

FROM CONSONANTS TO DOWNSTEP IN PODOKO\*

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This paper examines the relationship between consonants and tone in yet another Chadic language. By positing various underlying tone patterns and a floating high tone in the associative construction, most of the tone changes become explainable. The data consist of 309 disyllabic nouns divided into nine subclasses on the basis of the tonal perturbations which occur in three different grammatical environments. In the process of describing these changes, several generalizations about consonants and tone receive added confirmation, including: voiced implosives acting like voiceless consonants, prenasalized voiced stops patterning with voiced stops instead of with nasals, the lack of influence of syllable-final consonants, and downstep influenced only by voiced non-implosive obstruents. On the other hand, Podoko emerges as one of the rare languages where downstep always precedes a low tone and never a high.

1. Introduction

This paper is a first attempt to explain the various tonal perturbations which occur in the Podoko language.<sup>1</sup> It shows the importance of consonant types in conditioning downstep, thus supporting the findings of previous linguists concerning the influence of consonants on tone. It is based on a corpus of 309 disyllabic nouns and their tone changes in three very different

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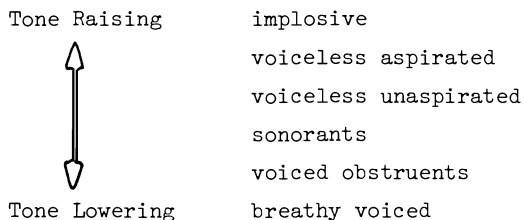
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<sup>1</sup>Podoko (Podokwo, Parəkwa) has been classified by Newman [1977] as belonging to the Mandara Group of the A Subbranch of the Biu-Mandara Branch of the Chadic language family. This language is spoken by about 20,000 people who live in the Mora District of the Northern Province of Cameroon.

grammatical environments.

## 2. Consonant Classes

Hyman and Schuh [1974:110] constructed the following continuum to summarize the tone raising or lowering effect of certain kinds of consonants:



Within the above hierarchy, sonorants are said to be neutral with respect to tone while implosives and voiceless consonants tend to raise tone and voiced obstruents and breathy voiced tend to lower tone [Hyman and Schuh 1974:106].

This grouping of tone classes will be reinforced by the following charts of the consonants from 309 disyllabic nouns in Podoko. The following letters will be used to symbolize the different groups of consonants:<sup>2</sup>

ɓ	for implosives /ɓ, ɗ/
p	for voiceless stops /p, t, ts, k, kw, ?/
f	for voiceless fricatives /f, s, h, hw, sl/
l	for liquids and semivowels /l, r, w, y/
m	for nasals /m, n/
b	for voiced stops /b, d, dz, g, gw/
v	for voiced fricatives /v, z, zl/
mb	for prenasalized stops /mb, nd, ndz, ng, ngw/ <sup>3</sup>

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<sup>2</sup>The orthographic diagraphs sl and zl represent the voiceless lateral fricative [ɬ] and the voiced lateral fricative [ɮ] respectively. A raised ʸ preceding a word represents the word-level prosody of palatalization.

<sup>3</sup>The prenasalized stops have been ordered last because of evidence that they have an even stronger "tone lowering" effect than the simple voiced stops [Hombert 1978:91].

Disyllabic nouns can be divided into four tone classes, with these in turn divided into a total of nine subclasses. Characteristics of these classes are presented in Table 4 (p. 137) and are discussed in detail in section 3. Briefly, the four main classes are based on underlying tone patterns (LL, HL, LH, HH), and the subclasses within these classes are based on differing tonal behavior of nouns with the same underlying tones within certain syntactic frames.

Table 1 shows the frequency of word initial consonant types (tone raising, neutral, and tone lowering) of the disyllabic nouns listed in the appendix. Each of the tone classes is given with one characteristic Podoko example. By studying Table 1 one can see a definite interrelationship between various tone classes and consonant types. Classes 2a, 2b, and 3c contain only words which begin with voiced obstruents. Classes 1a, 3a, 3b, 4a, and 4b, on the other hand, contain only a few exceptional words which begin with voiced obstruents. The obvious conclusion is that "tone-raising" and "neutral" consonants pattern together in Podoko over against the "tone-lowering" voiced obstruents. This observation will be reinforced when we examine the downstep rules in section 3.1.

Table 1 also adds weight to earlier observations that implosives, though voiced, pattern with voiceless consonants. Also prenasalized stops, though a combination of nasal and stop, pattern with the voiced stops and not with nasal consonants.

