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The Phonetics And Phonology Of Bora Tone

Amy Beth Roe

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THE PHONETICS AND PHONOLOGY OF BORA TONE

by

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Bachelor of Arts, University of Minnesota Duluth, 2006
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A Thesis
Submitted to the Graduate Faculty

of the

University of North Dakota

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for the degree of

Master of Arts

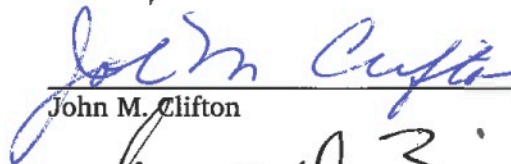
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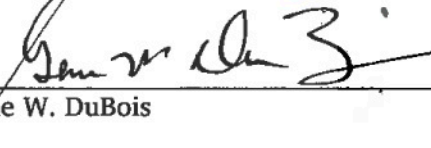
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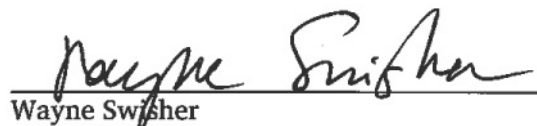


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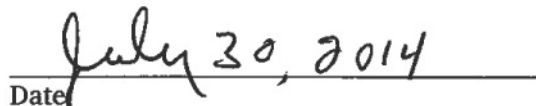


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This thesis is being submitted by the appointed advisory committee as having met all of the requirements of the School of Graduate Studies at the University of North Dakota and is hereby approved.



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Above all, I would like to give honor and glory to the Lord, Who created all peoples and the languages they speak.

ABBREVIATIONS

1GEN	First person genitive	TBU	Tone Bearing Unit
3SG	Third person singular	TERM	Terminal/dead
AN	Animate	TRANS	Translative
AUG	Augmentative	U. Form	Underlying form
C	Consonant	V	Vowel
DIM	Diminutive	VZR	Verbalizer
DU	Dual		
F	Feminine		
GEN	Genitive		
IN	Inanimate		
ITER	Iterative aspect		
M	Masculine		
MOM	Single action verb		
NEG	Negative		
OCP	Obligatory Contour Principle		
PL	Plural		
PUR	Purpose		
REFL	Reflexive		
RELOC	Relocation		
SG	Singular		
SOC	Sociative case		
S. Form	Surface form		

ABSTRACT

Bora is a Witotoan language spoken in Peru and Colombia. It has an unusual mixed tone/stress system in which L is the specified tone and H the unspecified tone. In this thesis, I describe the underlying tone patterns of noun and verb roots and show how their surface representations change in different phonological environments. I examine noun stems with seven different suffixes and one prefix and verb stems with thirteen different suffixes.

Disyllabic noun roots have three underlying tone patterns: $L\emptyset$, $\emptyset L$, and $\emptyset\emptyset$. Additionally, Bora has a low boundary tone that associates to the right edge of noun phrases. Verb roots are underlyingly toneless. However, verb stems with bound suffixes are assigned one of the following tone patterns based on their suffix: $L\emptyset$, $\emptyset L$, or $\emptyset\emptyset$. Bora also has a verbal boundary tone that associates to the right edge of verb stems. Affixes may be toneless, have underlying low tones, or have floating low tones.

In addition to the underlying tone patterns of morphemes, Bora assigns low tones to stressed syllables. One and two syllable words have stress on the penultimate syllable, while longer words have antepenultimate stress.

In Bora, the Obligatory Contour Principle restricts sequences of adjacent low tones. Bora exhibits three responses to OCP conflicts: L Merger, L Deletion, and L Delinking. The choice of OCP resolution is lexically and phonologically determined.

CHAPTER 1

INTRODUCTION

Bora [boa]² is a Witotoan³ language spoken along the Amazon River. There are approximately 3,000 Bora people living in Peru and 650 in Colombia (Crevels 2007:116).⁴ Mirañá, a close dialectal variant of Bora, is also spoken in the northwestern Amazon region of Colombia (Crevels 2007:151), although Seifart (2005:21) notes that the Mirañá people consider themselves ethnically and linguistically distinct from the Bora people. In the past, the Mirañá dialect was also spoken in Brazil, where it was known as Miranha, but speakers there have shifted to Portuguese (Crevels 2007:151).⁵

² Languages are identified using ISO 639-3 language codes, which are provided in square brackets following the language name.

³ In this paper, I follow the traditional classification of Bora as a Witotoan language, as supported by Tax (1960:433), Key (1979:104), Thiesen and Thiesen (1975:11), Greenberg (1987:385), Aschmann (1994:2), and Thiesen and Weber (2012:1). However Solís Fonseca (2003:149) argues that Bora is not a Witotoan language, suggesting instead that Bora and Witoto descended from the same proto language and branched into separate language families in the distant past. Kaufman (1994:63) also considers Boran and Witotoan to be different language families in the Bora-Witotoan stock. He further divides the Boran language family into two languages, Bora-Muinane and Bora-Miranya, the latter of which has two dialects: Bora (Peru) and Miranya (Colombia).

⁴ Of the approximately 3,000 Bora people in Peru, 2,000 are fluent Bora speakers. The number of fluent speakers in Colombia is unknown.

⁵ While there are still approximately 600 ethnic Miranha people living in the Brazilian Amazon, there are no reported L1 speakers and Miranha is considered to be dormant in Brazil (Crevels 2007:151).

I elicited data for this project in two Bora communities in northern Peru, San Andrés and Brillo Nuevo. San Andrés is located on the Momón River, a tributary of the Nanay, one of the major tributaries of the Amazon River, while Brillo Nuevo is near the Colombian border on the remote Yaguasyacu River. Figure 1 shows a map of the area where I conducted my research.⁶

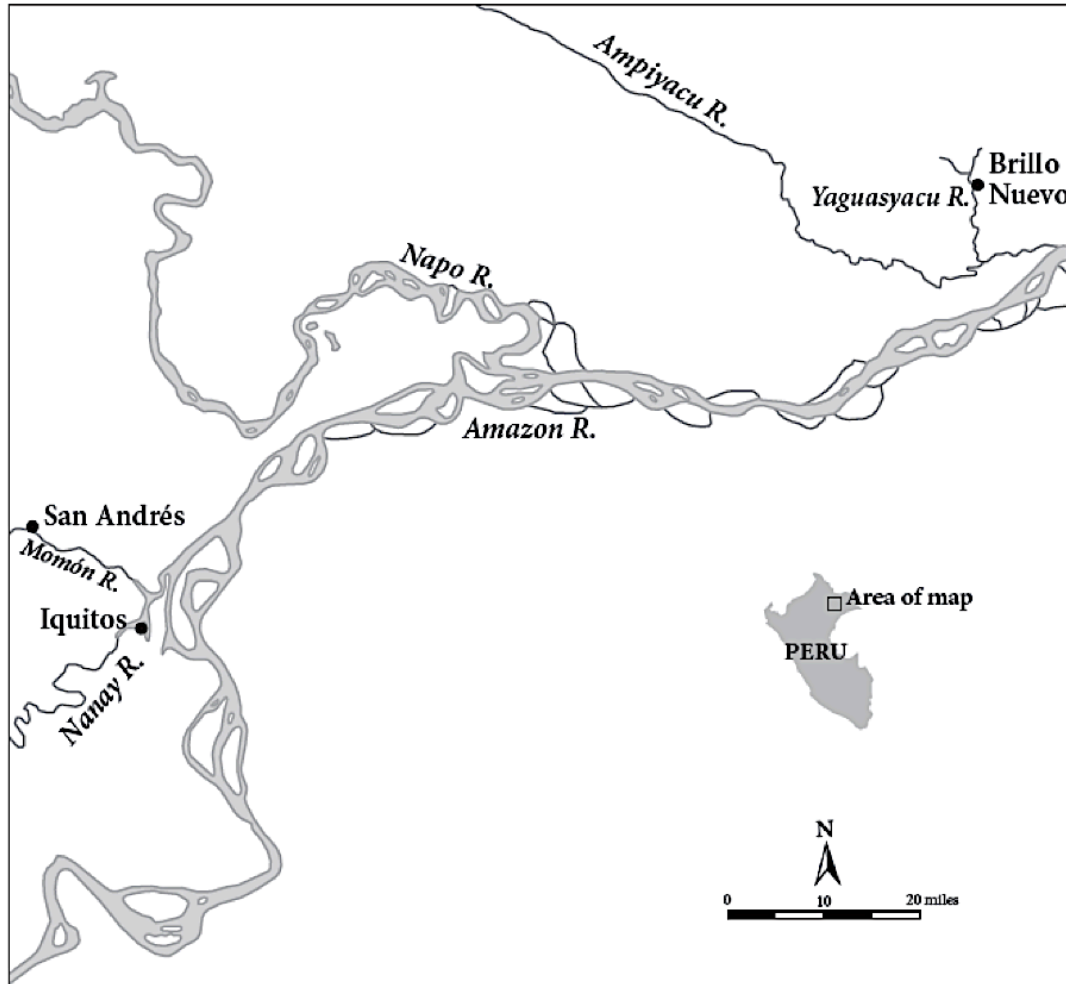


Figure 1. Map of Research Area in Peru

⁶ Map created for this thesis by Mapping Specialists Limited. I own the copyright under Section 101 of the Copyright Act (title 17 of the *U.S. Code*), as the map was commissioned as a “work made for hire”.

The purpose of this thesis is to describe selected aspects of the Bora tone system.

Three questions guided my research:

- 1) How many underlying tone patterns associate to noun and verb roots?
- 2) How are these patterns realized in different phonological environments?
- 3) What are the acoustic correlates of high and low tone?

The thesis is structured as follows. Chapter 1 is introductory in nature, with an outline of research methodology and practices in Section 1.1 followed by a brief overview of the Bora language in Section 1.2. In Section 1.3, I relate the history of the Bora people and assess Bora language use. I conclude this chapter in Section 1.4 by summarizing documents of interest to readers who would like to learn more about the Bora tone system.

In Chapter 2, I establish the acoustic correlates of high and low tone in Bora by measuring intensity, duration, and fundamental frequency. The majority of the analysis is based on the speech of six male research subjects. However, I also present a more limited study of the fundamental frequencies of four female speakers.

Chapters 3 and 4 are dedicated to a phonological description of the tone system. I examine the underlying tone patterns of nouns (Chapter 3) and verbs (Chapter 4) and show how their surface patterns change in different phonological environments. I also discuss the relationship between stress and tone.

In Chapter 5, I provide a summary of nominal and verbal tone, compare my analysis to previous studies by Thiesen and Weber (2001, 2012) and Seifart (2005), and pose questions for future research. I also suggest orthography revisions and develop ideas for teaching students to identify and write tone.

Throughout this analysis, I reference the work of Thiesen and Weber (2012), who have done extensive research on the Bora tone system. This raises the question: Why present a new analysis of Bora tone? The primary reason is that existing work on the subject is based on the tones of individual syllables, while I examine the underlying

tone patterns of morphemes, following the methodology described in Snider (2013). As I discuss in Chapter 5, this allows me to make some generalizations that would not be possible in a syllable-level approach.

Thiesen and Weber (2012:98) provide the following assessment of their work on Bora tone: “[O]ur description – and the analysis implicit in it – are too complicated. Of course, the complexity of the facts themselves cannot be reduced. . . . The challenge, therefore, is to find analyses that reduce the complexity.” In subsequent chapters, I show how the analysis of Bora tone can be simplified by considering the underlying patterns of morphemes.

1.1 Research Methodology and Practices

Research for this project was conducted between June of 2010 and July of 2013 under a proposal approved by the University of North Dakota’s Institutional Review Board.⁷ I took three fieldwork trips to Peru, each of which lasted 6-9 weeks, during which I gathered data from speakers in San Andrés and Brillo Nuevo. Residents of both of these communities use Bora as their primary language of communication.

My initial sources of data were the Bora/Spanish dictionary (Thiesen and Thiesen 1998) and the description of the tone system in Thiesen and Weber (2012).⁸ I also referred to Wes Thiesen’s field notebooks, which are on microfiche at the Language and Culture Archives in Dallas, Texas.⁹ From these sources, I compiled a preliminary

⁷ Project Title: The Phonetics and Phonology of Bora Tone, IRB-201006-356.

⁸ As this text had not yet been published, I used a draft provided by David Weber.

⁹ I am indebted to David Weber, who requested the field notebooks on my behalf; to Mary Ruth Wise, who worked tirelessly to locate them, as they were in storage waiting to be processed; and to Hugh Paterson III, who scanned the notebooks and converted them to PDF files.

wordlist that was revised and expanded with input from Bora speakers, resulting in a final corpus of 500 noun stems and 300 verb stems.¹⁰ I then elicited each of these stems with a series of affixes. Animate nouns were elicited with seven suffixes and one prefix,¹¹ inanimate nouns with six suffixes and one prefix,¹² and verbs with thirteen suffixes.¹³

My primary language consultants were two L1 speakers of Bora from the community of Brillo Nuevo. To elicit data, I gave these consultants a list of noun and verb stems, to which they orally added affixes while I transcribed what they said. Then, we checked my transcription together.

I gathered additional data by working long-distance with a Bora speaker living in Iquitos. I e-mailed her a set of paradigms with the noun and verb stems I needed. She wrote in the forms with affixes and sent the files back to me.¹⁴

Drawing from the corpus of data I had compiled for the phonological analysis, I assembled a set of words for audio recording. These recordings form the basis of the acoustic analysis presented in Chapter 2. (A description of the research methodology used for the acoustic analysis can be found in Section 2.2.)

¹⁰ Throughout this paper, I focus primarily on one, two, and three syllable stems. Although I elicited stems longer than three syllables, I do not include them in the phonological analysis in Chapters 3 and 4 because nearly all of them are compounds. Approximately 400 of the 500 noun stems in my corpus and 200 of the verb stems are three syllables or shorter. These stems are listed in Appendices C and D.

¹¹ For a list of animate noun suffixes elicited for this analysis, see Tables 4 and 6.

¹² For a list of inanimate noun suffixes elicited for this analysis, see Tables 5 and 6.

¹³ For a list of verb suffixes elicited for this analysis, see Table 8.

¹⁴ During my trips to Peru, I worked closely with this speaker and found that her tone transcription is even better than mine. As this speaker was a licensed teacher who had worked for many years in the bilingual school in Brillo Nuevo, she had extensive experience teaching students to identify and write tone in Bora.

1.2 An Overview of the Bora Language

In this section, I present a basic overview of the Bora language as background for the discussion of tone in the remainder of the thesis. In Section 1.2.1, I describe Bora segmental phonology, while in Section 1.2.2, I outline the syllable profiles¹⁵ of noun and verb roots. The following two sections are dedicated to the morphology of Bora nouns (Section 1.2.3) and verbs (Section 1.2.4). In Section 1.2.5, I introduce the Bora tone system and discuss the role of tone in Bora drum communication.

1.2.1 Vowel Inventory

Bora has an inventory of six vowels that also exhibit contrastive length. These are presented in Table 1.

Table 1. Vowel Inventory

	Front	Central	Back
high	i / i:	ɨ / ɨ:	u / u:
mid	ɛ / ɛ:		o / o:
low		a / a:	

The Bora vowel system is striking in that it contains three high unrounded vowels, /i/, /ɨ/ and /u/. Such a combination is exceedingly rare; of the 451 languages in the UCLA Phonological Segment Inventory Database (UPSID), only nine have a central vowel and a back vowel whose features are otherwise identical (Parker 2000). In describing the three-way contrast between /i/, /ɨ/ and /u/, Parker (2001:193) states: “Probably no other language in the world has a phonological vowel system exactly like that of Bora.”

¹⁵ Throughout this thesis, I use the term “syllable profile” to refer to the sequence of consonants and vowels in a given word.

Bora displays a limited vowel harmony system in which the high front unrounded vowel [i] assimilates to [i] when it directly precedes syllables with [i]. This is shown in (1a), where the vowel of the second person genitive prefix *ti-* assimilates to the initial [i] of the following root. In (1b), the vowel does not assimilate because it is followed by a syllable with [ɛ]. Vowel harmony of this variety applies across morpheme boundaries but not across word boundaries.

1. a. tí-mí:ʔǎ:
2GenSg-skin
'your skin, hide, fur'
- b. tí-ʔé:k^hǒ:
2GenSg-meat
'your meat'

A number of suffixes in Bora cause the vowel of the preceding syllable to lengthen. The final /o/ of *úxì-ʔò* 'banana' lengthens when it is followed by the inanimate dual suffix *-k^hu* or the inanimate plural suffix *-nɛ* in (2b) and (2c), but not when it is followed by the diminutive suffix *-kɾu:*, as in (2d).

	U. Form	S. Form
2. a.	/uxi-ʔo/	úxì-ʔò banana-oblong 'banana'
b.	/uxi-ʔo:-k ^h u/	úxì-ʔó:-k ^h ù banana-oblong-InDu 'two bananas'
c.	/uxi-ʔo:-nɛ/	úxì-ʔó:-nè banana-oblong-InPl 'bananas'
d.	/uxi-ʔo-kɾu:	úxí-ʔó-kɾù? banana-oblong-DIM 'small banana'

To explain this lengthening, I propose that *-k^hu* and *-nɛ* have underlying moras that associate to the vowels of preceding syllables. (I develop this idea further in Chapter 3.)

The consonant inventory of Bora has nineteen phonemes. These are presented in Table 2.

Table 2. Consonant Inventory

	Labial	Alveolar	Palatal	Velar	Labial-Velar	Glottal
Stop	p	t		k	$\widehat{kp} \sim k^w$	ʔ
Stop: Aspirate	p ^h	t ^h		k ^h		
Affricate		ts	tʃ			
Affricate: Aspirate		ts ^h	tʃ ^h			
Nasal	m	n	ɲ			
Fricative	β			x		
Approximant		j				
Flap		ɾ				

All consonants except [\widehat{kp}] may be either palatalized or nonpalatalized, with palatalization occurring primarily after [i] and [a] (see Example (3) for exceptions).¹⁶ Aschmann (1993:18) accounts for this distribution by reconstructing proto Bora-Muinane with the diphthong [ai], which palatalizes the following consonant, and a subsequent rule that reduces [ai] to [a] preceding a palatalized consonant.¹⁷

A handful of Bora words have palatalized consonants that do not follow [i] or [a]; some of these are presented in (3). Thiesen and Weber (2012:38) conclude that “...palatalized consonants have now become independent phonemes (in at least some

¹⁶ For a more detailed discussion of palatalized phonemes in Bora, see Thiesen and Weber (2012:37).

¹⁷ Seifart (2005:33-36) similarly suggests that Mirañá (a dialect of Bora) has a seven vowel system, with the six vowels in Table 1 and an underlying vowel /aj/, which causes palatalization.

contexts)”. Seifart (2005:35-36), however, considers these words to be exceptions.¹⁸

All of the examples in my data are word-initial.

3. k^hɛ:ʔɛ̀ì ‘self-centered person’
 t^hòk^háʔò ‘wave’
 nà:mákpà ‘witch doctor, enchanter’

Thiesen and Thiesen (1975:3) transcribe the Bora /r/ as a voiced alveolar trill, but I hear it as a retroflexed tap. Aschmann (1993:6) also analyzes this sound as retroflexed, although he considers it to be a voiced retroflexed alveolar fricative. It is occasionally pronounced as the non-retroflexed tap /r/, especially word-medially among younger speakers; this is likely due to the influence of Spanish. Its palatalized counterpart is [j].

The double stop [kp̠] varies phonetically with [k^w]. I observed that older speakers were more likely to use [kp̠] while younger speakers showed a preference for [k^w], especially word-medially and in rapid speech.

1.2.2 Syllable Profiles

Bora syllables are primarily (C)V and (C)V:. The only permissible syllable codas are [x] and [ʔ]. In coda position, [x] is limited to word-medial syllables preceding stops, leading Aschmann (1993:18) to consider it a remnant of Proto Witotoan geminate stops. Thus, Aschmann analyzes [x] not as a coda but as part of the onset of the following syllable, forming what he terms a “pre-aspirated stop”.

[ʔ] has much freer distribution, occurring both word-finally and word-medially before any consonant. In isolation, all vowel-final stems have glottal codas, which I do not include in the transcriptions in this paper for three reasons:

- a) Glottal codas are highly predictable.

¹⁸ Seifart (2005:36) concludes that palatalized affricates are independent phonemes, while other palatalized consonants are allophones of their non-palatalized counterparts.

- b) They do not occur utterance-medially.
- c) They have no bearing on tone patterns.

Thiesen and Weber (2012:36) report that Bora also has underlying word-final glottal codas that occur utterance-medially, but I do not have any examples of these in my data.

A number of suffixes cause glottal stops or velar fricatives to be inserted between suffixes and preceding syllables. Example (4) presents a verb with the iterative verb class suffix *-xk^ho*.

4. pópò-xk^hò ‘to hit with something pointy to make holes’

Syllables may begin with vowels or single consonants. With the exception of the double stop /*k^w*/ and its allophone [k^w], Bora does not allow complex onsets. I consider palatalized consonants to be single phonemes rather than sequences.

In isolation, both vowel-initial stems and glottal-initial stems are pronounced with glottal onsets. They are contrastive utterance-medially, where stems with underlying glottal phonemes preserve onsets while vowel-initial stems do not. This is illustrated in (5), where the glottal stop is present in the underlying form of [ʔàxtʃ^hì] ‘son’, but not in the underlying form of [ʔòxtsò] ‘smoke’. Although both of these words are pronounced with glottal stops in isolation, they contrast in the frame *tíjè ____* ‘say ____.’

5. a. ʔòxtsò ‘smoke’
 b. tíjè òxtsò ‘say smoke’
 c. ʔàxtʃ^hì ‘son’
 d. tíjè ʔàxtʃ^hì ‘say son’

As the examples in (5) reveal, words with underlying glottal onsets are contrastive with vowel-initial words utterance-medially.

This analysis is based on monosyllabic and disyllabic roots, many of which combine with class marker suffixes to form two, three, and four syllable stems. While longer stems exist in Bora, the majority are compounds, consisting of multiple roots or roots

with more than one class suffix. In order to clearly present the underlying tone patterns of noun and verb stems, I elicited monosyllabic and disyllabic roots with no more than one class marker suffix.

Disyllabic roots are structured around the following syllable template:

$$6. \quad (C) V \left\{ \begin{array}{c} x \\ ? \\ : \end{array} \right\} (C) V \left\{ \begin{array}{c} ? \\ : \end{array} \right\}$$

In Example (7), I present the most common noun root syllable profiles. Class markers are separated from the roots with hyphens.

7.	(C)V	k ^h ù-ḱpà	‘bed’
	(C)V:	p ^h ǎ:-pà	‘pool in the curve of a river’
	(C)VC	ts ^h ò-xk ^h ò	‘otter’
	(C)V(C)V	úímò-pà	‘monkey’
	(C)V:(C)V	k ^h ú:mu-ḱ	‘yellow-footed tortoise’ ¹⁹
	(C)VCCV	t ^h àʔk ^h á-pà	‘sugar apple’ ²⁰
	(C)V(C)V:	p ^h áʔǎ:-ʔò	‘axe’

Verb roots follow the same syllable profiles as noun roots, as shown in (8). Verb stems may consist of free roots or roots with bound suffixes. For further discussion of verb stems, see Chapter 4.

¹⁹ *Chelonoidis denticulata*, the third-largest species of mainland tortoise in the world. They are found throughout the Amazon Basin.

²⁰ The fruit of *annonn squamosa*, also known as sweetsop. It has a green rind and creamy yellow flesh that tastes like custard.

8.	(C)V	tó-mèì	‘to be eaten’
	(C)V:	p ^h è:-t ^h è	‘to shine’
	(C)VC	ts ^h òx-ts ^h ò	‘to bathe’
	(C)V(C)V	ítʃ ^h i-t ^h è	‘to get scared, to be frightened’
	(C)V:(C)V	úxè-t ^h è	‘to arrive’
	(C)VCCV	táɽx-ts ^h ò	‘to dry in the sun’
	(C)V(C)V:	t ^h éβè:-βè	‘to hide’

Seifart (2005:6) observes that Bora generally allows only one heavy syllable (a syllable containing a long vowel or a coda) per word, which is supported by my data. Of the 500 nouns and 300 verbs I elicited, none of the verbs and only 24 of the nouns have more than one heavy syllable.²¹ It is probable that the 24 exceptions are compounds.

Nouns with more than one heavy syllable follow the syllable profiles in (9). I do not include these with the other profiles in (7) as they represent less than 5% of the noun sample and less than 3% of the total sample of noun and verb roots:

9.	(C)V:(C)V:	pà:ɽá:-k̄pà	‘eel’
	(C)VCCV:	páxk̄è:-k̄pà	‘mark, notch’

1.2.3 Morphology of Bora Nouns

Bora morphology is agglutinative and almost exclusively suffixal. While Bora nouns have hundreds of possible suffix morphemes, there is only one set of nominal prefixes, which mark the genitive case. In Chapter 3, I examine nouns with one prefix, the first person singular genitive *t^ha-*.

²¹ I found one word with a long vowel followed by a coda: *á:ʔk^hù-pà* ‘seat’. I do not include this in the list of syllable profiles as I only found one instance in 800 roots (.001% of the sample).

Noun roots combine with class suffixes to form noun stems. Bora has over sixty noun class markers, including *-xi* ‘flat and round’, *-k^ho* ‘long and slender’, and *-ʔɛ* ‘botanical’. In order to analyze words of different lengths, syllable shapes, and underlying tone patterns, I elicited data with eight of the most productive class markers. These are presented in Table 3.

Table 3. Noun Class Markers

Class Suffix	Meaning	Example
<i>-k^ho</i>	stick-shaped (long, slender, pointed)	nòx-k ^h ò stork-stick.shaped ‘stork’
<i>-:pɛ</i>	masculine singular (person or animal)	míně:-pè peccary-SgM ‘male peccary’
<i>-ʔɛ:</i>	botanical (tree or plant)	níjì-ʔè chambira-botanical ‘chambira palm’
<i>-ʔo</i>	1) elongated, oval-shaped 2) enclosure	nè:βá-ʔò peg-elongated.and.round ‘peg’
<i>-xi</i>	flat and round, disk-shaped	t ^h à:pó-xì pill-disk.shaped ‘pill’
<i>-u</i>	1) small and spherical 2) string, thread	ù:ɽí:-ù bubble-spherical ‘bubble’
<i>-kpa</i>	flat and rectangular, plank-shaped	tʃé:ʔò-kpà door-plank.shaped ‘door’
<i>-pa</i>	Wide variety of uses, including (but not limited to): 1) log-shaped 2) box-shaped 3) thick liquid 4) soft fruit 5) year	ò:ɽí-pà abscess-thick.liquid ‘abscess’

Nominal affixes are added to roots in the following order:

10. (Genitive)-Noun Root-(Classifier)-(AUG/DIM)-(Du/Pl)-(Terminal)-(Case)

The order of nominal affixes is illustrated in (11). The noun stem $p^h\varepsilon:tf\varepsilon$ ‘niece’ consists of the root $p^h\varepsilon:$ and the feminine class suffix $-tf\varepsilon$. In the following example, the noun stem occurs with the genitive prefix and each of the possible types of suffixes listed above:

11. $t^h\acute{a}$ - $p\varepsilon$ $-tf\varepsilon$ $-\widehat{kpu}:$ $-mu$ $-u\beta u$ $-m\grave{a}$
 1SgGen niece F DIM AnPl Term ACC
 ‘with my little nieces who have died’

In Bora, animate and inanimate nouns take separate sets of number suffixes. These are presented in Tables 4 and 5.²²

Table 4. Animate Number Suffixes

Suffix	Gloss	Example
∅	ANIMATE SINGULAR	$m\acute{a}m\grave{a}-p\grave{a}$ rattlesnake-log.shaped ‘rattlesnake’
$-mu\upsilon t^h\grave{i}$	MASCULINE ANIMATE DUAL	$m\acute{a}m\acute{a}-p\grave{a}-mu\acute{u}t^h\grave{i}$ rattlesnake-log.shaped-AnDuM ‘two male rattlesnakes’
$-mu\upsilon p^h\grave{i}$	FEMININE ANIMATE DUAL	$m\acute{a}m\acute{a}-p\grave{a}-mu\acute{u}p^h\grave{i}$ rattlesnake-log.shaped-AnDuF ‘two female rattlesnakes’
$-mu$	ANIMATE PLURAL (more than two)	$m\acute{a}m\grave{a}-p\acute{a}-mu$ rattlesnake-log.shaped-AnPl ‘rattlesnakes’

²² This is not an exhaustive list; Bora has a total of five plural suffixes, three of which are not included in this analysis due to space and time limitations: $-ʔ\eta\varepsilon$ ‘various’, $-\beta\alpha$, which is used for numbers and quantities, and $-ʔxi$, which pluralizes pronoun + classifier expressions.

Table 5. Inanimate Number Suffixes

Suffix	Gloss	Example
∅	INANIMATE SINGULAR	pòʔtó-ḱpà paddle-plank.shaped 'paddle'
:-k ^h u	INANIMATE DUAL	pòʔtó-ḱpá:-k ^h ù paddle-plank.shaped-InDu 'two paddles'
:-nɛ	INANIMATE PLURAL	pòʔtó-ḱpá:-nè paddle-plank.shaped-InPl 'paddles'

Other suffixes do not distinguish for animacy. Table 6 lists the remaining nominal suffixes I elicited for this analysis, including examples of each suffix with an animate noun and an inanimate noun.

Table 6. Stem Suffixes

Suffix	Gloss	Example
-ḱpɯ(u)	DIMINUTIVE	òʔpá-ḱpù 'small capybara' ²³ ʔàʔtʃá-ḱpù 'small sore'
-k ^h opa	AUGMENTATIVE	òʔpá-k ^h òpà 'large capybara' ʔàʔtʃá-k ^h òpà 'large sore'
-uβɯ	TERMINATED, DEAD	óʔpà-úβù 'dead capybara' ʔàʔtʃá-úβù 'sore that is now a scar'
-ma	SOCIATIVE	óʔpà-mà 'with a capybara' ʔàʔtʃá-mà 'with a sore'

1.2.4 Morphology of Bora Verbs

Verb stems may be simple (consisting of a free root), complex (consisting of a root and a bound suffix), or compound (consisting of more than one root or a root and multiple suffixes). In this analysis, I examine simple and complex verb stems.

²³ *Hydrochoerus hydrochaeris*, the largest rodent in the world. It is closely related to guinea pigs and rock cavies.

There are two types of verbal suffixes in Bora, Derivation I suffixes, which form part of the verb stem, and Derivation II suffixes, which modify the verb stem.²⁴ As shown in (12) and (13) some verb roots combine with more than one Derivation I suffix. Each suffix changes the meaning of the verb stem.

12. a. póʔi:-t^hɛ
recover-become
'to recover'
- b. póʔi:-ts^hò
recover-CAUS
'to comfort, to console'
13. a. tá:ʔi-t^hɛ
dry-become
'to dry off'
- b. tà:ʔi-βɛ
dry-VZR
'to be very thirsty'

Bora has a wide repertoire of Derivation I suffixes. For this analysis, I elicited roots with some of the most productive Derivation I suffixes, which are displayed in Table 7.

²⁴ I discuss these suffixes in more detail in Chapter 4.

Table 7. Derivation I Suffixes (Verbs)

Suffix	Gloss	Example
-t ^h ɛ	TRANSLATIVE (‘to become’)	k ^h ó:ʔà-t ^h ɛ̃ cold-TRANSL ‘to cool, to chill’
-ts ^h o	CAUSATIVE	p ^h é:t ^h ɛ̃-t ^h ò light-CAUS ‘to light’
-βɛ ²⁵	a) VERBALIZER b) SINGLE ACTION	p ^h ɪ:ʔí-βɛ̃ close-VZL ‘to come close, to approach’ í:k ^h ù-βɛ̃ serve-MOM ‘to serve’
-βa	VERBALIZER	t ^h á:pà-βà wife-VZL ‘to get married, to take a wife’
-mèi	REFLEXIVE	á:mú-mèi hit-REFL ‘to hit oneself’
-k ^h o	ITERATIVE	tímáx-k ^h ò chew-ITER ‘to chew’
-xk ^h o -ʔk ^h o	ITERATIVE	k ^h áxù-xk ^h ò expel.from.throat-ITER ‘to expel something from one’s throat’ kᵛpáʔi-ʔk ^h ò fry.ITER ‘to fry’

²⁵ Two Derivation I suffixes have the form -βɛ. One is a verbalizer that is affixed to nouns while the other combines with verbs to indicate a one-time action. As I discuss further in Chapter 4, these suffixes have contrastive underlying tone patterns.

As previously discussed, the verb suffixes in Table 7 combine with verb roots to form complex verb stems. In Bora, verb stems (either simple or complex) may be further modified by Derivation II suffixes, which are presented in Table 8.²⁶

²⁶ See Chapter 4 for further discussion of the differences between Derivation I and Derivation II suffixes.

Table 8. Derivation II Suffixes

Suffix	Meaning	Example	Gloss
∅		ts ^h òx ^h ts ^h ò	‘to bathe (someone or something else)’ ²⁷
-βa	COMES TO	ts ^h òx ^h ts ^h ó-βá bathe-comes.to	‘comes to bathe’
-t ^h ε	GOES TO	ts ^h òx ^h ts ^h ò-t ^h é bathe-goes.to	‘goes to bathe’
-xε	RETURNS FROM	ts ^h òx ^h ts ^h ò-xé bathe-returns.from	‘returns from bathing’
-εtʃε	3SgF	ts ^h òx ^h ts ^h ò-tʃè bathe-3SgF	‘she bathes’
-ωβε	3SgM	ts ^h òx ^h -ts ^h ǒ:-βε bathe-3SgM	‘he bathes’
-mu ^h ts ^h ì	DuM	ts ^h òx ^h ts ^h ò-mu ^h ts ^h ì bathe-DuM	‘they (two men) bathe’
-mu ^h wp ^h ì	DuF	ts ^h òx ^h ts ^h ò-mu ^h wp ^h ì bathe-DuF	‘they (two women) bathe’
-mε	3Pl	ts ^h òx ^h ts ^h ó-mε bathe-3Pl	‘they bathe’
-t ^h ω	NEGATIVE	ts ^h òx ^h ts ^h ò-t ^h ú bathe-NEG	‘doesn’t bathe’
-xu:k ^h o	NOW	ts ^h òx ^h ts ^h ó-xu:k ^h ó: bathe-now	‘is bathing now’
-ts ^h o	CAUSATIVE	ts ^h òx ^h ts ^h ò-ts ^h ó bathe-CAUS	‘causes to bathe’
-tʃaʔì	FRUSTRATIVE	ts ^h òx ^h ts ^h ò-tʃaʔì bathe-FRUST	‘unable to bathe’
-k ^h i	PURPOSE	ts ^h òx ^h ts ^h ò-k ^h ì bathe-PUR	‘in order to bathe’

²⁷ This verb is used for bathing another person (such as a baby) or an animal.

1.2.5 Introduction to Bora Tone

Bora has a mixed tone/stress system. Five processes contribute to the surface tone patterns of words:

- a) underlying tone patterns
- b) boundary tones²⁸
- c) stress tones
- d) floating tones²⁹
- e) default high tones

Bora has two phonetic level tones, High and Low, and two contour tones, LH and HL. While level tones may occur on both long and short vowels, contour tones are limited to long vowels. (I discuss this further in Section 3.1)

Researchers have claimed that in Bora, Low is the marked tone and High the unmarked tone (Aschmann 1993, Thiesen 1996, Thiesen and Weber 2001, Seifart 2005, Thiesen and Weber 2012). This system is extremely unusual; in the vast majority of the world's tonal languages, High is marked and Low is unmarked. In Section 3.1, I present my own arguments for High being the unmarked tone in Bora.

