Downstep and Contour Formation in Medumba: A Prosodic Account

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1. Introduction

Medumba is a Grassfields Bantu language spoken in the West Province of Cameroon. The Grassfields languages are known for their complex tone systems, and Medumba is no exception. Jan Voorhoeve first analyzed parts of the language in detail in the 1960s and '70s, offering influential analyses of its tone system (Voorhoeve, 1965, 1967, 1968, 1971, 1976; Watters, 2003). Focusing on the associative construction, he grouped all monosyllabic nouns into four different tone melodies—melodies that are not at all obvious from their isolation forms.

The proposed sequence /H(L)H/[1], as analyzed by Voorhoeve (1971), is realized on the surface in one of three ways: [H ˡH], [H͡L H], or [H H]. Voorhoeve was able to account for the first representation, which is very common, with a simple downstep rule. However, this rule as it stands cannot account for either surface representation that lacks downstep—rules that refer to specific grammatical constructions would be needed in these cases (Voorhoeve, 1976). This paper argues that prosodic structure plays an important role in the application of downstep and Voorhoeve's other tone rules. The downstep rule—in addition to certain consonant alternations described by Voorhoeve (1965)—is sensitive to the prosodic boundary of the phonological word.

Section 2 summarizes the analysis of Voorhoeve (1971), focusing on the representation of nouns and the rules needed for the associative construction. This section also illustrates the problems with the existing rules as they apply to other aspects of the grammar. Section 3 uses the consonant alternations—lateralization, spirantization, and final devoicing—from Voorhoeve (1965) as evidence for prosodic boundaries in Medumba, and shows how certain grammatical elements, such as pronouns, are best treated as clitics, while others, such as the yes-no question marker, are not. The application of downstep is then reanalyzed in light of this new prosodic structure.

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[1]Tones in parentheses represent floating tones. The sequence here is a H, followed by a floating (unassociated) L, followed by H. This floating tone can either be part the underlying lexical representation of a word, or a grammatical floating tone between words. Throughout this paper, the down arrow (ˡ) is used to indicate downstep.

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2. Previous Analysis

2.1. Tone

Voorhoeve (1971) first analyzed Medumba (calling it Bamileke-Bangangté) using floating tones. While most nouns are monosyllabic, Voorhoeve proposed that they have a three-tone structure reminiscent of their Proto-Bantu roots (e.g. (T)-T(T) for a monosyllabic word, relating historically to a trisyllabic version). Voorhoeve (1971) tested "320 one-syllable nouns in more than forty different frames" to provide evidence of these floating tones preceding and following the monosyllabic noun stem (Voorhoeve, 1971:46). Voorhoeve argued that the use of floating tones was necessary to account for contextual variation in tone patterns that was otherwise inexplicable from the point of view of the isolation or citation forms of the words involved.

Monosyllabic nouns in Medumba pattern into three surface tone types. They can be described as high, low, and falling low. Phrase-finally in certain constructions, high and low tone nouns are neutralized (the relevant underlying tones to be argued for are shown in the glosses below):

(1) a. **mə ˡjən mvən** [ˉ - ˎ]
H (L) L (L)
I see chief
'I saw the chief.'

b. **mə ˡjən kɔ** [ˉ - _]
H (L) L (H)
I see spear
'I saw the spear.'

c. **mə ˡjən ˡmɛn** [ˉ - _]
H (L) H (L)
I see child
'I saw the child.' (Voorhoeve, 1971:46)

The nouns **kɔ** 'spear' and **mɛn** 'child' are pronounced at different levels in isolation: **mɛn** is pronounced high, [ˉ], while **kɔ** is one level lower, [˗]. However, in the above examples, they are produced at the same level. Conversely, high tone nouns that have the same level in isolation are differentiated in certain contexts. Below, two such high nouns display differences in the same environment:

(2) a. **mə jən ˡmɛn ˡki** [ˉ - _ _]
H (L) H (L) H
I see child Q
'Did I see the child?'

b. **mə jən ˡʧʉ ki** [ˉ - _ _]
H (L) H (H) H
I see tree Q
'Did I see the tree?'

In this frame, the high tone noun **mɛn** 'child' lowers (i.e. downsteps) the high tone question marker one level, while the high tone noun **ʧʉ** 'tree' does not. This suggests different tonal representations for each noun, despite their similarities in isolation, as shown in the glosses above.

