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The Tonology of Depressor Consonants:
Evidence from Mijikenda and Nguni

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1. Introduction.

Over the past few years we have been exploring the tonal structure of two different Bantu subgroups. Mijikenda constitutes one of these subgroups and Nguni the other.

Mijikenda consists of a group of nine closely related languages (Chichonyi, Chidigo, Chiduruma, Chidzihana, Chikambe, Chikauma, Chirabai, Chirihe, Kigiryama) spoken along the Eastern coast of Africa from around Malindi in Kenya down to Tanga on the northern coast of Tanzania. It is a member of the Sabaki branch of the North East Coastal Bantu family of languages, and as such is closely related to the Swahili language group.

Nguni languages are sometimes classified into two broad categories, namely the "Tekela" dialects and the "Zunda" dialects. The Tekela group includes Swati, Bhaca, Lala, Nhlanguwini, Phuthi, and Sumayela Ndebele (=Northern Transvaal Ndebele). The Zunda dialects include such well-known languages as Zulu, Zimbabwean Ndebele, and Xhosa, as well as (perhaps) Ndundza Ndebele (=South Ndebele). Dialectal variation within Xhosa and Zulu is known to exist, but the tonal aspect of this variation has not been thoroughly studied. These languages belong to Zone S in the Guthrie classification, and thus seem to have no especially close link to the Mijikenda.

While our interest in these languages has quite independent origins, it has become clear that the juxtaposition of these two subgroups in our research has been fortunate indeed. For Mijikenda and Nguni both exhibit two phenomena that are of considerable theoretical interest: namely, the long-distance displacement of High tones from their point of origin (whether via a "spreading" or some sort of "shift" operation is an issue that we shall address) and a significant interaction between tone and a class of consonants that are generally referred to in the literature as "depressor" consonants. We shall demonstrate below that there are significant parallels between the Mijikenda and the Nguni tonological systems, although this parallelism is not necessarily immediately obvious.

Given the limitations of space, we will not be able to fully justify many aspects of our analysis of Mijikenda and Nguni. Suffice it to say that the analysis presented here is based on a considerable body of data, and detailed presentations of these data will be forthcoming.

We will proceed as follows. First, we give a brief introduction to the theoretical issues we will be concerned with. Next we give an account of the central long-distance rule in Mijikenda and discuss its interaction with depressor consonants. The implications of this interaction for the theory of phonology are then examined. The same procedure is then followed for Nguni as well.

2. Theoretical issues.

The "displacement" of a High tone from one tone-bearing unit to some other tone-bearing unit has been a central topic in the development of the autosegmental theory of tone. Issues concerning such displacements include: is displacement linked to metrical structure, and if so, in what ways? is

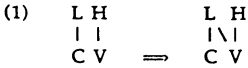
displacement accomplished by means of a spreading rule, or is it better viewed as the direct realignment of a High tone from one position in the representation to another? In what follows, we will assume that in both Mijikenda and Nguni, displacement is dependent on metrical structure, but we shall not pursue this in any detail here. Instead, we will focus on whether the displacement involves spreading or shifting.

The tonal behavior of so-called "depressor" consonants has not attracted the same amount of theoretical attention as the displacement of High tones. The term "depressor" consonant arose in connection with the description of Nguni languages, and these languages have provided some of the most striking examples of how consonants can interfere with the tonal pattern of a language. There are two closely related phenomena in Nguni languages that require the recognition of depressor consonants and which suggest some sort of identification of depressor consonants with low tones. We review these two phenomena below, though they are not the principle focus of our discussion of depressor consonants.

In Nguni, a High-toned syllable that has a depressor consonant in onset position is realized phonetically with a "lowering" of the tone in the initial portion of the syllable. This in general produces a surface rising tone (though we shall see below that in certain instances the phonetics may be somewhat different). We can illustrate this phenomenon by citing some examples from Siswati, a Nguni language spoken in Swaziland and in the Eastern Transvaal region of the Republic of South Africa. For instance, in most environments in Siswati, the infinitive prefix /ku/ is preceded by a floating High tone (originally part of a "preprefix" element); when the verb stem is toneless, this High tone docks on the antepenult syllable. In examples such as *ku-phocé:la* 'to force, compel' and *ku-hlokó:ta* 'to prod', the antepenult does not have a depressor onset and the syllable is pronounced with a level High tone. In *ku-vímbe:la*, however, the antepenult syllable begins with a depressor consonant and the High on that syllable has a distinctively rising character. (In our transcription of Siswati, we underline syllables that are "depressed"; in Siswati, any syllable beginning with a depressor consonant is depressed, but there are other depressed syllables as well.)

High-toned verb stems in Siswati ordinarily have a High tone associated with the first stem syllable (though in trisyllabic or longer stems, this High realigns to a following syllable -- see the final section of the paper for discussion). In examples such as *kú-sá:la* 'to remain', *kú-bé:ka* 'to put' and *kú-sé:nga* 'to milk', we see that the floating H of the infinitive construction links to the prefix while the stem H is linked to the first stem syllable (which is penult in the word and thus lengthened by a general penult lengthening rule in the language). In these examples, the first stem syllable does not have a depressor onset, and the High tone on this syllable is realized with a High tone that (in the speech of our consultant) has a gradual descent over the long vowel. In the dialect that we have studied, there is no downstepping between these two High tones. In examples such as *kú-vú:ka* 'to wake up' and *kú-dlú:la* 'to play', on the other hand, the High on the first syllable of the stem is pronounced with a mainly level pitch. This level pitch is downstepped to a very considerable degree in comparison with the prefix High tone. Clearly, the depressor onset to this syllable is affecting the phonetic shape (turning a somewhat falling pitch into a level pitch) of the syllable by depressing the initial stages of the tone. The downstepping is also a reflection of the essentially low nature of depressor consonants.