Disyllabic noun roots have three underlying tone patterns, $\emptyset L$, $L\emptyset$ and $\emptyset\emptyset$, which give rise to the surface patterns HL, LH, and HH. Verb roots, in contrast, are underlyingly toneless. Disyllabic verbs have three surface tone patterns, HL, LH, and

²⁸ There are two boundary tones in Bora: a nominal boundary low tone that docks on the right edge of noun phrases, and a verbal boundary low tone that applies to verb stems (without stem suffixes) in isolation and at the end of a verb phrase. I describe the boundary tone in more detail in Chapters 3 and 4.

²⁹ Due to time and space constraints, I do not discuss floating tones in detail in this thesis. One example of floating tone is the imperative mood, which causes a low tone to dock on the second syllable of verbs: *èxùíβà* 'to dig', *éxùíβà* 'dig!', *ḱpà̀mù* 'to make notches', *ḱpá̀mù* 'make notches!'

HH, which are determined by affixes, boundary tones, and stress. I describe nominal tone in more detail in Chapter 3 and verbal tone in Chapter 4.

Tone plays an important role both in the Bora language and in the culture of the Bora people, as evidenced by drum communication. In the past, the Bora people were able to transmit messages by beating the tones on a pair of drums called the *manguaré*.³⁰ Drumbeats were used to call everyone together for a meeting, report success after a hunting trip, organize celebrations, announce someone's arrival, and connect with the spirit realm (Walton and Walton 1975). They also provided a means of communicating over long distances, as *manguaré* drums could be heard up to twenty miles away (Whiffen 1915).³¹ A Bora elder told me that drum messages used a combination of established drum signals and the tone patterns of words.

Figure 2 shows a pair of *manguaré* drums. Low tones are beaten on the large drum³² while high tones are beaten on the small drum.³³

³⁰ *Manguaré* drums were made from hollowed-out logs and were beaten with two wooden mallets covered in black rubber.

³¹ This form of communication is rapidly disappearing. In the communities where I worked, only the oldest men know how to play the *manguaré* drums. San Andrés no longer has a *manguaré*, having sold theirs to a museum, although they make small models to sell to tourists. Brillo Nuevo still has a *manguaré*, but it is kept in one of the elders' houses and is rarely used. The Bora people now use modern devices such as satellite phones, landline pay phones, and two-way radios to communicate over long distances.

³² In Bora mythology, the small drum represents a Bora man, while the large drum represents a woman who is expecting a child.

³³ For more information about Bora drum communication, see Meyer, Dentel, and Seifart (2013), Thiesen (1971), and Thiesen (1969).



Figure 2. *Manguaré* drums at the Milwaukee Public Museum

1.3 History of the Bora People

The Bora people originated in the Caquetá department³⁴ of the Amazon,³⁵ where they lived along the Igara-Paraná and Cahinari Rivers (Solís Fonseca 2003:146). They were fierce, cannibalistic warriors who frequently attacked other tribes, believing that they would become more powerful if they ate parts of their fallen enemies (Steward 1948). Bora society was structured around patrilineal clans whose members lived in communal thatched-roof houses called *malocas* (Solís Fonseca 2003:148). The head of the clan, either the father or the grandfather, occupied the place of honor at the back of the *maloca*, while his sons and their families slept on raised platforms along the sides

³⁴ ‘Department’ is a common translation of the Spanish *departamento*, which describes a province, region, or territory.

³⁵ In Peru, the term “Amazon” refers not only to the Amazon River, but to its tributaries and the surrounding rainforest. Although this area is politically divided between Colombia, Ecuador, Peru, and Brazil, it is often considered one cohesive region.

(Thiesen and Weber 2012:7). Although most Bora families now live in small houses built on stilts, one of the elders in Brillo Nuevo still lives in a traditional *maloca*.

In the late 1800s, companies began harvesting rubber along the Amazon River. Representatives from the rubber companies traveled to Bora villages, where they handed out axes, machetes, mirrors, colorful beads, and cooking utensils in exchange for raw latex³⁶ collected from the rainforest (Casement 1998). If Bora workers did not deliver enough latex, they were beaten or tortured.

In 1912, an American named Hardenburg published a firsthand account of the atrocities committed by the rubber companies. He described how native people were castrated, burned to death, crucified upside down, and flogged “until their bones [were] laid bare” (Hardenburg 1912:84-85). Desperate to escape the rubber companies, some Bora workers and their families fled deep into the jungle, where they lived in hiding. During the Rubber Boom, many Bora people died from abuse, genocide, and lack of medical care. They were further decimated by European diseases, against which they had no immunity. Whiffen (1915:59) estimates that in the early 1900s, there were around 15,000 Bora people living in the Amazon Basin. By 1940, Steward (1948:751) reports that the population had been reduced to 500.

Peru and Colombia had disputes over rights to the Caquetá department of the Amazon until 1911, when Peru ceded control of this territory to Colombia. In response, Casa Arana, a Peruvian rubber company, relocated many of its Bora workers to the Loreto region of Peru.³⁷ Today, there more are ethnic Bora people in Peru than in Colombia (Crevels 2007:116).³⁸

³⁶ The ingredient used to make rubber. In its natural form, it is a sticky, milky liquid that is tapped from rubber trees.

³⁷ The Bora people who live in Peru still feel a strong connection to the Caquetá department of Colombia. When I spoke with my language consultants in Brillo Nuevo about their history, all

As the Rubber Boom came to an end, other outsiders, known as *patrones*, settled in the Amazon basin. In exchange for labor, the *patrones* provided the Bora people with basic medical care, organized community events, and prohibited outsiders from visiting them (Thiesen and Weber 2012:11). They also sold blankets, flashlights, boat motors, tools, and other goods on credit, often charging 50% to 200% more than the original price (Garcés 1968). To pay for the items, Bora workers harvested latex, chicle,³⁹ rosewood and other raw materials from the rainforest. As soon as the *patrones* received payment, they handed out more goods on credit, trapping the Bora people in a cycle of debt and exploitation that lasted for several decades.

1.3.1 Current Situation of the Bora People

Today, most of the Bora people live in thatched-roof houses that are raised on stilts to keep them above the flood levels of the Amazon River. Almost all of the houses are wired for electricity, and in the evenings generators⁴⁰ provide power for electric lights and satellite televisions.⁴¹ As they gain more understanding of malaria, dengue fever,

of them knew which village in Colombia their family was from. The elders remembered a time when the clans in Brillo Nuevo spoke different dialects.

³⁸ There are approximately 3,000 ethnic Bora people in Peru and 650 in Colombia.

³⁹ A natural gum that is tapped from trees in the *Manilkara* genus and boiled until it reaches the desired thickness.

⁴⁰ Brillo Nuevo has one large generator, and each household contributes money toward gasoline. In San Andrés, families rely on individual generators to power their homes. Generators usually run from 6:00 p.m, when it gets dark in the Amazon rainforest, until 8:00 p.m., when most families go to bed.

⁴¹ Television is becoming an important part of Bora life. In the community of Brillo Nuevo, friends and neighbors gather every evening at the homes with satellite dishes, where they watch television together until the generator is turned off at 8:00 p.m. All of the programming is in Spanish.

and other mosquito-borne illnesses, some families are covering their windows with mosquito netting.

The staple of the Bora diet is *má:ʔǒ*, a flat, round bread made from manioc, which the Bora people dip in various sauces.⁴² Sources of protein include fish, chicken, eggs, and *suri* (palm beetle grubs). In Brillo Nuevo, many of the families still cultivate crops such as manioc, sweet potatoes, soursop, coca,⁴³ and plantains. They also hunt and gather edible plants from the rainforest.

The Bora people earn money by producing traditional arts and crafts, such as baskets, jewelry, and headdresses, which are sold to tourists in Iquitos. Some families also welcome tourists and researchers into their homes, charging a small fee for room and board. One family in the community of San Andrés plans to open a lodge where tourists can take *ayawaska*, a hallucinogenic drug, under the guidance of a shaman. Other people work as loggers, government representatives, tour guides, or teachers in the bilingual school in Brillo Nuevo.

The religious beliefs of the Bora community are in transition. In the past, the Bora people believed that the spirits of animals had special powers, either to protect people or to bring them harm. Each clan had a shaman who was respected and greatly feared for his connection to the animal spirits (Thiesen and Weber 2012:19). These traditional beliefs waned as the Bora people converted to Christianity, although in recent years, some people have returned to the practices of their ancestors. While at one time nearly all of the residents of Brillo Nuevo identified themselves as Christians, only a handful of

⁴² *má:ʔǒ*: bread resembles a large or extra large pizza crust. It is dense and chewy, leading Thiesen and Weber (2012:14) to describe it as “similar to a crusty gumdrop”.

⁴³ The Bora people toast coca leaves over the fire by putting them in a large cast-iron pot (without water) and stirring them with their hands to prevent them from burning. Chewing the toasted leaves produces a mild stimulant, similar to drinking a cup of coffee.

families continue to attend church services. At least one former Christian in Brillo Nuevo is a practicing shaman, while another man in San Andrés is studying shamanism. Many Bora people are uncertain about their spiritual beliefs.

For decades, Bora communities have been relatively isolated from the modern world, hidden by hundreds of kilometers of jungle and rivers. Contact with outsiders, however, is increasing. Only forty-five minutes from the city of Iquitos by motorboat, the community of San Andrés is a popular destination for tourists, missionaries, researchers, medical teams, and NGOs. The residents of San Andrés also make frequent trips to Iquitos to go shopping or to sell their traditional arts and crafts. Some families have satellite phones and televisions, and one man has an e-mail account that he checks when he goes into the city.

Two days from Iquitos by *rápido* (a fast motorboat), Brillo Nuevo is much more isolated, receiving a small number of missionaries and researchers each year. Although there are few outside visitors, the residents of Brillo Nuevo are exposed to the outside world on a daily basis through satellite television. Additionally, they travel outside of their community to stock up on supplies in the nearby town of Pebas or compete in soccer tournaments against other indigenous villages. They occasionally make the two-day trip to Iquitos, and a few members of the community have even traveled to Lima by airplane.

1.3.2 State of Bora Language Usage

The Bora people currently live between two cultures, rooted in their traditional lifestyle but increasingly branching out toward the modern world. This is reflected in their language. All of the Bora people speak at least some Spanish, and it is becoming the dominant language among younger speakers.

As I spent time in the communities of San Andrés and Brillo Nuevo, I observed various levels of proficiency in Bora. Speakers over the age of fifty demonstrated the

highest level of fluency. They read the wordlist with confidence, knew the definitions of all the words, and were consistent in their pronunciation of the tones.

Adults between the ages of thirty and fifty spoke a slightly more simplified dialect of Bora. Although they conversed easily in the language, they did not have the same breadth of vocabulary as the elders in the community and they sometimes disagreed⁴⁴ over the pronunciation of words with irregular tone patterns.

Young adults (under the age of thirty) often paused as they read the wordlist, sounding out words multiple times before deciding on the pronunciation they thought was correct. They inconsistently simplified the tone patterns of words with complex morphology, showing variation between speakers and within a single speaker.⁴⁵ There are several possible explanations:

- a) The tone system of Bora may be shifting.
- b) Young adults may not be strong readers.
- c) Young adults may have incomplete acquisition of the Bora language due to the influence of Spanish.

I did not elicit data from speakers under the age of twenty. During my time in Brillo Nuevo, however, I observed children speaking both Bora and Spanish. While the school in Brillo Nuevo is classified as bilingual, the director reported that most of the instruction is in Spanish and many of the current teachers do not speak Bora. Several families told me that children typically speak Bora at home and learn Spanish when they enter school.

⁴⁴ My primary language consultants were a brother and sister in their forties. When they disagreed over a particular word, they checked its tone pattern with their mother, an elder speaker of Bora. This developed into a friendly competition to see whose tone pattern was the “winner”.

⁴⁵ It is common for older speakers to correct the tone patterns of younger speakers.

In the community of San Andrés, children understand most Bora conversations and can produce basic words and phrases, but they are not fluent. It is common to hear parents speaking to their children in Bora and the children responding in Spanish. Education in the local school is entirely in Spanish. Although families petitioned the government for a bilingual program, they were informed that there were not enough Bora-speaking teachers. One father told me that he hopes that San Andrés will one day have a bilingual school where his children can practice their heritage language.

In Brillo Nuevo, Bora is a language in transition; in San Andrés, it is a language in decline. Whether due to natural processes, the influence of Spanish, or incomplete language acquisition, tone patterns in Bora are simplifying. In contemplating the future of the Bora tone system, it may be insightful to look at other languages in the Witotoan family. Aschmann (1993) briefly describes the tone and stress systems of six Witotoan languages, which I have arranged in the following chart:

Table 9. Tone and Stress in Witotoan Languages

Bora [boa]	Two tones
Bora Muinane [bmr] ⁴⁶	Two tones
Nipode Huitoto [hux] ⁴⁷	One accent
Minica Huitoto [hto]	One accent
Murui Huitoto [huu]	Stress system ⁴⁸
Ocaina [oca]	Mixed tone/stress system

⁴⁶ Throughout this paper, I refer to Muinane [bmr] as Bora Muinane to differentiate it from Muinane Huitoto [hux], also known as Nipode Huitoto.

⁴⁷ Also called Muinane Huitoto.

⁴⁸ Aschmann (1993:14) states that the high tone that marks stress in Murui Huitoto is non-contrastive, separating it from the contrastive accent systems of Nipode Huitoto and Minica Huitoto.

Aschmann (1993) reconstructs Proto Witotoan with two tones, High and Low. While researchers have claimed that the tone system has been preserved by Bora and its closest relative, Bora Muinane (Walton and Walton 1972:42; Aschmann 1993; Thiesen and Weber 2012), I consider Bora to have a mixed tone/stress system. I develop this argument further in Chapters 3 and 4.

Nipode Huitoto and Minica Huitoto have one accented syllable per word that is assigned high tone (Minor 1956:37). In Nipode Huitoto the accent generally falls on the first syllable (Minor and Hendrich de Minor 1971:137), while in Minica Huitoto it falls on either the first or second syllable (Minor, Hendrich de Minor and Levinsohn 1982:6). In Murui Huitoto, words have high tone on the first syllable and slightly raised pitch on the third syllable, which Burtch (1975:1) analyzes as primary and secondary stress markers.

Ocaina employs a mixed tone/stress system that Aschmann (1993:16)⁴⁹ considers to be somewhere between the tone systems of Bora and Bora Muinane and the accent system of the Huitoto languages. At the present time, there is not enough information on Ocaina to determine whether it is similar to my analysis of the mixed tone/stress system of Bora.

In summary, the future of Bora tone is uncertain. Bora may settle on a simplified mixed tone/stress system or it may collapse into an accent system like that of Nipode Huitoto or Minica Huitoto. Tone contrasts in Bora may eventually disappear completely.

⁴⁹ Ocaina words may either be toneless or have high tone on one syllable (Agnew and Pike 1957:26). However, in Ocaina, second person singular is indicated by a high tone on the first syllable of a word, which can result in a word with two high tones (Leach 1971).

1.4 Literature Review

From the 1950s to the 1990s, Wes and Eva Thiesen, linguists with the Summer Institute of Linguistics, lived among the Bora people and studied their language. They developed a Bora orthography, produced literacy materials, and taught many Bora people to read and write. Wes Thiesen wrote extensively about Bora tone, both in the literacy workbooks he created for the Bora people and in academic publications. Most of the existing literature about Bora references the Thiesens' fieldwork and follows their analysis of the tone system.

In the remainder of this section, I summarize documents of interest to those who would like to learn more about the Bora language. For complete bibliographic information, refer to the bibliography in the appendices.

- Aschmann, Richard P. 1993. *Proto Witotoan*.

Aschmann shows the genetic relationship between six Witotoan languages (Bora, Muinane, Nipode Huitoto, Minica Huitoto, Murui Huitoto, and Ocaina) and reconstructs Proto Witotoan. Although he does not analyze tone in depth, he suggests that Proto Witotoan had two surface tones, High and Low. He also briefly discusses tone contrasts in each of the daughter languages.

- Parker, Steve. 2001. *The Acoustic Qualities of Bora Vowels*.

In this paper, Parker analyzes the acoustic qualities of the six Bora vowels: /a/, /ɛ/, /i/, /i/, /o/, and /u/. He confirms that the only difference between the central vowel /i/ and the back vowel /u/ is backness.

- Seifart, Frank. 2002. *El sistema de clasificación nominal del miraña*.

Seifart describes the noun class system of Mirañá, a dialectical variant of Bora. Although the main focus of his research is noun class suffixes, he provides a brief analysis of tone in the introductory chapter. Seifart considers Mirañá to be an accent language, in which each morpheme is either accented (with one low tone on

the stressed syllable) or unaccented (underlyingly toneless). However, his description of the accent system of Mirañá closely follows Thiesen and Weber's analysis of the Bora tone system (Thiesen and Weber 2001).

- Seifart, Frank. 2005. *The Structure and Use of Shape-Based Noun Classes in Miraña (North West Amazon)*.

In this book, Seifart examines noun class suffixes in Mirañá. Although he previously suggested that Mirañá was an accent language (Seifart 2002), in this book he considers Mirañá to have a tone system with two tones (High and Low). He generally follows Thiesen and Weber's tone analysis (Thiesen and Weber 2001), although he differs from them on several points, one of them being the tones of class suffixes. While Thiesen and Weber consider many noun class suffixes to have lexical tone, Seifart argues that noun class markers are underlyingly toneless (with the exception of the inanimate class marker *-nɛ* and the animate plural *-mɛ*, which he analyzes with floating low tones).

- Thiesen, Eva, and Wesley Thiesen. 1985. *El manguaré facilita la lectura del bora*.
- Thiesen, Eva, and Wesley Thiesen. 1989. *El manguaré facilita la escritura del bora*.

In these two workbooks, which were written for native speakers of Bora, Thiesen and Thiesen use *manguaré* drum signals to illustrate the difference between high and low tone.⁵⁰

- Thiesen, Eva, and Wesley Thiesen. 1998. *Diccionario Bora-Castellano, Castellano-Bora*.

A bilingual dictionary (Bora/Spanish, Spanish/Bora). The appendices contain a comprehensive list of Bora class suffixes.

⁵⁰ For more information about *manguaré* drum communication, see Section 1.2.5.

- Thiesen, Wesley. 1998. *Gramática del idioma bora*.

In this grammar, Thiesen describes Bora phonology, morphology, and syntax in a straightforward style that is accessible to the general reader. His description of the tone system, which is based on a syllable-level approach, includes many examples. This text is intended to be a companion volume to the Bora/Spanish dictionary.

- Thiesen, Wesley, and David Weber. 2001. *A synopsis of Bora tone*.

This work paper provides a basic overview of the Bora tone system.

- Thiesen, Wesley, and David Weber. 2012. *A Grammar of Bora with Special Attention to Tone*.

This book builds on Thiesen (1998) and Thiesen and Weber (2001), expanding the description of the tone system and providing numerous examples. While Chapter 3 is dedicated to tone, the authors discuss the subject in almost every chapter due to the extensive use of grammatical tone in Bora.

- Yip, Moira. 2002. *Tone*.

This textbook on tonal phonology contains a brief description of Bora tone in the chapter on South American tonal languages. Using data from Thiesen and Weber (2001), Yip presents an Optimality Theory analysis of the restriction on adjacent low tones in Bora. This is the only published OT analysis of Bora tone.

In this chapter, I have laid the foundation for the analysis of the tone system by describing research methodology and practices, providing a brief overview of the Bora language, and relating the history of the Bora people. In the next three chapters, I present my analysis of the Bora tone system. As discussed in Section 1.2.5, Bora has an extremely unusual tone system in which Low is the marked tone and High the unmarked tone (see also Section 3.1). The goal of this investigation is to examine the underlying tone patterns of noun and verb roots, thereby providing a different perspective on this fascinating tonal language. It is my hope that the insights gained

from this analysis will ultimately benefit the Bora people by enabling them to better understand and write tone.

CHAPTER 2

ACOUSTIC ANALYSIS

Bora has two phonetic tones, High and Low. As I describe further in Chapter 3, Low is the marked tone and High the unmarked tone (see Section 3.1.1). The Bora tone system is highly unusual; while as many as 60 to 70 percent of the world's languages are tonal (Yip 2002:1), only a small number have been claimed to have unmarked high tone, and even fewer have been analyzed phonetically. The purpose of this chapter is to document this unusual tone system by defining the acoustic correlates of high and low tone in Bora.

As tone has frequently been overlooked or under-described in linguistic analysis, much research remains to be done on tonal languages. Bora, like many other minority tonal languages, is in danger of disappearing, making language documentation a critically important task. In fifteen or twenty years, it may no longer be possible to elicit the data required for an in-depth analysis of Bora tone.

2.1 Working with Research Subjects

The acoustic analysis in this chapter is based on data from six male research subjects and four female research subjects. I begin the analysis with data gathered from male speakers, which I use to measure fundamental frequency (Section 2.3.1) duration (Section 2.3.2) and intensity (Section 2.3.3). In Section 2.4, I present a more limited study of the pitch of female speakers. This is followed by a brief discussion of voicing contrasts in Section 2.5.

The director of the bilingual school in Brillo Nuevo assisted in the selection of research subjects, making recommendations based on literacy level⁵¹ and proficiency in Bora. Subjects were chosen according to the following criteria:

- a) Must be an L1 speaker of Bora who grew up in a community where Bora is the primary language of communication.
- b) Must be over the age of 18.
- c) Must be able to read fluently and confidently.

Table 10 lists the reference code, age, and residence of each male research subject.⁵² Corresponding information about female research subjects can be found in Section 2.4.

Table 10. Male Research Participants

Reference Code	Age	Residence
M1	26	Brillo Nuevo
M2	35	Brillo Nuevo
M3	50	Brillo Nuevo
M4	59	Brillo Nuevo
M5	60	Brillo Nuevo
M6	60	Brillo Nuevo

⁵¹ To record words for acoustic analysis, I experimented with three methods of audio recording: a) Saying the word aloud in Spanish and asking the subject to repeat it in Bora, b) Asking a Bora speaker to read the word aloud in Bora for the subject to repeat, c) Asking the subject to read the words from a wordlist. I found that when I used method (a), research subjects often gave me a different version of the word than the one on my wordlist, either by adding suffixes to the word, substituting the word with a different word in Bora, or saying the word back to me in Spanish. I avoided method (b) because I wanted to examine dialectical differences between older speakers and younger speakers (see Section 1.1.3), so it was important that research subjects not be influenced by the tonal melodies of another speaker.⁵¹ Because of these factors, I used method (c), in which speakers read aloud from a wordlist. Therefore, literacy level was an important criteria in selecting language consultants.

⁵² Before participating in this study, subjects were asked to sign a consent form. Copies of this form in both English and Spanish can be found in Appendix A.

The director of the bilingual school recommended M1 as a research subject because he was a gifted student who had graduated at the top of his class. Although he was only 26 years old, he had been elected president of Brillo Nuevo and was respected by everyone in the community. Like other young adults, M1 spoke a somewhat simplified dialect of Bora (see Section 1.3.2).

Both M2 and M6 had previously worked as consultants for linguistic research. M6 was one of the main contributors to the Bora/Spanish dictionary (Thiesen and Thiesen 1998) and was known in the community as an expert on the Bora language. In addition to providing their voices for the audio recordings, M4 and M6 read over my wordlists and made numerous revisions and suggestions. M6 was missing several teeth toward the back of his mouth, but this had no noticeable effect on his pronunciation.

M3 was selected as a research participant because of his strong literacy skills, which he developed by reading the Bora New Testament aloud each week in the local church. (As there are few written materials in Bora, I found that the most fluent readers were those who regularly read aloud from the Bora translation of the New Testament.)

While M4 was an excellent reader, I was initially concerned about the quality of his recordings because he read the wordlist with a wad of coca leaves in his mouth.⁵³ Despite the coca leaves, his articulation was very clear and I had no difficulty analyzing the words he recorded.

M5 had previous recording experience as the narrator of the audio version of the Bora New Testament.⁵⁴ Although he was missing his two front teeth, this had no noticeable effect on his pronunciation.

⁵³ I asked M4 to remove the coca leaves before recording, but he told me that he needed them to concentrate.

⁵⁴ The audio version of the Bora New Testament was produced by the organization Faith Comes by Hearing (product code N2BOATBL).

2.2 Methods for Audio Recording

For the acoustic analysis, I recorded examples of each of the six Bora vowels, both short and long, with high tone and low tone. I also recorded one instance of each long vowel with a LH contour tone.⁵⁵ All vowels were originally recorded in the first syllable of words, but I had to discard several items from my wordlist because of errors in transcription or pronunciation.⁵⁶

The following tables list the words used for the acoustic analysis.⁵⁷ Words with high tone are in Table 11, words with low tone in Table 12, and words with contour tones in Table 13. It should be noted that the words in these tables do not have the same onsets, as my primary focus in recording audio was to check my transcription of tone for the phonological analysis.⁵⁸ Therefore, I did not elicit examples of each vowel in the same environment. This may influence the results of the acoustic analysis, as one would expect words with voiceless obstruent onsets to have slightly higher pitch than vowel-initial words.

⁵⁵ HL contour tones exist in Bora, but they are much less common than LH contour tones (see Section 3.1). In order to limit the scope of this paper, I chose to focus the acoustic analysis on LH contour tones.

⁵⁶ I discuss this further in Section 2.2.1.

⁵⁷ This list does include the words I discarded because of errors in transcription or pronunciation. For a discussion of the words I discarded, see Section 2.2.1.

⁵⁸ These recordings were based on my preliminary wordlist, which was considerably shorter than my final corpus of 500 noun stems and 300 verb stems.

Table 11. Words with High Tone

Vowel	Bora Word	Gloss
á	t ^h áʔtì	‘grandfather’
á:	á:t ^h àʔè	‘stinging nettle’
é	t ^h éʔìjè	‘rivers’
é:	tʃ ^h é:ʔòk ^h pà	‘door’
í	íxk ^h ǒ:	‘nest’
í:	í:pí:k ^h pù	‘a small amount of coca leaves’
í	p ^h ík ^h áú:nè	‘yuccas’
í:	p ^h í:k ^h ǎ:	‘yucca’
ó	p ^h tóxk ^h òk ^h pá:k ^h ù	‘two knives’
ó:	k ^h ó:k ^h pàʔò	‘match’
ú	úxk ^h àʔé:k ^h ù	‘two beards’
ú:	k ^h ú:βèpà	‘black rag’

Table 12. Words with Low Tone

Vowel	Bora Word	Gloss
à	ʔàʔtʃ ^h à	‘sore’
à:	pà:k ^h pájù	‘non-venomous spider’
è	t ^h ápèʔtʃ ^h è	‘my niece’
è	tèxúú ~ tè:xúú	‘hen without a tail’
è:	è:βák ^h o	‘the Tunchi ⁵⁹ is coming’
ì	nìʔpà	‘alligator’
ì:	nì:x ^h áú	‘sea urchin’
ì	p ^h íʔt ^h ók ^h pà	‘comb’
ì:	ì:t ^h é:p ^h è	‘overseer’
ò	t ^h òʔxípa	‘baby sling’
ò:	k ^h ò:k ^h páʔò	‘proper name’
ù	xùβájè	‘paths’
ù:	xù:βák ^h ù	‘two paths’

⁵⁹ The Tunchi is a ghoulish creature who haunts the rainforest. The Bora people know when the Tunchi is coming because he makes an eerie whistling or hissing sound.

Table 13. Words with Contour Tones

Vowel	Bora Word	Gloss
ǎ:	p ^h ík ^h ǎ:	‘yucca’
ě:	t ^h ě:ʔì	‘river’
ĩ:	ĩ:pà	‘ash deer’
ĩ:	ĩ:xù	‘garbage’
ö:	ö:βè	‘food’
ũ:	xũ:βà	‘path’

To record words for acoustic analysis, I asked speakers to read five versions of the wordlist with the words arranged in different orders each time. Words were recorded in the frame /tíjè ____ / (‘say ____’), which provided a consistent phonological environment in which to study the pitch of the vowels.⁶⁰ In order to minimize acoustic interference from background noises, the wordlists were recorded in the quietest place I could find. In Iquitos, I worked in the home of one of my language consultants, while in Brillo Nuevo, I made the recordings in an empty house.

I recorded the wordlists with a Zoom H4N digital recorder that was connected to an omnidirectional MM-Dual Ear PSM Series Dual Earset Microphone with a frequency response of 30 Hz to 18,000 Hz and sensitivity of -47.96 dB at 1,000 Hz. Files were recorded in .wav format at 24-bit depth with a sampling rate of 48 kHz.

Data was recorded to an SD memory card and then transferred to my computer, where I used Audacity (version 2.0.5) to cut the recordings into smaller files consisting of one word each. I imported these files to Praat (Boersma and Weenink 2012), which I used to measure the length, intensity, and fundamental frequency of each vowel. I

⁶⁰ My language consultants were unable to think of a frame in which a word followed the elicited form. For most words, this was not significant, as I analyzed the vowel in the first or second syllable of the word. It was significant for p^hík^hǎ: ‘rotten yucca’, as I show in Section 2.3.1.4, because I analyzed the final vowel /ǎ:/. As it occurs in phrase-final position, the pitch of /ǎ:/ is likely lower than it would be phrase-medially.

viewed most tokens in Praat's default window of 75 Hz to 500 Hz, although for creaky voice, I changed the window to 25 Hz to 200 Hz.

Using Praat, I examined a wide-band spectrogram of each token and identified the steady-state period of the tone. Intensity and fundamental frequency were measured at the midpoint of the steady state, where the formants were the darkest and the pitch contour was the most stable. Length was measured across the vowel, from the point where the formants began to darken and the waves took on characteristic peaks, to the point where the formants faded and the waveform lost its shape, as shown in Figure 1. The spectrogram in Figure 3 shows the word $p^h k^h \check{a}$: 'rotten yucca', with lines marking where I divided the vowels.

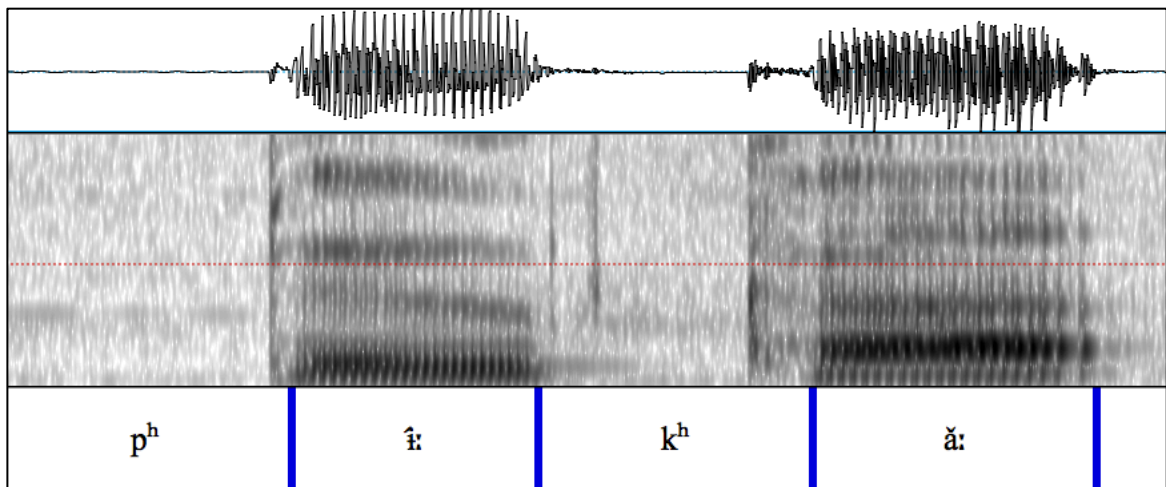


Figure 3. Vowel Length Measurement

2.2.1 Challenges During Data Analysis

As previously mentioned, I discarded several items from my original wordlist because of errors in transcription or pronunciation. One of these words, $\check{a}p^j\text{è}$ 'there he is', was eliminated because several research subjects read it with high tone instead of a contour tone. I did not have any other recordings of / \check{a} :/ in the first syllable of a word, so I analyzed the final vowel of $p^h k^h \check{a}$: 'rotten yucca', making a note that there could be some acoustic variation because the vowel occurred word-finally. (In this chapter, I

always indicate when differences in pitch, length, or intensity could be attributed to the position of the vowel in the word.)

Two of the words I thought had short vowels turned out, upon closer inspection, to have long vowels. While some speakers wrote and pronounced these words with short vowels, *tèxú:* ‘hen without a tail’ and *t^hó?k^hú:* ‘rotten yucca’, other speakers lengthened the vowels when they read the words out loud: *tè:xú:* ‘hen without a tail’ and *t^hó:k^hú:* ‘rotten yucca’.⁶¹ Because of this inconsistency, I discarded *t^hó?k^hú:* ‘rotten yucca’ and took pitch and length measurements for /ó/ from the second syllable of *p^htóxk^hòkpá:k^hù* ‘two knives’, making a note that there could be some acoustic variation because the vowel occurs in the second syllable of the word.⁶² For /è/, I measured the length of the second syllable of *t^hápè?ɣ^hè* ‘my niece’.⁶³ However, I was unable to measure the F₀ of the /è/ in *t^hápè?ɣ^hè* because speakers consistently pronounced it with creaky voice, so I took pitch measurements from the original word, *tèxú:* ~ *tè:xú:* ‘hen without a tail’. As I demonstrate later in this paper, the variation in the length of the vowel does not affect the pitch analysis, as there is no statistically significant difference between the pitch of long vowels and short vowels in Bora (see Section 2.3.1.1).

⁶¹ It should be noted that both of these vowels occur before a HL contour tone, so there may be a phonological process which lengthens short vowels before a HL contour. However, I did not have enough data to test this hypothesis, so this remains an area for future research. (HL contour tones are relatively rare; the majority of the contour tones in my data were LH.)

⁶² I did not have another example in my recordings of a word with /ó/ in the first syllable.

⁶³ I did not have another example in my recordings of a word with /è/ in the first syllable.

2.3 Acoustic Analysis of Male Speakers

Three acoustic properties can influence how listeners perceive tone contrasts: length, loudness, and pitch. In this section, I examine each of these properties to determine how the Bora language differentiates between high tone and low tone.

2.3.1 Fundamental Frequency

Fundamental frequency, or F_0 , is the acoustic correlate of pitch. Overall mean F_0 values for high and low tone, based on the speech of six male research subjects, are shown in Table 14. In Bora, fundamental frequency may be influenced by vowel height; for example, the mean F_0 of the low vowel [a] is, predictably, slightly lower than the mean F_0 of the high vowel [i]. In order to account for pitch variations due to vowel height, subjects recorded five repetitions of each vowel (both short and long) with high tone and low tone. The values in Table 14 reflect the combined mean F_0 of short and long vowels.

Table 14. Mean F_0 for male speakers (in Hz)

Tone	N	Mean F_0	Max	Min	Standard Deviation
L	504	107	138	87	8.95
H	505	141	197	107	19.72

2.3.1.1 Fundamental Frequency and Vowel Length

I used a paired *t*-test to determine whether there is a statistically significant difference in the fundamental frequencies of long vowels and short vowels in Bora. For the *t*-test, I paired the mean F_0 values of each short vowel against the mean F_0 values of the corresponding long vowel. This resulted in six pairs of vowels, one for each male speaker.⁶⁴

⁶⁴ I only had five pairs of vowels for /ε/ because one male speaker recorded all of the examples of low-toned /ε/ with high tone. For all other vowels, I had six pairs.