There exist two types of word patterns in Podoko for disyllabic nouns: two open syllables (CV.CV), and one closed and one open syllable (CVL.CV) where the first syllable is closed by either of the liquid consonants (L), /l/ or /r/, and the V of this syllable is limited to /ə/. These syllable final liquid consonants have no influence on tone. This agrees with the general observation by Hombert [1976:92] that the only consonants which can affect a tone while being syllable final are the laryngeals /ʔ/ and /h/. Table 2, therefore, will only refer to those word medial consonants which begin a new syllable.

Table 1: Initial Consonants

Tone Class	"Tone-Raising"			"Neutral"		"Tone-Lowering"		
	ḃ	p	f	l	m	b	v	mb
1a take 'thorn'	7	18	20	9	11	0	0	0
1b zəte 'sky'	2	3	3	1	4	20	14	8
2a vədə 'night'	0	0	0	0	0	15	16	10
2b vaga 'place'	0	0	0	0	0	21	19	5
3a dəfə 'fufu'	3	17	13	2	7	0	0	1
3b kəda 'dog'	1	11	5	3	6	0	0	0
3c buti 'a sauce'	0	0	0	0	0	4	4	0
4a kata 'sifter'	1	3	5	2	5	0	0	0
4b ʏtsaga 'cooking pot'	0	4	1	0	3	1	0	1

Though the medial consonants do not present such a clear-cut distinction as the initial consonants regarding voiced obstruents versus other consonants, close examination reveals that tone classes 2b, 3b, and 4b are overwhelmingly voiced obstruents, while classes 1a, 2a, 3a, 3c, and 4a contain only an exceptional voiced obstruent. Concerning these exceptions with medial consonants, perhaps a closer examination of voiced obstruents in class 3a will prove helpful. These three exceptions (marked with an asterisk (\*) in Table 2) are:

ʔuba 'tuber'  
 ʔuvə 'excrement'  
 ʔuzlə 'natural well'

The first syllable /ʔu/ is an unusual Podoko syllable type. Thus, the ex-

Table 2: Medial Consonants

Tone Class	"Tone-Raising"			"Neutral"		"Tone-Lowering"		
	ḅ	p	f	l	m	b	v	mb
1a takə 'thorn'	9	14	14	21	5	0	2	0
1b zətə 'sky'	4	4	1	17	8	5	6	10
2a vədə 'night'	9	4	5	16	7	0	0	0
2b vaga 'place'	0	0	2	1	0	22	10	10
3a dəfə 'fufu'	6	1	9	21	3	1*	2*	0
3b kəda 'dog'	0	0	1	1	1	8	11	4
3c buti 'a sauce'	1	1	0	2	1	0	1	2
4a kata 'sifter'	3	2	1	5	2	0	2	1
4b ytsaga 'cooking pot'	0	0	1	0	0	5	3	1

ceptional nature of the voiced medial obstruents in tone class 3a is paralleled by a highly unusual type of Podoko syllable. It thus seems reasonable to conclude that these three exceptions (and perhaps the other exceptions as well) are due to some as yet undetermined historical changes.

Our final table in this section will be a summary of Tables 1 and 2. By using a plus (+) to indicate voiced obstruents and a minus (-) to indicate all of the other consonants, we can summarize the consonant types of each syllable as in Table 3.

The reader is reminded that all the tables in this section have been based upon a corpus of 309 disyllabic nouns which can be found in the Appendix. It is also in the Appendix that one can find that the words in tone class 1b contain only three combinations of consonant types and not the four possibilities that might be expected from Tables 1 and 2. The importance of this correlation between tone classes and consonant types will become appar-

Table 3: Distribution of Consonant Types in Tone Classes

Tone Class	Consonant Type
1a takə 'thorn'	- -
1b { navə 'body' zətə 'sky' bidə 'bracelet'	- +
	+ -
	+ +
2a vədə 'night'	+ -
2b vəga 'place'	+ +
3a dəfə 'fufu'	- -
3b kəda 'dog'	- +
3c buti 'a sauce'	+ -
4a kətə 'sifter'	- -
4b ʔtsaga 'cooking pot'	- +

ent in the following section, where the tone perturbations of each sub-class are shown and explained.

