, high tone attraction, resistance of vowels to become lax and devoiced); in secondary feet of that type, it is extremely difficult to tell which syllable heads it since, as previously mentioned, both short vowels become lax and they do not attract high tones. The phenomenon of vowel devoicing in Shipibo provides evidence for headiness within secondary (CV.CV)-feet.

Vowel devoicing optionally occurs in Shipibo when a vowel occurs between a voiceless fricative and a voiceless stop. However, besides the segmental environment, additional requirements should be met. Vowel devoicing can optionally occur if the targeted vowel is in an even syllable counting from left to right. It cannot occur when the vowel is in an odd syllable. Let us examine the data in (13) to (15).

In (13), we have the noun /atapa/ ‘hen’, the diminutive suffix /-ʂuku/ and the plural suffix /-bu/. The prosodic representation in (13) shows three metrical feet. As explained in chapter 2, after the main stress, the word pitch steadily falls. Thus, in (13), the heads of secondary feet do not obtain any high tone that could indicate headiness. Furthermore, in contrast to short vowels bearing main stress, short vowels beyond the main foot become lax.

When it comes to vowel devoicing, the vowel /u/ that occurs in the fourth syllable in (13) can optionally devoice. Thus, both forms in (13.a) and (13.b) occur in Shipibo[6].

(13) a. (ˈa.tɐ.)(ˌpɐ.-ʂʊ)(ˌkʊ.-bʊ) ‘little hens’

b. (ˈa.tɐ.)(ˌpɐ.-ʂʉ̥)(ˌkʊ.-bʊ) ‘little hens’

In contrast to the optionality with regard to vowel devoicing observed in (13), the examples in (14) and (15) show that a vowel cannot devoice when occurring in an odd syllable even if the right segmental context for devoicing is present. The forms in (14.b) and (15.b) do not occur in Shipibo.

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[6] Vowel usually gets centralized when occurring close to the retroflex fricative [ʂ]. Thus, in the examples in (13) to (15), the vowel /u/ not only becomes lax but also centralized (that is, [ʉ]).

(14) a. (ˈbu.nɐ.)(-ˌʂʊ.kʊ.)-bʊ ‘little bees’

b. *(ˈbu.nɐ.)(-ˌʂṳ̥.kʊ.)-bʊ

(15) a. (ˈma.rɐ.)(ˌtɪ.tʃʊ.)(-ˌʂʊ.kʊ.)-bʊ ‘little hammers’

b. *(ˈma.rɐ.)(ˌtɪ.tʃʊ.)(-ˌʂṳ̥.kʊ.)-bʊ

The odd-versus-even-syllable asymmetry for vowel devoicing presented in (13), (14) and (15) is taken as evidence for the status of ‘stressed’ of the third syllable in (14) and the fifth syllable in (15). Their position as heads of secondary feet allows those syllables to resist vowel devoicing. In contrast, the fourth syllable in (13) is not ‘stressed’ and therefore vulnerable to undergoing vowel devoicing.

This dissertation also takes the evidence brought by vowel devoicing as an indicator that when two open syllables with short vowels group together, the leftmost syllable occupies the head of that foot (that is, a trochaic foot). In (16), as usual, the head of the main foot is indicated by the symbol [ˈ] and the head of secondary feet, by the symbol [ˌ].

(16) a. (ˈba.na)(-ˌya.ma).-kɨ ‘(he) did not plant (it)’

b. (ˈba.na)(-ˌya.ma)(-ˌniʃ.kɨ) ‘(he) did not plant (it)’ (remote past)

c. (ˈbu.nɐ.)(-ˌʂu.ku.)-bu ‘little bees’

d. (ˈa.ta.)(ˌpa.-ʂu)(ˌku.-bu) ‘little hens’

e. (ˈma.ra.)(ˌti.tʃu.)(-ˌʂu.ku.)-bu ‘little hammers’

2.3 The Avoidance of (H.L) and (H) Feet

Although Shipibo is a trochaic language when syllable weight is not at play (see (16)), heavy (i.e. bimoraic) syllables cannot form their own (H)-feet neither can they be part of (H.L)-feet. The behavior of the allomorphy /-ribiː/ and /-riːba/, observed in the suffix 'again', provides us with evidence for the avoidance of both (H) and (HL)-feet. See (17) and (18).

The data in (17) shows that when the suffix 'again' is attached to the root /yunu/ 'to command', only the allomorph /-ribiː/ can surface. As pointed out by the ungrammatical forms in (17.b) and (17.c), the allomorph /-riːba/ cannot be selected in that context. If the allomorph /-riːba/ were selected, either both syllables would group together in a trochaic (HL)-foot or the leftmost syllable with the long vowel would form a (H)-foot. Shipibo grammar avoids them by selecting the allomorph /-ribiː/.

(17) a. ✓(ˈyu.nu)(-ri.ˌbiː)-kɨ '(he) commanded (it) again'

b. *(ˈyu.nu)(-ˌriː.ba)-kɨ

c. *(ˈyu.nu)(-ˌriː)(ba-kɨ)

Because of the same reasons, the allomorph /-riːba/ is chosen instead, in (18.a). If the allomorph /-ribiː/ were selected, its syllable with the long vowel would group together with the following syllable creating a trochaic (HL)-foot or the syllable with the long vowel would form a (H)-foot.

(18) a. ✓(pi.-ˈri:)(ba.-kɨ) ‘(he) ate again’

b. *(ˈpi.-ri)(ˌbi:.-kɨ)

c. *(ˈpi.-ri)(ˌbi:)-kɨ

Further evidence of the avoidance of (HL)-feet in Shipibo comes from the behavior of monosyllabic roots with long vowels. Although Shipibo tries to avoid both (HL) and (H) feet, under pressure it can tolerate the occurrence of a (H)-foot but never the occurrence of a trochaic (HL) one. See (19).

(19) a. (ˈ**tɨ:**)(-ma-ˌri:)(ba-kɨ)

b. *(ˈ**tɨ:**.-ma)(-ri.ˌbi:)-kɨ

work-causative-again-past

‘(he) made (him) work again’

In Shipibo, the long vowels of monosyllabic roots cannot shorten. They keep their length even if they are suffixed. The data in (19) has one of those roots: /tɨ:/ ‘to work’. Since vowel shortening is not an option in (19), the Shipibo grammar has two choices left: (i) to allow the initial syllable with the long vowel to form its own (H)-foot as in (19.a) or (ii) to reinforce the disyllabic size of metrical feet and foot together the initial two syllables into a trochaic (HL) foot, as in (19.b).

As shown by the ungrammaticality of (19.b), Shipibo rules out the latter option in favor of the former one. If Shipibo allowed the occurrence of the (HL)-foot, then we would expect the allomorph /-ribiː/ to be selected, but it is not. In that context, the allomorph /-riːba/ occurs, indicating that the initial syllable with the long vowel in (19.a) forms its own foot.

In contrast, when instead of a monosyllabic root with a long vowel, there is one with a short vowel; the initial syllable does group together with the following one into a single disyllabic foot. See (20). Unlike in (19.a), this time the allomorph /-ribiː/ is selected.

(20) (ˈpi.-ma)(-ri.ˌbiː)-kɨ

eat-causative-again-past

‘(he) made (him) eat again’

2.4 The Avoidance of Unstressed Long Vowels

In Shipibo, long vowels only occur in head positions within the prosodic structure. Shipibo does not allow the occurrence of metrical feet that contain a heavy syllable in which that syllable does not occupy the head of that foot. Thus, both (ˈL.H) and (H.H) feet are also banned. See (21) and (22).

(21) Avoidance of Trochaic (ˈL.H)-Feet

a. /kapɨː/ → (ka.ˈpɨː) ‘crocodile’

b. *(ˈka.pɨː)

(22) Avoidance of Trochaic and Iambic (H.H)-Feet

a. /tɨː -wɨː/ → (ˈtɨː).-wɨ work! (imperative)

b. *(ˈtɨː.wɨː)

c. *(tɨː.ˈwɨː)

Long vowels cannot occur unfooted, either. The data in (23) to (25) show the behavior of the imperative suffix, /-wɨː/. When it occurs in an unfooted position, its long vowel shortens (see (23)) but when it is footed, it occupies the head of the foot that houses it (see (24) and (25)).

(23) /yunu -wɨː/ → (ˈyu.nu)-wɨ

command -imperative

command (it)!

(24) /pi -wɨː/ → (pi.-ˈwɨː)

eat -imperative

eat (it)!

(25) /yunu -ma -wɨː/ → (ˈyu.nu)(-ma.-ˌwɨː)

command -causative -imperative

make (him) command (it)!

3 Formal Analysis

3.1 Theoretical Basis

The aim of this section is to present the theoretical tools with which a formal account for the metrical system of Shipibo can be proposed. As presented in chapter 3, with regard to metrical representations, the dissertation assumes *Metrical Phonology* (de Lacy 1997; 2002; Gussenhoven 2005; Halle and Vergnaud 1987; Hayes 1980; 1995; Kager 2005; Liberman and Prince 1977; McCarthy 1993; Prince 1980; 1983; 1985, among many others). This dissertation assumes the theoretical framework of *Optimality Theory* (OT) as proposed by Prince and Smolensky 1993; 2004 and also McCarthy and Prince 1993b[7].

In OT, syllable weight can be thought of as the conflict between constraints that impose contextual restrictions on the distribution of weight (*WT-restrictors*) and constraints that resist quantity adjustments (*QA-Inhibitors*). In (26) and (27), QA-inhibitors and WT-restrictors are characterized in terms of their effects.

(26) *QA-Inhibitors*: Constraints that preserve vowel length or create heavy closed syllables without caring about the metrical context in which they occur. They resist quantity adjustments.

(27) *WT-restrictors*: Constraints that impose contextual restrictions on the distribution of syllable weight.

[7] For introductory books on Optimality Theory, see Kager 1999; McCarthy 2002b (see also de Lacy to appear 2005; Dekkers, Leeuw et al. 2000; Legendre, Grimshaw et al. 2001; McCarthy 2004b, among others for advanced books and references to other important works).

For example, if a language bans the occurrence of heavy syllables in unstressed positions, input long vowels may be forced either to interrupt the rhythmic chain of disyllabic feet and form their own feet so that they occur in a head syllable or to undergo vowel shortening. The former strategy implies shrinking the disyllabic foot and allowing an (H)-foot to emerge in order to be faithful to vowel length. The latter strategy involves being unfaithful to vowel length in order to satisfy foot-disyllabicity.

Constraints that preserve vowel length or create heavy closed syllables without caring about the metrical context can be grouped under the label of *Inhibitors of Quantity Adjustments* (henceforth, *QA-Inhibitors*). They resist quantity adjustments by demanding faithfulness to vowel length or the avoidance of non-moraic codas.

In the case of vowel length, the relevant QA-Inhibitor is WEIGHT-IDENT (McCarthy 2000; McCarthy and Prince 1995; Sprouse 1996). For closed syllables, the relevant QA-Inhibitor is WEIGHT-BY-POSITION (Broselow, Chen et al. 1997; Hayes 1989; 1994; Moren 2000). The definitions of these constraints are given in (28) and (29), respectively.

(28) WEIGHT-IDENT: Correspondent vowels have identical moraic specification.

(29) WEIGHT-BY-POSITION (WBP): Codas are moraic.

Constraints that impose restrictions on the distribution of weight can be grouped under the label of *Weight-Restrictors* (henceforth, *WT-Restrictors*). These constraints are characterized by penalizing the occurrence of syllables with certain weight in a specific metrical context. The most common WT-restrictors are, for example, STRESS-TO-WEIGHT

PRINCIPLE (Gouskova 2003; Hayes 1995; Kager 1997; 1999; Moren 1999; Prince 1990), WEIGHT-TO-STRESS PRINCIPLE (Hayes 1995; Kager 1999; 2005; McCarthy and Prince 1993b; Prince 1990; Prince and Smolensky 1993), GROUPING HARMONY[8] (Bakovic 1996a; b; Gouskova 2003; Green 1996; 1997; Hayes 1995; Prince 1990; Prince and Smolensky 1993; 2004).

The constraint GROUPING HARMONY refers to the well known avoidance that natural languages show of grouping together a heavy syllable followed by a light one within a foot; that is, the uneven trochaic (HL) foot. This constraint penalizes the occurrence of heavy syllables as heads of these trochaic feet. See definition in (30).

The constraint WEIGHT-TO-STRESS PRINCIPLE penalizes the occurrence of heavy syllables in non-head positions in the metrical structure. It can be informally paraphrased as 'heavy syllables are stressed'. See definition in (31).

The constraint STRESS-TO-WEIGHT PRINCIPLE penalizes the occurrence of light stressed syllables. It can be paraphrased as 'stressed syllables are heavy'. See definition in (32).

(30) GROUPING HARMONY: Do not have uneven trochees (i.e. (H.L) feet).

(31) WEIGHT-TO-STRESS PRINCIPLE (WSP): Heavy syllables occupy head positions ('If heavy, then stressed').

(32) STRESS-TO-WEIGHT PRINCIPLE (SWP): Syllables in head positions are heavy ('If stressed, then heavy').

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[8] Prince and Smolensky 1993 renamed the constraint GROUPING HARMONY as RHYTHMIC HARMONY (RHHRM).

Besides QA-inhibitors and WT-restrictors, other relevant constraints the analysis presented in this chapter will refer to are:

(33) TROCHEE: Feet are left-headed.

(34) IAMB: Feet are right-headed.

(35) PARSE(σ): Syllables are footed.

(36) LXWD=PRWD: Lexical Words correspond to Prosodic Words.

(37) WEIGHT-IDENT-BD (WT-IDENT-BD): Base-Derived correspondent vowels in nouns have the same moraic content.

3.1.1 Foot Size

This dissertation assumes the classical constraint FOOT-BINARITY proposed by Prince 1980 (see also Hayes 1985; McCarthy and Prince 1986; Prince 1990; Prince and Smolensky 1993; 2004) but argues that another constraint, *FOOT(σ), is necessary to more accurately regulate the size of metrical feet.

The constraint FOOT-BINARITY plays a crucial role in governing the size of metrical feet by requiring feet to be binary either under a syllabic or moraic analysis. Assuming that GEN does not create feet bigger than two syllables[9], FOOT-BINARITY amounts to penalizing feet smaller than two moras. In this dissertation, FOOT-BINARITY is

[9] The existence of trisyllabic or bigger feet is controversial. There are languages that have ternary rhythm but this does not necessarily mean that syllables are grouped in trios. For the purposes of this research, I will take the position that GEN does not create feet bigger than two syllables. Cases of ternary rhythm can be obtained through weak local parsing (see Elenbaas and Kager 1999, see also Hyde 2001; 2002 for a different approach). Cases of unbounded feet can be analyzed as the occurrence of a single foot containing the PrWd main head (see Bakovic 1998; McCarthy 2002a; 2003a; b; Prince 1985).

referred to as *FOOT(μ). Thus, as observed in (38), the constraint *FOOT(μ) is satisfied either by a heavy syllable forming its own foot[10] or by a foot formed by two syllables, but it is violated by a monomoraic syllable forming a degenerate foot.

(38) FOOT-BINARITY as the ban on (L)-feet

	*FOOT(μ) (=FOOT-BINARITY)
a. (σ.σ)	✓
b. ($\sigma_{\mu\mu}$)	✓
c. (σ_{μ})	*

In addition to *FOOT(μ), this dissertation proposes another constraint that penalizes feet smaller than two syllables. This is the constraint: *FOOT(σ). The definitions of *FOOT(μ) and *FOOT(σ) are given in (39) and (40).

(39) *FOOT(μ): Do not have feet smaller than two moras.

(40) *FOOT(σ): Do not have feet smaller than two syllables.

Thus, whereas the well known avoidance of degenerate (L)-feet is expressed through the classical constraint *FOOT(μ), the constraint *FOOT(σ) penalizes feet smaller than two syllables; that is, both (L) and (H) feet.

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[10] In this dissertation, heavy (bimoraic) syllables will be usually represented by ‘H’ and light (monomoraic) syllables by ‘L’. However, in those cases, where it is necessary to emphasize, for expository purposes, the moraic content of syllables, as is the case in (38), heavy syllables will be represented as ($\sigma_{\mu\mu}$) and light syllables as (σ_{μ}).

An important relation between the constraints *FOOT(μ) and *FOOT(σ) is that they are stringent. That is, the violation of *FOOT(μ) always implies the violation of *FOOT(σ). This is shown in (41). This relation ensures that if, for some reason, the disyllabic foot were blocked from occurring, the (H)-foot would be immediately preferred over the (L)-foot.

(41) Preferred Foot-Sizes

	*FOOT(μ)	*FOOT(σ)
a. (σ.σ)		
b. (H)		*
c. (L)	*	*

The stringent relation that holds between the constraints *FOOT(μ) and *FOOT(σ) also means that they cannot be directly ranked. When it is possible to find evidence to rank them, a third constraint must dominate one of them and be dominated by the other. Thus, *FOOT(μ) and *FOOT(σ) can be indirectly ranked by transitivity (see de Lacy 2002; Prince 1997 for further discussion on the ranking of stringent constraints).

See the ranking in (42) and tableaux in (43) and (44) as an example of how to rank the stringent constraints *FOOT(μ) and *FOOT(σ). Assume that in this grammar, vowel length cannot be shortened and that degenerate (L)-feet as well as trochaic (HL)-feet are completely banned.

(42) *FOOT(μ), LX=PRWD >> GROUPING HARMONY, WT-IDENT >> *FOOT(σ), PARSE(σ)

(43)	/CV: CV/	GROUPING HARMONY	WEIGHT-IDENT	*FOOT(σ)	PARSE(σ)
a.	☞ (H).L			*	*
b.	(L.L)		*!W	L	L
c.	(H.L)	*!W		L	L

(44)	/ CV /	LX=PRWD	*FOOT(μ)	WEIGHT-IDENT	*FOOT(σ)	PARSE(σ)
a.	☞ (H)			*	*	
b.	(L)		*!W	L	*	
c.	L	*!W		L	L	*W

The constraint *FOOT(μ) is able to dominate *FOOT(σ) by transitivity: the constraint *FOOT(μ) outranks WEIGHT-IDENT in (44), which in turn dominates *FOOT(σ) (see (43)) and therefore, *FOOT(μ) must also outrank *FOOT(μ).

In sum, alone the stringent relationship between the constraints *FOOT(μ) and *FOOT(σ) creates a scale of preference on foot sizes. See the scale in (45). In this scale, disyllabic feet and bimoraic (H)-feet do not have the same status. Disyllabic feet are more desirable than bimoraic (H)-feet, and these, in turn, are more desirable than monomoraic (L)-feet. This is an important departure from current assumptions that take both disyllabic and bimoraic feet to have an equal status of 'preferability' against monomoraic feet (c.f. Hayes 1985; McCarthy and Prince 1986; Prince 1980; 1990; Prince and Smolensky 1993; 2004).

(45) *Scale of Preferability on Foot-Size*

(σ.σ) > (H) > (L)

Of course, an OT grammar is the global result of all constraints. Thus, although when taken in isolation, the constraints *FOOT(μ) and *FOOT(σ) favor the occurrence of disyllabic feet, in a broader perspective the interaction of these two constraints with the other constraints can prevent disyllabic feet to emerge, allowing the emergence of the (H)-foot, as shown above in (42).

3.1.2 The Need for the Constraint *FOOT(σ)

Shipibo is a language that allows the occurrence of heavy syllables and in spite of its preferred trochaic rhythm, it does not allow heavy syllables to form their own feet. This is a situation that cannot be handled alone by the constraint *FOOT(μ) (i.e. by the classical constraint FOOT-BINARITY). This constraint by penalizing degenerate (L)-feet equally favors both disyllabic feet and (H)-feet. It cannot draw a distinction between them, although it is necessary for languages like Shipibo.

Thus, if grammars only had the constraint *FOOT(μ), then it would be expected that in Shipibo, long vowels formed their own feet when convenient. However, Shipibo has a clear preference for disyllabic feet. It prefers to adjust syllable weight, when necessary, in order to avoid bimoraic (H)-feet.

As an example, assume a hypothetical input like / CVː CVː CVː /. As shown in Chapter 2, long vowels that would occur in odd syllables are shortened in Shipibo. Thus, the input / CVː CVː CVː / is mapped onto [(CV.CVː).CV].

From the perspective of the constraint *FOOT(μ), the form [(CV.CVː).CV] is better than *[(CVː)(CV.CVː)] or *[(CV.CV)(CVː)] since no (H)-foot occurs in the former. See tableau (46). Thus, by enforcing disyllabic feet, a grammar can rule out the occurrence of (H)-feet. The winner candidate undergoes minimal quantity adjustments so it can comply with the restrictions that the grammar imposes on the distribution of long vowels. In Shipibo, those restrictions are: (i) long vowels cannot occur in 'unstressed' syllables, (ii) as heads of trochaic (HL)-feet or (iii) forming their own feet.

(46)	/ CVː CVː CVː/	*FOOT(μ)	*FOOT(σ)	PARSE(σ)	WEIGHT-IDENT
a.	☞ (L.H).L			*	**
b.	(L.L).L			*	***!
c.	(H)(L.H)		*!		*
d.	(L.L)(H)		*!		**
e.	(L.H)(L)	*!	*		**

In contrast, an analysis that only considers the constraint *FOOT(μ) finds surprising that the candidate [(CV.CVː).CV] is preferred over *[(CVː)(CV.CVː)] or *[(CV.CV)(CVː)]. See tableau (47). Relevant constraints like PARSE(σ) and WEIGHT-IDENT favor the wrong candidate *[(CVː)(CV.CVː)]. The desired winner candidate, indicated by a sad face '☹', is harmonically-bound (that is, left without chance to win the competition under any ranking).

(47)	/ CVː CVː CVː/	*FOOT(μ)	PARSE(σ)	WEIGHT-IDENT
a.	💣 (H)(L.H)			*
b.	(L.L)(H)			*!*
c.	☹ (L.H).L		*!	**
d.	(L.L).L		*!	***
e.	(L.H)(L)	*!		**

Although proposals to modify FOOT-BINARITY (here, labeled as *FOOT(μ)) are not new (see Crowhurst and Hewitt 1995a; Downing 1998; Everett 1990; 1996; 2002; 2003; Green and Kenstowicz 1995; Hewitt 1994, among others), the present proposal crucially differs from previous works in that it does not try to replace FOOT-BINARITY or split it into several different constraints, rather it keeps its classical formulation and argues for the existence of a new constraint: *FOOT(σ) ('do not have feet smaller than two syllables').

The stringency relation held by both constraints, *FOOT(μ) and *FOOT(σ) together with the interaction with other constraints, makes it possible to model the three degrees of preference on the size of metrical feet observed in the scale in (45) and supported by languages like Shipibo: (σ.σ) > (H) > (L).

3.2 Foot Disyllabicity and the Distributional Restrictions on Long Vowels

This section presents a formal analysis on how the pressure for avoiding feet smaller than two syllables and respecting the restrictions imposed on the distribution of heavy syllables in Shipibo creates a language in which syllable weight is adjusted to fit into disyllabic feet and not the other way around; that is, foot size accommodating syllable weight, as it is usually assumed to occur.

The remainder of this chapter focuses on heavy syllables with long vowels[11]. The relevant QA-inhibitor with regard to vowel length is the constraint WEIGHT-IDENT (see definition in (48)).

(48) WEIGHT-IDENT: Correspondent vowels have identical moraic specification.

The restrictions that Shipibo grammar imposes on the distribution of heavy syllables are presented again in (49).

(49) Restrictions on the Distribution of Heavy Syllables in Shipibo

a. In spite of the system being trochaic by default, heavy syllables cannot form their own foot.

b. Heavy syllables cannot occur as heads of uneven trochaic feet (that is, (HL)-feet are banned).

c. Heavy syllables cannot occur in non-head positions within the metrical structure (that is, unstressed heavy syllables are banned).

[11] The case of closed syllables will be discussed in chapter 5 since it involves variable weight, a phenomenon that deserves separate examination.

These distributional restrictions point to the WT-restrictors WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY. The ban on unstressed heavy syllables clearly indicates that the constraint WEIGHT-TO-STRESS PRINCIPLE is at work. See definition in (50). The avoidance of a heavy syllable followed by a light syllable within a foot indicates the effects of GROUPING HARMONY. See definition in (51).

(50) WEIGHT-TO-STRESS PRINCIPLE (WSP): Heavy syllables occur in head-positions.

(51) GROUPING HARMONY (GH): Do not have uneven trochees (that is, ban (HL) feet).

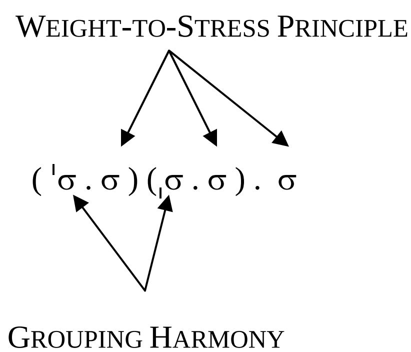
The ranking in (52) is responsible for banning long vowels in odd and unfooted syllables in Shipibo.

(52) WSP, GROUPING HARMONY, *FOOT(σ) >> WEIGHT-IDENT

The ranking in (52) rules out candidates that do not completely adhere to foot-disyllabicity. The WT-restrictors WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY by dominating WEIGHT-IDENT trigger vowel shortening in order to ban the occurrence of long vowels in unstressed positions and as heads of trochaic feet.

The contexts targeted by WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY are graphically represented in (53). The example shows a candidate with trochaic feet running from left to right. The arrows indicate the positions in which heavy syllables are banned. A candidate like this satisfies *FOOT(σ) but can only win, under the ranking in (52), if it does not contain a heavy syllable.

(53) *Contexts Targeted by the WT-restrictors in Shipibo*



The effects of *FOOT(σ), WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY on long vowels are shown in tableaux (54) and (55). In tableau (54), a long vowel is forced to shorten in order to avoid the occurrence of an uneven trochee and thus to satisfy GROUPING HARMONY. The ranking of *FOOT(σ) over WEIGHT-IDENT prevents the possibility of saving the long vowel by allowing it to form its own (H)-foot.

(54) / CV:CV / → (ˈCV.CV)

		GROUPING HARMONY	*FOOT(σ)	WEIGHT-IDENT
a.	☞ (ˈCV.CV)			*
b.	(ˈCV:).CV		*!W	L
c.	(ˈCV:.CV)	*!W		L

Tableau (55) shows the effect of WEIGHT-TO-STRESS PRINCIPLE on long vowels that would be mapped onto unstressed syllables. These vowels are shortened. They are not allowed to form an (H)-foot since, in this grammar, it is more important to satisfy *FOOT(σ) than to respect vowel length.

(55) / CV CV CVː / → (ˈCV.CV).CV

		WSP	*FOOT(σ)	WEIGHT-IDENT
a.	☞ (ˈCV.CV).CV			*
b.	(ˈCV.CV)(CVː)		*!W	L
c.	(ˈCV.CV).CVː	*!W		L

3.3 The Rise of Quantity Sensitivity

As just explained, the ranking in (52) precludes the possibility of having heavy syllables with long vowels occurring in unstressed positions and in uneven trochees. Under the ranking in (52), candidates with trochaic feet could never win if they contain a syllable with a long vowel. They would occur either unstressed, which violates WEIGHT-TO-STRESS PRINCIPLE, or as heads of disyllabic trochaic feet, which violates GROUPING HARMONY.

However, both WT-restrictors in (52) do not penalize heavy syllables as heads of iambic feet. As an illustration, the graph in (56) shows the contexts targeted by WEIGHT-TO-STRESS PRINCIPLE in a candidate with iambic feet.

(56) *Contexts Targeted by the WSP in Shipibo*

WEIGHT-TO-STRESS PRINCIPLE

(σ .ˈσ) (σ .ˌσ). σ

However, the cost of allowing heavy syllables with long vowels to surface as heads of iambic feet is to violate TROCHEE, the constraint that otherwise gives Shipibo its default rhythm. The definitions of the rhythmic constraints TROCHEE and IAMB are given in (57) and (58).

(57) TROCHEE: Feet are left-headed.

(58) IAMB: Feet are right-headed.

The following tableau shows that Shipibo is a trochaic language by default[12]. An iambic analysis of /CVCV/ is ruled out because it violates the constraint TROCHEE. An example of this type of Shipibo word is (ˈti.ta) ‘mother’.

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[12] The language Yidin^y (Crowhurst and Hewitt 1995b; Dixon 1977; Hayes 1982; 1995; Nash 1979; Poser 1986) has a similar pattern, that is, heavy syllables attract stress in the head of iambic feet but if no heavy syllable occurs in that position, the language has a trochaic rhythm.

(59) / CVCV / → (ˈCV.CV)

		TROCHEE	IAMB
a.	☞ (ˈL.L)		*
b.	(L.ˈL)	*!W	L

However, the constraint TROCHEE is not undominated in this language. It is crucially dominated by WEIGHT-IDENT. This ranking is important because it opens a context in which long vowels can occur in Shipibo: the head of iambic feet.