The mean F_0 values used for the t -test are plotted in the following figures. Figure 4 shows the mean F_0 values of short low-toned vowels for each male research subject, while Figure 5 shows the F_0 values of long low-toned vowels (based on five repetitions of each vowel per speaker).

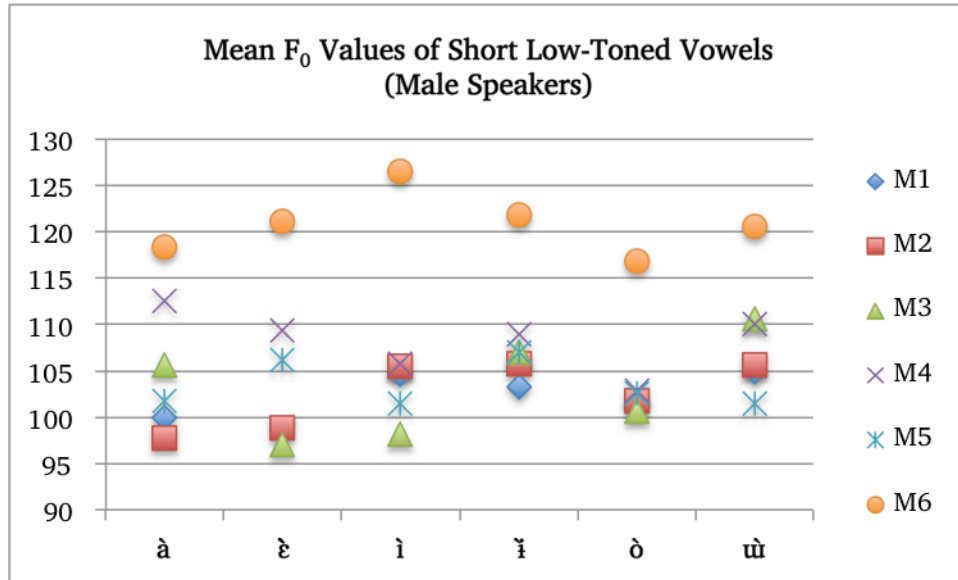


Figure 4. Mean F_0 Values of Short Low-Toned Vowels (male speakers)

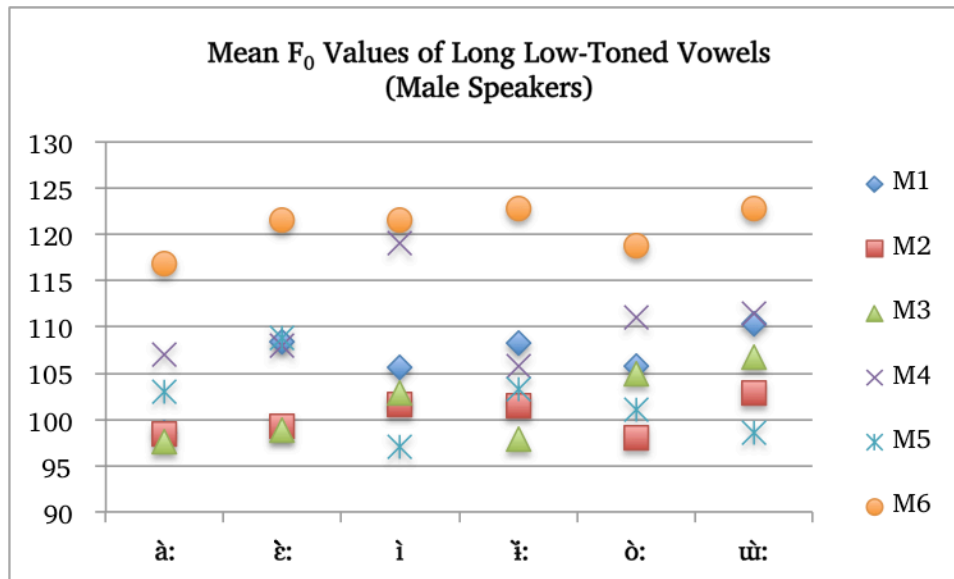


Figure 5. Mean F_0 Values of Long Low-Toned Vowels (male speakers)

Figure 6 plots the mean F_0 of short high-toned vowels for male speakers, while Figure 7 shows the mean F_0 of long high-toned vowels.

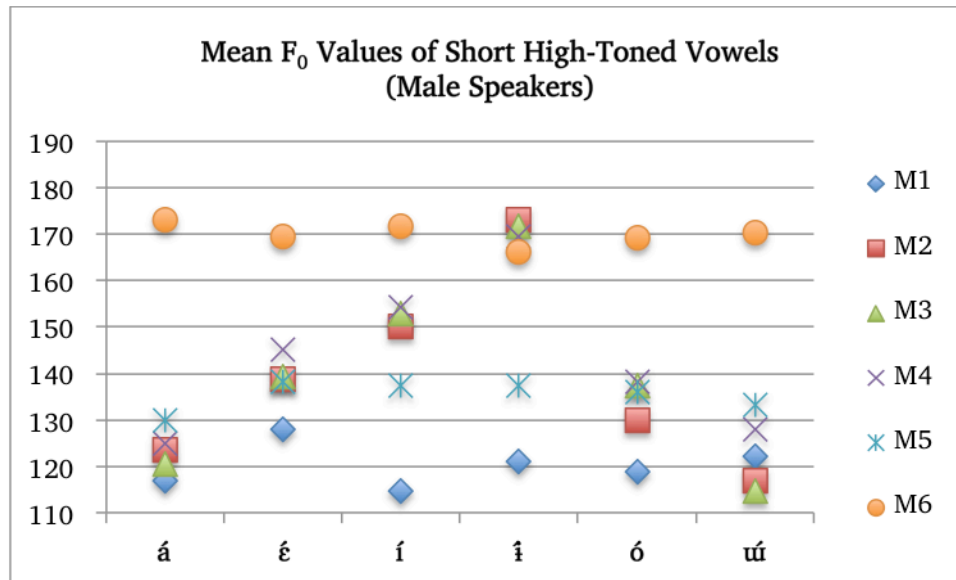


Figure 6. Mean F₀ Values of Short High-Toned Vowels (Male Speakers)

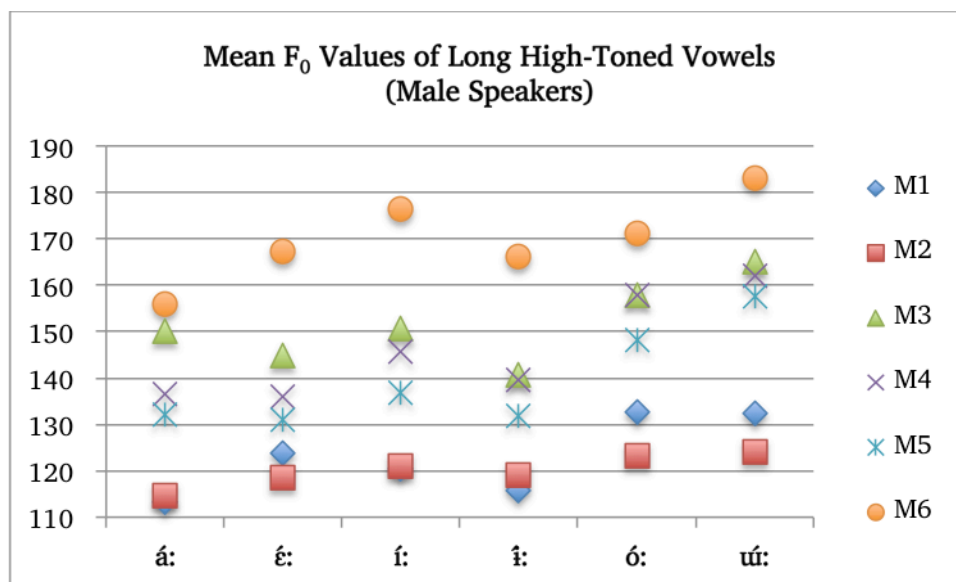


Figure 7 Mean F₀ Values of Long High-Toned Vowels (Male Speakers)

As previously discussed, I used the data in Figures 4-7 to conduct a series of *t*-tests in which I paired the mean F₀ of each short vowel against the mean F₀ of the corresponding long vowel. To determine whether the difference in F₀ was statistically significant, I assumed the standard α value of .05. Table 15 shows the results for low-toned vowels Table 16 shows the results for high-toned vowels.

Table 15. *t*-test Comparing Low-Toned Short and Long Vowels

Vowel	t	df	p-value
a, a:	1.65	5	.1598
ɛ, ɛ:	.45	4	.6759
ɪ, ɪ:	.32	5	.7641
ɪ, i:	1.22	5	.2765
o, o:	1.26	5	.2634
ʊ, ʊ:	.06	5	.9570

Table 16. *t*-test Comparing High-Toned Short and Long Vowels

Vowel	t	df	p-value
á, á:	.35	5	.7402
é, é:	1.79	5	.1139
í, í:	.955	5	.3834
í, i:	2.46	5	.0574
ó, ó:	2.35	5	.0657
ú, ú:	3.4	5	.0193

Assuming the standard α value of .05, only one pair of vowels, /ú/ and /ú:/ shows a statistically significant difference in fundamental frequency. Other pairs of vowels show no significant difference between the mean F_0 of long vowels and the mean F_0 of short vowels, indicating that the difference in fundamental frequency between /ú/ and /ú:/ is accidentally significant. Based on the results of this *t*-test, I conclude that there is no correlation between fundamental frequency and vowel length in Bora.

2.3.1.2 Range of Mean F_0 Values

As illustrated by Figures 4-7, the range of mean F_0 values for low tone among male speakers is around 100 Hz to 130 Hz, while the range of mean F_0 values for high tone is around 115 Hz to 180 Hz. Note that these numbers reflect the mean fundamental frequency of each vowel per speaker; the range of raw scores is wider. The difference in pitch between high tone and low tone depends on the individual speaker. Some male speakers have less than 20 Hz between the mean F_0 of low tones and the mean F_0 of high tones, while other speakers have nearly 50 Hz. Figures 8 and 9 show the range of mean F_0 values for two male research subjects, M1 and M6. Each point on the graphs is

based on ten repetitions of each vowel (five repetitions with short vowels and five repetitions with long vowels).

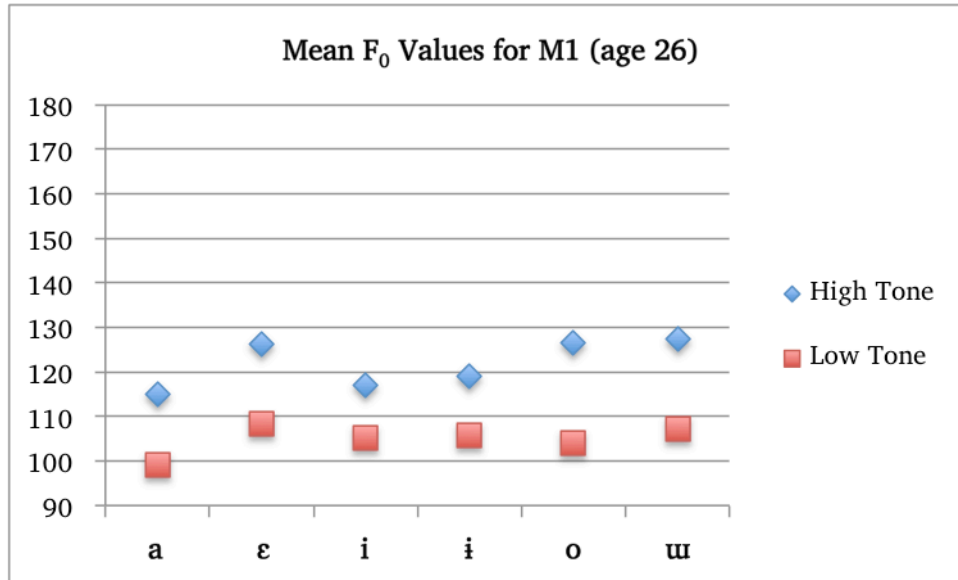


Figure 8. F₀ Range of M1 (age 20)

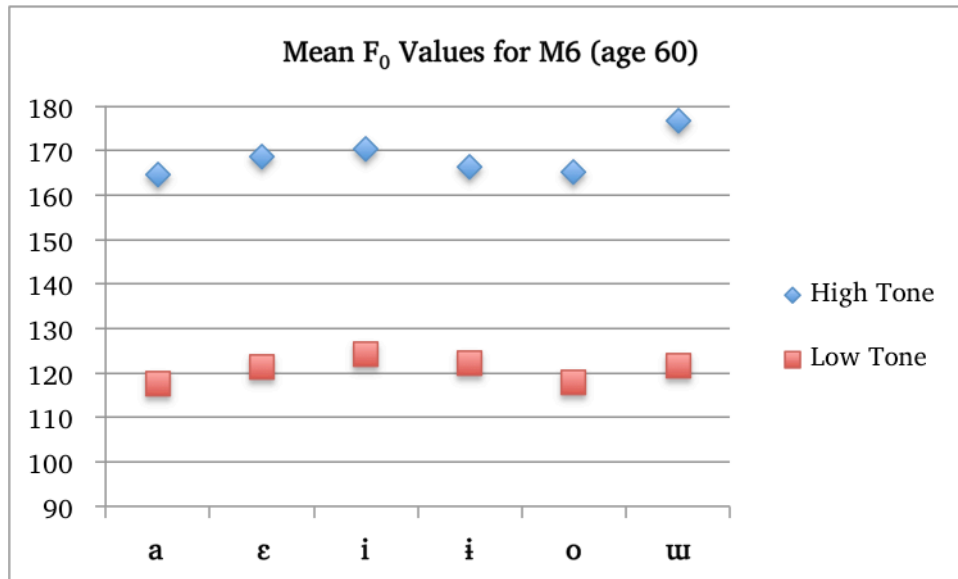


Figure 9. F₀ Range of M6 (age 60)

As shown in the above figures, M1 has an F₀ range of around 30 Hz, with less than 20 Hz between the mean F₀ values for high tone and the mean F₀ values for low tone. In contrast, M6 has a range of around 60 Hz, with more than 40 Hz between the mean F₀ values for high tone and the mean F₀ values for low tone.

2.3.1.3 *t*-test Results

In order to quantify the difference between high and low tone, I compared the mean F_0 of high-toned vowels to the mean F_0 of low-toned vowels using a paired *t*-test. I conducted two separate series of *t*-tests, one for short vowels and the other for long vowels. For each series of *t*-tests, I paired the mean F_0 of each high-toned vowel against the mean F_0 of the corresponding low-toned vowel. This resulted in six pairs of vowels per *t*-test (one pair for each male speaker).⁶⁵ To determine whether the difference in F_0 was statistically significant, I assumed the standard α value of .05. Table 17 provides the results of the *t*-test for short vowels, while Table 18 provides the results of the *t*-test for long vowels.

Table 17. *t*-test Comparing the F_0 of Short Vowels with Level Tone

Vowel	t	df	p-value
a	3.39	5	.0195
ɛ	7.03	4	.0022
i	4.61	5	.0058
ɪ	5.32	5	.0031
o	6.78	5	.0011
ʊ	5.99	5	.0019

Table 18. *t*-test Comparing the F_0 of Long Vowels with Level Tone

Vowel	t	df	p-value
a:	5.19	5	.0035
ɛ:	5.37	5	.003
i:	5.16	5	.0036
ɪ:	4.97	5	.0042
o:	8.17	5	.0004
ʊ:	5.96	5	.0019

As shown in the above tables, the p-value for each comparison is less than the standard α value of .05, indicating that the difference in F_0 values is statistically

⁶⁵ I only had five pairs of vowels for /ɛ/ because one male speaker recorded all of the examples of low-toned /ɛ/ with high tone. For all other vowels, I had six pairs.

significant. The results of the paired *t*-test demonstrate that the difference in pitch between high-toned vowels and low-toned vowels is not due to chance.

2.3.1.4 Fundamental Frequency of Contour Tones

Short vowels in Bora may have either high tone or low tone, while long vowels may have high tone, low tone, or the contour tones HL or LH. For this analysis, I examined long vowels with the melody LH, which occurs more frequently in Bora than the contour tone HL.⁶⁶ Figure 8 compares the mean F_0 values of high and low tone in a LH contour, based on five repetitions of each vowel by six male research subjects. As discussed in Section 2.2.1, all vowels in the acoustic analysis occur in the first syllable of words except /ǎ:/, which occurs in the final syllable of *p^hik^hǎ:* ‘rotten yucca’. The fundamental frequency of the high portion of /ǎ:/ was significantly lower than for the other vowels, which is explained by its position word-finally and phrase-finally.

⁶⁶ See Section 3.1 for a more detailed explanation of contour tones in Bora.

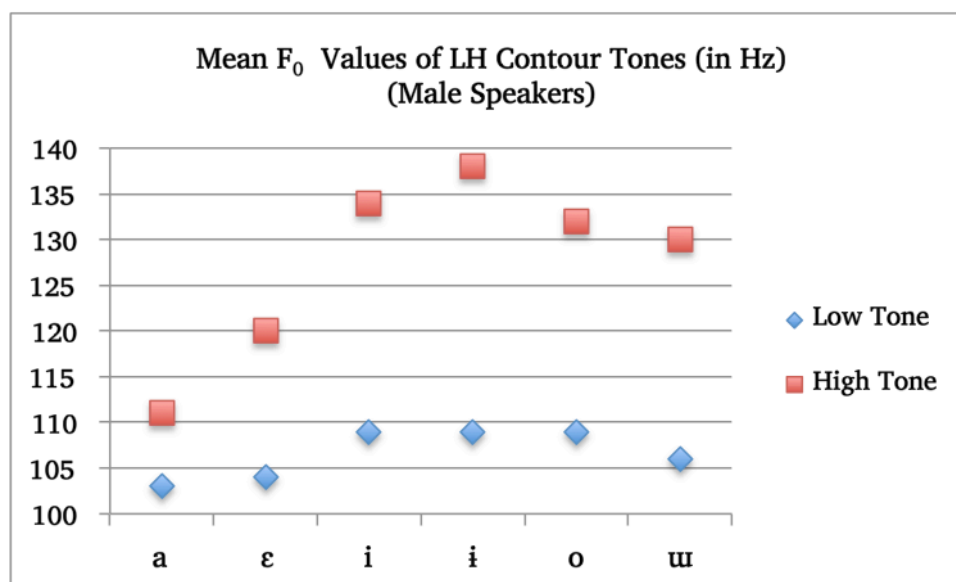


Figure 10. Mean F₀ Values of LH Contour Tones

Table 19 compares the mean fundamental frequencies of level tones and contour tones. The mean F₀ values for the low tones of LH contours were very close to the mean F₀ values for level low tones. However, the mean F₀ values for the high tones of LH contours were, for the most part, significantly lower than the mean F₀ values for level high tones. Following the terminology of Stewart (1983:57-78), this could be attributed to “automatic downstep”, a natural process which causes high tones to be pronounced at a lower register when it is directly preceded by low tones. It could also be explained by the fact that, in a contour tone, two tones (High and Low) must be articulated over the span of one long vowel, giving less time for the high tone to rise.

Table 19. Mean F₀ Values for Level Tones and Contour Tones

Vowel	Level Low F ₀	Contour Low F ₀	Level High F ₀	Contour High F ₀
a	105	103	137	111
ε	107	104	140	120
i	108	110	142	134
i	108	109	139	138
o	106	109	141	132
u	109	106	149	130

2.3.2 Duration

I measured the duration of vowels with high and low pitch to establish whether length is an acoustic correlate of tone in Bora. Table 20 lists the overall mean lengths for vowels with high tone and low tone, which were calculated based on five repetitions of each vowel by six male research subjects:

Table 20. Mean length of Bora vowels (in seconds)

Vowel	N	Mean Length	Standard Deviation
Short High	158	.110	.025
Long Low	176	.213	.038
Long High	155	.211	.032

I compared the mean lengths of vowels with high tone and low tone using a paired *t*-test. I conducted two *t*-tests, one for short vowels and one for long vowels, in which I compared the mean length of each high and low vowel for each male speaker. Figures 11 and 12 plot the mean lengths of short vowels with low tone and high tone, while Figures 13 and 14 plot the mean lengths of long vowels.

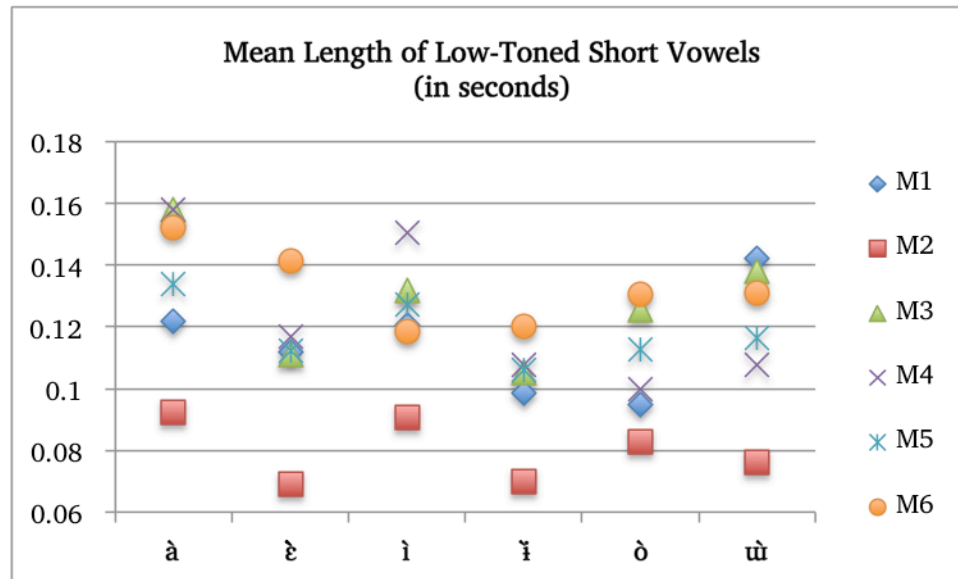


Figure 11. Mean Length of Low-Toned Short Vowels (in seconds)

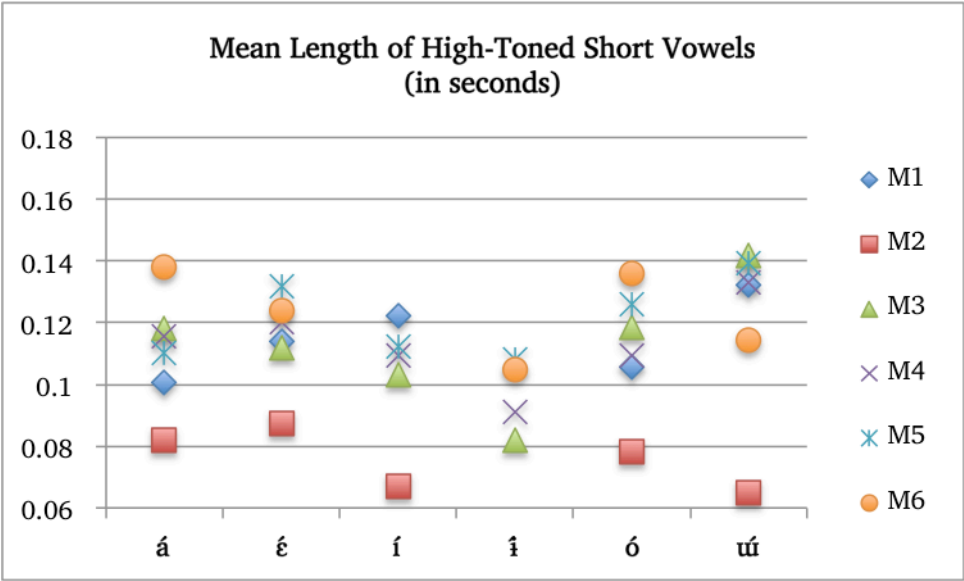


Figure 12. Mean Length of High-Toned Short Vowels (in seconds)

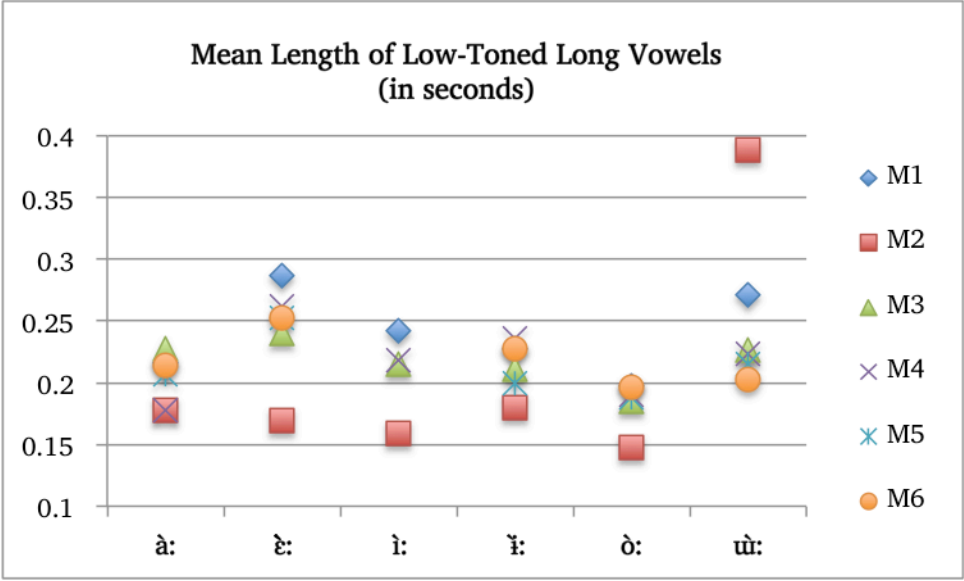


Figure 13. Mean Length of Low-Toned Long Vowels (in seconds)

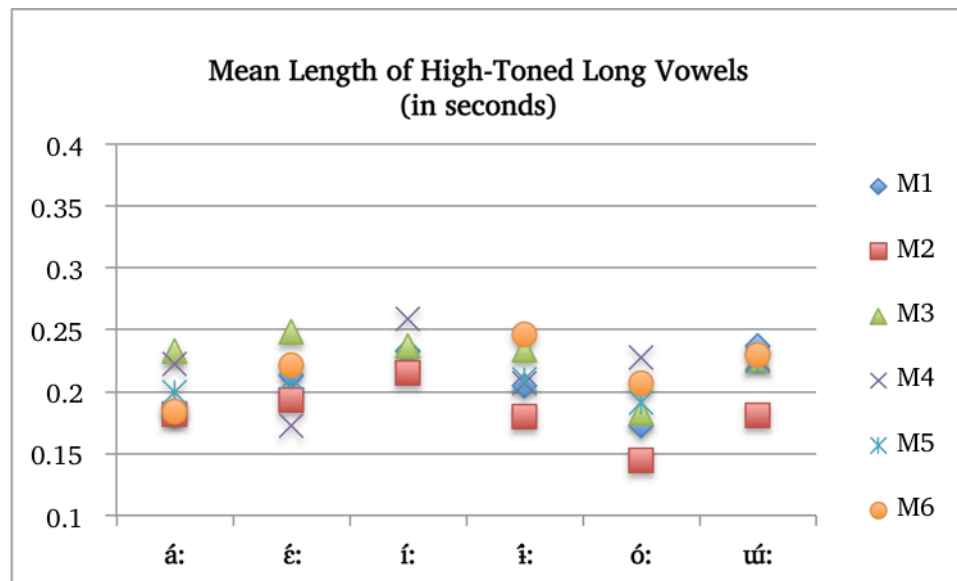


Figure 14. Mean Length of High-Toned Long Vowels (in seconds)

I used the data in Figures 11 and 12 to compare the lengths of short vowels with low tone and high tone, and the data in Figures 13 and 14 to compare the lengths of long vowels with low tone and high tone. Thus, for each t-test, I had 36 pairs (six pairs of vowels for six male speakers).⁶⁷ Table 21 shows the results of the t-test.

Table 21. *t*-test Comparing Vowel Length (in seconds)

Vowel	t	df	p-value
Short	2.51	33	.0174
Long	1.03	32	.3097

Assuming the standard α value of .05, the *t*-test showed a statistically significant difference between the lengths of short vowels with low tone and high tone, with low-toned vowels being slightly longer than high-toned vowels. The *t*-test showed no statistically significant difference in the length of long vowels with low tone and high tone. It is possible that the difference in length between high-toned and low-toned

⁶⁷ However, I only had 34 pairs for single vowels and 32 pairs for long vowels because some speakers misread the tones of the words I recorded for analysis.

short vowels is accidentally significant. Another possible explanation is that Bora uses length as an additional contrastive feature for vowels with short duration.

As previously discussed, long vowels in Bora may have the contour tones HL or LH. I measured the length of vowels with the contour tone LH.⁶⁸ Table 22 shows the mean length of long vowels with low tone, high tone, and the LH contour tone. The mean length is based on five repetitions of each of the six Bora vowels by six male speakers.

Table 22. Length of long vowels with level tones vs. contour tones

Vowel	N	Mean Length (in seconds)	Standard Deviation
Long L	176	.213	.038
Long H	155	.211	.032
Long LH	150	.256	.05

As shown in Table 22, long vowels with the melody LH are longer than long vowels with level tones, which is logical because the vowel needs to accommodate a rise in pitch.

2.3.3 Intensity

I measured intensity to determine whether loudness is an acoustic correlate of tone in Bora. Intensity measurements were taken at the midpoint of the steady-state of each vowel, where the formants were the darkest and the intensity contour had reached its peak.⁶⁹ Table 23 shows the mean intensity for vowels with high tone and low tone, based on five repetitions of each vowel by six male research subjects:

⁶⁸ HL contour tones are relatively rare in Bora.

⁶⁹ I used the Praat program (Boersma and Weenink 2012) to measure intensity. For a more detailed description of audio recording methods, see Section 2.2.

Table 23. Intensity of Short and Long Vowels

Vowel	N	Mean Intensity (in dB)	Standard Deviation
Short H	171	63.97	8.07
Short L	170	61.97	8.7
Long H	170	64.56	8.03
Long L	176	63.58	6.45

For both short and long vowels, the mean intensity ranged from around 62 decibels to around 65 decibels, with high tones being slightly louder than low tones. To determine whether this difference in intensity was statistically significant, I used two paired *t*-tests, one for long vowels and the other for short vowels. For each *t*-test, I compared the mean intensity of each high-toned vowel for each speaker with the mean intensity of the corresponding low-toned vowel. Figures 15 and 16 show the mean intensity of short vowels with low tone and high tone, while Figures 17 and 18 show the mean intensity of long vowels.

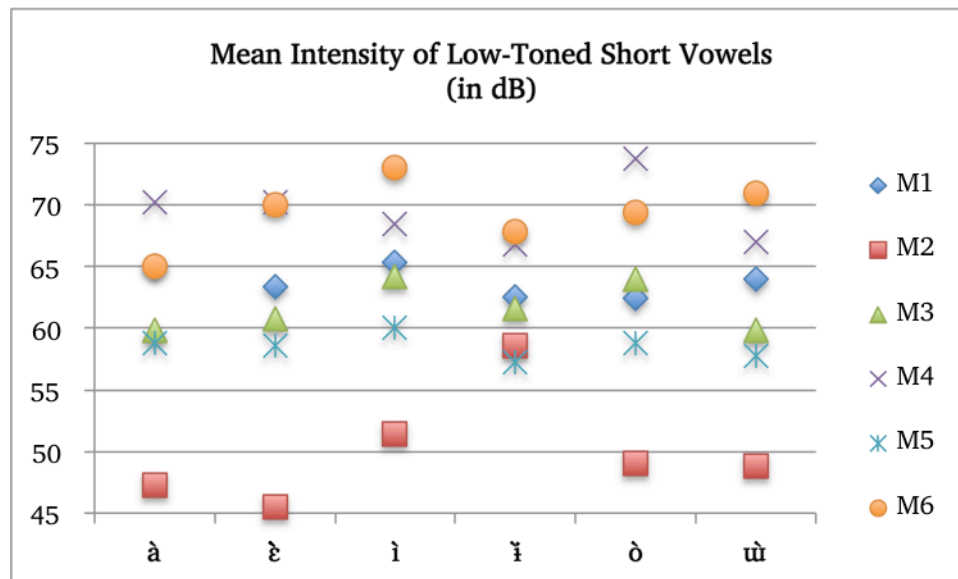


Figure 15. Intensity of Low-Toned Short Vowels (in dB)

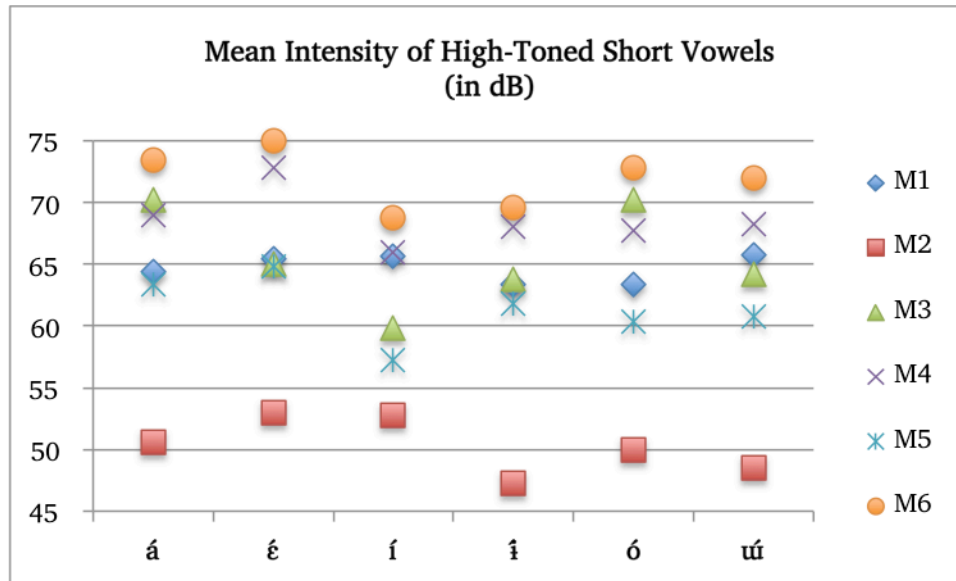


Figure 16. Intensity of High-Toned Short Vowels (in dB)

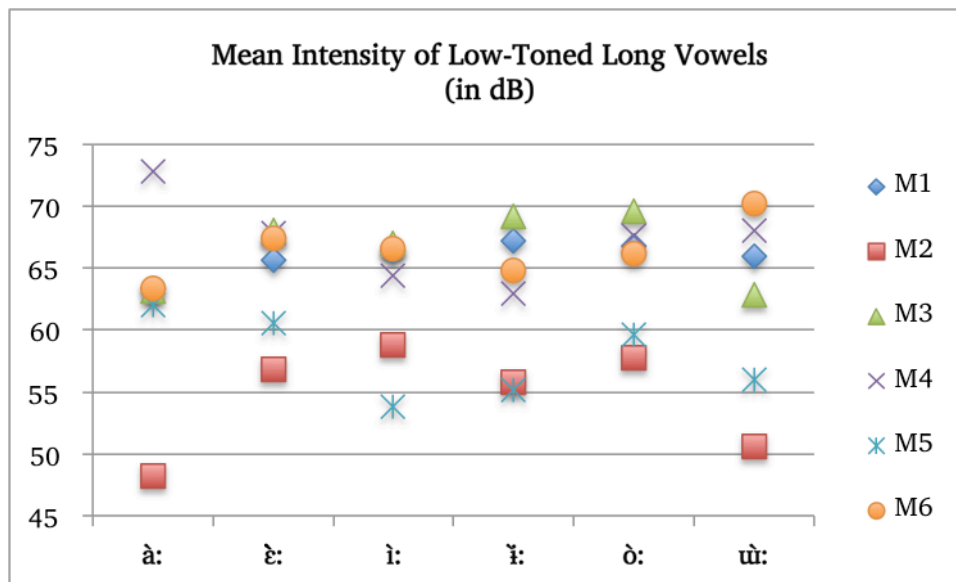


Figure 17. Intensity of Low-Toned Long Vowels (in dB)

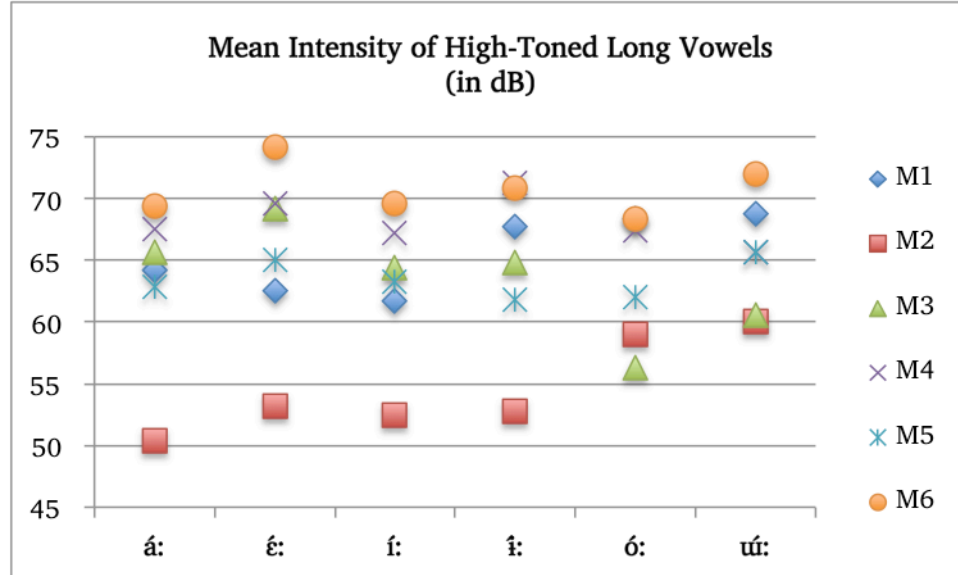


Figure 18. Intensity of High-Toned Long Vowels

For the *t*-test, I paired the data in Figure 15 against the data in Figure 16, and the data in Figure 17 against the data in Figure 18. The results of the *t*-test are presented in Table 24.

