

## A DOMAIN-BASED APPROACH TO SETSWANA TONE

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### 1. INTRODUCTION

The tonal morphology of most eastern and southern Bantu languages is particularly complex, and many theoretical concepts and notational devices worked out by phonologists in the past twenty years have their origin in attempts at understanding how Bantu tone works and at describing Bantu tone systems in the simplest possible way. Bantu tonology played a crucial role in the development of autosegmental phonology. More recently, the distinction between "marked" elements and "default" elements proved to be particularly useful in the description of many Bantu tone systems.

For example, Setswana illustrates the dissymmetry between the H tone and the L tone characteristic of many Bantu languages: H tones tend to spread, whereas nothing similar occurs with L tones. Ex. (1) & (2) show that a H-toned subject marker exerts an influence on the tonal melody of a L-toned verb stem – ex. (1) – whereas the tonal melody of a H-toned stem is not affected by the presence of a L-toned subject marker – ex. (2).

- |     |    |   |    |   |
|-----|----|---|----|---|
| (1) | a. | <u>lò</u> -bàlà sìnttè<br>Lo bala sentle<br>'You (pl) are reading properly' | b. | <u>bá</u> -bálá sìnttè<br>Ba bala sentle<br>'They are reading properly' |
| (2) | a. | bá-kwálá sìnttè<br>Ba kwala sentle<br>'They are writing properly'           | b. | rì-kwálá sìnttè<br>Re kwala sentle<br>'We are writing properly'         |

This suggests excluding the L tone from underlying representations and analyzing it as a default tone. In the variant of autosegmental tonology proposed here, underlying H tones (or sequences of underlying H tones) generate domains that tend to expand by annexing the following syllables, and L tones are simply associated to syllables that do not happen to be included in the domain of a H tone, as shown in ex. (3) – note that syllable nuclei underlyingly associated with a H tone are underlined, and that limits of H tone domains are indicated by parentheses.





- c.  $ba + ka + kwala + a$  →  $[baka] + [kwala]$   
 →  $[baka] + [kwala]$   
 →  $[baka][kwala]$   
 →  $[ba]ka[kwala]$   
 →  $bakakwala$

This explanation is consistent with the fact that in such configurations, an additional L-toned syllable may appear, as in ex. (9) – note that the double vowel does not represent a long vowel, but rather two identical vowels with the status of syllable nuclei separated from each other by an empty onset:

- (9)  $\dot{r}\dot{i}-k\acute{a}\acute{a}-\acute{o}\acute{a} \ n\acute{a}\acute{e}$   
 Re kaa ja nae  
 'We can eat with him / her'

An interesting explanation of this additional syllable is that, in cases when the deletion of an empty syllable would lead to the adjacency of two monosyllabic H domains (i.e. H domains neither of which can contract), a copy of the preceding vowel can associate with the nucleus of the empty syllable in order to avoid the violation of the OCP which would follow from the deletion of this empty syllable, as shown in (10):

- (10)  $ri + ka + d\dot{z}\dot{a} + a$  →  $ri[ka] + [d\dot{z}\dot{a}]$   
 →  $ri[ka] + [d\dot{z}\dot{a}]$   
 →  $ri[ka] + a[d\dot{z}\dot{a}]$   
 →  $\dot{r}\dot{i}k\acute{a}\acute{a}d\dot{z}\dot{a}$

#### 4. A RULE-BASED ACCOUNT OF EXPANSION AND CONTRACTION OF H-DOMAINS IN SETSWANA

In Setswana, as in many Bantu languages, the tonal morphology of the verb is particularly complex. Therefore, the mere fact that a relatively simple and principled description of the tonal morphology of the Setswana verb can be gotten within the framework outlined in the preceding sections is by no means a trivial achievement.

Creissels et al. (1997) provides a comprehensive description of the tonal variations of Setswana verb forms, and shows that every detail of these variations can be accounted for by the system of ordered rules summarized in (11).

(11) a. **Morphological rules**

- Rton1a*: In the subjunctive positive, if no object marker is present, a H tone associates to the final, the first syllable of lexically toneless stems takes a H tone, and the second syllable of stems comprising three syllables or more takes a L tone.  
*Rton1b*: In certain tenses, a grammatical H tone associates with the only syllable of monosyllabic stems (if it is not already associated with a H tone) and with the second syllable of non-monosyllabic stems.

- b. **Constitution of H domains**: Every maximal sequence of H-toned syllables within the limits of a word constitutes a H domain.

c. **Expansion of H domains**

*Rton2a*: A H domain including the second syllable of a stem comprising three syllables or more expands to the right, and the only limitation to its expansion is that it must not come into contact with another H domain within the limits of the word.

