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A synopsis of Bora tone

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The tonal system of Bora, a Witotoan language of Colombia and Peru, has high and low tones. Most tonal phenomena refer to low—not high—tone. For example, virtually all lexically marked tones are low. Further, many suffixes assign low tones to preceding syllables, but never creating a sequence of adjacent low tones. This is modeled with the cyclical addition of suffixes where adjacent low tones are avoided by either blocking the placement of the suffix's low tone or by delinking a previously assigned low tone. Finally, low tone plays a role in various syntactic constructions.

1 Introduction

Tone plays a major role in the Bora language.[3] Each syllable bears either high or low tone. Both roots and affixes may bear lexical tones. The tones of a suffix are often realized on its host, usually on its penultimate or final syllable. A tone (or tone pattern) may be a morpheme, derivational or inflectional. And tone figures significantly in marking various grammatical structures.

One indication of the significant role of tone in Bora is this: By beating the tones on large hollow-log drums, messages can be communicated (up to twenty kilometers away!).

Our intention in this paper is to acquaint the reader with the major features of Bora's tone system.[4] The descriptive framework is broadly generative, employing cyclic derivations that tightly integrate tonal phonology with morphology. We believe the analysis implicit in this description is essentially correct but we do not understand some phenomena, nor have we sought to frame a solution within a more modern framework such as optimality theory.

This paper is organized as follows. The segments are introduced in this section. Section 2 discusses the tonal elements, their distribution, and some allophonic processes affecting tone. Section 3 discusses the role of tone in word formation: default tone (3.1), lexically marked tone (3.2), the cyclic addition of suffixes (3.3), blocking and delinking (3.4), nonfinite verbs (3.5), imperatives (3.6), subordinate verbs (3.7), and negatives (3.8). Section 4 discusses tone in relation to syntactic boundaries: proclitics (4.1), genitives (4.2), and classifiers (4.3). Section 5 presents areas that need further study. Abbreviations and conventions are listed in appendix A.

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[3] Bora is a Witotoan language spoken by 2–3000 people in the Amazon basin, both north and south of the eastern end of the border between Colombia and Peru. Bora is agglutinative. Its word order type is OV but allows considerable word order freedom; the subject may occur in various positions: SOV, OSV, or most frequently as a suffix: OV-s.

[4] Those who wish to see more detail may consult Thiesen and Weber [8].

The Bora vowels are given in Table 1 and the consonants in Table 2. The symbols in parentheses are those used in the practical orthography.

Table 1: Vowels

		front	central	back −round	back +round
high	tense	i (i)			
	lax		ɨ (ɨ)	ɯ (u)	
mid	tense				
	lax	ɛ(e)			o (o) [a]
low	tense				
	lax		a (a)		

[a] /o/ is the only rounded vowel, and is only slightly rounded. See Parker [3] for phonetic details.

There are also long vowels. These are represented in the practical orthography by doubling the vowel.

Table 2: Consonants

		labial	coronal		dorsal	laryngeal
obstruent	lenis	p (b)	t (d)	ʦ (ds)	k (g)	ʔ (h)
	fortis	p^h (p)	t^h (t)	$ʦ^h$ (ts)	k^h (k or c)	
	lenis palat	p^j (by)	$tʲ$ (dy)	$ʦ^j \sim ʧ$ (ll)	k^j (gy)	$ʔ^j$ (hy)
	fortis palat	p^{jh} (py)	$tʲ^h$ (ty)	$ʦ^{jh} \sim ʧ^h$ (ch)	k^{jh} (ky)	
	labio-velar				kp ∼ k^w (w)	
fricative	plain	β (v)			x ∼ h (j)	
	palat	$β^j$ (vy)			h^j (jy)	
nasal	plain	m (m)	n (n)			
	palat	m^j (my)	n^j (ñ)			
resonant	plain		ɾ (r)			
	palat		y (y)			

See Thiesen and Weber [8] for discussions of allophony, palatalization, syllable weight, etc.

2 Tonal elements, distribution, allophony

Bora has two contrastive level tones; no contour tones. The system works almost entirely in terms of low tones. That is, many generalizations can be simply stated in terms of low tones in a way that is not possible in terms of high tone. Also, virtually all lexically marked tones are low.

Every syllable carries either a high or low tone. Any number of high tones may occur one after another:[5]

(1) Dííbyeke o ájtyúmɨ́túrónáa ó waajácú múha teene méénune.
tíː.p^jɛ̀.k^hɛ̀ ò á^x.$tʲ^h$ɯ́ɯ.mɨ́.t^hɯ́ɯ.ɾó.ná.à ó kpàː.há.k^hɯ́ɯ mɯ́ɯ.ʔà t^hɛ̀ː.nɛ̀ méː.nɯ̀ɯ.nɛ̀
him I not.see I know who that do
'Although I did not see him, I know who did it.'

[5] A sequence of high tones rises slightly, i.e., the pitch of each syllable is slightly higher than that of the preceding syllable.

A sequence of two low tones may occur ONLY at the end of a tonal word or phrase:[6] *$\overset{L}{\sigma}\ \overset{L}{\sigma}\ \sigma$. We call this the *LLX constraint. It has a pervasive influence on the tone system. It applies both within a word and across word boundaries within a tonal phrase (a crucial point for our analysis of the genitive construction outlined in section 4.2).

The tone system is blind to vowel length: WHERE tones dock depends on *syllables*, with no regard for whether these have short or long vowels.

However, an allophonic processes relates tone and length. At the end of a tonal phrase, a low tone syllable with a long vowel (Figure 1 a) splits into two syllables[7] with low-high tones (Figure 1 b):

Figure 1: The relationship of tone and syllabification

This applies in the penultimate and final syllables:

Penultimate Low Tone Split (PLTS): $\overset{L}{\sigma}\text{:} \longrightarrow \overset{L}{\sigma}\overset{H}{\sigma}$ /#(...$\overset{T}{\sigma}$)_$\overset{L}{\sigma}$##[8]

Final Low Tone Split (FLTS): $\overset{L}{\sigma}\text{:} \longrightarrow \overset{L}{\sigma}\overset{H}{\sigma}$ /#((...$\overset{H}{\sigma}$)$\overset{T}{\sigma}$)_##

The tone represented by T in these rules must not be low; otherwise the rules would produce violations of the *LLX constraint.

PLTS is illustrated in 2, both words of which are assumed to occur at the end of a tonal phrase:

(2) a. t^{h}à.á.pò CV.V.CV (taábo) /t$^{h}\overset{L}{\text{a}}$:pò/ 'medicine'

b. t^{h}á:.pò.ó.pè CV:.CV.V.CV (táábooóbe) /t^{h}á:p$\overset{L}{\text{o}}$–:pè/ 'He medicates.'

The final syllable of t^{h}a:po 'medicate' in 2b receives both length and low tone from –Ⓛ:pɛ ⟨SgM⟩ and consequently undergoes PLTS.

Consider example 3 in which the quote is set by /n$\overset{L}{\varepsilon}$–:pɛ/ 'he said'. In 3a /n$\overset{L}{\varepsilon}$–:pɛ/ is followed by a direct quote, thus ending a tonal phrase. It therefore meets the conditions for PLTS. By contrast, 3b /n$\overset{L}{\varepsilon}$–:pɛ/ is followed by an indirect quote; in this case it does not end a tonal phrase so does not undergo PLTS.

(3) a. Oke neébe, "Péjcore ...".

b. Oke neebe péjcore ....

a. òk^{h}è nèépè p^{h}ɛ́^{x}k^{h}òɾè 'He said to me, "Tomorrow..."

b. òk^{h}è nè:pè p^{h}ɛ́^{x}k^{h}òɾè 'He told me that tomorrow...'

We now illustrate FLTS. For some morphemes it is not obvious that the final vowel to which FLTS applies is long. For example the first person pronoun o 'I' does not have a long vowel but when spoken in isolation is pronounced òó. In this case we assume it is lengthened to meet a minimality constraint, thereby meeting the conditions for FLTS.

In example 4, FLTS does not apply in 4a because "house" is not at the end of tonal phrase: FLTS does apply in 4b, where it ends the tonal phrase, assuming that its final vowel is lengthened (by a process we will not discuss here):[9]

[6] When two low tones occur at the end of a word, the second has a slightly lower pitch than the first.

[7] These are pronounced as two phonetic syllables, not as a glide.

[8] We are using # to indicate word boundaries and ## to indicate phrase boundaries.

[9] Also note also the contrast between mé:nù:pè (non-final) in 4a and mé:nùɯ́pè (final) in 4b, these differing by the application of PLTS.

(4) { a. hà̱ mɛ́ːnʊ̀ɪ̀–ːpɛ̀ (Ja méénuúbe.)
house make-⟨SgM⟩
b. mɛ́ːnʊ̀ɪ̀–ːpɛ̀ hà̱á̱ (Méénuube jaá.)
make-⟨SgM⟩ house } 'He made/makes a house.'