Effects such as these have been taken to suggest a close connection between depressor consonants and Low tone. The details of the formulation of this connection depend ultimately on one's theory of phonological representation. If one's theory permits tonal specifications on non-moraic consonants, then one might propose that (at some point in the derivation) a Low tone is associated with depressor consonants, and this Low tone spreads onto the following High-toned vowel, thus creating a rising tone on that vowel.



If one were to adopt a position that tones cannot be linked directly to consonants, then one would have to develop a proposal whereby depressor consonants induce the introduction of a Low tone into the tonal tier (and link that tone to the moraic element following the depressor consonant).

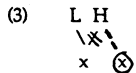
In some Nguni languages (including Siswati) there is another phenomenon that is connected to this rising tone. When a High syllable with a depressor onset is followed by a (non-final) syllable that does not have a depressor onset, then the High tone spreads onto that syllable (and delinks from the depressed syllable). If the syllable that the High spreads to is short, then that syllable is simply realized with a High tone. If the syllable is long (i.e. is a lengthened penult syllable), then the syllable is realized with a very distinctive falling tone (quite different from the gradually descending High tone on non-depressed penult syllables discussed above).

Consider the following examples from Siswati: *ku-vimbe:la* 'to trap' and *ku-vikê:la* 'to doge'. These examples involve toneless verb stems in the infinitive. Ordinarily, the floating H tone of the preprefix associates to the antepenult syllable of the word. But the antepenultimate syllable here has a depressor onset. We do not find a rising tone on this syllable, but instead find that this syllable is low and the following syllable (the lengthened penult syllable) has a falling tone. The onset of the penult syllable here is not a depressor consonant. This example contrasts with *ku-vimbe;la* cited earlier, where the antepenult syllable has a rising tone (not indicated in the transcription) and there is no falling tone on the penultimate syllable. The reason of course is that in *ku-vimbe;la* the penultimate syllable has a depressor in onset position.

The examples in (2) below show more examples of the depressor-induced High tone shift. In the forms in the first column, there are no underlying High tones. In the second column, the subject prefix *ba* has an underlying High tone. This High tone would be expected to appear on the antepenult, but here the antepenult has a depressor onset, and we see the shift to the penult.

(2)	siyabongelana	bayabongelâna	(congratulate e.o.)
	ngiyabingelela	bayabingelêla	(greet)
	ngiyahlembisisa	bayahlembisîsa	(organize well)
	ngiyahlanganyela	bayahlanganyêla	(gang up)

The precise account of the process illustrated above again depends on the details of the phonological representation assumed. If skeletal positions are taken to be the tone-bearing units, then given the output structure in (1), we can account for this Depressor-Induced High Tone Spreading phenomenon by postulating a rule such as in (3):



(where "x" stands for tone-bearing unit).

(We ignore here the details of how to explain why the lengthened syllable, when it receives the spreading of the H from the depressed syllable, develops into a falling tone. This matter is tangential to our concerns here.)

When the depressed syllable with a rising tone is followed by another depressed syllable, rule (3) will not be able to apply since its structural description is not met. Specifically, the tone-bearing unit with a LH sequence is not followed by an unassociated tone-bearing unit, but rather by a depressor consonant with a Low tone (or – under the scenario where depressor consonants do not actually have a Low tone, but only induce a Low tone – by a mora that has received a Low tone by inducement from the depressor consonant). The above phenomenon supports the connection between depressor consonants and Low tones in that it shows that the Low tone induced by depressors blocks rule (3) from applying.

We have discussed two examples that suggest a relationship between depressor consonants and Low tone. In one of these cases, the depressor consonant seems to prevent a spreading rule from applying. This indicates clearly that there is strong potential for interaction between rules of High tone displacement mentioned at the beginning of this section and depressor consonants. It is this interaction that we will focus on in the present paper, and the implications that this interaction has for (a) the question of whether long-distance displacement is by spreading or shifting and (b) the correctness of the claim that depressor consonants are linked to Low tones or induce Low tones on following morae and therefore necessarily block spreading of a High tone across them.

3. Mijikenda.

We assume that in the underlying structure of Mijikenda, only High tones are specified. Low tones do not occur. At some point, syllables that are not associated to High will receive a default Low tone specification.

In Mijikenda, there is overwhelming evidence that a (pre-penultimate) High tone is attracted to the penultimate syllable of the representation. We believe that this attraction-to-the-penult is actually a case of attraction-to-accent, i.e. we believe that the penultimate syllable is metrically prominent and that a High tone located earlier in the word is attracted to this prominence (rather than to the penultimate syllable as such). There is much about the details of this process that we will not go into here – specifically, we ignore the complications that arise when more than one High tone appears underlyingly in a representation.