*Rton2b*: H domains whose last syllable is not the second syllable of the stem expand to the right, but their expansion is limited by the following conditions:

- in general, such a H domain can annex at most two toneless syllables,
- an additional toneless syllable can be annexed if and only if the second annexed syllable represents an object marker,
- the last syllable annexed to the H domain must not be empty,
- the expansion must not bring the H domain into contact with another H domain within the limits of the word.

d. **Rules concerning empty syllables**

*Resya*: If an empty syllable surrounded by two monosyllabic H domains immediately precedes a monosyllabic stem, its nucleus associates with a copy of the preceding vowel.

*Resyb*: A copy of the following vowel is optionally associated with the nucleus of an empty syllable satisfying the following conditions:

- it must be in antepenultimate position,
- it must be immediately preceded by a H-toned syllable,
- it must be immediately followed by a H-toned syllable having an empty onset and belonging to the same morpheme.

*Resyc*: The empty syllables that remain after the application of *Resya* and *Resyb* are deleted.

e. **Rules operating on adjacent H domains**

*Rton3a*: The right edge of a non-monosyllabic H domain immediately preceding another H domain shifts one syllable to the left, irrespective of the number of syllables of the second H domain.

*Rton3b*: The left edge of a non-monosyllabic H domain immediately preceded by a monosyllabic H domain shifts one syllable to the right.

*Rton3c*: Two monosyllabic H domains brought into contact by rule *Resyc* fuse.

f. **The optional realization  $\acute{o} \acute{o} \acute{o}$  of certain sequences  $\acute{o} \acute{o} \acute{o}$**

*Rton4*: If two H domains are separated by a toneless syllable representing the formative of the present negative participial or of the perfect negative participial, this toneless syllable is optionally annexed by the following H domain, but the H domains brought into contact by this annexation remain distinct and are separated from each other by a downstep.

g. **Tonal alternations affecting the final syllable of the verb in certain tenses**

*Rton5a*: In certain tenses, if the last syllable of a verb form in clause-final position belongs to a non-monosyllabic H domain, the right edge of this H domain shifts one syllable to the left.

*Rton5b*: In certain tenses, if the last syllable of a verb form in non-clause-final position belongs to a non-monosyllabic H domain, the right edge of this H domain shifts one syllable to the left if and only if the following conditions are both satisfied:

- the following word must not be a substantive or a proper name;
- the first syllable of the following word must belong to a H domain.

The rules summarized in (11) determine what may be called the basic melody of the verbal word; this basic melody may be modified by the subsequent application of post-lexical rules that automatically apply in Setswana at word boundaries and before a pause, irrespective of the grammatical nature of the units involved. These post-lexical rules are given in (12).

- (12) a. When words are concatenated, a H domain whose right edge coincides with a word boundary annexes the initial syllable of the following word if this initial syllable does not belong to a H domain and if this annexation does not lead to a violation of the OCP.
- b. If two H domains are brought into contact by the concatenation of words and if the H domain at the beginning of the second word is monosyllabic, the H domains fuse.
- c. If two H domains are brought into contact by the concatenation of words and if the H domain at the beginning of the second word is not monosyllabic, they are separated from each other by a downstep.
- d. If the right edge of a non-monosyllabic H domain coincides with a pause, it shifts one syllable to the left.

##### 5. SETSWANA TONE AND OPTIMAL DOMAINS THEORY

Within a rule-based model of phonology, a comprehensive description of the tone system of Setswana by means of a relatively small number of rules operating on the delimitation of H domains is possible. The ordering of these rules is largely a consequence of the principles of lexical phonology, and the processes they describe can most of the time be considered as consequences of general principles: in Setswana as in many Bantu languages, monosyllabic H domains tend to be avoided, the adjacency of H domains tends to be avoided, a coincidence between the right edge of a H domain and a pause tends to be avoided, and the rules predicting the delimitation of H domains in Setswana are to a large extent repair rules that rectify undesirable configurations. The question now is: would it be possible to go further, and to account for the same data within a constraint-based model of phonology?

Cassimjee & Kisseberth (1998) develops a domain-based approach to Bantu tone within the framework of optimality theory. In this paper, Cassimjee & Kisseberth propose to explain what autosegmental analyses have described as bounded spreading as the extension of a H domain motivated by the need to avoid violating a constraint such that a H domain should not be monomoraic or monosyllabic. However, such a constraint can hardly account for the delimitation of the domain of the H tone underlyingly associated with the first syllable of the verb stem in ex. (13):

- |         |   |    |   |
|---------|---|----|---|
| (13) a. | <b>rì-tlhókómélèsèxà sìnttè</b><br>Re tlhokomelesega sentle<br>'We are treated properly'  | b. | <b>rì-bérékélàna sìnttè</b><br>Re berekelana sentle<br>'We are working for each other properly' |
| c.      | <b>rì-búisánà sìnttè</b><br>Re buisana sentle<br>'We are speaking to each other properly' | d. | <b>rì-thúsánà sìnttè</b><br>Re thusana sentle<br>'We are helping each other properly'           |
| e.      | <b>rì-kwálá sìnttè</b><br>Re kwala sentle<br>'We are writing properly'                    | f. | <b>rì-dzá sìnttè</b><br>Re ja sentle<br>'We are eating properly'                                |