### 3. Tone Changes

Now that we have seen that Podoko consonants pattern into two main groups, i.e. voiced obstruents and everything else, we are in a position to examine the effect of these consonants on tone. Basically, in Podoko, voiced obstruents can cause downstep while other consonants cannot. The following table will present the tone changes to be discussed in the rest of this paper. We have already examined the left part of the table in the preceding section. We now add a column where we posit an underlying tone pattern with disyllabic combination of high (H) and low (L) tones. The rest of the table con-

Table 4: Tone Changes

Tone Class	Consonant Type	Underlying Tone	à ndà ndè __ sèrá 'there are __ two'		Tone in Isolation	Associative Phrase hwédè __ 'stomach of __'
1a takè 'thorn'	- -	L L	2 2	2 1	2 2	2 2 1 2
1b { nave 'body' zètè 'sky' bidè 'bracelet'	- +	L L	2 2	2 1	2 2	2 2 1 3
	+ -					
	+ +					
2a vèdè 'night'	+ -	H L	1 2	2 1	3 3	2 2 1 3
2b vaga 'place'	+ +	H L	1 3	3 2	3 3	2 2 1 3
3a dāfè 'fufu'	- -	L H	2 1	2 1	{ 2 2 3 3 }	2 2 1 2
3b kəda 'dog'	- +	L H	2 1	3 2	3 3	2 2 1 3
3c buti 'a sauce'	+ -	L H	2 1	2 1	2 1	2 1 3 2
4a kata 'sifter'	- -	H H	2 1	2 1	2 1	2 2 1 1
4b ytsaga 'cooking pot'	- +	H H	2 1	3 2	2 1	2 2 1 1

sists of three basic tone frames with the phonetic pitch levels marked with numbers (1 for "high", 2 for "low", 3 for "downstepped low"). In the fourth column, which has the context à ndà ndè \_\_ sèrá 'there are two \_\_', the numbers on the left hand side indicate the tone on the noun, while the numbers on the right indicate the tone on the numeral sèrá 'two'. This context was chosen because it represents the most frequent tone changes. The tone of the preceding verb does not play a role. The tone of the following modifier must be a low tone in order to be downstepped (since high tones do not downstep in Podoko).

Careful observation of the preceding chart will show that all three tone

frames are needed to distinguish the nine tone sub-classes from each other. It should be admitted at this point that the underlying L-H pattern for class 3c is the least sure. Not only does this class undergo very unusual tone changes in the associative construction, but it consists of very few nouns (8 disyllabic nouns). Perhaps when this study can be broadened to include more data, the exact nature of these unusual changes will become more apparent.

3.1. General downstep. Downstep, the lowering of the entire tone register, is an often reported feature of African languages. In Niger-Congo languages, downstep is almost always limited to a H tone after a preceding H tone (symbolized H<sup>1</sup>H). This phenomena is the result of the common historical process of a HLH tone series, which first undergoes phonetic downdrift and then the loss of the intervening L tone [Schuh 1978:239]. Recently, however, downstepping L tones and downstep without downdrift have both been discovered in Dschang-Bamileke [Tadadjeu 1974]. It is interesting that the tone series H<sup>1</sup>L is possible in Dschang-Bamileke. In Podoko this same series is the major environment where downstep occurs. In fact, if one set aside the very exceptional nature of tone patterns in isolation, H<sup>1</sup>L is the *only* place downstep can occur in Podoko. Since we will show that downstep is predictable on the basis of voiced obstruents, we will call it phonetic downstep, which Schuh shows to be characteristic of several Chadic languages [Schuh 1971:31].

The nature of Podoko downstep can be seen in our first tone frame from Table 4 above. The following example is characteristic of tone class 1 (both a and b subclasses) where the underlying tone of LL for /tàkè/ 'thorn' does not change:

		<u>Tone Class</u>
(1)	à ndà ndè tàkè sèrá	'there are two thorns'
	2 2 2 2 2 2 1	1a
	be be thorn two	

The first word in the above sentence is a grammatical marker that distinguishes the non-narrative perfective or non-imperative verbs. The numbers under the vowels refer to the tone on the syllable and correspond to the numbers in Table 4 above.

Perhaps the best place to see the influence of downstep is in the follow-



ing two examples from tone classes 2a and 2b.

		<u>Tone Class</u>
(2)	à ndà ndè véððè sèrà 2 2 2 1 2 2 1 be be night two	'there are two nights' 2a
(3)	à ndà ndè vá'gà sèrà 2 2 2 1 3 3 2 be be place two	'there are two places' 2b

