



Tonal Processes in Ñkòròò (Kirika)

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ABSTRACT

About sixty to seventy percent of the world’s languages are tonal. The majority of African languages are either tonal or tonal-accent languages. The most outstanding characteristic of tones in African languages is their independence with respect to their tone bearing units. Just as tone bearing units or speech sound segments are modified in certain definable environments, tones are also modified in certain phonetic environments giving rise to tonal processes. This paper discusses seven tonal processes that are evident in Ñkòròò, an Eastern Ìjò language belonging to the Niger-Congo phylum. Ñkòròò is a register tone language having high and low tones in addition to a downstepped high tone. The tonal processes include tone stability, tone elision, tone assimilation, tone dissimilation, tone copying, tone replacement, and tone metathesis. The autosegmental phonology theory that treats tones as autonomous segments was employed to provide a graphic illustration of the tonal processes. The major findings reveal that tone stability results in floating low tones and syllabic nasals, tone elision give rise to an unusual CRV syllable structure, and tonal processes are instrumental to the construction of various grammatical units such as nominal constructions, verb inflections, imperative verb forms, reduplicants, and coordinating conjunctions. The paper concludes that tonal processes in Ñkòròò are conditioned by both the phonetic environment and grammatical constraints.

Keywords:

Ñkòròò, Ìjò, tonal processes, tone stability, and tone-syntax interface.

1. Introduction

Tone is a suprasegmental feature that employs the pitch of the voice in signifying lexical and grammatical meanings. It can be used to mark prosodic domains in the word, phrase, or utterance and to distinguish between sentence types (Hyman 2013, p. 24). About sixty to seventy percent of the world’s languages are tonal (Yip, 2002). These languages are mostly found in Africa and Asia. According to Yip (2002, p.1), a language is a tone language "if the pitch of a word can change the meaning of the word." In tone languages, pitch can be used to distinguish word meanings (that is, lexical function) or to convey grammatical distinctions

(that is, grammatical function). Hence, tone is the use of changes in pitch to indicate lexical or grammatical meaning. Each syllable in a word carries its own tone. Tones are marked on tone-bearing units which include vowels and syllabic nasals.

The majority of African languages are either tonal or tonal-accent languages. The commonest tone system opposes two distinctive levels; high (H) and low (L), and often allows two or more of these tones in succession on a single syllable, creating contour tones. African languages employ both level and contour tones giving rise to register tone languages and contour tone languages

respectively. The most outstanding characteristic of tones in African languages is their independence with respect to their segmental support. Tones behave very much as though they exist separately from the sound segments that bear them. This is the foundation of tone stability. Hence, a tone may survive after its tone bearing unit has been deleted. Other tonal phenomena typical of African tone systems include, tone melodies, floating tones, tone shift, downstep, downdrift, etc.

Nkọrọọ is an Eastern Ijọ language spoken in the Niger Delta region of Nigeria, West Africa. It is coordinate with the dialect cluster of Kalabari, Ijani, and Kirikẹ (Jenewari, 1989; Williamson and Blench, 2000). Although they are known as Nkọrọọ (Nkoro) in official documents, the people refer to themselves and the language they speak as Kirika. Kirika was their forefather who led the migration out of the present day Bayelsa state, Nigeria, to Opobo/Nkọrọọ local government area in Rivers State, Nigeria, where they are presently located (Obikudo, 2013, 2022). Nkọrọọ operates a register tone system that is made up of two level tones; high (H), ['] and low (L), [ˉ] plus a downstepped high otherwise known as a downstep [̋]. The downstep is a phenomenon whereby a high tone is lowered in the absence of any low tone in the phonetic representation. This non-surfacing low tone that causes the downstep is referred to as a floating tone. Therefore, a downstep can also be described as non-automatic lowering of a high tone due to the presence of a floating low tone. In the Ijọ orthography, the low tone is left unmarked, while the downstepped high tone is marked with a macron (ā). In this work however, all tones are phonetically marked and all consonant and vowel segments are also phonetically transcribed using the International Phonetic Alphabet (IPA). In Nkọrọọ (Kirika), the level tones contrast in lexical items. However, when words come together in larger grammatical units, such as phrases, clauses, and sentences, tonal behavior is not often predictable. This is because tone tends to act independently of the syllables that bear them. This paper investigates the processes that characterize tonal behavior

in Nkọrọọ within the word and in domains that are larger than the word (that is, across morpheme/word boundaries). Seeing that tone plays a role in the grammar of languages, a linguistic description of the tonal behavior in these linguistic domains will shed light on how the tonal interfaces are realized and conditioned in Nkọrọọ.