Table 24. *t*-test Comparing Intensity

Vowel	t	df	p-value
Short	2.32	35	.0266
Long	1.45	35	.1573

Assuming the standard α value of .05, there is a statistically significant difference between short vowels with low tone and short vowels with high tone. (The mean values in Table 23 indicate that high-toned short vowels have greater intensity than low-toned short vowels.) However, the *t*-test does not show a significant difference in intensity between long vowels with high tone and long vowels with low tone.

I also measured the intensity of long vowels with the contour tone LH, taking the measurement for low tone toward the beginning of the vowel and the measurement for

high tone toward the end of the vowel. Table 25 gives the mean intensity for each tone in LH contours.

Table 25. Intensity Measurements within a LH Contour Tone

Tone	N	Mean Intensity (in db)	Standard Deviation
L	154	62.21	7.49
H	153	65.16	7.68

The mean intensity for high tones in LH contours is approximately four decibels higher than the mean intensity for low tones. This difference is statistically significant, as shown in Table 26.

Table 26. *t*-test Comparing Intensity within a LH Contour Tone

t	df	p-value
5.75	152	< .0001

In conclusion, short vowels and long vowels with contour tones show contrastive levels of intensity, while long vowels with level tones do not. It is possible that intensity is used as a distinguishing feature for tones with short durations. However, it is also possible that the difference in intensity on contour tones is due to L being measured at the beginning of the vowel and H at the end. In future research, LH contour tones should be compared to HL contour tones to determine whether intensity correlates with tone or with the point of measurement on the vowel.

2.4 Acoustic Analysis of Female Speakers

This section contains a brief acoustic analysis of female speakers. In contrast to my analysis of male speakers, in which I examine length, intensity, and fundamental frequency, this description of female speakers is limited to pitch. Although I used nearly all of the same words for female speakers, it was not possible to use an identical wordlist because I lost some of my data for female speakers when a virus infected my computer and all of my backup hard-drives. While for male speakers, I analyzed the

/i:/ in the word /nì:x'áù/ 'sea urchin', for female speakers, I analyzed the /i:/ in the phrase /á:nú nì:βúíkpà/ 'this man's little deer'. All other words were the same (for a complete list, see Tables 11 and 12 in Section 2.2).

I elicited data from four female research subjects between the ages of 23 and 68, all of whom were originally from the community of Brillo Nuevo. Table 27 provides the reference code, age, and residence of each female speaker.

Table 27. Female Research Participants

Reference Code	Age	Residence
F1	23	Brillo Nuevo
F2	47	Brillo Nuevo
F3	48	Iquitos
F4	68	Iquitos

As discussed in Section 2.1, the director of the bilingual school assisted in the selection of research subjects. The director recommended F1 because she had been the strongest reader in her class. Like other young adults, F1 spoke a somewhat simplified dialect of Bora (see Section 1.3.2).

F2 was selected for her strong literacy skills, which she developed by reading the Bora New Testament aloud in the local church.

F3 was a licensed teacher who had taught for years in the bilingual school in Brillo Nuevo. Although she was living in Iquitos at the time I made the recordings, she continued to speak Bora on a daily basis with her mother and siblings.

F4 spent most of her life in Brillo Nuevo and moved to Iquitos as an older adult. She spoke some Spanish, but Bora remained her dominant language, so her family members often translated conversations from Spanish to Bora so she could follow what was being said. She was the mother of F3.

2.4.1 *Fundamental Frequency of Female Speakers*

Table 28 lists the mean fundamental frequencies of high and low tone for female speakers. Each research subject recorded ten repetitions of each of the six Bora vowels

([a] [ɛ], [i], [ī], [o], [ʊ]): five repetitions of each vowel in its short form, and five repetitions of each vowel in its long form. Thus, the values in Table 28 reflect the mean fundamental frequencies of short and long vowels combined:

Table 28. Mean F_0 for female speakers (in Hz)

Tone	N	Mean F_0	Max	Min	Standard Deviation
L	221	180	229	105	26.49
H	233	234	309	137	31.49

As discussed in Section 2.3, it is important to consider the fundamental frequency of each vowel individually, as F_0 values may be influenced by the place of articulation of the vowel. Figure 19 illustrates the mean F_0 of each vowel with low tone, while Figure 20 shows the mean F_0 of each vowel with high tone. Values are given in Hz.

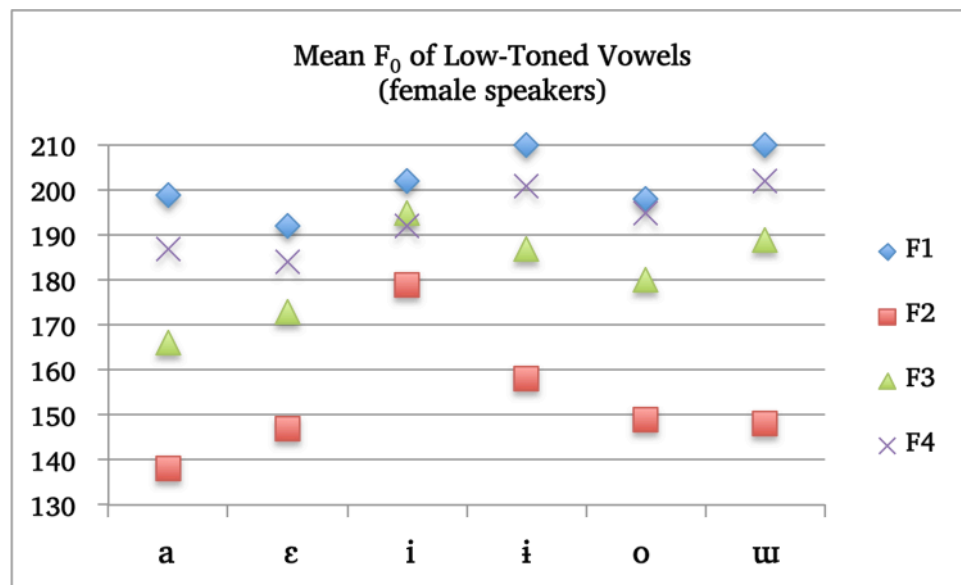


Figure 19. Mean F_0 Values of Low-Toned Vowels (female speakers)

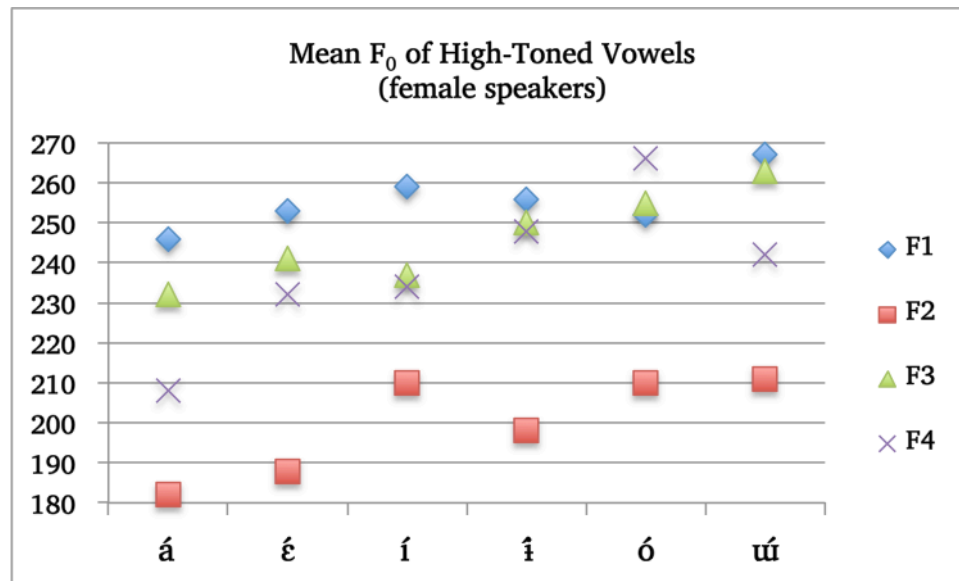


Figure 20. Mean F₀ Values of High-Toned Vowels (female speakers)

As these shown in Figures 19 and 20, the fundamental frequency of low-toned vowels ranges from approximately 140 Hz to 210 Hz, while the fundamental frequency of high-toned vowels ranges from approximately 180 Hz to 270 Hz.

2.4.1.1 F₀ Range of Female Speakers

The F₀ range of individual female speakers varied greatly, although the mean difference in fundamental frequency between high tone and low tone was around 50 Hz. Figures 21 and 22 show the F₀ range of two female research subjects, F3, and F4.

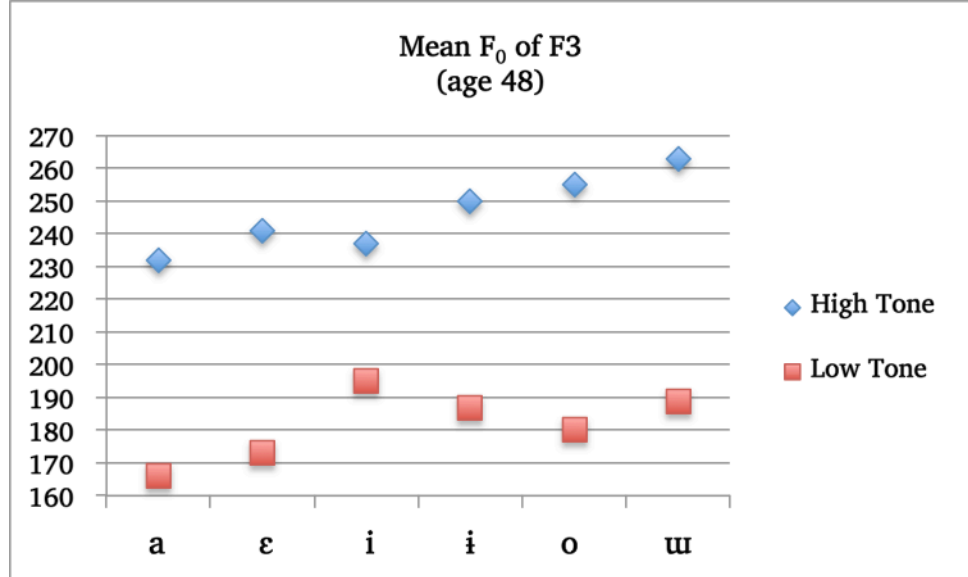


Figure 21. F₀ Range of F3 (age 48)

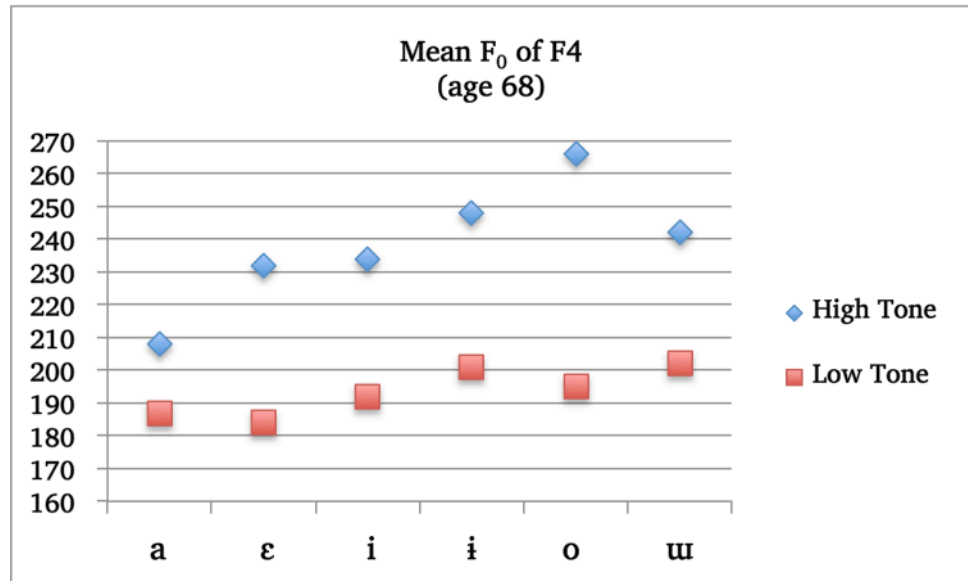


Figure 22. F₀ Range of F4 (age 68)

Figure 21 shows that F3 has an F₀ range of approximately 100 Hz, while F4 has an F₀ range of approximately 90 Hz. This is a wider range than the range for male speakers (as previously shown in Figures 8 and 9, individual male speakers displayed an F₀ range between 30 and 60 Hz.)

2.5 Creaky Voice vs. Modal Voice

As demonstrated by the acoustic measurements in this chapter, Bora uses fundamental frequency (and, to a more limited extent, length and intensity) to differentiate between high and low tone. The Bora tone system has one additional phonetic feature: laryngeal setting. High-toned vowels are uttered in modal voice,⁷⁰ while low-toned vowels are often accompanied by creaky voice, especially at the end of a tonal phrase. Ladefoged and Maddieson (1996:48) define modal voice as “regular vibrations of the vocal folds at any frequency within the speaker’s normal range”. Creaky voice is characterized by “vocal cords vibrating anteriorly, but with the arytenoid cartilages pressed together; considerably lower rate of airflow than modal voice” (Ladefoged and Maddieson 1996:48).

As described in Chapters 1 and 3, Bora has a low boundary tone that associates to the right edge of noun phrases (see Sections 1.2.5 and 3.1). This final low tone is always articulated with creaky voice, to the extent that the boundary tone could be considered a boundary voicing change with accompanying low tone.

⁷⁰ Vowels with high tone are almost always spoken in modal voice. However, a high-toned vowel may take on creaky voice if it occurs between two low-toned vowels or if it directly precedes a glottal stop.

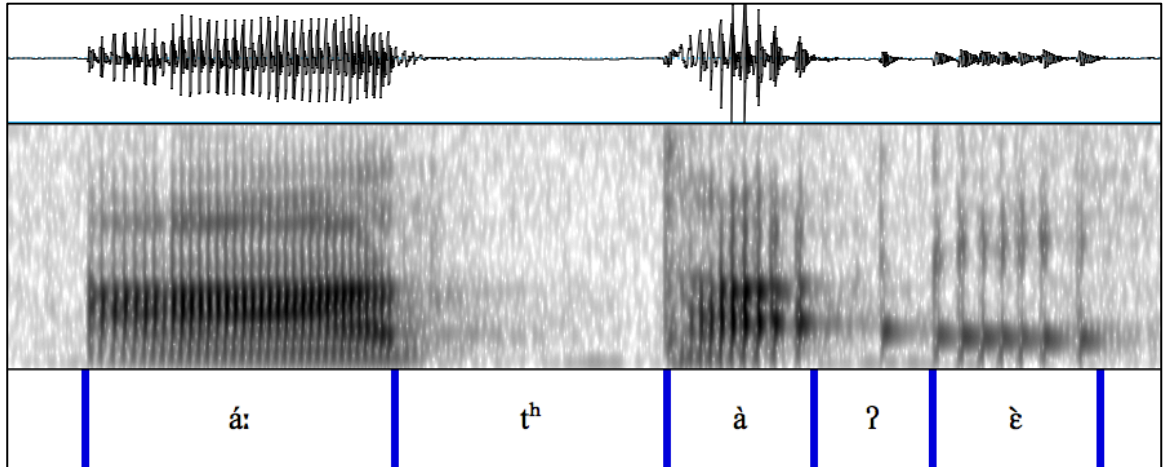


Figure 23. Creaky voice on the final two syllables of /á:tʰàʔè/ ‘stinging nettle’

Figure 23 is a spectrogram of the word /á:tʰàʔè/ ‘stinging nettle’, which was originally recorded in the frame /tíɲè á:tʰàʔè/ ‘say ‘stinging nettle’’.⁷¹ The final two syllables of /á:tʰàʔè/ have low tone accompanied by creaky voice.

The spectrogram in Figure 23 illustrates the difference in vocal register between high tone and low tone. In the first syllable, the long high vowel /á:/ has dark formants and tight vocal pulses, indicating that it was pronounced with modal voice. In contrast, the low /à/ and the final /è/ were pronounced with creaky voice: the formants are less dark, the waveforms are shorter (indicating less intensity), and the vocal pulses are spaced further apart.

Creaky voice appears to be an obligatory feature of phrase-final low tones. Phrase-medial low tones, however, may be produced with or without creaky voice, depending on the speaker. I observed that all speakers were more likely to use creaky voice when vowels directly preceded glottal stops.

⁷¹ The word in Figure 23 was recorded by the female language consultant F2.

2.6 Conclusions

The primary acoustic correlate of tone in Bora is fundamental frequency, with high tone having higher pitch than low tone. Male speakers had approximately 20 to 50 Hz between the mean F_0 of low tone and high tone, while female speakers typically had over 50 Hz between the mean F_0 of low tone and high tone.

Length is also an acoustic correlate of tone, with low-toned vowels having a longer mean duration than high-toned vowels. High tone may also be accompanied by higher intensity, especially on short vowels and contour tones. Another phonetic feature of the Bora tone system is vocal register. Boundary low tones at the end of a phrase are always accompanied by creaky voice, while phrase-medial low tones may be produced with either creaky voice or modal voice.

CHAPTER 3

NOMINAL TONE

In this chapter, I describe nominal tone in Bora, focusing on the tone patterns of disyllabic noun roots. I provide an overview of the Bora tone system in Section 3.1, where I present evidence to support the claim that Low is specified and High unspecified. In Section 3.2, I establish the underlying tone patterns of noun roots and provide examples of animate and inanimate nouns with contrastive tones. In Section 3.3, I explain why Bora should be analyzed as having a mixed tone/stress system. In Section 3.4, I discuss the case marker *-ma*, while in Section 3.5 I examine the first person genitive prefix *t^ha-*. I conclude this chapter in Section 3.6 with a summary of nominal tone and stress.

3.1 Overview of Bora Tone

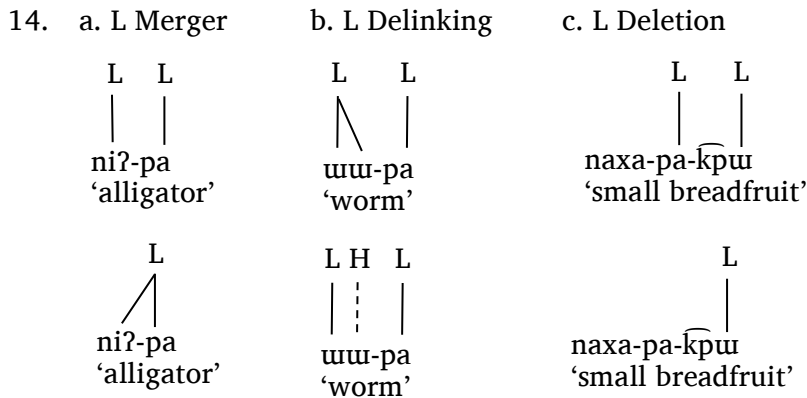
In Bora, disyllabic noun roots have the underlying tone patterns $L\emptyset$, $\emptyset L$, and $\emptyset\emptyset$, which give rise to two level surface tones: High and Low. Pike (1948:5) defines a level tone as “one in which, within the limits of perception, the pitch of its syllable does not rise or fall.” Bora also has two contour tones, HL and LH. Contour tones have “a perceptible rise or fall, or some combination of rise and fall, such as rising-falling or

falling-rising” (Pike 1948:5). In Bora, level tones occur on all vowels, while contour tones are limited to long vowels in specific environments.⁷²

The Obligatory Contour Principle (Leben 1973, Goldsmith 1976) places the following constraint on sequences of identical tones: “At the melodic level of the grammar, any two adjacent tonemes must be distinct” (Goldsmith 1976:36). Although the OCP is no longer claimed to apply universally, in Bora it prohibits sequences of adjacent low tones.⁷³ Bora resolves OCP conflicts in three ways:

- a) L Merger
- b) L Delinking
- c) L Deletion

Example (14) illustrates the three types of OCP resolutions:



The choice of resolution is phonologically, grammatically, and lexically determined. In Bora, L Merger is limited to phrase-final short vowels. When two low tones occur on adjacent phrase-final short vowels, they merge into one L that is linked to two moras.

⁷² Because contour tones are limited to long vowels, Thiesen and Weber (2012:60) analyze long vowels with contour tones as two separate syllables. For example, they consider a long vowel with the contour tone LH to be a low-toned syllable followed by a high-toned syllable.

⁷³ I analyze final LL sequences as one low tone linked to two moras (see L Merger in Example 14). Thus, I do not consider them to be a violation of the OCP.

L Delinking occurs in two environments: a) to break up sequences of three low-toned moras that involve long vowels, and b) to resolve word-medial OCP conflicts between boundary tones and the underlying tones of verb suffixes (I describe this in more detail in Chapter 4).

Other word-medial OCP conflicts are resolved by L Deletion. These conflicts occur at morpheme boundaries or when stressed moras (which bear low stress tones) are adjacent to moras with underlying low tones. In general, underlying tones of roots take precedence over affix tones, and underlying tones of both roots and affixes take precedence over the low tone that marks stress. However, some affixes, such as the first person genitive prefix *t^ha-*, delete conflicting low tones from the root (see Section 3.4).

Bora assigns low tones to stressed moras. Two and three syllable words have stress on the penultimate mora while longer words have antepenultimate stress.⁷⁴ In addition to the L stress marker, Bora has a boundary L that docks on the right edge of noun phrases. OCP conflicts occur when nouns with penultimate stress occur phrase-finally, as the low tone that marks stress is adjacent to the low boundary tone.

Bora resolves these phrase-final tone conflicts through L Merger or L Delinking. When the final two syllables of a given word have short vowels, their low tones merge into a single L that is linked to two moras, as illustrated by the example in (14a).

Bora nouns have a constraint against sequences of three low-toned moras. When nouns have long vowels in the penultimate or final syllables, the assignment of stress tones and boundary tones results in three adjacent low-toned moras.⁷⁵ Bora resolves the OCP conflict by delinking the low tone from the second mora. As the mora is now

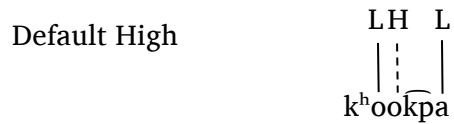
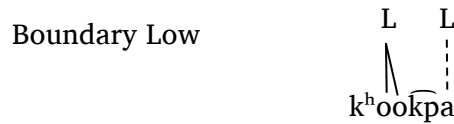
⁷⁴ I discuss stress in more detail in Section 3.3.

⁷⁵ As previously stated, Bora assigns stress to the penultimate mora of two and three syllable words. When the penultimate mora occurs on a long vowel, the entire long vowel takes low tone.

toneless, a default high tone is inserted, breaking up the illegal cluster. This is illustrated in (15).

15. U. Form S. Form
 /k^ho:-kpa/ k^hǝ:-kpa
 ‘cut, gash’

The derivation of this word is shown in (16). To clearly demonstrate how tones associate to moras, the long vowel is represented as a double vowel: /oo/.
 16. U. Form /k^hoo:kpa/
 ‘cut, gash’



Surface Form k^hǝ:-kpa

As suffixes are applied to noun stems, stress is reassigned and the conditions that lead to OCP violations no longer exist. This is shown by the examples in (17).

17. U. Form S. Form
 a. /aɲa:-xi/ áɲǎ:-xì
 poison.dart.frog-disk.shaped
 ‘poison dart frog’
 b. /aɲa:-xi-k^hòpa/ áɲá:-xí-k^hòpà
 poison.dart.frog-disk.shaped-AUG
 ‘big poison dart frog’

In Bora, the OCP prohibits two low tones from associating to the same vowel. When two and three syllable nouns have long vowels in the final syllable, the low stress tone associates to the first mora of the long vowel and the boundary low tone associates to the second mora of the long vowel. To resolve the resulting OCP conflict, the boundary tone delinks from the final mora.⁷⁶ Example (20) shows a noun with a final long vowel.

18. U. Form S. Form
 /pak^ho:/ pák^hǒ:
 ‘caterpillar sp.’

The derivation of *pák^hǒ:* is presented in (19). As in (16), the long vowel is written as a double vowel /oo/ to clearly represent how tones associate to moras.

19. U. Form /pak^ho:/
 ‘caterpillar sp.’
- Stress Assignment
- L
 |
 pak^hoo
- Boundary Low
- L L
 | |
 pak^hoo
- L Delinking
- L
 |
 pak^hoo
- Default High
- H L H
 | | |
 pak^hoo
- Surface Form pák^hǒ:

⁷⁶ Some irregular words, such as *mùñâ:* ‘compatriot’ have a HL contour tone on the final syllable. I analyze these words as having underlying low tones.

22.	U. Form	S. Form
	/nu:ʔ/	nu:ʔ
		'knitting, weaving (n.)'

The LH contour tone in (22) is derived from the same process as the LH contour tone in (21). Monosyllabic roots have a LL sequence in which the first L is assigned to the stressed mora, while the second L is a boundary tone. As the OCP prohibits two low tones from associating to the same vowel, the second L in the sequence delinks and a default high tone is inserted. Thus, the surface tone pattern of monosyllabic free roots is LH.

3.1.1 *Marked and Unmarked Tone*

As stated elsewhere, the TBU in Bora is best analyzed as the mora. Evidence that tones associate to moras is provided by contour tones, which are limited to bimoraic (long) vowels (see Examples 15, 17, 20 and 21).

As demonstrated by the acoustic analysis in Chapter 2, Bora vowels may be phonetically high or low in pitch. Phonologically, however, the tone system can be described as a contrast between L and \emptyset . In underlying forms, vowels are either specified for low tone or unspecified (underlyingly toneless), in which case they are assigned surface high tones by a default rule. Hyman (2000) calls this a “privative” tone system, which he defines as “the presence vs. absence of tone, rather than two indications of tone.”

The analysis of High as the unspecified tone in Bora contradicts Pulleyblank’s (1986:125-133) claim that in privative languages, Low is the universal default tone. Pulleyblank suggests that in privative tone systems, high tone is universally specified while low tone is universally unspecified. Although this hypothesis holds true for most privative tone systems, it is contradicted by Bora and a small number of other tonal languages, as I explain in more detail below. Hyman (2012:4) observes that “in privative systems. . . the one specific tone is presumably also the marked value.”

Therefore, most privative tone systems may be assumed to have marked high tone and unmarked low tone. This is supported by Maddieson (1978:342), who observes that “systems in which high tones are marked are more frequent than systems in which low tones are marked.”

The Bora tone system is striking in that Low is better analyzed as specified and High as unspecified, as attested by Aschmann (1994), Thiesen (1996), Thiesen and Weber (2001), Seifart (2005), and Thiesen and Weber (2012). While as many as 70 percent of the world’s languages are tonal (Yip 2002:1), only a handful of languages have been claimed to have marked low tone and unmarked high tone. Among them are Igbo,⁷⁷ a Niger-Congo language of southwestern Nigeria (Clark 1989); Ruwund, a Bantu language of Zaire and Angola (Nash 1994); and Slave, an Athabaskan language spoken in the Northwest Territories of Canada (Hargus and Rice 2005).⁷⁸ Although the Bora tone system is extremely unusual, there is compelling evidence to support the claim that Low is the marked tone and High the unmarked tone.

One piece of evidence for this claim is that the OCP restricts sequences of adjacent low tones in Bora while freely allowing sequences of adjacent high tones.⁷⁹ Hyman (2012:4) suggests that in privative tone systems, the marked tone “can be subject to an OCP constraint” while the unmarked tone cannot. Thus, the restriction on adjacent low

⁷⁷ Igbo has three surface tones: Low, High, and Downstepped High. However, Clark (1989) argues convincingly that Igbo has a two-way contrast between L and \emptyset in underlying forms.

⁷⁸ At least two of these languages, Slave and Ruwund, appear to be cases of tonal “flip-flop” – that is, their surface tone patterns are the reverse of the tone patterns of the proto language (Hargus and Rice 2005:8, Nash 1994:225). It is possible that Bora is also an example of tonal flip-flop, but at the present time, tone in the Witotoan language family has not been described to the extent necessary to reconstruct Proto Witotoan tone. (Aschmann (1993) proposes two surface tones (High and Low) for Proto Bora Muinane, but he does not analyze the tone system in depth.)

⁷⁹ See the beginning of Section 3.1 for more information about OCP restrictions in Bora.

tones supports the claim that Low is the marked tone in Bora. It is possible that at the point in the phonological derivation at which the OCP is enforced, only low tones are present in Bora and thereby subject to OCP constraints.

There are three compelling reasons why Low should be considered the marked tone in Bora.

- a) Low tones are more stable than high tones.⁸⁰ Unless there is an OCP conflict, low tones always take precedence over high tones. (Low tones are only replaced by high tones when there is a violation of the OCP.)
- b) It is possible to make predictions and generalizations about the tone system based on the behavior of low tones, but not on the behavior of high tones.
- c) The OCP prohibits sequences of phrase-medial adjacent low tones, but places no such restriction on high tones. Following Hyman's description of privative languages (2012:4), the marked tone in a privative language can be subject to OCP constraints while the unmarked tone cannot. The fact that the OCP only places restrictions on low tones in Bora suggests that Low is the unmarked tone.

The difference between low and toneless TBUs is revealed by the derivations in (23), which consist of a noun root and the class suffix *-ʔo* 'elongated, oval-shaped'.

⁸⁰ Clark (1989:26) provides a similar argument for Low being the default tone in Igbo, a language of southwestern Nigeria. In Igbo, low-toned verbal suffixes are tonally stable, while suffixes which are underlyingly toneless fluctuate between high tone and low tone, depending on the verb root.

23.	a. L∅	b. ∅L	c. ∅∅
U. Form	/t ^h ù:ɾa-ʔo/ 'woodpecker'	/p ^h a:pì-ʔo/ 'hummingbird'	/p ^h a:tʃ ^h a-ʔo/ 'cassava dough' ⁸¹
Stress	$\begin{array}{cc} L & L \\ & \vdots \\ t^h u: \text{r} a - \text{?} o \end{array}$	$\begin{array}{c} L \\ \vdots \\ p^h a: p i - \text{?} o \end{array}$	$\begin{array}{cc} L & L \\ \diagdown & \vdots \\ p^h a: t \text{c}^h a - \text{?} o \end{array}$
Boundary Low	$\begin{array}{ccc} L & L & L \\ & & \vdots \\ t^h u: \text{r} a - \text{?} o \end{array}$	$\begin{array}{cc} L & L \\ & \vdots \\ p^h a: p i - \text{?} o \end{array}$	$\begin{array}{ccc} L & L & L \\ \diagdown & \vdots & \vdots \\ p^h a: t \text{c}^h a - \text{?} o \end{array}$
L Deletion	$\begin{array}{cc} L & L \\ & \\ t^h u: \text{r} a - \text{?} o \end{array}$	-----	$\begin{array}{cc} L & L \\ & \\ p^h a: t \text{c}^h a - \text{?} o \end{array}$
L Merger	-----	$\begin{array}{c} L \\ \diagup \\ p^h a: p i - \text{?} o \end{array}$	$\begin{array}{c} L \\ \diagup \\ p^h a: t \text{c}^h a - \text{?} o \end{array}$
Default High	$\begin{array}{ccc} L & H & L \\ & \vdots & \\ t^h u: \text{r} a - \text{?} o \end{array}$	$\begin{array}{cc} H & L \\ \vdots & \diagup \\ p^h a: p i - \text{?} o \end{array}$	$\begin{array}{cc} H & L \\ \vdots & \diagup \\ p^h a: t \text{c}^h a - \text{?} o \end{array}$
Surface Form	t ^h ù:ɾá-ʔò	p ^h á:pì-ʔò	p ^h á:tʃ ^h à-ʔò

In (23a), the noun root has the underlying tone pattern L∅. When the low stress tone and the low boundary tone associate to the penultimate and final syllables, the resulting tone pattern is *LLL, which violates the OCP. To satisfy the OCP, the middle low tone in the sequence is deleted. Now toneless, the penultimate mora is assigned high tone by a default rule, resulting in the surface pattern LHL.

⁸¹ Dough made from cassava flour. Cassava flour is processed from the tuber of *Manihot esculenta* (bitter cassava), a shrub native to South America.

Although the noun stems in (23b) and (23c) have the same surface pattern, HLL, they have contrastive underlying tones. The noun root in (23c) is underlyingly toneless, while the noun root in (23b) has the underlying tone pattern \emptyset L. These contrastive tone patterns become clear when suffixes are added to the stem, as shown by the examples below:

24.	U. Form	S. Form
a.	/p ^h a:pì-ʔo/	p ^h á:pì-ʔò 'hummingbird'
b.	/p ^h a:pì-ʔo-ɯβɯ/	p ^h á:pì-ʔó-úβù 'dead hummingbird'
c.	/p ^h a:tʃ ^h a-ʔo/	p ^h á:tʃ ^h à-ʔò 'cassava dough'
d.	/p ^h a:tʃ ^h a-ʔo-ɯβɯ/	p ^h á:tʃ ^h á-ʔò-úβù 'rotten/spoiled cassava dough'

Although p^há:pìʔò 'hummingbird' and p^há:tʃ^hàʔò 'cassava dough' have the same surface tones, p^há:pìʔò has the underlying tone pattern \emptyset L, while p^há:tʃ^hàʔò is underlyingly toneless. These contrastive tone patterns become apparent when -úβù 'TERMINAL' is affixed to the noun stem. In (24b), an OCP violation occurs when the low stress marker associates to the antepenultimate syllable of p^há:pìʔóúβù, as the preceding syllable has underlying low tone. The OCP conflict is resolved by deleting the stress marker. In (24d), the noun stem p^há:tʃ^hàʔò is underlyingly toneless, so the low stress tone associates to the antepenultimate syllable.