One place where we can clearly see attraction-to-accent in Mijikenda is in the present tense form of the verb. Verb stems are of two tonal types in Mijikenda (as in many other Bantu languages). One type has an underlyingly High tone in its structure. The other type has no tonal specifications. The present tense form of the verb consists of a prefix marking the subject, a tense marker /na/, and the verb stem. The verb stem ends in the final vowel /a/. In the present tense, first and second perfect subject prefixes do not have a High tone, while third person subject prefixes do. The tense marker /na/ does not contribute a High tone to the representation. Verb stems are either High-toned or toneless, and the final vowel contributes no tone to the representation. In (3) below we illustrate toneless verb stems. (The nine Mijikenda languages are abbreviated as follows: Ch=Chichonyi, Di=Chidigo, Du=Chiduruma, Dz=Chidzihana, Gi=Kigiryama, Kam=Chikambe, Kau=Chikauma, Ra=Chirabai, Ri=Chirihe. The acute mark over a vowel indicates a High tone. In Chidigo, a High tone which in other dialects is linked to the penult surfaces as a rising-falling sequence over the last two syllables if the final syllable does not have a depressor onset. This phenomenon represents another case of depressor consonants blocking the local spread of a High tone, but we do not explore this matter here.)

- (4) ni-na-rima [Ch,Di,Du,Dz,Gi,Kam,Ra] n-a-rima [Kau,Ri] (cultivate)
 yu-na-ríma [Du,Dz,Kam] a-na-ríma [Ch,Gi,Ra] a-na-r'ímà [Di] w-a-ríma [Kau,Ri]
- ni-na-sukuma [Ch,Di,Du,Dz,Gi,Kam,Ra] n-a-sukuma [Kau,Ri] (push)
 yu-na-sukúma [Du,Dz,Kam] a-na-sukúma [Ch,Gi,Ra] a-na-suk'úma [Di] w-a-sukúma [Kau,Ri]

ni-na-sonjerera [Ch,Dz,Kam] ni-na-sengerera [Di,Du] ni-na-songerera [Gi,Ra]
 n-a-sonjerera [Ri] n-a-sonjerera [Kau] (approach)

yu-na-sonjeréra [Dz,Kam] yu-na-sengeréra [Du] a-na-sonjeréra [Ch] a-na-senger'érá [Di]
 a-na-songeréra [Gi,Ra] w-a-sonjeréra [Ri] w-a-sonjeréra [Kau]

If we examine these data, there is a very clear pattern. The verb stems in the above data do not have any inherent High tone. The tense/aspect prefix (/na/ or /a/, depending on dialect) also does not have any inherent High tone. There is a contrast in the subject prefixes however: first person subject prefixes have no High, but third person subject prefixes do. The High tone that is contributed by the third person subject prefixes does not however appear on the surface associated to that prefix. Rather, the High tone appears on the penult syllable of the word (in Chidigo, the fact that the penultimate syllable is the target is obscured, since in the examples above the High tone surfaces as a rising-falling pattern over the last two syllables; in our discussion, we will largely ignore this phonetic complication in Chidigo, though it is of relevance to point out that when the penult in Chidigo is followed by an ultimate syllable that has a depressor onset, then the penultimate High shows up as such).

Assuming that it is the metrical prominence of the penultimate syllable that attracts the High tone to that syllable, the most pressing question that we face is the following: does the High tone spread to the metrically prominent syllable, or does it shift (realign) to that syllable?

If Attraction-to-Accent involves the spreading of a High tone to the penult, then we must assume that there is also a rule of Delinking, which would be formulated somewhat as in (5):

- (5) H
 ~~x~~ |
 xx (iterative, left-to-right)

In a shifting analysis, the High tone would never associate to tone-bearing units located between the point of origin of the High tone and the metrically prominent syllable. It would leap to the penult, and in the process disassociate from its point of origin.

Given the data in (4) we have no basis for choosing between a two-step operation of spreading and subsequent delinking and a one-step operation of shifting the H tone. Critical evidence will be developed below.

Attraction-to-Accent crosses the consonants that we are going to argue are depressor consonants in Mijikenda – namely, the set of voiced oral obstruents (note that prenasalized stops in Mijikenda are not depressors, in contrast to the Nguni languages dealt with later).

We find the following data in seven of the nine Mijikenda languages.

- (6) ni-na-gula [Ch,Di,Du,Dz,Gi,Kam,Ra] n-a-gula (buy)
 yu-na-gúla [Du,Dz,Kam] a-na-gúla [Ch,Gi,Ra] a-na-g'úlâ [Di]
- ni-na-jitha [Ch,Di,Du,Dz,Kam,Ra] ni-na-githa [Gi] (cook)
 yu-na-jitha [Du,Dz,Kam] a-na-jitha [Ch,Ra] a-na-githa [Gi] a-na-j'íthâ [Di]
- ni-na-galuka [Ch,Di,Du,Dz,Gi,Kam,Ra] (change)
 yu-na-galúka [Dz,Du,Kam] a-na-galúka [Ch,Gi,Ra] a-na-gal'úkâ [Di]

ni-na-lagula [Ch,Di,Du,Dz,Gi,Kam,Ra] (treat medically)
 yu-na-lagúla [Du,Dz,Kam] a-na-lagúla [Ch,Gi,Ra] a-na-lag'úla [Di]

ni-na-rejeza [Du,Dz] ni-na-regeza [Ch,Di,Kam,Ra] ni-na-regezha [Gi] (loosen)
 yu-na-rejéza [Du,Dz] yu-na-regéza [Kam] a-na-regéza [Ch,Di,Ra] a-na-regézha [Gi]

We have of course not yet given any evidence that the voiced obstruents are indeed depressor consonants in these seven Mijikenda languages. Assume for now that such evidence can be provided. The issue then confronting us is this: does the ability of a H tone to spread/shift past the depressor consonants in the data above pose any difficulty for the proposition that depressor consonants are associated with a Low tone at some point in the derivation? The answer is of course "not necessarily", since we could assume that spreading/shift takes place before the assignment of Low tones to depressor consonants (but this would require some explicit ordering).