3 Tone in word formation

3.1 Default tone

Tones may default to low at the end of a phrase, but the general default tone is high.

Final default low tone (FDLT): By default the final syllable of a tonal phrase bears low tone. Nouns ordinarily end in two low tones phrase-finally, as illustrated in 5:

(5) { kpà̱ˣpʰì̱ / níːβʊ̀ʊ̱̀kpà̱ } ʊ́mɨβá–ʔì { Wajpi úmɨváhi. / Níivuwa úmɨváhi. } 'The { man / deer } escapes.'

Note: "phrase final" in 5 is the end of the subject noun phrase, not the end of the entire sentence.

Verbs ordinarily end in a single low tone phrase-finally. For example, in 6a the verb has a subject marking classifier followed immediately by an appositive subject noun phrase. Thus the verb is not phrase final so does not undergo FDLT, and thus bears a high tone. By contrast, in 6b it is phrase final and undergoes FDLT, thus bearing a low tone:

(6) a. màˣtsʲʰó–mɛ̱́ tsʲíʔʲò–mʊ́ʊ́tsʰì (Majchómé llíhyomútsi.) 'Mother and father eat.'
eat-⟨AnPl⟩ mother-DuM
b. màˣtsʲʰó–mɛ̱̀ (Majchóme.) 'They eat (bread).'
eat-⟨AnPl⟩

An outstanding challenge is to precisely characterize "phrase final." This will have to take into account that what is "final" for FDLT may not be "final" for PLTS and FLTS.

Default high tone (DHT): The overall default tone is high. In tone derivations we capture this by positing a late rule (applying after FDLT) that places high tone on any syllable that is not marked for tone. DHT and FDLT are illustrated in the derivations of Figure 2.[10]

Figure 2: Derivation: ʊ́mɛ̀ʔɛ̀, níːβʊ̀ʊ̀kpà, tsʲámàːɾà

```
umehe   tree        ni:vuwa   deer        llama:ra   lemon
| | |               |  | |                 | |  |
| L L   FDLT        |  L L   FDLT          | L  L   FDLT
H : :   DHT         H  : :   DHT           H :  :   DHT
: : :               :  : :                 : :H :   PLTS
: : :               :  : :                 : :: :
úmehe 'tree'        ní:vuwa 'deer'         llámaára 'lemon'
```

Consider the derivation of the sentence in Figure 3, in which DHT imposes four high tones. The final vowel of the first word does not undergo FDLT because it is not phrase final.[11] (In derivations underscores tie a tone to the suffix that imposes it. The cyclic addition of suffixes is discussed in section 3.3; "blocked" is discussed in section 3.4, and "subordinate" in section 3.7.)

[10] In derivations, the bars indicate the association of a tone with a vowel. The colons are simply to guide the eye to the corresponding vowel in the complete word at the bottom of the derivation. To the right of each morpheme is its gloss. To the right of tones is the reason for that tone.

[11] Compare this with example 5, where the subjects are treated as final and therefore undergo FDLT.

Figure 3: Derivation: tsʲíːnʲáhàː–tʰɛ́–ːpɛ́ mùɯˣtʰá–ʔì

```
lli:ñaja:  hunt            mujta  be.lost
  |  | |                    |  |
  |  | L__te  go to do      L__._hi  <t>
  H  | :   |   subordinate  :  |  |
  :  | :   +      blocked   :  |  |
  :  | :   L_:be  <SgM>     :  |  |
  :  | :   |   |            :  |  L   FDLT
  :  H :   H   H  DHT       :  H  :   DHT
  :  : :   :   :            :  :  :
llí:ñája:-té-:bé           mujtá-hi
hunt-go.do-<SgM>           be.lost-<t>  'The one who went to hunt got lost.'
```

3.2 Lexically marked tone

Morphemes may have lexically marked tones on any but the final syllable.[12] All lexically marked tones are low with the exception of certain nouns and pronouns having lexically marked *high* tones.[13] For example, lexically marked lows occur on the second syllable of the verb ɨʔβɛ̲tʰɛ 'to stop doing', the first syllable of the noun o̲βaʔtsʰa 'male adolescent', and the first syllable of the suffix –kpɯ̲ɯ(ɯ) 'diminutive'.

Consider the derivations in Figure 4:

Figure 4: Derivation: úɯmɨʔɛ́–βùɯ, úɯmɛ́ʔɛ̀–βùɯ, nòʔkʰó–kpùɯ

```
umehe    tree              umɨhe    field              nohco    stork
| | |                     | L |    lexical            L  |    lexical
| | |                     | : +       blocked          :  ._wu(u)  diminutive
| | L_vu    goal          | : L_vu    goal             :  |  L     lexical
| | :  |                  | : |  |                       :  |  :
| | :  L   FDLT           | : |  L   FDLT              :  |  :
H H :  :   DHT            H : H  :   DHT                :  H  :     DHT
: : :  :                  : : :  :                      :  :  :
úméhe-vu 'to the tree'    úmɨhé-vu 'to the field'      nohcó-wu 'little stork'
```

The first derivation above has no lexically marked tone whereas the second and third do. In the second derivation the root's lexically marked low blocks the docking of the suffix's Ⓛ. In the third, there is a syllable between the lexically marked low of the root and of the suffix so there is no conflict.

Many suffixes have a low tone to be docked on their hosts' final or penultimate syllable. For example, in Figure 3 –Ⓛːpɛ ⟨SgM⟩ and –Ⓛtʰɛ 'go to do' impose a low on the host's final syllable, while –Ⓛ◯ʔi ⟨t⟩ imposes a low on the host's penult.

A few suffixes impose a tone on the host's initial syllable. For example, #σ̲...–(ː)βà 'have' imposes a low tone on the root's initial syllable, as illustrated in 7 with /mɛːni/ 'pig' and /okʰahi/ 'tapir':

(7) a. ó mɛ̲ːní–βá–ʔì (ó meenívàhi) 'I have a pig.'
I pig-have-⟨t⟩

b. ó o̲kʰáhì–ːβá–ʔì (ó ocájiivàhi) 'I have a tapir.'
I tapir-have-⟨t⟩

[12]The final syllable is not an available site for a lexically marked tone probably because its identity would be almost totally masked by the docking of tones associated with suffixes.

[13]Some of these are: i– 'that', aːnɯ 'this (SgM)', kʰaːni 'father', amana 'porpoise', kʰoːmi 'town', maːni 'tobacco paste', aˣtsʲʰɯʔoːɯ 'flashlight'. We understand very little about the tonal behaviors of such nouns.

And a few suffixes affect both the host's initial and final tones; for example, see #Ⓗ…–Ⓛhɨ́ːβa 'deny' in Figure 7 below.

3.3 The cyclic addition of suffixes

A suffix may bear one or more floating tones to be docked on its host, generally on its penultimate or final syllable. Suffixes are attached cyclically ([[[root -suffix] -suffix] -suffix]…), each suffix docking its (floating) tones when it attaches. If a suffix's tones are not associated on the cycle in which it is attached, they are never associated.

The cyclic nature of suffixation is illustrated in the tone derivations in Figure 5 and 6:

Figure 5: Derivation: úɪmɛ̀ʔɛ́–ːnɛ̀–ʔánʲɛ̀, níːβɪ́ɪ́kpà–ɪ́ɪβʊ̀ɪ–mà

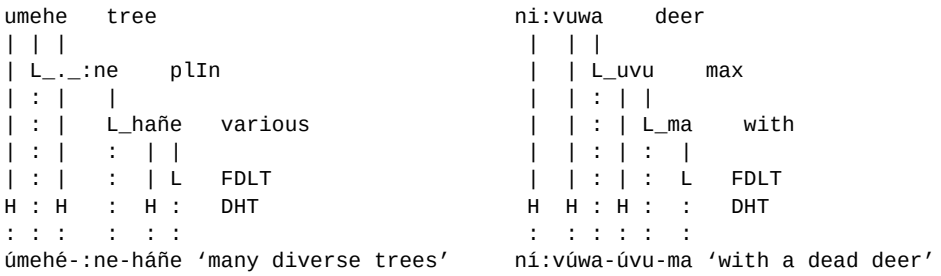
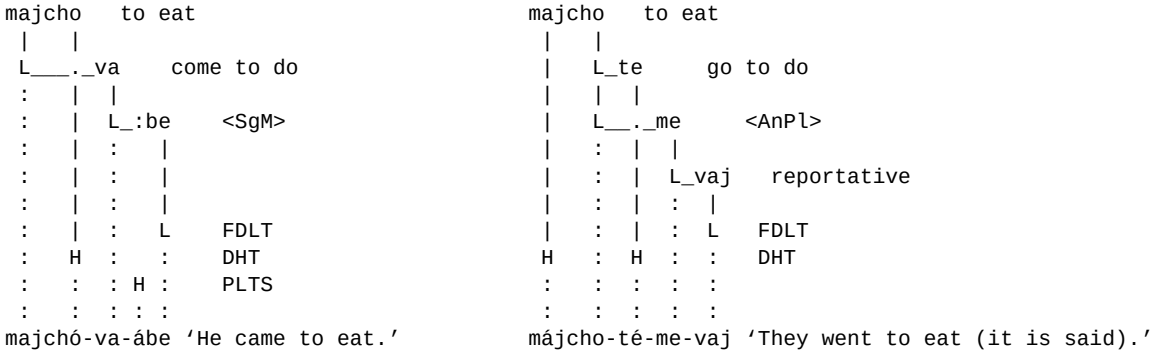


Figure 6: Derivation: màˣtsʲʰó–βà–ːpɛ̀ máˣtsʲʰò–tʰé–mɛ̀–βàˣ



The derivation in Figure 7 provides rather compelling evidence for cyclical tone attachment. (BLOCKING and DELINKING are discussed below in section 3.4.)