2. Theoretical framework

This study takes its theoretical underpinning from the Autosegmental Phonology model (Goldsmith, 1976, 1990). Within the autosegmental framework, tone as well as other articulatory parameters such as voicing, aspiration, and nasalization are treated as autonomous units from the sound segments that bear them (Katamba, 1989). Tones are capable of undergoing processes independent of their tone bearing units. They can survive the deletion or loss of syllabicity of a tone bearing unit, exhibiting a stability that proves their autonomy. Although tone stability is not a universal phenomenon, it provides evidence for the treatment of tones as autonomous segments.

The organization of phonological representations within autosegmental phonology is arranged on different tiers. The elements on the tiers are linked by association lines that enable a one-to-one mapping such that tones can be mapped onto their tone bearing units. This representation also makes it possible for one to show when a tone is not linked to any tone bearing unit, as in floating tones, or when a tone is disassociated or delinked from its tone bearing unit via phonological processes such as elision. An unbroken association line indicates an existing association, a crossed association line indicates a delinked association, while a dashed association line indicates a new or relinked association. The principles that determine the association of elements on each tier are constrained by the Well-Formedness Condition (WFC) which specifies that each vowel must be associated with at least one tone and vice versa, and disallows the crossing of association lines (Goldsmith, 1976, 1990; Katamba, 1989). Autosegmental phonology also incorporates the

Obligatory Contour Principle (OCP) that disallows the co-occurrence of two adjacent identical tones except when they are separated by a word boundary.

3. Tonal processes in Nkɔ̀rɔ̀ɔ̀

The peak of each syllable in Nkɔ̀rɔ̀ɔ̀ always bears a tone. Therefore, tone is the deciding factor for identifying a syllable. Just as sound segments are modified in certain definable environments, tones are also modified in certain phonetic environments. These modifications are known as tonal processes. Tonal processes cause changes at the suprasegmental level. They include tone stability, tone assimilation (spreading), tone dissimilation, tone elision, tone copying, tone replacement, and tone metathesis.

3.1 Tone stability

Tone shows a kind of stability that cannot be accounted for if it is assumed to be an integral part of the phonological segment (that is, the consonant or vowel segment) on which it appears in the phonetic representation. In many languages, when an underlying tone bearing segment is either deleted or becomes non-syllabic and loses its ability to bear tone, the tone still survives and surfaces on an adjacent syllable. The fact that tones can survive either the deletion or loss of syllabicity of the sound segments that bear them is one of the evidences

of their tone autonomy and an argument for the autosegmental approach.

In Nkɔ̀rɔ̀ɔ̀, it is not always the case that tone gets deleted along with its tone bearing unit. Sometimes a tone may remain as the sole realization of a grammatical particle after the original consonant and vowel disappear, so it can only be heard by its effect on other tones. Generally in languages, this process of tone stability may result in a downstep, or it may combine with other tones to form contours. In Nkɔ̀rɔ̀ɔ̀, a low tone may remain as a floating tone after the tone bearing unit is deleted. The floating low tone affects the following high tone thereby resulting in a downstepped high tone. Tone stability may be observed within the word as seen in example (1) where the vowel in the second syllable is deleted but its low tone remains, unassociated to any sound segment in the phonetic representation. This causes the following high tone to be downstepped. An autosegmental analysis giving a graphic representation of this process is given below. The number of tones on the tonal tier remains the same after the vowel in the second syllable has been deleted while the number of syllables on the syllable tier is reduced to four.

- (1) a. jésìmókùlá → jés̩mókùlá 'after'
 - b. lásìmókùlá → lás̩mókùlá 'after'
- (informal use)