If we follow the shift analysis, the story of the above data is over – that is, we simply assume shift occurs before depressor consonants receive their Low tone, and thus the surface results are guaranteed. If we follow the spreading analysis, we must also consider the relationship of Low-Insertion to Delink. If Delink occurs before Low-Insertion, of course all is well. If Delink occurs after Low-Insertion, then Low-Insertion would be creating a structure where association lines cross and the issue would have to be addressed as to whether rules such as Low-Insertion can yield violations of the No-Crossing of Association Line Principle and if so what is done to "repair" the violations.

In Chikauma and Chirihe we find more interesting data.

- | | | |
|-----|---------------------|----------------------|
| (7) | n-a-gula [Kau,Ri] | w-á-g'úla [Kau,Ri] |
| | n-a-jitha [Kau,Ri] | w-á-j!itha [Kau,Ri] |
| | n-a-galuka [Kau,Ri] | w-á-gal'úka [Kau,Ri] |
| | n-a-lagula [Kau,Ri] | w-a-lág'úla [Kau,Ri] |
| | n-a-rejeza [Kau,Ri] | w-a-réj!éza [Kau,Ri] |

How are we to explain these data? There is a single H tone in the UR. This High tone clearly spreads/shifts to the penult. But there is a High tone located in front of each depressor consonant in the path between the point of origin of the H tone and the metrically prominent syllable (in the examples in (3) there is only one depressor consonant in the path; below we will see cases where two, three or more are possible). How are these "spurious" High tones to be explained?

These spurious High tones appear only in the presence of an underlying High tone and only on the path between the point of origin of the High tone and its final landing site on the penult. The spurious Highs must then in some way derive from the association of the underlying High to the relevant syllables. The explanation for these data clearly then must derive from the spreading of the underlying High tone from its point of origin to the penultimate syllable. The shift analysis must be wrong because in the shift analysis there is no point at which the underlying High is ever associated with the syllables where the spurious Highs appear.

But if the origin of the spurious High tones derives from the spreading of a (single) High tone, then we must assume that somehow this underlying High tone undergoes (in just these cases) a process of fission whereby it is decomposed into two (or more, see below) High tones. What remains to be explained is the precise nature of this fission. Before developing our account of fission, we need to demonstrate in a little more detail additional evidence concerning fission.

In (7) we saw cases where a depressor consonant in the verb stem induces fission. An object prefix with a depressor consonant will have a similar effect:

- (8) nakufugula, naBafugula, nazifugula [Kau] (untie)
 wanifúg!úla, wázif!úg!úla [Kau]
- nakusonjerera, naBasonjerera, nazisonjerera [Kau] (approach)
 wanisonjeréra, wázisonjer!éra [Kau]
- nakutsukula, naBatsukula, nazitsukula [Kau]
 wanitsukúla, waBatsukúla, wázitsuk!úla [Kau]

In these data we see that a H tone is anchored to each syllable that (a) is in the path from the original site of a H tone to the penultimate syllable and (b) is followed by a syllable with a depressor onset. The examples cited contain in some cases one spurious High tone, in other cases two spurious High tones.

High-toned verb stems in Mijikenda provide additional evidence for the general occurrence of fission in Chikauma and Chirihe (in contrast to the other seven languages). It can be argued that in Mijikenda, as in many Bantu languages, High-toned verb stems have an unassociated High tone in their underlying structure which is mapped onto the first syllable of the stem. However, the High tone that is linked to the first syllable will then undergo Attraction-to-Accent and spread to the penultimate syllable. In (9a) we give examples where there are no depressor consonants in non-final syllables in the stem; in (9b) we give examples where there is a depressor consonant in the onset to the first stem syllable; in (9c) we give examples where there is a depressor consonant between the first and the penultimate syllable. (We have just cited two other dialects, Ch and Dz, in comparison with Kau and Ri. Ch and Dz are representative of the other dialects as well.)

- (9) (a) ni-na-rísa [Ch,Dz] n-a-rísa [Kau,Ri] (feed)
 ni-na-lála [Ch,Dz] n-a-lála [Kau,Ri] (sleep)
 ni-na-hiríka [Ch,Dz] n-a-hiríka [Kau,Ri] (send)
 ni-na-kalánga [Ch,Dz] n-a-kalánga [Kau,Ri] (fry)
 ni-na-kalangira [Ch,Dz] n-a-kalangira [Kau,Ri] (fry for)
- (b) ni-na-vúndza [Ch,Dz] n-a-vúndza [Kau,Ri] (break)
 ni-na-vyála [Ch,Dz] n-a-vyála [Kau,Ri] (give birth)
- (c) ni-na-hegúla [Ch,Dz] n-a-hég!úla [Kau,Ri] (take s.t. off cooking stones)
 ni-na-subútu [Ch,Dz] n-a-súb!útu [Kau,Ri] (dare)
 ni-na-galagála [Ch,Dz] n-a-galág!ála [Kau,Ri] (toss and turn)

These data show that fission occurs inside the High verb stem in Chikauma and Chirihe, but not in the other seven languages; however, fission occurs only in front of a depressor consonant that is on the path between the first stem syllable and the penult syllable. In other words, the facts concerning fission support the position that the High tone in these verb stems originates on the first stem syllable and spreads to the penult syllable.