Figure 7: Derivation: á:ʔɨβɛβá–:pè–hɨ́:βà

```
a:hɨve    to visit
L  | |    lexical
|  + |       blocked
|  L_._va    come to do
|  | |  |
|  | |  L_:be    <SgM>
$  | |  $   |          delinked
H  | |  |   L_jɨ:va    deny
:  | |  |   :  |  |
:  | |  |   :  |  L    FDLT
H  H H  H   :  H  :    DHT
:  : :  :   :  :  :
á:hɨvé-vá-:be-jɨ:va  'He did not come to visit.'
```

/a̱:ʔɨyɛ/ 'visit' has a lexically marked low tone on its initial syllable. When –Ⓛ◯βa 'come to do' is suffixed, its Ⓛ is blocked by the root's lexical low tone. However, this lexical low tone is *subsequently* delinked by #Ⓗ…–Ⓛhɨ:(βa) 'deny' and ends up high. To elaborate: the lexically marked low tone must be present at one stage to block the docking of another low, but it is subsequently deleted and the syllable surfaces as high.

For more evidence for the cyclic nature of tone see examples 49 and 55 below.

3.4 Blocking and delinking

As suffixes are cyclically added their tones may come into conflict with the host's tones; that is, to dock their tone would create a sequence of nonfinal low tones violating the *LLX constraint. Each case is resolved in one of two ways:

Blocking: The most common way is simply to not dock the suffix's tone. (This is *phonological*: it is blind to morpheme identity.)

Delinking: Some suffixes have the power to delink the host's offending tone. (This is *morphophonemic*: only certain morphemes can delink a host's conflicting tone, in some cases doing so only to certain other morphemes.)

Blocking is illustrated in Figure 8, after which we describe the tonal effects of successively adding suffixes:

Figure 8: Derivation: ɨ́ʔβɛ̀tʰɛ́–tsʰò–tʰɛ́–ɾò–:pɛ̀

```
ɨhvete   finish
|  L |   lexical
|  : +        blocked
|  : L_tso    causative
|  : |   |
|  : |   L_te    go to do
|  : |   :  +        blocked
|  : |   :  L_ro     CE
|  : |   :  |  |
|  : |   :  |  L_:be    <SgM>
|  : |   :  |  :   |
|  : |   :  |  :   L   FDLT
H  : H   :  H  :   :   DHT
:  : :   :  :  : H :   PLTS
:  : :   :  :  : : :
ɨhveté-tso-té-ro-óbe 'In vain did he go to make it stop.'
```

1. The Ⓛ of –Ⓛtsʰo (-tso) 'causative' is blocked by the root's lexically marked low; it does not dock.
2. The Ⓛ of –Ⓛtʰɛ (-te) 'go to do' docks on the host's final syllable. The Ⓛ of –Ⓛtsʰo, because it did not dock (as just stated), does not block the Ⓛ of –Ⓛtʰɛ.
3. The Ⓛ of –Ⓛɾo (-ro) 'contra-expectation' is blocked by the Ⓛ of –Ⓛtʰɛ, so does not dock.
4. The Ⓛ of –Ⓛːpɛ (-ːbe) ⟨SgM⟩ docks. The Ⓛ of –Ⓛɾo does not block it because it did not dock.

We now illustrate delinking. The person markers[14] delink conflicting tones. For example, in Figure 9 the Ⓛ of –Ⓛːpɛ ⟨SgM⟩ is adjacent to the Ⓛ of –Ⓛːβɛ 'become'.[15] This conflict is resolved by delinking the Ⓛ of –Ⓛːβɛ. (In derivations delinking is represented by $.)

Figure 9: Derivation: mɛ́ːní–ːβʲɛ̀–ːpɛ̀

```
me:ni
 |  |
 |  L_:vye   become
 |  $    |       delinked
 |  |    L_:be   <SgM>
 |  |    :   |
 |  |    :   L    FDLT
 H  H    :   :    DHT
 :  :    : H :    PLTS
 :  :    : : :
mé:ní-:vye-ébe 'He became a pig.'
```

Figure 10 illustrates –Ⓛti (-di) 'animate' and –Ⓛma (-ma) 'with' delinking conflicting tones:[16] Note that –kpʊ̀ʊ̀ɯ 'diminutive' is bisyllabic.

Figure 10: Derivation: ní:βʊ́ʊ́kpá–kpʊ́ʊ̀ɪ–tì, ʊ́ɯmɛ́ʔɛ́kpá–kpʊ́ʊ̀ɪ–mà

```
ni:vuwa   deer                    umehe   tree
 |  | |                           | | |
 |  | . wuu   diminutive          | | ._wa   board
 |  | |  L|   lexical            | | |  |
 |  | |  $|      delinked         | | |  ._wuu    diminutive
 |  | |  |L_di   animate          | | |  |  L|    lexical
 |  | |  |:  |                    | | |  |  $|       delinked
 |  | |  |:  L    FDLT            | | |  |  |L_ma    with
 H  H H  H:  :    DHT              | | |  |  |:  :
 :  : :  ::  :                     | | |  |  |:  L    FDLT
ní:vúwá-wúu-di 'little deer'       H H H  H  H:  :    DHT
                                   | | |  :  ::  :
                                   úméhé-wá-wúu-ma  'with a little board'
```

Figure 11 shows that –Ⓛː 'future' can delink the Ⓛ of –Ⓛtʰɛ 'go to do':

[14] –Ⓛːpɛ ⟨SgM⟩, –Ⓛtsʲɛ ⟨SgF⟩, –Ⓛmɯtsʰi ⟨DuM⟩, –Ⓛmɯpʰɨ ⟨DuF⟩ and –Ⓛ◯mɛ ⟨AnPl⟩

[15] These are adjacent despite the intervening mora (length). As previously stated, tone rules are blind to syllable quantity.

[16] Other suffixes that behave this way are: –Ⓛkʰɛ 'objAn', –Ⓛkʰi 'purpose', –Ⓛtʰɛ 'go to do' and –Ⓛ◯tɯ 'like'

Figure 11: Derivation: ó máˣtsʲʰó–tʰɛ́–ɛ́–ʔì

```
o  majcho    eat
|   |   |
|   |   L_te   go to do
|   |   $  |      delinked
|   |   |  L_:    future
|   |   +  :         blocked by the L of future
|   |   L__.___hi    <t>
|   |   |  :    |
|   |   |  :    L   FDLT
H   H   H  :    :   DHT
:   :   :  : H  :   PLTS
:   :   :  : :  :
ó  májchó-te-é-hi   'I will go to eat.'
```

Figure 12 illustrates various cases of delinking, among them –Ⓛɾo ∼ –Ⓛɾa 'CE' delinking the Ⓛ of the first syllable of –Ⓛ◯hɯ̈ᴸkʰo: as in :

Figure 12: Derivation: máˣtsʲʰó–tsʰò–tʰɛ́–hɯ̈kʰó:–ɾò–:pɛ̀, ɨ́ʔβɛ̀tʰɛ́–tsʰò–hɛ́–hɯ́kʰò:–ɾá–ʔì

```
majcho   to eat
 |   |
 |   L_tso    cause
 |   $   |       delinked
 |   |   L_te    go to do
 |   |   |  |
 |   |   L__._juco:   already
 |   |   :  |  L |    lexical
 |   |   :  |  $ |        delinked
 |   |   :  |  | L__ro    CE
 |   |   :  |  | $   |        delinked
 |   |   :  |  | |   L_:be    <SgM>
 |   |   :  |  | |   :   :
 |   |   :  |  | |   :   L    FDLT
 H   H   :  H  H H   :   :    DHT
 :   :   :  :  : :   : H :    PLTS
 :   :   :  :  : :   : : :
májchó-tso-té-júcó:-ro-óbe
'He already went to make them eat
 (but without succeeding).'
```

```
ɨhvete   to finish
|  L |   lexical
|  : +        blocked
|  : L_tso    cause
|  : |   |
|  : |   L_je   return from doing
|  : |   |  |
|  : |   L__._juco:   already
|  : |   :  |  L |    lexical
|  : |   :  |  $ |       delinked
|  : |   :  |  | L__ra   CE
|  : |   :  |  | |   |
|  : |   :  |  | L___._hi   <t>
|  : |   :  |  | :   |  |
|  : |   :  |  | :   |  L   FDLT
H  : H   :  H  H :   H  :   DHT
:  : :   :  :  : :   :  :
ɨ́hveté-tso-jé-júco:-rá-hi
'(Someone) already returned from trying to make
him/her/it finish (but without succeeding).'
```