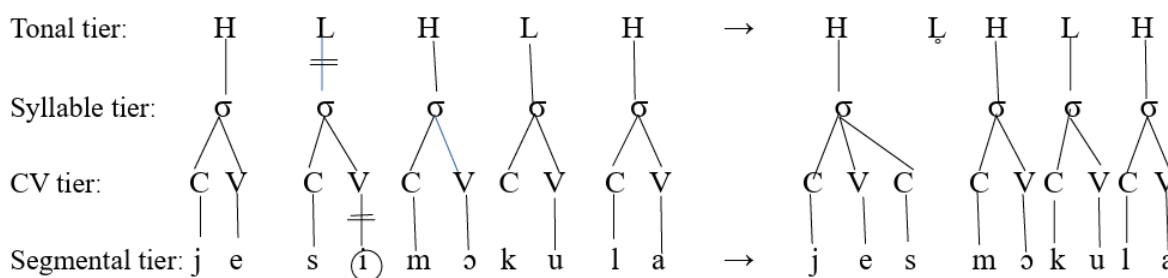


Fig. 1: Tone stability within the word resulting in a floating low tone

Tone stability within the word may also be observed in cases where word-final vowels are deleted but their tones are retained on the preceding nasal, making it syllabic. Such words must contain a final CV syllable where the C is a nasal (N) as seen in example (2a, b & c). An autosegmental representation of example (2a) is given in figure 2 below.

- (2) a. mú → m̩ 'the', 'future time marker'

tier and tone stability. It is also possible for a tone bearing unit to be deleted in a word or a construction (that is, across morpheme or word boundaries), along with its tone. The deletion of the tone bearing unit and its tone within the word is usually due to a speaker's pronunciation in rapid speech. In examples (4a & b), the last CV syllable is deleted along with its tone. The process begins with the deletion of the intervocalic consonant, creating a vowel hiatus.

Eventually, the vowel and its tone are also deleted. In examples (4c – e), only the tone and its tone bearing unit are deleted (that is, a vowel or syllabic nasal). The resultant consonant cluster in examples (4c & d) is an unusual syllable structure in the language that points to the domain that constrains the deletion process. Hence, a vowel and its tone may be deleted when occurring between a stop and a rhotic as shown in figure 4.

- Tone elision within the word
- (4) a. -sùkù → -sù → -sù 'perfective aspect'
 b. mí⁺mí → mí⁺í → mí 'this'
 c. íkùrú → íkrú 'crawl'
 d. pàràpàrà → pràprà 'be sweet'
 e. òdè → dè 'accusative'

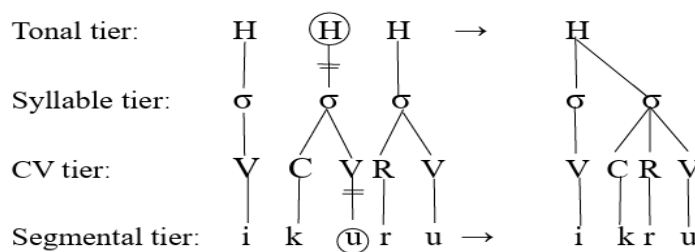


Fig. 4: Tone elision within the word resulting in CRV syllable structure

Tones may also be deleted across morpheme boundary, alongside their tone bearing units as observed in example (5). In example (5a), the low tone on the last syllable of the first morpheme is deleted as well as the vowel which forms the first syllable of the second morpheme. Its high tone reassociates with the preceding syllable whose low tone has been deleted as

represented in figure 5. The reverse occurs in example (5b) where the vowel of the first morpheme (which is monosyllabic) is deleted and its high tone gets reassigned to the first syllable of the second morpheme whose low tone has been deleted. In both cases, it is the low tone that gets deleted and the high tone that is reassigned at morpheme boundary.

- (5) a. mí⁺ò (H L) + ókù (H L) → mí⁺ókù (H H L)
 'here' 'time' 'now'
 b. mí (H) + àngà (L L) → mángà (H L)
 'this' 'corner' 'here'