Because the low and falling low nouns are neutralized in many contexts, and the high tone nouns are differentiated in many contexts, Voorhoeve was able to deduce the following tone melodies for each type of noun:

(3)

mvən	'chief'	L(L)
kɔ	'spear'	L(H)
mɛn	'child'	H(L)
ʧʉ	'tree'	H(H)

(Voorhoeve, 1971:48)

Additionally, for reasons both historical and related to the associative construction, Voorhoeve posited a floating L tone occurring before *all* nouns,[2] making the representations more precisely the following:

(4)	**mvən**	'chief'	(L)L(L)	
	kɔ	'spear'	(L)L(H)	
	mɛn	'child'	(L)H(L)	
	ʧʉ	'tree'	(L)H(H)	(Voorhoeve, 1971:50)

With these representations in his arsenal, Voorhoeve was then able to successfully tackle the patterns seen in the Medumba associative construction. The associative construction is usually represented as *Noun$_1$ of Noun$_2$*. With a constant Noun$_2$, only four patterns should arise in the associative construction if Noun$_1$ is taken to be the only variable (based on the possible sequences in (4)). However, because Voorhoeve observed more patterns than this, he posited a floating tone as the associative marker, shown in (5), to account for this additional variation.

(5) *The ___ of the child*

mfən	'chief'	L(L)–(L)–(L)H(L)	[ˍ ˉ]
bam	'belly'	L(L)–(H)–(L)H̲(L)	[ˊ ˍ]
naʔ	'cow'	L(H)–(L)–(L)H(L)	[ˍ ˉ]
kɔ	'spear'	L(H)–(H)–(L)H̲(L)	[ˊ ˍ]
mɛn	'child'	H(L)–(L)–(L)H(L)	[ˉ ˉ] or [ˋ ˉ]
ju	'thing'	H(L)–(H̲)–(L)H̲(L)	[ˉ ˍ] or [ˋ ˍ]
njwi	'women'	H(H)–(L)–(L)H(L)	[ˊ ˉ] or [ˋ ˉ]
ti	'tree'	H(H)–(H)–(L)H̲(L)	[ˊ ˉ] (Voorhoeve, 1971:50)

These underlying representations, shown in the third column (with the floating tones indicated in parentheses, downstepped H tones indicated via underline, and the associative marker offset by dashes), were only the beginning in accounting for the surface patterns, represented by pitch levels in the rightmost column. The associative marker, as will be discussed below in (7), is either (H) or (L), depending on the class of Noun$_1$. How these tone sequences ultimately form the surface tone patterns will be shown below.

Voorhoeve posits a set of ordered rules, paraphrased below:

(6) a. **Downstep Rule:** A H is downstepped after a preceding HL sequence.
b. **Tone Deletion Rule:** Any floating tone directly adjacent to an associated tone is deleted.[3]
c. **Tone Attachment Rule (Optional):** Any remaining floating tones attach to the left to form a contour.

Below, I give a sample derivation for the phrase **jú ↓↓mɛ́n** 'thing of child'. Here, AM stands for Associative Marker. The associative marker in Medumba consists solely of a floating tone, which is either H or L depending on the noun class of Noun$_1$. In this particular case, the associative marker is H.

(7) a. **ju** **AM** **mɛn**
(L) H (L) (H) (L) H (L)
Underlying Representation

[2]This would include nouns from the historically prefixless class 1a. Voorhoeve does not address this distinction directly, but we have found no nouns without this prefix floating (L) tone, including **sáŋ** 'bird' (cf. Hyman, 2003). It is possible that all nouns have been reanalyzed to include this floating L prefix. Such a simplification of lexical floating tones is not unheard of for this region; for a more extreme case, see Chumbow & Nguendjio (1991).

[3]Voorhoeve's original phrasing referred to "non-segmental tones" and "segmental tones", respectively. (Voorhoeve, 1971:51). Because this was not in an autosegmental framework, any floating L that caused downstep would remain floating, and would be targeted for deletion by this rule. However, we could say that a floating L associates to some other node to cause downstep (e.g. Hyman, 1992), and therefore would not have to delete in the derivation.

b. **ju** **AM** **mɛn**
(L) H (L) (ˡH) (L) ˡH (L)

Downstep Rule

c. **ju** **AM** **mɛn**
H (ˡH) ˡH

Tone Deletion Rule

d. **ju** **mɛn**
H‿ˡH ˡH [↖_]

Tone Attachment Rule

The final result consists of a H‿ˡH contour on the first word, followed by an additional downstepped H. Because the last rule, the Tone Attachment Rule, is optional, the phrase can also be pronounced as H ˡˡH. Voorhoeve expressed this difference with the following tone letters: A double-downstep example is expressed as [¯ _], while an example consisting of only a single downstep would be [¯ -].