3.5 Nonfinite verbs

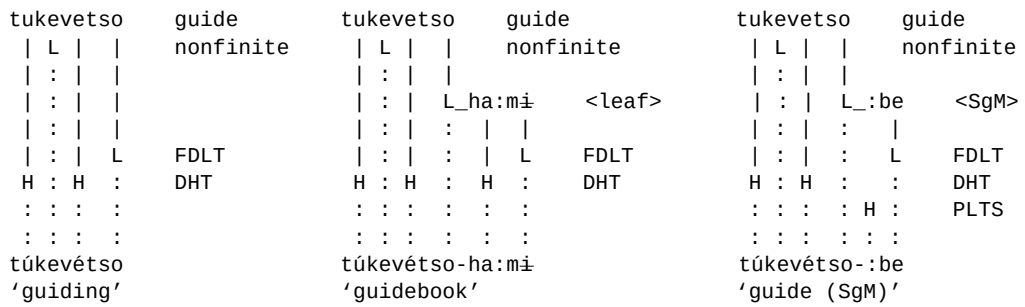
Verb stems are made nonfinite (infinitivalized, nominalized) by imposing a low tone (represented below with N) regressive to the antepenult, that is, on the earliest possible syllable of the stem's last three. [17] This tone delinks any other conflicting tones.

$$\begin{array}{llll} \sigma & (\sigma & (\sigma)) &]_{\text{finite verb}} \quad \# \\ \Updownarrow & & & \\ \overset{\text{N}}{\sigma} & (\sigma & (\sigma)) &]_{\text{nonfinite verb}} \quad \# \end{array}$$

[17] It is as though the N were tethered to the end of the stem with an elastic that allowed it to stretch back up to three syllables, but no farther.

Examples follow (using simply L for N):

Figure 13: Derivation: tʰɯ́kʰɛβɛ́tsʰò, tʰɯ́kʰɛβɛ́tsʰò–ʔà:mɨ̀, tʰɯ́kʰɛβɛ́tsʰò–:pɛ̀



Note that in 8 the nonfinite low tone blocks the docking of the Ⓛ of –Ⓛ:pɛ ⟨SgM⟩:

(8) tʰᴺa:pó–:pɛ̀ (taabóóbe) 'the doctor'

3.6 Imperatives

The subject of an imperative (i.e., the addressee) is indicated by a prefixed (procliticized) pronoun[18] as follows:

singular subject:

If the verb is monosyllabic, prefix ti– 'you'.

(9) tí–tʲò–: (¡Dídyoó!) 'Eat (meat)!'
you-eat-emph

If the verb stem is polysyllabic and begins with a vowel, prefix t– 'you':

(10) t–ó:–tʰɛ̀–: (¡Dóóteé!) 'Go eat (meat, singular emphatic)!'
you-eat-go.do-emph

If the verb stem is polysyllabic and begins with a consonant, leave the subject implicit (adding no prefix):

(11) __máˣtsʲʰò (Májcho.) 'Eat!' (singular)
eat

plural subject: In all cases, prefix mɛ 'SAP' (speech act participant):

(12) mé tò:–tʰɛ̀ (¡Médoóte!) 'Go eat (pl., meat)!'
SAP eat-go.do

Imperative verbs bear an imperative low tone (represented below with I) docked according to the following rule:

> Let n be the number of syllables of the pronoun+verb stem. I docks regressive to the antepenult ($\ldots \overset{\text{L}}{\sigma}(\sigma(\sigma))\#$) but never more than $n-1$ syllables from the end of the stem.

What might explain this pattern? We suggest that it follows from assuming that imperatives basically consist of a monosyllabic pronoun prefixed (procliticized) to a nonfinite verb: $[\sigma]_{\text{pronoun}}+[(\ldots \overset{\text{L}}{\sigma}(\sigma(\sigma)))]_{\text{nonfinite verb}}$. The following is given for comparison:

[18] These are the same morphemes as the corresponding possessors in the genitive construction.

IMPERATIVE	NONFINITE
$\overset{\text{I}}{\sigma\sigma}$	$\overset{\text{N}}{\sigma}$
$\overset{\text{I}}{\sigma\sigma\sigma}$	$\overset{\text{N}}{\sigma\sigma}$
$\overset{\text{I}}{\sigma\sigma\sigma\sigma}$	$\overset{\text{N}}{\sigma\sigma\sigma}$
$(\ldots\sigma)\overset{\text{I}}{\sigma\sigma\sigma}$	$(\ldots\sigma)\overset{\text{N}}{\sigma\sigma\sigma}$

Treating imperatives as pronoun+nonfinite verb stem works nicely when the pronoun is present, as is the case for all plural imperatives, as well as for the singular imperatives of monosyllabic verbs. We assume that these cases are what give rise to the imperative tone *pattern*.

However, the singular imperatives of polysyllabic verbs do not have an additional syllable corresponding to the pronoun. Nonetheless, they are treated *as though this were the case*. Consequently the imperative tone docks one short of where the nonfinite tone would dock; for example, in 11 I docks on the final syllable of ma^{x}ts^{jh}o 'eat'. In sum, the imperative tone *pattern* applies to the singular imperatives of polysyllabic verbs as though they were a pronoun and a verb stem having one less syllable than it actually has.

We now illustrate the various cases:

1. There are no monosyllabic imperatives.

2. If the combination of the proclitic and verb stem have two or three syllables, then the second syllable of the combination bears a low tone. (Of course, syllables are counted before the application of PLTS or FLTS.)
   Bisyllabic:

   (13) tí–p$^{jh}\overset{\text{I}}{\varepsilon}$–: (Dípyeé.) 'Go!'
   youImp-go-emph

   Trisyllabic:

   (14) t–á:p$\overset{\text{I}}{\text{ɯ}}$k^{h}ùɪ (Dáábucu!) 'Endure!'
   youImp-endure

   (15) mɛ́ m$\overset{\text{I}}{\text{a}}^{x}$ts^{jh}ò (Mémajcho!) 'Eat (AnPl)!'
   SAP eat

   Example 16 is trisyllabic but ends up with four syllables due to the application of PLTS:

   (16) t–ák$^{h}\overset{\text{I}}{\text{ɯ}}$–:βɛ̀ (Dácuúve!) 'Sit down!'
   youImp-sit-sIn

3. If the combination of the proclitic and verb stem have more than three syllables, then the stem bears low tone on the antepenult. This tone delinks any conflicting lexically marked tones. Examples follow. (imipa^{x}ts^{jh}o 'fix' has no lexically marked tones, $\overset{\text{L}}{\text{a}}$kpak$^{h}\overset{\text{L}}{\text{ɯ}}$nɯ 'yawn' has lexically marked lows on its first and third syllables, and k^{h}aβɯ$\overset{\text{L}}{\text{ɪ}}$ʔh^{j}ak^{h}o 'push' has a lexically marked low on its third syllable.)

   (17) a. t–ím$\overset{\text{I}}{\text{i}}$pá^{x}ts^{jh}ò (Dímibájcho!) 'Fix it! (sg.)'
   b. t–ákp$\overset{\text{I}}{\text{a}}$k^{h}ɯ́nùɪ (Dáwacúnu!) 'Yawn! (sg.)'
   c. k^{h}áβɯ́$\overset{\text{I}}{\text{ɪ}}$ʔh^{j}ák^{h}ò (Cávúihjyáco!) 'Push! (sg.)'

   (18) mɛ́ ím$\overset{\text{I}}{\text{i}}$pá^{x}ts^{jh}ò (Méímibájcho!) 'Fix it (plural)!'

When the root is followed by derivational suffixes, the antepenult is determined from the end of the *stem*, as illustrated in the following:

(19) a. t–óm$\overset{\text{I}}{\text{a}}$–^{x}k^{h}ò (Dómajco!) 'Touch!' (sg.)
youImp-touch-implore
b. má^{x}ts$^{jh}\overset{\text{I}}{\text{o}}$–t^{h}ɛ̀ (Májchote!) 'Go to eat! (sg.) eat-go.do

(20) t–ímɨ́pá^{x}ʦ^{jh}ò (Dímibájcho!) 'Fix it! (sg.)'
t–ímípá^{x}ʦ^{jh}ó–ʦ^{h}ò (Dímíbajchótso!) 'Cause it to be fixed!'
t–ímípá^{x}ʦ^{jh}ó–ʦ^{h}ó–t^{h}ɛ̀ (Dímíbájchotsóte!) 'Go cause it to be fixed!'