3.2 Underlying Tone Patterns of Noun Roots

In this section, I analyze the underlying tone patterns of disyllabic noun roots, which combine with noun class suffixes to form three and four syllable noun stems. While longer noun stems exist in Bora, I have chosen not to include them because many of them are compounds (consisting of multiple roots or roots with multiple suffixes). Bora also has a number of shorter noun stems consisting of a monosyllabic root and a

noun class suffix, but these are relatively rare. Consequently, I limit the following analysis to disyllabic noun roots.

As mentioned at the beginning of Section 3.1, disyllabic noun roots have the following underlying patterns: $L\emptyset$, $\emptyset L$, and $\emptyset\emptyset$. There is no underlying LL pattern, which suggests that in underlying forms low tones are only singly linked.⁸²

A small number of noun roots in Bora are free. These roots may either be toneless (as in (25a) and (25b)) or have an underlying low tone, as in (25c) and (25d).

25.	U. Form	S. Form
a.	/iʔtʰɛ/	iʔtʰɛ 'coatimundi' ⁸³
b.	/iʔtʰɛ-wβw/	iʔtʰɛ-úβw 'dead coatimundi'
c.	/àʔtʰa/	àʔtʰà 'wound'
d.	/àʔtʰa-wβw/	àʔtʰá-úβw 'that which once was a wound and is now a scar'

Most noun roots in Bora are complex, consisting of a root and an obligatory class marker suffix.⁸⁴ Class markers are assigned based on the semantic domain of the noun (examples include $-k^h\text{o}$ 'stick-shaped', $-u$ 'round', and $-ʔɛ$ 'botanical'). Thiesen and Weber (2012) describe three types of class markers: a) those with floating low tones that dock one syllable to the left of the suffix, b) those with floating low tones that dock two syllables to the left of the suffix, and c) those that are toneless. As I demonstrate in

⁸² Refer to (23) for examples of nouns with contrastive underlying tone patterns.

⁸³ *Nasua Nasua*, a ring-tailed mammal related to the raccoon.

⁸⁴ For this analysis, I elicited nouns with eight of the most productive nominal noun class suffixes, which are listed in Section 1.2.3. For a comprehensive list of noun class suffixes see Thiesen and Thiesen (1998), Seifart (2002), Seifart (2005), and Thiesen and Weber (2012).

this chapter, nominal tone in Bora can be better described without requiring floating tones on class suffixes. This is preferable because it greatly simplifies the analysis of Bora tone.

Seifart (2005:44), analyzes all but two noun classifiers as toneless.⁸⁵ To account for the low tones that Thiesen and Weber analyze as floating tones, he posits a “tone assignment rule” that causes low tones to dock on the final syllable of noun roots when class suffixes are added. Seifart’s tone assignment rule does not explain why low tones sometimes occur on the final syllables of noun roots, as in *mámà-pá-mù* ‘rattlesnakes’, and sometimes occur on class markers, as in *mámá-pà-úβù* ‘dead rattlesnakes’. Thus, Seifart analyzes many stem suffixes as having floating low tones that delink the final L on the root. As I describe further in Section 3.3, these low tones can be explained as tones that associate to stressed syllables.

I consider all noun class suffixes in Bora to be toneless. This analysis is supported by the derivations previously shown in Section 3.1 (see examples (23) and (24)), in which noun stems have different surface patterns even though they have the same class suffix. These surface patterns can be explained by contrastive underlying tones. This eliminates the need for noun class suffixes to have floating tones, thereby simplifying the analysis.

Generally speaking, the syllable profiles of noun roots do not influence the tone patterns of noun stems in Bora. The only exceptions, as described in Section 3.1, are contour tones, which are limited to syllables with long vowels. The presence or absence

⁸⁵ Seifart lists two exceptions in the Mirañá dialect: the inanimate noun class suffix *-ne* and the animate plural class marker *-me*, both of which he analyzes with a floating low tone that docks on the penultimate syllable of the root. I consider the Bora equivalents *-ne* InPl and *-mu* AnPl to be stem suffixes rather than noun class suffixes. Therefore, I analyze all noun class suffixes in Bora as toneless.

of a coda plays no role in tone.⁸⁶ This is illustrated by the nouns in (26), which consist of roots with the underlying tone pattern LØ and the noun class suffix -xì ‘flat and round’.⁸⁷

26.	Profile	U. Pattern	S. Form
a.	VCV	LØ	ìkṙá-xì ⁸⁸ cassava.starch-flat.and.round ‘cassava starch’
b.	CV:V	LØ	nì:ó-xì whirlwind-flat.and.round ‘whirlwind’
c.	V:CV	LØ	ù:mé-xì leech-flat.and.round ‘leech’
d.	CVCCV	LØ	tò?kṙá-xì spider-flat.and.round ‘long-legged spider (sp.)’
e.	CVCV:	LØ	gòrò:-xì mushroom.flat-and-round ‘mushroom’

As the examples in (26) illustrate, disyllabic noun roots with the same underlying tone pattern have identical surface tones, regardless of the syllable profile of the noun stem. Although the noun stems in (26) have different syllable profiles, they all have the tone pattern LHL in the surface form.

⁸⁶ For an inventory of syllable profiles in Bora, see Section 1.2.3.

⁸⁷ As previously discussed, noun class suffixes are underlyingly toneless. In the examples in (10), -xì occurs at the end of a noun phrase and is therefore assigned a boundary low tone. It becomes apparent that -xì is underlyingly toneless when additional suffixes are applied to the stem, as in [ù:mé-xí-mù] ‘leeches’.

⁸⁸ As stated elsewhere, I analyze kṙ as a unit rather than a consonant cluster.

3.3 Stem Suffixes and Stress

As mentioned in Chapter 1, Bora has a mixed tone/stress system. In addition to the underlying tone pattern of the noun root, Bora assigns low tones to stressed syllables.⁸⁹ (Tone is the only indicator of stress in Bora.) Thus, the surface patterns of Bora nouns are the result of five sources of tone:

- a) underlying tone patterns
- b) boundary tones that dock onto the final syllables of noun phrases⁹⁰
- c) stress tones
- d) floating tones
- e) default high tones

Two and three syllable nouns have low tone on the penultimate syllable, which I analyze as a stress marker. This is shown in (11).

27.	U. Form	S. Form
a.	/oxts ^h o/	òxts ^h ò 'smoke'
b.	/k ^h úni:-u/	k ^h úniǎ:-ù yam-round 'yam'

The noun roots in (27) are underlyingly toneless. As previously discussed, the final low tone is a boundary tone that docks onto the right edge of noun phrases, while the low tone on the penultimate syllable in (27a) is attributable to stress. In (27b), an OCP conflict occurs when stress is applied to the penultimate long vowel, producing a

⁸⁹ Michael (2010) presents evidence that Iquito [iqu], a Zaparoan language spoken in the Amazon region of Peru and Ecuador, also has a mixed tone/stress system. Similar to Bora, Iquito is a privative language, although H is the specified tone and L unspecified. Iquito requires each prosodic word to have at least one H tone. Words that are underlyingly toneless have high tone on the syllable that bears primary stress. Michael observes that “the tonal system [of Iquito] is partially dependent on the stress system. . . for meeting an obligatory tone requirement.”

⁹⁰ In isolation, all nouns have a boundary low tone on the final syllable.

sequence of three low-toned moras. In order to avoid an OCP violation, a high tone is inserted between the two low tones, resulting in a LH contour tone on the penultimate syllable (see Section 3.1).

As previously discussed, roots combine with noun class suffixes to form noun stems. In addition to these class markers, Bora has affixes that modify the noun stem, which I refer to as “stem affixes” to distinguish them from the class markers. Stem affixes differ from class suffixes in four ways:

- a) Most noun roots have obligatory class suffixes. Stem affixes, in contrast, are not required; nouns may occur with or without stem affixes.
- b) Stem affixes can be added to all count nouns, while class markers are distributed to a limited set of roots according to semantic category: $-ʔ\epsilon$ ‘botanical’, $-k^h\sigma$ ‘stick-shaped’, etc.
- c) Class markers always precede stem suffixes.
- d) Class markers change the meaning of noun stems. Stem affixes modify the noun stem for size, quantity, and state, but do not change its meaning. This

is demonstrated in (28).

28.	Root + Class Marker	Stem + Stem Suffix
a.	úxì-ʔò banana-oval ‘banana’	úxì-ʔó:-k ^h ùʔ banana-oval-InDu ‘two bananas’
b.	úxì-pà banana-thick.liquid ‘banana drink’	úxì-pá:-k ^h ùʔ banana-thick.liquid-InDu ‘two quantities of banana drink’
c.	úxì-k ^h ò banana-stick.shaped ‘banana tree’	úxì-k ^h ó:-k ^h ùʔ banana-stick.shaped-InDu ‘two banana trees’

In (28a), the noun root *uxi* combines with the class suffix $-ʔ\sigma$ ‘elongated, oval’ to form the noun stem ‘banana’, while in (28b) the same root combines with the class suffix $-pa$ ‘thick liquid’ to form the noun stem ‘banana drink’, and in (28c) with the class suffix $-k^h\sigma$ to form the noun stem ‘banana tree’. In contrast, the stem suffix $-k^h\grave{u}$:

‘inanimate dual’ modifies the noun for number but does not change the meaning of the noun itself.

The noun stems in (28) provide additional evidence in favor of toneless class markers. If class markers have floating tones, one would expect roots to display contrastive patterns as they combine with different class suffixes. The absence of such contrasts in my data supports an analysis in which tone patterns are a function of the root.

In Table 29, I provide a list of the nominal stem suffixes I elicited for this analysis. Both of the example nouns, $\grave{a}?\beta\acute{o}\text{-}\widehat{k\acute{p}\grave{a}}$ ‘feather headdress’ and $tʃ^h\grave{a}?\acute{k}^h\acute{a}\text{-}\widehat{k\acute{p}\grave{a}}$ ‘guinea pig’ have the underlying tone pattern $L\emptyset$.⁹¹

⁹¹ See Appendix B for examples of nouns with each underlying tone pattern ($\emptyset L$, $L\emptyset$, and $\emptyset\emptyset$) with each stem suffix.

Table 29. Nominal Stem Suffixes

Suffix	Gloss	Animate Noun	Inanimate Noun
-kpù:	DIM	tʰàʔkʰá-ḱpá-ḱpù? guinea.pig-rectangular-DIM 'small guinea pig'	àʔβó-ḱpá-ḱpù? feather.headdress-rectangular-DIM 'small feather headdress'
-kʰòpa	AUG	tʰàʔkʰá-ḱpá-kòpà guinea.pig-rectangular-AUG 'large guinea pig'	àʔβó-ḱpá-kʰòpà feather.headdress-rectangular-AUG 'large feather headdress'
-wβw	TERM	tʰàʔkʰá-ḱpà-úβw guinea.pig-rectangular-TERM 'dead guinea pig'	àʔβó-ḱpà-úβw feather.headdress-rectangular-TERM 'that which used to be a feather headdress'
-mwtsʰi	AnDuM	tʰàʔkʰá-ḱpà-mwtsʰi guinea.pig-rectangular-AnDuM 'two male guinea pigs'	
-mwɸʰi	AnDuF	tʰàʔkʰá-ḱpà-mwɸʰi guinea.pig-rectangular-AnDuF 'two female guinea pigs'	
-mw	AnPl	tʰàʔkʰá-ḱpá-mw guinea.pig-rectangular-AnPl 'guinea pigs'	
:-kʰw	InDu		àʔβó-ḱpá:-kʰw feather.headdress-rectangular-InDu 'two feather headdresses'
:-nɛ	InPl		àʔβó-ḱpá:-nɛ feather.headdress-rectangular-InPl 'feather headdresses'

3.3.1 OCP Conflicts

As shown previously, two and three syllable noun stems have penultimate stress, while longer noun stems have antepenultimate stress. As affixes are added to two and three syllable stems, the stressed syllable shifts from the penultimate syllable to the antepenultimate syllable. This is illustrated by the examples in (29).

29.	U. Form	S. Form
a.	/nixt ^h i-a-xi/	níxt ^h i-à-xì piranha-flat.and.round 'piranha'
b.	/nixt ^h i-a-xi-mu/	níxt ^h i-à-xí-mù piranha-flat.and.round-AnPl 'piranhas'
c.	/nixt ^h i-a-xi-wβu/	níxt ^h i-á-xì-úβù piranha-flat.and.round-TERM 'dead piranha'

In (29a), the penultimate syllable of *níxt^hi-à-jî* 'piranha' is stressed. With the addition of the animate plural suffix in (29b) and the terminated/deceased suffix in (29c), stress moves to the antepenultimate syllable, as the noun is longer than three syllables. The low tone on the final syllable is a boundary tone that docks onto the right edge of noun phrases.

As discussed in Section 3.1, the OCP restricts sequences of adjacent low tones in Bora. OCP conflicts arise when stressed syllables directly precede or follow syllables with underlying low tones, generating the sequence *LL. These OCP violations are resolved by deleting the low tone that marks stress from the stressed mora.

The following derivations illustrate how stress tones interact with underlying tones. As the noun stems have three syllables, stress is assigned to the penultimate syllable. When the suffixes *-mu* 'animate plural' and *-muts^{hi}* 'animate dual masculine' are applied to the noun stem, they add syllables to the noun, causing stress to shift to the antepenultimate mora.

30.	a. Noun Stem	b. Stem + -mu	c. Stem + -muɬ ^{hi}
U. Form	/tʰàʔk ^h a-kpá/	/tʰàʔk ^h a-kpá-mu/	/tʰàʔk ^h a-kpá-muɬ ^{hi} /
	‘guinea pig’	‘guinea pigs’	‘two guinea pigs’
Stress Assignment	$\begin{array}{c} L \quad L \\ \quad \\ tʰaʔk^h a-kpá \end{array}$	$\begin{array}{c} L \quad L \\ \quad \\ tʰaʔk^h a-kpá-mu \end{array}$	$\begin{array}{c} L \quad L \\ \quad \\ tʰaʔk^h a-kpá-muɬ^hi \end{array}$
Boundary Low	$\begin{array}{c} L \quad L \quad L \\ \quad \quad \\ tʰaʔk^h a-kpá \end{array}$	$\begin{array}{c} L \quad L \quad L \\ \quad \quad \\ tʰaʔk^h a-kpá-mu \end{array}$	$\begin{array}{c} L \quad L \quad L \\ \quad \quad \\ tʰaʔk^h a-kpá-muɬ^hi \end{array}$
L Deletion	$\begin{array}{c} L \quad L \\ \quad \\ tʰaʔk^h a-kpá \end{array}$	$\begin{array}{c} L \quad L \\ \quad \\ tʰaʔk^h a-kpá-mu \end{array}$	
Default High	$\begin{array}{c} L \quad H \quad L \\ \quad \quad \\ tʰaʔk^h a-kpá \end{array}$	$\begin{array}{c} L \quad H \quad L \\ \quad \quad \\ tʰaʔk^h a-kpá-mu \end{array}$	$\begin{array}{c} L \quad H \quad L \quad H \quad L \\ \quad \quad \quad \quad \\ tʰaʔk^h a-kpá-muɬ^hi \end{array}$
Surface Form	tʰàʔk ^h á-kpà	tʰàʔk ^h á-kpá-mù	tʰàʔk ^h á-kpà-muɬ ^{hi}

In (30), the noun root has the underlying tone pattern $L\emptyset$. When low stress tone and the low boundary tone associate to the penultimate and final syllables of (30a), a sequence of three low tones results, thereby violating the OCP. To satisfy the OCP, the low tone that marks stress is deleted from the penultimate syllable.

In (30b), the toneless suffix *-mu* ‘ANIMATE PLURAL’, is affixed to the stem. As previously discussed, nouns with more than three syllables have antepenultimate stress. However, this creates an OCP violation, as the preceding syllable has underlying low tone. To satisfy the OCP, the low tone that marks stress is deleted from the penultimate syllable.

one-to-one correspondence between tones and moras, the additional low tone is deleted.⁹²

The same occurs when the toneless suffix *-mu* ‘ANIMATE PLURAL’, is affixed to the noun stem in (31b). With the addition of the suffix, stress moves to the antepenultimate syllable, which already has low tone from the underlying pattern of the root. Again, the low tone that marks stress is deleted to avoid an OCP conflict.

In (31c), the toneless suffix *-muts^{hi}* ‘ANIMATE DUAL MASCULINE’ is affixed to the noun stem. An OCP conflict occurs when the low tone that marks stress is assigned to the antepenultimate mora, as the preceding syllable has low tone from the underlying pattern of the root. In order to avoid an OCP violation, the low tone that marks stress is deleted.

3.3.2 Stem Suffixes with Underlying Low Tones

Two types of underlying low tones may cause OCP conflicts: a) underlying tone patterns of roots, and b) underlying low tones on stem suffixes. Two nominal stem suffixes have underlying low tones: *-kpù(:)* ‘diminutive’⁹³ and *-k^hòpa* ‘augmentative’. Derivations with these suffixes are shown in (32).

⁹² An alternative analysis is that the low stress marker merges with the underlying tone, resulting in a single L. However, as illustrated by the derivations in 21 and 23, L Merger does not occur when two low tones are assigned to long vowels. Instead, one of the low tones delinks and a default high tone is inserted to break up the illegal cluster. This indicates that Bora does not use L Merger to resolve OCP conflicts within long vowels. Thus, when two low tones are assigned to the same short vowel, I consider the OCP resolution as L Deletion. This analysis keeps the OCP resolutions in (31a) and (31b) consistent with the resolution in (31c), which is a clear example of L Deletion.

⁹³ The diminutive suffix is also used as a term of endearment: *t^hà:tʃ^hé-úí-kpù?* ‘my little grandmother’ or ‘my dear grandmother’, *ʔáxtʃ^hí-kpù?* ‘my little son’ or ‘my beloved son’.

32.	a. Noun Stem	b. Stem + $\widehat{-k\acute{p}\omega\grave{\mu}}$	c. Stem + $-k^h\grave{o}pa$
U. Form	/naxa-pa/ 'breadfruit' ⁹⁴	/naxa-pa- $\widehat{k\acute{p}\omega\grave{\mu}}$ / 'small breadfruit'	/naxa-pa-k ^h o ^h pa/ 'large breadfruit'
Stress Assignment	L naxa-pa	L L naxa-pa- $\widehat{k\acute{p}\omega\grave{\mu}}$	L L naxa-pa-k ^h o ^h pa
Boundary Low	L L naxa-pa	L L L naxa-pa- $\widehat{k\acute{p}\omega\grave{\mu}}$	L L L naxa-pa-k ^h o ^h pa
L Deletion	-----	L L naxa-pa- $\widehat{k\acute{p}\omega\grave{\mu}}$	L L naxa-pa-k ^h o ^h pa
L Merger	L / naxa-pa	L / naxa-pa- $\widehat{k\acute{p}\omega\grave{\mu}}$	L / naxa-pa-k ^h o ^h pa
Default High	H L / naxa-pa	H L / naxa-pa- $\widehat{k\acute{p}\omega\grave{\mu}}$	H L / naxa-pa-k ^h o ^h pa
Surface Form	náxà-pà	náxá-pá- $\widehat{k\acute{p}\omega\grave{\mu}}$?	náxá-pá-k ^h òpà

As shown by the derivations in (32), Bora does not use L Delinking to resolve tone conflicts between underlying tones and the low tone that marks stress. Instead, the underlying tone merges with the boundary tone while the low tone that marks stress is deleted from the antepenultimate mora.

⁹⁴ *Artocarpus altilis*, a non-native species that has become widespread in the Amazon basin. The starchy fruit may be baked or roasted, and the seeds have a peanut flavor when boiled.

The diminutive suffix *-kpù(:)* is irregular. Unlike other suffixes, its surface form changes depending on its environment. Phrase-finally, as shown in the derivations in (32), it occurs as a single vowel with a glottal coda: $[-kpùʔ]$.⁹⁵ In medial environments, it is pronounced with a long vowel with a contour tone (see (33a)). It is interesting to note that while Bora permits other morphemes with long vowels to have level low tones, the diminutive suffix never occurs word-medially with level tone (either high or low); it always has the contour tones LH or HL. To explain this inconsistency, I follow Thiesen and Weber (2012), who propose that the diminutive suffix has an underlying mora that causes the vowel to lengthen in medial environments.⁹⁶ Thus, the long vowel of the diminutive suffix is comprised of a vowel followed by a nonsegmental mora. The fact that the diminutive suffix always occurs word-medially with a contour tone indicates that the OCP does not permit two low tones to associate to both a nonsegmental mora and a vowel. (In phrase-final environments, the two low tones merge into a single L that is associated to two moras.)

(33a) shows the diminutive suffix in the middle of a word, while (33b) shows the diminutive suffix phrase-finally, where the vowel is shortened and a glottal coda is inserted.

⁹⁵ In Bora, all vowel-final words have a glottal coda at the end of a phrase. For a more detailed explanation of glottal codas, refer to Section 1.2.2.

⁹⁶ It is possible that the diminutive suffix historically had two syllables, one of which has disappeared, leaving behind an underlying mora.

33. a. ʔáxtʃ^hí-ḱpũ:-mù mǎ⁹⁷ tsǎ:-pè
 son-DIM-AnPl ACC come-3MSg
 ‘he is coming here with my small⁹⁸ sons’
- b. ʔáxtʃ^hí-ḱpũʔ
 son-DIM
 ‘(my) small son’⁹⁹

In (33a), the diminutive suffix precedes a syllable with low tone. As described above, the underlying low tone of the diminutive suffix associates to the rightmost possible mora. In order to avoid an OCP conflict with the low tone of the following syllable, the underlying low tone is realized on the first mora of the diminutive suffix, resulting in the contour tone LH. In (33b), the diminutive suffix occurs at the end of a noun phrase, so it has a short vowel followed by a glottal coda. As the examples in (33) demonstrate, underlying moras are realized as vowel length in medial environments and as a glottal stop phrase-finally.

3.3.3 *Animate and Inanimate Number Suffixes*

As noted previously, Bora nouns are either Animate or Inanimate. These two types of nouns take separate sets of suffixes. Animate nouns may be modified by the animate number suffixes *-mu* ‘AnPl’, *-muts^hi* ‘AnDuM’ and *-mup^hi* ‘AnDuF’, while inanimate nouns take the inanimate number suffixes *:-k^hu* ‘InDu’ and *:-nɛ* ‘InPl’.

The inanimate suffixes *:-k^hu* ‘InDu’ and *:-nɛ* ‘ cause the vowel of the preceding syllable to lengthen. This is shown in (34).

⁹⁷ The case marker *-ma* follows irregular tone patterns (see Section 3.4).

⁹⁸ As the diminutive suffix is also used as a term of endearment, this could also be glossed: ‘He is coming here with my beloved sons.’

⁹⁹ If kinship words occur without the genitive case, it is assumed that the speaker is talking about his/her family member.

34.	U. Form	S. Form
a.	/ò:ɽi-pa/	ò:ɽí-pà abscess-thick.liquid 'abscess'
b.	/ò:ɽi-pa-μk ^h u/	ò:ɽí-pá:-k ^h ù abscess-thick.liquid-InDu 'two abscesses'
c.	/ò:ɽi-pa-μnɛ/	ò:ɽí-pá:-nè abscess-thick.liquid-InPl 'abscesses'

In (34a) the noun stem for 'abscess' ends in a single vowel, reflecting its underlying form. In (34b) and (34c), the vowel lengthens when the inanimate number suffixes are added to the stem.

Like the diminutive suffix (see Section 3.2.2), I analyze inanimate number suffixes as having underlying moras. However, unlike the diminutive suffix, which is itself lengthened in medial environments, the underlying moras of the inanimate number suffixes are realized on the vowel of the preceding syllable. To explain this difference, I propose that the diminutive suffix has an underlying mora is morpheme-final, while inanimate number suffixes have an underlying mora that is morpheme-initial.

Vowel lengthening does not change the tone pattern of noun stems. This is shown in (35). Interestingly, the low tone that marks stress, which usually occurs on the antepenultimate mora, is realized on the antepenultimate syllable. This indicates that stress does not count the nonsegmental mora that lengthens the preceding vowel, which is unexpected.

35.	a. $\emptyset L$	b. $L\emptyset$	c. $\emptyset\emptyset$
U. Form	/i:mù-ʔo/	/nè:βá-ʔo/	/k ^h ó:xu-ʔo/
Root	í:mù-ʔò beehive-oblong 'beehive'	nè:βá-ʔò peg-oblong 'peg'	k ^h ó:xù-ʔò avocado-oblong 'avocado'
-μk ^h u 'InDu'	í:mù-ʔó:-k ^h ù beehive-oblong-InDu 'two beehives'	nè:βá-ʔó:-k ^h ù peg-oblong-InDu 'two pegs'	k ^h ó:xù-ʔó:-k ^h ù avocado-oblong-InDu 'two avocados'
-μne 'InPl'	í:mù-ʔó:-nè beehive-oblong-InPl 'beehives'	nè:βá-ʔó:-nè peg-oblong-InPl 'pegs'	k ^h ó:xù-ʔó:-nè avocado-oblong-InPl 'avocados'

As illustrated by the examples in (35), the tone patterns of nouns do not change when the penultimate syllable is lengthened by an underlying mora.

3.3.4 The Case Marker *-ma*

In this section, I briefly discuss the case marker *-ma* 'SOCIATIVE'. Bora has six additional case markers (not including nominative case, which is unmarked). Due to time constraints, however, I was only able to elicit nouns with *-ma*. While I did not elicit the other six class markers, examples in Thiesen and Weber (2012) and Seifart (2006) indicate that they follow the same tonal behavior as *-ma*. However, more data is required in order to conduct an in-depth analysis of the tones of Bora case markers. Although case markers are largely outside the scope of this thesis, I briefly describe the sociative case marker in this section.

Thiesen and Weber (2012) and Seifart (2006) analyze case markers as suffixes, although Seifart usually separates them from noun phrases, which he encloses in brackets. Case marker suffixes occur at the end of noun phrases and may only be followed by the restrictive marker *-ɾɛ*, which Thiesen and Weber (2012:310) analyze as a clitic. Examples of noun stems with the sociative case marker *-ma* are presented below.

36.	U. Form	S. Form
a.	/àŋw-ɯ/	àŋú-ù-mà bullet-round with 'with a bullet'
b.	/p ^h a:ɾà-ji/	p ^h á:ɾà-ǰí-mà shovel-flat.and.round with 'with a shovel'
c.	/wkpá:-ji/	úkpá:-ǰí-mà axe-flat.and.round with 'with an axe'
37.	U. Form	S. Form + ma
a.	/ɲà:ma-kpá/	ɲà:má-kpà-mà witch.doctor-slab-SOC 'with a witch doctor'
b.	/k ^h ɯ?mà-kpá/	k ^h ú?mà-kpá-mà lame.person-slab-SOC 'with a lame person'
c.	/a:nuw-kpá/	á:nuú-kpà-mà cassava.shoot-slab-SOC 'with a cassava shoot for planting'

The sociative case marker *-ma* always has low tone, which I analyze as the boundary low tone that docks onto the right edge of noun phrases. When *-ma* affixes to the right edge of a given noun, the low tone that marks stress does not associate to the antepenultimate syllable of the noun. (This is illustrated by the examples in (36a), (36c), (37a), and (37c)). The low tone that marks stress is presumably deleted in order to avoid a sequence of three low-toned moras. Based on this tonal behavior, I follow Thiesen and Weber (2012:310) in analyzing case markers as suffixes with floating low tones that associate to the preceding syllable.

As previously stated, I analyze the low tone on *-ma* as the boundary tone that associates to the final syllable of noun phrases. This is illustrated by the examples in (38), in which the low tone on *-ma* marks the boundary between the noun phrase and the following verb phrase.

38. a. p^hà:kpájù-mà tsǎ:-p^hè?
 spider-ACC come-3SgM
 'he is coming here with a spider [in his hand]'.
 b. ápá:-pè-mà tsǎ:-p^hè?
 father-in-law-ACC come-3SgM
 'he is coming here with (my) father-in-law.'¹⁰⁰

In summary, *-ma* displays different tonal behavior than other stem suffixes. When stem suffixes are applied to nouns, stress follows a predictable pattern: two and three syllable nouns have penultimate stress, while longer nouns have antepenultimate stress. When *-ma* follows a noun stem, the final syllable of the stem has low tone and stress is not assigned to the penultimate syllable.

Case markers are an area for further research in Bora. In the future, noun stems should be elicited with all seven case marker suffixes. Additionally, the relationship between case markers and stress should be examined by adding case markers to nouns with more than three syllables.

3.4 Genitive Prefix

Although Bora is almost exclusively suffixal, nouns take one set of prefixes that mark the genitive case. Due to time limitations, I elicited nouns with only one prefix, the first person genitive *t^ha-*. When two-syllable nouns are marked for genitive case, the prefix has low tone and the noun stem has the surface pattern HL. This is shown in (39).

¹⁰⁰ Some kinship words may occur with or without the genitive prefix. When kinship words occur without the genitive prefix, it is assumed that the speaker is talking about his/her family member. My Bora language consultant told me that there is no difference in meaning when the genitive prefix is used.

	Noun Stem	1GEN + Noun Stem
39.	tʃ ^h ɛ:-ùʔ armadillo-round 'armadillo'	tà-tʃ ^h ɛ:-ùʔ 1GEN-armadillo-round 'my armadillo'

When the genitive prefix attaches to noun stems with three or more syllables, the genitive prefix has high tone and the first syllable of the noun (regardless of the underlying tone pattern of the root) has low tone. This is illustrated in (40).

	U. Pattern	U. Form	S. Form + t ^h a-
40. a.	LØ	/ɾò:u:kpa/	t ^h á-ɾò:ú:kpà 1GEN-clay.whistle-plank.shaped 'my clay whistle'
b.	ØL	/o:p ^h à-ʔo/	t ^h á-ò:p ^h á-ʔò 1GEN-paiche.fish-oblong 'my paiche fish'
c.	ØØ	/a:k ^h u:p ^h a/	t ^h á-à:k ^h ú:p ^h à 1GEN-edible.frog-rectangular 'my edible frog'

Although the nouns in (40) have contrastive underlying tones, they have the same tone patterns following the genitive prefix. I follow Thiesen and Weber (2012:58), who analyze the genitive prefix as having a floating low tone that delinks conflicting tones on the root. The floating tone associates to the right unless it has no option but to associate to the left.

On two-syllable noun stems, the floating tone is blocked from associating to the right. There are two possible reasons: a) this would produce an OCP conflict with the final boundary tone, or b) it is blocked by the low tone that marks stress. Thus, the floating low tone docks on the genitive prefix. On nouns with three or more syllables, the floating low tone is free to associate to the first syllable of the noun stem.

3.5 Conclusion

As described in this chapter, disyllabic noun roots have three underlying tonepatterns: LØ, ØL, and ØØ. These tone patterns are realized in surface forms as LH, HL, and HH.

In Bora, noun stems may be simple (free roots), complex (roots with one class suffix), or compound (multiple roots or roots with multiple class suffixes). Noun class markers, which are underlyingly toneless, are assigned to roots based on the semantic domain of the noun.

Noun stems may be modified for gender, number, and state by stem affixes. These affixes may be toneless or have underlying low tone. In this chapter, I examine two stem suffixes with underlying low tones: *-k̄p̄iù:* ‘diminutive’ and *-k^hòpa* ‘augmentative’.

Bora has a set of stem prefixes that mark the genitive case. When the first person genitive prefix *t^ha-* is affixed to two-syllable nouns, the prefix itself has low tone. When it is affixed to nouns with three or more syllables, *t^ha-* has high tone and the first syllable of the noun stem has low tone.

In addition to the underlying tones of roots and suffixes, Bora has a stress system that assigns low tone to stressed moras. Two and three syllable nouns have penultimate stress, while longer nouns have antepenultimate stress.

In Bora, the OCP prohibits sequences of adjacent low tones. OCP conflicts arise when stressed moras are adjacent to moras with underlying low tones. OCP violations are resolved by merging two low tones, deleting one of the low tones, or inserting a high tone.

In summary, the surface patterns of nouns in Bora result from five sources of tone: underlying tones, boundary tones, stress tones, floating tones, and default high tones. In the following chapter, I examine the tone and stress of Bora verbs.

CHAPTER 4

VERBAL TONE

In this chapter, I examine verbal tone in Bora. As described in Chapter 3, noun roots have three underlying tone patterns: $\emptyset L$, $L\emptyset$ and $\emptyset\emptyset$. Verb roots, in contrast, are underlyingly toneless; the surface pattern of verbs depends on affixes, boundary tones, and stress assignment. In Section 4.1, I outline the basic structure of verb stems. In Section 4.2, I provide a list of common Derivation I suffixes and establish their underlying tone patterns, while in Section 4.3, I describe the tones of Derivation II suffixes. I briefly discuss monosyllabic verb roots in Section 4.4 before concluding the chapter with a summary of verbal tone in Section 4.5.

The analysis in this chapter is based on monosyllabic and disyllabic verb roots, many of which combine with verb class suffixes to form two, three, and four syllable verb stems. While longer verb stems exist in Bora, most are compounds, consisting of multiple roots or roots with more than suffix. Therefore, in order to clearly portray the underlying pattern of each morpheme, this analysis is based on monosyllabic and disyllabic roots that have no more than one Derivation I suffix.

4.1 The Structure of Verb Stems

In Bora, verb roots are either simple (consisting of a free root) or complex (consisting of a root and a Derivation I suffix). The verb in (41a) is an example of a free root while (41b) has the Derivation I suffix $-?k^ho$ 'ITERATIVE'.

		U. Form	S. Form
41.	a.	/nani/	nàni 'to steal'
	b.	/ts ^h uɣu-ʔk ^h o/	ts ^h úɣù-ʔk ^h ò hiccup-ITER 'to have the hiccups'

Bora assigns low tones to stressed syllables. Two and three syllable words have penultimate stress, while words with four or more syllables have antepenultimate stress (see Section 4.1.2). Additionally, Bora has a low boundary tone that docks on the right edge of verb stems. Thus, the verbs in (41) are assigned two low tones: a penultimate stress marker and a final boundary tone. As the initial syllable of the verb in (41b) is underlyingly toneless, it is assigned a surface high tone. The derivations of the verbs in (41) are shown in example (42).

The OCP restricts sequences of adjacent low tones in Bora¹⁰¹. As previously noted, Bora exhibits three responses to OCP conflicts: L Merger, L Deletion, and L Delinking. L Merger is limited to word-final monomoraic syllables, where conflicting low tones merge into a single L that is linked to two moras. L Delinking occurs in two environments: a) to break up clusters of three word-final low-toned moras, and b) to avoid OCP violations between boundary tones and the underlying tones of verb suffixes (I describe this further in Section 4.3.1). Other word-medial OCP conflicts are resolved through L Deletion.

In the examples in (41), an OCP violation arises when the low tone that marks stress and the verbal boundary tone are assigned to adjacent syllables. Since the conflicting low tones occur on word-final monomoraic syllables, Bora uses L Merger to satisfy the OCP. This is shown in the derivations in (42).

¹⁰¹ For further discussion, refer to Section 3.1.