This is the famous "double downstep" example that has been cited various times (Hyman & Tadadjeu, 1976; Hyman, 2001, 2003; Chumbow & Nguendjio, 1991) for its theoretical and typological importance. The unique nature of the H(LHL)H sequence makes double-downstep exceedingly rare, both cross-linguistically and in Medumba.

2.2. Problems

Just as with the yes-no question marker from (2a–b), the sequence of H(L)H in the associative construction causes downstep. This is expected based on Voorhoeve's rules as the Downstep rule is ordered first. However, there are several environments where a H(L)H sequence clearly does not cause downstep. Possessive and demonstrative pronoun constructions are such environments.[4]

(8) a. **lâk** **sʉ́m** [↖¯]
H (L) H
eye 1SG.POSS.3
'my eye'

b. * **lák** **ˡsʉ́m** [¯_]
H (L) H
eye 1SG.POSS.3
'my eye'

Applying the downstep rule to (8b) results in an incorrect pronunciation. Instead, the sequence H(L)H is pronounced either with a contour as in (8a) or as H H. (In this example, the HL contour on the first syllable is optional and is usually present only in slower speech.) It is not unusual for pronouns crosslinguistically to be treated differently by the phonology of a language, especially if they are clitics. As the incongruous tonal behavior in regards to downstep is limited to pronouns, this suggests that a different prosodic structure may be at play. The following sections will test for this structure and attempt to reconcile the rules offered by Voorhoeve.

3. Prosodic reanalysis

This section will show that pronouns and certain other grammatical morphemes behave differently from overt nouns with respect to phonological alternations, even in similar segmental environments. The final analysis will treat these pronouns and grammatical items as clitics, which will be the trigger for certain segmental processes described in the following sections.

Voorhoeve (1965) describes several allophonic variations that will be used as tests for prosodic boundaries:

> So, in final position /d/ has an allophone [l] before phonemic vowel, and an allophone [t] before consonant or pause; /g/ has an allophone [ʁ] before phonemic vowel and an allophone

[4]Nouns that are analyzed as H(H), such as **sáŋ** 'bird', do not show the same contour alternation in (8a). A reviewer points out that the possessive pronoun is historically *ì-súm`, and that it could possibly be the floating tone from the loss of that initial vowel in this pronoun that is causing this contour. However, because **sáŋ sʉ́m** 'my bird' can only be pronounced [¯ ¯], it seems to still be the floating (L) from the lexical representation of **lák** that causes this contour.

[k] before consonant or pause. /b/ has an allophone [p] before consonant or pause, /ʔ/ has no allophone. (Voorhoeve, 1965:328)

These are paraphrased below:

(9) a. **Lateralization:** In root-final[5] position, /d/ becomes [l] before a vowel.
b. **Spirantization:** In root-final position, /g/ becomes [ɣ][6] before a vowel.
c. **Final Devoicing:** In root-final position, /b d g/ become [p t k] before a consonant or pause.

3.1. Lateralization and Spirantization

Lateralization and spirantization (L&S) pattern together in their distributions and both are types of lenition effects. L&S are most evident in Medumba words that end in /d/ or /g/. The words that will be used are **/ˋndùdˊ/** 'cloud', **/ˋmʙágə́/** 'fire', and **/ˋmvɛ́dˊ/** 'relative/oil'.[7] Not only do all of these words contain the proper consonants for our purposes (i.e. they reveal the effects of these rules), they are also each in a noun class that takes a vowel-initial possessive pronoun. This puts the final consonants in the proper environment to potentially undergo L&S. These are shown below. The allophonic change is indicated by square brackets.

(10)	**ndù[l] ám**	(11) **mvɛ́[l] àm**	(12) **mʙá[ɣ] ám**
	L (H) H	H (L) L	H (H) H
	cloud 1SG.POSS.2	relative 1SG.POSS.1	fire 1SG.POSS.2
	'my cloud'	'my relative'	'my fire'

In (10) and (11), the final /d/ is realized as the allophone [l] before the possessive pronoun. Furthermore, the /g/ in (12) is realized as the fricative [ɣ]. This is thus an environment where L&S apply.