Assuming, as we do, that both of the nouns /véððè/ 'night' and /vá'gà/ 'place' have an underlying HL tone pattern, we need to explain the downstepping of the tone register which occurs in example (3) but not in (2). The downstepped L tone (symbolized ' ) occurs on the second syllable of /vá'gà/ and is realized phonetically on the tone level 3. The fact that this is a downstepping of the entire tone register and not just a temporary lowering of a low tone is seen in the phonetic tones 3-2 on the numeral /sèrà/ 'two'. In example (2) which doesn't have downstepping the phonetic tones of /sèrà/ are 2-1. The reason why nouns from tone class 2b are downstepped in this environment and tone class 2a nouns are not is found in their consonant types. While both tone classes begin with voiced obstruents, only tone class 2b has voiced obstruents in the second syllable. It is precisely these voiced consonants on the second syllable, *together with a HL tone pattern*, which causes downstep. This rule might be formalized as follows:

$$L \rightarrow 'L /_N [ C \quad V \quad \left( \begin{array}{c} 1 \\ r \end{array} \right) C \quad \text{---} ]_N$$

$$\left[ \begin{array}{l} [+H] \\ [+vd.] \\ [+obst] \\ [-impl] \end{array} \right]$$

This rule says that a L tone becomes a *downstepped L* whenever it is preceded by a high tone in the same noun (symbolized by N subscripted to the bracket sign) and is preceded by a voiced obstruent.

We are now ready to look at classes 3 and 4. The noun /ðáfá/ 'fufu' (tone class 3a) will be given as representative of the tone changes in classes 3a, 3c, and 4a and the noun /kèðá/ 'dog' (tone class 3b) as representative of the tone changes in classes 3b and 4b. The two contrasting tone patterns are:

			<u>Tone Class</u>
(4)	à ndà ndè dáfé sèrá	'there are two (servings of) fufu'	3a
	2 2 2 2 1 2 1		
	be be fufu two		
(5)	à ndà ndè kèdá 'sèrá	'there are two dogs'	3b
	2 2 2 2 1 3 2		
	be be dog two		

In the above examples, the underlying LH tone pattern on both nouns does not change, but /kèdá/ causes a downstep to be found before the following adjective (once again indicated by the phonetic 3-2 on /sèrá/). It is significant that in this case as well, the downstep occurs between a H and L tone even though a word boundary is involved. And as usual, the consonant of the second syllable of the disyllabic noun must be a voiced obstruent. This rule could be formalized as follows:

$$H \rightarrow H^l / \text{N} [ \text{C V} \left( \begin{array}{c} | \\ r \end{array} \right) \text{C} \text{---} ] \text{N} \text{C V} \\ \left[ \begin{array}{l} +\text{vd.} \\ +\text{obst} \\ -\text{impl} \end{array} \right] \quad \quad \quad [-\text{H}]$$

This rule says that a H tone is changed to a *downstepping H* (H followed by a downstep) whenever it occurs on the second syllable of a disyllabic noun, is immediately preceded by a voiced obstruent, and is followed by a L tone syllable.

It should be mentioned here that the L tone (2) found on the first syllable of class 4 nouns in this environment is beyond present explanation. We have posited an underlying HH pattern for class 4 nouns on the basis of their behavior in the associative construction (described in section 3.2. below), yet they behave like LH nouns before the adjective /sèrá/ as below:

			<u>Tone Class</u>
(6)	à ndà ndè kàtá sèrá	'there are two sifters'	4a
	2 2 2 2 1 2 1		
	be be sifters two		

Perhaps further analysis will bring to light the reason why H goes to L in this environment.

To summarize our findings in this section, we can say that downstep in environments like that preceding /sèrá/ 'two' are caused by the following two factors together:

1. Second syllable of noun must begin with a voiced obstruent.
2. There must be a HL pattern either within the noun or between noun and following word.

If these conditions are met, a downstep is inserted between the H and L tone. These seem to be the most general conditions for downstep. Downstep will also be mentioned in the following sections, but it is a downstep influenced by the peculiar tonal properties of the associative construction and of nouns in isolation.

3.2. Associative high tone.<sup>4</sup> The associative (noun-noun) construction is characterized by a floating H tone between the two nouns. The behavior of this tone and its consequences for downstep are the focus of this section. The Podoko floating H tone almost always docks<sup>5</sup> to the right, thereby influencing the tone of the second noun. We shall save until the end of this section the exceptional case of class 3c where the floating tone docks to the left. The first noun of an associative construction never undergoes tonal change except when the second noun is from tone class 3c.

The nouns in tone class 1 with an underlying LL pattern provide our most straightforward examples. The first noun in an associative construction maintains its isolation tone pattern (described in section 3.3 below). We will use the head noun /hwədɛ/ 'stomach' which translates 'the inside of' with another noun. The tone of the **second** noun changes in the following examples from LL to either HL or H<sup>1</sup>L:

			<u>Tone Class</u>
(7)	hwədɛ      tákà 2 2      1 2 stomach thorn	'the inside of the thorn'	1a
(8)	hwədɛ      ná'và 2 2      1 3 stomach body	'the inside of the body'	1b

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<sup>4</sup>This section deals only with head nouns in the singular. When the head noun is plural an associative marker /dǎ/ is manifest, e.g.

tǎgwàkì      dá màrà      'mother's sheep'  
sheep (pl.) of mother

<sup>5</sup>The "docking" of floating tones is described in Goldsmith [1976:46].