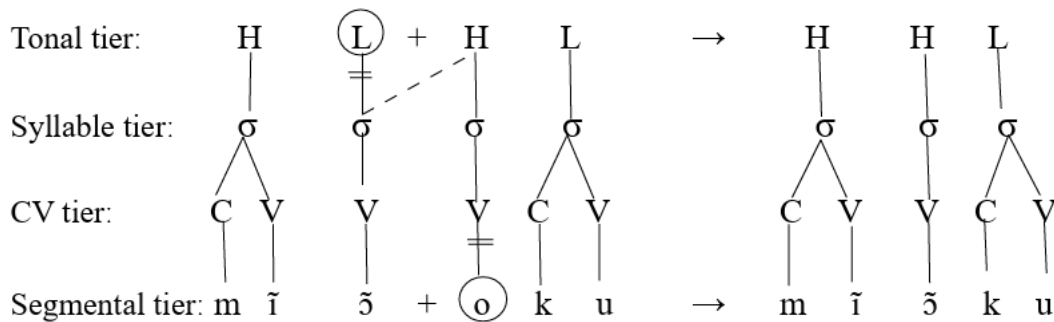


Fig 5: Tone elision across morpheme boundary

3.3 Tone assimilation

Tone assimilation is a process that refers to a situation where one tone becomes more like or even identical to another tone near it. This means that a tone that is associated with one vowel may spread to an adjacent vowel or vowels. It also means that a tone can be raised or lowered when it occurs in the environment of a higher or lower tone. Tone assimilation can be either anticipatory or perseverative. In terms of direction, tone assimilation can be classified as either vertical or horizontal. In vertical assimilation, tones are either raised in the environment of a higher tone or lowered in the environment of a lower tone. In other words, the affected tone assimilates the pitch height of the motivating tone. Thus, in an anticipatory vertical assimilation, a tone is typically raised before a higher tone. For instance, a low tone may become a mid tone when it precedes a high tone. In a perseverative vertical assimilation, a tone is typically lowered after a lower tone. So, a high tone may be lowered to a mid tone when it occurs after a low tone. Generally speaking, vertical assimilations do not occur when a preceding tone is higher than a following tone, as in a H-L sequence. Another possibility for vertical assimilation in a L-H sequence is that the L may rise as high as the H is lowered. In this case, we obtain a M-M sequence. Vertical assimilation is mostly observed in three tone languages.

Horizontal assimilation, which is also called 'spreading', can be partial or complete. Spreading involves a tone moving beyond its original domain to replace or displace the tone on the following syllable. In other words, the motivating tone enlarges its domain to accommodate an adjacent tone. In a partial horizontal assimilation, the motivating tone extends its domain to include part of an adjacent tone thus resulting in a contour tone, either rising or falling. The spreading process is not complete as the tone of one syllable spreads onto an adjacent syllable while the adjacent syllable still retains its original tone thus creating a contour tone. Complete horizontal assimilation occurs when the tone that spreads completely obliterates the affected tone so that there is no trace of the underlying tone of the syllable on which the spreading occurs.

Tone spreading or horizontal assimilation is a common tonal process in Nkɔrɔɔ. This process is usually total and so does not result in contour tones as is the case in partial horizontal assimilation. In the examples below, tone spreading is observed across morpheme boundary in two environments, first, where the domain of assimilation is restricted to only the first syllable of the second morpheme (example 6) and secondly, where the domain includes all the syllables of the second morpheme (example 7).

- (6) a. ígbá (H H) + mìnè (L L) → ígbá mínè (H H H L)
 'drum' 'beat instrument' 'beat drum'
- b. siè (L L) + fùlà (H L) → siè fùlà (L L L L)
 'be bad' 'saliva' 'curse' (n)

c. ìbì (L L) + dúś (H H) → ìbì dùś (L L L H)
'be good' 'spirit' 'Holy Spirit'

d. tòkú (L H) + nìḡgì (L L) → tòkú níḡgì (L H H L)
'child' 'mother' 'placenta'

Example (6) reveals that both high and low tones are restricted to spreading to the immediately preceding syllable. In example (7), only the low tone spreads across all syllables.

(7) a. bára (H L) + rímémé (H H H) → bára m̀m̀m̀m̀ (H L L L L)
'hand', 'arm' 'nail, claw' 'fingernail'

b. kírì (H L) + tòkú (L H) → kírìtòkù (H L L L)
'land, ground' 'child' 'spy'

c. m̀ndì (L L) + íkákí (H H H) → m̀ndì ìkàkì (L L L L L)
'water' 'tortoise' 'turtle'

The examples above show that while high tone spreading is restricted to the penultimate syllable, low tone spreading is unrestricted as summarized in the rules below.

High tone spreading

R1: H H L L → H H H L

R2: L H L L → L H H L

Low tone spreading

R3: L L H L → L L L L

R4: H L H H H → H L L L L

R5: L L H H H → L L L L L

Note that it is possible to have words consisting of two morphemes where both morphemes bear high tones throughout and there is no tonal change across boundary as in the word **fúróbó** 'thief' where **fúró** means 'steal' and **bó** means 'person'. This is not a case of tone spreading and so is not discussed here.