Additional evidence for fission can be derived from the phrasal tonology of Mijikenda. The Attraction-to-Accent rule is actually a rule that applies not just at the word level, but also at a phrasal level. In particular, if a word with a H tone in its underlying structure is followed by a toneless word, then the H of the first word will realign to the penultimate syllable of the second word.

In the following examples, the verb has an underlying H verb stem and the following noun is toneless underlyingly.

- (10) n -a-rya nyáma [Ri] 'I am eating meat'
 n-a-ona chí-faránga [Ri] 'I see a chick'
 n-a-ona ngúwo [Ri] 'I see clothes'


These data indicate that Attraction-to-Accent (and Delinking) operate between words.

In (11) we show examples where a depressor consonant is on the path between the point of origin of the High tone in the verb and the penultimate syllable of the following noun.

- (11) ní-na-ona mu-gánga [Ch] 'I see a doctor'
 ní-na-ona déthe [Ch] 'I see a valley'
 vs.
 n-a-ona mú-g!ánga [Kau,Ri]
 n-a-oná d!éthe [Kau,Ri]
- yu-na-gula ngúwo [Ch] '(s)he is buying clothes'
 vs.
 w-á-gula ng!úwo [Kau,Ri]
- yu-na-jitha nyáma [Ch] '(s)he is cooking meat'
 vs.
 w-á-jitha ny!áma [Kau,Ri]

In general the data in (11) simply reflect the fact that Chikauma and Chirihe have fission under the conditions that we have already spelled out. Specifically, we see that in n-a-ona mú-g!ánga, there is a depressor consonant in the noun that stands between the High verb stem and the penult syllable, thus we find a High tone both on mu and the penult of the noun. In w-á-jitha ny!áma, we find a depressor consonant in the verb between the High subject prefix and the penult of the noun, thus we find a High tone on wa as well as on the penult of the noun. The Ch data illustrate the fact that the other languages do not have fission and thus there is only a High tone on the penult of the noun. [It is interesting to note however that Chidigo also shows a more limited form of fission. It is only at the phrasal level, and the spurious High only shows up in front of a depressor in the ultimate syllable of a word. We do not attempt here to deal with this example.]

Having given considerable motivation for fission, let us look closely at exactly how it ought to be explained. In particular, let us consider more explicitly the relationship between fission and the analysis of depressor consonants as being associated with Low tones. Let us consider two scenarios. Under the first scenario, Low tones have not been assigned to depressor consonants at the point where Attraction-to-Accent applies. In a case such as w-á-zi-f!úg!úla, then, the output of Attraction-to-Accent will be:

- (12) 

Given such a representation, if the next rule to apply is the rule inserting Low tones on depressor consonants (and if this rule places the Low tones on the same tier as the High tone), we immediately face a dilemma. Where do we place the Low tones for /z/ and /g/? in front of the H? after the H? both

in front and after? Not only is the placement of the Lows relative to the H indeterminate, but the result (wherever we locate the Low tones) is an ill-formed representation, since association lines will be crossing. [If Delinking were to apply before the insertion of Low tones, of course, we would derive the correct form for the other seven languages, but not for Chikauma and Chirihe.]

Under the second scenario, the rule inserting Low tones on depressor consonants applies before Attraction-to-Accent. This means that Attraction-to-Accent must be permitted to spread a High tone to the penultimate syllable across depressor consonants (i.e. it must create violations of the No Crossing of Association Lines Principle). Under this scenario there is of course no question of where the Low tones in w-á-zi-fúg!úla are located relative to the underlying High tone (they are to the right of that High tone).

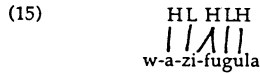


Under either scenario, the result however is that an inadmissible representation has been constructed. If we assume that inadmissible structures may be derived by rules but must be immediately repaired, then we can immediately see that fission is a possible repair strategy. Specifically, suppose that a possible repair strategy is that in (14) below:

(14) Maintenance of Association Lines Strategy (=MALS)

Retain all the linkages (between a given syllable and H tone) specified in the representation but make the minimal modifications to satisfy the No-Crossing Principle.

The minimal way in which syllables can continue to be associated with a High tone but have no crossing of association lines is for the underlying High tone to undergo fission.



Of course, MALS does not immediately yield the correct surface form. The rule of Delinking will have to apply to the output of Fission to delink all but the rightmost syllable in a High-span (i.e. in a sequence of syllables all linked to the same High tone). The representation in (15) will undergo Delinking, resulting in the representation shown in (16).



The correct surface form follows from a general principle whereby a HLH sequence always results in the downstepping of the second H.

Let us summarize. (i) The phenomenon of fission in Chikauma and Chirihe provides evidence that Attraction-to-Accent is a spreading phenomenon. (ii) It is clear that the joint result of Attraction-to-Accent and the assignment of Low tones to depressor consonants is a representation that violates some principle (since fission can only be understood as somehow the result of the incompatibility of these two rules). (iii) If we assume that the Low tones associated with depressor consonants are on the same tier as High tones, then the representational incompatibility is the crossing of association lines. (iv) The

surface fission of the underlying High tone can be interpreted as the result of a particular repair strategy: the Maintenance of Association Lines Principle.