The first low tone in 21 is lexically marked on the verb ǎkpák^{h}ʉ́nɯ́ while the second is the imperative low tone:

(21) mɛ́ ǎkpák^{h}ʉ́nɯ́–t^{h}ɛ̀ (Méawákunúte!) 'Go yawn! (pl.)'

An imperative can be made more emphatic by the addition of –Ⓛː, thus satisfying the conditions for FLTS; compare the normal and emphatic imperatives in the following:

(22) a. má^{x}ʦ^{jh}ó (Májcho.) 'Eat!' (sg., nonemphatic)
b. má^{x}ʦ^{jh}ó–ː (Májchoó!) 'Eat!' (sg., emphatic)
eat-emph

(23) a. t–ímɨ́pá^{x}ʦ^{jh}ò–ː (Dímibájchoó!) 'Fix it! (emphatic)'
you-fix-emph
b. t–ímípá^{x}ʦ^{jh}ó–t^{h}ɛ̀–ː (Dímíbajchóteé!) 'Go fix it! (emphatic)'
you-fix-go.do-emph

3.7 Subordinate verbs

SUBORDINATE VERBS, the main verbs of complements, relative clauses, or adverbial clauses, always bear a high tone on their initial syllable. We believe subordinate verbs are *derived* by a productive lexical rule:[19]

$$\begin{array}{ll} \#[\sigma & (\mathrm{X}) \quad]_{\text{main verb}} \\ \Updownarrow & \\ \#[\overset{\mathrm{H}}{\sigma} & (\mathrm{X}) \quad]_{\text{subordinate verb}} \end{array}$$

We now illustrate subordinate clauses, representing the high tone on the subordinate verb with S. Example 24 contrasts a complement (to a sensory verb) with a nonfinite verb: 24a has a subordinate clause (headed by a verb with an initial high tone, represented by S); 24b has a nonfinite verb (with a low antepenult tone, represented by N). The meanings differ in the expected way.

(24) ó á^{x}ʧ^{jh}ʉ̀mɨ́–ʔ I see-⟨t⟩ { a. S áí– / b. N áí– burn } –ːβ^{j}ɛ̀–hà -sIn-⟨shelter⟩ { a. (Ó ájtyumɨ́ áíívyeja.) 'I saw a house burning.' / b. (Ó ájtyumɨ́ aíívyeja.) 'I saw a burned house.' }

Examples 25 contrasts a main verb with the corresponding relative clause:

(25) a. mà^{x}ʦ^{jh}ó–mɛ̀ (Majchóme.) 'They are eating (bread).'
b. mǎ^{x}ʦ^{jh}ò–mɛ̀ (májchome) 'those who are eating (bread)'

Example 26 illustrates an adverbial clause with –ʔà^{x}ʦ^{jh}íː(h^{j}ʉ̀) 'if', as well as an object complement:

(26) U ááhɨ́vetéhajchíí ó imíllé uma o pééneé.
[ʉ̀ ǎːʔɨ́βɛ̀–t^{h}ɛ́]–ʔà^{x}ʦ^{jh}íː ó ìmíʦ^{j}ɛ́–ʔ [ʉ̀–mà ò p^{h}ɛ̌ː]–nɛ̀ɛ́
you visit-go.do -if I want-⟨t⟩ you-with I go -⟨ø⟩
'If you go visiting, I want to go with you.'

[19] We further believe that subordinate verbs head subordinate clauses, and that subordinate clauses are subcategorized for, either by a governing verb or by suffixes like –k^{h}a 'counter factual conditional', –k^{h}ǒːk^{h}a 'when', –ʔǎ^{x}ʦ^{jh}iːh^{j}ɯ 'if (conditional)', –ih^{j}ɯ 'when (at that time)', –Ⓛk^{h}i 'purpose', –naǎːk^{h}a 'while', and –ne ⟨event⟩ or ⟨ø⟩. We might also include –Ⓛ◯ʔtɯ 'similarity' but it may occur with nonfinite verbs(?).

We reject the idea that the high initial tone of a subordinate clause is a floating tone associated with a subordinating suffix.

3.8 Negatives

A negative clause[20] is formed by tsʰ$\overset{H}{\text{a}}$ʔa 'not' followed by a subordinate clause, the verb of which ends with –Ⓛtʰɯ(–nɛ) 'negative(-⟨n⟩)':

(27) tsʰ$\overset{H}{\text{a}}$ʔà tì–pʲɛ̀ mà$\overset{S}{\text{x}}$tsʲʰò–tʰɯ́ɪ–nɛ̀ (Tsá dibye májchotú(ne).) 'He has not eaten.'
not that-⟨SgM⟩ eat-neg-⟨n⟩

(28) tsʰ$\overset{H}{\text{a}}$ʔà ò $\overset{S}{\text{a}}$ːʔɨβɛ̀–tʰɯ́ɪ (Tsá o ááhɨvetú.) 'I did not go home.'
not I go.home-neg

Three features suggest that the "core" clause is subordinate, that it is structurally a complement to a higher predicate tsʰ$\overset{H}{\text{a}}$ʔa 'not':

1. The high tone on the verb's first syllable can be identified with the high tone marking subordinate verbs.
2. The proclitic subject pronoun (as in 28) bears low tone. This is characteristic of subordinate clauses; see section 4.1.
3. –nɛ ⟨n⟩ following the verb can be identified with –nɛ ⟨ø⟩, which is used in forming subordinate clauses. This classifier provides a nominal head which the subordinate clause structurally modifies (somewhat like *the claim* in …*deny* [$_{\text{NP}}$ *the claim* [$_{\text{subordinate clause}}$ *that I went home*]]).

The structure of 28 is roughly as given in 29:

(29) [$_{\text{V}}$ tsʰ$\overset{H}{\text{a}}$ʔà] [$_{\text{NP}}$ [$_{\text{S}}$ ò $\overset{S}{\text{a}}$ːʔɨβɛ̀–tʰɯ̀ɪ] nɛ̀]
not I go.home-neg ⟨ø⟩

4 Tone and syntactic boundaries

Tone may apply across syntactic boundaries, and there may be a floating tone at a syntactic boundary.

4.1 The tones of proclitics

When the pronouns o 'I', ɯ 'you', i 'self', and mɛ 'SAP' occur before a verb, they cliticize to it. By virtue of forming phonological phrases with their host, they must bear tones that—when taken together with their host—do not violate the *LLX constraint. They are assigned tone by the following rule:

subordinate: If the verb is subordinate, the pronoun bears low tone. (Recall that the initial syllable of the verb of a subordinate clause bears high tone.)

(30) mɛ̀ kʰáʔkʰɯ́ɪ$\text{x}$tsʰó–nɛ̀ (mecáhcújtsóne) 'after you have believed'
SAP believe-⟨event⟩

A clause negated by tsʰ$\overset{H}{\text{a}}$ʔ 'no' behaves as though subordinate:

(31) tsʰ$\overset{H}{\text{a}}$ʔ ò máˣtsʲʰò–tʰɛ́–tʰɯ́ɪ–(nɛ̀) (Tsá o májchotétú(ne).) 'I did not go to eat.'
no I eat-go.do-neg-⟨n⟩

main: If the verb is not subordinate, then there are two cases:

monosyllabic stem: If the verb stem is monosyllabic, the pronoun bears low tone, presumably because –Ⓛ◯ʔi ⟨t⟩ and –Ⓛ◯hɯ̄$\overset{L}{\text{k}}$ʰo 'now' dock Ⓛ on the proclitic.

[20] We limit our discussion here to cases with preverbal subjects.

(32) a. $\underline{\overset{\text{L}}{\text{o}}}$ tó:–ʔì (O dóóhi.) 'I eat meat.'
I eat-⟨t⟩

b. $\underline{\overset{\text{L}}{\text{o}}}$ pʰɛ́–hɯ̀kʰó:–ʔì (O péjucóóhi.) 'I go now.'
I go-now-⟨t⟩

Compare 33a and 33b.

In 33a the Ⓛ of –Ⓛ◯ʔi reaches the proclitic, whereas in 33b the future adds a syllable-projecting mora, so the Ⓛ docks on the root and the proclitic bears high tone:

(33) a. $\overset{\text{L}}{\text{o}}$ nɛ́:–ʔì: (O nééhií.) 'I say.'
I go:-⟨t⟩

b. $\underline{\text{ó}}$ $\overset{\text{L}}{\text{n}}$ɛ́–ɛ́–ʔì (Ó neéhi.) 'I will say.'
I go-fut-⟨t⟩

There are exceptional cases that we do not understand. For example in 32b we saw that –Ⓛ◯$\overset{\text{L}}{\text{h}}$ɯ̀kʰo 'now' docks Ⓛ on the proclitic, but this is not the case when the future tense directly follows the root:

(34) $\underline{\text{ó}}$ pʰɛ́–hɯ́kʰò–ó–ʔì (Ó péjúcoóhi.)
I go-now-fut-⟨t⟩

polysyllabic stem: If the verb stem is polysyllabic the pronoun bears high tone, presumably as the result of DHT.