42. U. Form	/nani / 'to steal'	/ts ^h uɣu-ʔk ^h o/ 'to hiccup'
Stress Assignment		
Boundary Tone		
L Merger		
Default High	-----	
Surface Form	nàni	ts ^h úɣù-ʔk ^h ò

Verbal boundary tones differ from the nominal boundary tones described in Chapter 3. While nominal boundary tones apply to the end of noun phrases, verbal boundary tones dock on the right edge of verb stems.¹⁰² This is illustrated by the examples in (43), where the Derivation II suffix, -t^hε 'goes to do', is added to the verb stem. The final syllable of the verb stem has low tone, while the suffix, which is underlyingly toneless, is assigned high tone in the surface form.

¹⁰² In Example (43), pàxà 'to sacrifice' is a simple verb stem (consisting of a free root), while táɽàx-t^hò 'to dry in the sun' is a complex verb stem consisting of a root and the causative Derivation I suffix -t^hò. For an explanation of the difference between Derivation I and Derivation II suffixes, see Section 4.3.

43. a. pàxà sacrifice 'to sacrifice' tářix-ts^hò dry.in.the.sun-CAUS 'to dry (something) in the sun'
- b. páxà-t^hé sacrifice-goes.to 'goes to sacrifice' tářix-ts^hò-t^hé dry.in.the.sun-goes.to 'goes to dry (something) in the sun'

Example (44) shows the derivations of the verbs in (43).

44.	a.	b.
U. Form	/paxa-t ^h ε/ 'goes to sacrifice'	/tařix-ts ^h o-t ^h ε/ 'goes to dry (something) in the sun'
Stress Assignment	L paxa-t ^h ε	L tařix-ts ^h o-t ^h ε
Boundary Tone	L L paxa-t ^h ε	L L tařix-ts ^h o-t ^h ε
L Deletion	L paxa-t ^h ε	L tařix-ts ^h o-t ^h ε
Default High	H L H paxa-t ^h ε	H L H tařix-ts ^h o-t ^h ε
Surface Form	páxà-t ^h é	tářix-ts ^h ò-t ^h é

In (44a), the low tone that marks stress is assigned to the same syllable as the verbal boundary tone, violating the OCP. Bora resolves this conflict by deleting the low tone that marks stress from the penultimate syllable. In (44b), the stressed syllable precedes the boundary low tone, so the low stress tone is once again deleted in order to avoid an OCP conflict. The remaining syllables, which are toneless, are assigned surface high tones.

4.1.1 Free Roots

In Bora, verb roots are underlyingly toneless. In surface forms, verbs are assigned two low tones: a low tone that associates to the stressed syllable and a boundary tone that docks on the right edge of verb stems. This is illustrated by the examples in (45).

45. a. t^haxù
 'to mix'
- b. k^hpàʔp^hè
 'to fly'

In isolation, verb stems with the syllable profiles (C)V:(C)V and (C)V(C)V: also have the tone pattern LL. While Bora usually avoids clusters of three low-toned moras, verb stems have the tone pattern LL to distinguish them from their nominalized forms. This is shown in (46).

46.	Verb	Nominalized Verb
a.	nù:ò 'to bite, sting'	nũ:ò 'a bite or a sting'
b.	wàk ^h ũ: 'to poison'	wàk ^h ũ: 'the act of poisoning someone or something'

In summary, verb roots are underlyingly toneless. In surface forms, disyllabic verb stems have the tone pattern LL regardless of the syllable profile of the verb root.

4.1.2 Verbal Stress

In Bora, low tones associate to stressed syllables. Two and three syllable words have penultimate stress, while words longer than three syllables have antepenultimate stress. OCP conflicts occur when stressed syllables are adjacent to low-toned syllables. Word-medially, Bora resolves these conflicts by deleting the low stress marker. Word-finally, the low tones merge into a single L that is associated to two moras.

As previously noted, Bora verb roots are underlyingly toneless. When roots combine with Derivation I suffixes, they are assigned one of the following tone patterns based on their suffix: $\emptyset\emptyset$, $L\emptyset$, or $\emptyset L$.

Example (47) shows the interaction between stress and each of the three verbal tone patterns ($\emptyset\emptyset$, $L\emptyset$, or $\emptyset L$).

47.	a. $\emptyset\emptyset$	b. $L\emptyset$	c. $\emptyset L$
U. Form	/ɛxɛx-ts ^h o/ cough-CAUS 'to cough'	/àxk ^h ɛ-βa/ wake.up-VZR 'to wake up involuntarily'	/iʔβɛ-t ^h ɛ/ stop-TRANSL 'to cease, to stop doing'
Stress Assignment	L ɛxɛx-ts ^h o	L L axk ^h ɛ-βa	L L iʔβɛ-t ^h ɛ
Boundary Tone	L L ɛxɛx-ts ^h o	L L L axk ^h ɛ-βa	L L L iʔβɛ-t ^h ɛ
L Deletion	-----	L L axk ^h ɛ-βa	L L iʔβɛ-t ^h ɛ
L Merger	L / \ ɛxɛx-ts ^h o	-----	L / \ iʔβɛ-t ^h ɛ
Default High	H L / \ ɛxɛx-ts ^h o	L H L axk ^h ɛ-βa	H L / \ iʔβɛ-t ^h ɛ
Surface Form	éxèx-ts ^h ò	àxk ^h é-βà	íʔβè-t ^h è

In (47a), the verb stem takes the Derivation I suffix -ts^ho, so the root is assigned the tone pattern $\emptyset\emptyset$. The low tone on the penultimate syllable is a stress marker while the low tone on the final syllable of the verb stem is a boundary tone. As the initial syllable of the stem is underlyingly toneless, it is assigned high tone in the surface form.

In (47b) the verb stem takes the Derivation I suffix -βa, so it the root is assigned the tone pattern $L\emptyset$. An OCP conflict arises when the stress system assigns a low tone

adjacent to the low tone on the root, producing the sequence *LL. Bora resolves this conflict by deleting the low stress tone.

In (47c) the verb stem takes the Derivation I suffix $-t^h\varepsilon$, so it is assigned the tone pattern \emptyset L. Thus, two low tones are designated to the penultimate syllable: one from the stress system and the other from the verb class marker. In order to avoid an OCP violation, the stress marker deleted from the penultimate syllable.

Although the verb stems in (47a) and (47c) have the same surface pattern, the tones assigned by the Derivation I suffixes are contrastive underlyingly. This is revealed when Derivation II suffixes are added to each verb, as shown in (48).

48. a. / $\varepsilon x \varepsilon x - t^h o - t^h \omega$ /
- $\acute{\varepsilon} x \acute{\varepsilon} x - t^h \grave{o} - t^h \acute{\omega}$
cough-CAUS-NEG
'does not cough'
- b. / $i \beta \beta \varepsilon - t^h \varepsilon - t^h \omega$ /
- $\acute{i} \beta \beta \varepsilon - t^h \acute{\varepsilon} - t^h \acute{\omega}$
stop-TRANSL-NEG
'does not stop'

The verb stem in (48a) is underlyingly toneless. The verbal boundary tone associates to the final syllable of the stem, while the remaining syllables are assigned default high tones in the surface form. In (48b), the verb stem takes the Derivation I suffix $-t^h\varepsilon$, so the root is assigned the tone pattern \emptyset L. In order to avoid an OCP violation, the verbal boundary tone is deleted from the syllable adjacent to the low tone of the root. Thus, although the verb stems in (48) have the same surface patterns in isolation, the addition of the negative suffix reveals that Derivation I suffixes are indeed underlyingly contrastive.

4.2 Derivation I Suffixes

As previously mentioned, verb roots are underlyingly toneless. When Derivation I suffixes are affixed to verb roots, one of the following tone patterns is assigned to the

root based on its suffix: \emptyset L, L \emptyset or $\emptyset\emptyset$. This is shown in Tables 30-32. There is no *LL pattern, suggesting that in underlying forms low tones are only singly linked.

Table 30. Derivation I Suffixes that Assign $\emptyset\emptyset$ to the Root

Suffix	Verb
-xk ^h o ~ -ʔk ^h o ITER	tímà-xk ^h ò chew-ITER 'to chew' ts ^h úíguì-ʔk ^h ò to.hiccup-ITER 'to have the hiccups'
-ts ^h o CAUS	t ^h úí:βà-t ^h ò blood-CAUS 'to bleed'
-βε MOM	úíʔts ^h à:-βè flood-MOM 'to flood'
-mèi REFL	k̄pák ^h í-úí-mèì poison-REFL 'to poison oneself'

Table 31. Derivation I Suffixes that Assign L \emptyset to the Root

Suffix	Verb
-βε VZR	k ^h è:mé-βè old-VZR 'to grow'
-k ^h ò ITER	ts ^h òá-k ^h ò spill-ITER 'to spill, to pour out'
-βa VZR RELOC	àxk ^h é-βà -VZR 'to wake up involuntarily'

Table 32. Derivation I Suffixes that Assign \emptyset L to the Root

Suffix	Bora Verb
-t ^h ε TRANSL	úí:xè-t ^h è arrive-TRANSL 'to arrive'

Since tone patterns to verb stems according to their Derivation I suffix, it is possible to predict the surface pattern of verbs based on their morphology. Additionally, the

same verb root may have contrastive surface patterns if it combines with different suffixes. This is illustrated in (49), where the pattern of the verb root /aβʲɛ/ ‘hurt’ is LH when followed by -βɛ, but HL when followed by -tʰɛ.

49. a. àβʲɛ-βɛ
hurt-VZR
‘to suffer, to feel bad’
- b. áβʲɛ-tʰɛ
hurt-TRANSL
‘to get worse’

Generally speaking, disyllabic verb roots with the same Derivation I suffix have the same surface pattern regardless of the syllable profile of the root.¹⁰³ This is illustrated by the examples in (50), in which disyllabic roots with different syllable profiles have the same surface pattern (HLL) when followed by the translative suffix -tʰɛ.

	Syllable Profile	Verb Stem
50. a.	VCV	íʈʰi-tʰjɛ ¹⁰⁴ scared-TRANSL ‘to be scared’
b.	VCCV	íʈβɛ-tʰɛ stop-TRANSL ‘to stop’
c.	CVVCV	tá:ɽ-tʰɛ dry-TRANSL ‘to dry off’
d.	CVCVV	póʔɽ-tʰɛ recover-TRANSL ‘to recover’

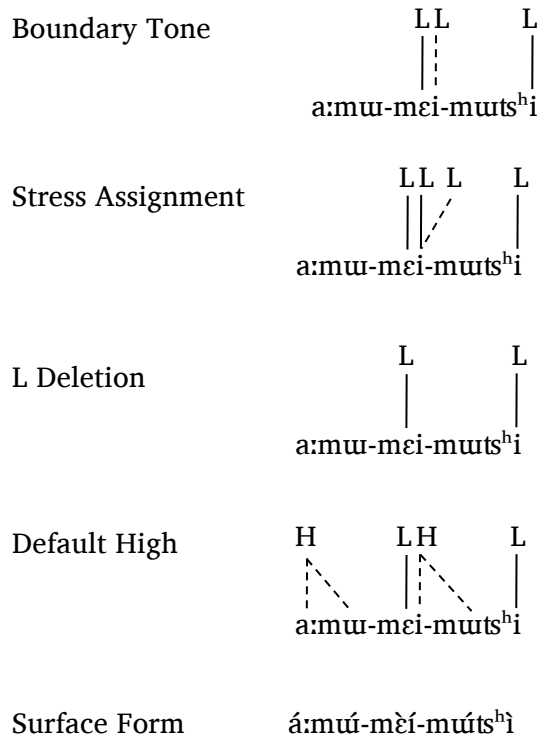
In addition to the patterns they assign to roots, Derivation I suffixes may themselves have low tones. One of the suffixes in my data has an underlying low tone: the reflexive suffix -mɛi. Phrase-finally, the underlying low tone on the suffix merges with

¹⁰³ Verb roots with the syllable profile (C)VCCV behave differently than other disyllabic roots when stem suffixes are added to the root. I discuss this further in Section 4.3.3.

¹⁰⁴ In Bora, consonants are palatalized after [i].

the verbal boundary tone, resulting in one low tone that is linked to two moras. In medial environments, where Bora does not permit L Merger, the verbal boundary tone is deleted. This is shown in (51), where a verb with *-mèi* is followed by the dual masculine suffix *-muʔs^{hì}*.

51. U. Form a:mʉ-mèi-mʉʔs^{hì}
 hit-REFL-DuM
 ‘they (two men) hit themselves’



In (51), the reflexive suffix *-mèi* assigns the tone pattern $\emptyset\emptyset$ to the verb root. The underlying low tone on *-mèi* causes the verbal boundary tone to be deleted from the final syllable of the verb stem, since this would create the sequence *LL, thereby violating the OCP. The low tone that marks antepenultimate stress is deleted in order to avoid an OCP conflict. As the final syllable of *-muʔs^{hì}* ‘dual masculine’ has an underlying low tone, the resulting surface pattern is HHLHHL.

To conclude this section, simple verb stems consist of a verb root, while complex verb stems consist of a verb root and a bound Derivation I suffix. The following tone

patterns are assigned to verbs based on their Derivation I suffix: $\emptyset\emptyset$, $L\emptyset$, or $\emptyset L$. Derivation I suffixes may have underlying low tones. When verb stems occur in isolation or in phrase-final position, a boundary low tone docks on its right edge. Bora also has a stress system that assigns low tone to the penultimate or antepenultimate syllables of verbs.

4.3 Derivation II Suffixes

As previously discussed, verb roots combine with Derivation I suffixes to form complex verb stems. In addition to Derivation I suffixes, Bora has suffixes that modify verb stems (which I refer to as Derivation II suffixes). Derivation II suffixes differ from Derivation I suffixes in five ways:

- a) Many verb stems require a Derivation I suffix but no stems require a Derivation II suffix.
- b) Derivation II apply to all verbs while Derivation I suffixes are distributed to a limited set of verb stems based on the state or action the verb describes (single action, multiple action, causative, reflexive, etc.)
- c) Derivation I suffixes always precede Derivation II suffixes.
- d) The verbal boundary docks on Derivation I suffixes (which form part of the verb stem) but not on Derivation II suffixes.
- e) Verb stems with Derivation I suffixes can be nominalized, while verbs with Derivation II suffixes cannot. Nominalization is illustrated by the examples in (52).

52. a. Verb stem: $k^h\acute{a}p\grave{o}ʔ-k^h\grave{o}$
 'to stab, prick, pierce'
- b. Nominalized verb: $k^h\acute{a}p\acute{o}ʔk^h\grave{o}$
 'awl'

In Bora, Derivation II suffixes may be toneless or have underlying low tones. This is shown in (53).

53.	Suffix	Verb + Suffix
a.	-xε 'returns from'	k̄pá:xà-xé investigate-returns.from 'returns from investigating'
b.	-tʃ ^h ɛ̃ SgF	k̄pá:xà-tʃ ^h ɛ̃ investigate-SgF 'she investigates'
c.	-ɾaʔi FRUST	k̄pá:xà-ɾáʔi investigate-FRUST 'to be thwarted in the attempt to investigate'
d.	-xùk ^h o:	k̄pà:xá-xùk ^h ó: investigate-now 'is investigating'

Thiesen and Weber (2012) account for the final low tones in (53b) and (53c) by positing a boundary tone that docks on the right edge of verb phrases. However, this does not explain why the verbs in (53a) and (53d) end in high tones, as High is a default tone that is automatically assigned to toneless syllables. If the low tone is, indeed, a boundary tone, one would expect it to appear on the final syllable of all verbs.

If boundary tones dock on the right edge of verb phrases, as Thiesen and Weber suggest, Derivation II suffixes like -xε 'returns from' must have underlying high tones that prevent boundary tones from docking on the same syllable. This complicates the analysis, as it requires the presence of an underlying high tone when thus far, all underlying tones have been Low.

As an alternative solution, I suggest that Derivation II suffixes have the following underlying tone patterns: ∅, L, ∅L, and L∅.¹⁰⁵ These patterns eliminate the need for phrase-final verbal boundary tones and explain why some suffixes have surface high tones (they are underlyingly toneless), while others have low tones.

¹⁰⁵ Another possible analysis is that stem suffixes can have at most one low tone in the underlying form that is preattached to a particular TBU.

To test this hypothesis, it is necessary to elicit verbs with contrastive Derivation II suffixes in medial environments. If suffixes $-t^h\epsilon$ ‘SgF’ have underlying low tones, one would expect them to appear word-medially and phrase-medially. If, however, the low tone is a boundary tone, one would expect the suffixes to have high tone in medial environments. Because of time constraints, I did not elicit verbs in a frame for this analysis, so this remains an area for further research.

The Derivation II suffixes that form part of this analysis are presented in (54), along with their proposed underlying tone patterns.

54.	\emptyset	L	\emptyset L	L \emptyset
	$-\beta a$	$-k^h i$	$-mu\upsilon t s^h i$	$-x\upsilon c o:$
	‘comes to do’	PUR	DuM	‘now’
	$-t^h \epsilon$	$t^h \epsilon$	$-m\upsilon p^h i$	
	‘goes to do’	SgF	DuF	
	$-x \epsilon$	$-m \epsilon$	$-r a ? i$	
	‘returns from doing’	‘Pl’	FRUST	
	$-t^h \upsilon$		$-: p \epsilon$	
	NEG		SgM	
	$-t s^h o$			
	CAUS			

The same suffixes are shown with corresponding examples in (55).

55. ∅	όρδ-?k ^h δ eat.quickly-ITER 'to eat quickly'
-βα ¹⁰⁶ 'comes to'	όρδ-?k ^h ό-βά eat.quickly-ITER-comes.to 'comes to eat quickly'
-t ^h ε 'goes to'	όρδ-?k ^h δ-t ^h έ eat.quickly-ITER-goes.to 'goes to eat quickly'
-xε 'returns from'	όρδ-?k ^h δ-xέ eat.quickly-ITER-returns.from 'returns from eating quickly'
-t ^h ω NEG	όρδ-?k ^h δ-t ^h ύ eat.quickly-ITER-NEG 'does not eat quickly'
-ts ^h ο CAUS	όρδ-?k ^h δ-ts ^h ό eat.quickly-ITER-CAUS 'causes to eat quickly'
-k ^h ι PUR	όρδ-?k ^h δ-k ^h ι eat.quickly-ITER-PUR 'in order to eat quickly'
-tʃ ^h ε SgF	όρδ-?k ^h δ-tʃ ^h ε eat.quickly-ITER-SgF 'she eats quickly'
-mε Pl ¹⁰⁷	όρδ-?k ^h ό-mε eat.quickly-ITER-PL 'they eat quickly'
-muɾts ^h ι DuM	όρδ-?k ^h δ-muɾts ^h ι eat.quickly-ITER-DuM 'the two of them (m) eat quickly'
-muɾp ^h ι DuF	όρδ-?k ^h δ-muɾp ^h ι eat.quickly-ITER-DuF 'the two of them (f) eat quickly'

¹⁰⁶ -βα causes verb stems to have irregular tone patterns. For further discussion, see Section 4.3.2.

¹⁰⁷ More than two.

-raʔi FRUST	óɾó-ʔk ^h ò-ɾáʔi eat.quickly-ITER-FRUST 'unable to eat quickly'
-:pè SgM	óɾó-ʔk ^h ǒ:-pè eat.quickly-ITER-SgM 'he eats quickly'
-xuìk ^h o: 'now'	óɾò-ʔk ^h ó-xuìk ^h ó: eat.quickly-ITER-now 'is eating quickly now'

As shown in Examples 54 and 55, the surface forms of Derivation II suffixes indicate that they have contrastive underlying tone patterns. Although this hypothesis remains to be tested by eliciting verbs phrase-medially, it explains the surface tones of Derivation II suffixes and the interaction between these suffixes and boundary tones (as I discuss in Section 4.3.1).

4.3.1 Derivation II Suffixes with Underlying Low Tones

I analyze some Derivation II suffixes as having underlying low tones. When these suffixes are attached to verbs, their underlying low tones conflict with the boundary low tone on the right edge of the verb stem. When the penultimate and final syllables of the verb have short vowels, the conflict is resolved by L Merger. This is illustrated by the derivations in (56).

56.	a.	b.
U. Form	/ts ^h iβa-tʃ ^h ɛ/ bring-SgF 'she brings'	/ts ^h i p ^h u-ʔk ^h o-tʃ ^h ɛ/ sob-ITER-SgF 'she sobs'
Stress Assignment	$\begin{array}{cc} L & L \\ \vdots & \\ ts^hi\beta a-tʃ^h\epsilon \end{array}$	$\begin{array}{cc} L & L \\ \vdots & \\ ts^hi p^h u-ʔk^h o-tʃ^h\epsilon \end{array}$
Boundary Tone	$\begin{array}{ccc} L & L & L \\ \diagdown & & \\ ts^hi\beta a-tʃ^h\epsilon \end{array}$	$\begin{array}{ccc} L & L & L \\ & \vdots & \\ ts^hi p^h u-ʔk^h o-tʃ^h\epsilon \end{array}$
L Deletion	$\begin{array}{cc} L & L \\ & \\ ts^hi\beta a-tʃ^h\epsilon \end{array}$	-----
L Merger	$\begin{array}{c} L \\ \diagup \\ ts^hi\beta a-tʃ^h\epsilon \end{array}$	$\begin{array}{c} L \\ \diagup \\ ts^hi p^h u-ʔk^h o-tʃ^h\epsilon \end{array}$
Default High	$\begin{array}{cc} H & L \\ \vdots & \diagup \\ ts^hi\beta a-tʃ^h\epsilon \end{array}$	$\begin{array}{ccc} H & H & L \\ \vdots & \vdots & \diagup \\ ts^hi p^h u-ʔk^h o-tʃ^h\epsilon \end{array}$
Surface Form	ts ^h iβà-tʃ ^h ɛ	ts ^h i p ^h ú-ʔk ^h ò-tʃ ^h ɛ

The verbal boundary tone predictably associates to the right edge of both verb stems in (56). An OCP conflict occurs when the feminine singular suffix -tʃ^hɛ, which has an underlying low tone, is attached to the verbs. As shown in the above derivations, the OCP conflict is resolved by L Merger.

Word-medially, tone conflicts between boundary tones and the underlying tones of verb suffixes are resolved by L Delinking. For reasons not completely understood, the delinked tone associates one mora to the left of its original mora. This is depicted in (57).

57.	a.	b.
U. Form	/ts ^h iβa-xùk ^h o:/ bring-now 'is bringing now'	/ts ^h ip ^h u-ʔk ^h o-xùk ^h o:/ sob-now 'is sobbing now'
Stress	$\begin{array}{c} L \quad L \\ \quad \\ ts^hi\beta a-xu\grave{k}^ho: \end{array}$	$\begin{array}{c} L \quad L \\ \quad \\ ts^hip^hu-ʔk^ho-xu\grave{k}^ho: \end{array}$
Boundary Tone	$\begin{array}{c} L \quad L \quad L \\ \diagdown \quad \quad \\ ts^hi\beta a-xu\grave{k}^ho: \end{array}$	$\begin{array}{c} L \quad L \quad L \\ \diagdown \quad \quad \\ ts^hip^hu-ʔk^ho-xu\grave{k}^ho: \end{array}$
L Deletion	$\begin{array}{c} L \quad L \\ \quad \\ ts^hi\beta a-xu\grave{k}^ho: \end{array}$	$\begin{array}{c} L \quad L \\ \quad \\ ts^hip^hu-ʔk^ho-xu\grave{k}^ho: \end{array}$
L Delinking	$\begin{array}{c} L \quad L \\ \quad \\ ts^hi\beta a-xu\grave{k}^ho: \end{array}$	$\begin{array}{c} L \quad L \\ \quad \\ ts^hip^hu-ʔk^ho-xu\grave{k}^ho: \end{array}$
Default High	$\begin{array}{c} L \quad H \quad L \quad H \\ \quad \cdot \quad \quad \cdot \\ ts^hi\beta a-xu\grave{k}^ho: \end{array}$	$\begin{array}{c} H \quad L \quad H \quad L \quad H \\ \cdot \quad \quad \cdot \quad \quad \cdot \\ ts^hip^hu-ʔk^ho-xu\grave{k}^ho: \end{array}$
Surface Form	ts ^h iβá-xùk ^h ó:	ts ^h í ^h p ^h ù-ʔk ^h ó-xùk ^h ó:

In both (57a) and (57b), the underlying low tone of the suffix conflicts with the boundary tone at the right edge of the verb stem. Bora satisfies the OCP by delinking the conflicting low tone and inserting a default high tone to break up the illegal *LL sequence.

4.3.2 Irregular Derivation II Suffixes

Two Derivation II suffixes in my data, *-βa* 'comes to do' and *-mè* 'plural', cause verb stems to have irregular tone patterns. When *-βa* and *-mè* are affixed to verb stems, the verb has low tone on the antepenultimate syllable, even though two and three syllable

verbs would normally have low stress tones on the penultimate syllable. This is illustrated by the examples in (58).

58.	U. Form	S. Form
a.	/naʔts ^h i-βa/	nàʔts ^h i-βá woo-comes.to 'comes to win someone's love'
b.	/naʔts ^h i-mè/	nàʔts ^h i-mè woo-3Pl 'they win someone's love'
c.	/k̄pá:xa-tso-βa/	k̄pá:xà-tsó-βá reveal.something.embarrassing-comes.to 'comes to reveal something embarrassing'
d.	/k̄pá:xa-tso-mè/	k̄pá:xà-tsó-mè reveal.something.embarrassing-3Pl 'they reveal something embarrassing'

One possible analysis is that the irregular suffixes *-βa* 'comes to do' and *mè* 'plural' trigger L Delinking. As Bora has a one-to-one correspondence between tones and moras, the high tone associates to the final syllable of the stem and the low boundary tone associates to the preceding syllable. However, this analysis is problematic because this environment should not trigger L Delinking.¹⁰⁸ As *-βa* is toneless, it should not produce an OCP conflict, while the low tone on *-mè* should be resolved by L Merger.

The suffixes *-βa* and *-mè* exhibit different tonal behaviors when they are attached to verbs with the underlying tone pattern LH. This is shown in (59).

¹⁰⁸ As previously discussed, L Delinking is used in two environments: a) word-finally to break up illegal clusters of three low-toned moras, or b) word-medially to solve OCP conflicts between the verbal boundary tone and the underlying tones of Derivation II suffixes.

- 59.
- | | | |
|----|--|--|
| | -βa | -mè |
| a. | k ^h òé-βà-βá
'comes to stay' | k ^h òé-βá-mè
'they stay' |
| b. | ìʔxjuí-βà-βá
'comes to talk' | ìʔxjuí-βá-mè
'they talk' |

As the verbs in (59) reveal, the final syllables of verb stems have low tone before *-βa* and high tone before *-mè*. Further research is needed to determine why these suffixes produce irregular tone patterns, and why *-βa* and *-mè* behave differently when they are attached to LØ verb stems.

4.3.3 Derivation II Suffixes that Cause Lengthening

The singular masculine suffix *-pè* causes the vowel of the preceding syllable to lengthen.¹⁰⁹ This produces an OCP conflict, as verbs with *-pè* have three word-final low-toned moras: the underlying L on the masculine suffix and the boundary L on the verb stem (which is associated to the lengthend vowel). As shown in the derivation in (60),¹¹⁰ Bora satisfies the OCP through L Delinking. I do not show stress assignment in the following derivation because low stress tone is deleted to prevent an OCP conflict with the low boundary tone.

¹⁰⁹ The nominal suffixes *-k^hu* 'InDu' and *-mɛ* 'InPl' also cause suffixes to lengthen. As discussed in Chapter 3, I propose that these suffixes historically had two syllables, one of which has disappeared, leaving an underlying mora that associates to the preceding syllable.

¹¹⁰ I do not include stress in the derivation in (60) because the low tone that marks stress is deleted in order to avoid an OCP conflict. The verb in (60) has stress on the penultimate syllable.

60.	U. Form	/k ^h ʊkpa-ɪpɛ/ sleep-3SgM 'he sleeps'
	Boundary Tone	 k ^h ʊkpaape
	L Delinking	 k ^h ʊkpaape
	Default High	 k ^h ʊkpaape
	Surface Form	k ^h ʊkpa:-pɛ

When *-pɛ* is added to verb stems that end in a long vowel, an additional mora is added to the long vowel, resulting in an ultra-heavy syllable with three moras. This is shown in (61a). When *-pɛ* is attached to verb stems with Derivation I suffixes, it causes the vowel of the suffix to lengthen. This is depicted in (61b).

61.	Verb Stem	<i>-pɛ</i>
a.	/t ^h okpa:/	/t ^h okpa:-ɪpɛ/
	t ^h okpa: 'to sweat'	t ^h okpa:á-pɛ 'he sweats'
b.	/k ^h apo-ʔk ^h o/	/k ^h apo-ʔk ^h o-ɪpɛ/
	k ^h ápò-ʔk ^h ò 'to puncture'	k ^h ápó-ʔk ^h ö:-pɛ 'he punctures'

As the examples in 60 and 61 reveal, the singular masculine suffix *-pɛ* has an underlying mora that causes the vowel of the preceding syllable to lengthen. The mora associates to the Derivation II suffix regardless of whether the final syllable has a short vowel or a long vowel.

4.3.4 (C)V(C)V: *Verb Roots*

In general, the syllable profile of verb stems does not influence the tone pattern of the verb (see Section 4.1). Thus, given the same Derivation I suffix, verb stems with the profile CVCV have the same tone pattern as those with the profile CV:CV. However, (C)V(C)V: verb stems differ slightly from verb stems with other syllable profiles when suffixes are attached to the stem.

Table 33 compares a CVCV: root and a CVCV root.

Table 33. CVCV: Root vs. CVCV Root (ØL Tone Pattern)

Suffix	CVCV:	CVCV (Regular)
Ø	t ^h úpò: 'to shoot an arrow'	ts ^h ínù 'to fish with a net'
-k ^h PUR	t ^h úpò:-k ^h shoot.arrow-PUR 'in order to shoot an arrow'	ts ^h ínù-k ^h fish.with.net-PUR 'in order to fish with a net'
-t ^h ɛ SgF	t ^h úpò:-t ^h ɛ shoot.arrow-SgF 'she shoots an arrow'	ts ^h ínù-t ^h ɛ fish.with.net-SgF 'she fishes with a net'
-t ^h ɛ ¹¹¹ 'goes to'	t ^h úpò:-t ^h ɛ shoot.arrow-goes.to 'goes to shoot an arrow'	ts ^h ínù-t ^h ɛ fish.with.net-goes.to 'goes to fish with a net'
-xɛ 'returns from'	t ^h úpò?-xɛ shoot.arrow-returns.from 'returns from shooting an arrow'	ts ^h ínù-xɛ fish.with.net-returns.from 'returns from fishing with a net'
-ɾaʔi ¹¹² 'FRUST'	t ^h úpò:-ɾáʔi shoot.arrow-FRUST 'thwarted in the attempt to shoot an arrow'	ts ^h ínù-ɾáʔi fish.with.net-FRUST 'thwarted in the attempt to fish with a net'
-:pɛ SgM	t ^h úpò:ó-pɛ shoot.arrow-SgM 'he shoots an arrow'	ts ^h ínù:-pɛ fish.with.net-SgM 'he fishes with a net'

The above examples reveal slight variations between CVCV: stems and regular verb stems. When the inflectional suffix *-t^hɛ* is added to CVCV: stems, the long vowel takes the contour tone LH. This contour tone, which is the result of L Delinking, breaks up the illegal cluster of three low-toned moras at the end of the verb. However, it is unclear why the penultimate LH contour tone occurs before *-t^hɛ* 'SgF' and not before *-k^h* 'PURPOSE'. This is an area for further research.

¹¹¹ The suffixes [-tso] 'CAUS' and [-t^hɯ] 'NEG' follow the same tone pattern as [-t^hɛ] 'goes to'.

¹¹² The suffixes [-muɬ^hi] 'DuM' and [-muɸ^hi] 'DuF' follow the same tone pattern as [-ɾaʔi] 'FRUST'.

Before *-xɛ* ‘returns from’, the long vowel of a CVCV: verb shortens to a single vowel and a glottal coda is inserted. The glottal coda is not inserted before other suffixes. Nor is it inserted when verbs with other syllable profiles combine with *-xɛ*.

CVCV: verb stems follow regular tone patterns when the suffixes *-ʔaʔi* ‘FRUSTRATIVE’ and *-pɛ* ‘MASCULINE SINGULAR’ are added to the stem. Note that the underlying mora of the masculine singular suffix *-pɛ* associates to the long vowel, producing an ultra-heavy syllable with three moras.

4.4 Monosyllabic Verb Roots

As discussed at the beginning of this chapter, monosyllabic verb roots are relatively rare in Bora. Of the 300 verbs I elicited for this analysis, twenty three are monosyllabic: eleven of these are free roots and twelve are followed by a bound Derivation I suffix. Because examples of monosyllabic roots are limited, it is difficult to make generalizations about their behavior. However, in this section I describe some of my observations concerning monosyllabic roots.

As mentioned above, Bora stems may be simple or complex. All of the simple monosyllabic stems have long vowels, indicating that Bora has a minimum requirement of two moras per stem. Complex stems may have either single vowels or long vowels. Examples of simple and complex stems with monosyllabic roots are presented in (62).

62.	U. Form	S. Form
a.	/ts ^h o:/	ts ^h ò: 'to burn the hair off an animal hide, leaving only the skin'
b.	/ni:-t ^h jɛ/	nì:-t ^h jè ¹¹³ descend-TRANSL 'to go down, to descend'
c.	/do-mèi/	dó-mèi eat.meat-REFL 'to be eaten'

As previously discussed, Bora has a verbal boundary tone that docks onto the final syllable of verb stems. The boundary tone applies regardless of the tone of the penultimate syllable. The penultimate low tones in (62a) and (62b) are attributable to stress, while the low tone on *-mèi* in (62c) is underlying. To satisfy the OCP, the two low tones merge into a single L that is associated to two moras.

As suffixes are added to the stem, the verbal boundary tone remains on the monosyllabic root. This is shown by the derivations of the verb *t^hà:* 'to cry' in (63) and (64). I do not show stress assignment in the following derivation because low stress tone is deleted to prevent an OCP conflict with the low boundary tone.

¹¹³ As described in Section 4.3.4, (C)V:(C)V verb roots and (C)V(C)V: verb roots have low tone to differentiate them from their nominalized counterparts: *nì:-t^hjè* 'to descend, to come down', and *nĩ:-t^hjè* 'descent'.

63.	a.	b.
U. Form	/t ^h a:-t ^h u/ cry-NEG 'does not cry'	/t ^h a:-k ^h i/ cry-PUR 'in order to cry'
Boundary Low	L ⋮ t ^h aa-t ^h u	L L ⋮ t ^h aa-k ^h i
L Delinking	-----	L L t ^h aa-k ^h i
Default High	L H \ t ^h aa-t ^h u	LH L ⋮ t ^h aa-k ^h i
Surface Form	tà:-t ^h ú	tǎ:-k ^h ì

In (63a), the verb is followed by the toneless Derivation II suffix *-t^hu* 'NEGATIVE'. The verbal boundary tone docks on the final syllable of the verb stem (which only has one syllable, as it is a monosyllabic root) and the toneless suffix is assigned a surface high tone. In (63b), the verb takes the suffix *-k^hi* 'purpose', which has an underlying low tone. This results in a sequence of three adjacent low-toned moras. The second low tone delinks and a default high tone is inserted to break up the illegal cluster.

In (64), disyllabic Derivation II suffixes are added to *t^hà:* 'to cry'. As noted in Section 4.3.4, long vowels shorten before the suffix *-xu^hk^ho:* 'now'.