Up until this point we have focused our attention on Chikauma and Chirihe, the two Mijikenda languages which very clearly have fission as a repair strategy. Let us now turn our attention briefly to the other Mijikenda languages. All the languages show evidence that the voiced oral obstruents are depressors. We will cite just one set of data to illustrate this point, and space will not permit us to discuss the full range of issues raised by this data set. Consider the following examples of High verb stems in the present tense. In (17), we illustrate the behavior of verb stems that do not have a voiced oral obstruent in the onset to the first syllable.

- (17) ninalála, yunalála [Du] (sleep)
 ninalála, yunalála [Dz]
 ninalála, analála [Di,Gi]
 ninalála, analála [Ra]
 ninalála, análála [Ch]
 ninalála, yunalála [Ka]
 nalála, wálála [Kau,Ri]
- ninakalángá, yunakálángá [Du] (fry)
 ninakalángá, yunakálángá [Dz]
 ninakalángá, yunakálángá [Kam]
 ninakalángá, anakálángá [Di]
 ninakalángá, anakálángá [Ch]
 ninakalángá, anakálángá [Ra]
 ninakalángá, anakálángá [Gi]
 nakalángá, wakálángá [Kau,Ri]

Notice that in the first person case, there is just the underlying High tone of the verb stem, and this High tone spreads to the penult syllable as described earlier. The third person forms, on the other hand, involve two underlying High tones: one that originates on the third person subject prefix and another that originates in the verb stem. There is considerable variation as to precisely what happens in this situation, and it would take us too far afield to work out the precise rules for each language. It is important to note, however, that in general the prefixal H spreads/shifts to the first stem syllable.

(18) below shows that when the verb stem begins with a voiced oral obstruent a different tone pattern emerges: the prefix H fails to get into the verb stem.

- (18) ninavúndza (other languages) navúndza [Kau,Ri] (break)
 yunáv!úndza/anáv!úndza (other languages) wáv!úndza [Kau,Ri]
- ninagalagála (other languages) nagalág!ála [Kau,Ri] (toss and turn)
 yunágagalag!ála/anágagalag!ála (other languages) wág!ág!ála [Kau,Ri]

The failure of the H of the prefix to spread/shift into the stem in (18) is clear evidence that voiced oral obstruents in all Mijikenda languages have "depressor"-type effects.

But if all of the Mijikenda languages do assign a Low tone to depressor consonants, then we must also provide an account of those languages where we do not find fission as a result of Attraction-to-Accent. There are of course various possibilities: perhaps Attraction-to-Accent is really a shift operation in these languages and a spread operation in Chikauma and Chirihe; perhaps Attraction-to-

Accent and Delinking are ordered prior to the insertion of Low tones on depressor consonants; perhaps the answer lies in the typology of repair strategies.

We cannot go into a proper exploration of the possible explanations for the lack of fission in the other seven Mijikenda languages, for it would require us to engage in a more extended analysis of the complex body of Mijikenda tonology than there is space for here. But it should be obvious that the Mijikenda system is an especially fertile area for trying to come to grips with the interplay between long-distance tone rules and depressor consonants.

4. Nguni.

Is Mijikenda an isolated case? A close look at Nguni reveals that in fact fission also occurs in Nguni, although the result is somewhat different from the Mijikenda case. We have not yet surveyed all of the Nguni languages, and will confine our discussion here to one of the Nguni languages, Siswati. There are however parallels in other varieties (e.g. our research has found parallels in Xhosa and Rycroft's work on Zimbabwean Ndebele reveals additional affinities).

We will assume an analysis of Siswati whereby only High tones are specified in underlying representations. Low tones will be introduced by default onto all morae that are not linked to a High tone (following the operation of the tonological rules of the language). Verb stems in Siswati are either toneless or have a H tone that links initially to the first stem mora. In certain tenses there is a tonal contrast between first and second person subject markers which are toneless and third person subject markers which have a H tone associated to them.

In Siswati, as in Nguni in general, there is a rule that has the result that a pre-antepenultimate H is attracted to the antepenult syllable in certain verb tenses. We will again assume that this is a case of attraction of a H tone to a metrically prominent syllable, but we do not undertake to develop the details of such an analysis here since it is beyond the immediate concerns of this paper. We call this rule Attraction-to-Accent for ease of reference. We illustrate the process in Siswati by citing the present tense form of toneless verb stems and comparing first person and third person forms.

(19)	ngi-ya-ba:la	ba-yá-ba:la	(write)
	ngi-ya-laye:la	ba-ya-láye:la	(order)
	ngi-ya-tsele:ka	ba-ya-tséle:ka	(pour in)
	ngi-ya-liba:la	ba-ya-líba:la	(forget)
	ngi-ya-tsikame:ta	ba-ya-tsikáme:ta	(disturb)
	si-ya-tselela:na	ba-ya-tseléla:na	(pour for e.o.)
	ngi-ya-gobondze:la	bayagobóndze:la	(bend)
	ngi-ya-gilikidze:la	bayagilikídze:la	(stumble)

From these data, we can see that in the first person forms, the verb is entirely low-toned. This is because none of the morphological elements making up the first person form has a High tone underlyingly. On the other hand, the third person forms show that the High tone contributed by the third person subject prefix realigns itself to the antepenultimate syllable.

One essential question that must be addressed in analyzing the above data is the following: is Attraction-to-Accent a spreading rule or a shifting rule? Examination of the data in (19) does not immediately give any indication of what the appropriate analysis might be.