(35) $\underline{\text{ó}}$ máˣtsʲʰò–tʰɛ́–ʔì (Ó májchotéhi.) 'I go eat'
I eat-go.do-⟨t⟩

4.2 Genitive

The genitive construction is formed by juxtaposing the possessor (modifier) and the head

$$[_{\text{NP}} \quad \text{NP}_{\text{possessor}} \quad \text{N}_{\text{head}} \,]$$

The possessor and head form a single tonal phrase within which the *LLX constraint must be respected. A floating low tone, the GENITIVE TONE, occurs at the juncture between the possessor and head:

$$[_{\text{tonal phrase}} \quad \text{NP}_{\text{possessor}} \quad \text{Ⓖ} \quad \text{N}_{\text{head}} \,]$$

When the head is mono- or bisyllabic, the genitive tone docks on the possessor's final syllable. When the head has more than two syllables, the genitive tone docks on the head's initial syllable.

The possibilities are charted in Table 3. (The numbers in brackets refer to examples below. The genitive low tone is indicated by a G over the vowel.)

Table 3: The basic tone patterns of the genitive construction

		HEAD (POSSESSED)		
		σ#	*σσ*#	*σσσ*(…)
MODIFIER	#*σ*	$\overset{\text{G}}{\sigma}\cdot\,\sigma$ [36]	$\overset{\text{G}}{\sigma}\cdot\,\acute{\sigma}\;\sigma$ [39]	$\acute{\sigma}\cdot\overset{\text{G}}{\sigma}\;\acute{\sigma}\;\sigma$(…) [42]
(POSSESSOR)	#*σσ*	$\acute{\sigma}\;\overset{\text{G}}{\sigma}\cdot\,\sigma$ [37]	$\acute{\sigma}\;\overset{\text{G}}{\sigma}\cdot\,\acute{\sigma}\;\sigma$ [40]	$\overset{\text{H}}{\sigma}\;\acute{\sigma}\cdot\overset{\text{G}}{\sigma}\;\acute{\sigma}\;\sigma$(…) [43]
	(…)*σσσ*	(…*σ*) $\acute{\sigma}\;\overset{\text{G}}{\sigma}\cdot\,\sigma$ [38]	(…*σ*) $\acute{\sigma}\;\overset{\text{G}}{\sigma}\cdot\,\acute{\sigma}\;\sigma$ [41]	(…)$\overset{\text{H}}{\sigma\sigma}\;\acute{\sigma}\cdot\overset{\text{G}}{\sigma}\;\acute{\sigma}\;\sigma$(…) [44]

(36) $\text{t}^{\text{h}}\overset{\text{G}}{\text{a}}$ʔ hʲà (tahjya) 'my house'
my house

(37) tí–:$\text{p}^{\text{j}}\overset{\text{G}}{\varepsilon}$ hà (dííbye ja) 'his house'
that-⟨SgM⟩ house

(38) a. mɛ́ːní–mɯ̄̀ hà (méénímu ja) 'pigs' house'
pig-pl house
b. kpàʔáɾó hà (waháro ja) 'mother's house'
mother

(39) a. tʰá máˣtsʲʰò (tamájcho) 'my food'
my food
b. tʰá mɛ́ːnì (tamééni) 'my pig'
my pig
c. ɨʔ míːnɛ̀ (ɨhmɨ́ɨne) 'his canoe'
self transport-⟨ø⟩

(40) a. tíːpʲɛ́ máˣtsʲʰò (dííbye májcho) 'his food'
that-⟨SgM⟩ food
b. tíːpʲɛ́ ɛ́ʔ–hà (dííbye éhja) 'his (house, clothes, etc.)'
that-⟨SgM⟩ thm-⟨shelter⟩

(41) mɛ́ːní–mɯ̄̀ máˣtsʲʰò (méénímu májcho) 'pigs' food'
pig-pl food

(42) a. tʰá mɛ́ːní–mɯ̀ (támeenímu) 'my pigs'
my pigs-plAn
b. tʰá óːʔí–ːpʲʰɛ̀ (táoohíipye) 'my dog'
my dog-⟨SgM⟩

(43) tíːpʲɛ́ nɪ́ːβɯ́kpà (dííbyé niivúwa) 'his deer'
that-⟨SgM⟩ deer

(44) a. kpàʔáɾó óːʔíːpʲɛ̀ (waháró oohíibye) 'mother's dog'
mother dog-⟨SgM⟩
b. kpàʔáɾó mɛ́ːní–mɯ̀ (waháró meenímu) 'mother's pigs'
mother pig-plAn
c. [kpàʔáɾò–mɯ́tsʰí mɛ́ːní–mɯ̀] Ⓖ hà (waháromútsí meenímu ja) 'parents' pigs' house'
mother-⟨DuF⟩ pig-plAn house

Two factors complicate the basic genitive tone patterns presented above. First, stem-forming suffixes must be counted in determining the number of syllables of the head. For example, the roots in 45 are bisyllabic, but are followed by a stem-forming affix[21] that makes the stem trisyllabic. Thus Ⓖ docks on the root's initial syllable:

(45) a. níːβɯ́kpáˣtsʰɨ́ːmɛ́–nɛ̀ (níívúwáj tsɨ́imène) 'deer's child'
b. tʰá mɛ́ːní–mɯ̀ (támeenímu) 'my pigs'
c. áːnɯ́ óːʔíːpʲɛ̀ (áánú oohíibye) 'his dog'

Suffixes that do not form part of the stem are not counted in determining where to dock Ⓖ. For example, in 46 the head is counted as bisyllabic in all three cases, despite the suffixes that follow in 46b and 46c; consequently Ⓖ remains on the possessor throughout:

(46) a. tʰá mɛ́ːnì (tamééni) 'my pig'
my pig
b. tʰá mɛ́ːní–kʰòpà (taméénícoba) 'my big pig'
my pig-aug
c. tʰá mɛ́ːnì–ɾɛ́–hɯ̀kʰò (tamééniyéjuco) 'now only my pig'
my pig-only-focus

[21] Each of these suffixes is a classifier and hence derivational.

Second, some roots have lexically marked tones that block the docking of Ⓖ. For example, the first syllable of nâ˒pè (nahbe) 'brother' bears a lexically marked low tone. When it heads a genitive construction, being bisyllabic, Ⓖ should dock on the possessor's final syllable. However this would violate the *LLX constraint (since the possessor and head are in a single phrase). The lexically marked low of nâ˒pè blocks the docking of Ⓖ and consequently the possessor's final syllable bears high tone:

(47) a. tʰá̲ nʲâ˒pè (táñahbe) 'my brother'
b. mɯ́ɯ́ː˒á̲ nâ˒pè (múúhá nahbe) 'our brother'
c. kpâ˒áɾó̲ nâ˒pè (waháró nahbe) 'mother's brother'

A similar case (the mirror image) is when the second syllable of a trisyllabic head bears a lexically marked low tone, e.g. kʰaɾâkʰa 'chicken' in 48:

(48) a. tʰá kʰáɾâkʰà (tácáraca) 'my chicken'
b. mɯ́ɯ́ː˒á kʰáɾâkʰà (múúhá cáraca) 'our chicken'
c. kpà˒áɾó kʰáɾâkʰà (waháró cáraca) 'mother's chicken'

The tone derivation for 48a is as follows:

Figure 14: Tone derivation: tʰá kʰáɾàkʰà

```
ta  caraca
 |  /| L |    lexical
 | + | : |    blocked by caraca's L
 | G | : |
 |   : : L    FDLT
 H   H : :    DHT
 :   : : :
tá  cáraca
```

In 49 the possessor bears high tone where low tone is expected. (Ⓖ docks on the end of the possessor when the head is bisyllabic.)

(49) tʰá̲ nʲá˒pè–kʰè (táñáhbeke) 'my brother (object)'
my brother-objAn

How can we understand this? Recall that nʲâ˒pɛ has a lexically marked low tone. This Ⓛ blocks the genitive from docking on the possessor's final syllable. Subsequently –Ⓛkʰɛ 'animate object' delinks this Ⓛ. This analysis depends on a cyclic application of tone modifications, one when the possessor and noun are joined in the genitive construction, the other when the case marker is added. The derivation is as follows:

Figure 15: Derivation: tʰá nʲá˒pè–kʰè

```
ta  ñahbe
 |\  L  |    lexical
 | + |  |    blocked by ñahbe's L
 | G |  |
 |   $  |       delinked
 |   |  L_ke    objAn
 |   |  :  |
 |   |  :  L   FDLT
 H   H  :  :   DHT
 :   :  :  :
tá  ñáhbe-ke
```

4.3 Classifiers

Counts of Bora texts show that roughly four out of every ten words has a classifier. These are suffixes that refer to classes of beings, objects, events, etc. In Thiesen and Weber [8] we claim that classifiers head noun phrases.