L&S also apply between a verb and object pronoun, given the proper segmental environment. This is shown below with the verb 'to eat', **/fɛ́d/**.

(13)	**mʙʉ́ ↓fɛ́[l] ám**	(14) **mʙʉ́ ↓fɛ́[l] ú**	(15) **mʙʉ́ ↓fɛ́[l] í**
	H (L) H H	H (L) H H	H (L) H H
	dog eat 1SG.OBJ	dog eat 2SG.OBJ	dog eat 3SG.OBJ
	'The dog ate me.'	'The dog ate you.'	'The dog ate him.'

The first, second, and third person singular object pronouns in these examples are [ám], [ú], and [í], respectively. Using them with a verb ending in /d/ triggers the lateralization rule. The downstep between the subject and verb is caused by the floating L on **mʙʉ́** 'dog' (but for a more detailed treatment, see Danis, 2011).

Furthermore, the word for 'fire' **/ˋmʙágə́/** shows that the spirantization process applies within a single lexical word. In context, the word is either realized as [mʙák] (usually before another word) or as [mʙáɣə], usually at the end of a phrase.

L&S are blocked when the item after the first noun is an overt noun, not a pronoun. This will be shown with proper nouns. As very few native Medumba words begin with a vowel, and those that do are either pronouns (as shown above) or certain grammatical markers (e.g. the *wh*-marker and future marker), we elicited vowel-initial proper nouns that the speaker is comfortable producing.

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[5]It is necessary to point out and explain the somewhat vague environment of "final position". Voorhoeve (1965) investigates the "morpheme" in Medumba. As he analyzed every morpheme, or root, to be monosyllabic, "final position" can either refer to the end of a word or the coda of a syllable. This distinction will become relevant in Section 3.2 in the discussion of the Final Devoicing rule.

[6]Voorhoeve describes this sound as a uvular fricative but in our elicitations it is closer to a velar fricative.

[7]The diacritics here represent floating tones when they appear over a blank space, e.g. the underlying tones for 'cloud' would be (L)L(H). The symbol ʙ represents a voiced bilabial trill.

(16) a. **ndù[t] à.ɾì.ân**
L (H) L.L.HL
cloud AM.1 Ariane
'cloud of Ariane'

b. **ndù[t] à.mé.ɾì.gə̀**
L (H) L.H.L.L
cloud AM.1 America
'cloud of America'

(17) a. **mʙɔ́[k] à.ɾì.ân**
H (H) L.L.HL
fire AM.1 Ariane
'fire of Ariane'

b. **mʙɔ́[k] à.mé.ɾì.gə̀**
H (H) L.H.L.L
fire AM.1 America
'fire of America'

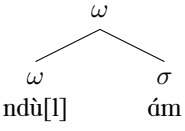
(18) a. **mvɛ́[t] à.ɾì.ân**
H (L) L.L.HL
oil AM.2 Ariane
'oil of Ariane'

b. **mvɛ́[t] à.mé.ɾì.gə̀**
H (L) L.H.L.L
oil AM.2 America
'oil of America'

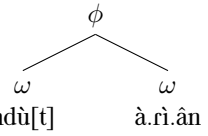
Because these lenition processes happen either within a single word (as in 'fire') or between noun and pronoun, but *not* between noun and noun, we can limit the domain of L&S to the phonological word.

Both the head noun and the second noun in constructions in (16a–18b) are phonological words, as each word is an overt noun. This, plus the fact that L&S do not apply, indicates a larger boundary between the two nouns in the associative construction than between a noun plus a clitic possessive pronoun. This difference can be formalized prosodically in the following way:

(19) 'my cloud'



(20) 'cloud of Ariane'



The L&S rules would then have to be formulated to only occur within the domain of the phonological word (ω). The figures above assume a theory of recursive phonological word formation (e.g. Zec & Inkelas 1991), but a formalization based on the Clitic/Composite Group (Nespor & Vogel, 1986; Vogel, 2009) is equally compatible with this data.