Put in different terms, since WEIGHT-IDENT outranks TROCHEE, it is more important to preserve long vowels that to respect the trochaic rhythm. However, the desire for heavy syllables has to be restricted to those contexts not banned by the WT-restrictors WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY.

The ranking in (60) is a slightly modified version of (52). The inclusion of the constraints in charge of rhythm ranked below WEIGHT-IDENT can now account for the occurrence of long vowels as heads of iambic feet.

(60) WSP, GH, *FOOT(σ) >> WEIGHT-IDENT >> TROCHEE >> IAMB

Tableau (61), which has an input / CVCVː /, shows how the ranking of WEIGHT-IDENT outranking TROCHEE allows long vowels to pop up as heads of iambic feet: (CV.ˈCVː). The winner candidate of (61) is attested to in Shipibo words like (ka.ˈpɨː) ‘crocodile’. The WT-restrictors that dominate WEIGHT-IDENT cannot do anything to stop the long vowel from surfacing in (61). Candidate (61.b) unnecessarily violates WEIGHT-IDENT. Candidate (61.c) is ruled out because it violates *FOOT(σ).

Candidate (61.c) respects foot-disyllabicity, vowel length and rhythm, but it violates the top ranked constraint WEIGHT-TO-STRESS PRINCIPLE. The comparison of candidate (61.c) with the winner candidate is interesting because it makes clear why the metrical structure of Shipibo is sensitive to syllable weight. Shipibo quantity-sensitivity emerges as a strategy to ‘save’ the long vowels that manage to occur as heads of iambic feet so that WEIGHT-TO-STRESS PRINCIPLE cannot ban them.

(61) / CVCV: / → (CV.ˈCV:)

	/ CVCV: /	WSP	*FOOT(σ)	WEIGHT-IDENT	TROCHEE	IAMB
a.	☞ (CV.ˈCV:)				*	
b.	(ˈCV.CV)			*!W	L	*W
c.	CV.(ˈCV:)		*!W		L	
d.	(ˈCV.CV:)	*!W			L	*W

3.4 The Rhythmic Allomorphy of the Suffix ‘again’

The ranking in (60), repeated in (62), has another welcome result: it accounts for the rhythmic allomorphy observed in the suffix ‘again’.

(62) WSP, GH, *FOOT(σ) >> WEIGHT-IDENT >> TROCHEE >> IAMB

With regard to this suffix, two different groups of speakers can be identified: the older speakers for whom the suffix is realized as [-rɪ.biː] and [-riː.bɐ] and the younger speakers, for whom the same suffix is realized as [-rɪ.biː] and [-riː.bɪ][13]. In spite of the different realizations of the suffix ‘again’ by these groups, the behavior of the suffix is metrically similar. In both groups, the form [-rɪ.biː] occurs when the syllables of the suffix group into a single metrical foot. The form [-riː.bɐ] (older speakers) or [-riː.bɪ] (younger speakers) appears when the syllables of the suffix are split between two feet. The long vowel always occupies the head position of an iambic foot.

With regard to the group of older speakers, in this dissertation, the suffix meaning ‘again’ is analyzed as having two different phonological representations: /-ribiː/ ~ /-riːba/. See examples in (5) to (8), repeated in (63).

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[13] It seems that the realization [-rɪ.biː] and [-riː.bɪ] observed in younger speakers for the suffix ‘again’ is relatively new since Lauriault 1948 does not mention it. An additional interesting fact that merits more research is that for both groups the only acceptable realization of the suffix ‘again’ when added to monosyllabic roots with short vowels is: [-riː.bɐ].

(i) [pi -ˈriː.bɐ.-kɨ], *[pi -ˈriː.bɪ.-kɨ] ‘(he) ate (it) again’
(ii) [bu -ˈriː.bɐ.-kɨ], *[bu -ˈriː.bɪ.-kɨ] ‘(he) took (it) again’

(63) The Allomorphy of the Suffix ‘again’: /-riːba/ and /-ribiː/

a. /pi -riːba -kɨ/ → (pi.-ˈriː)(bɐ.-kɨ) ‘(he) ate again’

b. /yunu -ribiː -kɨ/ → (ˈyu.nʊ)(-rɪ.ˌbiː)-kɨ ‘(he) commanded (it) again’

c. /yunu -ma -riːba -kɨ/ → (ˈyu.nʊ)(-mɐ.-ˌriː)(bɐ.-kɨ) ‘(he) made (him) command again’

d. /yunu -yama -ribiː -kɨ/ → (ˈyu.nʊ)(-ˌyɐ.mɐ)(-rɪ.ˌbiː)-kɨ ‘(he) didn’t command again’

One could be tempted, in the case of the older Shipibo speakers, to analyze the suffix ‘again’ as having only one phonological representation with two long vowels (that is, /-riːbiː/). Under this analysis, one of the vowels always shortens on the surface according to the metrical position in which it appears. However, under this alternative, it is unexpected that when the final /iː/-vowel of the suffix shortens, it becomes a low or mid lax vowel (i.e. [a], [ɐ], [ə]), instead of a high lax [ɪ]-vowel.

One cannot argue that the /iː/-vowel reduces to a low or mid vowel. First, this does not occur with the initial /iː/-vowel of the suffix: [-rɪ.biː], *[-rə.biː]. Second, not even the speakers that have [-riː.bɪ] instead of [-riː.bɐ] reduce final unstressed vowel to a central low or mid lax vowel. Third, in general, in unstressed positions, both the /iː/ and /i/ vowels become a lax [ɪ]-vowels, but not [ɐ] or [ə]. This is shown by the examples in (64) and (66).

In the examples in (64) and (66), the two suffixes, /-bi/ (action carried out in the opposite direction) and /-bitʃu/ ‘only’, contain the segmental sequence /bi/ occurring in an unstressed position. The sequence appears underlined. As observed, the unstressed vowel /i/ always become a lax high [ɪ]-vowel, never a lax mid or low [ɐ] or [ə]-vowel. Thus, if the suffix ‘again’ had only one phonological representation, /-riːbiː/, one would wrongly expect it to surface as *[-riː.bɪ] with the group of older speakers when it occurs split between two metrical feet. However, in that context, the suffix occurs as [-riː.bɐ] or [-riː.bə].

(64) a. /yunu -ma -bitʃu -kɨ/ → [(ˈyu.nʊ)(-ˌmɐ-bɪ)(ˌtʃʊ.-kɨ)]

b. *[(ˈyu.nʊ)(-ˌmɐ-bə)(ˌtʃʊ.-kɨ)].

command -causative -only -past_tense

‘(he) only made (him) command (it)’

(65) a. /nini -ma -bi -kɨ/ → [(ˈni.nɪ)(-ˌmɐ.-bɪ)-kɨ]

b. *[(ˈni.nɪ)(-ˌmɐ.-bɐ)-kɨ]

pull -causative -opposite_direction -past_tense

‘(he) made (him) pulled (it in the opposite direction)’

(66) a. /nini -bi -wɨː/ → [(ˈni.nɪ)(-bɪ-ˌwɨː)]

b. *[(ˈni.nɪ)(-bɐ-ˌwɨː)]

pull -opposite_direction -imperative

‘pull (it in the opposite direction)!’

In contrast, in the case of the younger Shipibo speakers it is possible to argue for a single phonological representation of the suffix ‘again’; namely, /-riːbiː/. The long vowel mapped onto a non-head position within the prosodic structure gets shortened. See (67).

(67) The Allomorphy of the Suffix ‘again’: /-riːbiː/ → [-rɪ.biː] and [-riː.bɪ]

a. /yunu -riːbiː -kɨ/ → (ˈyu.nʊ)(-rɪ.ˌbiː)-kɨ ‘(he) commanded (it) again’

b. /yunu -ma -riːbiː -kɨ/ → (ˈyu.nʊ)(-mɐ.-ˌriː)(bɪ.-kɨ) ‘(he) made (him) command again’

c. /yunu -yama -riːbiː -kɨ/ → (ˈyu.nʊ)(-ˌyɐ.mɐ)(-rɪ.ˌbiː)-kɨ ‘(he) didn’t command again’

Tableaux (68) and (69) show the role that GROUPING HARMONY plays in determining the output form of the suffix. This W-restrictor rules out candidates in which a heavy syllable occurs as the head of an uneven trochee. In tableau (68), both syllables of the suffix ‘again’ are parsed within a single foot. However, candidate (68.b) is ruled out because it contains a (HL)-foot and this violates GROUPING HARMONY.

Candidate (68.a) wins the competition avoiding the occurrence of a (HL)-foot. The cost of avoiding it is to allow an iambic foot. Thus, GROUPING HARMONY is satisfied at the cost of violating the trochaic rhythm.

(68) (ˈyu.nʊ)(-rɪ.ˌbiː).-kɨ ‘(he) commanded (it) again’

		GROUPING HARMONY	TROCHEE	IAMB
a.	☞ …(-rɪ.ˌbiː).-kɨ		*	
b.	…(-ˌriː.bɐ).-kɨ	*!		*

In tableau (69), the syllables of the suffix are split into two feet. Similar to the previous case, candidate (69.b) is ruled out because it has an uneven trochaic (HL)-foot and thus violates GROUPING HARMONY. Candidate (69.a) is chosen as the winner candidate since the long vowel occupies the head of the iambic feet. This satisfies GROUPING HARMONY at the cost of violating TROCHEE.

(69) (ˈyu.nʊ)(-mɐ.ˌ-riː)(bɐ.-kɨ) ‘(he) made (him) command (it) again’

		GROUPING HARMONY	TROCHEE	IAMB
a.	☞…(-mɐ.-ˌriː)(bɐ.-kɨ)		*	
b.	…(-ˌmɐ.-ri)(ˌbiː.-kɨ)	*!		*

In those grammars in which the suffix ‘again’ is represented as /-riːbiː/, the tableaux in (70) to (72) show the important role that the constraints WEIGHT-TO-STRESS PRINCIPLE, *FOOT(σ) and WEIGHT-IDENT play in selecting the right output form.

In tableau (70), WEIGHT-TO-STRESS PRINCIPLE eliminates candidate (b), which in order to be faithful to vowel length surfaces with both of its vowels long and parsed within a disyllabic foot. However, since one of the long vowels occupies a non-head position, WEIGHT-TO-STRESS PRINCIPLE is violated. In contrast, candidate (70.a) wins by satisfying WEIGHT-TO-STRESS PRINCIPLE and at the cost of violating WEIGHT-IDENT and TROCHEE.

(70) (ˈyu.nʊ)(rɪ.ˌbiː).kɨ ‘(he) commanded (it) again’

	/…-riːbiː… /	WSP	WEIGHT-IDENT	TROCHEE	IAMB
a.	☞ …(rɪ.ˌbiː)…		*	*	
b.	…(ˌriː.biː)…	*!			*

In tableau (71), candidate (b) is faithful to vowel length at the cost of giving up foot-disyllabicity. DISYLLABIC-FOOT rules it out. Candidate (71.a) is the winner because it parses both syllables into a disyllabic foot by minimally violating WEIGHT- IDENT.

(71) (ˈyu.nʊ)(rɪ.ˌbiː).kɨ ‘(he) commanded (it) again’

	/…-riːbiː… /	*FOOT(σ)	WEIGHT- IDENT	TROCHEE
a.	☞ …(rɪ.ˌbiː)…		*	*
b.	…(ˌriː)(ˌbiː)…	**!		

In contrast, in (72), candidate (b) satisfies all the constraint dominating WEIGHT-IDENT, but it violates WEIGHT-IDENT twice. Candidate (72.a), which also satisfies the constraints dominating WEIGHT-IDENT, wins by violating WEIGHT-IDENT only once.

(72) (ˈyʊ.nʊ)(rɪ.ˌbiː).kɨ ‘(he) commanded (it) again’

	/…-riːbiː… /	WEIGHT-IDENT	TROCHEE	IAMB
a.	☞ …(<u>rɪ.ˌbiː</u>)…	*	*	
b.	…(ˌ<u>rɪ.bɪ</u>)…	**!		*

Thus, the ranking in (62), repeated in (73), restricts the distribution of long vowels. They do not occur unstressed or as heads of trochaic feet. However, the ranking does not completely ban their occurrence. They can occur as heads of iambs, a context in which both WT-restrictors, WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY, are satisfied. This is possible because WEIGHT-IDENT outranks the constraints in charge of rhythm. This opens a context in which long vowels are not penalized.

(73) WSP, GH, *FOOT(σ) >> WEIGHT-IDENT >> TROCHEE >> IAMB

The graph in (74) shows schematically how the ranking in (73) maps input long and short vowels according to the metrical context.

(74)

/ CVCV / → /CVːCV / →	(ˈCV.CV)	e.g. (ˈba.kɨ), (ˈti.ta), etc.
/ CVCVː / → / CVːCVː / →	(CV.ˈCVː)	e.g. (ka.ˈpɨː), (pa.ˈbiː).ki, etc.
/ … CV / → / … CVː / →	…(σ.σ).CV	e.g. (ˈʔa.ta).pa, (ˈʂon.ta).ko, etc.

Important to the mappings of long vowels is that Shipibo does not accept QS-footing (i.e. the (H)-foot) as a strategy to avoid quantity-adjustments. Thus, syllable weight is subordinated to the aim of achieving feet of disyllabic size.

3.5 The Emergence of the (H)-Foot in Shipibo

3.5.1 The (H)-Foot to avoid a (L)-foot

Panoan languages like Shipibo overwhelmingly prefer disyllabic feet. However, two types of (H)-feet can occur under certain conditions. The first type of (H)-foot emerges in order to avoid a degenerate (L)-foot. In Shipibo, this type of (H)-foot is found in monosyllables. The data in (75) shows examples of monosyllabic noun roots. They always surface with long vowels. Monosyllabic noun roots are the only monosyllables that can occur bare.

(75) Monosyllabic Noun Roots

a. (tɨː) ‘work’ (noun)

b. (boː) ‘healed skin’ (noun)

c. (tsaː) ‘splinter’ (noun)

d. *(CV)

Shipibo lacks monosyllabic noun roots with short vowel, as shown in (75.d). This indicates that input short-vowels in monosylables undergo vowel lengthening. This lenghtening is clearly motivated to achieve a minimal moraic size, which is required by the constraint *FOOT(μ). See definition in (76). The vowel lengthening triggered to satisfy *FOOT(μ) violates the QA-inhibitor WEIGHT-IDENT.

(76) *FOOT(μ): Do not have feet smaller than two moras.

Furthermore, a constraint requiring the footing of a syllable must dominate *FOOT(σ). This is the constraint LXWD=PRWD (Prince and Smolensky 1993), which requires lexical words to be PrWds. In turn, this implies lexical words inherit all the prosodic hierarchy below the PrWd node (i.e. feet, syllables, moras). See definition in (77).

(77) LXWD=PRWD: Lexical Words correspond to Prosodic Words.

The ranking in (78) creates (H)-feet to avoid having light syllables forming their own feet. In the case of monosyllables, the constraint LXWD=PRWD guarantees that they are minimally footed in order to belong to a PrWd. All this is obtained at the cost of giving up foot-disyllabicity and triggering vowel lengthening when necessary. The ranking of *FOOT(σ) over WEIGHT-IDENT was already justified (see tableau (71)).

(78) *(H)-Foot to Avoid a (L)-Foot*

*FOOT(μ), LXWD=PRWD >> *FOOT(σ) >> WEIGHT-IDENT

Tableau (79) has as an input a noun monosyllabic root with a long vowel. Candidate (b) is eliminated because it does not correspond to a PrWd, violating the constraint LXWD=PRWD. In contrast, candidate (a) wins the competition even though it violates the constraint *FOOT(σ), which penalizes feet smaller than two syllables.

(79) (ˈtʃiː) ‘fire’

	/tʃiː/	LXWD=PRWD	*FOOT(σ)
a.	☞ (H)		*
b.	H	*!	

Even in the case that the input of a noun monosyllabic root had a short vowel, the ranking of the constraints LXWD=PRWD and *FOOT(μ) over the constraint *FOOT(σ) ensures a long vowel in the output. This is shown in tableau (80). Candidate (c) is eliminated because it does not correspond to a PrWd, violating the constraint LXWD=PRWD. Candidate (b) does correspond to a PrWd; however, its PrWd node dominates a (L)-foot. This violates the constraint *FOOT(μ) and thus it is ruled out. Candidate (a) wins the competition even though it violates the constraint *FOOT(σ), which penalizes feet smaller than two syllables.

(80) (ˈtʃiː) ‘fire’

	/tʃi/	LXWD=PRWD	*FT(μ)	*FOOT(σ)	WEIGHT-IDENT
a.	☞ (H)			*	*
b.	(L)		*!	*	
c.	L	*!			

The emergence of the (H)-foot in Shipibo is interesting because, in spite of the overwhelming preference for disyllabic feet, Shipibo does not employ any strategy to achieve foot-disyllabicity for the size of its minimal words[14]. Furthermore, although the (H)-foot does emerge in monosyllables, it cannot emerge in greater PrWds. This situation can only be obtained by embracing foot disyllabicity as the foot size that feet aspire to achieve. In contrast, whereas foot binarity can obtain monosyllables that are minimally bimoraic, it cannot avoid, at the same time, the occurrence of (H)-feet in a grammar sensitive to syllables weight, as is the case of Shipibo.

[14] The insertion of segments to obtain a disyllabic foot is ruled out by DEP-SEG outranking *FOOT(σ).

3.5.2 The (H)-Foot When a Disyllabic Foot is Blocked

Thus far, putting aside the trigger of vowel lengthening in order to avoid the occurrence of a degenerate (L)-foot, Shipibo is a language that resorts to vowel shortening in order to obtain disyllabic feet and respect the distributional restrictions imposed on heavy syllables. The trigger of vowel shortening to subordinate syllable weight to foot-size is mainly obtained by the ranking in (52), repeated in (81).

(81) WSP, GH, *FOOT(σ) >> WEIGHT-IDENT

Observe that if WEIGHT-IDENT and the WT-restrictors (i.e. WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY) dominated *FOOT(σ), the results would be rather different: (H)-feet would appear. See ranking in (82).

(82) WSP, GH, WEIGHT-IDENT >> *FOOT(σ)

Under the ranking in (82), quantity-adjustments would be blocked but the restrictions on the distribution of heavy syllables that Shipibo imposes would still hold. Under those circumstances, foot-disyllabicity would have to be abandoned and the (H)-feet would emerge as a strategy to guarantee stressed heavy syllables and avoid uneven trochees. If Shipibo had the ranking in (82), then it would look more like Cairene Arabic, in which heavy syllables form their own feet (see Hayes 1995).

However, in spite of the fact that Shipibo has the ranking shown in (81), a situation exists in which (H)-feet emerge motivated by a ranking similar to (82). In those cases, the (H)-foot appears for the same reasons it does in languages such as Cairene Arabic, that is, in order to be faithful to vowel length and respect the restrictions on the distribution of heavy syllables.

This result can be obtained when WT-restrictors and *FOOT(σ) outrank the relevant QA-inhibitor (in the present case, WEIGHT-IDENT) but at the same time the WT-restrictors and a more specific type of QA-inhibitor (represented as WEIGHT-IDENT♠ in (83)) dominates *FOOT(σ).

(83) WEIGHT-IDENT♠, WSP, GH >> *FOOT(σ) >> WEIGHT-IDENT

In the ranking in (83), WEIGHT-IDENT♠ refers to a constraint that demands faithfulness to vowel length in a specific context or under specific conditions. Thus, whereas the ranking of WEIGHT-TO-STRESS PRINCIPLE, GROUPING HARMONY and *FOOT(σ) enforces foot-disyllabicity and quantity-adjustments in general, the ranking of WEIGHT-IDENT♠, WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY over *FOOT(σ) allows the creation of (H)-feet in the context targeted by WEIGHT-IDENT♠.

The (H)-feet created by WEIGHT-IDENT♠ do not emerge in order to avoid degenerate (L)-feet as in the previous section. They emerge to respect vowel length and at the same time to obey the restrictions on their distribution. The satisfaction of both requirements makes it impossible to achieve disyllabic feet.

In Shipibo, a specific type of QA-inhibitor is WEIGHT-IDENT-BD. This constraint establishes correspondence relations between Base and Derived nouns with regard to the moraic content associated with vowels. On the extension of Correspondence Theory (McCarthy and Prince 1995) to relations between surface forms within a paradigm: the Base (B) and the Derived form (D), see Benua 1997. See definition in (84).

(84) WEIGHT-IDENT-BD (WT-IDENT-BD): BD-correspondent vowels in nouns have the same moraic content.

With the constraint WEIGHT-IDENT-BD, the ranking of Shipibo that governs foot-size looks like (85).

(85) WEIGHT-IDENT-BD, WSP, GH >> *FOOT(σ) >> WEIGHT-IDENT

The constraint WEIGHT-IDENT-BD demands output-to-output faithfulness for long vowels in monosyllabic nouns and denominalized monosyllabic verbs. Thus, forms based on or derived from a monosyllabic noun (which always surfaces with long vowels) also inherit the long vowel of the monosyllabic noun. The graph in (86) shows this schematically.

(86)
/ CV /$_{\text{noun}}$ → (ˈCVː) e.g. (ˈ**tʃiː**) ‘fire’.
/ CVː /$_{\text{noun}}$ → (ˈCVː)

↓ WEIGHT-IDENT-BD

/ CV$_{\text{noun}}$ -CV / → (ˈCVː)-CV e.g.(ˈ**tʃiː**)-ki ‘fire’ (locative)
/ CVː$_{\text{noun}}$ -CV / → (ˈCVː)-CV *(ˈ**tʃi**.-ki)

The faithfulness to long vowels in monosyllabic-noun roots blocks the trigger of vowel shortening that Shipibo would otherwise manifest. However, the restrictions on the distribution of heavy syllables still hold: they cannot occur in unstressed positions and they cannot occur as heads of (HL)-feet. Thus, as a strategy to respect both the length of these long vowels and the distributional restrictions on heavy syllables, Shipibo shrinks the ideal disyllabic size of feet and allows the (H)-foot to emerge.

Before showing how the ranking in (85) creates (H)-feet when disyllabic feet cannot be achieved, let us present the data that support this analysis.

In Shipibo, the long vowels of monosyllabic nouns never shorten, not even if they are suffixed with enough phonological material to form a disyllabic foot. See data in (87).

(87) Long Vowels in Monosyllabic Noun Roots

a. (ˈ**tʃiː**) ‘fire’

b. (ˈ**tʃiː**)-ki ‘fire’ (locative)

c. (ˈ**tʃiː**)-rɨs ‘only the fire’

Monosyllabic verbs have, in general, short vowels. However, unless they are monosyllabic nouns, they can never occur bare. Monosyllabic verbs always occur suffixed and since verbal suffixes have at least one vowel, the minimal disyllabic foot is guaranteed. See data in (88).

(88) Monosyllabic Root Verbs with Short Vowels

a. (ˈ**pi**.-ti)	‘to eat’ (/-ti/ infinitive)
b. (ˈ**pi**.-kɨ)	‘(he) ate (it)’ (/-kɨ/ past tense)
c. (**pi**.-ˈnon)	‘(he) ate (it)’ (/-non/ switch reference)
d. *(**pi**)	(verb ‘*eat’*)

The data in (89)-(91) show denominalized verbs, which always have long vowels.

(89)

a. (ˈ**tɨː**)	‘work’ (*noun*)
b. (ˈ**tɨː**)-ti	‘to work’ (*infinitive verb*)
c. (ˈ**tɨː**)-kɨ	‘(he) worked’ (*finite verb*)

(90)

a. (ˈ**tsaː**)	‘splinter’ (*noun*)
b. (ˈ**tsaː**)-ti	‘to splinter’ (*infinitive verb*)
c. (ˈ**tsaː**)-kɨ	‘(it) splintered’ (*finite verb*)

(91) a. (ˈ**boː**) ‘healed skin’ (*noun*)

b. (ˈ**boː**)-ti ‘to heal’ (*infinitive verb*)

c. (ˈ**boː**)-kɨ ‘(it) healed’ (*finite verb*)

Independent evidence that monosyllabic roots with long vowels form their own foot comes from the behavior of the suffix /-riːbiː/ ‘again’. See data in (92) and (93). If the suffix formed a disyllabic foot, either *(ˈ**tɨː**.-riː)(bə.-kɨ) or *(ˈ**tɨː**.-**ʂ̪on**)(-rɪ.biː)-kɨ would occur, impossible outputs in Shipibo.

(92) (ˈ**tɨː**)(-rɪ.ˌbiː)-kɨ *(ˈ**tɨː**.-riː)(bə.-kɨ)

work-again-past

‘(he) worked again’

(93) (ˈ**tɨː**)(-**ʂ̪on**.-ˌriː)(bə.-kɨ) *(ˈ**tɨː**.-**ʂ̪on**)(-rɪ.biː)-kɨ

work-beneficial-again-past

‘(he) worked (for him) again’

Thus, the behavior of monosyllabic nouns creates an interesting asymmetry in the treatment of long vowels. Whereas input long vowels in odd-syllables in polysyllabic roots and in monosyllabic verbs always shorten in order to achieve disyllabic feet, long vowels in monosyllabic roots never shorten and they form their own feet. This is shown schematically in (94).

(94) Monosyllabic Noun + Suffix: / CV(ː)$_{noun}$ -CV / → (ˈ<u>CVː</u>)-CV

Monosyllabic Verb + Suffix: / CV(ː)$_{verb}$ -CV / → (ˈ<u>CV</u>.CV)

Polysyllabic Root: / CV(ː)CV /$_{noun/verb}$ → (ˈ<u>CV</u>.CV)

The constraint WEIGHT-IDENT-BD, by outranking *FOOT(σ), is responsible for enforcing the respect of long vowels in the derived forms of monosyllabic nouns. This is shown in tableau (95). Candidate (95.b) is ruled out because in the derived form (that is, (ˈtɨ.-kɨ)), the initial syllable does not have the same moraic content as in the base form (that is, (ˈtɨː)). This violates the higher ranked constraint WEIGHT-IDENT-BD. The slashes in tableau (95) separate the violations incurred by the base and the derived form.

In contrast, candidate (95.a) wins because the derived form, (ˈtɨː)-kɨ, satisfies WEIGHT-IDENT-BD, since the root vowel has the same moraic content as the base, (ˈtɨː). Candidate (95.a) obtains this result at the price of abandoning foot-disyllabicity and therefore violating *FOOT(σ).

(95) (ˈtɨː) ‘work’ (noun) ~ (ˈtɨː)-kɨ ‘(he) worked’

		WEIGHT-IDENT-BD	*FOOT(σ)
a.	☞ (ˈtɨː) ~ (ˈtɨː)-kɨ		*/*
b.	(ˈtɨː) ~ (ˈtɨ.-kɨ)	*!W	*/L

Tableaux (96) and (97) show that the constraint GROUPING HARMONY and WEIGHT-TO-STRESS PRINCIPLE also dominate the constraint *FOOT(σ). Tableau (96) accounts for why the long vowels of verb-monosyllabic roots form their own foot instead of grouping with the following syllable and thus obtaining a disyllabic foot. The answer is in the avoidance of the uneven trochaic (HL)-foot. If the syllable with the long vowel grouped together with the following syllable, the W-restrictor GROUPING HARMONY would be violated.

(96) (ˈtɨː) 'work' (noun) ~ (ˈtɨː)-kɨ '(he) worked'

		GROUPING HARMONY	*FOOT(σ)
a.	☞ (ˈtɨː) ~ (ˈtɨː)-kɨ		*/*
b.	(ˈtɨː) ~ (ˈtɨː.-kɨ)	/*!W	*/L

Tableau (97) shows that WEIGHT-TO-STRESS PRINCIPLE outranks *FOOT(σ). Candidate (97.b) satisfies *FOOT(σ) by allowing two heavy syllables to be footed in the same foot. However, it is eliminated because it violates WEIGHT-TO-STRESS PRINCIPLE. In contrast, candidate (97.a) is chosen as the winner because it satisfies WEIGHT-TO-STRESS PRINCIPLE, but at the cost of abandoning foot-disyllabicity.

(97) (ˈtɨː) 'work' (noun) ~ (ˈtɨː)(-rɪ.ˌbiː)-kɨ '(he) worked again'

		WEIGHT-TO-STRESS PRINCIPLE	*FOOT(σ)
a.	☞ (ˈtɨː) ~ (ˈtɨː)(-rɪ.ˌbiː)-kɨ		*/*
b.	(ˈtɨː) ~ (ˈtɨː.-riː)(bə.-kɨ)	/*!	*/

The emergence of the (H)-foot in this situation only affects monosyllabic nouns since they are the only roots force to undergo vowel lengthening in order to avoid a degenerate (L)-foot. Therefore, they are the only *Bases* that contain long vowels that cannot be shortened. All derived forms in OO-correspondent relations with them inherit the long vowels of these Bases.

An alternative approach to account for the long vowels in monosyllables is to use alignment constraints that require that the right edge of the stem be aligned with the right edge of a PrWd. In the case of monosyllabic stems, the vowel surfaces long in order to be aligned with the right edge of a foot.