			<u>Tone Class</u>
(9)	hwədǎ zǎ'tà 2 2 1 3 stomach sky	'the inside of the sky'	1b
(10)	hwədǎ bǎ'dǎ 2 2 1 3 stomach bracelet	'the inside of the bracelet'	1b

It is crucial that only example (7) above ends on a regular L tone, the other three ending on a downstepped L tone. Example (7) is also the only one where *neither* syllable contains a voiced obstruent. We thus have the case that downstep occurs in the second noun of an associative construction whenever *either* of its syllables contains a voiced obstruent. This contrasts with our more general cases of downstep (described in 3.1 above) where downstep was only triggered if a voiced obstruent occurred in the *second* syllable. It is crucial here that Podoko does not allow contour tones. Thus, when the floating H tone docks on the LL pattern, the resulting HLL pattern must be realized as level tones on two syllables. Thus the first syllable takes the floating H tone and the second syllable the underlying LL pattern, which is changed to DL as in the following schema:

$$/X H L L/ \rightarrow X H \overline{D L} \rightarrow X H \overline{D L}$$

$$1 2 2 \quad 1 3 2 \quad 1 3 3$$

The above schema reflects the fact that any L tone following a D tone is always realized on the same level.

Tone classes 2 and 4 may or may not take a floating H tone. Since these classes begin with an underlying H tone which can absorb the floating H tone, it is impossible to tell if the floating tone is actually there. However, for the sake of overall consistency, we posit a floating H tone which docks to the right producing HHL (class 2) and HHH (class 4) patterns, which are realized HL and HH because of the Podoko restriction against contour tones. Once again, downstep occurs whenever a HL pattern occurs with a voiced obstruent on *either* syllable as below:

			<u>Tone Class</u>
(11)	hwədǎ vǎ'dǎ 2 2 1 3 stomach night	'the inside of the night'	2a

			<u>Tone Class</u>
(12)	hwàdǎ vá'gà 2 2 1 3 stomach place	'the inside of the place'	2b
(13)	hwàdǎ kátá 2 2 1 1 stomach sifter	'the inside of the sifter'	4a
(14)	hwàdǎ ʔtságá 2 2 1 1 stomach cooking pot	'the inside of the cooking pot'	4b

The most drastic changes resulting from the associative H tone occur in tone class 3. Within this class, the tone docks in two different directions producing two different results. The more "normal" cases of classes 3a and 3b are given below:

			<u>Tone Class</u>
(15)	hwàdǎ dáfà 2 2 1 2 stomach fufu	'the inside of the fufu'	3a
(16)	hwàdǎ kǎ'dà 2 2 1 3 stomach dog	'the inside of the dog'	3b

It should be remembered that the above examples have second nouns with an underlying LH pattern. When the floating H associative tone docks to the right, this produces HLH pattern. This poses a problem for Podoko, since there are only two syllables for these three tones and Podoko does not permit tone glides. Most downstepping languages, faced with a similar problem, would convert HLH to H<sup>1</sup>H. Podoko does not. Instead, the final (underlying) H tone is dropped resulting in a HL pattern. This HL pattern is then downstepped in the case of tone class 3b with voiced obstruents, but left unmodified in class 3a with no voiced obstruents.

This leaves the unusual case of tone class 3c, shown below:

			<u>Tone Class</u>
(17)	hwàdǎ ʔbùtǎ 2 1 3 2 stomach a sauce	'the inside of a sauce'	3c

It seems that in the above case, Podoko docks first to the right giving a HLH pattern for two syllables. Then instead of dropping the final H tone like

classes 3a and 3b, class 3c reassigns the tones from the right. This results in the floating H associative tone being reassigned to the first noun, replacing the second tone of the first noun. Once again, since class 3c has a voiced obstruent, downstep takes place. Because of the reassignment of tones, however, this is the only associative construction where downstep occurs on the first syllable of the second noun.

In conclusion, the special nature of the associative construction with its floating H tone results in the broadening of our downstep rule, *in this specific environment*, to be triggered by a voiced obstruent in *either* syllable instead of just the second syllable.