64.	a.	b.
U. Form	/t ^h a:-muɽts ^h i/ cry-DuM 'they (two men) cry'	/t ^h a:-xuɽk ^h o:/ cry-now 'is crying now'
Boundary Low	$\begin{array}{c} L \quad L \\ \vdots \quad \\ t^h a:-mu\text{r}ts^h i \end{array}$	$\begin{array}{c} L \quad L \\ \vdots \quad \\ t^h a-xu\text{r}k^h o: \end{array}$
L Delinking	-----	$\begin{array}{c} L \\ \\ t^h a-xu\text{r}k^h o: \end{array}$
Default High	$\begin{array}{c} L \quad H \quad L \\ \quad \vdots \quad \\ t^h a:-mu\text{r}ts^h i \end{array}$	$\begin{array}{c} H \quad L \quad H \\ \vdots \quad \quad \vdots \\ t^h a-xu\text{r}k^h o: \end{array}$
Surface Form	t ^h à:-muɽts ^h i	t ^h á-xuɽk ^h ó:

In (64a), the verbal boundary tone associates to the monosyllabic verb stem. The first syllable of the dual masculine suffix *-muɽts^hi* is toneless, and therefore is assigned a surface high tone, while the final syllable of the suffix has an underlying low tone.

In (64b), the suffix *-xuɽk^ho:* 'now' has an underlying low tone on the first syllable. An OCP conflict occurs when the boundary tone associates to the monosyllabic verb stem, as this results in the sequence *LL word-medially. Bora resolves the conflict by inserting a high tone between the two low tones. However, as long vowels shorten before *-xuɽk^ho:*, the verb stem only has one mora. The high tone associates to the monosyllabic stem, while the low tone is unable to associate as there are no available moras.

Complex verb stems with a monosyllabic root follow the same tone pattern as free disyllabic roots. This is shown in (65).

their Derivation I suffix, monosyllabic roots are not assigned surface tone patterns even when they combine with Derivation I suffixes. In isolation, verb stems with monosyllabic roots have the surface pattern LL, as expected due to the verbal boundary tone and the low stress marker. As Derivation II suffixes are added to the stem, monosyllabic roots take default high tone, thereby revealing that they are underlyingly toneless.

4.5 Summary of Verbal Tone

In Bora, verb roots are underlyingly toneless. Verb stems may be simple (consisting of a free root) or complex (consisting of a root and a bound Derivation I suffix). When verb roots combine with Derivation I suffixes, they are assigned one of the following tone patterns based on their suffix: \emptyset L, L \emptyset and $\emptyset\emptyset$. Additionally, Bora has a verbal boundary tone that associates to the right edge of verb stems.

Bora assigns low tones to stressed syllables. Two and three syllable words have stress on the penultimate syllable while longer words have stress on the antepenultimate syllable.

The surface melodies of nouns and verbs are the result of five sources of tone: underlying tones, stress tones, boundary tones, floating tones, and default high tones. In Bora, the OCP restricts sequences of adjacent low tones. Bora exhibits three responses to OCP conflicts: L Merger, L Deletion, and L Delinking. When low tones occur on adjacent phrase-final vowels, the low tones merge into one L that is linked to two moras. L Delinking resolves tone conflicts between the verbal boundary tone and the underlying tones of Derivation II suffixes.

In Chapter 5, I compare my analysis of nominal and verbal tone to the analyses of Thiesen and Weber (2012) and Seifart (2006), discuss why the Bora people have difficulty writing tone, and pose questions for further research.

CHAPTER 5

CONCLUSION

Bora has a mixed tone/stress system. There are two level tones, H and L, and two contour tones, HL and LH. Level tones occur on both short and long vowels, while contour tones are restricted to long vowels. There are four sources of low tone: underlying tones, stress tones, boundary tones, and floating tones. Unspecified (default) tones, which are assigned to toneless syllables in surface forms, are high. Bora is extremely unusual in that L is the specified tone and H unspecified.

In Bora, noun and verb stems may be simple (free roots), complex (roots with one suffix), or compound (more than one root, or roots with multiple suffixes). In order to clearly present the underlying tones of roots and affixes, the analysis in this paper is based on simple and complex stems.

As discussed in Chapter 3, disyllabic noun roots have three underlying tone patterns: LØ, ØL, and ØØ. Complex stems consist of roots with class marker suffixes, which are assigned to nouns based on their semantic domain. In addition to class markers, Bora has suffixes that modify noun stems for gender, number, case, and size. While class markers are toneless, stem suffixes may be toneless, have underlying low tones, or have floating low tones. Bora also has a low boundary tone that associates to the right edge of noun phrases.

Verb roots are underlyingly toneless (see Chapter 4). Simple stems are assigned default high tones, while complex stems have one of three tone patterns (LØ, ØL, or ØØ), depending on their suffix. As verbs with the same bound suffix have identical

surface tones, it is possible to predict the tone pattern of a given verb based on its morphology.

There are two types of verb suffixes: Derivation I suffixes, which form part of the verb stem, and Derivation II suffixes, which modify the verb stem. Suffixes may either be toneless or have underlying low tones.

As noted at the beginning of this chapter, Bora has a mixed tone/stress system. Two and three syllable words have stress on the penultimate syllable, while longer words have antepenultimate stress. Low tones are assigned to stressed syllables.

In Bora, the OCP restricts sequences of adjacent low tones. Bora exhibits three resolutions to OCP conflicts: L Merger, L Deletion, and L Delinking. The choice of resolution is lexically and phonologically determined. Sequences of word-final low-toned moras are resolved either through L Merger, in which the low tones merge into a single L that is linked to multiple moras, or L Delinking, in clusters of three low tones are resolved by delinking one the middle low tone and inserting a default high tone. L Delinking is also used word-medially to resolve OCP conflicts between boundary tones and the underlying tones of verb suffixes.

Other word-medial OCP conflicts are resolved by L Deletion. These conflicts occur at morpheme boundaries or when stressed syllables are adjacent to syllables with underlying low tones. In general, underlying tones of morphemes take precedence over affix tones, and underlying tones of both roots and affixes take precedence over the low tone that marks stress. Some affixes, such as the first person genitive prefix *t^ha-*, have floating tones that take precedence over the underlying tones of morphemes.¹¹⁴

¹¹⁴ As discussed in Chapter 3, the genitive prefix has a floating low tone. When the genitive case marker affixes to two syllable nouns, the low tone is realized on the prefix itself. When it affixes to nouns with three or more syllables, the low tone docks onto the first syllable of the noun stem. Conflicting tones on the noun stem are deleted.

5.1 Comparison to Previous Analyses

In this section, I compare my analysis to previous studies of Bora tone, which are published in Thiesen and Weber (2001), Thiesen and Weber (2012) and Seifart (2005).¹¹⁵ For the most part, Seifart’s analysis follows that of Thiesen and Weber, although, as I describe below, there are several points on which they disagree. It is important to note that Seifart elicited data from the Mirañá dialect, which is 94% intelligible with Bora. Therefore, his work may reflect slight dialectical variations in tone.

Thiesen and Weber (2012:56) and Seifart (2005:39) describe Bora/Mirañá as having two level tones, High and Low. While I consider long vowels with the patterns LH and HL to have contour tones, Thiesen and Weber analyze these vowels as separate syllables.¹¹⁶ However, as shown in (67), many of these long vowels occur in other environments with level low tones, which should be prohibited by the OCP if they are separate syllables. Therefore, I regard them as bimoraic vowels that are linked to two tones.

¹¹⁵ A brief description of tone in the Mirañá dialect can also be found in Seifart (2002). In this analysis, he describes Mirañá as having an accent system, a position he later reverses (Seifart 2005:40).

¹¹⁶ Seifart (2005:39) does not mention contour tones in the Mirañá dialect, although he provides the following description: “All syllables, regardless of whether their nucleus is a long or short vowel, or whether a glottal stop or fricative occurs in coda position, are treated in the same way in the assignment of tones.” Additionally, his examples do not have contour tones where the Bora equivalents do: *ámánà* ‘dolphin’ (Mirañá), *ámánǎ* ‘dolphin’ (Bora), *k^hík^hɪ̀:ʔè* ‘bat’ (Mirañá), *k^hík^hɪ̀xʔè* ‘bat’ (Bora).

67. Contour	Level Low Tone
p ^h áxk ^h ɛ̃:-k̄pà	p ^h áxk ^h ɛ̃:-k̄pà-k ^h òpà
mark-plank.shaped	mark-plank.shaped-AUG
‘mark, notch’	‘big mark, notch’

Thiesen and Weber (2012:70) and Seifart (2005:40) state that the OCP prohibits adjacent low tones except at the end of tonal phrases. Rather than posit an exception to the OCP, I suggest that the adjacent low tones merge into a single L that is linked to two moras.

Thiesen and Weber list two strategies that Bora uses to resolve OCP violations: Blocking, in which low tones are blocked from associating to conflicting syllables, and Delinking, in which the low tones of affixes “delink” the low tones of stems. They also suggest a third possible method, Bumping, in which low tones are “bumped” one syllable to the left to avoid having two adjacent L syllables.

As I consider tones to be deleted, I combine Blocking and Delinking in one strategy: L Deletion. To this I add L Merger and L Delinking.

In Bora, clusters of three low-toned moras occur when the penultimate or final syllables have long vowels. In this environment, Thiesen and Weber propose that the long vowel “splits” into two syllables, one L and the other H. I explain this as L Delinking, in which a low tone is delinked and a default high tone is inserted,¹¹⁷ forming the contour tone LH.

Some long vowel sequences do not trigger L Delinking. These include verb stems with the syllable profile (C)V:(C)V and (C)V(C)V:, which have the surface pattern LL to distinguish them from their nominalized forms. This is shown in (68).

¹¹⁷ As previously discussed, verb stems have three adjacent low-toned moras. Additionally, some verbal suffixes with low tone permit the preceding vowel to have low tone even if the vowel is long. This appears to be lexically and grammatically determined.

68.	Verb	Nominalized Form
a.	gò:k ^h ò 'to laugh, to smile'	gǒ:k ^h ò 'laugh, smile'
b.	k ^h átǰò: 'to make a trap' ¹¹⁸	k ^h átǰǒ: 'trap'

I consider the examples in (68) to be different responses to OCP violations. When L sequences involve penultimate or final long vowels, noun stems break up the illegal cluster through L Delinking, while verb stems satisfy the OCP with L Merger. Thus, the choice of OCP resolution is determined by the grammatical category of the stem.

When suffixes are added to stems, nouns continue to resolve OCP conflicts with L Delinking, while verbs use either L Delinking or L Merger. This is lexically determined. For further discussion, refer to Section 4.2.

5.1.1 *Words with Underlying High Tones*

Thiesen and Weber (2012) describe nouns as having underlying low tones¹¹⁹ or (extremely rarely) underlying high tones. Of the approximately thirty words they list with underlying high tones, all but one end in long vowels with LH contours. Example (69) shows a noun stem that Thiesen and Weber analyze as having underlying high tone. For comparative purposes, I include a regular noun stem with the same syllable profile.

¹¹⁸ This word refers to a specific type of trap used for catching fish. It is made out of the trunk of a palm tree.

¹¹⁹ Thiesen and Weber call these “lexically marked” tones rather than underlying tones.

69.	Regular Noun	Irregular Noun ("Underlying H")
a.	má:ʔǎ: 'animal hide'	k ^h á:t ^h ũ: 'sweet potato'
b.	má:ʔǎ:-k ^h ù 'two animal hides'	k ^h á:t ^h ũ: ¹²⁰ 'two sweet potatoes'
c.	t ^h à-má:ʔǎ: 'my animal hide'	t ^h áx-k ^h ǎ:t ^h ù 'my sweet potato'

The two nouns in (69) have identical surface tone patterns in isolation, as shown by the forms in (69a). However, the dual form of /k^ha:t^hu:/ 'sweet potato' is irregular. Instead of taking the inanimate dual suffix -k^hù, a level low tone appears on the final syllable of the noun stem.

As described in Section 3.4, the genitive prefix is accompanied by a floating low tone. When disyllabic noun stems are marked for genitive case, the floating low tone associates to the genitive prefix. Although it is disyllabic, the irregular noun has high tone on the genitive prefix and the floating low tone associates onto the long vowel of the noun stem, producing the contour tone LH.

Example (70) presents two additional words that Thiesen and Weber (2012) analyze as having underlying H. I do not have any examples of regular nouns with this syllable profile.

¹²⁰ Although this does not have the dual suffix, my language consultant gave it to me as the dual form.

70.	Irregular Noun	Irregular Noun
a.	páxk ^h ě: 'root'	íxk ^h ǒ: 'nest'
b.	páxk ^h è-k ^h ù 'two roots'	íxk ^h ó-k ^h ǔ: 'two nests'
c.	t ^h à-páxk ^h ě: 'my root'	tá-íxk ^h ǒ 'my nest'

Although nouns in (70) follow regular tone patterns in isolation, they exhibit multiple irregularities when affixes are added to the stem. In (70b), the final vowel of each stem shortens before the the inanimate dual suffix *-k^hù*. This is contrary to expectation, as *-k^hù* has an underlying mora that normally lengthens the vowel of the preceding syllable. In *íxk^hó-k^hǔ* 'two nests', the lengthening is realized on the suffix, while none of the syllables in *páxk^hè-k^hù* 'two roots' are lengthened.

In (70c), *t^hà-páxk^hě* 'my root' follows regular tone patterns: the floating low tone associates to the vowel of the genitive prefix. In contrast, *tá-íxk^hǒ* 'my nest' is irregular. The floating low tone associates neither to the genitive prefix nor to the first syllable of the noun stem.

In summary, the verbs Thiesen and Weber (2012) posit with underlying high tones exhibit multiple irregularities. Hence, I consider them to be exceptions whose derivational history is unclear. I analyze all underlying tones in Bora as being low tones.

5.1.2 *Floating Low Tones*

Thiesen and Weber (2012:63) and Seifart (2005:42-43) describe three types of suffixes: a) those with floating low tones that dock on the immediately preceding syllable, b) those with floating low tones that dock two syllable to the left of the suffix, and c) those without floating tones.

In Thiesen and Weber's analysis, both class markers and stem suffixes can have floating low tones. While Seifart agrees that "derivational and inflectional morphemes

and clitics” can have floating low tones, he considers all but two class markers to be toneless. He posits a “tone assignment rule” that causes low tones to dock on the final syllable of noun roots when class suffixes are added. However, as discussed in Chapter 3, the tone assignment rule does not explain why low tones sometimes occur on the final syllables of noun roots, as in *mámà-pá-mù* ‘rattlesnakes’, and sometimes occur on class markers, as in *mámá-pà-úβù* ‘dead rattlesnakes’. To solve this problem, Seifart analyzes many stem suffixes as having floating low tones that delink the final L on the root.

I consider all noun class suffixes in Bora to be toneless. This analysis is supported by nouns that have contrastive surface patterns even though they have the same class marker (see Section 3.2 for examples). However, verbs are assigned tone patterns (L \emptyset , \emptyset L, or $\emptyset\emptyset$) based on their Derivation I suffixes.

In my analysis, very few stem affixes have floating low tones. Exceptions include genitive prefixes, which have floating low tones that dock on the first syllable of the noun stem, and (possibly) case marker suffixes like the sociative suffix *-ma*. Other low tones on noun and verb stems can be explained by underlying low tones, boundary tones, and low tones that are assigned to stressed syllables.

5.1.3 Word-Level vs. Syllable-Level Approach

Previous studies of Bora take a syllable-level approach to analyzing the tone system (see Thiesen and Weber (2012) and Seifart (2005)). Thiesen and Weber (2012:98) make the following assessment of their analysis: “A reader commented, ‘You can’t be right. It is too complicated. How would children learn it?’ We agree that our description – and the analysis implicit in it – are too complex.”

In contrast to Thiesen and Weber (2001, 2012) and Seifart (2005), I examine the tone patterns of morphemes as a whole, following the methodology laid out in Snider (2013). This allows me to make some generalizations that would not be possible in a

syllable-level approach. For example, organizing disyllabic roots based on their surface tones reveals that there are only three patterns for disyllabic nouns in Bora: HL, LH, and HH. As each of these behaves predictably when affixes are added to the stem, one can establish the basic tone patterns of nouns using only three representative examples. The same holds true for disyllabic verb roots, which also have three surface tone patterns. In response to the reader who asked Thiesen and Weber how children could learn Bora, it seems very feasible that they should be able to acquire three series of tone patterns for disyllabic noun roots and another three for disyllabic verb roots.

The syllable-level approach, with its focus on individual tones, does not distinguish these broad patterns. In its “zoomed in” view, the interaction between lexical tones, metrical tones, and boundary tones in Bora appears impossibly complex. However, when one “zooms out” to a morpheme-level view, predictable sets of tone patterns emerge.

Snider’s word-level approach benefits not only the linguist, who gains a broad perspective of tone patterns in the language, but would also be an excellent teaching tool for native speakers. I discuss this further in the following section.

5.2 Reading and Writing Tone

In the Bora orthography, high tones are written with acute accents over the vowels, while low tones are unmarked. Many Bora people have told me that although the tones help them when they are reading, they struggle to write them properly. Even the director of the bilingual school in Brillo Nuevo, who has years of educational training and experience, remarked that she often has to pause and think about tone patterns when she is writing. She shared the following story:

I went to a conference in Lima for bilingual educators. At the conference, we were divided into groups based on the language we spoke. We were then asked to write down some of our traditional stories so we could go back to the classroom and use them as reading

exercises with our students. At one point, I looked around and saw that other groups had written two or three stories, while we Bora teachers were still on our first story arguing about the tones! Why is Bora tone so difficult?

The director's experience at the conference raises the question: Should the Bora people write tone? Thiesen and Weber (2012:6) provide the following answer: "An initial attempt to teach the Bora people to read began by teaching them just the segmentals, deferring the issue of tone. This proved to be impractical, forcing the conclusion that tone should be taught first." Based on this information and my own analysis of the tone system, I conclude that tone should be represented in the Bora orthography. However, I recommend that the orthography be revised.

In my work with Bora speakers, I observed that while they always wrote the underlying tones of stems and affixes, they struggled to recognize boundary tones and the low tones of stressed suffixes. Mohanan (1982:27) states that "the judgments of native speakers of a language on the sameness and distinctness of sounds appear to be on [the] level [of lexical representation]." This explains why Bora speakers are more aware of underlying tones, which are part of the lexical representation, than boundary tones and stress tones, which result from post-lexical processes. Their difficulty in identifying boundary tones and stress tones supports the claim that orthographies should be based on the output of the lexical phonology (see Snider (2014)).

Therefore, I recommend that only lexical tones be written in Bora. This is problematic for the current orthography, in which all vowels with high tone are marked with an acute accent and all vowels with low tone are unmarked, as shown in (71).

Phonetic Transcription	Orthographic Representation
tàʔp ^h ék ^h ò	dahpéco
'flexible stick for making traps'	

Since High is the default tone in Bora, words frequently have multiple vowels that must be written with acute accents. This is illustrated by the example in (72).

72. Phonetic Transcription	Orthographic Representation
ú:pám ^í é:pèmuíts ^h í	úúbámyéébémuítsi
‘two male guests’	

From a purely practical perspective, Bora would be easier to write if the orthography were reversed and low tones were written instead of high tones. This is supported by the phonological analysis. Since, phonologically, L is the marked tone and H the unmarked tone, it would be a logical next step to mark low tones in the orthography but not high tones. Additionally, this would open the possibility of representing lexical low tones in the orthography and leaving post-lexical low tones unmarked.

I recommend orthography testing in which low tones are written but not high tones. I also recommend testing to determine whether post-lexical low tones, such as boundary tones and stress markers, need to be represented in the orthography. It is possible that only underlying tones and floating tones need to be written in Bora.

5.2.1 *Recommendations for Teaching Literacy*

For many years, Wes Thiesen taught the Bora people to write by beating the tones on a pair of hollow-log drums called the *manguaré* (see Section 1.2.5). While this method was highly effective, it no longer works for young learners, as only the elders in the community know how to play the *manguaré* drums.

Although I did not have the opportunity to observe any classes in the bilingual school in Brillo Nuevo, a Bora teacher told me that students are taught to read by sounding out the tones of individual syllables. I suggest instead that literacy education be based on the tone patterns of words as a whole. Disyllabic noun roots, for example, have three surface tone patterns: LH, HH, and HL. For beginning readers, each of these patterns could be color-coded for ease of identification (red nouns have the pattern LH, blue nouns have the pattern HL, and so on). Students could then learn the behavior of each type of noun when different affixes are added to the stem. Thus, rather than

looking at individual syllables, students would learn to identify nouns by their type and would therefore be able to predict their tone patterns in different environments. I believe that a word-level approach to teaching tone would greatly simplify reading and writing for students.

Snider (2013:26) reports that “even after speakers are made aware of the different pitch heights in the language, they are usually unable to discern which pitch is associated with which syllable or TBU.... The reason is that when it comes to tone, it is the melody that is relevant, not the individual pitches on the syllable.” He further observes that when native speakers of tone languages are asked for the tone of a particular syllable, they will often whistle, tap, or hum the melody until they arrive at the correct place in the word. I similarly noticed that when my language consultants were unsure of my transcription, they would sound it out carefully while moving their finger in the air, using a rising motion for high tone and a falling motion for low tone. These behaviors indicate that native speakers are more attuned to melodies than individual tones. Thus, using tone patterns as a basis for teaching literacy not only allows students to predict the tonal behavior of words, but also reflects how native speakers perceive pitch contrasts.

5.3 Questions for Future Research

There are a number of questions for further research. Due to time constraints, I elicited nouns with only one case marker, the sociative suffix *-ma*, and one prefix, the first person genitive singular *t^ha-*. As described in Section 3.3.4, case markers cause low tones to associate to the penultimate syllable of noun stems, so the low tone that marks stress is deleted to avoid an OCP conflict. In future research, nouns should be elicited with each of the seven Bora case marker suffixes in order to examine the tone of case markers in more detail.

In future studies, nouns should also be elicited with all of the genitive prefixes. As discussed in Chapter 3, the genitive prefix has a floating low tone. When the genitive prefix is affixed to disyllabic nouns, the low tone docks onto the prefix. When it is affixed to nouns with three or more syllables, the low tone associates to the first syllable of the noun stem. However, a number of nouns in Bora resist the low tone of the genitive prefix and instead have initial high tones, as shown in (73). Most of these irregular nouns have the underlying tone pattern $\emptyset L$. While the floating low tone of the genitive prefix usually deletes conflicting underlying tones, these irregular nouns delete the low tone of the genitive prefix from the first syllable of the noun stem. It is also interesting to note that in these instances, the floating low tone does not associate to the prefix.

73.	Noun Stem úúmì-ʔè field-BOT 'cultivated field'	Noun Stem + t ^h á- t ^h á-úúmì-ʔè 1SgGen-field-BOT 'my cultivated field'
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The nouns in (73) may have a different derivational history or they may simply be exceptions. They merit further investigation.

Other irregular suffixes include the Derivation II suffixes $-\beta a$ and $-mè$. Although the verbal boundary tone usually docks on the final syllable of the verb stem, a low tone docks one syllable to the left when $-\beta a$ and $-mè$ are added to the stem. There are two possible analyses. One is that $-\beta a$ and $-mè$ trigger L Delinking even though there is no OCP violation. Another possible analysis is that $-\beta a$ and $-mè$ delete the verbal boundary tone from the final syllable of the verb stem, thereby allowing the low tone that marks stress to associate to the antepenultimate syllable. These suffixes are an area for further research.

Another irregular verbal suffixes is $-k^h i$ 'PURPOSE', which has underlying low tone. When $-k^h i$ is added to a verb stem that ends in a long vowel, both the long vowel

and $-k^h\grave{i}$ have low tones. As Bora generally avoids clusters of three adjacent low-toned moras, it is unclear why this does not trigger L Delinking.

As discussed throughout this thesis, nearly all of the words used in this analysis were elicited in isolation. The greatest need for further research is to elicit words with contrastive tone patterns in frames. As the tones of final syllables in Bora are often obscured by boundary tones, eliciting words in medial environments will provide new insights into the behavior of tones in Bora.

APPENDICES

APPENDIX A

CONSENT FORMS

All of the Bora speakers who participated in this research gave me written permission to analyze and publish their data. Below is a copy of the consent form in Spanish, followed by an English translation:

Contrato Informal de Servicios

El proyecto en que estoy trabajando actualmente es una descripción de la lengua bora. Voy a usar los datos para hacer un análisis de los tonos de bora. Soy estudiante de la Universidad de North Dakota y esta investigación formará parte de mi tesis de maestría. Deseo que esta investigación sea lo más correcta y útil posible. Por lo tanto estoy solicitando su ayuda y deseo hacer un contrato con usted para poder llevar a cabo este proyecto. Voy a pedirle proveer grabaciones para archivar y analizar.

Su contribución a este proyecto es totalmente voluntaria, aunque usted va a ser compensado con un sueldo mutuamente establecido. No se espera ningún riesgo para usted durante esta investigación. Si en cualquier momento usted quiera terminar con su participación en este proyecto, puede retirarse sin penalidad. Usted será remunerado para su participación hasta ese punto.

Los resultados de este proyecto van a estar disponibles a la comunidad que habla esta lengua y al público en general en forma impresa, y también en forma electrónica, incluyendo las grabaciones digitales. La gente que audita los procedimientos IRB también tendrán acceso a los datos. El material será archivado en mi computadora y en una memoria para su preservación. No se harán ni se almacenarán grabaciones que usted no quiera que se preserven.

Al dar su consentimiento, usted indica que acepta las condiciones del proyecto y que el proyecto se llevará a cabo con respecto a su idioma con su apoyo voluntario. Usted va a recibir también una copia de este contrato.

Usted puede elegir ser reconocido públicamente por su participación en este trabajo o mantenerse anónimo, como usted desea.

Este contrato se guardará bajo llave por un período de por lo menos tres años después de terminar el estudio, aparte de los datos.

Cualquier persona que tome parte en este proyecto y que quiera más información sobre sus derechos, los resultados o el progreso de esta investigación, puede ponerse en contacto con los individuos listados abajo.

La familia Thiesen:

Ron y Annette Thiesen o Ruth Kerr:

Número de teléfono: [omitido]

Research & Development Compliance Staff

(Personal de Investigación y Conformidad de Desarrollos)

University of North Dakota

Twamley Hall Room 105

264 Centennial Drive Stop 7134

Grand Forks, ND, United States of America, 58202-7134

Número de teléfono:

1-701-777-4280

Asuntos Éticos

Por medio del presente contrato _____ autoriza a Amy Beth Roe para que el material lingüístico adquirido durante su trabajo sea publicado y/o compartido públicamente. Yo quiero/no quiero ser reconocido públicamente por mi participación. Si elijo ser reconocido por mi participación, esto implica que mi nombre figurará en cualquier publicación que se haga a base de los datos lingüísticos que proveo como parte de este trabajo.

Yo _____ estoy de acuerdo con estas condiciones y estoy de acuerdo a colaborar en el proyecto bora (la lengua que hablo) en la manera descrita arriba. Entiendo que voy a ser remunerado con un sueldo mutuamente establecido y que mi participación es voluntaria. No estoy bajo ninguna obligación a continuar trabajando si quiero terminar este contrato y puedo terminarlo en cualquier momento, sin penalidad. Seré pagado por mi trabajo hasta ese momento, al precio mutuamente establecido.

También entiendo que Amy Roe puede terminar este contrato en cualquier momento, pagándome solamente por el tiempo que yo he colaborado durante este proyecto. Entiendo que las grabaciones que se hacen serán archivadas y que también serán accesibles al público para propósitos de investigación académica.

Fecha _____

Nombre del hablante _____

Edad _____

Sexo _____

Firma del investigador _____

Translation
Informal Contract for Services

Translated by: Amy Roe

Qualifications: B.A. in Spanish, B.A.A. in Teaching Spanish, fluency in Spanish.

The project I am currently working on is a description of the Bora language. I am going to use the data to do an analysis of the tones of Bora. I am a student at the University of North Dakota, and this investigation will form part of my M.A. thesis. I want this investigation to be as accurate and useful as possible. For this reason, I am asking for your help and I want to make a contract with you so that I will be able to complete this project. I am going to ask you to provide recordings for archival and analysis.

Your contribution to this project is completely voluntary, although you will be compensated with a salary we both agree upon. There are no expected risks to you during this project. If at any point you would like to end your participation in this project, you may withdraw without penalty. You will be paid for your participation up to this point.

The results of this project will be available to the community which speaks this language and to the public in general in printed form and also in electronic form, including digital recordings. People who audit IRB procedures will also have access to the data. The material will be archived on my computer and on a flash drive for its preservation. I will not make or store recordings that you don't want to preserve.

Upon giving your consent, you will indicate that you accept the conditions of the project, and that the project will be completed with your voluntary assistance. You will also receive a copy of this contract. You can choose to be publically recognized for your participation in this work or remain anonymous.

This contract will remain under lock and key for a period of at least three years after the end of the study, separate from the data.

Anyone who takes part in this project and would like more information about his or her rights or the progress of the investigation can put himself or herself in contact with the individuals listed below:

The Thiesen family:

Ron and Annette Thiesen or Ruth Kerr

Telephone number: [omitted]

Research & Development Compliance Staff

University of North Dakota

Twamley Hall Room 105

264 Centennial Drive Stop 7134

Grand Forks, ND, United States of America, 58202-7134

Telephone number:

1-701-777-4280

Ethical Matters

By means of the following contract _____ authorizes Amy Beth Roe to publish or publically share the linguistic material acquired during her investigation. I want/don't want to be recognized publically for my participation. If I choose to be recognized for my participation, this implies that my name will be included in whatever publication is made based on the linguistic data that I provide during this investigation.

I _____ am in agreement with these conditions and I agree to collaborate in the project about the Bora language (the language that I speak) in the manner described above. I understand that I am going to be compensated with a salary we both decide upon, and that my participation is voluntary. I am not under any obligation to continue working if I want to end this contract, and I can end it at whatever time, without penalty. I will be paid for my work until that time, at the price we both agree upon.

I also understand that Amy Roe can end this contract at any time, paying me only for the time during which I have collaborated on this project. I understand that the recordings which are made will be archived and will be accessible to the public for purposes of academic investigation.

Date _____

Name of the speaker _____

Age _____

Sex _____

Researcher's signature: _____

APPENDIX B

REPRESENTATIVE TONE CHARTS

In this appendix, I present examples of noun and verb stems with contrastive tone patterns. Table 1 shows the derivations of animate nouns with the tone patterns LØ, ØL, and ØØ, while Table 2 shows the same information for inanimate nouns. All of the nouns in Tables 1 and 2 have the class suffix -ʔo ‘oblong’.

Table 1. Animate Noun Chart

U. Pattern	LØ	ØL	ØØ
Isolation	t ^h ù:ɹá-ʔò ‘woodpecker’	ó:p ^h à-ʔìò ‘paiche fish (sg)’	mámà-pà ‘rattlesnake’
-kpw(ɯ) DIM	t ^h ù:ɹá-ʔó-kpùèʔ	ó:p ^h à-ʔìó-kpùèʔ	mámá-pá-kpùèʔ
-k ^h opa AUG	t ^h ù:ɹá-ʔó-k ^h òpà	ó:p ^h à-ʔìó-k ^h òp ^h à	mámá-pá-k ^h òpàʔ
-mu AnPl	t ^h ù:ɹá-ʔó-mùè	ó:p ^h à-ʔìó-mùè	mámà-pá-mùèʔ
-ma SOC	t ^h ù:ɹá-ʔò-mà	ó:p ^h à-ʔìó-mà	mámá-pà-màʔ
ɯβɯ TERM	t ^h ù:ɹá-ʔò-úíβùè	ó:p ^h à-ʔìó-úíβùè	mámá-pà-úíβùèʔ
-muɿts ^h ì DuM	t ^h ù:ɹá-ʔò-muɿts ^h ì	ó:p ^h à-ʔìó-muɿts ^h ì	mámá-pà-muɿts ^h ì
-muɿp ^h ɿ DuF	t ^h ù:ɹá-ʔò-muɿp ^h ɿ	ó:p ^h à-ʔìó-muɿp ^h ɿ	mámá-pà-muɿp ^h ɿ
t ^h a- 1SgGEN	t ^h á-t ^h ù:ɹá-ʔò	t ^h á-ò:p ^h à-ʔìò	t ^h á-mámá-pàʔ

Table 2. Inanimate Noun Chart

U. Pattern	L∅	∅L	∅∅
Isolation	nè:βá-ʔò 'peg'	í:mù-ʔò 'beehive'	k ^h ó:xù-ʔò 'avocado'
-kpw(ɯ) DIM	nè:βá-ʔó-kpùʔ	í:mù-ʔó-kpùʔ	k ^h ó:xuí-ʔó-kpùʔ
-k ^h opa AUG	nè:βá-ʔó-k ^h òpà	í:mù-ʔó-k ^h òpà	k ^h ó:xuí-ʔó-k ^h òpà
-.k ^h ɯ InDu	nè:βá-ʔó:-k ^h ù	í:mù-ʔó:-k ^h ù	k ^h ó:xù-ʔó:-k ^h ù
-.nɛ InPl	nè:βá-ʔó:-nè	í:mù-ʔó:-nè	k ^h ó:xù-ʔó:-nè
-ma SOC	nè:βá-ʔò-mà	í:mù-ʔó-mà	k ^h ó:xuí-ʔò-mà
ɯβɯ TERM	nè:βá-ʔò-úβù	í:mù-ʔó-úβù	k ^h ó:xuí-ʔò-úβù
t ^h a- 1SgGEN	tá-nè:βá-ʔò	tá-ì:mú-ʔò	tá-k ^h ò:xuí-ʔò

The following table provides derivations of simple verb stems with the syllable profiles (C)V(C)V and (C)V(C)V:. Like all verb stems without Derivation I suffixes, these verbs are underlyingly toneless.

Table 3. Simple Verb Stems

	Simple Stem (C)V(C)V	Simple Stem (C)V(C)V:
Isolation	àkpà 'to be on a diet'	t ^h òkpà: 'to sweat'
-k ^h ì PUR	ákpà-k ^h ì	t ^h òkpà:-k ^h ì
-tʃè SgF	ákpà-tʃè	t ^h òkpà:-tʃè
-βa COMES TO	àkpá-βá	t ^h òkpá:-βá
-t ^h ɛ GOES TO	ákpà-t ^h ɛ	t ^h òkpà:-t ^h ɛ
-xɛ RETURNS FROM	ákpà-xɛ	t ^h òkpà?-xɛ
-t ^h u NEG	ákpà-t ^h uí	t ^h òkpà:-t ^h ù
-ts ^h o CAUS	ákpà-ts ^h ó	t ^h òkpà:-ts ^h ó
-mè Pl	àkpá-mè	t ^h òkpá:-mè
-xuìk ^h o: NOW	àkpá-xuìk ^h ó:	t ^h òkpá:-xuìk ^h ó:
-ɾaʔì FRUST	ákpà-ɾáʔì	t ^h òkpà:-ɾáʔì
-:pè SgM	ákpá:-pè	t ^h òkpà:-á-pè:
-muɽts ^h ì DuM	ákpà-muɽts ^h ì	t ^h òkpà:-muɽts ^h ì
-muɽp ^h ɪ DuF	ákpà-muɽp ^h ɪ	t ^h òkpà:-muɽp ^h ɪ

Table 4 shows the derivations of verb stems with the suffix $-t^h\epsilon$. Verbs with this suffix are assigned the tone pattern $\emptyset L$.