Tableau (98) has the constraint ALIGN-R (STEM, FT), which requires that the right edge of every Stem coincide with the right edge of a foot (McCarthy and Prince 1993a), dominating both *FOOT(σ) and WEIGHT IDENT. Even though candidate (98.b) satisfies the constraints *FOOT(σ) and WEIGHT IDENT, it is ruled out because it violates the higher ranked constraint ALIGN-R (STEM, FT). This ranking correctly chooses candidate (98.a) since it satisfies the constraint ALIGN-R (STEM, FT) at the cost of violating the constraints *FOOT(σ) and WEIGHT IDENT.

(98) (ˈtʃiː) ‘fire’

	/tʃi -ki/	ALIGN-R (STEM,FT)	*FOOT(σ)	WEIGHT IDENT
a.	☞ (ˈtʃiː)-ki		*	*
b.	(ˈtʃi.-ki)	*!		

A problem for this approach is that it incorrectly predicts that the final syllables of stems with an odd number of syllables would behave in the same way as monosyllables. That is, the odd syllable would surface with a long vowel in order to make the right edge of a foot coincide with the right edge of the PrWd. See (99).

(99) a. (ˈa.ta)pa ‘hen’

b. *(ˈa.ta)(paː)

In tableau (100), the constraint ALIGN-R (STEM, FT) incorrectly eliminates candidate (100.b), which is the actual winner and chooses candidate (100.a) for the same reasons it chose (ˈtʃiː)-ki in tableau (98): the right edge of its stem is aligned with the right edge of a foot.

(100) (ˈa.ta)pa, *(ˈa.ta)(paː) ‘hen’

	/ atapa /	ALIGN-R (STEM, FT)	*FOOT(σ)	WEIGHT IDENT
a.	☹ (ˈa.ta)(paː)		*	*
b.	(ˈa.ta)pa	*!		

An important lesson learnt from the emergence of this (H)-foot in Shipibo is that it clearly indicates that disyllabic feet and bimoraic (H)-feet have a different status of preferability. This situation stands at odds with foot-binarity, which can only distinguish both the disyllabic feet and the (H)-feet against the (L)-foot. In contrast, this result makes sense under foot-disyllabicity since disyllabic feet are the preferred foot-size. The (H)-foot only emerges when a disyllabic foot cannot be obtained.

The problem with foot-binarity is that it leaves open two foot-sizes from which other constraints choose one: disyllabic or bimoraic size. Under foot-binarity, the (H)-foot will always be favored when it comes to map long vowels. The (H)-foot guarantees that heavy syllables occupy head positions so no further quantity adjustments are necessary, which also implies satisfaction of WEIGHT IDENT. However, languages like Shipibo show that the striving for disyllabicity is more important than the respect for WEIGHT IDENT, a result that cannot be obtained with foot-binarity.

Foot-disyllabicity is not only valid for languages that prefer disyllabic feet. The interaction of foot-disyllabicity and the restrictions on syllable weight can derive QS-footing, as well. This dissertation has shown this for Shipibo. In contrast, foot-binarity can only obtain disyllabic feet if the metrical structure of a given language does not interact with quantity. If it does, under foot-binarity, heavy syllables would inexorably be forced to form their own (H)-feet.

4 Conclusions

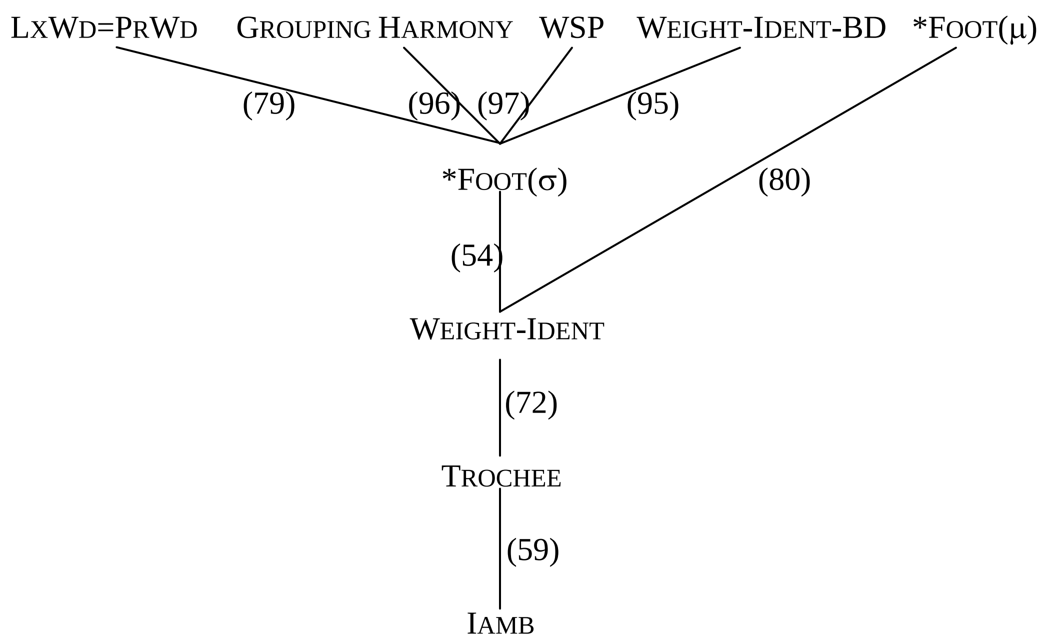
This chapter has shown that foot-disyllabicity is not only able to account for footing in languages in which heavy syllables prefer to form their own foot. It can also account for languages sensitive to syllable weight but with QI-footing.

Moreover, the chapter has made clear that there is no clear cut between quantity-sensitive and quantity-insensitive languages, an observation also made by Alber 1999; Kager 1992. Quantity sensitivity is contextually determined by the interaction of *FOOT(σ), *FOOT(μ) and the constraints in charge of syllable weight and its distributional restrictions.

As stated at the outset, foot-disyllabicity is central to the understanding of the nature of the (H)-foot and why grammars resort to it. This chapter has shown that grammars favor disyllabic feet over bimoraic (H)-feet. They do not have the same status of ‘preferability’. In Shipibo, for example, the (H)-foot emerges only when a disyllabic foot cannot be obtained or in order to avoid a degenerate (L)-foot.

The grammar that governs foot size and the quantity adjustments of vowel length in Shipibo is presented in (101). The numbers refer to the tableaux in which the elementary ranking condition between two constraints was established.

(101) Shipibo Grammar for Foot Size and Quantity Adjustments in Long Vowels



Chapter 5: Contextual Weight of Closed Syllables

1 Introduction

The previous chapter showed that the interaction of the constraint *FOOT(σ), which demands feet to be disyllabic, and the compliance with the restrictions imposed on the distribution of heavy syllables with long vowels trigger vowel shortening in Shipibo. The result is that vowel length is adjusted to fit disyllabic feet and to avoid unstressed heavy syllables, (H)-feet and uneven trochaic (HL)-feet. In spite of these strict restrictions on the distribution of long vowels in Shipibo, they manage to appear as heads of iambic feet, a context not affected by those restrictions.

This chapter shows that this interaction not only affects vowel length but also the weight of closed syllables. In Shipibo, just as long vowels are forced to shorten, closed syllables are inhibited from acquiring a moraic coda in unstressed positions and in order to avoid having them as heads of uneven (HL)-trochees or as heads of (H)-feet. Moreover, similar to long vowels, heavy closed syllables can only occur as heads of iambic feet. This chapter provides extensive and detailed evidence in support of an analysis of variable weight in closed syllables.

The existence of languages in which the weight of closed syllables can be contextually variable is not new (see Broselow, Chen et al. 1997; Chung 2002; Gordon 2004a; Hayes 1994; McCarthy 1979; Moren 1999; 2000; Rosenthall and van der Hulst 1999; Vaysman 2004, among others). However, unlike cases in which contextual closed-syllable weight only occurs marginally, in the case of Shipibo, the weight of closed syllables changes according to the position in which they occur within the prosodic structure. They follow the same pattern that leads long vowels to shorten rhythmically throughout the PrWd. See generalizations in (1).

(1) Contextual Weight of Closed Syllables in Shipibo

a. Closed syllables are light (i.e. monomoraic) in order to avoid:

   i. The occurrence of unstressed heavy closed syllables.

   ii. Having uneven trochaic (H.L)-feet.

   iii. Having heavy closed syllables forming their own (H)-feet.

b. Closed syllables are heavy (i.e. bimoraic) when they occur as heads of disyllabic iambic feet.

The chapter is organized as follows: section §2 presents evidence for the contextual weight of closed syllables in Shipibo. Sections §3 offers a fomal account of why closed syllables have different weights depending on the metrical position in which they occur. This section also discusses the origin of Shipibo's sensitivity to syllable weight. Section §4 discusses the most plausible alternatives to the variable weight of closed syllables in Shipibo and shows why they fail in handling the phenomenon. Section §5 presents the conclusions.

2 Evidence for the Weight of Closed Syllables

This section presents evidence about the variable weight of closed syllables in Shipibo. Three types of evidence are provided: (i) from the patterns of syllables with long and short vowels; (ii) from footing; and (iii) from the distribution of high tones.

(2) Sources of Evidence for the Contextual Weight of Closed Syllables in Shipibo

a. Contrasting patterns with syllables with long and short vowels.

b. Footing.

c. Distribution of high tones.

The data presented in this section come from several fieldtrips the author of this dissertation carried out in Shipibo communities in Peru (Pucallpa and Lima) between 1997 and 2004.

2.1 Evidence from Patterning Tests

Heavy closed syllables in Shipibo not only have the same behavior observed in syllables with long vowels (see chapter 2) but also they endure the same restrictions on the distribution of their weight. Heavy closed syllables cannot occur in unstressed positions or as heads of (H) and (H.L) feet.

In (3), the reader can compare the behavior of closed syllables against the behavior of syllables with long and short vowels. The first column contains cases of long vowels and the second column cases of closed syllables. Closed syllables have been underlined for easier identification.

In the data in (3), syllables with long vowels and closed syllables that occur in the head of iambic feet attract the ‘main stress’ (i.e. the head of the PrWd). Main stress never occurs beyond the initial two syllables of the PrWd, that is, beyond the initial foot. In Shipibo, the head of the PrWd always occurs in association with a high tone.

(3) <u>*Shipibo: Comparison of Vowel Length and Closed Syllables*</u>

a.	(ˈba.kɨ)	‘child’	b.	(ˈ<u>mis</u>.ku)	‘cramp’
c.	(ka.ˈpɨː)	‘crocodile’	d.	(wi.ˈ<u>taʂ</u>)	‘leg’
e.	(wɨs.ˈtiː)	‘few’	f.	(<u>tʃun</u>.ˈ<u>kɨʂ</u>)	‘(sp. of) bird’
g.	(ˈʔa.ta).pa	‘hen’	h.	(ˈ<u>ʂun</u>.ta).ku	‘young woman’
			i.	(ˈsa.pi).<u>tun</u>	‘(sp. of) fish’
j.	(pa.ˈbiː).ki	‘ear’	k.	(ku.ˈ<u>nun</u>).bi	‘(sp. of) sweet fruit’)
l.	(ran.ˈpɨː).pi	‘the back of the knee’	m.	(<u>mis</u>.ˈ<u>pan</u>).<u>mis</u>	‘tamale seller’

The pairs (c)-(d) and (j)-(k) show that closed syllables attract stress, as syllables with long vowels do. The data in (3.i) and (3.m) show two cases of unfooted closed syllables. Whereas in (3.m), one can argue that in order to avoid a clash, the final closed syllable is left unparsed, the data in (3.i) clearly show that Shipibo prefers unfooted closed syllables rather than allowing them to form a (H)-foot.

The data pairs in (e)-(f) and (l)-(m) are revealing with regard to the weight of closed syllables. In (3.e), the syllable with the long vowel obtains the main stress over the initial closed syllable. This indicates that the initial closed syllable is light. Remember that Shipibo is a trochaic language by default (see (3.a-b) and (3.g-i)) so the achievement of iambicity cannot be the cause of this pattern.

The pattern observed in (3.e) cannot be attributed to syllables with long vowels being heavier than closed syllables. Observe that (3.f) has two closed syllables but it obtains the same stress pattern as in (3.e). Words of this type indicate that whereas the initial closed syllable is light, the second closed syllable is heavy (compare it to (3.c)).

An additional observation is that Shipibo lacks a word with the shape *[ˈCVː.CVC], which indicates that the long vowel shortens in that position in order to let the closed syllable obtain the stress: [CV.ˈCVC]. This adds additional evidence against claiming that syllables with long vowels are preferred over closed syllables for stress assignment.

Words like (3.m) have three closed syllables, but only the second one behaves heavy. Words as in (3.m) obtain the same stress pattern as if they were words in (3.j).

The graphs in (4) and (5) show schematically how Shipibo distributes weight within the metrical structure for both vowel length and closed syllables. They are shown within a single page to facilitate the reader's comparison of the input-output mappings.

(4) *<u>Shipibo: Quantity Adjustments of Long Vowels</u>*

a. / CV CV / → (ˈ<u>L</u>.L) (e.g. (ˈba.kɨ) ‘child’, (ˈti.ta) ‘mother’)

b. / <u>CV</u>ː CV / → (ˈ<u>L</u>.L)

c. / CV(C) <u>CV</u>ː / → (L.ˈ<u>H</u>) (e.g. (ka.ˈpɨː) ‘crocodile’, (tun.ˈbuː) ‘herd’)

d. / <u>CV</u>ː <u>CV</u>ː / → (L.ˈ<u>H</u>)

e. /…<u>CV</u>ː / → …(σ.σ).<u>L</u> (e.g. (ˈʔa.ta).pa ‘hen’, (ˈʂun.ta).ku ‘young woman’)

f. /…<u>CV</u> / → …(σ.σ).<u>L</u>

(5) *<u>Shipibo: Variable Weight of Closed-Syllables</u>*

a. / <u>CVC</u> CV / ⟶ (ˈ<u>L</u>.L)

(e.g. (ˈ<u>mis</u>.ku) ‘cramp’, (ˈ<u>ʂun</u>.ta).ku ‘young woman’)

b. / CV(ː) <u>CVC</u> / ⟶ (L.ˈ<u>H</u>)

(e.g. (wi.ˈ<u>taʂ</u>) ‘leg’, (ku.ˈ<u>nun</u>).bi ‘(sp. of) sweet fruit’)

c. / <u>CVC</u> <u>CVC</u> / ⟶ (<u>L</u>.ˈ<u>H</u>)

(e.g. (<u>tʃun</u>.ˈ<u>kɨʂ</u>) ‘(Sp. of) bird’, (<u>mis</u>.ˈ<u>pan</u>).mis ‘tamale seller’)

d. /…<u>CVC</u> / ⟶ …(σ.σ).<u>L</u>

(e.g. (ˈsa.pi).<u>tun</u> ‘(Sp. of) fish’, (run.ˈtan).<u>his</u> ‘medicine’)

2.1.1 Evidence from Footing

In Shipibo, footing also indicates that closed syllables have different moraic contents. The two allomorphs, /-rɪbiː/ and /-riːba/, of the suffix 'again' are helpful here. As already shown, the alternation depends on the position that the suffix syllables end up occupying in the metrical structure of the PrWd. In both cases, the long vowel always occurs in the head of an iambic foot (go to chapters 2 and 3 for more information). See examples in (6) and (7).

(6) (ˈyu.nu)(-ri.ˌbiː) -kɨ

command -again -past_tense

'(he) commanded (it) again'

(7) (ˈyu.nu)(-ma.-ˌriː)(ba.-kɨ)

command -causative -again -past_tense

'(he) made (him) command (it) again'

The alternation of this suffix can be used as an indicator of whether or not the syllables preceding it group in disyllabic feet. This, in turn, provides information as to whether syllables are heavy (i.e. bimoraic) or light (i.e. monomoraic).

For example, in the case of monosyllabic roots with long vowels, they always form their own foot. However, monosyllables with short vowels and with closed syllables group together with the following syllable. See data in (8).

(8) a. (ˈ**tɨː**)(-ri.biː)-kɨ * (**tɨː**.-riː)(ba.-kɨ) work-again-past

b. (**his**.-ˈriː)(ba.-kɨ) * (**his**)(-ri.biː)-kɨ see-again-past

c. (**pi**.-ˈriː)(ba.-kɨ) * (**pi**)(-ri.biː)-kɨ eat-again-past

In (8.a), the allomorph is [-ri.biː], indicating that the preceding syllable, which has a long vowel, forms its own foot. Compare (8.a) to (8.b) and (8.c). In the latter cases, the allomorph surfaces as [-riː.ba]. This indicates that the previous syllable groups with the next one into a single metrical foot. Thus, word-initial closed syllables pattern with open syllables with short vowels and not with syllables with long vowels.

The allomorphy of the suffix 'again' not only provides evidence for the footing and weight of monosyllables but also indicates the footing and weight of other syllables in odd positions. See data in (9) sand (10). In all these cases, in contrast to (8.a), the odd closed syllables cannot form their own feet; otherwise, the occurrence of the wrong allomorph for the suffix 'again' would be predicted.

(9) (ˈ**mɨʂ̩**.tɨ)(-ri.biː).-kɨ

cut_his_hand -again -past_tense

'(he) cut his hand again'

(10) (ˈpu.ta)(-**ʂun**.-<u>riː)(ba</u>.-kɨ)

throw-beneficial-again-past

'(he) threw (it) (for him) again'

In (9), if the closed syllable of /mɨʂtɨ/ 'to cut (one's hand)' formed its own foot, the suffix 'again' would incorrectly surface as [-riːba], as shown in (11.a). Unlike the cases in (9), the closed syllable is not initial in (10). It appears on the third position within the PrWd. Here, closed syllables do not form their own feet either, as the incorrect selection of the allomorph 'again' shows in (11.b). This indicates that they are light. Compare them with (8.a).

(11) a. *(**mɨʂ**)(tɨ.-<u>riː)(ba</u>.-kɨ)

b. * (pu.ta)(-**ʂun**)(-<u>ri.biː</u>)-kɨ

The selection of the allomorph for the suffix 'again' also points out the contrasting behavior between closed-syllables and syllables with long vowels in words containing two initial closed syllables and words containing an initial long-voweled syllable followed by a closed syllable. Two initial closed syllables group together into a foot. See data in (12).

However, in (13), the syllable with the long vowel forms its own foot, leaving the following closed syllable to group with next syllable in the second foot. This contrast points out that the initial closed syllable of (12) is light whereas the second is heavy.

(12) (**mis**.ˈ**pan**)(-ri.ˌbiː)-kɨ

cook_tamale -past

'(he) cooked tamale'

(13) (ˈ**tɨː**)(-**ʂun**.-ˌriː)(ba.-kɨ)

work-beneficial-again-past

'(he) worked (for him) again'

2.2 Evidence from High Tones

A different type of evidence on the weight of closed syllables comes from the distribution of high tones. This evidence is particular useful in determining the weight of closed syllables beyond the main foot of the PrWd.

In Shipibo, the head of the PrWd, be it light or heavy, always occurs associated with a high tone. See data in (14). As usual, the head of the PrWd is indicated by the symbol [ˈ] and the high tones by an acute accent.

(14) a. (ˈtí.ta) ‘mother’

b. (ˈmís.ku) ‘cramp’

c. (ka.ˈpɨ́ː) ‘crocodile’

d. (wi.ˈtáʂ) ‘leg’

e. (tʃun.ˈkɨ́ʂ) ‘(sp. of) bird’

f. (wɨs.ˈtíː) ‘few’

g. (mis.ˈpán).mis ‘tamale seller’

h. (ˈsá.pi).tun ‘(sp. of) fish’

In Shipibo, secondary feet only obtain a high tone if their head has a heavy syllable. After the high tone associated with the PrWd main head, the pitch quickly falls until it reaches the end of the word.

The data in (15) show examples of words in which secondary feet do not occur associated with high tones. All the syllables in these examples are open and contain a short vowel. In the data, the symbol [ˌ] indicates the syllable occupying the head of the foot and [́] indicates a high tone.

(15) a. (ˈʔá.ta)(ˌpa.-bu) ‘hens’

b. (ˈʔá.ta)(ˌpa.-ʂu)(ˌku.-bu) ‘little hens’

Unlike the examples in (15), the data in (16) contain examples containing closed syllables that occupy the heads of trochaic disyllabic feet. As observed in the transcriptions, those closed syllables do not obtain any high tone. In both cases in (15) and (16), after the high tone associated with the main stress, the pitch steadily falls as it approaches the right edge of the PrWd. See chapter 2 (section 3) for examples of pitch-extractions.

(16) a. (ˈbú.na)(-ˌ**run**.ki) ‘(sp. of) bee’ (reportative)

b. (ˈpú.ta)(-ˌ**ʂ̯un**.-kɨ) ‘(he) threw (it for you)’

c. (ˈsá.pi)(ˌ**tun**.-bu) ‘(sp. of) Fish’

It is also worth remembering that it is not possible to argue that the words in (15) and (16) only have one foot because the alternation observed in the suffix ‘again’ depends on the presence of disyllabic feet running throughout the PrWd.

In contrast, those secondary feet that have heavy syllables with long vowels do obtain a high tone. See data in (17).

(17) a. (ʔu.ˈnán)(-ri.ˌ**bíː**)(-kas.-kɨ) ‘(he) wanted to know (about him) again’

b. (ˈká.-ma)(-ri.ˌ**bíː**).-kɨ ‘(he) made (him) go again’

In the words in (17), after the high tone associated with the PrWd main head, the pitch starts to fall but it rises up on the heavy syllable contained in the secondary feet. The rise is not as high as in the case of the PrWd main head, though. After the rise on the secondary foot, the pitch quickly falls again. For the examples of pitch-extractions of words like in (17), go to chapter 2 (section 3).

Now, in contrast to the data in (16) and similar to the data in (17), the examples in (18) have closed syllables that behave as syllables with long vowels. They attract their own high tone in formal speech.

(18)	a. (ˈbú.na)(-bu.-ˌ**rún**)ki	‘(sp. of) bee’ (plural-reportative)
	b. (ˈpú.ta)(-ma.ˌ-**ʂún**).kɨ	‘(he) made (him) throw (it for you)’

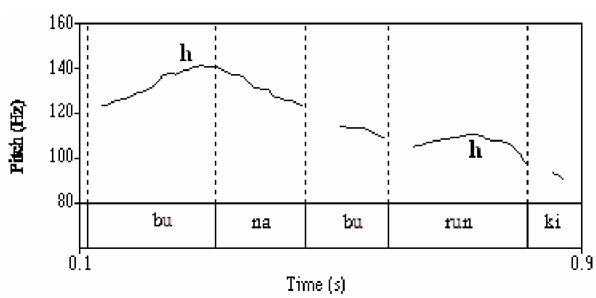
Thus, both the data in (16) and in (18) have closed syllables. However, whereas, in (16), they occur as the heads of trochaic feet and without high tones, in (18), they occur as the heads of iambic feet and with high tones. Second, in (18), the closed syllables pattern with the long vowels: both receive high tones when occupy the head of iambic feet.

This contrast strongly indicates that closed syllables in (16) are light (i.e. monomoraic) whereas the closed syllables of (18) are heavy (i.e. bimoraic). The contrast is better observed in (19) and (22).

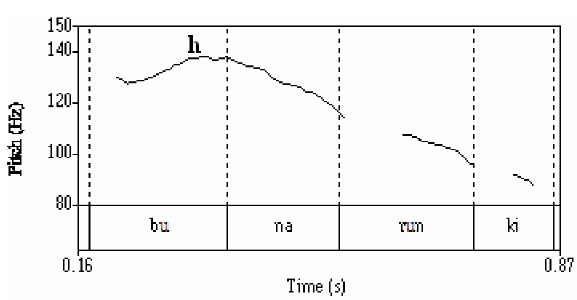
(19)	a. (ˈbú.na)(-bu.-**rún**)ki	‘(sp. of) bee’ (plural-reportative)
	b. (ˈbú.na)(-ˌ**run**.ki)	‘(sp. of) bee’ (reportative)

In (19), both examples have the root /buna/ ‘(sp. of) bee’ and the reportative suffix /-runki/. In addition, (19.a) has the plural suffix /-bu/, which occurs between the root and the reportative suffix. The suffix /-bu/ pushes the following closed syllable to occupy the head of an iambic foot. In this position, the closed syllable [**run**] occurs associated with a high tone. In contrast, in (19.b), the closed syllable [**run**] occupies the head of trochaic foot. In this position, it occurs without any high tone associated to it. See pitch-contours in (20) and (21).

(20) (ˈbú.na)(bu.**rún**).ki



(21) (ˈbú.na)(**run**.ki)



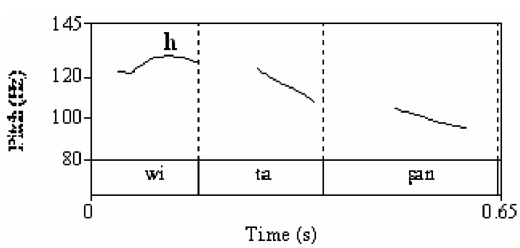
An example similar to (19) is presented in (22). Both examples have the root /puta/ ‘to throw’ and the suffixes /-ʂun/ (beneficial) and /-kɨ/ (past tense). The example in (22.a) has the additional suffix /-ma/ (causative).

(22) a. (ˈpú.ta)(-ma.-ˌ**ʂún**).-kɨ ‘(he) made (him) throw (it for you)’

b. (ˈpú.ta)(-ˌ**ʂun**.-kɨ) ‘(he) threw (it for you)’

In (23), there is an example of a closed syllable that occurs in an unfooted position. In this context, the closed syllable is also light. It cannot attract a high tone.

(23) (ˈwí.ta).**ʂan** ‘leg (ergative)’



2.3 Summary

This section has brought evidence from different sources that indicate that closed syllables contextually vary their weight in Shipibo according to the metrical context in which they occur. Furthermore, the evidence not only further supports the analysis presented for long vowels in chapter §2, but also shows that the same forces that restrict the distribution of heavy syllables with long vowels are also responsible for the variable weight of closed syllables. Heavy closed syllables occur in the same contexts where syllables with long vowels are allowed and light closed syllables occur in the same environments where long vowels undergo shortening.

3 Formal Analysis of the Contextual Weight of Closed Syllables

The constraint *FOOT(σ), which demands foot-disyllabicity, together with the restrictions imposed on its distribution have been proven central in accounting for the quantity adjustments of long vowels in Shipibo.

Since Shipibo has a clear preference for disyllabic feet, long vowels shorten in unstressed positions to satisfy the conditions imposed by the W-restrictor WEIGHT-TO-STRESS PRINCIPLE. They also shorten when they occur as heads of trochaic feet in order to satisfy the prohibition on uneven trochaic (H.L)-feet, that is, GROUPING HARMONY. The driving force for achieving disyllabic feet (that is, *FOOT(σ)) restrains Shipibo from fulfilling the restrictions on the distribution of long vowels by resorting to the (H)-foot.

An interesting characteristic of Shipibo is how it becomes sensitive to syllable weight. Due to the ranking of the constraint TROCHEE below the QA-inhibitor WEIGHT-IDENT, a context is created in which syllables with long vowels can safely occur. This metrical environment is the head of iambic feet.

In this position, both WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY, the WT-restrictors, are satisfied. The urgency to satisfy WEIGHT-TO-STRESS PRINCIPLE makes Shipibo a language sensitive to syllable weight by discarding trochaic (ˈL.H) analyses. The ranking that enforces foot-disyllabicity and regulates the distribution of long vowels in Shipibo is shown in (24).

(24) *Ranking Governing the Distribution of Long Vowels*

WSP, GH, *FOOT(σ) >> WEIGHT-IDENT >> TROCHEE

These same forces governing the distribution of long vowels are also responsible for the weight of closed syllables. Parallel to vowel shortening, closed syllables show variable weight as a way to comply with the restrictions imposed by the WT-restrictors WEIGHT-TO-STRESS PRINCIPLE and GROUPING HARMONY. However, in contrast to the case of long vowels, the relevant QA-inhibitor for closed syllables is: WEIGHT-BY-POSITION (that is, codas must be moraic). See definition in (25).

(25) WEIGHT-BY-POSITION (WBP): Codas are moraic.

The ranking governing the weight of closed syllables in Shipibo is presented below in (26).

(26) *Ranking Governing the Weight of Closed Syllables*

WSP, GH, *FOOT(σ) >> WEIGHT-BY-POSITION >> TROCHEE

The ranking in (26) enforces foot-disyllabicity (due to *FOOT(σ)) and bans the occurrence of heavy closed syllables in unstressed positions (due to WEIGHT-TO-STRESS PRINCIPLE) and as heads of uneven trochees (due to GROUPING HARMONY). The ranking of WEIGHT-BY-POSITION over TROCHEE opens a context in the head of iambic feet for heavy closed syllables to occur. The occurrence of heavy closed syllables in this context makes Shipibo sensitive to the weight of closed syllables.

The scheme in (27) shows how the ranking in (26) contextually governs the weight of closed syllables. Closed syllables appear shaded so the reader can easily locate them.