There is powerful evidence that Attraction-to-Accent is a spread rule in Siswati. Consider the following data from High-toned verb stems.

(20)	ngiyafi:hla ngiyabó:na	bayáfi:hla bayábó:na	(hide) (see)
	ngiyabuyí:sa ngiyasebé:nta ngiyabulá:la ngiyapheléli:sa ngiyakhuléke:la ngiyafinyéle:la	bayábúyí:sa bayásébé:nta bayábúlá:la bayáphéléli:sa bayákhúléke:la bayáfínyéle:la	(return) (work) (kill) (complete s.t.) (call out s.o.'s name) (reach)

Consider the first person data first. Notice that in bisyllabic High verbs, the H tone is associated to the first stem syllable; in trisyllabic stems, the H is associated to the second stem syllable; in longer stems, the H is always on the antepenultimate syllable. We assume that the High tone of these stems is initially linked to the first stem syllable. In the longer cases, it is realigned to the antepenult by Attraction-to-Accent. Without going into the details of the analysis, we believe that even the trisyllabic cases – where the High tone realigns to the penult – are properly subsumed under the same Attraction-to-Accent process.

Now consider the third person forms. Notice that the High tone contributed by the third person subject prefix is not realized on the subject prefix, but on the next syllable to the right (the prefix /ya/ that characterizes the present tense when the present tense form of the verb is phrase-final). In a full treatment of the metrical structure of Siswati, we would claim that this realignment of the subject H to /ya/ is also a reflection of an appropriately expanded Attraction-to-Accent rule. But what is of concern to us is the following observation: all of the syllables starting from the beginning of the verb stem up to the place where the stem High realigns are realized with a High tone. Thus we do not find *bayáfínyéle:la but rather bayáfínyéle:la. How are we to account for the fact that the initial stem syllable is raised? We cannot postulate a rule in Siswati that raises a low syllable between two High tones, since there are very clear counterexamples to such a hypothetical rule.

The answer we suggest is the following. The High tone of the stem initially links to the first stem syllable. Attraction-to-Accent ultimately spreads this High to the right. The result is a multiply-linked High structure that we will refer to as a High-span. A High-span ordinarily undergoes the rule of Delinking, with all but the last element in the High-span being delinked. However, the data in (20) above suggest that Delinking is applicable only if the High-span is preceded by a Low tone or no tone whatsoever. A preceding High tone protects a High-span from Delinking. Under this analysis, in a word such as bayáfínyéle:la there are two High-spans. The first High-span is a H linked to the subject prefix that has also spread to the /ya/ prefix. The second High-span is a H linked to the first stem syllable that has also spread to the antepenultimate syllable. The first H-span is unprotected, thus the syllable on the left branch is delinked. The second H-span is protected and no delinking occurs. We thus get the correct surface form.

There is additional evidence that Attraction-to-Accent produces High-spans and that High-spans are protected by a preceding High. Recall our analysis of the third person form of toneless verb stems in the present tense. We claimed that the High of the subject prefix is realigned to the antepenult via Attraction-to-Accent. Let us now consider such verb forms when they are located after the word ngi-tsi-té.... 'I said...' (which has an alternative form ngi-tsi-tée....).

- (21) ngi-tsi-té ú-yá-liba:la 'I said he is being forgetful'
(cf. ngi-tsi-tée u-ya-liba:la)

ngi-tsi-té bá-yá-tséle:ka 'I said they are arriving in full force'
(cf. ngi-tsi-tée ba-ya-tséle:ka)

ngi-tsi-té bá-yá-tseléla:na 'I said they are pouring for one another'
(cf. ngi-tsi-tée ba-ya-tseléla:na)

ngi-tsi-té bá-yá-tsándze:la 'I said they are winding s.t. around'
(cf. ngi-tsi-tée ba-ya-tsándze:la)

Notice that when the ngi-tsi-tée... form is used, then the following verb shows a High only on the syllable to which the prefix H realigns in the isolation form. But when ngi-tsi-té... is used, then all of the syllables of the verb beginning from the subject prefix up to the point of realignment are High-toned. This is understandable if the syllables from the subject prefix to the point of realignment are all members of a High-span created by Attraction-to-Accent, and the H at the end of the preceding word is serving to protect that High-span.

Let us now consider depressor consonants. It is clear that the Attraction-to-Accent rule crosses depressor consonants in Siswati (we have already discussed in section 1 the evidence that there are depressor consonants in Siswati).

- | | | | |
|------|-------------------|------------------|---------------------|
| (22) | ngiyavaleli:sa | bayavaléli:sa | (bid farewell) |
| | siyabongela:na | bayabongelá:na | (congratulate e.o.) |
| | ngiyabingele:la | bayabingelê:la | (greet) |
| | ngiyahlembisi:sa | bayahlembisi:sa | (organize well) |
| | ngiyahlanganye:la | bayahlanganyê:la | (gang up) |

In these data we see that the H tone that originates in the subject prefix has realigned to the right of a depressor consonant onto the antepenultimate syllable. In the event that the depressor consonant happens to be the onset of the antepenultimate syllable, the additional shift of the High to the following syllable discussed in section 1 occurs.

The High tone that is initially linked to the first stem syllable of a High verb stem is also able to cross a depressor consonant.