The low tone of a classifier, represented below by C, is located by the following rule (with a few exceptions):

1. $\ldots \overset{C}{\sigma}$–$\sigma$## Monosyllabic classifiers place a low tone on their host's final syllable.

2. Bisyllabic classifiers:

2.1 ##σ–$\overset{C}{\sigma}\sigma$## After a monosyllabic host a bisyllabic classifier bears a low tone on its initial syllable.

2.2 $\ldots\sigma\overset{C}{\sigma}$–$\sigma\sigma$## After a polysyllabic host a bisyllabic classifier imposes a low tone on the host's final syllable.

3. $\ldots\sigma$–$\overset{C}{\sigma}\sigma\sigma\ldots$ Longer classifiers (three or more syllables) bear a low tone on their initial syllable.

A monosyllabic classifier (case 1) is illustrated in 50. In 50a and 50c, © docks on the host's final syllable. In 50b © can not dock on the host because it's final syllable already has a lexically marked high tone, and in 50d © is blocked by the host's lexically marked low tone. The derivations are given in Figure 16.

(50) a. ʦʰ$\overset{C}{\text{ì}}$ː–kpà (tsiíwa) 'other plank'
b. $\overset{H}{\text{i}}$–kpà (íwaá) 'that plank'
c. ʦʰɯ́ːkʰá–$\overset{C}{\text{à}}$–kpà (tsúúcáawa) 'old plank'
d. ʦʰí$\overset{L}{\varepsilon}$mé–kpà (tsíeméwa) 'some kind of plank'

Figure 16: Derivation: ʦʰìː–kpà, í–kpàá, ʦʰɯ́ːkʰá–à–kpà, ʦʰíɛ̀mé–kpà

```
tsi:   other          i   that          tsu:ca    earlier time    tsíemé    some kind
  |                   H   lexical         |  |                      |L |    lexical
  L__wa    <plank>   +       blocked      |  ._e    pertain         |: +       blocked
  :   :              L_wa    <plank>      |  | |                    |: L_wa    <plank>
  :   :              :  |                 |  | L_wa    <plank>     |: |  |
  :   :              :  |                 |  | :  |                |: |  |
  :   L    FDLT      :  L    FDLT         |  | :  L    FDLT        |: |  L    FDLT
  :   :              :  :                 H  H :  :    DHT          H: H  :    DHT
  :H  :    PLTS      :  :H   FLTS         :  : :  :                 :: :  :
  ::  :              :  ::                :  : :  :                 :: :  :
tsií-wa              í-waá               tsúúcá-a-wa               tsíemé-wa
'other plank         'that plank'        'old plank'               'some kind of plank'
```

A bisyllabic classifier (case 2) is illustrated in 51. In 51a and 51b, © is on the classifier's initial syllable as expected (case 2a). In 51c © docks on the host's final syllable as expected (case 2b). In 51d © is blocked by the host's lexically marked low tone and is thus not docked.

(51) a. ʦʰí–ʔ$\overset{C}{\text{a}}$ːmɨ̀ (tsíhaámɨ) 'other leaf'
b. $\overset{H}{\text{i}}$–ʔ$\overset{C}{\text{a}}$ːmɨ̀ (íhaámɨ) 'that leaf'
c. ʦʰɯ́ːkʰá–$\overset{C}{\text{à}}$–ʔáːmɨ̀ (tsúúcáahɨ́ámɨ) 'old leaf'
d. ʦʰí$\overset{L}{\varepsilon}$mé–ʔáːmɨ̀ (tsíeméhɨ́ámɨ) 'some kind of leaf'

A polysyllabic classifier (case 3) is illustrated in 52:

(52) a. tsʰí–$\overset{C}{\text{a}}$ːmáì (tsíaamái) ‘other row’
b. $\overset{H}{\text{i}}$–$\overset{C}{\text{a}}$ːmáì (íaamái) ‘that row’
c. tsʰɯ́ːkʰá–á–$\overset{C}{\text{a}}$ːmáì (tsúúcááaamái) ‘old row’
d. tsʰí$\overset{L}{\text{ɛ}}$mɛ́–$\overset{C}{\text{a}}$ːmáì (tsíeméaamái) ‘some kind of row’

With a few exceptions, classifiers do not delink conflicting low tones but they do block the docking of a tone that would conflict. Thus, when a noun bears more than one classifier, generally the low imposed by the first classifier is realized, but not necessarily that of the second. For example, in 53 the © of –ʔɛ̀ ⟨tree⟩ docks on the host’s final syllable and blocks the © of –ʔàːmɨ̀.

(53) tsʲámáːɾ$\overset{C}{\text{a}}$–ʔɛ́–ʔáːmɨ̀ (llámáárahéháámɨ) ‘leaf of a lemon tree’
lemon-⟨tree⟩-⟨leaf⟩

Classifier-terminated phrases are remarkably like genitive constructions:

1. In Thiesen and Weber [8] we argue that classifiers head their phrases. On this view they are structurally parallel to the genitive construction; both are instances of $[_{\text{NP}}\ \text{NP}_{\text{modifier}}\ \text{N}_{\text{head}}]$.
2. In both cases the modifier and head form a single tonal phrase within which the *LLX constraint may not be violated.
3. Both have a floating low tone at the boundary between the modifier and head.
4. With the single exception of case 2.1 (page 17), the rule for WHERE to dock the floating low tone is the same: on the modifier’s final syllable if the head is one or two syllables; on the head’s initial syllable if it is longer.

5 Areas for further study

Many several issues beg for further study:

1. Some nouns have a lexically marked high tone on their initial syllable; see footnote 13 for examples. We understand little about the tonal behavior of such words nor, for that matter, about lexically marked high tones generally.
2. Some words (roots) simply demonstrate exceptional tonal behavior (at least relative to our analysis).[22] For example, consider the words in Table 4:

Table 4: Words with exceptional tone

		my	X	his/her	X
		H	HL	HL	HL
mother	/tsʰɨːhɯ/	tʰáː	tsʰíːhɯ̀	tíːpʲɛ̀ˣ	tsʰíːhɯ̀
wife	/tʰaːpa/	á	tʲʰáːpà	tíːpʲɛ̀	tʰáːpà
		H	HL	HH	LL
father-in-law	/paːpɛ/	á	páːpɛ̀	tíːpʲɛ́	pàːpɛ̀
father	/kʰ$\overset{H}{\text{a}}$ːni/	tʰáː	kʰáːnì	tíːpʲɛ́ˣ	kʰàːnì
husband	/tʰahɨ/	á	tʲʰáhɨ̀	tíːtsʲɛ́	tʰàhɨ̀

[22] Many such words are kinship terms, e.g., kpàˣpʰì ‘man’ tsʲìːʔíyò ‘male child/parent’ kpàtsʲɛ̀ ‘woman’ kpàʔáɾò ‘female child/parent’. This is perhaps not too surprising since kinship terms are frequent.

Consider the first two rows ('mother' and 'wife'). The second column is as expected, but in the first the possessor should have low rather than high tone; compare 39.

Consider the last three rows ('father-in-law', 'father' and 'husband'). The first column has the same unexpected high tone on the possessor as in the first two rows. In the second column the final syllable of the possessor should have low rather than high tone; compare 40.

Moreover, there is abundant evidence that 'father' bears a lexically marked *high* tone on its first syllable: $k^{h}\overset{H}{a}$:ni. However, in the second column it bears a low tone on its initial syllable.

3. In an appendix in Thiesen and Weber [8] we list most of the suffixes with an explicit representation of their tonal properties. However, these are working hypotheses; we do not yet fully understand the tonal properties of some suffixes.

   For example, when –Ⓛtɯ̀ɪ follows a monosyllabic classifier, it does not ordinarily delink the low tone imposed by that classifier on the preceding syllable; see 54a. However, if the preceding (monosyllabic) classifier's Ⓛ is not docked (blocked by a preceding Ⓛ), quite unexpectedly the Ⓛ of –Ⓛtɯ̀ɪ does not dock; see see 54b:

   (54) a. ɯ́mɛ́ʔɛ̀–kpá–tɯ̀ɪ (úmèhewádu) 'like a plank-like thing'.
   tree-⟨plank⟩-like
   b. kpá$^{\overset{L}{x}}$k^{h}ó–ʔɛ́–tɯ̀ɪ (wajcóhédu) 'like a flowering tree'
   flower-⟨tree⟩-like

   It is as though the classifier's Ⓛ is both present (to block the Ⓛ of –Ⓛtɯ̀ɪ) and absent. We do not know why.

4. Several rules (FDLT, PLTS and FLTS) are conditioned to apply only "phrase final," but we have not adequately defined what this means. Different rules will require different broader or narrower notions of "final"; e.g., FDLT applies more generally (perhaps *word*-finally) than PLTS and FLTS.