(27) <u>*Contextual Weight of Closed Syllables*</u>

CV.CV → (ˈL.L)

CVC.CV → (ˈL.L), but not *(ˈH)L, it violates *FOOT(σ)

*(ˈH.L), it violates GH

*(ˈHH), it violates WSP

CV.CVC → (L.ˈH), but not *(ˈL.H), it violates WSP

CVC.CVC → (L.ˈH), but not *(ˈH)L, it violates *FOOT(σ)

*(ˈH.L), it violates GH

*(ˈH.H), it violates WSP

*(ˈL.L), it violates WBP twice

….CVC → …(σ. σ).L, but not *(ˈH), it violates *FOOT(σ)

*H, it violates WSP

It is important to note that under the approach put forth in this dissertation, both the weight of closed syllables as well as the mapping of long vowels are subject to the conflict between foot-disyllabicity and the metrical forces that govern the, distribution of syllable weight. Thus, although the ability of metrical structure to influence the weight of closed syllables might seem an obvious development, it is not what is currently assumed implicitly or explicitly. Even though most researchers would agree that the metrical environment influences vowel length, for closed syllables, the position generally assumed is that their weight is completely blind to the metrical environment. The weight of closed syllables is assumed constant throughout a given language. Somehow, in this view, WT-restrictors like GROUPING HARMONY and WEIGHT-TO-STRESS PRINCIPLE always fail to have any effect on the weight of closed syllables.

Languages like Shipibo stand out against this position. The weight of closed syllables varies according to the metrical context in which they occur. Whether a closed syllable surfaces light or heavy depends on the general restrictions imposed on heavy syllables.

3.1 Light Closed-Syllables

This section shows that the preference for disyllabic feet and the restrictions on the distribution of heavy syllables in Shipibo force closed syllables to be light in unstressed positions and in the heads of trochaic feet. The evidence presented, in section §2, on patterning with vowel length, footing and distribution of high tones supports the winner candidates shown in the tableaux below.

In tableau (28), the initial closed syllable is forced to be light. It cannot form its own foot because that would violate *FOOT(σ). The closed syllable cannot be heavy and occur as the head of a trochaic foot. This would violate GROUPING HARMONY.

(28) (ˈ<u>mis</u>.ku) ‘cramp’

		GROUPING HARMONY	*FOOT(σ)	WEIGHT-BY-POSITION
a.	☞ (ˈL.L)			*
b.	(ˈH).L		*!W	L
c.	(ˈH.L)	*!W		L

The evidence in support of the winner candidate in (28.a) comes from footing. If the closed syllable were heavy and formed its own foot, then the suffix ‘again’ would surface as [-ri.biː]. This rules out candidate (28.b). See (29.b). In contrast, monosyllables with long vowels do form their own foot in order to satisfy GROUPING HARMONY. See (29.a).

(29) a. (ˈ**tɨː**)(-ri.biː)-kɨ * (**tɨː**.-riː)(ba.-kɨ) ‘(he) worked again’

b. (**his**.-ˈriː)(ba.-kɨ) * (**his**)(-ri.biː)-kɨ ‘(he) saw (it) again’

Moreover, in chapter §4, it was shown that for the case of monosyllables that GROUPING HARMONY dominates *FOOT(σ). This independent motivated ranking rules out candidate (28.c).

Tableau (30) shows that unfooted closed syllables are light. The ranking of WEIGHT-TO-STRESS PRINCIPLE and *FOOT(σ) over WEIGHT-BY-POSITION bans it.

(30) (ˈsa.pi).<u>tun</u> '(sp. of) fish'

		WSP	*FOOT(σ)	WEIGHT-BY-POSITION
a.	☞ (ˈL.L).L			*
b.	(ˈL.L)(ˌH)		*!W	L
c.	(ˈL.L).H	*!W		L

Candidate (30.a) finds support in the distribution of high tones. If the final syllable were heavy, it would occur associated with a high tone as in (31.b) (compare it with (31.a)).

(31) a. (ˈbá.na)-**ʂun** '(he) plants (it)' (switch reference)

b. (ˈbá.na)(-ma.-ˌ**ʂún**) '(he) makes (him) plant (it)' (switch reference)

3.2 Heavy Closed Syllables

Sensitivity to syllable weight also arises in the case of closed syllables. See tableau (32). The ranking of WEIGHT-BY-POSITION over TROCHEE allows the occurrence of heavy closed syllables in the head of iambic feet. As explained above, in the case of closed syllables, the emergence of sensitivity to the syllable weight also means the occurrence of closed syllables with contextual weight. In contrast to tableaux (28) and (30), tableau (32) has a heavy syllable.

(32) / witaʂ̥ / → (wi.ˈtaʂ̥)

		*FOOT(σ)	WEIGHT-BY-POSITION	TROCHEE
a.	☞ (L.ˈH)			*
b.	(ˈL.L)		*!W	L
c.	L.(ˈH)	*!W		L

Evidence in favor of candidate (32.a) comes from the position of the high tone and the patterning of syllables with long vowels. The closed syllable receives the high tone instead of the initial one. This pattern is similar to the one observed in long vowels. See data in (33).

(33) a. (ˈtí.ta) ‘mother’

b. (ka.ˈpɨ́ː) ‘crocodile’

c. (wi.ˈtáʂ̥) ‘leg’

One of the most remarkable patterns found in Shipibo is in words with consecutive closed syllables, as in the Shipibo words (tʃun.ˈkɨʂ̥) ‘(a type of) bird’ and (mis.ˈpan).mis ‘tamale seller’. These words only have one of their closed syllables heavy. Parallel to the case of inputs with two long vowels /CVː CVː/, only the closed syllable that occupies the head of an iambic foot manages to be heavy. The other are forced to be light.

Tableau (34) shows how the word / tʃunkɨʂ̥ / is mapped onto candidate (34.a), in which the initial closed syllable is light and the second heavy. The initial closed syllable is light in order to satisfy GROUPING HARMONY in candidate (34.d). Both closed syllables cannot be heavy since this would violate WEIGHT-TO-STRESS PRINCIPLE. This discards candidate (34.c). Candidate (34.b) is ruled out because it violates unnecessarily twice the constraint WEIGHT-BY-POSITION.

Candidate (34.a) wins the competition by violating WEIGHT-BY-POSITION just once but at the cost of reversing the default trochaic rhythm of the language.

(34) (tʃun.ˈkɨʂ̥) ‘(sp. of) bird’

		GH	WSP	WEIGHT-BY-POSITION	TROCHEE
a.	☞ (L.ˈH)			*	*
b.	(ˈL.L)			*!*W	L
c.	(ˈH.H)		*!W	L	L
d.	(ˈH.L)	*!W		*	L

A similar mapping is obtained for the word (mis.ˈpan).mis ‘tamale seller’ in tableau (35). However, the difference this time is that one out of the three closed syllables surfaces heavy. The initial one and the unfooted closed syllables are forced to be light.

(35) (mis.ˈpan).mis

		*FOOT(σ)	WEIGHT-BY-POSITION	TROCHEE
a.	☞ (L.ˈH)L		**	*
b.	(ˈL.L)L		***!W	L
c.	(ˈLL)(ˌH)	*!W	**	L

An important observation to make with regard to words that follow the pattern of (tʃun.ˈkɨʂ̬) ‘(sp. of) bird’ or (mis.ˈpan).mis ‘tamale seller’ is that they do not have lexical stress. The position of their stress is completely predictable by the ranking of constraints.

The data in (36) to (38) is shown in support of the predictability of the stress pattern of this type of words. In (36), the suffixes /-kɨ/ and /-a/ are added to the root /kɨpɨn/ ‘to open’. When the suffix /-kɨ/ (past tense) is added, the root surfaces with a closed syllable occupying the head of the PrWd. See (36.a). However, when the suffix /a/ is added, the final consonant of the root is parsed as the onset of the final vowel. In this case, the two initial syllables of the PrWd are open and have short vowels. As predicted, the stress positions on the initial syllable.

(36) a. (kɨ.ˈpɨn)-kɨ ‘(he) opened (it)’

b. (ˈkɨ.pɨ).n-a ‘opened’ (past participle)

The same pattern of ‘stress shift’ is observed in (37) and (38). However, this time the roots /panʃin/ ‘to ripen’ and /mispan/ ‘to cook tamale’ provide the necessary segments to obtain two closed syllables or a closed syllable followed by an open one depending on the suffix attached. What is important to observe in (37) and (38) is that ‘stress shifts’ as predicted. If, in Shipibo, words like these were exceptional (that is, if they had lexical stress), the stress would not jump onto the preceding syllable as in (37.b) and (38.b).

(37) a. (pan.ˈʃin)-ti ‘to ripen’

b. (ˈpan.ʃi).n-a ‘ripened’ (past participle)

(38) a. (mis.ˈpan)-kɨ ‘(he) cooked tamale’

b. (ˈmis.pa).n-a ‘cooked (tamale)’ (past participle)

3.3 Variable Weight of Closed Syllables beyond the Main Foot

The grammar in (26), repeated in (39), can also account for the weight of closed syllables beyond the main foot. This grammar correctly predicts that those closed syllables must follow the same behavior of closed syllables in the main foot.

(39) <u>*Ranking Governing the Weight of Closed Syllables*</u>

WSP, GH, *FOOT(σ) >> WEIGHT-BY-POSITION >> TROCHEE

Tableau (40) shows an example of a heavy closed syllable in a secondary foot. The high tones have been included in the transcription in (40) in order to provide a sharper contrast with the tableaux following it.

(40) (ˈbú.na)(bu.ˌ**rún**)ki ‘(sp. of) bee’ (plural-reportative)

		WSP	WEIGHT-BY-POSITION	TROCHEE
a.	☞(ˈL.L)(L.ˌH)L			*
b.	(ˈL.L)(L.L)L		*!	
c.	(ˈL.L)(L.H)L	*!		

Unlike tableau (40), tableau (41) shows an example of a light closed syllable that occurs in a secondary foot. This closed syllable does not occur associated with a high tone.

(41) (ˈsá.pi)(ˌ**tun**.bu) ‘(sp. of) fish’ (plural)

		GH	WEIGHT-BY-POSITION
a.	☞ (ˈL.L)(ˌL.L)		*
b.	(ˈL.L)(ˌH.L)	*!	

4 Alternative Analyses

This section presents alternative analyses to the contextual weight of closed syllables of Shipibo presented in this chapter. The goal of this section is to show that the most plausible alternatives cannot account for the behavior of the weight of closed syllables in languages like Shipibo.

4.1 Process-Driven Weight

The weight of closed syllables in Shipibo cannot be accounted for by claiming that it is process-driven, that is, that closed syllables are heavy or light depending on the specific properties of the phonological processes that affect them (Gordon 1999; 2000; 2002a; b; 2002b; 2004b).

In Shipibo, closed syllables can only have as a coda one of the following segments: [n, s, ʃ, ʂ]. Syllables closed by any of those segments behave light or heavy depending on the context in which they occur. It is worth mentioning that closed syllables in general can bear a high tone so that it is not possible to claim that certain closed syllables are heavy or light depending on the ability of their codas to bear tones.

As also shown, in section §2, evidence coming from the patterning with long/short vowels, footing and the distribution of high tones indicates that all closed syllables contextually vary their weight.

4.2 Syllables Weight as a Reflex of Coda Inventory

The weight of closed syllables in Shipibo is also problematic for an approach in which their weight is predicted from voicing and sonorancy (Gordon 1999). This approach posits the hypothesis that if the number of obstruent segments in the coda inventory of a language is greater than the number of sonorant codas, then the language is predicted to lack heavy closed syllables. However, if the number of sonorant codas is greater than the number of obstruents in the coda inventory, the language is predicted to have heavy closed syllables.

In Shipibo, the number of coda obstruents (i.e. [s, ʃ, ʂ]) with regard to the coda sonorants (i.e. [n]) occurs in the ratio 3:1. This incorrectly predicts that Shipibo should lack heavy closed syllables. The case of Shipibo adds to other four counterexamples that Gordon 1999 cites: Nganasan (Helimski 1998; Tereshchenko 1979; Vaysman 2004), Nyawaygi (Dixon 1983), Lhasa Tibetan (Dawson 1980; Meredith 1990; Odden 1979), and Tidore (Pikkert and Pikkert 1995).

4.3 Prominence-Based Analysis

If a prominence-based analysis were undertaken, one could argue that Shipibo assigns main stress to the rightmost heavy syllable. Otherwise, it occurs on the initial syllable. The right results would be obtained for disyllabic words. However, it cannot account for the pattern in words of more than two syllables when at least one closed syllable occurs beyond the initial two. See table in (42).

(42)

		Variable Weight Analysis	Prominence (Alternative) Analysis
Disyllabic Words			
CV.CV	→	(ˈL.L)	ˈL.L
CVC.CV	→	(ˈL.L)	ˈH.L
CV.CVC	→	(L.ˈH)	L.ˈH
CVC.CVC	→	(L.ˈH)	H.ˈH
Trisyllabic Words			
CV.CV.CVC	→	(ˈL.L) L	* L.L.ˈH

The prominence analysis yields incorrect results for words as in (43). It predicts that (43.b) *[sa.pi.ˈtun] would be the surfacing form. The main stress is expected to occur beyond the first two syllables of the PrWd when there is a closed syllable available to the right side. However, the main stress in Shipibo is bounded within the first two syllables because they form a disyllabic foot.

(43) a. (ˈsa.pi) tun ‘(sp. of) fish’

b. * sa.pi.ˈtun

4.4 A Quantity-Sensitive Footing Analysis

Shipibo words as in (44) are unexpected under an analysis that proposes a QS-footing.

(44) a. (mis.ˈpan) mis ‘tamale seller’

b. *(mis)(pan)(ˈmis)

c. * (ˈmis)(pan)(mis)

Under this analysis, one could argue that, in Shipibo, closed syllables are always heavy and that bimoraic (H)-feet are allowed. Thus, either two light syllables group together to form a (LL)-foot or a heavy syllable forms its own foot (H).

Furthermore, one could argue that main stress must be located either in the leftmost foot or in the rightmost foot of the PrWd. Neither of these possibilities yields satisfactory results for the stress patterns shown in Shipibo. With the leftmost foot bearing the main stress, it incorrectly predicts that main stress occurs on the first syllable in words having an initial closed syllable since it forms its own foot and therefore is the leftmost foot of the PrWd. See (45).

(45)

Disyllabic Words		Variable Weight Analysis	QS Footing Analysis with Main Stress in the Leftmost Foot
CV.CV	→	(ˈL.L)	(ˈL.L)
CVC.CV	→	(ˈL.L)	(ˈH)L
CV.CVC	→	(L.ˈH)	L(ˈH)
CVC.CVC	→	(L.ˈH)	* (ˈH)(H)
Trisyllabic Words			
CVC.CVC.CVC	→	(L.ˈH) L	* (ˈH)(H)(H)

If the analysis based on a quantity-sensitive footing is undertaken but with the rightmost foot bearing the main stress, the result would also be incorrect. It incorrectly predicts that the final closed syllable of words with three closed syllables bears the main stress since it forms its own foot and is the rightmost.

Shipibo does not show *non-finality* effects so it is not possible to claim non-finality effects are responsible for the non-occurrence of main stress in the final closed syllable in (44). See table in (46).

(46)

		QI Footing Analysis	QS Footing Analysis with Main Stress in the Rightmost Foot
Disyllabic Words			
CV.CV	→	(ˈL.L)	(ˈL.L)
CVC.CV	→	(ˈL.L)	(ˈH)L
CV.CVC	→	(L.ˈH)	L(ˈH)
CVC.CVC	→	(L.ˈH)	(H)(ˈH)
Trisyllabic Words			
CVC.CVC.CVC	→	(L.ˈH) L	* (H)(H)(ˈH)

5 Conclusions

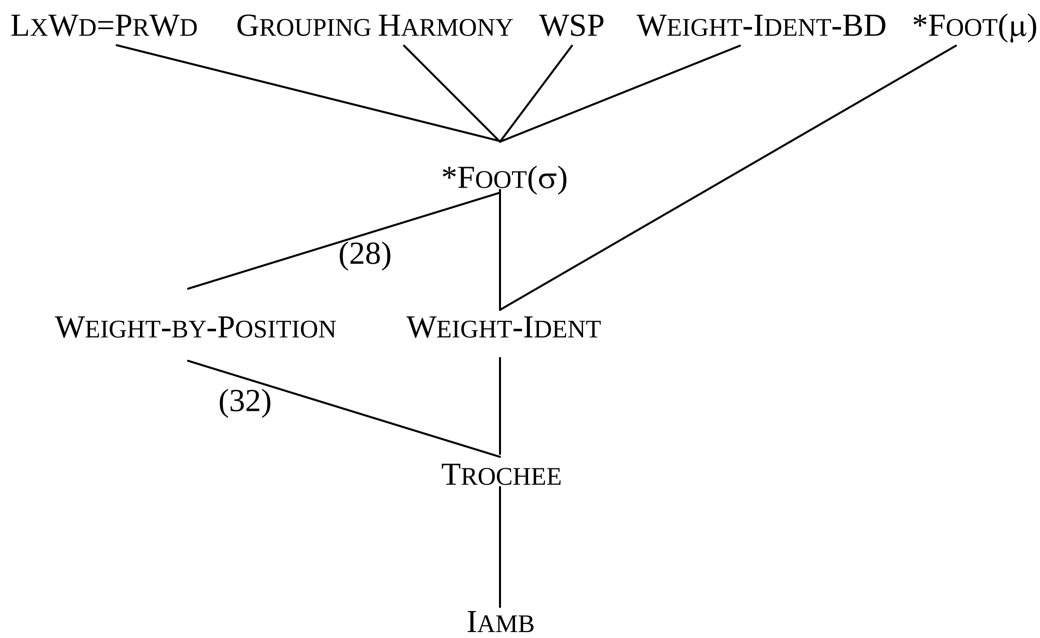
This chapter has shown that the interaction of foot-disyllabicity (i.e. *FOOT(σ)) and the restrictions that a language imposes on the distribution of weight do not only affect vowel length but also have consequences for the weight of closed syllables.

The chapter has concentrated on how the interaction of foot disyllabicity and the restrictions on the distribution of heavy syllables force closed syllables in Shipibo to vary their weight throughout the entire PrWd according to the metrical environment in which they occur.

Parallel to the behavior of vowel length, in Shipibo closed syllables are light in order to avoid unstressed heavy syllables and heavy syllables as heads of (H.L) and (H)-feet. However, Shipibo, by having the constraint TROCHEE ranked below WEIGHT-BY-POSITION, opens a context in which closed syllables can be heavy and at the same time respect the distributional restrictions on heavy syllables: the heads of iambic feet. In this context, closed syllables are heavy by reversing the default rhythm of the language. This rhythm reversal is the origin of Shipibo's sensitivity to syllable weight and the cause of the contextual weight of closed syllables.

The Shipibo grammar shown in (47) includes the constraint WEIGHT-BY-POSITION (WBP). This grammar accounts for the disyllabic size of metrical feet in Shipibo, the quantity adjustments of long vowels and the contextual weight of closed syllables. All the elementary ranking conditions were justified in chapter 4, except for those that relate to the constraint WEIGHT-BY-POSITION. The numbers refer to the relevant tableaux that demonstrate that *FOOT(σ) dominates WBP and that WBP outranks TROCHEE.

(47) Shipibo –Revised Grammar for Foot Size and Contextual Syllable Weight



Chapter 6: Metrically Conditioned Glottal-Coalescence in Capanahua

1 Introduction

This chapter studies the interplay between foot-disyllabicity (i.e. *FOOT(σ)), the weight of closed syllables and the role of faithfulness constraints in connection to the phenomenon of metrically conditioned glottal-coalescence in Capanahua, another Panoan language, with the same metrical system as Shipibo. Metrically conditioned glottal-coalescence has a rhythmic fashion. Glottal stops that would occur as codas of unstressed syllables are forced to coalesce with the preceding vowel. However, the coalescence is inhibited in stressed syllables.

This rhythmic alternation of Capanahua can be observed in the data in (1) (the examples (c) and (d) originally come from Loos 1969:182. The examples (a) and (b) come from my own fieldwork (in Iquitos, Peru in the summer 2001)[1]. This phenomenon was first identified by Loos 1969[2]. Although Loos considered the process deletion, the occurrence of creaky voice left by glottal stops in the preceding vowels indicates that it is coalescence.

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[1] I would like to thank Mrs. Saira Solivan Chumo, Mr. Benigno Rios Sachibo and Mr. Omer Pizarro Huaninchi as well as all the members of the Capanahua community 'Limoncocha' (Alto Tapiche River, Iquitos, Peru) who participated in the fieldwork interviews for their valued support in helping in the investigation of their language as well as for their hospitality and friendship.

[2] Other works on Capanahua include: Loos 1963, 1969, 1976; Schoolland 1976; Loos 1978; Safir 1979; Hall Loos and Loos 1980; Loos and Loos 1998; Loos 1999; Camacho and Elias-Ulloa 2001; Elias-Ulloa 2002; Gonzalez 2002; Elias-Ulloa 2003; Gonzalez 2003; Elias-Ulloa to appear 2005a.

In the examples in (1), the heads of the PrWds are indicated by the symbol [ˈ], the heads of secondary feet by the symbol [ˌ] and glottalized vowels are indicated by the subscript symbol [̰].

(1)	a. (ˈtuʔ.ku)(-ˌtaʔ.-ki)	‘it’s a frog’
	b. (ˈtuʔ.ku)(-ˌraʔ.-ta̰) -ki	‘it’s probably a frog’
	c. (ˈʔu.tʃi)(ˌti.-ra̰)(-ˌtaʔ.-ki)	‘it’s probably a dog’
	d. (ˈʔu.tʃi)(ˌti.-ma)(-ˌraʔ.-ta̰)-ki	‘it’s probably not a dog’

The boxes shown in (1) are intended to facilitate the identification of the alternation undergone by the same morpheme as it occupies different positions in the metrical structure. The box with solid lines indicates the alternations of the evidential suffix, /-taʔ/ and the dotted box indicates the alternation of the suffix /-raʔ/ ‘probably’.

In (1.a), the evidential suffix, /-taʔ/, surfaces with a coda glottal stop, [-taʔ], because it has been parsed in an odd syllable counting from left to right. However, in (1.b), the same suffix surfaces with glottalized vowel, [-ta̰]. In this case, the suffix occupies an even syllable.

Additionally, observe in (1.b) that the suffix /-raʔ/ ‘probably’ surfaces with a coda glottal stop, [-raʔ], since it is parsed in an odd syllable. Now compare it to (1.c), in which the same suffix surfaces with a glottalized vowel [-ra̰]. This time, the suffix occurs attached immediately after a trisyllabic root, /ʔu.tʃi.ti/ 'dog', and thus it appears in an even syllable. The alternation continues as the number of syllables increases.

Glottal-coalescence in Capanahua is analyzed as a type of *NoCoda* effect. The coalescence is triggered as a way to avoid non-moraic codas (WEIGHT-BY-POSITION) and at the same time to enforce the occurrence of disyllabic feet as well as the compliance on the distributional restrictions of heavy syllables. As in Shipibo, those restrictions are: the avoidance of heavy syllables in unstressed positions and as heads of (H.L) and (H)-feet.

Coalescence becomes possible in Capanahua because the anti-coalescence constraint, UNIFORMITY, is ranked below WEIGHT-BY-POSITION and the WT-restrictors. Glottal-coalescence in head syllables is inhibited by a positional faithfulness constraint requiring that segments that belong to a head syllable have unique input correspondents (UNIFORMITY-ˈσ).

This chapter is organized as follows. Section §2 provides a general overview of Capanahua sound system with especial attention to the phonotactics of [constricted glottis] segments and the parallels between Capanahua's and Shipibo's metrical systems. Section §3 presents the formal analysis of the metrically conditioned glottal-coalescence of Capanahua. In particular, it shows how the metrical system of Capanahua triggers and inhibits glottal-coalescence in metrical environments (§3.2) as well as accounts for why the process only affects glottal-stops that otherwise would occur in coda position while other possible coda-segments are not affected (§3.3). The chapter conclusions are presented in §4.

2 An Overview of Capanahua Phonology

This section provides descriptive generalizations about the distribution of [constricted glottis] segments (henceforth, [c.g.] segments) in Capanahua, that is, glottal stops and glottalized vowels. The appendix also shows parallels between Shipibo and Capanahua with regard to the metrical system (in particular, the quantity-insensitive footing and the sensitivity of syllable weight).

This section is organized as follows: section §2.1 presents the most important phonotactic characteristics of Capanahua; section §2.2 presents the distribution of [c.g.] segments in Capanahua – onset glottal stops in §2.2.1, coda glottal stops in §2.2.2, glottalized vowels in §2.2.3; and section §2.3 provides a brief overview of the metrical system of Capanahua and draws attention to the similarities with the metrical system presented for Shipibo.

2.1 Basic Phonotactics of Capanahua

Capanahua has fifteen consonantal segments. See (2). The glottal stop [ʔ] occurs obligatorily at the beginning of words that otherwise would begin with a vowel. The voiced bilabial is always fricative. In this dissertation is represented by [b]. The symbol [ʂ] represents a voiceless retroflex sibilant.

(2) Consonants of Capanahua

p	t			k	ʔ
b					
	s	ʃ	ʂ		h
	ts	tʃ			
	r				
m	n				
w		y			

Capanahua also has four vowels. Each vowel has a long counterpart. See (3). In this dissertation, the symbol [u] represents a high back slightly-rounded vowel and the symbol [ɨ], a high central unrounded vowel.

(3) Vowels of Capanahua

i / iː	ɨ / ɨː	u / uː
	a / aː	

Capanahua's long vowels are subject to the same distributional restrictions presented for Shipibo. They only occur in monosyllabic noun roots (e.g. (ˈbuː) 'hair', (ˈhɨː) 'pucapuro' (sp. of insect)), in some monosyllabic verb roots (e.g. (ˈtɨː).-ti 'to work' (infinitive form) and in even syllables (e.g. (ka.ˈpɨː) ‘crocodile’, (yu.ˈmɨː)(tsu.-kin) ‘to steal’ (infinitive form). Syllable nuclei cannot host diphthongs.

In coda position, only the segments [s, ʃ, ʂ, n, ʔ] can occur. However, as will be shortly discussed in detail, further restrictions are imposed on glottal stops in coda position. Capanahua does not allow complex onset or complex codas[3].

Vowels preceding a nasal coda always surface strongly nasalized (e.g. (ʃĩŋ.ˈkũn) ‘(sp. of) banana’). As has been independently observed in Matses, another Panoan language (Fleck 2003), in Capanahua, vowels can surface strongly nasalized but the nasal coda, origin of the nasalization, also surfaces. In clusters, nasals take the point of articulation of the following consonant and in the PrWd final position, nasals tend to surface as a velar [ŋ].

The size of lexical words is overwhelmingly disyllabic. However, it is possible to find some monosyllabic and trisyllabic roots. I am not aware of any monomorphemic root greater than three syllables. All the cases I have encountered of potential quadrisyllabic roots are compounds or suffixed roots. For example, the word in (4.a), (ˈbɨ.nɨ)(ˌyaʔ.pa) ‘married (woman)’, comes from the noun root (ˈbɨ.nɨ) ‘male’ and the suffix /-yaʔpa/ (adjectivizer). In the word in (4.b), (ˈka.pa)(ˌna.wa) ‘Capanahua’ (the name by which the Capanahua people are known) comes from (ˈka.pa) ‘squirrel’ and (ˈna.wa) ‘people, foreigner’.

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[3] I am only aware of one clitic/suffix, which has a complex onset [ska] ‘then, after that’. Its origin is not clear since it does not seem to have a counterpart in other Panoan languages.

(4) a. (ˈbɨ.nɨ)(ˌyaʔ.pa) ‘married (woman)’

b. (ˈka.pa)(ˌna.wa) ‘Capanahua’

The syllabic structures of Capanahua words show interesting phonotactic restrictions. Setting aside the glottal stops, which will be discussed in length in the following sections, words always begin with a consonant but they can end in a vowel or in a consonant.

Onsetless vowels are completely forbidden in odd syllables but allowed in even syllables. That is, only the second syllable of a word counting from left to right can appear onsetless. See examples in (5).

(5) a. (ˈra.u) ‘ornament’

b. (ˈma.ɨ) ‘masato (kind of drink)’

c. (wɨ.ˈun).tin ‘(sp. of) bird’

Thus, two heterosyllabic vowels can occur in contact without any intervening consonant only at the syllabic margin between the first and second syllables of a word. See (6.a). The ban on onsetless vowels in odd syllables is schematically represented in (6.b) and (6.c).

(6) a. ✓(CV.V)

b. *(V.CV)

c. *(CV.CV).V

2.2 Distribution of [c.g] Segments

This section discusses three major generalizations concerning the distribution of [c.g.] segments in Capanahua. The generalizations are given in (7).

(7) *Generalizations on the Distribution of [c.g.] Segments*

a. Coda glottal stops only occur in head syllables.

b. Glottalized vowels only occur in non-head syllables.

c. [c.g.] segments (glottal stops and glottalized vowels) only occur in morpheme initial syllables.

This section is organized as follows: sections §2.2.1 and §2.2.2 present the distribution of onset and coda glottal stops, respectively; and §2.2.3, the distribution of glottalized vowels.