- (23) ngi-ya-gcugcú:ta 'I am urging'
ngi-ya-phambani:sa 'I am confusing'

We have so far established that Attraction-to-Accent crosses depressor consonants. Let us now consider cases where the High-span that occurs across a depressor consonant is in a protected environment. We will study two structures. First, we look at third person forms of High verb stems where the verb stem contains a depressor consonant. Consider first bisyllabic stems.

- | | | | |
|------|------------|------------|---------|
| (24) | ngiyazú:la | bayáz!ú:la | wander |
| | ngiyavú:na | bayáv!ú:na | harvest |

Here the verb stem H is singly-linked (i.e. there is no High-span). A depressor consonant occurs between the H-span over the prefixes and the H of the verb stem. Notice that there is a downstep between these two High tones. This is a direct effect of the depressor consonant (cf. forms such as ba-yá-bó:na where there is no downstep between the prefix H-span and the H of the verb stem).

- | | | | |
|------|--------------------------------|-------------------------------|----------------------------|
| (25) | ngiyazintf:la
ngiyavungú:la | bayázintf:la
bayávung!ú:la | hit hard
pick the teeth |
|------|--------------------------------|-------------------------------|----------------------------|

Notice that here the prefixal H does not protect the High-span in the verb stem. The reason should be clear. The depressor consonant is associated to a Low tone (or induces a Low tone) and thus prevents the protection from occurring (since the High span in the verb will not be immediately adjacent to a H in the prefix).

Consider some additional data:

- | | | | |
|------|---------------------------------|--------------------------------|--------------|
| (26) | ngiyatjengí:sa
ngiyatingé:la | bayátjengf:sa
bayátíng!é:la | show
hunt |
|------|---------------------------------|--------------------------------|--------------|

These data are quite interesting because we see that a H-span that has a depressor consonant in its interior cannot be protected by a preceding H tone. The H-span with an internal depressor consonant apparently constitutes a well-formedness violation. This violation is repaired by a rule we will refer to simply as Repair Delinking.

- (27) Repair Delinking:

In a H-span with an internal depressor consonant, delink all but the final syllable in the span.

Repair Delinking is not blocked by the presence of a preceding H tone.

The Siswati story is however more complex. Let us next look at cases where *ngi-tsi-té...* protects a verb form with an underlying H on the subject prefix and no other High tone in its structure.

- (28) *ngi-tsi-té bá-yá-gucú:la* 'I said they are changing'
(cf. *ngitsitée bayagucú:la*)
- ngi-tsi-té ú-yá-vuméla:na* 'I said he is allowing people'
(cf. *ngi-tsi-tée u-ya-vuméla:na*)
- ngi-tsi-té bá-yá-bongelá:na* 'I said they are congratulating each other'
(cf. *ngitsitée bayabongelá:na*)
- ngi-tsi-té bá-yá-phendvulá:na* 'I said they are replying to each other'
(cf. *ngitsitée bayaphendvulá:na*)
- ngi-tsi-té bá-yá-hlembisi:sa* 'I said they are organizing very well'
(cf. *ngitsitée ba-ya-hlembisi:sa*)

We see that when the H-span from the subject prefix up to the point of realignment in the verb stem is in a protected position (preceded by *ngi-tsi-té...*) fission does occur, yielding two High tones. The first H tone (actually a High-span) is over the prefixes. The second High tone is the one on the target of realignment (antepenultimate syllable).

We saw in our discussion of Mijikenda, a H-span with an "internal" depressor consonant (i.e. a depressor consonant that is onset to a mora located between the two morae that are the endpoints of the H-span) undergoes a fission process that, given x number of internal depressor consonants, yields $x+1$

High tones. In Siswati, on the other hand, an internal depressor consonant in a H-span is repaired differently. If the H-span is internal to a stem, Repair Delinking applies to remove the violation. If the H-span crosses a prefix-stem structure, then the H bifurcates into two H-spans: the first over the prefixes and the second over the stem. The first H span will not contain a violation of well-formedness (there are no internal depressor consonants) and will not be affected by Repair Delinking. The second H-span in the stem will be subject to Repair Delinking.

But notice: the fission of a H in a H-span crossing prefixes and the stem is only in a protected environment. In an unprotected environment, we get forms without any High tones on the prefixes: ngitsitée bayabongelâ:na, not *ba-yá-bongelâ:na. What this means is that we adopt a fission repair strategy just in the event that the general Delinking rule does not solve the problem. The complex facts of Siswati thus require all of the principles listed in (29).

- (29) Delinking
Fission of an offending H span (if it crosses a prefix-stem structure)
Repair Delinking

We have demonstrated in this paper that High tones spread across depressor consonants, but that this results in a structure that offends apparently universal well-formedness condition that bars a depressor consonant internal to a High span. Repair Delinking may in some cases serve to eliminate the offending structure. But in other cases, Fission of the High tone seems to represent a possible repair strategy.

We do not wish to be understood as maintaining that the ill-formedness of a depressor consonant internal to a High-span is necessarily expressed in terms of a crossing of association lines. This represents one formalization. We suspect that the more appropriate formalizations may emerge (in terms of the "grounding" relationship between High tone and depressor consonants – see the work of Archangeli and Pulleyblank (in press). What is critical is that rules produce the offending structure in Mijikenda and Nguni, and the offending structures may be repaired by the fission of a feature.

References

Archangeli, D. and D. Pulleyblank (in press). *Grounded Phonology*. MIT Press, Cambridge, MA.