3.3. Nouns in isolation. Of all the tone changes, nouns in isolation are the most difficult to predict. Only class 1a, 1b and the exceptional 3c are pronounced in isolation with their underlying tone pattern. Everything else seems to be an exception to the rules we have posited for the same nouns in context. Perhaps the most difficult is the 3-3 tone pattern of classes 2a, 2b, and 3b. These classes seem to have in common three factors:

1. an underlying H tone
2. an underlying L tone
3. a voiced obstruent on the H syllable

Though these are the same factors common in our other downstep rules, they are here without any apparent ordering. Thus, the LH of class 3b downsteps like the HL of classes 2a and 2b. As in the associative construction, the voiced obstruent can be on either syllable, being on the first in 2a, the second in 3b, and on both in 2b. What is unusual is that the underlying H tones are deleted and the downstep feature moved to the front of the word, as below:

			<u>Tone Class</u>
(18)	'və̀dà̀ 3 3	'night'	2a
(19)	'và̀gà̀ 3 3	'place'	2b
(20)	'kə̀dà̀ 3 3	'dog'	3b

Of all the tone patterns, the tone of class 3a nouns in isolation is most

in limbo. Sometimes these nouns are pronounced 2-2 like class 1 nouns, sometimes 3-3 like class 3b nouns, and sometimes they have an intermediate unique 2-3 pattern. While the underlying pattern of 3a is LH, there are no voiced obstruents. The ambivalence of class 3a nouns between low and downstepped L patterns thus seems to be an extension of downstepping beyond syllables beginning in voiced obstruents, at least in isolation forms.

The exceptional class 3c is realized in isolation as its underlying LH pattern. Thus this pattern is exceptional in isolation a bit the same way as it was exceptional in the associative phrase. In all its environments, class 3c nouns adhere rigidly to their underlying LH pattern resisting other influences. This rigid adherence to the underlying pattern in all environments makes them exceptions.

Once again, tone class 4 nouns prove to be inexplicable. From an *underlying HH pattern* they develop a 2-1 pattern in isolation, as below:

			<u>Tone Class</u>
(21)	kàtá 2 1	'sifter'	4a
(22)	ʸtsàgá 2 1	'cooking pot'	4b

About all that can be said concerning these exceptional changes is that they are the same as the exceptional changes which these nouns underwent in section 3.1 above. In both cases, a L tone appears on the first syllable.

An alternative analysis of class 4 nouns could have been presented. Instead of giving them an underlying HH pattern, we could have given them an underlying LH pattern and called them classes 3d and 3e. This would solve the problem of the unidentified L tone on the first syllable in isolation. Unfortunately, however, it would make our analysis of the associative construction much more complex. We would end up with five subclasses of an underlying LH pattern that do three different things in the associative construction. These differences could not be attributed to underlying tone differences or to consonant types since classes 3a and 3b have the same consonant patterns as classes 4a and 4b. For these reasons we are presently postulating an underlying HH pattern for class 4 nouns.

#### 4. Conclusion

This paper has added support from one additional language to several generalizations that have been observed by various linguists. First, implosive consonants, though voiced, pattern with voiceless consonants when influencing tone. Second, prenasalized voiced stops pattern with voiced stops, and not with nasal consonants, when influencing tone. Third, the tone-lowering effect of consonants is limited to voiced non-implosive obstruents. Fourth, syllable-final consonants (only /l/ and /r/ in Podoko) have no effect on tone.

With respect to the language specific properties of Podoko, we have observed that the so-called "neutral" consonants pattern with the voiceless consonants. We also saw that downstep is limited even in its most general application to specific tonal as well as consonant environments. All voiced obstruents do not always result in downstep. It is only when voiced obstruents combine with a HL tone pattern that downstepping occurs. We also examined the nature of the floating H tone associative marker, and observed the various results when it docked to the right.

In this paper we examined 309 disyllabic nouns and their tone perturbations in three separate environments. We have seen that downstep resulting from the combination of voiced obstruents and a HL tone pattern with slight modifications in the presence of a floating associative tone, have explained the vast majority of these tone changes. One is seriously tempted to analyze the entire system as consisting of underlying H and L tone and a few "phonetic downstep" rules. There are various tone changes which still lack explanation, however. Perhaps when a wider corpus is established which includes changes in the verb phrase, a consistent overall analysis will become evident. In the meantime, the role of voiced obstruents in triggering downstep is an important first step.



## APPENDIX

## List of Nouns by Tone Classes

The + sign indicates that a syllable begins in a voiced obstruent, the - sign that it begins in some other consonant (cf. Tables 3 and 4).