2.2.1 Onset Glottal Stops

All words begin with a consonant. Glottal stops always occur as the initial onset of words that otherwise would begin with a vowel. In other words, in Capanahua, words do not exist that begin with an onsetless syllable. See data in (8).

(8) a. (ˈʔɨ.pa) ‘dad’

b. (ˈʔis.ku) ‘fin bone’

c. (ʔa.ˈmɨn) ‘ronsoco (sp. of rodent)’

d. (ʔiʃ.ˈmin) ‘condor’

Furthermore, glottal stops always intervene as onsets at morphemic boundaries when a morpheme ends in a vowel and the following one begins in a vowel. Thus, vowels never come into contact at morphemic boundaries (Loos 1969)[4]. See data in (9)

(9) a. /bana -i/ → (ˈba.na)-ʔi ‘(he) plants (it)’

b. /bana -ipi -ki/ → (ˈba.na)(-ʔi.pi)-ki ‘(he) planted (it yesterday)’

The data in (10) show cases in which a vowel-initial morpheme follows a consonant-final morpheme. The final consonant is parsed as the onset of the following morpheme initial vowel and no glottal stop intervenes between them.

[4] Loos 1969 also reports that glottal stops are inserted at sentence junctures if the sentence begins with the segment [b] or [r]: [ʔbanawɨ] ‘plant (imperative)’, [ʔbimi banawɨ] ‘plant fruit (imperative)’, [ʔra̰ma rɨrawɨ] ‘chop now (imperative)’. The context that triggers the insertion in the examples provided by Loos 1969, can be recast as the left edge of intonational phrases. However, this dissertation does not account for this type of insertion since it is beyond its scope and more research is necessary in order to gain a better understanding of Capanahua suprasegmental patterns beyond the PrWd.

(10) a. /ʔunan -i/ → (ˈʔu.na).n-i ‘(he) knew (it)’

b. /ʔunan -ipi -ki/ → (ˈʔu.na)(.n-i.pi)-ki ‘(he) knew (it yesterday)’

Glottal stops do not occur beyond the initial syllable of a morpheme. This restriction is shown schematically in (11).

(11) a. *CV.ʔV

b. *CVC.ʔV

c. *CV.CV.ʔV

Potential counterexamples to the generalization in (11.a) are words like, (ˈraʔ.u) ‘medicine’, in which a glottal stop intervenes between the first and second vowel. However, in these cases the glottal stop belongs to the initial syllable and not to the onset of the second one. See (12).

(12) a. (ˈraʔ.u) ‘medicine’

b. (ˈtaʔ.ɨ) ‘foot

The syllabification presented in (12) finds support in cases like in (13). When a glottal stop intervenes between the vowel of the word initial syllable and the vowel of a head syllable, the glottal stop either coalesces with the preceding vowel or it occurs as its coda. This dissertation takes the optional coalescence as evidence that that glottal stop is syllabified as a coda, not as an onset. A similar pattern is found with coda glottal stops in the data in (18).

(13) a. (yṵ.ˈaː) ~ (yuʔ.ˈaː) ‘yucca’

b. (ma̰.ˈin) ~ (maʔ.ˈin) ‘(sp. of) Monkey’

2.2.2 Coda Glottal Stops

Coda glottal stops can only occur in morpheme initial syllables (that is, in the initial syllable of roots and affixes) if they are also head syllables.

The examples in (14) have three morphemes whose initial syllable surface with a coda glottal stop: the root [<u>tuʔ</u>.ku] ‘frog’, the disyllabic suffix [-<u>riʔ</u>.bi] ‘again’ and the monosyllabic suffix/clitic [-<u>taʔ</u>] (evidential). The suffix /-ki/ indicates that the examples are in declarative mood. All the syllables that have a coda glottal stop in (14) are morpheme initial syllables and the head of their respective feet.

(14) a. / <u>tuʔ</u>ku -<u>taʔ</u> -ki / → (ˈ<u>tuʔ</u>.ku)(-ˌ<u>taʔ</u>.-ki) ‘it is a frog’

b. / <u>tuʔ</u>ku -<u>riʔ</u>bi -<u>taʔ</u> -ki / → (ˈ<u>tuʔ</u>.ku)(-ˌ<u>riʔ</u>.bi)(-ˌ<u>taʔ</u>.-ki) ‘it is again a frog’

The occurrence of coda glottal stop is not predictable, that is, not all morpheme initial syllables host a coda glottal stop. In fact, it is possible to find (quasi) minimal pairs in which one member has a coda glottal stop and the other does not. See (15) and (16).

(15) a. (ˈtuʔ.ku) ‘frog’

b. (ˈtu.ku) ‘sting’

(16) a. (ˈkuʔ.ka).ti ‘to have one’s face swelled up’

b. (ˈku.ka) ‘uncle’

The occurrence of coda glottal stops in morpheme initial syllables does not restrict what the onset of the following syllable can be. It occurs before stops, fricatives, affricates, nasals and even glides. See data in (17) from Loos and Loos 1998.

(17) a. (ˈmaʔ.tu) ‘hill’

b. (ˈʔiʔ.bu) ‘owner’

c. (ˈhuʔ.ʃi) ‘old sister (of a woman)’

d. (ˈpɨʔ.tʃa).kin ‘to stretch’

e. (ˈtaʔ.nu) ‘(sp. of) tree worm’

f. (ˈnuʔ.wɨ).ni ‘nice’

Furthermore, in word-initial syllables that are non-head syllables, either coda glottal stops surface in coda position or they coalesce with the preceding vowel, resulting in a glottalized vowel on the surface. This is exemplified by the data in (18).

(18) a. (baʔ.ˈkiʃ) ~ (ba̰.ˈkiʃ) ‘tomorrow, yesterday’

b. (paʔ.ˈnun) ~ (pa̰.ˈnun) ‘(sp. of) frog’

c. (piʔ.ˈwaʂ)-kin ~ (pḭ.ˈwaʂ)-kin ‘to scratch’

d. (kɨʔ.ˈʃin) ~ (kɨ̰.ˈʃin) ‘(sp. of) Lizard’

Loos 1969:182-3[5] reports cases of coda glottal stops that never coalesce with the preceding vowel. The syllables containing this type of coda glottal stop always surface stressed, that is, in head position. They are marked by a high tone (e.g. -ʂáʔn (near future), -ʂíʔki (future) and /-yáʔpa/ (adjectivizer)). See the examples for the adjectivizer /-yáʔpa/.

(19) a. (ˈpɨʔi)(-ˌyáʔ.pa)(-ˌtaʔ.-ki) ‘(he) has wings (leaf-with)’

Leaf-adjectivizer-evidential-declarative

b. (ˈʔu.tʃi)(ti -ˌyáʔ)(ˌpa-ta̰).-ki ‘(he) has a dog’

Dog-adjectivizer-evidential-declarative

[5] In the original examples of Loos, the tones are not provided for this set of data. I have added the tone for /-yáʔpa/ to make the case clearer.

2.2.3 Glottalized Vowels

Glottalized vowels occur in non-head syllables (either in non-head syllables of feet or in unfooted syllables). The data in (20) show examples of non-head syllables belonging to feet. These examples also contain the two morphemes presented in (14), which show an underlying glottal stop: /-riʔbi/ 'again' and /-taʔ/ (evidential).

However, this time, these suffixes are attached to a trisyllabic root /ʔutʃiti/ 'dog'. The result is that glottal stops surface as creaky voice in the preceding vowel. The difference with the examples in (14) is that the morpheme initial syllables that otherwise would have hosted the glottal stop in coda position occur in non-head positions.

(20) a. / ʔutʃiti -taʔ -ki / → (ˈʔu.tʃi)(ˌti.-ta̰)-ki 'it is a dog'

b. / ʔutʃiti -riʔbi -taʔ -ki / → (ˈʔu.tʃi)(ˌti.-rḭ)(ˌbi.-ta̰)-ki 'it is again a dog'

Unfooted syllables also show glottalized vowels instead of a coda glottal stop. See data in (21). The suffix /-taʔ/ surfaces as the unfooted syllable of the first PrWd. The input glottal-stop of /-taʔ/ coalesces together with the preceding vowel. The symbol # indicates a pause.

(21) [(ˈhu.ni)-ta̰]$_{\text{PrWd}}$ # [(ˈpa.kɨ)-ʂun]$_{\text{PrWd}}$

man-evidential # fall-switch_reference

'then, the man fell'

Glottal coalescence cannot only be observed in suffixes but also in root initial syllables that occupy non-head positions. Loos 1969:194 presents the examples in (22). In (22.a), the verb [tʃaʔ.tʃi] '(to) poke' has a coda glottal stop in its initial syllable. The suffix /-kin/ shows the verb is a type of infinitival form.

When the prefix pi- 'ribs' is attached to the verb 'to poke' in (22.b), the initial syllable of the verb ends up in a non-head position within the PrWd. In this context, the glottal stop appears as creaky voice in the preceding vowel.

(22) a. /tʃaʔtʃi -kin/ → (ˈtʃaʔ.tʃi)-kin 'to poke (him)'

b. /pi- tʃaʔtʃi -kin/ → (ˈpi-.tʃa̰)(tʃi.-kin) 'to poke (him) in the ribs'

Finally, Loos 1969 suggests that clitics/suffixes[6] like /-taʔ/ surface with their coda glottal stops when they are uttered in isolation. However, these are not cases of unfooted syllables. Following Selkirk 1995, these particular cases can be understood as functional words that surface with the structure of a PrWd because there is no phonological material on which they can lean or to which they can be attached. See (23).

(23) [$(\text{ˈtaʔ})_{\text{PRWD}}$] (evidential clitic/suffix in isolation)

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[6] In Panoan languages, the status of some non-root morphemes (like /(-)taʔ/) as affixes or clitics is unclear. In non-predicative sentences, they behave as second position clitics (see example in (21)), but in predicative sentences and in other contexts, it behaves as a suffix. It positions before tense morphemes.

2.3 Capanahua Metrical System

The data in (24) and (25) come from Loos 1969; Loos and Loos 1998. The data are shown as evidence of the parallels between Shipibo and Capanahua with regard to footing and treatment of syllable weight. In the examples, heads are indicated by the symbol [ˈ].

(24) Trochaic (ˈL.L)-Feet

a. (ˈni.ʃi) ‘rope’

b. (ˈbɨʃ.pi) ‘plant shoot’

c. (ˈʔi.ku).nin ‘nephew (son of a female sister)’

d. (ˈʔa.ta).pa ‘hen’

e. (ˈkɨs.ka).pa ‘type, sort, kind’

(25) Iambic (L.ˈH)-Feet

a. (wi.ˈriʃ) ‘thin’

b. (ʂ̩un.ˈtɨʂ̩) ‘seedless cotton’

c. (kɨʂ̩.ˈkan).kin ‘to incline’

d. (ka.ˈpɨː) ‘crocodile’

e. (ra.ˈbɨː).bi ‘both’

Capanahua also has monosyllabic roots with long vowels. Like Shipibo, these long vowels do not shorten and they form their own (H)-feet in contrast to CVC and CV monosyllables. See data in (26) to (28).

(26) (a) (ˈtɨː)(-ˌma-rḭ)(ˌbi.-kin)

(b) * (ˈtɨː-ma)(-ˌriʔ.bi)-kin

work -causative -again –tense ('and he) made (him) work again')

(27) (a) (ˈhis.-ma)(-ˌriʔ.bi).-kin

(b) * (ˈhis)(-ˌma.-rḭ)(bi.-kin)

see -causative -again -tense ('and he) showed (it to him) again')

(28) (a) (ˈpi.-ma)(-ˌriʔ.bi).-kin

(b) * (ˈpi)(-ˌma.-rḭ)(ˌbi.-kin)

eat -causative -again –tense ('and he) made (him) eat (it) again')

3 Analysis for the Metrically Conditioned Glottal-Coalescence

3.1 Introduction

This section presents a formal analysis for the metrically conditioned glottal-coalescence shown in Capanahua (see examples of this rhythmic segmental phenomenon in (1) and in the sections §2.2.2 and §2.2.3). In this language, the ranking responsible for the quantity-adjustments of the weight of closed syllables has the additional effect of forcing the coalescence of glottal stops[7] that would surface as codas of unstressed syllables.

Capanahua triggers metrical-conditioned glottal coalescence in order to avoid the occurrence of non-moraic codas in non-head syllables. The same metrical forces that govern the distribution of prosodic heads and the adjustment of quantity within disyllabic feet are the forces triggering glottal coalescence. Furthermore, glottal coalescence is inhibited in head positions due to a positional requirement that demands that each input segment must be individually mapped onto a head syllable.

Metrical-conditioned coalescence targets glottal stops due to their similarity with vowels with regard to their feature make-up. Both vowels and glottal stops are [+sonorant] and [-consonantal]. In Capanahua, it is important to preserve the specifications [±sonorant], [±consonantal] of input segments. As long as these specifications are preserved in the output correspondents, coalescence can be triggered; otherwise, it is inhibited. When an input vowel and a glottal stop are mapped onto a single output segment, all those specifications can be preserved.

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[7] This phenomenon has been traditionally described as 'coda glottal-stop deletion' after the pioneering work of Loos 1969 (see also Safir 1979; Elias-Ulloa 2003; Gonzalez 2003; Elias-Ulloa to appear 2005b).

However, if a vowel and a coda consonant other than a glottal stop were to be mapped together, the output segment could not preserve the specifications [±sonorant] and [±consonantal] of both input segments, and therefore, coalescence would be inhibited.

This section is organized as follows: section §3.2 addresses the factors involved in the trigger and inhibition of glottal coalescence in head syllables; section §3.3 demonstrates why metrical-conditioned coalescence is trigged on glottal stops that would otherwise occupy a coda position but it is inhibited on other codas; section §3.4 presents evidence of how coalescence is not only responsible for the rhythmic alternation of glottal stops and glottalized vowels, but also it restricts the possible syllabic structure of words; the contextual triggering and inhibition of coalescence accounts for otherwise puzzling gaps in the inventory of possible words of Capanahua, such as the banning of onsetless vowels in odd syllables (that is, *<u>V</u>.CV, *CV.CV.<u>V</u>), but not in even syllables (that is, ✓CV.<u>V</u>).

3.2 Metrically Conditioned Glottal Coalescence

Glottal coalescence does not occur without restrictions in Capanahua. The metrical system of the language governs the occurrence of glottal coalescence. In Capanahua, glottal coalescence is inhibited in head positions, but triggered in non-head positions within the prosodic structure. See the examples in (29) to (31). The head of the Prosodic Word (PrWd) is indicated by the symbol [ˈ] and, the head syllables of secondary feet by the symbol [ˌ].

The examples in (29) and (30) show cases in which glottal coalescence is inhibited. In (29), the disyllabic root /tuʔku/ 'frog' has an input glottal stop which is parsed in the initial syllable of the morpheme. This syllable is also the head of the PrWd. Coalescence is inhibited from occurring in this position.

(29) /tuʔku/ → (ˈtuʔ.ku) 'frog'

→ *(ˈtṵ.ku)

In (30), the suffixes /-taʔ/ (evidential) and /-ki/ (declarative) appear attached to the root /tuʔku/ 'frog'. The suffix /-taʔ/ is parsed as the head syllable of the second foot, and as can be observed, glottal coalescence is inhibited, as well.

(30) /tuʔku -taʔ -ki/ → (ˈtuʔ.ku)(-ˌtaʔ.-ki) 'it's a frog'

→ *(ˈtṵ.ku)(-ˌta̰.-ki)

The examples in (31) also contain the suffix /-taʔ/. However, in contrast to (30), in both examples given in (31), the suffix /-taʔ/ does not occur in a head syllable. In (31.a), it occurs in an unfooted syllable and in (31.b), in the non-head syllable of the second metrical foot. In both case, glottal coalescence is triggered.

(31) a. /tuʔku -taʔ/ → (ˈtuʔ.ku).-ta̰ ‘frog (evidential)’

b. /ʔutʃiti -taʔ -ki/ → (ˈʔu.tʃi)(ˌti.-ta̰)-ki ‘it’s probably a dog’

The aim of this section is to show that the explanation to the rhythmic segmental alternation observed in (29) to (31) is in how the metrical system of Capanahua manipulates the weight of their closed syllables.

3.2.1 The Role of Faithfulness Constraints and the Occurrence of Codas

The case of Shipibo showed that the weight of closed syllables can be affected by the metrical environment in which they occur. The ranking responsible for the contextual weight of closed syllables is repeated in (32).

(32) GH, WSP >> *FOOT(σ) >> WBP >> TROCHEE

As in Shipibo, this ranking also allows Capanahua to contextually adjust the quantity of its closed syllables to avoid heavy syllables to head (H)- or (H.L)-feet (due to

*FOOT(σ) and GROUPING HARMONY – GH, respectively) as well as to avoid heavy syllables in non-head positions (WEIGHT-TO-STRESS PRINCIPLE - WSP).

Thus, in Capanahua, odd closed syllables are forced to be light (i.e. their coda is not associated with a mora) and even closed syllables are allowed to be heavy (i.e. their coda is moraic)[8]. Thus, in (33.b), the initial closed syllables surfaces light whereas in (33.c), the second closed syllable is heavy. In (33.d-e), only even closed syllables are heavy (they attract the main stress away from odd closed syllables). Odd closed syllables are light.

(33) a. / niʃi / → (ˈni.ʃi) ‘rope’

b. /bɨʃpi/ → (ˈbɨʃ.pi) ‘plant shoot’

c. /wiriʃ/ → (wi.ˈriʃ$_{\mu}$) ‘thin’

d. /ʂ̺untɨʂ̺/ → (ʂ̺un.ˈtɨʂ̺$_{\mu}$) ‘seedless cotton’

e. /ʔikunin/ → (ˈʔi.ku).nin ‘nephew’

f. /kɨʂ̺kankin/ → (kɨʂ̺.ˈkan$_{\mu}$).kin ‘to incline’

However, contextually manipulating the weight of closed syllables is not the only way to satisfy WT-restrictors (i.e. GROUPING HARMONY, WSP) and the QA-inhibitor WEIGHT-BY-POSITION. The lack of codas is the perfect solution that satisfies all those markedness constraints in (32). In order to avoid the occurrence of codas, WT-restrictors

[8] As in Shipibo, even closed syllables in Capanahua pattern with syllables with long vowels while odd closed syllables pattern with open syllables with short vowels. This is determined using the same tests employed for determining the weight of closed syllables in Shipibo (see chapter 2).

and WEIGHT-BY-POSITION must dominate faithfulness constraints, which govern the mapping of segments. This ranking results in the *NoCoda* effect (i.e. the avoidance of codas in order to satisfy WT-restrictors and the QA-inhibitor WEIGHT-BY-POSITION).

In Shipibo and Capanahua, the occurrence of coda segments means that faithfulness constraints governing the mapping of segments are ranked high enough so that codas are not avoided by deletion, insertion, metathesis, etc. However, the avoidance of coda glottal stops by coalescence means that the faithfulness constraint UNIFORMITY (the anti-coalescence constraint; see definition in (36)) is dominated by all the markedness constraints in (32).

The following shows how the ranking of the faithfulness constraints MAX-SEG, DEP-SEG, and UNIFORMITY with regard to the markedness constraints in (32) plays a crucial role in allowing or avoiding coda segments to occur in Capanahua.

- <u>*MAX-SEG*</u>

In Capanahua, the initial syllable of a word as [(ˈhis.-ma).-ʔi][9] ‘(he) shows (it)’ is banned from having a moraic coda because it would either create an uneven trochaic *[(ˈhis$_{\mu}$.-ma).-ʔi] foot, violating GH, or it would shrink the disyllabic size of the foot to *[(ˈhis$_{\mu}$)(-ma.-ʔi)] , thus violating *FOOT(σ).

However, the strategies to avoid the uneven trochee and thus satisfy GH are not exhausted. It is possible to satisfy *FOOT(σ), GH, and WSP without having to tolerate a

[9] This word is structured out of the root /his/ ‘to see’, and the suffixes /-ma/ (causative) and /-ʔi/ (present tense).

non-moraic coda as it occurs in the initial syllable of the word [(ˈhis.-ma).-ʔi]. This strategy is coda-deletion. If the initial syllable of this word lost its coda, *[(ˈhi.-ma).-ʔi], not only would the constraints *FOOT(σ), GH, and WSP be satisfied but also WBP, since there is no coda to penalize.

As the star indicates in the word *[(ˈhi.-ma).-ʔi], this coda-deletion is not allowed in Capanahua. In order to block it, the faithfulness constraint MAX-SEG has to outrank WBP. This is shown in tableau (34).

(34) *The Role of MAX-SEG*

	his -ma -ʔi	MAX-SEG	WBP
a.	☞(ˈhis.-ma)...		*
b.	(ˈhi.-ma)...	*!W	L

- <u>*DEP-SEG*</u>

Coda-deletion is not the only strategy left in order to satisfy the constraints *FOOT(σ), GH, and WSP, though. Vowel-insertion is also a possible strategy to consider. It is possible to satisfy *FOOT(σ), GH, and WSP as well as WBP by inserting a vowel after a consonant that otherwise would surface in coda position.

Since Capanahua does not employ this possibility, the constraint DEP-SEG, which penalizes the insertion of segments, must also dominate the constraint WBP as well as PARSE(σ) (i.e. 'do not have unfooted syllables'), which penalizes the occurrence of unfooted syllables. This is shown in (35).

(35) *The Role of* DEP-SEG

	his -ma -ʔi	DEP-SEG	PARSE(σ)	WBP
a.	☞(ˈhis.-ma).-ʔi		*	*
b.	(ˈhi.s*i*)(-ma.-ʔi)	*!W	L	L

- <u>*UNIFORMITY and Glottal Coalescence*</u>

By having the constraints MAX-SEG and DEP-SEG dominating WBP, Capanahua prohibits coda-deletion and vowel-insertion as strategies to avoid having both closed syllables with non-moraic codas (which violates WBP) and closed syllables with moraic codas that would violate GH, WSP or *FOOT(σ).

Nevertheless, there is still a way of satisfying the faithfulness constraints MAX-SEG and DEP-SEG and all the markedness constraints in (32), that is, *FOOT(σ), GH, WSP and WBP. This is coda coalescence.

The occurrence of a non-moraic coda would violate WBP. However, if an input segment that would surface in a coda position coalesces with a surrounding segment, WBP would be satisfied. Furthermore, since coalescence implies that input segments obtain output correspondents, MAX-SEG is also satisfied. The remaining constraints, DEP-SEG, GH, WSP and *FOOT(σ) are also pleased by coda-coalescence. The only constraint that is violated is UNIFORMITY, the anti-coalescence constraint (its definition is repeated in (36)).

(36) UNIFORMITY: Each output segment has only one input correspondent ('Do not coalesce segments').

The occurrence of glottal coalescence in Capanahua indicates that the constraint UNIFORMITY is not undominated in this language. Tableau (37) shows that in Capanahua, MAX-SEG must dominate UNIFORMITY and *[C.G.], a markedness constraint penalizing the occurrence of segments specified as [constricted glottis].

(37) / ʔutʃiti -$t_1 a_2 ʔ_3$ -ki / → (ˈʔu.tʃi.)(ti.-ta̰)-ki 'it is a dog'

	/ ʔotʃiti -$t_1 a_2 ʔ_3$ -ki /	MAX-SEG	*[C.G.]	UNIFORMITY
a.	☞…(ti.-t_1a̰$_{2,3}$)-ki		*	*
b.	…(ti.-$t_1 a_2$)-ki	*!W	L	L

In fact, as will be shown, UNIFORMITY is not only dominated by MAX-SEG, but also by the low ranked constraint TROCHEE of the ranking in (32), which in turn means that all the constraints that dominate TROCHEE (that is, DEP-SEG, GH, WSP, *FOOT(σ) and WBP) also dominate UNIFORMITY. Each one of those constraints acts as a trigger of glottal coalescence in Capanahua[10]. See ranking in (38).

(38) MAX-SEG, DEP-SEG, GH, WSP >> *FOOT(σ) >> WBP >> TROCHEE>> UNIFORMITY

[10] The only exception is the constraint GROUPING HARMONY because there is a positional requirement that inhibits coalescence in a head syllable, the context in which GROUPING HARMONY could have shown its behavior as trigger of glottal coalescence.

3.2.2 The Triggers of Glottal Coalescence

This section shows how the faithfulness constraint UNIFORMITY by sitting at the bottom of the ranking in (38) opens the door for glottal coalescence to occur.

Tableau (39) shows how the constraint TROCHEE triggers glottal coalescence by avoiding the occurrence of a moraic coda. The input of this tableau has the evidential suffix /-taʔ/, which contains a glottal stop. In candidate (39.a), this glottal stop surfaces coalesced with the preceding vowel, whereas in candidate (39.b), it surfaces as a moraic coda.

Candidate (39.b) is ruled out because it violates the constraint TROCHEE. In contrast, candidate (39.a) satisfies the constraint TROCHEE by triggering glottal coalescence. The cost of satisfying this constraint is the violation of the faithfulness constraint UNIFORMITY.

(39) / ʔutʃiti -$t_1a_2ʔ_3$ -ki / → (ˈʔu.tʃi.)(ti.-ta̰)-ki ‘it is a dog’

		TROCHEE	UNIFORMITY
a.	☞…(ˌti.-$t_1$$a̰_{2,3}$)-ki		*
b.	…(ti.-ˌ$t_1a_2ʔ_{μ3}$)-ki	*!W	L

Tableau (40) shows that coda glottal-coalescence occurs in order to satisfy the constraints *FOOT(σ) (‘do not have feet smaller than two syllables’), WSP (‘heavy syllables are stressed') and WBP ('codas are moraic'). The cost of satisfying all these constraints is to violate the anti-coalescence constraint UNIFORMITY.

(40) /tuʔku -ta₂ʔ₃ / → (ˈtu₂ʔ₃.ku)-ta̰ 'frog' (evidential)

		*FOOT(σ)	WSP	WBP	UNIFORMITY
a.	☞(ˈtuʔ.ku)-ta̰$_{2,3}$				*
b.	(ˈtuʔ.ku)-ta$_2$ʔ$_3$			*!W	L
c.	(ˈtuʔ.ku)-ta$_2$ʔ$_{\mu\,3}$		*!W		L
d.	(ˈtuʔ.ku)(-ta$_2$ʔ$_{\mu\,3}$)	*!W			L

The input of tableau (40) is the disyllabic root /tuʔku/ 'frog' and the evidential suffix /-taʔ/. In all the candidates, the suffix /-taʔ/ appears attached immediately after the root. In Capanahua, it is more important to avoid having a non-moraic coda glottal stop than to avoid coalescence. Thus, candidate (40.b) is ruled out because it violates the markedness constraint WBP. In contrast, candidate (40.a) satisfies WBP by coalescing the glottal stop of the suffix /-taʔ/ with the preceding vowel.

Tableau (40) also shows that in Capanahua, it is more important to avoid having a heavy syllable that is not in a head position than to allow coalescence. Thus, coalescence cannot be avoided even by making the final glottal stop moraic in the output since this would create a heavy but unfooted closed syllable, which violates the markedness constraint WSP (compare candidate (40.a) to candidate (40.c)).

Candidate (40.d) shows that glottal coalescence cannot be avoided by parsing a heavy closed syllable into its own foot. This violates the markedness constraint *FOOT(σ), which penalizes feet smaller than two syllables. Thus, in Capanahua, it is more important to respect the disyllabic size of metrical feet than to avoid glottal coalescence.

Tableau (42) shows that the faithfulness constraint DEP-SEG (see definition in (41)) can also act as a trigger of glottal coalescence by blocking the possibility of inserting a vowel when a glottal stop would otherwise end up parsed in coda position.

(41) DEP-SEG: Output segments have input correspondents.

Candidate (42.b) is eliminated because it has an output vowel [i_a] that does not have an input correspondent. This violates the faithfulness constraint DEP-SEG. Candidate (42.a) wins the competition by respecting DEP-SEG, although it has to trigger glottal coalescence.

(42) /tuʔku -ta$_2$ʔ$_3$ / → (ˈtu$_2$ʔ$_3$.ku)-ta̰ ‘frog’ (evidential)

		DEP-SEG	UNIFORMITY
a.	☞(ˈtuʔ.ku)-ta̰$_{2,3}$		*
b.	(ˈtuʔ.ku)(-ta$_2$ʔ$_3$$i_a$)	*!W	L

3.2.3 The Role of Ident [c.g.] in Regulating Glottal Coalescence

Thus far, it has been shown that those constraints that govern the distribution of heads and the adjustments of quantity within quantity-insensitive footing in Capanahua are also responsible for triggering glottal coalescence by outranking the anti-coalescence constraint UNIFORMITY. See (43).

(43) MAX-SEG, DEP-SEG, WSP, GH >> *FOOT(σ) >> WBP >> TROCHEE >> UNIFORMITY

However, though the ranking in (43) guarantees glottal coalescence, it does not regulate the type of coalescence that could emerge from mapping together a glottal stop and a vowel. In Capanahua, this mapping always results in a glottalized vowel, which indicates that the feature [constricted glottis] (henceforth [c.g.]) of glottal stops must be preserved in the output correspondent (that is, /$V_1ʔ_2$/ $\rightarrow$ [$\underset{\sim}{V}_{1,2}$]). This dissertation asssumes that the feature [c.g.] is privative (Lombardi 1991; see also Jakobson, Fant and Halle 1952; Jakobson and Halle 1956; Chomsky and Halle 1968; Steriade 1995; de Lacy 2002, among others on literature about privative, binary and multi-valued features).