In each of these sentences, there is a single underlying H tone associated to the first syllable of the verb stem, as shown in (14):

- |         |                                   |    |                               |
|---------|-----------------------------------|----|-------------------------------|
| (14) a. | <b>rì-[tlhókómé]lèsèxà sìnttè</b> | b. | <b>rì-[bérékélà]na sìnttè</b> |
| c.      | <b>rì-[búisà]nà sìnttè</b>        | d. | <b>rì-[thúsàna] sìnttè</b>    |
| e.      | <b>rì-[kwálá] sìnttè</b>          | f. | <b>rì-[dzá] sìnttè</b>        |

Ex. (13a) to (13c) clearly involve a case of bounded spreading: the right edge of the H domain is not aligned with the right edge of the word, and the domain of the H tone underlyingly associated to the first syllable of the stem annexes a limited number of syllables, irrespective of the length of the stem. These facts are easily accounted for in a rule-based model following the principles of lexical phonology: in such a framework, the delimitation of the H domains in ex. (13) can be correctly predicted by positing an expansion rule with a maximum range of two syllables operating within word limits – see (11c) – followed by a post-lexical expansion rule with a maximum range of one syllable – see (12a). By a contrast, putative constraint according to which H domains should not be monosyllabic does not explain why the domain of the H tone underlyingly associated to the first syllable of the stem may annex two or even three syllables.

Ex. (15) provides additional evidence against the hypothesis according to which bounded spreading results from a constraint on the minimal size of H domains.

- |         |   |    |   |
|---------|---|----|---|
| (15) a. | <b>bá-tlhókómélèsèxà sìnttè</b><br>Ba tlhokomelesega sentle<br>'They are treated properly'  | b. | <b>bá-bérékélàna sìnttè</b><br>Ba berekelana sentle<br>'They are working for each other properly' |
| c.      | <b>bá-búisánà sìnttè</b><br>Ba buisana sentle<br>'They are speaking to each other properly' | d. | <b>bá-thúsánà sìnttè</b><br>Ba thusana sentle<br>'They are helping each other properly'           |
| e.      | <b>bá-kwálá sìnttè</b><br>Ba kwala sentle<br>'They are writing properly'                    | f. | <b>bá-dzá sìnttè</b><br>Ba ja sentle<br>'They are eating properly'                                |

The only difference between ex. (13) and ex. (15) is that in the sentences of ex. (15), there is an additional underlying H tone associated to the subject marker, as shown in (16).

- |      |    |                              |    |                           |
|------|----|------------------------------|----|---------------------------|
| (16) | a. | [bā-t̥h̥kome]leseya sɪnt̥t̥e | b. | [bā-b̥ereke]lana sɪnt̥t̥e |
|      | c. | [bā-b̥uɪsa]na sɪnt̥t̥e       | d. | [bā-th̥usana sɪ]nt̥t̥e    |
|      | e. | [bā-kwala sɪ]nt̥t̥e          | f. | [bā-d̥ʒa sɪ]nt̥t̥e        |

In these sentences, it must be assumed that the two underlying H tones generate a single domain: if these H tones generated two distinct domains, the domain generated by the lexical H tone would be expected to contract in order to avoid adjacency with the domain of the H tone of the subject marker, as in ex. (6d) to (6f) above. The problem now is that, if bounded spreading truly resulted from a constraint on the minimal size of H domains, the right edge of a H domain beginning with the first syllable of the verb – as in ex. (15) – would not be expected to coincide with the right edge of a H domain beginning with the second syllable – as in ex. (13). Here again, this problem does not exist in a rule-based description, since the expansion rules accounting for ex. (13) account equally for ex. (15).

Such phenomena constitute a major challenge to optimal domains theory. In its presents state, this theory explains unbounded spreading by means of alignment constraints and tries to explain bounded spreading by means of a constraint banning non-monosyllabic domains; but this explanation is not very convincing, since it applies only to the very particular case of bounded spreading in which a single additional syllable is added to an originally monosyllabic domain. It fails to explain cases of bounded spreading with a possible range of two or three syllables, or cases of bounded spreading in which non-monosyllabic domains expand in the same way as monosyllabic domains. The fact that optimal domains theory unquestionably captures the general principles underlying certain tonal processes characteristic of Bantu tone systems in a particularly insightful way must not make one forget that there are also tonal phenomena that are relatively common in Bantu languages (in particular, bounded spreading not limited to originally monosyllabic H domains) for which no simple and convincing explanation has yet been proposed in this framework.

## REFERENCES

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