Tone Class la (- -)

bəsə	'thigh'	ʔʔusa	'a tree'
ʏbakwə	'a place' <sup>6</sup>	səpa	'next year'
ḅelma	'gravestone'	ʏsəwa	'last day of funeral'
ḅurə	'salt'	sakə	'rope'
dəya	'bird'	safi	'chaff'
dawa	'a game, kneecap'	suba	'brisket'
dirə	'beans'	susa	'greeting'
pəhwə	'flour'	ʏsuti	'a grass'
ʏpəhi	'beer'	ʏsula	'trip'
ʏpəwi	'a grass'	haslə	'termite'
padā	'goat's beard'	hayə	'earth'
patsa	'sun'	hwəḁə	'stomach'
take	'thorn'	hwətse	'ashes'
təwa	'a measure'	ʏhwəli	'cloud, a tree'
ʏtusi	'a soft rock'	hwadḁə	'wind'
ʏtsətse	'flea'	sləḁə	'meat'
tsaki	'poison'	ʏsləsli	'egg'
ʏkəlfə	'fish'	sləmə	'ear'
kayə	'house'	slaslə	'bone'
kwəma	'mouse'	slala	'neighborhood'
ʏkwəri	'urine'	slirə	'teeth'
kwara	'neck'	ləḁə	'pus'
kwari	'law'	layə	'a charm'
ʔuba	'breast'	ʏlaki	'sugar cane'

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<sup>6</sup>When the indefinite article appears in the definition it indicates 'a specific kind of \_\_\_'.

ɣlutɕə	'hearth'	mayə	'hunger'
lufə	'handle'	mamə	'honey'
rəhə	'saliva'	mutə	'sacrifice'
ɣrəwə	'cow manure'	muva	'lap, retaining wall'
raslə	'brain'	muvə	'sickle'
wadɑ	'weevil'	murə	'a plant'
məkwa	'boundary'	ɣmumi	'beard'
madi	'stream bed'	ɣnatsa	'birth place'
malə	'oil'		

Tone Class 1b (- +)

βərzi	'joint'	ɣsluzə	'cotton'
ɖizla	'wrist'	sləndzi	'best friend'
ɣtembi	'a spice'	ɣəngwə	'water pot'
tuvə	'a place'	ɣmandza	'a wasp'
ɣkadə	'granary'	mingwə	'mosquito'
hala	'level area'	navə	'body'
	(+ -)		
βərkwə	'blanket'	virə	'bedroom'
ɣbəlma	'potash'	ɣvula	'mollusk'
ɣbudɑ	'bubble'	zətə	'sky'
bayə	'chosen brother'	ɣzəhi	'a tree'
dələ	'threshing floor'	zələ	'a hawk'
dərmə	'a fruit'	zəma	'roofing of stalks'
dama	'sibling'	zara	'area underneath roof'
duli	'sweet beer'	ɣzani	'spoon-shaped calabash'
dzakwə	'hat'	ɣzawa	'cow's tail'
gəɖɑ	'a game'	zubi	'marrow'
gərə	'a contemporary'	zlaya	'justice'
gəma	'debt'	mbela	'unweaned child's younger sibling'
ganə	'squirrel'	ndərə	'peanuts'
ɣganə	'a tree'	ndadi	'raindrop'
vari	'muzzle'		

yndzəwə	'fly'	yndzərə	'sleep'
ndzawi	'immature peanut'	ngwətse	'hair'
	(+ +)		
banda	'grilled fish'	Ygwada	'a mouse'
bangwə	'a hairstyle'	Yzembə	'navel'
bida	'bracelet'	zlibə	'pocket'
ybuzli	'small granary'	Yndərngə	'stingy person'
dəngə	'beam'		

Tone Class 2a (+ -)

bəfə	'lungs'	vulə	'bed bug'
ybara	'a game'	zəkwe	'smoke'
buta	'gap between teeth'	Yzərwə	'shame'
dəwə	'girl'	Yzəmə	'a mouse'
Ydəsə	'bronze'	zulə	'priest'
dirə	'a garment'	Yzulə	'a flute'
dina	'religion'	zlərə	'a fly'
dzəmi	'stalks tied together'	zləmə	'stable'
dzərə	'mortar'	zlaḽi	'left-handed person'
Ydzəka	'border'	zlaḽa	'suffering'
gasa	'forced work'	mbəḽa	'couch-grass'
gana	'price'	Ymbəli	'sore'
giwa	'hut'	mbaya	'spotted animal'
gwəlmə	'a tree'	Ymbabə	'planting stick'
gwadi	'word'	Yndərda	'anus'
vəḽə	'night'	ndula	'wild cat'
vəhwə	'field'	Yndzana	'a horn'
vəyə	'rainy season'	ngabə	'crowd'
Yvəlke	'calf'	ngwəlfə	'blind person'
vara	'relative'	Yngwəḽi	'okra'
vira	'rabbit'		