3.4 Tone dissimilation

Another tonal process found in Nkọrọọ is tone dissimilation which is a situation where tones adjacent to one another become more

unlike one another. For instance, when a word is reduplicated, the norm is that both sound segments and tone undergo reduplication as in the words **òkòòkò** 'parrot' and **féréféré** 'be light'. However, there are words where the sound segments undergo total reduplication but the tones of the reduplicated segments are dissimilar. This is seen in ideophonic Nkọrọọ verbs where the initial segments bear low tones while the reduplicated segments bear high tones.

(8) Tone dissimilation in totally reduplicated verbs

a. gbàlìgbálí (L L H H) 'be rough'

b. kàràkàrá (L L H H) 'be equal'

c. pìḡgèpíḡgè (L L H H) 'be crooked'

d. bèrìàbèríá (L L L H H H) 'resemble'

e. gòbìlègòbìlé (L L L H H H) 'be crooked'

f. kpòkòròkpókóró (L L L H H H) 'be round'

Tone dissimilation in nouns is not restricted to a particular pattern as shown in the examples below. If the stem bears high tones, then the reduplicant bears low tones and vice versa.

- (9) Tone dissimilation in nouns
 - a. gùàgúá (L L H H) 'color'
 - b. kpárákpàrà (H H L L) 'medium-sized sardine'

Across morpheme boundary, tone dissimilation can be observed in some nominal compounds. In the proximal demonstrative + noun compound, when the demonstrative combines with consonant-initial nouns, tone spreading at morpheme boundary is blocked. Both the singular and plural proximal demonstrative

bear high tones. Instead of the high tone spreading to the noun being modified by the demonstrative, its original tones are replaced with low tones throughout, creating tone dissimilation at morpheme boundary. This process does not apply if the noun is vowel-initial or begins with a syllabic nasal.

- (10) a. mí (H) + kíní (H H) → mí kìnì (H L L)
 - 'this' 'person' 'this person'
- b. má (H) + lúbárí (H H H) → má lùbàrì (H L L L)
 - 'these' 'stone' 'these stones'

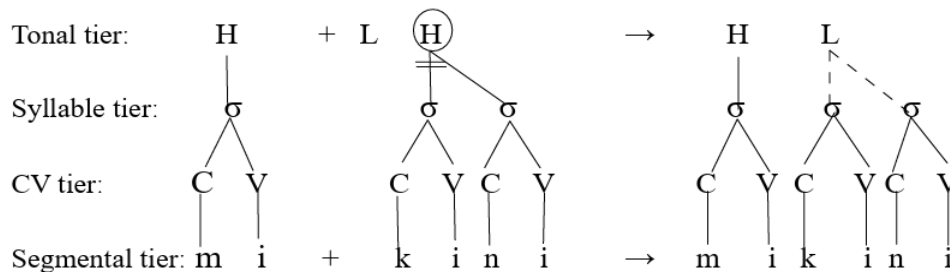


Fig. 6: Tonal dissimilation across morpheme boundary in a nominal compound

The adjective + noun construction (with the modifying adjective being **ájá** meaning 'new') is another nominal compound where tone dissimilation occurs. Again, the original tones of the noun are replaced by all low tones, creating tone dissimilation at morpheme boundary.

- (11) a. ájá (H H) + kúrá (H H) → ájá kùrà (H H L L)
 - 'new' 'year' 'new year'
- b. ájá (H H) + àkàlú (L L H) → ájá àkàlù (H H L L L)
 - 'new' 'moon' 'new moon'

Another tonal phenomenon that resembles tonal dissimilation is found when the intensifier **-sí** is suffixed to a verb. Inherently,

the intensifier bears a high tone, however certain phonotactic constraints prevent it from bearing the same tone as the preceding syllable

3.6 Tone replacement

Tone replacement is yet another tonal process that is evident in Nkɔ̀rɔ̀. It occurs when the inherent tone of a morpheme is replaced by a grammatical tone and is often observed in most languages within the verb and noun-noun

(16) Tone replacement in singular affirmative verb forms

a. fírí (H H) 'pluck'	píṅkó firì	'Pluck feathers!'
b. múnò (H L) 'sleep'	mùnò	'Sleep!'
c. màṅgí (L H) 'run'	màṅgì	'Run!'
d. gbéṅí (H L̥ H) 'grind'	àkàdà gbèṅ	'Grind pepper!'