The faithfulness constraint IDENT-[C.G.], whose definition is given in (44), plays a crucial role in ensuring that the specification [c.g] of input glottal stops is preserved in the output.

(44) IDENT-[C.G.]: The output correspondent of a glottal stop is specified as [c.g.].

Tableau (45) shows that 'vacuous coalescence' is not an option in Capanahua. The faithfulness constraint IDENT-[C.G.], which demands that the output correspondent of a glottal stop must also be specified as [c.g.] bans it.

Both candidates in (45) undergo glottal coalescence in their unfooted syllables. However, they display two different types of coalescence. Candidate (45.b) shows 'vacuous glottal-coalescence', that is, a glottal stop is mapped together with the preceding vowel onto the surface, but the resulting output segment lacks the [c.g.] specification of the glottal stop. This candidate is ruled out by the faithfulness constraint IDENT-[C.G.].

In contrast, in candidate (45.a), the resulting segment of glottal coalescence does show the [c.g.] specification of the input glottal stop. This satisfies the constraint IDENT-[C.G.], which chooses it as the winner of the competition. Thus, in Capanahua, it is more important to preserve the [c.g.] specification of an input glottal stop than to avoid the occurrence of glottalized vowels.

(45) /tuʔku -ta$_2$ʔ$_3$ / → (ˈtu$_2$ʔ$_3$.ku)-ta̰ 'frog' (evidential)

		IDENT-[C.G.]	*[C.G.]
a.	☞(ˈtuʔ.ku)-ta̰$_{2,3}$		*
b.	(ˈtuʔ.ku)-ta$_{2,3}$	*!W	L

3.2.4 Positional Faithfulness and the Inhibition of Glottal Coalescence

This dissertation proposes a Positional Faithfulness account (Jun 1995; Beckman 1997; Casali 1997; Beckman 1998; Alderete 1999) for the inhibition of glottal coalescence in

Capanahua. Positional faithfulness claims that prominent and privileged positions can reinforce faithfulness relations that are usually disregarded in other positions within a given grammar.

In Capanahua, the idea is that head syllables demand that each segment that belongs to them must have only one correspondent in the input. This constraint will be referred to as the constraint UNIFORMITY-ˈσ. Thus, UNIFORMITY-ˈσ bans the mapping of two input segments onto a single output segment in head syllables. See its definition in (46).

(46) UNIFORMITY-ˈσ: Each segment of a head syllable has only one input correspondent ('do not coalesce segments in head syllables').

The effect of UNIFORMITY-ˈσ is presented in tableau (47). The input of this tableau has a root that contains a glottal stop: /tuʔku/ 'frog'. In both candidates, the input glottal stop is parsed as part of the head syllable of the PrWd.

In candidate (47.b), the input glottal stop is mapped together with the preceding vowel into an output [c.g.] vowel. This vowel belongs to the head of the PrWd. This violates the positional faithfulness constraint UNIFORMITY-ˈσ, which rules out this candidate.

In contrast, in candidate (47.a), glottal coalescence is inhibited. The input glottal stop, /$ʔ_3$/, surfaces as an independent segment. This satisfies the faithfulness constraint

UNIFORMITY-ˈσ. The cost paid for the inhibition of glottal coalescence is to have a non-moraic coda, violating the markedness constraint WEIGHT-BY-POSITION (WBP).

(47) /tu₂ʔ₃ku/ → (ˈtu₂ʔ₃.ku) '(sp. of) frog'

		UNIFORMITY-ˈσ	WBP	UNIFORMITY
a.	☞(ˈtu₂ʔ₃.ku)		*	
b.	(ˈtṵ₂,₃.ku)	*!W	L	*W

Tableau (40) has already shown that the markedness constraint WBP dominates the faithfulness constraint UNIFORMITY. Therefore, in tableau (47), the constraint UNIFORMITY-ˈσ must dominate WBP.

3.2.5 Inhibition of Glottal Coalescence in Non-Head Initial Syllables

When an input glottal stop is parsed in the initial syllable of a word but this syllable is not in a head position (that is, 'stressed'), free variation is observed between a glottalized vowel and a coda glottal stop. This variation is observed even in a single speaker. See data in (48).

(48) a. (ba̰.ˈkiʃ) ~ (baʔ.ˈkiʃ) ‘tomorrow, yesterday’

b. (pa̰.ˈnun) ~ (paʔ.ˈnun) ‘(sp. of) frog’

c. (pḭ.ˈwaʂ)-kin ~ (piʔ.ˈwaʂ)-kin ‘to scratch’

d. (kɨ̰.ˈʃin) ~ (kɨʔ.ˈʃin) ‘(sp. of) lizard’

If one decides to abstract away from the cases in which the glottal coalescence occurs and analyze the data in (48) as cases in which glottal coalescence is inhibited, then a positional faithfulness constraint, UNIFORMITY-σ1, can be posited. This constraint would demand that in word-initial syllables, each segment must have a unique input correspondent. Thus, coalescence would be banned from occurring in initial syllables. See the definition of UNIFORMITY-σ1 in (49).

(49) UNIFORMITY-σ1: Each segment in a word-initial syllable has only one input correspondent.

The tableau in (50) shows the effect of UNIFORMITY-σ1. The input of this tableau is the root /baʔkiʃ/ ‘yesterday, tomorrow’. This root has an input glottal stop that is parsed in the initial syllable of both candidates in (50).

Candidate (50.b) is eliminated by the constraint UNIFORMITY-σ1 since the initial syllable has a glottalized vowel, [a̰$_{2,3}$], with two input correspondents: /a$_2$/ and /ʔ$_3$/.

In contrast, candidate (50.a) is chosen as the winner since coalescence has been inhibited in its initial syllable in spite of the fact that it is a non-head syllable. This candidate satisfies UNIFORMITY-σ1 at the cost of allowing a non-moraic coda glottal stop to surface and thus violating WBP.

(50) / ba$_2$ʔ$_3$kiʃ / → (b$_1$a$_2$ʔ$_3$.ˈkiʃ) 'yesterday, tomorrow'

		UNIFORMITY-σ1	WBP	UNIFORMITY
a.	☞(b$_1$a$_2$ʔ$_3$.ˈkiʃ)		*	
b.	(b$_1$a̰$_{2,3}$.ˈkiʃ)	*!W	L	*W

The existence of the constraint UNIFORMITY-σ1 dominating WBP puts at risk the ranking of UNIFORMITY-ˈσ over WBP (see tableau (47)), since now it is not obvious which of the positional UNIFORMITY constraints dominate WBP.

In order to solve this disjunction, we need to find a context in which the positional faithfulness constraints UNIFORMITY-ˈσ and UNIFORMITY-σ1 do not overlap in their evaluation of candidates. This is accomplished by ranking the constraint UNIFORMITY-ˈσ through a candidate in which glottal coalescence is inhibited in a head syllable that is not word-initial. This is given in tableau (51). Thus, there is a guarantee that both UNIFORMITY-ˈσ and UNIFORMITY-σ1 dominate WBP.

(51) /tu$_2$ʔ$_3$ku -ta$_a$ʔ$_b$ -ki / → (ˈtu$_2$ʔ$_3$.ku)(-ˌta$_a$ʔ$_b$.-ki) ‘it is a frog’

		UNIFORMITY-ˈσ	WBP	UNIFORMITY	*[C.G.]
a.	☞…(-ˌta$_a$ʔ$_b$.-ki)		*		*
b.	…(-ˌta̰$_{a,b}$.-ki)	*!W	L	*W	*

3.3 Restricting Coalescence to Glottal Stops

In the previous sections, we discussed how the metrical system of Capanahua not only determines the distribution of prosodic heads and governs the quantity adjustments of syllable weight, but also triggers glottal coalescence as long as it does not occur in head syllables, where it is inhibited.

Thus, glottal stops that otherwise would surface in coda position are coalesced with the preceding vowel so that the metrical constraints WSP, WBP, *FOOT(σ) and TROCHEE are satisfied and still coda-deletion (MAX-SEG) and vowel-insertion (DEP-SEG) are avoided. The cost of satisfying all these constraints is the violation of the anti-coalescence constraint, UNIFORMITY, which ends up ranked at the bottom of the hierarchy.

But, if UNIFORMITY is at the bottom (see ranking in (38), repeated for convenience in (52)), what stops other coda consonants from coalescing? Suppose the root /wiriʃ/ ‘thin’, which has a final consonant, is evaluated by the ranking in (52). This ranking, instead of returning (wi.ˈriʃ)as the winner, would incorrectly return (ˈwi.ri$_{4,5}$), a candidate whose final consonant coalesces with the preceding vowel. See tableau (53).

(52) MAX-SEG, DEP-SEG, GH, WSP >> *FOOT(σ) >> WBP >> TROCHEE>> UNIFORMITY

Candidates (c), (d) and (e) in tableau (53) are correctly ruled out from the competition so no further comments will be made about them. The interesting case is the competition between the desired winner, candidate (53.b), and the actual winner, candidate (53.a). The desired winner is indicated by the symbol ☹, while the actual but incorrect winner is indicated by the symbol 💣.

The second syllable of candidate (53.b) has a moraic coda. This violates the constraint TROCHEE. In contrast, candidate (53.b) satisfies TROCHEE by coalescing the final consonant of the root /$ʃ_5$/ with the preceding vowel /i_4/ and thus violating the low-ranked constraint UNIFORMITY.

(53) (wi.ˈriʃ) 'thin'

	/ wiri$_4$ʃ$_5$ /	MAX-SEG	*FOOT(σ)	WBP	TROCHEE	UNIFORMITY
a.	💣(ˈwi.ri$_{4,5}$)					*
b.	☹ (wi.ˈriʃ$_\mu$)				*!W	L
c.	(ˈwi.riʃ)			*!W		L
d.	wi.(ˈriʃ$_\mu$)		*!W		*W	L
e.	(ˈwi.ri)	*!W				L

The problem presented in tableau (53) occurs because the analysis proposed thus far cannot distinguish between glottal stops and other segments. It treats alike all segments that could potentially occur in coda position.

This section examines the consequences of coalescence for segments other than glottal stops. In particular, it shows that, although the metrical system of Capanahua can trigger coalescence, requirements at the subsegmental level can inhibit it through IDENT IO [FEATURE] constraints. Thus, although the anti-coalescence constraint UNIFORMITY appears ranked at the bottom of constraint hierarchy, coalescence can still be inhibited by IDENT IO [FEATURE] constraints.

3.3.1 The Role of IDENT [CONSONANTAL]

In Capanahua, coalescence is restricted to glottal stops [ʔ] that would otherwise surface in coda position. Other possible coda segments in Capanahua, [s, ʃ, ʂ, n], are not affected by coalescence[11]. Interestingly, the segments [s, ʃ, ʂ, n] are distinguished as a class against glottal stops [ʔ] by the feature [±consonantal].

While the segments [s, ʃ, ʂ, n] are [+consonantal] because they are realized with a major constriction in the supralaryngeal cavity, glottal stops are [-consonantal] since they lack this constriction, as vowels/glides also do (Kenstowicz 1994:37).

[11] When the nasal consonant occurs in coda position, the preceding vowel surfaces strongly nasalized. However, it is always possible to perceive the point of articulation (POA) of the nasal. In clusters, it takes the POA of the following consonant. In word-final position, it surfaces as a dorsal nasal [ŋ]. Thus, nasals do not coalesce with vowels, but vowels do assimilate their nasality. My observations on the behavior of nasal codas in Capanahua and Shipibo coincide with those of Fleck 2003 for Matses, another Panoan language.

This dissertation proposes that coalescence in Capanahua is allowed to occur between segments that agree on the value of the feature [consonantal], but is inhibited if they have different values for this feature. Thus, the IDENT [CONSONANTAL] constraint, which demands that an input segment specified for [consonantal] have an output correspondent with an identical specification, plays a key role in inhibiting coalescence between segments that do not agree on the feature [consonantal]. See definition of IDENT [CONSONANTAL] in (54).

(54) IDENT [CONSONANTAL]: An input segment specified with a value for the feature [consonantal] has a correspondent with an identical specification.

When a glottal stop and a vowel are targeted by coalescence, IDENT [CONSONANTAL] does not inhibit it because both agree on the feature [consonantal]. They are both [+consonantal] so that glottal coalescence does not violate IDENT [CONSONANTAL]. This is shown in tableau (55).

(55) / ʔutʃiti -ta$_2$ʔ$_3$ -ki / → (ˈʔu.tʃi.)(ti.-ta̰)-ki 'it is a dog'

		IDENT [CONS]	WSP	UNIFORMITY
a.	☞…(ˌti.-ta̰$_{2,3}$)…	✓		*
b.	…(ˌti.-ta$_2$ʔ$_{\mu 3}$)…	✓	*!W	L

The input of tableau (55) has the evidential suffix /-taʔ/, which contains a glottal stop. In both candidates of this tableau, the suffix appears parsed as the non-head syllable of the second foot. However, they are distinguished because the glottal stop of the evidential suffix undergoes coalescence in candidate (55.a) but not in candidate (55.b).

In tableau (55), the trigger of coalescence is the constraint WSP. Candidate (55.b) is ruled out because it violates it. In contrast, candidate (55.a) avoids violating WSP by coalescing the glottal stop with the preceding vowel. This candidate wins the competition at the cost of violating the anti-coalescence constraint UNIFORMITY.

In contrast, when a [+consonantal] segment and a vowel are targeted by coalescence, the IDENT [CONSONANTAL] constraint inhibits it, because they have opposite values for the binary feature [consonantal]. This is shown in tableau (56).

The input of tableau (56) is the root /wiriʃ/ 'thin'. In both candidates considered, the final consonant is mapped as part of the second syllable of the PrWd. However, these candidates differ in how the final consonant is mapped. In candidate (56.a), the final consonant surfaces as an independent segment while in candidate (56.b), it surfaces coalesced with the preceding vowel[12].

Candidate (56.b) is eliminated from the competition because it violates the constraint IDENT [CONSONANTAL]. When the input /i_4/, a [-consonantal] segment, is fused with /$ʃ_5$/, a [+consonantal] segment, the output segment can be either plus or minus

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[12] Other possible candidates showing coalescence, as for example (wir$ʃ_{4,5}$), (wi$ʃ_{3,4,5}$) or even (ˈwir.$ʃ_{4,5}$$i_a$) have not been considered because they do not have any chance of winning. They not only violate IDENT [CONSONANTAL] and UNIFORMITY, as candidate (56.b) does, but in addition, they also violate constraints like DISYLLABIC-FOOT, *COMPLEX, DEP-SEG, etc.

[consonantal], but not both. This means that whatever the value the output segment takes for the feature [consonantal], the constraint IDENT [CONSONANTAL] is violated.

In contrast, candidate (56.a) wins the competition because it satisfies the constraint IDENT [CONSONANTAL] by inhibiting coalescence and at the cost of violating TROCHEE.

The satisfaction of the constraint IDENT [CONSONANTAL] is crucial to account for why glottal stops that would otherwise surface in coda are targeted by coalescence (see tableau (55)), whereas other coda segments (i.e. [s, ʃ, ʂ, n]) are not[13].

(56) / wiri$_4$ʃ$_5$ / → (wi.ˈriʃ) ‘thin’

		IDENT [CONS]	TROCHEE	UNIFORMITY
a.	☞ (wi.ˈri$_4$ʃ$_{\mu 5}$)		*	
b.	(ˈwi.ri$_{4,5}$)	*!W	L	*W

Capanahua not only provides evidence that the constraint IDENT [CONSONANTAL] dominates TROCHEE but also that it dominates the higher-ranked constraint WBP. This is shown in tableau (57).

The input of this tableau has a consonant cluster. In both candidates considered in this tableau, the first consonant of this cluster, /ʃ$_3$/, ends up parsed in the initial syllable.

[13] When a segment like [ʃ] coalesces with [i], other IDENT constraints, besides IDENT [CONSONANTAL], are also violated (for example, IDENT [STRIDENT]). However, what matters for the argument put forth here is that at least an IDENT constraint outranks the trigger of coalescence. Since the feature [±strident] cannot group together the segments [s, ʃ, ʂ, n] against [ʔ], I assume that the relevant feature must be [±consonantal].

As in previous cases, these candidates are distinguished on how the segment /ʃ₃/ is mapped on the surface. In candidate (57.a), the segment /ʃ₃/ surfaces as an independent segment, whereas in candidate (57.b), it surfaces coalesced with the preceding vowel.

Candidate (57.b) is eliminated because the coalescence of the segments /ɨ₂/ and /ʃ₃/ violates the constraint IDENT [CONSONANTAL]. In contrast, candidate (57.a) satisfies the constraint IDENT [CONSONANTAL] by inhibiting coalescence. The cost of satisfying IDENT [CONSONANTAL] is to have a non-moraic consonant, thus violating the constraint WBP – 'codas are moraic'.

Remember that, in this context, the coda of the syllable [bɨʃ] in (ˈbɨʃ.pi) cannot be moraic since it would create an uneven trochee and that would violate the higher-ranked constraint GROUPING-HARMONY.

(57) / $bɨ_2ʃ_3p_4i$ / → (ˈbɨʃ.pi) 'plant shoot'

		IDENT [CONS]	WBP	UNIFORMITY
a.	☞ (ˈ$bɨ_2ʃ_3.p_4i$)		*	
b.	(ˈ$bɨ_{2,3}.p_4i$)	*!W	L	*W

3.3.2 Lexical Stress and the Inhibition of Glottal Coalescence

Loos 1969 reports cases of suffixes containing coda glottal stops that never coalesce with the preceding vowel. Furthermore, the syllable containing the coda glottal stop always surfaces stressed, which is indicated by the presence of a high tone[14]. Examples of these suffixes with lexical stress are: /-ˈs̻aʔn/ (near future), /-ˈs̻iʔki/ (future) and /-ˈyaʔpa/ (adjectivizer). Lexical stress is indicated by the symbol [ˈ] in the phonological representations. Loos 1969:182-3 provides examples for the suffix /-ˈyaʔpa/. See (58)[15].

(58) a. (ˈpɨʔi)(-ˌyáʔ.pa)(-ˌtaʔ.-ki) ‘(he) has wings (leaf-with)’

leaf-adjectivizer-evidential-declarative

b. (ˈʔo.tʃi)(ti -ˌyáʔ)(pa-ta̰).-ki ‘(he) has a dog’

dog-adjectivizer-evidential-declarative

While in (58.a), the inhibition of glottal coalescence is expected, the inhibition of coalescence in (58.b) is surprising. It occurs in an even syllable instead of an odd syllable. Compare it with the data in (59). The example in (58.b) should behave as (59.b), but it does not. In (58.b), glottal coalescence is inhibited, while it is triggered in (59.b).

(59) a. (ˈʔu.tʃi.)(ti.-ta̰)-ki ‘it is a dog’

b. (ˈʔu.tʃi.)(ti.-ɾḭ)(bi.ta̰)-ki ‘it is again a dog’

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[14] Loos 1969 also reports other suffixes that have lexical stress but that do not contain any glottal stop (e.g. /-iˈpi/ (past tense), /-ˈwɨ/ (imperative)). Thus, there is no relation between having a glottal stop and being lexically stressed. In these suffixes, the lexical stress is also marked by a high tone on the surface.

[15] In the original examples, the tones are not provided for this set of data. I have added the high tone for the suffix /-ˈyaʔpa/ to make the examples clearer.

The preservation of lexical stress is accomplished through MATCH-LEXICAL HEAD ('preserve lexical heads in the output')[16]. See tableau (60).

Candidate (60.b) is eliminated from the competition because the initial syllable of the adjectivizer suffix, /-ˈyaʔpa/, does not occur in a head position. In contrast, in candidate (60.a), the initial syllable of /-ˈyaʔpa/ does occupy a head position. This satisfies MATCH-LEXICAL HEAD at the cost of violating the constraint TROCHEE[17].

(60) / ʔutʃiti -ˈyaʔpa -taʔ -ki/ → (ˈʔu.tʃi)(ti -ˈyaʔ)(pa-ta̰).-ki '(he) has a dog'

		MATCH-LEX HD	TROCHEE	UNIFORMITY
a.	☞…(ti.-ˌ$y_1a_2ʔ_{\mu 3}$)…		*	
b.	…(ˌti.-y_1a̰$_{2,3}$)…	*!W	L	*W

[16] By no means must MATCH-LEXICAL HEAD be considered a serious constraint. MATCH-LEXICAL HEAD is just a shortcut standing in for a constraint or set of constraints that form part of a theory of lexical stress. 'Lexical heads' or 'lexical stress' is a complex matter. There are many unsolved questions as for what exactly lexical stress is and how it should be addressed in metrical theory (see Kiparsky 1975; Bjorklund 1978; Davidson and Noyer 1997; Hayes 2005; Broselow in press; Hayes to appear). For example, if one assumes that inputs do not have prosodic structure, then how can faithfulness constraints ensure the preservation of lexical specified head? Segments cannot be specified as prosodic heads. Syllables are the prosodic units that occupy head positions in the prosodic hierarchy. If one treats lexical stress as a feature (or diacritic), then certain segments are marked to require that when prosodic structure is assigned, they should occupy head positions. However, this introduces a completely new conception of stress. Under the diacritic/feature approach, 'stress' is not anymore a shortcut to refer to prosodic structure but a segmental feature with which segments can be lexically specified. Since the nature of 'lexical stress' is out of the scope of this dissertation, I will use MATCH-LEXICAL HEAD as a way of dealing with whatever makes that certain syllables in the output *unexpectedly* want to occupy head positions within the prosodic hierarchy.

[17] Tableau (39) has already shown that the constraint TROCHEE outranks UNIFORMITY, therefore, MATCH-LEXICAL HEAD dominates the constraint TROCHEE in tableau (60).

In contrast, when the initial syllable of the suffix /-ˈyaʔpa/ is parsed as the head of a trochaic foot, the ranking in (52) predicts that the coda glottal stop would surface non-moraic in order to avoid creating an uneven trochee and thus satisfy the constraint GROUPING HARMONY. The cost of satisfying GROUPING HARMONY is to violate the lower ranked constraint WBP. See tableau (61).

(61) (ˈpɨʔi)(-<u>yaʔ</u>.pa)(-taʔ.-ki) ‘(he) has wings (leaf-with)’

		GROUPING HARMONY	WBP
a.	☞…(-ˌ$y_1a_2ʔ_3$.pa)…		*
b.	…(-ˌ$y_1a_2ʔ_{\mu 3}$.pa)…	*!W	L

Since lexical stress does not imply the presence of a heavy syllable, it is not surprising that the coda glottal stop in the initial syllable of the suffix /-ˈyaʔpa/ in candidate (61.a) surfaces non-moraic but still occupying a head position.

One could argue that when the initial syllable of the suffix /-ˈyaʔpa/ heads a trochaic foot, the coda glottal stop surfaces moraic and in order to avoid creating an uneven trochee, the foot size shrinks to a (H)-foot. In this case, the initial syllable of the suffix /-ˈyaʔpa/ would behave as the monosyllables with long vowels discussed in chapter §2 for Shipibo.

However, if this analysis were correct, one would predict that if a suffix as /-taʔ/ (evidential) is added after the suffix /-ˈyaʔpa/, the glottal stop of /-taʔ/ would coalesce with the preceding vowel since it would occupy a non-head position. See (62.b).

The data provided by Loos 1969:182-3 indicates that this is not the case. Glottal coalescence is inhibited in this case, which points out that /-taʔ/ is parsed in a head syllable. See (62.a). This, in turn, indicates that the suffix /-ˈyaʔpa/ does not disturb the quantity-insensitive footing of this language.

(62) a. (ˈpɨʔi)(-yáʔ.pa)(-taʔ.-ki) ‘(he) has wings (leaf-with)’

b. *(ˈpɨʔi)(-yáʔ)(pa.-ta̰)-ki

This behavior is predicted by the ranking of the constraint *FOOT(σ) (i.e. ‘do not have feet smaller than two syllables’) dominating WBP (i.e. ‘codas are moraic’). See tableau (63).

(63) (ˈpɨʔi)(-yaʔ.pa)(-taʔ.-ki) ‘(he) has wings (leaf-with)’

		*FOOT(σ)	WBP
a.	☞…(-ˌ$y_1a_2ʔ_3$.pa)…		*
b.	…(-ˌ$y_1a_2ʔ_{\mu3}$)(pa.…	*!W	L

3.3.3 The Role of Other IDENT Constraints in the Inhibition of Coalescence

Although the constraint IDENT [CONSONANTAL] plays a crucial role in inhibiting coalescence, it is possible to determine that other IDENT constraints also inhibit coalescence by outranking WBP. In this section, it is shown that at least IDENT [SONORANT] and IDENT [CONTINUANT] act as coalescence inhibitors, as well. See the definitions of IDENT [SONORANT] and IDENT [CONTINUANT] in (64) and (65).

(64) IDENT [SONORANT]: An input segment specified with a value for the feature [sonorant] has a correspondent with an identical specification.

(65) IDENT [CONTINUANT]: An input segment specified with a value for the feature [continuant] has a correspondent with an identical specification.

- *IDENT [CONTINUANT]*

Tableau (66) shows that the constraint IDENT [CONTINUANT] outranks WBP. The input of this tableau is the root /bɨʃpi/ 'plant shoot'. In candidate (66.a), the input segment /$ʃ_3$/ is parsed as the coda of the initial syllable, whereas in candidate (66.b), this segment is mapped together with the following consonant /p_4/ resulting in the coalesced segment [$ʃ_{3,4}$].

In this case, the constraint IDENT [CONSONANTAL] is satisfied since both /ʃ$_3$/ and /p$_4$/ are [+consonantal]. Thus, IDENT [CONSONANTAL] cannot inhibit coalescence. However, the impossibility of having them coalesced in Capanahua shows that there is a higher-ranked constraint dominating WBP, which inhibits coalesce. This is the constraint IDENT [CONTINUANT].

Candidate (66.b) is ruled out because it violates IDENT [CONTINUANT]. This candidate has coalesced the segment /ʃ$_3$/, which is [+continuant] and the segment /p$_4$/, which is [-continuant].

In contrast, candidate (66.a) satisfies the constraint IDENT [CONTINUANT] by inhibiting coalescence, and thus it is chosen as the winner of the competition. The cost of inhibiting coalescence is to have a non-moraic coda and therefore violate WBP[18].

(66) / bɨ$_2$ʃ$_3$p$_4$i / → (ˈbɨʃ.pi) ‘plant shoot’

		IDENT [CONT]	WBP	UNIFORMITY
a.	☞ (ˈbɨ$_2$ʃ$_3$.p$_4$i)		*	
b.	(ˈbɨ$_2$.ʃ$_{3,4}$i)	*!W	L	*W

[18] A candidate like (ˈbɨ$_2$.p$_{3,4}$i) does not have any chance of winning since it fares even worse that the loser candidate in tableau (66). It not only violates IDENT IO [CONTINUANT] and UNIFORMITY but also IDENT IO-[STRIDENT].

- <u>IDENT [SONORANT]</u>

Tableau (67) shows that the constraint IDENT [SONORANT] can also inhibit coalescence by outranking WBP. The input of this tableau has the root /ʃinti/ '(sp. of) cricket', which has a consonant cluster formed by /n_3/, a [+sonorant] segment and /t_4/, a [-sonorant] segment.

In candidate (67.a), the input segment /n_3/ is parsed as the coda of the initial syllable, whereas in candidate (67.b), this segment is mapped together with the following consonant /t_4/ resulting in the coalesced segment [$n_{3,4}$].

Candidate (67.b) is eliminated from the competition since it violates IDENT [SONORANT]: while the correspondent relation /n_3/ → [$n_{3,4}$] satisfies this constraint, the correspondent relation /t_4/ → [$n_{3,4}$] violates it.

In contrast, candidate (67.a) wins the competition by inhibiting coalescence and thus satisfying the constraint IDENT [SONORANT]. The price for this is to have a non-moraic coda and therefore violate WBP[19].

(67) / ʃi$n_3$$t_4$i / → (ˈʃin.ti) '(sp. of) cricket'

		IDENT [SON]	WBP	UNIFORMITY
a.	☞ (ˈʃ$i_2$$n_3$.$t_4$i)		*	
b.	(ˈʃi_2.$n_{3,4}$i)	*!W	L	*W

---

[19] A candidate like (ˈʃi_2.$t_{3,4}$i) in tableau (67) could not win since it not only violates IDENT [SONORANT] and UNIFORMITY but it also violates IDENT [NASAL].

3.4 The Constraint ONSET and its Role as Trigger of Coalescence

This section presents evidence of how coalescence is not only responsible for the rhythmic alternation of coda glottal stops and glottalized vowels, but also for the shape of syllabic structure of certain words. In particular, this section concentrates on how the contextual triggering and inhibition of metrical coalescence creates a gap in the inventory of possible words of Capanahua: while onsetless vowels are allowed to occur in even syllables, they are banned in odd syllables. This is schematically represented in (68).