Tone Class 2b (+ +)

bəngwi	'a sauce'	baba	'father'
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ɣdɛlgwə	'youth'	vadi	'plain'
daba	'hunchback'	vazi	'immature corn'
dagwa	'a monkey'	zəga	'a tree'
dangi	'cane'	zəngwa	'small field'
ɣdzəba	'tribe'	ɣzəbɛ	'distant relative'
ɣdzədzɛ	'parent-in-law'	zadə	'threshing stick'
dzazli	'muddy deposit'	ɣzaza	'a tree'
dzangɛ	'mountain'	zinda	'glutton'
ɣdzuvi	'grave'	zləba	'froth'
gənda	'robber'	zləbi	'falcon'
gaha	'a tree'	zləgwɛ	'leather garment'
gaga	'termite mound'	zlərgwa	'axe'
gazla	'a sauce'	ɣzləhi	'corn leaves'
gwədi	'a tree'	zlagwa	'feather'
gwəgwɛ	'cushion'	zlangwɛ	'natural grinding stone'
gwəmba	'frog'	ɣzlamba	'corner'
gwagwa	'back'	mbəlvɛ	'bull'
gwazla	'spotted animal'	ndərzla	'a portion'
gwanda	'green stalk'	ndzuvɛ	'hay'
vəngwɛ	'mouth'	ngwəzi	'rising smoke'
ɣvəgɛ	'hole'	ngwərə	'an insect'
vaga	'place'		

Tone Class 3a (- -)

dəwa	'a tree'	taya	'beads'
dəfɛ	'fufu'	karɛ	'fire'
dəla	'sauce'	kəwɛ	'calabash'
ɣpərsa	'horse'	kwɛla	'pipe'
ɣpatɛ	'g-string'	kwərə	'rock'
tərba	'mud'	kwədɪ	'worm'
tərə	'poorly-fired pottery'	ʔuba	'tuber'
təra	'moon'	ʔuvɛ	'excrement'
təyɛ	'large water pot'	ʔuzlə	'water hole'
ɣtəbɛ	'shiny ornament'	ʔusla	'arrow shaft'

fudá	'amusement'	Yhwase	'straw'
səwə	'well'	Ywədə	'spear handle'
Ysəsə	'shadow'	yəwə	'water'
Ysəmə	'high rock wall'	maya	'slave'
Ysapə	'small calabash'	mama	'mother'
sifi	'life'	muma	'a tree'
sirə	'jealousy'	nəsə	'woman'
sluli	'madman'	nafə	'tree'
həwa	'rain maker'	naslə	'village'
həyə	'guinea corn'	nawə	'goat'
harə	'arm'	mbulə	'tamarind'
Yhwəli	'twin'		

Tone Class 3b (- +)

ḃəlvə	'a tree'	sləva	'suitor'
pani	'stalk'	hengwa	'miser'
Ytəvə	'path'	Yhwərbə	'sister-in-law'
Ytəza	'guinea worm'	hwazli	'wild onion'
tagwi	'sheep'	regwa	'manure'
tuzlə	'long-necked water pot'	randza	'scorpion'
kədə	'dog'	rangə	'walled-in threshing floor'
kəwə	'calabash'	məgə	'idiot'
kamba	'bush area'	məza	'fat'
kwəza	'sickness'	Yməzə	'brown-colored animal'
kwəzlə	'darkness'	məzla	'sorcerer'
kwiha	'leather sack'	Ymadə	'sorceress'
Ysəgə	'leg'	muda	'field near home'

Tone Class 3c (+ -)

buti	'a sauce'	Yvərndə	'baby'
Ydzəli	'type'	zlana	'paradise'
Ydzadə	'ring'	zlazla	'corn sucker'
gawə	'medicine man'	zlambi	'wing'

Tone Class 4a (- -)

ḡule	'fufu stuck to pot'	sumə	'an insecticide'
ʏpapə	'foreleg'	ladā	'custom'
kata	'sifter'	yala	'family'
ʏkwərḡə	'a plant'	ʏməza	'cooked beans'
file	'elephant'	mirə	'dew'
hinda	'intestines'	muze	'blood'
səli	'money'	ʏmuni	'soot'
sabā	'bracelet'	nəhwa	'chief's daughter'

Tone Class 4b (- +)

pəgwi	'a place'	mubə	'torso'
ʏtsaga	'cooking pot'	muve	'sickle'
ʏkərŋə	'a grasshopper'	nava	'slave'
ʔifa	'a grasshopper'	dagwa	'tuberculosis'
ʏsladə	'a flute'	ndərza	'a tree'

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