Further evidence for the prosodic treatment of these rules results from the future tense marker /ù?/ and the *wh*-question marker /ɑ/. When either of these markers occurs after a noun, L&S will apply. However, as one is a tense marker and the other is a right-edge phrase marker, neither forms a syntactic constituent with the preceding noun. However, each marker does form a prosodic unit with the preceding noun, evidenced by L&S.

(21) a. **mʙɔ́[ɣ] ù? ˡnén**
H L H
fire FUT go
'The fire will go away.'

b. **mvɛ́[l] ù? ˡnén**
H L H
oil FUT go
'The oil will go away.'

Here, the future tense /ù?/ marker occurs immediately after the noun, and triggers L&S. This is also the case for the *wh*-question marker:

(22) a. **à wʉ́ z-à jə́n ndù[l] ɑ́**
L H L H L H
3SG who REL-3SG see cloud Q
'Who saw the cloud?'

b. **à wʉ́ z-à jə́n mʙɔ́[ɣ] ɑ́**
L H L H H H
3SG who REL-3SG see fire Q
'Who saw the fire?'

c. **à wúɪ́ z-à jə́n mvɛ́[l] ù**
L H L H H L
3SG who REL-3SG see oil Q
'Who saw the oil?'

Wh-questions in Medumba are formed with a cleft structure on the left and a right-edge marker /ɑ/. This marker is a trigger for L&S. (This marker is only a vowel, and is underlyingly toneless. The tone of the marker in the sentences above comes from the lexical floating tone after the noun. Because 'fire' is H(H), the tone of the question marker is H, whereas 'oil' is H(L), making the marker L.) By applying this prosodic structure, L&S can now be said to apply intervocalically within prosodic words, no longer having to refer to root final positions.

3.2. Final Devoicing

Voorhoeve's (1965) final devoicing rule calls for /b d g/ to become their voiceless counterparts before a consonant or pause. This is evident in both nouns and verbs that end in these consonants. In the following examples, the same verb meaning 'to eat' will be used.

(23) a. **mʙʉ́ ˡfɛ́[t] ˡsáŋɔ́**
H (L) H (L) H H
dog eat bird
'The dog ate the bird.'

b. **mʙʉ́ ˡfɛ́[t] ˡmɛ́n**
H (L) H (L) H
dog eat child
'The dog ate the child.'

c. **mʙʉ́ ˡfɛ́[t] ˡmʙʉ́**
H (L) H (L) H
dog eat dog
'The dog ate the dog.'

d. **mʙʉ́ ˡfɛ́[t] ndùt**
H (L) H (L) L (H)
dog eat cloud
'The dog ate the cloud.'

In these examples, the verb is expressed as [fɛt], as predicted by the final devoicing rule. So far, everything is in line with Voorhoeve's formulations. However, in the following examples, we see different results in similar segmental environments.

(24) a. **mʙʉ́ ˡfɛ́[d] bɔ̀n**
H (L) H L
dog eat 1PL.OBJ.INCL
'The dog ate us (inclusive).'

b. **mʙʉ́ ˡfɛ́[d] jáɣɔ́**
H (L) H H
dog eat 1PL.OBJ.EXCL
'The dog ate us (exclusive).'

c. **mʙʉ́ ˡfɛ́[d] zínɔ́**
H (L) H H
dog eat 2PL.OBJ
'The dog ate you (plural).'

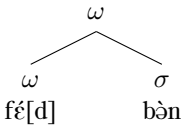
d. **mʙʉ́ ˡfɛ́[d] júbɔ́**
H (L) H H
dog eat 3PL.OBJ
'The dog ate them.'

In each of these examples, the verb ends in [d], even though the following word begins with a consonant. If we look at the prosodic formulations in (19–20), we can say that the sentences in (23a–23d), where the object is an overt noun, form a structure consisting of two phonological words, while the verb phrases in sentences (24a–24d) form a single phonological word with the object pronoun acting as a clitic. This disallows the final devoicing rule from applying, and the segmental environment does not allow L&S to apply, so the resulting segment is [d], unchanged from its underlying representation. A near-minimal pair that nicely shows this contrast is between (24a) and the following:

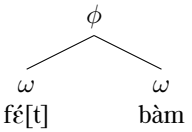
(25) **mʙʉ́ ˡfɛ́[t] bàm**
H (L) H (L) L
dog eat belly
'The dog ate the belly.'