Table 4. Verb Stem with the Tone Pattern $\emptyset L$

	$-t^h\epsilon$
Isolation	ítʃi-t ^h ɛ̃ 'to be scared'
-k ^h i PUR	ítʃi-t ^h ɛ̃-k ^h i
-tʃɛ̃ SgF	ítʃi-t ^h ɛ̃-tʃɛ̃
-βa COMES TO	ítʃi-t ^h ɛ̃-βá
-t ^h ɛ̃ GOES TO	ítʃi-t ^h ɛ̃-tɛ̃
-xɛ̃ RETURNS FROM	ítʃi-t ^h ɛ̃-xɛ̃
-t ^h u NEG	ítʃi-t ^h ɛ̃-t ^h ú
-ts ^h o CAUS	ítʃi-t ^h ɛ̃-ts ^h ó
-mɛ̃ Pl	ítʃi-t ^h ɛ̃-mɛ̃
-xùk ^h o: NOW	ítʃi-t ^h ɛ̃-xùk ^h ó:
-ʔaʔi FRUST	ítʃi-t ^h ɛ̃-ʔáʔi
-:pɛ̃ SgM	ítʃi-t ^h ɛ̃:-pɛ̃
-muʔts ^h i DuM	ítʃi-t ^h ɛ̃:-muʔts ^h i
-muʔp ^h i DuF	ítʃi-t ^h ɛ̃:-muʔp ^h i

The following table lists verb stems with the Derivation I suffixes -ʔk^ho/-xk^ho, -ts^ho, and -βε.¹²¹ Verbs with these suffixes are assigned the tone pattern ∅∅.

Table 5. Verb Stems with the Tone Pattern ∅∅

	-ʔk ^h o/-xk ^h o	-ts ^h o	-βε
Isolation	όρò-ʔk ^h ò 'to eat quickly'	ʧ ^h émè-t ^h ò 'to get sick'	tsíxì-βè 'to die'
-k ^h ì PUR	όρò-ʔk ^h ò-k ^h ì	ʧ ^h émé-t ^h ò-k ^h ì	tsíxì-βè-k ^h ì
-ʧè SgF	όρò-ʔk ^h ò-ʧè	ʧ ^h émé-t ^h ò-ʧè	tsíxì-βè-ʧè
-βá COMES TO	όρò-ʔk ^h ó-βá	ʧ ^h émè-t ^h ó-βá	tsíxì-βέ-βá
-t ^h é GOES TO	όρò-ʔk ^h ò-t ^h é	ʧ ^h émé-t ^h ò-t ^h é	tsíxì-βè-t ^h é
-xé RETURNS FROM	όρò-ʔk ^h ò-xé	ʧ ^h émé-t ^h ò-xé	tsíxì-βè-xé
-t ^h uí NEG	όρò-ʔk ^h ò-t ^h uí	ʧ ^h émé-t ^h ò-t ^h uí	tsíxì-βè-t ^h uí
-ts ^h ó CAUS	όρò-ʔk ^h ò-ts ^h ó	ʧ ^h émé-t ^h ò-ts ^h ó	tsíxì-βè-ts ^h ó
-mè Pl	όρò-ʔk ^h ó-mè	ʧ ^h émè-t ^h ó-mè	tsíxì-βέ-mè
-xuùk ^h ó: NOW	όρò-ʔk ^h ó-xuùk ^h ó:	ʧ ^h émè-t ^h ó-xuùk ^h ó:	tsíxì-βέ-xuùk ^h ó:
-ʧáʔì FRUST	όρò-ʔk ^h ò-ʧáʔì	ʧ ^h émé-t ^h ò-ʧáʔì	tsíxì-βè-ʧáʔì
-:pè SgM	όρò-ʔk ^h ò:-pè	ʧ ^h émé-t ^h ò:-pè	tsíxì-βέ:-pè
-muúts ^h ì DuM	όρò-ʔk ^h ò-muúts ^h ì	ʧ ^h émé-t ^h ò-muúts ^h ì	tsíxì-βè-muúts ^h ì
-muúp ^h ɿ DuF	όρò-ʔk ^h ò-muúp ^h ɿ	ʧ ^h émé-t ^h ò-muúp ^h ɿ	tsíxì-βè-muúp ^h ɿ

¹²¹ There are two -βε suffixes with contrastive tone patterns. One is listed in Table 5, while the other is listed in Table 6.

The following table lists verb stems with the Derivation I suffixes -k^ho and -βε.¹²²

Verbs with these suffixes are assigned the tone pattern LØ.

Table 6. Verb Stems with the Tone Pattern LØ

	-βε	-k ^h o
Isolation	àβʲé-βè 'to suffer'	ts ^h òá-k ^h ò 'to pour'
-k ^h ì PUR	àβʲé-βè-k ^h ì	ts ^h òá-k ^h ò-k ^h ì
-tʃè SgF	àβʲé-βè-tʃè	ts ^h òá-k ^h ò-tʃè
-βá COMES TO	àβʲé-βè-βá	ts ^h òá-k ^h ò-βá
-t ^h é GOES TO	àβʲé-βè-t ^h é	ts ^h òá-k ^h ò-t ^h é
-xé RETURNS FROM	àβʲé-βè-xé	ts ^h òá-k ^h ò-xé
-t ^h uí NEG	àβʲé-βè-t ^h uí	ts ^h òá-k ^h ò-t ^h uí
-ts ^h ó CAUS	àβʲé-βè-ts ^h ó	ts ^h òá-k ^h ò-ts ^h ó
-mè Pl	àβʲé-βé-mè	ts ^h òá-k ^h ò-mè
-xuùk ^h ó: NOW	àβʲé-βé-xuùk ^h ó:	ts ^h òá-k ^h ó-xuùk ^h ó:
-tʃáʔì FRUST	àβʲé-βè-tʃáʔì	ts ^h òá-k ^h ò-tʃáʔì
-:pè SgM	àβʲé-βè:-pè	ts ^h òá-k ^h ò:-pè
-muúts ^h ì DuM	àβʲé-βè-muúts ^h ì	ts ^h òá-k ^h ò-muúts ^h ì
-muúp ^h ì DuF	àβʲé-βè-muúp ^h ì	ts ^h òá-k ^h ò-muúp ^h ì

¹²² There are two -βε suffixes with contrastive tone patterns. One is listed in Table 5, while the other is listed in Table 6.

The following table shows a verb stem with the Derivation I suffix -mèi, which has an underlying low tone.

Table 7. Derivation I Suffix with Underlying Low Tone

	-mèi
Isolation	t ^h áú-mèi 'to ask'
-k ^h i PUR	t ^h áú-mèi-k ^h i
-tʃɛ SgF	t ^h áú-mèi-tʃɛ
-βa COMES TO	t ^h áú-mèi-βá
-t ^h ɛ GOES TO	t ^h áú-mèi-t ^h jé
-xɛ RETURNS FROM	t ^h áú-mèi-x ^j ɛ
-t ^h u NEG	t ^h áú-mèi-t ^h jú
-ts ^h o CAUS	t ^h áú-mèi-tʃ ^h ó
-mè Pl	t ^h áú-mèi-m ^j è
-xu ^h o: NOW	t ^h áú-mèi-xu ^h o:
-ʒaʒi FRUST	t ^h áú-mèi-jaʒi
-:pè SgM	t ^h áú-mèi:-p ^j è
-mu ^h ts ^h i DuM	t ^h áú-mèi-mu ^h ts ^h i
-mu ^h p ^h i DuF	t ^h áú-mèi-mu ^h p ^h i

APPENDIX C

LIST OF NOUN STEMS

In this section, I provide a list of one, two, and three syllable noun stems in Bora.

Stems are arranged alphabetically by syllable profile.

CV:

xǎ: house, building

(C)V(C)V

àŋùt black vulture (*Coragyps atratus*)
 àxì carana tree (*Mauritia carana*)¹²³
 ìkpà heart of palm
 k^hùkpà bed
 màmjè student, apprentice
 mèkpà wife
 nàmè coto banana (a reddish colored banana)
 nùtjè toucan
 ùtjè walk, journey, hunt
 ùxì banana

(C)V:(C)V

ǎ:k^hò male goat
 ǎ:xì mocambo seed (*Theobroma bicolor*)
 ǎ:?è mocambo tree (*Theobroma bicolor*)
 ǎ:?ò mocambo fruit, a type of cacao (*Theobroma bicolor*)
 ì:pà gray brocket deer (*Mazama gouazoubira*)
 ì:βò turtle (sp.)
 ǎ:k^hùt game, toy
 ǎ:xùt anteater (*Myrmecophaga tridactyla*)
 k^hǎ:ùt small tree (sp.) where pucacuro ants live
 k^hǎ:mè old man
 k^hò:ì twig
 k^hò:ìkpà crack, fissure
 kpǎ:?è mountain tree
 kpǎ:p^jà hammock
 kpǎ:x^jùt mosquito
 mǎ:nì peccary, wild boar
 mí:tj^hì: cat
 mǎ:nè canoe, boat
 nǎ:βè shadow, photograph, reflection
 nǎ:xì wild turkey

¹²³ The leaves of *Mauritia carana* are often used for making thatched roofs.

nũ:ò	bite, sting
pǎ:k ^h ò	Amazon grape (<i>Pourouma cecropiifolia</i>)
páxũ:	mountain
pě:ù	small bird (sp.) that lives in regrown forests
pě:ʔì	branch with Maraja palm fruits (<i>Bactris maraja</i>) ¹²⁴
p ^h ǎ:k ^h ò	green-colored lizard (sp.)
p ^h ǎ:pà	pool in the curve of a river
pǐ:ù	dale dale tuber (<i>Calathea allouia</i>)
ʔǒ:ù	dove (sp.)
ʔǒ:ʔò	mole cricket
tǎ:tʃì	parrot
t ^h ǎ:ʔò	kingfisher (sp.)
t ^h ě:ʔì	river
t ^h ũ:ʔì	rainbow
tš:ʔè	hot pepper plant
tʃě:ù	giant armadillo (<i>Priodontes maximus</i>)
tʃǒ:ʔà	dark green parrot (sp.)
ũ:pà	worm
ũ:pà	offer
xě:ù	domesticated animal
xũ:βà	path, trail

(C)V(C)V:

àɲũ:	bullet
ítsì:	self's daughter
k ^h à:nĩ:	father
k̄pámũ:	wart
k̄páʔǒ:	parrot (sp.)
k̄pátʃ ^h ǎ:	kinkajou (<i>Potos flavus</i>)
mù?mũ:	ghost, phantom
núk̄pà:	wing
pák ^h ǒ:	tinamou (sp.)
pók̄pǎ:	tail
púxǐ:	small green frog (sp.)
ts ^h ínũ:	trap made of netting
tʃ ^h í?k̄pǎ:	squirrel cuckoo (<i>Piaya cayana</i>)
xíʔǒ:	dry leaves
ʔáʔũ:	eye
ʔúmǐ:	face

(C)V:(C)V:

á:k̄pǎ:	tinamou (sp.)
í:m ^h ě:	self's aunt
í:βǎ:	red-and-green macaw (<i>Ara chloropterus</i>)

¹²⁴ The maraja palm has small, dark purple fruits with white flesh.

jó:ʔí:	red and green parrot (sp.)
k ^h á:tuǔ:	sweet potato
k ^h ó:xuù:	fish (sp.)
k ^h ó:ʔǒ:	long stick for reaching something
k ^h ú:pi:	caterpillar (sp.)
kpàxk ^h ò	flower
má:nǐ:	tobacco paste
mí:ʔě:	skin, hide, leather
ní:ʔjǒ:	female with young
ókpǎ:	opossum
ɾí:ǒ:	small toucan (sp.)
tè:xuú:	chicken without a tail
tʃ ^h ó:ɾǒ:	edible frog (sp.)
tʃí:ʔǒ:	heart of palm
tʃú:í:	small partridge (sp.)
ʔé:k ^h ǒ:	meat

(C)VCCV

àʔɾò	trap
àʔtʃà	sore, ulcer
ìʔtʃè	ring-tailed coati (<i>Nasua nasua</i>)
̀xk ^h uù	yellow-rumped cacique (<i>Cacicus cela</i>)
k ^h àʔpà	pucacuru ant ¹²⁵
k ^h òʔpà	large stick
kpàxk ^h ò	palometa fish (sp.)
kpàxp ^h ì	man
nàʔpè ¹²⁶	brother, male cousin
nèʔpà	mosquito (sp.) ¹²⁷
nìʔpà	alligator, caiman
nòʔk ^h ò	stork
nòʔxì	wave
nuùʔpà	sun, moon, clock
òx ^h ts ^h ò	smoke
òʔpà	capybara (a large rodent) (<i>Hydrochoerus hydrochaeris</i>)
tèʔts ^h ì	caterpillar (sp.)
t ^h èʔmuù	Peruvian red-necked owl monkey (<i>Aotus nancymaae</i>)
tòʔxì	handle
ts ^h òxk ^h ò	otter
tʃ ^h ixtʃ ^h ì	thunder ¹²⁸

¹²⁵ A species of fire ant with a painful sting. Its venom can cause blindness if it comes into contact with the eyes.

¹²⁶ My language consultants told me that this word never occurs without the genitive prefix.

¹²⁷ The mosquito known as *manta blanca*, which transmits malaria.

¹²⁸ The Bora words for sun, moon, stars, thunder, etc. are animate nouns.

tʃiʔp ^h ɛ̀	guinea pig
ùxk ^h ò	large sea lion (sp.)
ùʔpà	argument, dispute
ùʔtʃɛ̀	añashua fish (genus <i>Crenicichla</i>) ¹²⁹
ʔáxtʃ ^h i	(my) son

(C)VCCV:

íxk ^h ɔ̀	nest
k ^h ùʔtʃũ:	curve, something curved
níxk ^h ɛ̀:	tomb, grave
núxp ^h ǎ:	water
páxk ^h jɛ̀:	root
páxk ^h ú:	bone
ʔóxts ^h ɪ:	hand

(C)V(C)V(C)V

àtókpà	swamp, pond
áxìpà	caterpillar
àβ'ápa	heart of a plant or vegetable
ìkpáxì	cassava starch
ínàʔà	blue-and-yellow macaw (<i>Ara ararauna</i>)
ínèʔɛ̀	moriche palm tree (<i>Mauritia flexuosa</i>)
ínèʔò	fruit of the moriche palm (<i>Mauritia flexuosa</i>)
ínìxì	sábalo fish
k ^h áràk ^h à	chicken
k ^h úíkpaʔò	crested guan (<i>Penelope purpurascens</i>)
kpátsìù	cheek
kpàʔárò	mother
mámàpà	rattlesnake
mímòk ^h ò	knee
míxòkpà	rib
mónèʔɛ̀	tree (sp.) with a wide base
námèk ^h ò	colon
nàmék ^h ò	coto banana (red-colored banana)
náxàpà	breadfruit
náxàù	breadfruit seed
náxàʔɛ̀	breadfruit tree
némìù	elbow
néxùíkpa	arm
náxìpà	chambira fiber
náxìù	fruit of the chambira palm
náxìʔɛ̀	chambira plant
t ^h úxùʔò	nose

¹²⁹ Añashua fish (which the Bora people call añás-súa in Spanish), form part of the Bora diet. They are known for their delicious flesh.

úmèpà	sal de monte plant
úmè?è	tree (general term)
úmì?è	field
úmòpà	monkey (general term) ¹³⁰
únèù	lake
úxìk ^h ò	banana tree
úxìkpà	banana tree that grows in the mountains
úxìpà	banana drink
úxìpà	shoulder
úxìù	grain of corn
úxì?ò	banana
?á?ù?í	eyelash
?á?ùxì	eyeglasses
?á?à?ì	flamingo
?úmìk ^h ò	forehead

(C)V:(C)V(C)V

á:k ^h ò?ò	boa
á:k ^h ùpà	edible frog (sp.)
á:k ^h ù?è	tree used to make torches (sp.)
à:múpà	spear
à:núkpà	cassava shoot for planting
à:nú?ò	furrow for planting
á:ɽùpà	trap in the form of a basket for catching fish
á:t ^h à?è	stinging nettle
á:tìk ^h ò	tadpole
á:xàpà	opossum
é:tèpà	small fly (sp.)
é:βàk ^h ò	fetus
è:βékpà	measuring stick
è:βéxì	measuring scale
gò:ɽù	gizzard
í:kìpà	horsefly
ì:múpà	sugarcane
í:mù?ò	beehive, honeycomb
í:ɽùxì	the world ¹³¹
í:xìkpà	caterpillar
jù:jú?ò	cicada (sp.)
k ^h à:k ^h áù	species of driftwood catfish (in the family <i>Auchenipteridae</i>)
k ^h à:p ^h á?ò	dead branch of a river
k ^h á:tùpà	huito fruit (<i>Genipa americana</i>)
k ^h á:?à?ò	furrow
k ^h é:mètʃè	old woman

¹³⁰ May also refer to a person dressed as a monkey during a traditional celebration.

¹³¹ The same word is also used for country, continent, and territory.

k ^h è:ʔéì	egoist, person who thinks he/she is important
k ^h ó:k̄pàʔò	torch, match
k ^h ò:míù	fruit of the ungurahui palm (<i>Oenocarpus bataua</i>) ¹³²
k ^h ó:xùʔè	avocado tree
k ^h ó:xùʔò	avocado (fruit)
k ^h ú:mùxì	turtle
k ^h ú:mùʔè	cumala tree
k ^h ú:xùì	walking stick, cane
k ^h ú:xùʔò	half-burned stick that is carried away to light a fire somewhere else
k ^h ù:βépà	rat, mouse
k̄pà:p ^h éù	drop of water
mà:ník̄pà	piece of pitch
má:nìù	packet of tobacco paste
má:ɲàʔò	iguana
má:t ^h ík ^h ò	green lizard
má:ʔòxì	cassava
mè:k̄pák ^h ò	snail (sp.)
mé:mèù	peach palm fruit
mé:mèʔè	peach palm tree
mé:mèʔò	peach palm mash
mé:ts ^h àk̄pà	table
mí:ùʔò	dragonfly
mú:ts ^h ùʔò	leche caspi tree
ná:mòʔò	opossum
né:k̄pàjù	rock, stone
né:k̄pàp ^j à	waterfall
né:pàpà	annatto fruit
né:pàp ^h ì	edible snake (sp.) with red markings
nè:páxì	small aquatic turtle (sp.)
né:pàʔè	annatto plant
né:p ^h ík ^h ò	squirrel
nè:βáù	nut, grain
nè:βáʔò	shoot, sprig, sprout
ní:k̄pàù	head
nì:múík ^h ò	curassow (bird of the <i>Crax</i> genus)
nì:óxì	whirlwind
nì:pák̄pà	very loud cricket (sp.)
ní:x ^j àù	drop of rain
nì:x ^j áù	porcupine
ní:βùk̄pà	red brocket deer
ní:xík̄pà	tongue
nú:mìʔò	ear
nù:t ^h ák̄pà	knitting needle

¹³² The fruit of the ungurahui palm tastes similar to chocolate. The fruit is usually soaked before eating, which softens the pulp.

nú:xùk̀pà	hut
nà:mákpà	shaman, enchanter
ó:bàk̀pà	bald uakari monkey (<i>Cacajao calvus</i>)
ò:máù	beetle
ó:nà?è	huitina plant (<i>Xanthomosa</i> genus)
ó:p ^h à?ò	paiche fish (<i>Arapaima</i>)
ò:ɾípà	abscess
ò:ù?è	cumala tree
ò:ù?ò	fruit of the cumala tree
ó:βàxì	vineyard
ó:βì?ò	scorpion
pá:èxà	maloca (communal thatched-roof house)
pá:k ^h òù	Amazon grape (fruit)
pá:k̀pàxì	Goliath bird-eating spider (<i>Theraphosa blondi</i>)
pà:páxì	bedbug
pá:ɾàpà	packet of bullets
pà:ts ^h ú?è	fly
pà:xúɾì	cassava
pè:ɾópà	person with a shaved head
pè:ɾóù	shaved head
p ^h á:jù?è	snake (sp.)
p ^h á:k ^h òxì	green-colored lizard (sp.)
p ^h á:pì?ò	hummingbird
p ^h á:ɾàxì	shovel
p ^h á:ɬà?ò	cassava dough
p ^h è:t ^h éù	lightbulb
p ^h í:k ^h àù	cassava tuber
pí:k ^h àjì	mountain turkey (<i>Penelope montagnii</i>)
pò:áxù	tipití (strainer woven in the shape of a boa)
ɾò:ɬájì	mata mata turtle (<i>Chelus fimbriata</i>)
ɾò:ɬá?è	cocona plant
ɾò:úkpà	clay whistle
ɾò:ú?è	small wasp (sp.) that is a phosphorescent green color
t ^h á:k ^h à?è	South American bushmaster snake (<i>Lachesis muta</i>)
t ^h à:póɬè	female doctor
t ^h à:póxì	pill
t ^h à:ɬéù	grandmother
t ^h ó:mèù	wild almond nut
t ^h ù:ɾá?ò	woodpecker
tó:t ^h òù	squash
tò:tópà	butterfly
tó:ʔàk ^h ò	needlefish (<i>Pseudotyllosurus angusticeps</i>)
tsá:ɾàù	chicken (sp.) ¹³³
ts ^h ì:níù	very small mouse (sp.)

¹³³ Species of chicken with crested feathers.

ts ^h i:mènè	young man
tsí:tsìù	wallet, purse
tsí:tsìxì	coin, button
tʃé:ʔòkpà	door
tʃ ^h á:k ^h àʔè	ant (sp.)
tʃ ^h i:jákpà	false coral snake
tʃù:ʃìxì	fierce, aquatic animal who is said to shape-shift into people/objects
ú:k ^h ùmè	agouti (a type of rodent related to the guinea pig)
ù:méxì	leech
ú:p ^h ìtʃè	golden lion tamarin (<i>Leontopithecus rosalia</i>) ¹³⁴
ù:tʃ ^h áù	blue bird (sp.)

(C)V(C)V:(C)V

àmó:pè	fish
ájǎ:xì	cashew
gòrò:xì	mushroom
ìjá:pè	animal
íxù:ù	eared dove ¹³⁵ (<i>Zenaida auriculata</i>)
k ^h áɾǎ:xì	clay pot
k ^h áts ^h ò:kpà	wasp's nest (sp.)
k ^h úní:ù	potato
kpàt ^h á:xì	lid (for a pot or pan)
kpàxó:pè	person who is sent
mát ^h ǎ:kpà	scar
mékpǎ:xì	bird of prey
mǎ:pè	generous person
mǎ:tʃè	generous woman
míně:pè	peccary
mírú:kpà	palm beetle grub (larvae of <i>Rhynchophorus palmarum</i>)
námò:k ^h à	lightning bug
pátʃò:kpà	macana (weapon in the form of a machete made out of bloodwood)
p ^h áɾǎ:ʔò	crack, slit
p ^h èβé:pè	naked person
píʔi:pà	dale dale plant (<i>Calathea allouia</i>)
pípǎ:xì	small green frog (sp.)
póǎ:ʔò	bat (sp.)
tájǎ:tʃè	my sister, my (female) cousin
téʔě:ù	gull
t ^h ápǎ:pè	my nephew
t ^h ùpó:k ^h ò	arrow
ts ^h éɾě:ʔò	grasshopper, cricket
tsíú:ʔò	watermelon
tʃ ^h áʔi:kpà	headdress

¹³⁴ A type of monkey. Also known as the *golden marmoset*.

¹³⁵ Closely related to the mourning dove.

tú?k ^h ũ:pè	coward
ùrĩ:ù	bubble
úkpǎ:xì	axe

(C)V(C)V(C)V:

ákpá?ě:	tree (sp.) that grows on the riverbank
ámánǎ:	pink river dolphin (<i>Inia geoffrensis</i>)
í?páũ:	belly, gut
ó cáxí:	tapir (<i>Tapirus terrestris</i>)

(C)V:(C)V:(C)V

í:pî:kpà	coca plant
k ^h á:ts ^h õ:ù	fruit of the cumala tree
ó:ʔí:p'è	jaguar (<i>Panthera onca</i>)
pà:ʔá:kpà	eel
t ^h à:pó:pè	doctor, healer

(C)V(C)V:(C)V:

gò:ʔí:ũ:	red-colored fruit (sp.)
k ^h átsó:ʔě:	cumala tree
k ^h óná:ně:	edible frog (sp.)

(C)V:(C)V(C)V:

βú:ʔí?ĩ:	large edible frog (sp.)
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(C)V:(C)V:(C)V:

á:pá:pě:	my father-in-law
k ^h á:tú?ě:	huito plant (<i>Genipa americana</i>)
k ^h à:xá?õ:	furrow
ʔú:βá:pě:	shaman, healer

(C)VCCV(C)V

áxp ^h àk ^h ì	palm beetle grub
à?ʔóxì	guava (sp.)
á?tiù	cotton thread
á?ti?jè	cotton plant
à?βókpà	feather headdress
íxjàkpà	bench
íxjùpà	belly button
í?kpáxì	tooth, bird's beak
í?tè:ʔjè	female ancestor
kèxʔ ^h óxì	hat, cap
k ^h à?k ^h ái	hip
k ^h íxt ^h à?ò	insect in the flying stage
k ^h ú?màkpà	lame person

k ^h ù?rípà	doncella fish ¹³⁶ (<i>Pseudoplatystoma fasciatum</i>)
k ^h ù?βíkà	hook
kpàxk ^h ó?è	flowering plant
màxt ^h ókpà	scissors
mù?mípà	edible frog (sp.) with a flat body that lives in the river
nà?k ^h ó?ò	shrimp
nè?kpájù	crab
níxt ^h àxì	piranha
nìxt ^h úkpà	bar of soap, washboard
ní?x ^j ákà	smoky jungle frog (<i>Leptodactylus pentadactylus</i>) ¹³⁷
nà?k ^h óù	brown-colored butterfly (sp.)
nà?k ^h óù	bottle for tobacco paste
nòxk ^h áxì	bat (sp.)
ò?rópà	glutton
p ^h í?tókpà	comb
p ^h í?xáù	candy, bonbon, caramel
pò?táxì	plate
pò?tókpà	paddle
ɾòxɾók ^h ò	trumpet, horn
tà?p ^h ék ^h ò	flexible stick used to make traps
tà?ríxì	insect (sp.) ¹³⁸
té?ts ^h ípà	mountain lion
t ^h à?k ^h ápà	annona fruit
t ^h à?k ^h á?è	annona tree
t ^h à?tíù	grandfather
t ^h ó?mìpà	woodpecker
tò?kpáxì	long-legged spider (sp.)
tò?mítjè	person you treat as a sister
tò?xípà	baby sling
tó?xìù	rope for tying
tsù?tsápà	huicungo palm (<i>Astrocaryum carnosum</i>)
tsù?tsáù	fruit of the huicungo palm (<i>Astrocaryum carnosum</i>)
tjà?k ^h ákà	small guinea pig (sp.)
tú?k ^h ùxì	dove (sp.)
úx ^h ts ^h òk ^h ò	snail
?óxts ^h íkà	finger

(C)V:CCV(C)V

á?k^hùpà seat

¹³⁶ Species of catfish with long whiskers.

¹³⁷ Species of edible frog.

¹³⁸ Species of insect that makes noise to announce that summer is coming.

(C)VCCV:(C)V

p^háxk^hě:k̄pà mark, notch

(C)VCCV:CCV

íʔtê:xp^hì male ancestor

(C)V(C)VCCV

k^hàpóʔk^hò awl

népàxk^hě ayawaska

òβáʔts^hà young man

p^hátòʔxì string, cord

táʔòxpà perch

APPENDIX D LIST OF VERB STEMS

In this section, I provide a list of one, two, and three syllable verb stems in Bora. Stems are arranged alphabetically by syllable profile.

CV:

nè:	to say, to tell
nù:	to knit
pà:	to stick to, to penetrate
p ^h è:	to move from one place to another
pò:	to drill, make holes in
tò:	to eat meat

(C)V(C)V

àk̀pà	to be on a diet
ànù	to build a house for someone else
àtò	to sit down
àt̥i	to lie
ìt̥ò	to lay something down
k ^h ùk̀pà	to sleep
nàni	to steal
pàɲù	to deceive, to cheat
p ^h àxà	to sacrifice
t̥it̥ò	to ask, to interrogate
t̥ ^h è:mè	to get sick

(C)V:(C)V

à:pò	to set a trap for someone, to insult them
è:nù	to raise animals
ě:pù	to feed
è:βè	to read
gò:k ^h ò	to smile, to laugh
ì:k ^h ù	to play
ì:t ^h è	to look
k ^h à:nù	to crush, to grind
k ^h à:ɲù	to carry, to transport things
k ^h à:xà	to labor, to work
k ^h à:ʔà	to leave one's parents and live independently
k ^h à:βà	to love, to esteem, to respect
k ^h è:βà	to call
k ^h ò:βà	to cut up firewood
mě:nù	to make, to build
nè:ts ^h ò	to embarrass, to cause shame
nì:t ^h è	to go down, to descend
nì:ts ^h ù	to cut one's hair
nù:ò	to bite, to sting
ò:mì	to return
pè:ɾò	to shave
p ^h è:t ^h è	to shine

p ^h i:tʃ ^h ù	to carry on one's back
tsì:nè	to run
tsì:ts ^h ò	to invite someone to go
tʃɛ:nè	to eat fruit
tʃɛ:pò	to hear, to listen
tʃi:nè	to prefer
tʃi:nè	to prefer

(C)V(C)V:

k ^h àtʃò:	to set a trap for fish using a palm trunk
k̄pàtʃó:	to send
ɲámà:	to put a spell on
p ^h ik ^h jò:	to put
p ^h ijò:	to put a pot on the fire
pòʔi:	to recover, to get well

(C)V:(C)V:

k̄pà:gô:	to toss out, to throw away
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(C)VCCV

áɾàʔk ^h ò	to smell, to sniff
àxk ^j è	to get up
àxt ^h jè	to burn oneself
àxtʃ ^h ù	to light up, to illuminate
áβòʔpà	to bundle up
áβùʔk ^h ù	to bathe oneself
èʔtʃ ^h i	to sneeze
ìxtʃ ^h i	to swim
ìxtʃ ^h ò	to give someone something to drink
ìxk ^h ò	to pick fruit, nuts, berries
ìʔpò	to spread something out
ìʔtò	to bite
k ^h ixk ^h jò	to dance
k ^h ixt ^h jù	to mark, carve, chisel
màxtʃ ^h ò	to eat
màʔx ^j ù	to be stubborn, obstinate
mìʔtʃè	to lock
mòʔɲà	to walk stealthily, to creep up on
mùxt ^h á	to get lost
nàʔts ^h i	to win someone's heart
nèʔk ^h ò	to look for
nùxts ^h ò	to copy, to imitate
òxts ^h ò	to smoke (object)
òʔt ^h à	to whistle
pàxts ^h ò	to sow, to plant
p ^h àxt ^h jè	to move from one place to another
p ^h iʔk ^h jù	to choose, to select
p ^h iʔtò	to comb
pìʔts ^h à	to boast, to brag

pò?ti	to appear, to present oneself
tà?p ^h è	to cheat
tʃè?tò	to eat bread

(C)V(C)V(C)V

átʃixtʃ ^h ù	to breathe
àxèà	to lie down in a hammock
àxkéβà	to wake up involuntarily
áβ ^j èt ^h è	to get worse
àβ ^j éβè	to suffer
ímítʃè	to like, to want
ítʃít ^h jè	to scare, to frighten
ínárò	to make a roof with leaves
k ^h è?jénù	to get better, to recover
k ^h òéβà	to stay
p ^h ix ^j úk ^h ù	to fish with a hook
póxìts ^h ò	to comfort, to console
tsíxìβè	to die
tʃ ^h émèts ^h ò	to make someone sick, to cause illness
xùβájù	to make a path, trail

(C)V:(C)V(C)V

á:kìt ^h jè	to fall
á:pàt ^h è	to shut down, to turn off
à:ʒíβè	to go home
í:k ^h ùβè	to serve
ì:xíβè	to serve
k ^h à:t ^h únù	to write
k ^h è:méβè	to get old
né:pòts ^h ò	to shoot
né:ɾìβè	to climb, to go up
ò:ík ^h jù	to intervene
ó:mìtʃ ^h ò	to return something
ò:nóβà	to draw, to paint
ó:ɾìtʃ ^h ò	to swell
ó:tʃ ^h èβè	to be bored
p ^h à:x ^j úk ^h ù	to clean (oneself)
p ^h é:t ^h èts ^h ò	to light
p ^h è:ʒíβè	to come close, to draw near
tá:ɾìt ^h è	to dry oneself off
tà:ɾíβè	to be very thirsty
tò:ʒíβè	to scream, to shriek

(C)V(C)V:(C)V

ái:β ^j è	to burn oneself
ài:βè	to burn oneself
ák ^h ù:βè	to sit down
ékè:βè	to grab
ítʃǎ:jò	to beat

íts ^h à:βè	to remember
k ^h ápù:βè	to find
k ^h éβà:βè	to become famous
k ^h ímò:βè	to be sorry about, to be upset about
máxà:βè	to get wet
òí:β ^j è	to follow
óú:k ^h ù	to lack
óú:βè	to end, to finish
p ^h árù:βè	to bow down, to prostrate oneself
p ^h íà:pò	to help, to support
puú:βè	to sink, to submerge
tókpa:βè	to extend one's arms, to share
tópè:βè	to gather, to get together
tótfò:βè	to enter into action

(C)VCCV(C)V

áxt ^h ùmì	to see
éxkèts ^h ò	to assure
ìxt ^h íβ ^j è	to leave, to go outside
ì?puúk ^h ù	to lift, to raise
ì?x'úβà	to talk, to converse
ì?βét ^h è	to stop, to cease
ì?βét ^h è	to stop, to cease
k ^h á?k ^h ùts ^h ò	to believe, to have faith
k ^h à?p ^h íò	to empty, to pour out
máxk ^h ànù	to drown
màx ^h ts ^h íβà	to sing
nà?pénù	to accompany
nè?nítfè	to hate, to detest, to loathe
nìxt ^h úk ^h ù	to wash

(C)VCCV:(C)V

k ^h ó?pà:βè	to continue, to follow
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(C)VCCVCCV

k ^h ó?p ^h èx ^h ts ^h ò	to secure, to tighten
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(C)V(C)VCCV

éxè?ts ^h ò	to cough
éβèx ^h ts ^h ò	to propose something
gúíτù?k ^h ò	to roar, to growl
ím ^j èx ^h ts ^h ò	to season
ímùx ^h ts ^h ò	to sweeten
ípàx ^h ts ^h ò	to blow
ít ^h òx ^h ts ^h ò	to smoke meat
íβèx ^h ts ^h ò	to abandon, to leave
k ^h ámèx ^h ts ^h ò	to enlarge, to extend
k ^h ánòx ^h ò	to dig, to excavate
k ^h ánùxp ^h è	to moan

k ^h ápòʔk ^h ò	to puncture, to prick
k ^h áxùxk ^h ò	to expel something from one's throat
k ^h émùixts ^h ò	to enlarge, to grow in number
k ^h óβàxts ^h ò	to put wood on the fire
màtʃ ^h áʔk ^h ò	to be a rascal, to be mischievous
màtʃ ^h áʔk ^h ò	to be mischievous
néβèxts ^h ò	to reach, to hit the target
óròʔk ^h ò	to eat quickly
óxòxk ^h ò	to bark
p ^h àtʃóxk ^h ò	to elude, to escape
p ^h ít ^h àxk ^h ò	to say goodbye
p ^h íβàxts ^h ò	to participate with someone in an activity
píβàxts ^h ò	to obstruct
pópòxk ^h ò	to hit with something pointy in order to make holes
pót ^h òxk ^h ò	to rake
táʔixts ^h ò	to dry in the sun
tímàxk ^h ò	to chew
tómàxk ^h ò	to touch, to feel with one's fingers
tòmáxk ^h ò	to touch
tóʔòxk ^h ò	to touch, to examine with the hand
tʃépùixts ^h ò	to listen from a distance

C)V(C)V:CCV

k ^h átsâ:xk ^h ò	to put out a fire with water
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