(68) a. ✓(CV.<u>V</u>)

b. ✓(CV.<u>V</u>).CV

c. *(<u>V</u>.CV)

d. *(CV.CV).<u>V</u>

e. *(CV.V).<u>V</u>

The data in (69) present examples of words from Capanahua that follow the pattern in (68.a) and (68.b).

(69)	a. (ˈra.u)	‘ornament’
	b. (ˈma.ɨ)	‘masato (kind of drink)’
	c. (ˈʔa.i).ta	‘aunt, mother-in-law’
	d. (wɨ.ˈun).tin	‘(sp. of) bird’

The otherwise peculiar gap in (68.c-e) makes sense if one sees coalescence as an active force shaping the syllabic forms of words in Capanahua. However, unlike previous cases of coalescence, the trigger is the constraint ONSET (see definition in (70)).

(70) ONSET: Syllables have onsets.

While coalescence is triggered in hypothetical words like (68.d) and (68.e) in order to satisfies the constraint ONSET, it is inhibited in words like (5). The inhibitor in this case is the same constraint that inhibits glottal coalescence in head syllables: UNIFORMITY-ˈσ. If coalescence were triggered in words like (5.c), the resulting output segment would be parsed as part of a head syllable (that is, /C V_1 V_2 C V/ → *(ˈC$V_{1,2}$.CV)). This would violate UNIFORMITY-ˈσ.

Furthermore, the constraint ONSET is also responsible for the lack of words like (68.c). However, in this case is not coalescence what ONSET triggers but the epenthesis of an onset glottal stop. The following paragraphs show in detail how through the ranking in (71) the possible words and the gaps of (68) are accounted for.

(71) UNIFORMITY-ˈσ >> ONSET >> UNIFORMITY

3.4.1 Onset Insertion

In Capanahua, words that begin with an onsetless syllable are disallowed. In order to satisfy the constraint ONSET, Capanahua inserts a glottal stop violating the constraint DEP-SEG and *[C.G.]. This is shown in tableau (72).

(72) /atsa/ → (ˈʔa.tsa) ‘yucca’

	$/a_1ts_2a_3/$	ONSET	DEP-SEG	*[C.G.]
a.	☞ $(ˈʔ_a a_1.ts_2a_3)$		*	*
b.	$(ˈa_1.ts_2a_3)$	*!W	L	L

In order to guarantee an analysis of onset epenthesis and not one of initial vowel-deletion, the constraint MAX-SEG must outrank the constraints DEP-SEG, PARSE(σ), *[C.G.]. This is shown in tableau (73). Moreover, if the initial vowel-deletion analysis were correct, it could reduce words like /atsa/ ‘yucca’ to a word smaller than two syllables (/atsa/ → *[tsa]).

(73) $/a_1t_2a_3p_4a_5/ \rightarrow (ˈʔ_a a_1.t_2a_3).p_4a_5$

	$/a_1t_2a_3p_4a_5/$	MAX-SEG	DEP-SEG	PARSE(σ)	*[C.G.]
a.	☞ $(ˈʔ_a a_1.t_2a_3).p_4a_5$		*	*	*
b.	$(ˈt_2a_3.p_4a_5)$	*!W	L	L	L

Thus, words like (68.c) with an initial onsetless syllable do not exist in Capanahua because a glottal stop is inserted in order to satisfy the constraint ONSET. The constraint MAX-SEG ranked over DEP-SEG, PARSE(σ), *[C.G.] bans the deletion of words with initial vowels in order to ensure an onset for the initial syllable.

3.4.2 ONSET-Driven Coalescence

In the case of hypothetical inputs like /$CVCV_4V_5$/, the constraint ONSET by outranking the constraint UNIFORMITY triggers coalescence of the vowel / V_5/ that would otherwise surface onsetless with the preceding vowel / V_4/. Thus, these hypothetical words always surface as [$CV.CV_{4,5}$].

This is shown in tableau (75). Candidate (75.b) is ruled out by the constraint ONSET. In contrast, candidate (75.a) wins the competition by triggering coalescence and thus satisfying both ONSET and PARSE(σ). See the definition of PARSE(σ) in (74)

(74) PARSE(σ): Do not have unfooted syllables.

(75) /CVCVV/ → (CV.CV)

	/$CVCV_4V_5$/	ONSET	PARSE(σ)	UNIFORMITY
a.	☞ (ˈ$CV.CV_{4,5}$)			*
b.	(ˈ$CV.CV_4$).V_5	*!	*	

We can determine that it is ONSET and not PARSE(σ) that eliminates candidate (75.b). Tableau (72) showed that the constraint ONSET outranks DEP-SEG. Moreover, tableau (76) shows that the constraint DEP-SEG dominates PARSE(σ). Therefore, it follows that in tableau (75), ONSET must outrank PARSE(σ). Thus, when candidate (75.b) is evaluated, ONSET assesses the fatal violation that eliminates it.

(76) /ʔikonin/ → (ˈʔi.ko).nin 'nephew'

	/ ʔikonin /	DEP-SEG	PARSE(σ)	WBP
a.	☞(ˈʔi.ko).nin		*	*
a.	(ˈʔi.ko)(ˌni.n*i*)	*!W	L	L

- *Coalescence and not Deletion*

Tableau (75) begs the question: why analyze the winner candidate as undergoing coalescence instead of deletion of the final vowel? The answer is that the faithfulness constraint MAX-SEG, which penalizes deletion, dominates UNIFORMITY, so that deleting segments is more costly than coalescing them in Capanahua[20]. See tableau (77).

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[20] Tableau (40) showed that WBP dominates UNIFORMITY and tableau (34) showed that MAX-SEG dominates WBP; therefore, the ranking of MAX-SEG over UNIFORMITY in tableau (77) is independently motivated.

(77) /$CVCV_4V_5$/ → (ˈ$CV.CV_{4,5}$)

	/CVCVV/	MAX-SEG	UNIFORMITY
a.	☞ (ˈ$CV.CV_{4,5}$)		*
b.	(ˈ$CV.CV_4$)	*!W	L

Thus, the ranking of ONSET over UNIFORMITY, shown in (71), forces the coalescence of vowels that otherwise would surface onsetless. This explains why Capanahua lacks words with the syllabic structure *[(CV.CV).V].

- *<u>The Role of CONTIGUITY-O</u>*

Finally, one can argue that if ONSET is driving coalescence in these cases, hypothetical inputs like /CVCVV/ can obtain an onset for their final vowels so that no coalescence takes place.

The problem with this solution is that Capanahua does not insert onsets morpheme-internally, as shown by the existence of words as in (5), repeated in (78).

(78) a. (ˈra.u) ‘ornament’

b. (ˈma.ɨ) ‘masato (kind of drink)’

c. (ˈʔa.i).ta ‘aunt, mother-in-law’

d. (wɨ.ˈun).tin ‘(sp. of) bird’

The data in (78) show that the faithfulness constraint CONTIGUITY-O, which demands that segments should not be inserted within a morpheme, outranks the markedness constraint ONSET. See tableau (80). The definition of CONTIGUITY-O is presented in (79).

(79) CONTIGUITY-O: The portion of output segments standing in correspondence forms a contiguous string ('no intrusion')

The input of tableau (80) is the root /rao/ 'ornament'. This root has two vowels in contact, without any consonant intervening between them. Candidate (80.b) solves this problem by inserting an onset consonant[21] so that constraint ONSET can be satisfied. However, this violates the higher-ranked constraint CONTIGUITY-O, which eliminates this candidate: the output segments of /r_1/ and /a_2/ do not form a single string with the output segment of /o_3/. The inserted consonant [t_a] intervenes between them.

In contrast, candidate (80.a) satisfies the constraint CONTIGUITY-O by not providing an onset to its second syllable. The cost, of course, is to violate the markedness constraint ONSET. Moreover, tableau (72) showed that ONSET dominates DEP-SEG, so that in tableau (80), CONTIGUITY-O dominates ONSET.

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[21] Capanahua does not allow glottal stops to occur beyond the initial syllable of a morpheme. Thus, if Capanahua had to choose a consonant to insert as the onset of the second syllable in candidate (80.b), this would not be a glottal stop.

(80) /rau/ → (ˈra.u) ‘ornament’

	$/r_1a_2u_3/$	CONTIGUITY-O	ONSET	DEP-SEG
a.	☞ $(ˈr_1a_2.u_3)$		*	
b.	$(ˈr_1a_2.t_au_3)$	*!W	L	*W

Thus, while the constraint ONSET can trigger coalescence to avoid non-initial onsetless vowels and epenthesis to avoid initial onsetless vowels, morpheme-internally the constraint CONTIGUITY-O inhibits the effects of ONSET, as shown in tableau (80).

3.4.3 Inhibition of ONSET-Driven Coalescence

Although Capanahua bans the occurrence of words like *[(V.CV)], *[(CV.CV).V], it does have words with the syllabic shape [(CV.V)] and [(CV.V).CV]. While onsetless vowels are disallowed in odd syllables, they are allowed in even syllables.

This phonotactic pattern is the result of the conflict between the constraint ONSET and the positional faithfulness constraint UNIFORMITY-ˈσ, which penalizes the occurrence of coalescence in head syllables. It is worth remembering that UNIFORMITY-ˈσ is the same constraint invoked to inhibit glottal coalescence in head syllables (see (46) and (47)). The definition of this constraint is again presented in (81).

(81) UNIFORMITY-ˈσ: Each segment of a head syllable has only one input correspondent (‘do not coalesce segments in head syllables’).

The coalescence of onsetless vowels is inhibited when the resulting output segment would end up parsed in a head syllable. If words like /CV_1V_2CV/ underwent ONSET-driven coalescence, the result would be a word like *[(ˈ$CV_{1,2}$.CV)], which would violate UNIFORMITY-ˈσ.

Tableau (82) shows that the constraint UNIFORMITY-ˈσ by outranking ONSET inhibits ONSET-driven coalescence. The input of tableau (82) is the trisyllabic root /ʔaita/ ‘Aunt, mother-in-law’. This tableau considers two candidates. In candidate (82.a), the input segments /a_2/ and /i_3/ have different output correspondents. In contrast, in candidate (82.b), both input segments have been mapped into a single output segment on the surface.

Candidate (82.b) is ruled out because it violates the constraint UNIFORMITY-ˈσ, that is, the output segment [$a_{2,3}$] has two input correspondents and belongs to a head syllable. In contrast, candidate (82.a) wins the competition because it satisfies UNIFORMITY-ˈσ by inhibiting the coalescence of /a_2/ and /i_3/. The cost paid for satisfying this constraint is to have an onsetless syllable, which violates the constraint ONSET.

(82) (ˈʔa.i).ta 'aunt, mother-in-law'

	/ $ʔa_2i_3ta$ /	UNIFORMITY-ˈσ	ONSET	UNIFORMITY
a.	☞ (ˈ$ʔa_2.i_3$).ta		*	
b.	(ˈ$ʔa_{2,3.}$ta)	*!W	L	*W

Cases like (ˈʔa.i).ta 'aunt, mother-in-law' show that the positional faithfulness constraint UNIFORMITY-ˈσ is needed in Capanahua independently of glottal coalescence. Moreover, these cases also show that the need to avoid unfooted syllables (PARSE(σ) – 'do not have unfooted syllables') does not drive the pattern in (68) (repeated in (83)). If the constraint PARSE(σ) were the force behind (83), words like (ˈʔa.i).ta should not exist.

(83) a. ✓(CV.V̲)

b. ✓(CV.V̲).CV

c. *(V̲.CV)

d. *(CV.CV).V̲

e. *(CV.V).V̲

In sum, the constraint ONSET is the driving force behind (83). It triggers onset-insertion in vowel-initial words so that hypothetical inputs like /V.CV/ surface as [ʔV.CV]. Moreover, since segments cannot be inserted morpheme-internally (CONTIGUITY-O) nor deleted (MAX-SEG), it triggers ONSET-driven coalescence to avoid non-initial onsetless vowels. Thus hypothetical inputs /$CVCV_4V_5$/ surface as [($CV.CV_{4,5}$)].

However, when coalescence would threaten to violate the positional faithfulness constraint UNIFORMITY-ˈσ, ONSET-driven coalescence is inhibited. This accounts for why words like (ˈra.u) 'ornament', (ˈʔa.i).ta 'aunt, mother-in-law', or (wɨ.ˈun).tin '(sp. of) bird' do exist in Capanahua.

4 Conclusions

This chapter presented the metrically conditioned glottal-coalescence of Capanahua. It both provided a description of the phenomenon and proposed a formal analysis to account for it. The analysis showed that the same constraints that govern foot size, syllable weight and quantity-adjustments (see chapters 4 and 5) as well as those that ban consonant-deletion and vowel-insertion in order to avoid codas (MAX-SEG and DEP-SEG) are responsible for the trigger of glottal-coalescence.

The constraint UNIFORMITY by sitting at the bottom of the constraint hierarchy allows the trigger of coalescence in Capanahua as long as it does not occur in head syllables (due to UNIFORMITY-ˈσ)[22] and the output segment resulting from coalescence respects the value of the feature [consonantal] (due to IDENT [CONSONANTAL]).

Thus, both the positional faithfulness constraints UNIFORMITY-ˈσ and IDENT [CONSONANTAL] act as inhibitors of glottal-coalescence. The UNIFORMITY-ˈσ constraint ensures that glottal-coalescence never occurs in head syllables so that these syllables are the only places in which input glottal stops are mapped into coda positions.

The constraint IDENT [CONSONANTAL] inhibits coalescence of vowels and segments that do not share with vowels the value [-consonantal]. This requirement makes it possible that coalescence targets glottal stops [ʔ], which are [-consonantal] and not other segments, like [n, s, ʃ, ʂ], which are [+consonantal]. The role played by IDENT [CONSONANTAL] as an inhibitor of coalescence accounts for why, in non-head syllables,

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[22] Optionally, glottal coalescence will be inhibited in word-initial syllables in order to satisfy the positional faithfulness constraint UNIFORMITY-ˈσ1.

input glottal stops that otherwise would have occurred as codas coalesce with the preceding vowel but other possible coda consonants (i.e. [n, s, ʃ, ʂ]) cannot undergo coalescence. As a result of metrically triggering and inhibiting coalescence, the Capanahua segmental rhythmic phenomenon, originally reported by Loos 1969, is created.

Moreover, this chapter has shown that coalescence is not only affecting the surface form of input glottal stops but is indeed shaping the syllable structure of Capanahua words. The effects of coalescence are not only observed in the dynamic patterns of Capanahua phonology but also in its static patterns.

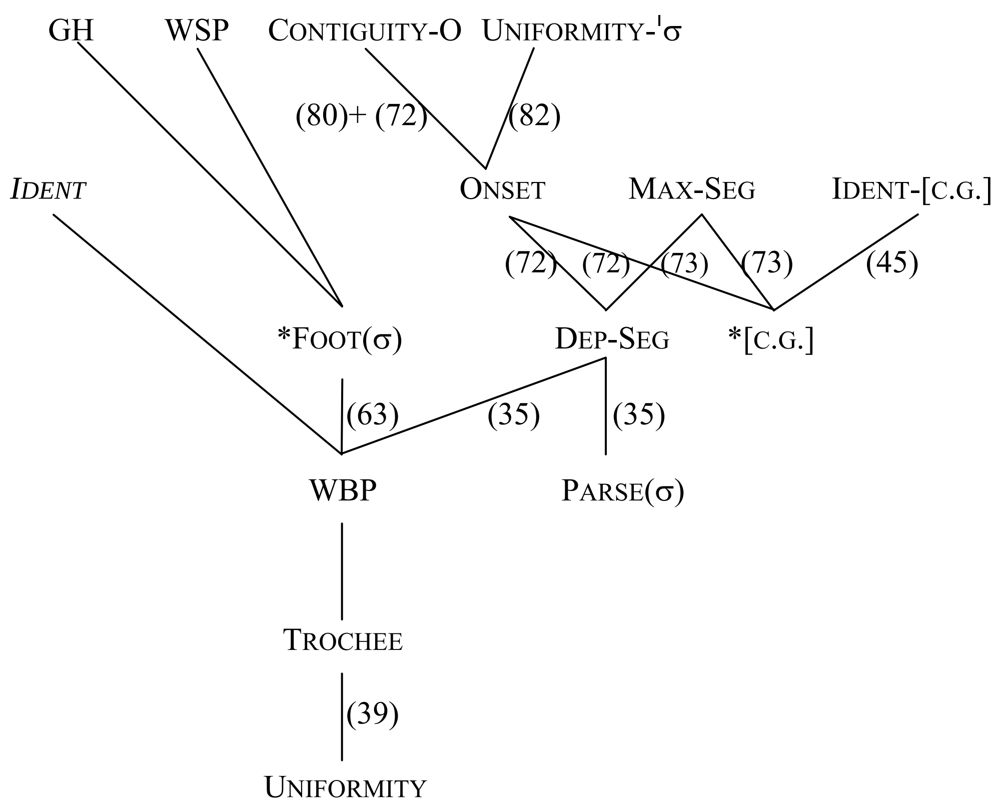
In this language, onsetless vowels can only occur in even syllables (e.g. [ˈma.ɨ] ‘masato (sp. of drink)’, [wɨ.ˈun.tin] ‘(sp. of) bird’), and not in odd syllables (i.e. *[V̲.CV], *[CV.CV.V̲]). The ranking of the positional faithfulness UNIFORMITY-ˈσ constraint over ONSET, and, in turn, the constraint ONSET dominating the general faithfulness constraint UNIFORMITY, account for this otherwise awkward phonotactic pattern (see section §3.4).

If coalescence were triggered in words like [ˈma.ɨ] and [wɨ.ˈun.tin] the constraint UNIFORMITY-ˈσ would be violated. In contrast, in hypothetical inputs like /$C_1V_2C_3V_4\underline{V}_5$/, the constraint ONSET by outranking UNIFORMITY triggers coalescence and bans the possibility of having words with the shape: *[$C_1V_2.C_3V_4.\underline{V}_5$]. These inputs are predicted to surface as [$C_1V_2.C_3V_{4,5}$].

Furthermore, the constraint ONSET by outranking DEP-SEG triggers the insertion of an onset in morphemes that would otherwise begin in a vowel: /atsa/ → [ˈʔatsa] ‘yucca’. However, since CONTIGUITY-O dominates ONSET, the insertion cannot occur morpheme-internally. This accounts why inputs like / maɨ / surface as [ˈma.ɨ] ‘masato (sp. of drink)’, that is, with the second syllable onsetless.

The final grammar of Capanahua is shown in (84). The label “*IDENT*” in (84) stands for the position in the ranking that the constraints IDENT [CONSONANTAL], IDENT [SONORANT] and IDENT [CONTINUANT] take (see tableaux (57), (66) and (67)). The same justification used in Shipibo for ranking GROUPING HARMONY and WSP over *FOOT(σ) and WEIGHT-BY-POSITION over TROCHEE can be also used in Capanahua (see chapter 4 and 5).

(84) <u>*Capanahua Final Grammar*</u>



Chapter 7: Further Discussion

1 Introduction

Thus far, this dissertation has presented the cases of Shipibo and Capanahua, two Panoan languages in which the requirement of having disyllabic feet and respect the distributional restrictions imposed on heavy syllables result in contextual adjustment of syllable weight. Central to the understanding of how syllable weight is treated in these languages, we find *FOOT(σ), a constraint proposed in this dissertation that penalizes the occurrence of metrical feet smaller than two syllables. This chapter explores the role that the constraint *FOOT(σ) plays in other grammars.

2 Other Interactions between Foot Disyllabicity and Syllable Weight

2.1 Gooniyandi: Foot-Disyllabicity without Quantity Adjustments

The enforcement of foot-disyllabicity does not necessarily imply the trigger of quantity adjustment, as in the case of Shipibo and Capanahua. If a grammar enforces foot-disyllabicity and inhibits quantity adjustments of syllable weight (that is, *FOOT(σ) and the QA-inhibitors WEIGHT-IDENT and WEIGHT-BY-POSITION are undominated), the result is the appearance of marked disyllabic feet. This is done at the cost of violating WT-restrictors, the constraints in charge of imposing restrictions on the distribution of syllable weight. The resulting feet are 'marked' in the sense that they may show unstressed heavy syllables or uneven (HL)-trochees.

An example of this type of ranking can be found in Gooniyandi (Kager 1995; McGregor 1990; 1993). In this language, long vowels can occur in both head-syllables and non-head syllables within disyllabic feet. See data in (1).

(1) Gooniyandi (Kager 1995; McGregor 1990; 1993)

a. (ˈba.ga)	‘burr’
b. (ˈnga.dda).gi	‘my’
c. (ˈnga.boː)	‘father’
d. (ˈda.goːr).la	‘hole, depression’
e. (ˈboːl.ga)	‘owl’
f. (ˈdoː.mboː)	‘old man’
g. (ˈngi.ddi)(ˌwarn.di)	‘across’
h. (ˈwi.li)(ˌmoː.roː)	‘chicken hawk’
i. (ˈba.boː)(ˌddoː.nggoː)	‘to the bottom’
j. (ˈja.mbin)(ˌba.roː)	‘(a type of fish)’

The ranking in (2) can account for Gooniyandi’s disyllabic feet, lack of quantity adjustments as well as its trochaic rhythm. This ranking, by having WEIGHT-IDENT and *FOOT(σ) undominated, frees long vowels from undergoing quantity adjustments but still forces them to be parsed into disyllabic feet.

(2) *Gooniyandi: Disyllabic Feet without Quantity Adjustments*

WEIGHT-IDENT, TROCHEE, *FOOT(σ) >> WSP, GH

The effects of the ranking in (2) are shown in tableaux (3) to (10). In tableau (3), the constraint WEIGHT-IDENT blocks the trochaic shortening that the constraint GROUPING HARMONY could otherwise have triggered. *FOOT(σ) prevents a syllable with a long vowel from forming its own foot.

(3) Gooniyandi: / CV: CV / → (ˈH.L)

	/ CV: CV /	WEIGHT-IDENT	*FOOT(σ)	GROUPING HARMONY
a.	☞ (ˈH.L)			*
b.	(ˈH).L		*!W	L
c.	(ˈL.L)	*!W		L

In tableau (4), the constraint WEIGHT-IDENT blocks the constraint WEIGHT-TO-STRESS PRINCIPLE from triggering vowel shortening. The constraint TROCHEE, since undominated, rules out an iambic analysis. *FOOT(σ) penalizes the occurrence of a foot smaller than two syllables.

(4) <u>Gooniyandi</u>: / CV CVː / → (ˈL.H)

	/ CV CVː /	WEIGHT-IDENT	TROCHEE	*FOOT(σ)	WSP
a.	☞ (ˈL.H)				*
b.	L.(ˈH)			*!W	L
c.	(L.ˈH)		*!W		L
d.	(ˈL.L)	*!W			L

- *<u>(H)-Feet in Gooniyandi</u>*

In Gooniyandi, there are two contexts in which (H)-feet do occur: monosyllables and final heavy syllables that would otherwise be left unfooted. See data in (5).

(5) <u>Gooniyandi</u> (Kager 1995; McGregor 1990; 1993)

a. (ˈmaː), *(ˈma) 'meat'

b. (ˈnga.dda)(ˌnyoː), *(ˈnga.daa).nyoː 'mother'

c. (ˈgoː.dda)(ˌngoːl), *(ˈgoː.dda).ngoːl 'magpie'

d. (ˈnga.dda).gi 'my'

e. (ˈda.goːr).la 'hole, depression'

With regard to the (H)-foot in the case of monosyllables (see (5.a)), it is clear that it emerges in order to avoid a degenerate (L)-foot and at the same time to guarantee that a lexical word correspond to a PrWd. This case is similar to Shipibo.

What is interesting about the data of Gooniyandi in (5.b-e) is the emergence of (H)-feet in order to avoid unfooted heavy syllables (see examples in (5.b-c)). However, in other contexts, disyllabic feet are clearly preferred. Put differently, in Gooniyandi, disyllabic feet are preferred over (H)-feet, but in those contexts in which a disyllabic foot cannot be achieved, the (H)-foot emerges.

As in Shipibo, Gooniyandi is another language that shows that disyllabic feet and bimoraic (H)-feet do not have the same status. Grammars favor disyllabic feet over (H)-feet whenever possible. This is also observed in the data in (6): in order to obtain disyllabic feet, heavy syllables do not form their own feet. Compare it to (5).

(6) <u>Gooniyandi</u> (Kager 1995; McGregor 1990; 1993)

a. (ˈnga.boː), *nga.(ˈboː) 'father'

b. (ˈda.goːr).la , *da.(ˈgoːr).la 'hole, depression'

c. (ˈja.mbin)(ˌba.roː), *(ˈja.mbin)ba(ˌroː) '(a type of fish)'

Key to the emergence of (H)-feet in this cases is that Gooniyandi does not tolerate quantity adjustments (that is, to satisfy WEIGHT-IDENT) and in addition, it bans degenerate (L)-feet (to satisfy *FOOT(μ))[1] and requires parsing as many syllables as possible (to satisfy PARSE(σ)). Thus, potential unfooted syllables with long vowels cannot undergo vowel shortening. The definition of PARSE(σ) is given in (7).

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[1] The avoidance of (L)-feet in Gooniyandi is not only observable in the lack of monomoraic words but also in the occurrence of unfooted monomoraic syllables (see (5.d-e)) given that PARSE(σ) dominates *FOOT(σ).

(7) PARSE(σ): Do not have unfooted syllables.

The ranking in (8) accounts for the occurrence of (H)-feet in Gooniyandi in order to avoid unfooted heavy syllables.

(8) *Gooniyandi: The (H)-Foot to Avoid Unfooted Heavy Syllables*

*FOOT(μ), WEIGHT-IDENT >> PARSE(σ) >> *FOOT(σ)

In the case of final syllables with long vowels that would otherwise be left unfooted, WEIGHT-IDENT, by dominating *FOOT(σ), blocks vowel shortening. Moreover, since PARSE(σ) also dominates *FOOT(σ), the syllable with the long vowel in (9) is forced to form its own foot. This is shown in tableau (9).

(9) Gooniyandi: / CV CV CV: / → (ˈL.L)(ˌH)

	/ CV CV CV: /	WEIGHT-IDENT	PARSE(σ)	*FOOT(σ)
a.	☞ (ˈL.L)(ˌH)			*
b.	(ˈL.L).H		*!W	L
c.	(ˈL.L).L	*!W		L

In contrast, the ranking of *FOOT(μ) over PARSE(σ) does not allow a final syllable with a short vowel to form its own foot. Moreover, since WEIGHT-IDENT also outranks PARSE(σ), vowel lengthening is also blocked. The result is that, in contrast to final syllables with long vowels, final syllables with short vowels can be left unfooted. See tableau (10).

(10) <u>Gooniyandi</u>: / CV CV <u>CV</u> / → (ˈL.L).<u>L</u>

	/ CV CV CV /	*FOOT(μ)	WEIGHT-IDENT	PARSE(σ)	*FOOT(σ)
a.	☞ (ˈL.L).L			*	
b.	(ˈL.L)(ˌH)		*!W	L	*W
c.	(ˈL.L)(ˌL)	*!W		L	*W

The final grammar of Gooniyandi is presented in (11). This grammar accounts for the inhibition of quantity adjustments, the disyllabic footing and the emergence of the (H)-foot to avoid an unfooted heavy syllable.

(11) *<u>Gooniyandi: Final Grammar</u>*

*FOOT(μ), WEIGHT-IDENT >> PARSE(σ) >> *FOOT(σ) >> WSP, GH

2.2 Guugu Yimidhirr: Foot-Disyllabicity and Long Vowels in Initial Foot

The case of Guugu Yimidhirr (Buckley 1998; Haviland 1979; Kager 1995; Zoll 1996; 1998; 2004b; c) has drawn a lot of attention recently because of its peculiar characteristics of restricting the occurrence of long vowels to the two initial syllables of its PrWds. The reference to the two initial syllables of PrWds suggests a disyllabic foot. This should not be surprising since the distribution of head syllables in Guugu Yimidhirr also indicates the language enforces foot-disyllabicity. What is remarkable is that only the initial disyllabic foot can host heavy syllables. Long vowels in other contexts are prohibited.

In this section, the case of Guugu Yimidhirr (Buckley 1998; Haviland 1979; Kager 1995; Zoll 1996; 1998; 2004b; c) is argued to have a grammar similar to Gooniyandi, that is, a ranking that favors the occurrence of long vowels. However, the difference with Gooniyandi is that, in Guugu Yimidhirr, a positional markedness constraint dominating WEIGHT-IDENT bans the occurrence of long vowels beyond the initial disyllabic foot.

Although most of grammars reported impose restrictions on the distribution of heavy syllables based on prominent versus non-prominent positions (that is, head versus non-head positions), some grammars resort to privilege positions (Beckman 1995; 1997; 1998; Buckley 1998; Davis 1999; Davis and Cho 2003; de Lacy 2002; Kenstowicz 1996; Nelson 1998; 2003; Prince and Smolensky 1993; Zoll 1996; 1997; 1998; 2004a; c). Examples of privilege positions are initial domains (e.g. initial syllable, initial foot).