In these two examples, the surface tones are the same, as both ‘belly’ and the inclusive form of ‘us’ are a falling low, and the segmental environment between the verb and object are the same. Yet, the final consonant of the verb differs. This is formalized below:

(26) a. ‘…ate us’



b. ‘…ate the belly’



The object pronoun again acts as a clitic[8] attaching to the verb.

However, the distribution of final devoicing cannot be fully explained prosodically. While in many cases, as in the examples above, the voicing contrast is clear, final devoicing also seems to apply within a phonological word when the following consonant is voiceless, i.e. as a sort of assimilation. An instrumental study measuring voicing on these consonants in various situations is needed to pinpoint the exact distribution of final devoicing.

An alternate analysis is to use coda devoicing to explain the data presented in this section, in addition to a voicing assimilation rule that only applies within a phonological word. Coda devoicing would apply in examples (23a–d), yet in (24a–d), a voicing assimilation process would occur because the verb and clitic pronoun are both within the domain of a single phonological word. In either analysis—final devoicing or coda devoicing—there are processes clearly sensitive to prosodic boundaries, indicated by the contrast in (26a–b).

3.3. Interaction with Tone

When the distribution of the consonant alternations discussed above is compared with that of downstep, patterns become clear. This is shown in Table 1.

Environment	Example		/H(L)H/:	Do L&S Apply?
Possessive Pronoun	lâk sám	‘my eye’	[H͡L H]	Yes
Demonstrative Pronoun	mvɛ́t lá	‘that oil’	[H H]	n/a
Object Pronoun	…fɛ́lɔ́m	‘…ate me’	n/a	Yes
wh-marker	…mvɛ́lɔ̀	‘(who saw) the oil?’	n/a	Yes
FUT marker	ndùlù?…	‘the cloud will…’	n/a	Yes
yes-no/rel. clause	…lák ꜜkí	‘(did I see) the eye?’	[H ꜜH]	No
Associative Construction	sáŋ ꜜmɛ́n	‘bird of child’	[H ꜜH]	No
Overt Object	…fɛ́t ꜜmɛ́n	‘…ate the child’	[H ꜜH]	No

Table 1: Correlation of consonant alternations with tone processes

The possessive, demonstrative, and object pronouns are all treated as clitics in this analysis, as they all trigger lateralization and spirantization. Additionally, H(L)H does not cause downstep in these same environments. Environments where lateralization and spirantization do not apply are the environments where /H(L)H/ does cause downstep. These involve the yes-no question marker, verbs with overt objects, and the associative construction. The cells marked as *n/a* indicate situations where we would not expect the proper environment for the alternation or tone sequence to arise, based on what we know of the phonology of the language.

If the lateralization and spirantization rules are analyzed as only occurring within the specific domain of the phonological word, we can now say that downstep is disallowed within this same domain.

[8]The pronouns in (24b–24d) all have a final schwa. This schwa is not pronounced when the pronoun is in non-final positions. Because clitics are represented as a syllable, the final schwa in these clitic pronouns would need to be treated extraprosodically.

3.4. Summary and Further Directions

This section has shown that the original problem with the application of Voorhoeve's downstep rule can be reconciled by expanding the analysis to include prosodic structure. A sequence of /H(L)H/, normally a trigger for downstep, is instead a trigger for a contour, not for downstep, when it occurs within a phonological word. Clitics are treated as syllables that attach to existing phonological words forming larger phonological words. Clitics in Medumba include various types of pronouns (possessive, demonstrative, object) as well as certain phonologically weak grammatical elements, such as a phrase-final *wh*-marker and the future tense marker.

A complete analysis would need to account for this prosodic parsing as there is some regularity in what types of grammatical elements are treated as clitics and what types are treated as words. The distribution of downstep indicates a constraint on downstep within a certain domain, in this case that of the phonological word.

4. Conclusion

To explain the processes of lateralization, spirantization, and downstep, we must make reference to the domain of the phonological word. Lateralization and spirantization occur only within this domain, while downstep is prohibited within this domain. Sequences of /H(L)H/ are realized as either [H͡L H] or [H H] within a single phonological word. An analysis of this sort makes ad hoc tone rules unnecessary to account for different surface representations of the same sequence among different grammatical constructions—this difference can now be treated prosodically. This also means that the associative construction in Medumba consists of two phonological words, as the lateralization and spirantization processes do not apply in this construction, and downstep does. As we continue to investigate the phonology of Medumba, we expect to find further processes that are sensitive to these same domains.

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