   Perhaps more seriously, we have made only feable attempts to relate "tonal phrase" to syntactic structure; one would expect a tight relationship.

5. PLTS and the *LLX constraint both work to avoid three moras of low tone, but our analysis does not capture this commonality.

6. We note the following similarity:

   (a) The low tone that makes a verb stem nonfinite (section 3.5) or imperative (section 3.6) docks on the earliest of *the last three syllables, counting from its end*: $\ldots\overset{N}{\sigma}(\sigma(\sigma))\#$.

   (b) The low "boundary" tone of the genitive construction (section 4.2) and that of classifiers (section 4.3) reaches the final syllable of the modifier only if it is among *the last three syllables, counting from the end of the head*: $[_{\text{modifier}}\ldots\overset{G}{\sigma}]\#[_{\text{noun stem}}\sigma(\sigma)]$.

   Nothing about our analysis captures this observation.

7. Consider 55:

   (55) díñáhbé táábake
   tí nʲá$^{\overset{L}{}}$ʔpɛ́ t^{h}á:pà–k^{h}ɛ̀ 'your brother's wife (object)'
   your brother wife-objAn

   Why does the first syllable of nʲá$^{\overset{L}{}}$ʔpɛ 'brother'—which has a lexically marked low tone—end up high? We have only some speculative comments to offer.

   First, if Ⓖ docks on the modifier's final syllable (as in Figure 17a), the modifier's penult (when present) must bear high tone to avoid violating the *LLX constraint. Surprisingly, it seems that this

pattern is carried through to cases in which Ⓖ docks on the head (as in Figure 17b), and even when Ⓖ does not dock anywhere (as in Figure 17c):

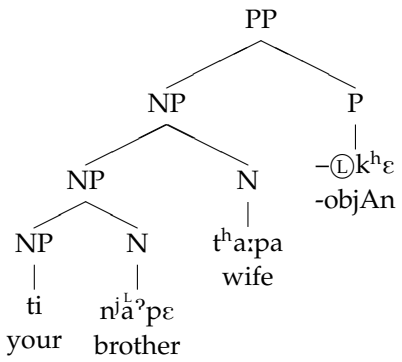
Figure 17: The possessor's penult high extension (PPHE)

	MODIFIER	·	HEAD
a.	$((\ldots\sigma)\overset{H}{\sigma})\overset{G}{\sigma}$	·	$\sigma(\sigma)\#$
b.	$((\ldots\sigma)\overset{H}{\underline{\sigma}})\overset{H}{\sigma}$	·	$\overset{G}{\sigma}\sigma\sigma(\sigma\ldots)$
c.	$((\ldots\sigma)\overset{H}{\underline{\sigma}})\overset{H}{\sigma}$	·	$\sigma\sigma\sigma(\sigma\ldots)$

We will refer to this pattern as the PPHE. Note that it is not motivated by any factor discussed in the text of this paper.

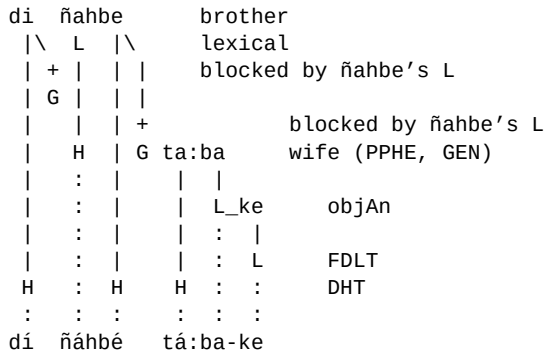
Second, we suggest the following (somewhat teleological) motivation for the PPHE. Suppose that the process of assigning tone in the genitive construction proceeds from left to right with only three syllable lookahead. At the point it assigns tone to the modifier's penult it can only "see" the next three syllables, i.e., the modifier's final syllable and the head's first two. Thus it cannot know whether Ⓖ will dock on the next syllable—in which case it would have to assign high tone—or on the head's initial syllable. The only possibility that will always avoid violating the *LLX constraint is to assign high tone to the modifier's penult.

Third, we assume that the structure for 55 is as follows:



On the first cycle the lexically marked low of n$\overset{L}{\underline{a}}$ʔpɛ 'brother' is present and blocks the docking of the preceding Ⓖ. On the second cycle it is present and blocks the docking of the following Ⓖ. However, n$\overset{L}{\underline{a}}$ʔpɛ terminates the possessor (on the second cycle) so, by the PPHE as a rule, its penultimate syllable must bear high tone. The derivation (which uses PPHE as a rule that overwrites the lexically marked low tone with high tone) follows:

Figure 18: Derivation: tí nʲáˀpɛ́ tʰá:pà–kʰɛ̀



8. Bora's tone system seems too complex. 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 complicated. Of course, the complexity of the facts themselves cannot be reduced. (Indeed, further study will undoubtedly bring to light more complexities.) The challenge, therefore, is to find analyses that reduce the complexity.

9. Bora—it seems—has no stress system aside from the system of tone: there do not seem to be stressed versus unstressed syllables, only high versus low tone syllables. In basic design, the Bora tone system is not unlike the accentual system of Lithuanian described by Kenstowicz [2, pp. 584ff]. We do not discount the possibility that Bora's tone system is a stress system implemented on tone. Kenstowicz [2] says that Milner proposes such an analysis for Winnebago; Kenstowicz writes (p. 595) "The accent is interpreted as high tone" and (p. 596) "The accent in Winnebago is apparently realized tonally (Milner 1979)". (Consult Kenstowicz [2] for references.)

10. Bora drum communication raises various intriguing questions: Given that there is relatively little lexical tone, why is it possible at all? What is the range of messages that can be communicated? To what extent does it depend on conventional frames?

11. Across Bora clans there are small dialect differences, most prominently, with regard to palatalization. There are differences in tone. This merits further study.

    Miraña is a language very closely related to Bora. Seifart [4] shows that its tone system is virtually identical to that described here for Bora. (Seifart's analysis is based on an earlier version of this paper; see [4, p. 33, footnote 16].) It remains to determine the exact differences and their significance.

    A language spoken to the north in Colombia, Muinane, is closely related to Bora. According to Mike Maxwell (personal communication) it has a pitch-accent system: very roughly, words begin with some number of high tone syllables and are thereafter followed by low tone syllables. Perhaps this is the result of the collapse of a system like that of Bora.

    Tone has not been sufficiently studied in other members of the Witotoan family such as Witoto and Ocaina.

    Aschmann [1] has done an admirable job of reconstructing the segmental phonology of Witotoan. However, reconstructing the system of tone is an outstanding challenge.

A Abbreviations and conventions

The examples normally present four types of information: (1) the Bora in a phonetic/phonemic form, using the International Phonetic Alphabet; (2) the Bora in the practical orthography, set in a sans serif font; (3) a

morpheme-by-morpheme gloss; and (4) a free translation.

Tones are normally represented by an acute or grave accent mark (for high and low tones, respectively). However, tones are sometimes represented by small letters written over the vowel to make explicit the reason for that tone.

+ blocking (in derivations)

$ delinking (in derivations)

⟨ ⟩ surrounds the gloss of a classifier

⟨**ø**⟩ 'thing' or 'event'

◯ a placeholder corresponding to the tone of a syllable; for example, –Ⓛ◯*sfx* indicates that the suffix *sfx* imposes a low tone on its host's penult.

AnPl animate plural

aug augment

$\overset{C}{\mathbf{v}}$ low tone of a classifier

DHT default high tone

DuF animate dual feminine

DuM animate dual masculine

emph emphatic

FDLT final default low tone

FLTS final low tone split

$\overset{G}{\mathbf{v}}$ low genitive tone

Ⓖ the floating low tone at the juncture between the modifier (possessor) and head (possessed) of a genitive construction

H high tone

$\overset{H}{\mathbf{v}}$ lexically marked high tone

$\overset{I}{\mathbf{v}}$ low imperative tone

InPl inanimate plural

LLX constraint against a nonfinal low tone sequence

L low tone

$\overset{L}{\mathbf{v}}$ lexically marked low tone

Ⓛ imposed low tone; for example, –Ⓛ*sfx* indicates that the suffix *–sfx* imposes a low tone on its host's final syllable, while –Ⓛ◯*sfx* indicates that it imposes a low tone on its host's penult.

max maximum, finalized

⟨**n**⟩ the negative verb-terminating classifier (used when there is a preverbal subject)

$\overset{N}{\mathbf{v}}$ nonfinite low tone

neg negative

objAn accusative case marker for animate objects

pl plural

plAn plural for animates

plIn plural for inanimates

PLTS penultimate low tone split

PPHE the possessor's penult high extension

$\overset{S}{\mathbf{v}}$ high initial tone of a subordinate verb

SAP speech act participant, first person plural inclusive

sg singular

SgF animate singular feminine

SgM animate singular masculine

sIn singular action, intransitive

T tone

⟨**t**⟩ the verb-terminating classifier (used when there is a preverbal subject)

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