Following Zoll 1998; 2004b; c[2] (see also Kager 1995), the constraint responsible for restricting the occurrence of long vowels to the initial foot in Guugu Yimidhirr is COINCIDE (INITIAL-FOOT). The role that this constraint plays is similar to the role played

[2] Guugu Yimidhirr presents processes of vowel lengthening and shortening that only affect the second syllable of PrWds (counting from left to right). These processes of vowel lengthening and shortening are triggered by some suffixes, which are usually analyzed as having a floating mora (see Kager 1995). Without those vowel-lengthening-and-shortening suffixes, it would have been possible to analyze Guugu Yimidhirr positing a positional faithfulness constraint (Alderete 1999; Beckman 1995; 1997; 1998; Casali 1997; Jun 1995; Smith 1997; 1998a; b; 2000a; b; Steriade 1995) requiring vowels in the initial foot to have input correspondents of identical moraic content. However, Zoll 1998; 2004b; c argues convincingly that a positional faithfulness constraint alone cannot handle the distribution of long vowels in Guugu Yimidhirr. In particular, a positional faithfulness constraint cannot account for why vowel lengthening is allowed to occur in a privilege position, as the initial foot, but blocked in non-privilege positions as non-initial feet.

by constraints like GROUPING HARMONY and WEIGHT-TO-STRESS PRINCIPLE. They are WT-restrictors. They impose restrictions on the distribution of weight. The definition of this constraint is presented in (12).

(12) COINCIDE (INITIAL-FOOT): Long vowels occur in the initial foot[3].

The ranking necessary to account for Guugu Yimidhirr's restrictions on long vowels within the initial disyllabic feet is shown in (13).

(13) COINCIDE(INITIAL-FOOT), *FOOT(σ) >> WEIGHT-IDENT >> GH, WSP >> TROCHEE

The ranking of both *FOOT(σ) and WEIGHT-IDENT over GROUPING HARMONY and WEIGHT-TO-STRESS PRINCIPLE, enforces foot-disyllabicity and inhibits quantity-adjustments of vowels. However, the ranking of COINCIDE(INITIAL-FOOT)[4] and *FOOT(σ) over WEIGHT-IDENT restricts the occurrence of long vowels to the initial disyllabic foot.

By enforcing foot-disyllabicity and sandwiching WEIGHT-IDENT between WT-restrictors, the result in (13) is the ban on long vowels beyond the initial foot but their 'almost' unrestricted occurrence within it.

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[3] The actual constraint that Zoll 1998; 2004b; c proposes is: COINCIDE (HEAVY SYLLABLE, HEAD PRWD) 'a heavy syllable belongs to the Head PrWd'. The term 'Head PrWd' refers to a type of super-foot in the case of [CVː.CVː] sequences. In this dissertation, there is no need for positing a new prosodic constituent, since these sequences are treated as trochaic feet.

[4] For the analysis of suffixes that trigger vowel shortening and vowel lengthening within the initial foot in Guugu Yimidhirr, see Zoll 1998; 2004b; c and Kager 1995.

The following paragraphs present and discuss the data from Guugu Yimidhirr (Buckley 1998; Haviland 1979; Kager 1995; Zoll 1996; 1998; 2004b; c). In particular, it discusses the controversy surrounding words with two initial syllables with long vowels.

In this language, the main foot is obligatorily aligned with the left edge of the PrWd. The data suggests that the right edge must also be aligned with a foot. Similarly to Gooniyandi (presented in the previous section), syllables that otherwise would occur unfooted form their own feet if they can be bimoraic. Since Guugu Yimidhirr bans long vowels beyond the initial foot, the only syllables that have a chance to form their own feet are heavy closed syllables.

When the main foot is formed by two light syllables or by a syllable with a long vowel followed by a light one, the initial syllable is designated as the head of the foot. Guugu Yimidhirr completely bans the occurrence of clashes (see also Bye 1996 for a similar observation). See (14) and (15).

(14) <u>Guugu Yimidhirr</u>: #(ˈL.L)...

a. (ˈbi.da)(ˌguɽ.gal) ‘child-PL-ADES’

b. (ˈmar.bu)(ˌgan) ‘cave-ABS’

c. (ˈdur.gin)(ˌbi.gu) ‘Indian Head (place name)’

d. (ˈmar.bu)(ˌgan)(bi.ˌgu) ‘cave-LOC-EMPH’ (‘still in the cave’)

(15) Guugu Yimidhirr: #(ˈH.L)...

a. (ˈguː.gu) ‘language-ABS’

b. (ˈbuː.ra)(ˌyay) ‘water-LOC’ (‘in the water’)

c. (ˈdaː.ba)(ˌŋal)(ŋa.ˌla) ‘ask-RED-IMP’ (‘keep asking!’)

When the main foot has a light syllable followed by a syllable with a long vowel, the latter is designated as the head of the foot. See (16).

(16) Guugu Yimidhirr: #(L.ˈH)...

a. (ma.ˈgiːl) ‘branch-ABS’

b. (ma.ˈyiː).ŋu ‘food-PURP’

c. (na.ˈmbaːl).ŋan ‘stone-ABL’ (‘from the stone’)

d. (ma.ˈgiːl)(nay.ˌgu) ‘branch-PL-EMPH’ (‘just branches’)

Guugu Yimidhirr also has main feet that contain two syllables with long vowels. See data in (17). These are controversial. According to Haviland 1979, both syllables are equally stressed[5]. Many proposals, which include the existence of recursive PrWds, feet with two heads and a distinction between ‘parsing foot’ and ‘stress foot’, have been put

[5] Although Haviland 1979 does not mention what is meant by ‘equally stressed’, one could hypothesize that in Guugu Yimidhirr, syllables with long vowels are associated to high tones. Thus, the presence of two high tones, one on each sylllable in (CV:.CV:)-feet might be what is described as ‘equally stressed’.

forward to solve this puzzle (see Buckley 1998; Bye 1996; Kager 1992b; 1995; Zoll 1996; 1998; 2004b; c).

(17) Guugu Yimidhirr: #(ˈH.H)...

a. (ˈbuː.raːy) ‘water-ABS’

b. (ˈmiː.daːr) ‘lift’

c. (ˈbuː.raːy)(ˌbi.gu) ‘water-LOC-EMPH’ (‘still in the water’)

d. (ˈdyiː.raːl)(ˌgal) ‘wife-ADES’

In spite of these feet being described as ‘equally stressed’, I would argue that they are disyllabic trochaic feet, as indicated in (17). That is, that only the initial syllable is the head in these feet: (ˈCVː.CVː). Phonological evidence for this analysis is found in the treatment that Guugu Yimidhirr gives to clash avoidance.

In the case of initial iambic feet, Guugu Yimidhirr forces the following foot to be iambic as well so that it avoids the occurrence of a clash (see (18.a))[6]. For the same reason, a final closed syllable is left unfooted (see (18.b)). In contrast, when there is no risk of a clash, a final closed syllable does occur footed (compare (18.b) to (18.c)). In (18.d), a closed syllable forms its own foot, then the last two syllables are forced to group into an iambic foot in order to avoid a clash.

[6] The glosses of the data in (18) can be found in (14) to (17).

(18) Guugu Yimidhirr: Head-syllables and Clash Avoidance

a. (ma.ˈgiːl)(nay.ˌgu), *(ma.ˈgiːl)(ˌnay.gu)

b. (na.ˈᵐbaːl).ŋan, *(na.ˈᵐbaːl)(ˌŋan)

c. (ˈbuː.ra)(ˌyay) *(ˈbuː.ra).yay

d. (ˈmar.bu)(ˌgan)(bi.ˌgu), *(ˈmar.bu)(ˌgan)(ˌbi.gu)

In the case of initial (CVː.CVː) feet, the following foot behaves as if no clash is created. For example, in (19.a), the foot following the initial one is trochaic. Observe that this word has enough room to shift the stress to the final syllable if there were a clash (i.e. *(buː.ˈraːy)(bi.ˌgu)), but this does not occur (compare it to (18.a)). Similarly, in (19.b), if the initial foot were right-headed, a clash would occur. However, if this were the case, Guugu Yimidhirr would leave the final syllable unfooted as in (18.b).

(19) Guugu Yimidhirr: Head-syllables and Clash Avoidance

a. (ˈbuː.raːy)(ˌbi.gu), *(buː.ˈraːy)(bi.ˌgu)

b. (ˈdyiː.raːl)(ˌgal), *(dyiː.ˈraːl).gal

The ranking for the distribution of long vowels in Guugu Yimidhirr is shown again in (20). Since WEIGHT-IDENT dominates GROUPING HARMONY, WEIGHT-TO-STRESS PRINCIPLE and TROCHEE, vowel shortening cannot be triggered. However, because the positional markedness constraint COINCIDE (INITIAL-FOOT), which penalizes the occurrence of long vowels beyond the initial foot, dominates WEIGHT-IDENT, long vowels are shortened except in the initial foot.

(20) *Guugu Yimidhirr: Long Vowels in a Privileged Position*

COINCIDE(INITIAL-FOOT), *FOOT(σ) >> WEIGHT-IDENT >> GH, WSP >> TROCHEE

The effects of the ranking in (20) are shown in tableaux (21) to (25). Tableau (21) shows that by outranking the constraint GROUPING HARMONY, WEIGHT-IDENT blocks trochaic shortening. *FOOT(σ) avoids a syllable with the long vowel forming its own foot.

(21) Guugu Yimidhirr: Long Vowels in initial (ˈH.L)-Foot

	/ CV: CV …/	*FOOT(σ)	WEIGHT-IDENT	GH
a.	☞ (ˈH.L)…			*
c.	(ˈL.L)…		*!W	L
b.	(ˈH).L.…	*!W		L

In tableau (22), the constraint WEIGHT-IDENT by outranking WEIGHT-TO-STRESS PRINCIPLE prevents the triggering of vowel shortening. The constraint *FOOT(σ) blocks the shrinking of the disyllabic feet. The constraint TROCHEE, although ranked below WEIGHT-IDENT, rules out an iambic analysis of [CV:.CV:] sequences.

(22) Guugu Yimidhirr: Long Vowels in initial (ˈH.H)-Foot

	/ CVː CVː …/	*FOOT(σ)	WEIGHT-IDENT	WSP	TROCHEE
a.	☞ (ˈH.H)…			*	
b.	(H.ˈH)…			*	*!W
c.	(L.ˈH)…		*!W	L	
d.	(ˈH)(ˌH)…	**!W		L	

Although within the initial foot, long vowels can occur in unstressed positions since the ranking of Guugu Yimidhirr, repeated in (23), disfavors quantity adjustments (i.e. WEIGHT-IDENT >> GROUPING HARMONY, WEIGHT-TO-STRESS PRINCIPLE), it also opens a context in which sensitivity to syllable weight can arise, similar to the case of Shipibo. The ranking of WEIGHT-TO-STRESS PRINCIPLE over TROCHEE ensures that initial input sequences like / CV CVː/ will be parsed into an iambic (L.ˈH) foot and not into a trochaic (ˈL.H)-foot.

(23) *Guugu Yimidhirr: Long Vowels in a Privileged Position*

COINCIDE(INITIAL-FOOT), *FOOT(σ) >> WEIGHT-IDENT >> GH, WSP >> TROCHEE

In tableau (24), by dominating TROCHEE, WEIGHT-IDENT inhibits iambic shortening (i.e. /LH/ → (ˈL.L)). Thus, although Guugu Yimidhirr prefers parsing pairs of syllables into disyllabic trochaic feet, in the case of initial [CV.CVː] sequences, it is forced to parse them as an iambic (L.ˈH) foot. This result is obtained because the urgency to satisfy WEIGHT-TO-STRESS PRINCIPLE overrides the trochaic rhythm.

(24) Guugu Yimidhirr: The Rise of Sensitivity to Syllable Weight

	/ CV CVː …/	WEIGHT-IDENT	WSP	TROCHEE
a.	☞ (L.ˈH)…			*
b.	(ˈL.H)…		*!W	L
c.	(ˈL.L)…	*!W		L

Now, beyond the initial foot, the positional markedness constraint COINCIDE(INITIAL-FOOT) takes charge of input long vowels. It forces them to map onto short vowels. See tableau (25).

(25) Guugu Yimidhirr: Long Vowels Banned beyond the Initial Foot

	/CV CV CVː CV/	COINCIDE(INITIAL-FOOT)	WEIGHT-IDENT	GH
a.	☞ (ˈL.L)(ˌL.L)		*	
b.	(ˈL.L)(ˌH.L)	*!W	L	*W

2.3 Arabic: The Triumph of the (H)-Foot

Thus far, the dissertation has presented cases in which the undominated status of the constraint *FOOT(σ) yields the occurrence of disyllabic feet with or without quantity adjustments.

The inclusion of the constraint *FOOT(σ), which penalizes the occurrence of feet smaller than two syllables, may raise concerns about the viability of modeling languages with heavy syllables that form their own feet. This section addresses those concerns by showing that the inclusion of *FOOT(σ) in the set of universal constraints, CON, does not prevent us to obtain languages that allow the emergence of the (H)-foot.

The following focuses on the discussion of Cairene Arabic[7] (Hayes 1995:67-71; Kenstowicz 1994:291-2; McCarthy 1979; Mitchell 1960; Prince 1990:9, among many others), a language in which heavy syllables form their own (H)-feet. See data in (26).

(26) <u>Cairene Arabic[8]</u>

a. (ˌʃa.ja)(ˈra.tu)		‘tree’ (nom. sg.)
b. (ˌʃa.ja)(ˈra.tu) hu		‘his tree’
c. (ˌʔad)(ˌwi.ya)(ˈtu.hu)		‘his drugs’ (nom) - Classical
d. (ˌqaː)(ˈhi.ra),	*(ˈqaː.hi).ra	‘Cairo’
e. (ˌʔaː)(ˈla.mu),	*(ˈʔaː.la).mu	‘his world’

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[7] This includes the variety used by Egyptian news broadcasters (Harrell 1960; Hayes 1995:130-2) called Modern Standard Arabic.

[8] The transcriptions of Cairene Arabic show where the heads of the secondary feet are. However, it is important to mention that those secondary heads seem not to be always phonetically implemented, but their role as heads can be deduced from the position of the main head (McCarthy 1979; Prince 1990).

f. (ˌhaː)(ˈdaː).ni, *(ˈhaː.daː).ni ‘these’ (m. dual) - Classical

g. (ˌdaw)(ˈliː) ya, *(ˈdaw.liː) ya ‘international’

h. (ˌqad)(ˈdam) na, *(ˈqad.dam) na ‘we presented’

In these type of Arabic, GROUPING HARMONY and WEIGHT-TO-STRESS PRINCIPLE impose restrictions on the distribution of heavy syllables. As in Shipibo, they cannot occur unstressed or as heads of uneven trochees. However, unlike Shipibo, in Cairene Arabic, long vowels do not undergo vowel shortening[9].

Thus, both the requirement to comply with the WT-restrictors (i.e. GROUPING HARMONY and WEIGHT-TO-STRESS PRINCIPLE) and to satisfy the QA-inhibitors (i.e. WEIGHT-IDENT and WEIGHT-BY-POSITION) makes it impossible to achieve disyllabic feet. This situation demands the shrinking of disyllabic feet and allowing the (H)-foot to emerge. See ranking in (27).

(27) (H)-feet in Cairene Arabic and Modern Standard Arabic

WEIGHT-IDENT, GROUPING HARMONY, WEIGHT-TO-STRESS PRINCIPLE >> *FOOT(σ)

Tableaux (28) and (29) show the effect of the ranking in (27). In both tableaux, heavy syllables with long vowels form their own feet in order to respect vowel length and the distributional restrictions on heavy syllables.

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[9] C.f. Palestinian Arabic (Hayes 1995; Kenstowicz 1983) where long vowels shorten in pretonic positions.

(28)	/ ʔaːlamu /	WEIGHT-IDENT	GROUPING HARMONY	*FOOT(σ)
a.	☞ (ˌH)(ˈLL)			**
b.	(ˈH.L).L		*!W	L
c.	(ˈL.L).L	*!W		L

(29)	/haː.daː.ni/	WEIGHT-TO-STRESS PRINCIPLE	*FOOT(σ)
a.	☞(ˌH)(ˈH)L		**
b.	(ˈH.H).L	*! W	L

Thus, foot-disyllabicity not only accounts for cases like Shipibo, which are sensitive to syllable weight but prefer disyllabic feet, but also accounts for languages like Cairene Arabic, which are also sensitive to syllable weight but cannot always achieve disyllabic feet. In languages like Cairene Arabic, the footing of heavy syllables into (H)-feet is motivated by trying to satisfy *QA-Inhibitors* (i.e. WEIGHT-IDENT or WEIGHT-BY-POSITION) and to comply with the restrictions imposed on the distribution of heavy syllables. This type of (H)-foot never triggers vowel lengthening since this would violate WEIGHT-IDENT. The cost of these priorities is giving up foot-disyllabicity.

3 Contextual CVC-Weight and the Emergence of the (H)-Foot

This dissertation showed that the interaction between the constraint *FOOT(σ) and those in charge of imposing restrictions on the distribution of heavy syllables in Shipibo results in closed syllables showing contextual weight. Aside from Shipibo, there are many other cases reported of closed syllables with contextual weight, which can be found in Broselow, Chen et al. 1997; Chung 2002; Gordon 2004; Hayes 1994; McCarthy 1979; Moren 1999; 2000; Rice 1995; Rosenthall and van der Hulst 1999; Vaysman 2004, among others. However, in contrast to Shipibo in which closed syllables vary their weight throughout the PrWd, most of the cases reported involve specific contexts in which either closed syllables that are generally light behave heavy, or closed syllables that are generally heavy behave light.

This section will not repeat those analyses but instead will concentrate on the case of Tamil (Bosch and Wiltshire 1992; Christdas 1988; 1996; Gordon 2004; Keane 2001; 2005; Vasanthakumari 1989). What is interesting about Tamil is that the emergence of the (H)-foot[10] in order to avoid a (L)-foot forces closed syllables to contextually vary their weight. This contrasts with Shipibo in which the striving to obtain disyllabic feet forces closed-syllables to vary their weight.

According to Christdas 1996, unstressed syllables in Tamil are characterized by undergoing vowel reduction or laxing whereas stressed syllables do not. The PrWd main head is always located in the initial syllable except when the sequence [CV CV:] is found.

[10] A case similar to Tamil, in which closed syllables are forced to be heavy in order to avoid a (L)-feet, is also found in Chugach Pacific Yupik (Hayes 1995; Leer 1985; Rosenthall and van der Hulst 1999).

In that case, main stress goes on the second syllable. See data in (30) and (31). As usual, the main head of the PrWd is indicated by the symbol [ˈ] and the head of secondary feet are indicated by the symbol [ˌ].

(30) Tamil: Initial Stress (Christdas 1996)

a. (ˈpa.lə)(ˌxaː).rə̃	'snacks'
b. (ˈva.jəl)	'field'
c. (ˈom.bə).dɯ	'nine'
c. (ˈraːt)(ˌti.ri)	'night'
d. (ˈruː)(ˌvaː)	'rupee'

(31) Tamil: Stress on Second Syllable (Christdas 1996)

d. (pə.ˈlaː)	'jack fruit'
e. (pə.ˈraː).dɪ	'complaint'

The analysis proposed here for Tamil sees closed syllables as generally light. As observed in (32.a), the second closed syllable fails to attract the stress. Compare it with the behavior of the long vowels in that position in (31). Words as in (32.b) also suggest that closed syllables are light. The closed syllable does not form its own foot since, otherwise, the following syllable would not undergo vowel reduction.

(32) Tamil (Christdas 1996)

a. (ˈva.jəl), *(və.ˈjal) 'field'

b. (ˈom.bə).dɯ, *(ˈom)(ˌba.dɯ) 'nine'

In contrast to the behavior of closed syllables above, initial closed syllables in Tamil are heavy. See data in (33).

(33) Tamil (Christdas 1996)

a. (ˈsan)(ˌdeː).xə̃ 'mother'

b. (ˈcan)(ˌtoː)(cə.ˌmaː).kə 'joyously' (adverb) (Keane 2001)

c. (ˈraːt)(ˌti.ri) 'night'

d. (ˈruː)(ˌvaː) 'rupee'

In both (33.a-b), the closed syllable obtains the main stress although the following syllable has a long vowel. Initial closed syllables in Tamil behave like syllables with long vowels (see (33.c-d)).

What makes initial closed syllables heavy in Tamil is an alignment constraint requiring that a stressed syllable be aligned with the left edge of the PrWd (see Gordon 2004 for a similar observation). See definition in (34). If in the examples in (33.a-b), the second syllable with the long vowel had obtained the main stress, then the constraint ALIGN-LEFT would be violated.

(34) ALIGN-LEFT: The PrWd left-edge is aligned with a head-syllable.

The ranking that accounts for the weight of closed syllables and Tamil as well as for the behavior of long vowels is given in (35).

(35) Tamil: General Ranking for Syllable Weight

*FOOT(μ), WEIGHT-ID, WSP, GH >> ALIGN-LEFT >> *FOOT(σ) >> WBP

Under the ranking in (35), Tamil is like Cairene Arabic. Long vowels do not shorten and heavy syllables cannot occur in unstressed positions or as heads of uneven trochees. The fulfillment of these requirements shrinks the disyllabic size of feet and allows the (H)-foot to emerge. This can be observed in (35) through the ranking of WEIGHT-IDENT, WEIGHT-TO-STRESS PRINCIPLE, and GROUPING HARMONY over *FOOT(σ). See tableaux in (36) and (37).

(36) /CV: CV: / → (ˈH)(ˌH) (e.g. (ˈruː)(ˌvaː) ‘rupee’)

		WEIGHT-TO-STRESS PRINCIPLE	WEIGHT-IDENT	*FOOT(σ)
a.	☞ (ˈH)(ˌH)			**
b.	(ˈL.L)		**!W	L
c.	(ˈH.H)	*!W		L

(37) /CV: CV CV / → (ˈH)(ˌL.L) (e.g. (ˈraːt)(ˌti.ri) 'night')

		GROUPING HARMONY	*FOOT(σ)
a.	☞ (ˈH)(ˌL.L)		**
b.	(ˈH.L).L	**!W	L

However, the story that the ranking in (35) tells is rather different for closed syllables. In this case, achieving disyllabic feet and avoiding unstressed heavy syllables as well as uneven trochees is more important than obtaining heavy closed syllables. This can be observed in (35) through the ranking of WEIGHT-TO-STRESS PRINCIPLE, GROUPING HARMONY and *FOOT(σ) over WEIGHT-BY-POSITION. Thus, closed syllables surface light when they do not occur in head-positions or as heads of trochaic feet. See tableaux (38) and (39).

(38) /CVC CV CV / → (ˈL.L).L (e.g. (ˈom.bə).dɯ 'nine')

		GROUPING HARMONY	*FOOT(σ)	WEIGHT-BY-POSITION
a.	☞(ˈL.L).L			*
b.	(ˈH)(ˌL.L)		*!W	L
c.	(ˈH.L).L	*!W		L

(39) /CV CVC / → (ˈL.L) (e.g. (ˈva.jəl)‘field’)

		WEIGHT-TO-STRESS PRINCIPLE	WEIGHT-BY-POSITION
a.	☞ (ˈL.L)		*
b.	(ˈL.H)	*!W	L

In the case of initial closed syllables followed by a syllable with a long vowel, the ranking of ALIGN-LEFT over WEIGHT-BY-POSITION is crucial. See an example in (40).

(40) <u>Tamil</u> (Hayes 1995; Leer 1985)

a. (ˈsan)(ˌdeː).xə̃ ‘mother’

b.*(san.ˈdeː).xə̃

The alignment constraint forces the closed syllable to be heavy in order to have a head syllable aligned with the PrWd left edge and to avoid a degenerate (L)-foot. If the closed syllable were light then the syllable with the long vowel would attract the stress away from the left edge. In other words, the pressure of having a head syllable aligned with the PrWd left edge creates a heavy syllable word-initially. This, in turn, is the cause of the variable weight of closed syllables in Tamil. This is shown in tableau (41).

(41) /CVC CV: CV / → (ˈH)(ˌH).L (e.g. (ˈsan)(ˌdeː).xə̃ 'mother')

		*FOOT(μ)	ALIGN-LEFT	*FOOT(σ)	WEIGHT-BY-POSITION
a.	☞(ˈH)(ˌH).L			**	
b.	(L.ˈH).L		*!W	L	*W
c.	(ˈL)(ˌH).L	*!W		**	*W

However, ALIGN-LEFT does not have the same effect on vowel length, that is, it cannot cause a short vowel to lengthen or shorten. This is because the constraint WEIGHT-IDENT dominates ALIGN-LEFT in the ranking in (35). See tableau (42).

(42) /CV CVː / → (L.ˈH) (e.g. (pə.ˈlaː) 'jack fruit')

		WEIGHT-IDENT	ALIGN-LEFT	*FOOT(σ)
a.	☞(L.ˈH)		*	
b.	(ˈL.L)	*!W	L	
c.	(ˈH)(ˌH)	*!W	L	**W

Words like (pə.ˈlaː) 'jack fruit' in Tamil also indicate that *FOOT(μ) and WEIGHT-TO-STRESS PRINCIPLE outrank ALIGN-LEFT. Otherwise, the syllable with the long vowel could have been left unstressed or the initial short-voweled syllable could have formed an (L)-foot in order to satisfy ALIGN-LEFT. See tableau (43).

(43) /CV CVː / → (L.ˈH) (e.g. (pə.ˈlaː) ‘jack fruit’)

		*FOOT(μ)	WSP	ALIGN-LEFT	*FOOT(σ)
a.	☞(L.ˈH)			*	
b.	(ˈL.H)		*!W	L	
d.	(ˈL)(ˌH)	*!W		L	**W

Whereas previous chapters have demonstrated the need of the constraint *FOOT(σ) for Panoan languages like Shipibo and Capanahua, this chapter has focused on the role of *FOOT(σ) in other grammars. With regard to closed syllables with contextual weight, section §3 has illustrated that the enforcement of foot-disyllabicity is not the only way to obtain contextual weight in closed syllables. The emergence of the (H)-foot to avoid a degenerate (L)-foot can make closed syllables vary their weight. The latter case has been argued with reference to the language Tamil (Bosch and Wiltshire 1992; Christdas 1988; 1996; Gordon 2004; Keane 2001; 2005; Vasanthakumari 1989).

In contrast to Shipibo, Tamil obtains contextual CVC-weight in initial syllables by means of a constraint that demands that a head syllable be aligned with an edge of the PrWd. Contextual CVC-weight, through the emergence of the (H)-foot, always has a more restricted distribution than in the case of disyllabic feet because it depends on the specific contexts in which a language allows the (H)-foot to emerge.

4 Conclusions

This chapter has shown that the inclusion of the constraint *FOOT(σ) not only makes it possible to account for quantity-insensitive footing in languages with heavy syllables but also the emergence of quantity-sensitive footing in languages in which heavy syllables form their own feet.

Moreover, the chapter has made clear that there is no clear cut between quantity-sensitive and quantity-insensitive languages, an observation also made by Alber 1999; Kager 1992a. Quantity sensitivity is contextually determined by the interaction of *FOOT(σ) and the constraints in charge of syllable weight and its distributional restrictions.

As stated at the outset of this dissertation, foot-disyllabicity (embodied in the constraint *FOOT(σ)) is central to the understanding of the emergence of the (H)-foot and why grammars resort to it. Alone the stringent relation between *FOOT(σ) and the classical *foot binarity* constraint, here labeled as *FOOT(μ), establishes a scale of preferability in which disyllabic feet are preferable than monosyllabic (H)-feet and in turn, monosyllabic (H)-feet are more preferable than monosyllabic (L)-feet.

However, the existence of other conflicting forces interacting with both stringent constraints, *FOOT(σ) and *FOOT(μ), can block the occurrence of disyllabic feet. Whether feet are disyllabic or monosyllabic (H)- or (L)-feet in a given metrical context depends on the conflict between satisfying the constraints *FOOT(σ) and *FOOT(μ), respecting QA-inhibitors and complying with WT-restrictors. Grammars trigger a number of strategies to solve this conflict. They can present apocope, syncope (see Gouskova 2002a; b; 2003a; b for the treatment of prosodically-triggered syncope and apocope), light closed syllables, vowel lengthening and shortening, quantity-sensitive footing (i.e. the (H)-foot), etc. Grammars sacrifice one of these three forces in order to satisfy the other two.

Thus, the respect for foot-disyllabicity and the restrictions on the distribution of weight results in the triggering of quantity adjustments (that is, the violation of QA-inhibitors). The respect for foot-disyllabicity and QA-inhibitors in a given context comes at the cost of allowing non-canonical feet to occur (that is, the violation of WT-restrictors). Finally, the respect for restrictions on the distribution of weight and the prohibition of quantity adjustments amounts to the contextual abandonment of foot-disyllabicity and the emergence of the (H)-foot (that is, the violation of *FOOT(σ)).

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