3.7 Tone metathesis

Tone metathesis is a process that involves the transposition of tones within a word. This means that a sequence of tones that occur in one order in one context, occur in the reverse order in another context. It refers to the re-ordering of tones. Buckley (2011) cites Hock (1985) as arguing that diachronic regular

(17) a. tókú (L H) + tókú (L H) → tókú tókù (L H H L)	
'child' 'child'	'grandchild'
b. óbórí (H H H) + tókú (L H) → óbórí tókù (H H H H L)	
'goat' 'child'	'kid'

The final HL pattern on the second noun in the output as seen in example (17) can be argued from three perspectives. First, from the perspective of tone spreading and elision, we may claim that the final high tone of the first noun spreads to the first syllable of the second noun. The initial low tone of the second noun then gets delinked and reassociates to the final syllable whose high tone is then deleted. This sounds plausible because both tone spreading and tone elision are attested processes in the language. Secondly, after the spreading of the final high tone of the first noun, a final L tone is inserted. This argument raises the question of the source and function of the inserted low tone. Thirdly, the HL output pattern is a case of metathesis where the sequence of LH on tókú 'child' is re-ordered to HL (tókù) in order to fulfill the tonal constraint on nominal constructions in the language in line with Hock (1985). The third argument is the position of this paper based on

compounds. The singular affirmative imperative verb form in Nkɔ̀rɔ̀ is derived by replacing the inherent tones of the verb with low tones. This process is more obvious when the verb bears at least one high tone.

metathesis in a language serves to enforce a structural constraint. This is the case in Nkɔ̀rɔ̀. Tone metathesis can be observed in noun + noun compounds where the process is employed in order to impose a fixed HL output pattern on the compound regardless of the input tone structure (Akinlabi et al., 2009).

an understanding of the overall grammatical structure of the language.

4. Conclusion

This paper discussed seven tone processes that occur in Nkɔ̀rɔ̀ (Kirika), a register tone Ijoid language with high and low tones, plus a downstepped high tone. They include tone stability, tone spreading, tone dissimilation, tone elision, tone copying, tone replacement, and tone metathesis. The findings revealed that the domain of occurrence include within the word and across morpheme and word boundaries.

Tone stability within the word gives rise to either floating low tones or syllabic nasals, and may occur across word boundary on the tone tier without recourse to the syllable tier, providing evidence of the autonomy of tone as postulated by the autosegmental theory. Tone elision within the word is mostly employed in

rapid speech and also involves either the deletion of the tone bearing unit alone or the entire syllable. When a vowel occurring between a stop and a rhotic is deleted along with its tone, the syllable structure of the word is altered resulting in a CRV syllable structure, which is an unusual structure in the language. Tone spreading in Nkq̄r̄q̄ occurs across boundaries and never results in contour tones, however, the domain of the spread of the high tone is more restricted than that of the low tone. While high tones may spread to the immediately following syllable after a boundary, low tones may spread to all the syllables across boundaries. Tone dissimilation was observed in certain nominal compounds, specifically the proximal demonstrative + noun construction and the adjective (ájá) + noun where high tone spreading is blocked across morpheme boundary and the noun tone is replaced by all low tones. The data on tone metathesis showed that the process is constrained by the nature of the nominal construction in which it occurs.

The processes of tone spreading, tone dissimilation, tone copying, tone replacement, and tone metathesis are instrumental to the construction of various grammatical units such as nominal constructions, verb inflections, imperative verb forms, reduplicants, and coordinating conjunctions. According to Hyman (2007, p. 483), tone systems are a "potential gold mine for future investigations" and studies on tone in African languages have helped in shaping phonological theories and frameworks of the phonology-syntax interface. By providing a linguistic description of how tone is realized and conditioned in various contexts, the findings of this paper affirm that tonal processes are not only conditioned by the phonetic environment in which tones occur but also by grammatical constraints, thus attesting to the importance of tone in the overall grammatical structure of tonal languages. It is hoped that the work will contribute further to an understanding of tonal behavior in syntactic contexts and to the literature on the tone-syntax interface.

Abbreviations

↓	downstep
-	bound morpheme
→	becomes
σ	syllable
+	morpheme boundary
#	word boundary
	association line
⊥	new association line
⊥	delinked association line
3	3 rd person pronoun
C	consonant
CONJ	conjunction
DEF	definite article
F	feminine
H´	high tone
INT	intensifier
L,`	low tone
L _o	floating low tone
M	masculine
N	nasal, neuter
NOM	nominative
PN	personal name
R	rhotic
SG	singular

Ⓣ	deleted tone slot where T stands for any tone
Ⓥ	deleted vowel slot where V stands for any vowel
V	vowel

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