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IsiXhosa Verbal Tonology: A Comprehensive Non-Derivational Account*

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IsiXhosa, a Bantu language of South Africa, features a rich system of morphologically and tonologically complex verbal inflection paradigms. This paper takes an Optimality Theoretic approach to accounting for the distribution of high tones in IsiXhosa verbal paradigms, exploring the complex interactions between the tonology and prosodic and morphological structure. The result is that all 43 of the verbal inflection paradigms listed by Claughton (1983) are generated by a single constraint hierarchy characterized by morphologically conditioned rerankings, unrankings, and reformulations. This analysis therefore makes the broader prediction that given a non-derivational, constraint-based view of grammar, morphology can extend beyond morphemes into the constraint hierarchy itself.

1 Introduction

The tonal systems of Bantu languages are characterized by the exceptional mobility of their high tones, which are able to spread from their lexical source across one or even several morphemes to anchor on or near a metrically prominent syllable. These high tones often leave no surface trace of their origins (see Downing 1990 on IsiZulu), and can even cross prosodic word boundaries (see Kisseberth 1984 on Digo and Kenstowicz and Kisseberth 1990 on Chizigula). This paper focuses on the tonology of verbal inflections in IsiXhosa, a Nguni language of the Southern Bantu family with approximately six million speakers in the Transkei and Ciskei regions of South Africa.

Beyond the mobility of its high tones, IsiXhosa is typical of Bantu languages in that it features both lexically high-toned and toneless morphemes, including roots and subject agreement markers (hereafter SM).[1] Interestingly, the pattern of tonal mobility is not uniform across inflection paradigms, as shown in (1). In the short present indicative example in (1a), consisting of a toneless SM, a high-toned verb root, and the toneless

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[1] I follow a number of previous authors in assuming that the relevant distinction here is one of high-toned vs. toneless, since low tones appear to play no active role in Bantu tonology (see, e.g., Clements and Goldsmith 1984; Goldsmith, Peterson and Drogo 1986; and Downing 1990). One apparent exception to this general assumption is Venda, in which there is evidence that low tones play an active role in the phonology (see Cassimjee 1983, 1990 for details).

indicative (IND) mood marker *-a*, high tone appears on the antepenult. In the singular imperative example in (1b), consisting only of the root and the indicative marker, high tone appears on the penult:

(1) a. ndi-bonísiis-a
SM-root-IND
'I show clearly'

b. bonisíís-a
root-IND
'show clearly!'

The high tone in both examples in (1) may optionally spread from the left edge of its source (here, the verb root) to either the antepenult (2a) or the penult (2b):

(2) a. ndi-bónísiis-a
SM-root-IND
'I show clearly'

b. bónísíís-a
root-IND
'show clearly!'

If toneless SM *ndi-* in (1a) and (2a) is replaced by the high-toned SM *bá-*, only one of the two high tones may surface — again on the antepenult:

(3) a. ba-bonísiis-a
SM-root-IND
'they show clearly'

b. *bá-bonísiis-a
SM-root-IND
'they show clearly'

In other paradigms, however, it is possible for multiple high tones to appear. This is the case in the long form of the present indicative in (4a), as well as in the short perfect in (4b):

(4) a. bá-ya-bonísiis-a
SM-PRES-root-IND
'they show clearly'

b. bá-shukumis-ée
SM-root-PERF
'they have shaken'

Previous analyses of IsiXhosa tonology (e.g., Goldsmith, Peterson and Drogo 1986; Downing 1990; Kisseberth 1993) only scratch the surface of formally accounting for the distribution of high tone in IsiXhosa verbs, examining only a handful of the 43 inflection paradigms described by Claughton (1983). It is the goal of this paper to provide a comprehensive and integrated analysis for all 43 of the verbal inflections included in Claughton's (1983) paradigm list. As part of this study, I have obtained confirmation for each paradigm in extensive elicitation sessions with a native speaker consultant, Phelisa Zihlangu, from Qonce (King William's Town), South Africa.

Goldsmith, Peterson and Drogo (1986) and Downing (1990) follow the central premise that a shift in the position of abstract "accent" — distinct from metrical prominence — is responsible for the association of high tone to the antepenult in paradigms like the short present in (1a), but to the penult in paradigms like the singular imperative in (1b). I will suggest here, however, that the notion of "accent" is dispensable in IsiXhosa, that metrical prominence is invariable and always concrete, and that the difference between the two paradigm types is essentially morphological in nature.

My proposal is couched in Optimality Theory (see Prince and Smolensky 1993; McCarthy and Prince 1993, 1995), a non-derivational approach to phonology which replaces ordered rules with ranked constraints and serial derivations with a potentially infinite number of parallel well-formedness evaluations. The central premise behind an Optimality Theoretic view of grammar is that constraints are violable regardless of rank and that well-formedness is a function of minimal constraint violation — the candidate which emerges as optimal is not necessarily the one which complies fully with every constraint, but simply the one which violates the fewest constraints of the highest rank.

A recurrent theme in the Optimality Theoretic literature is the notion of edge-oriented alignment (see esp. McCarthy and Prince 1993, 1995 and references therein). As we will see, IsiXhosa adds to the growing corpus of evidence suggesting that the edges of both prosodic and morphological constituents can be of equal relevance in determining well-formedness. Under the analysis developed here, the location of high tone in the examples given in (1-4) is fundamentally reliant on prosodic structure, most crucially on the metrically prominent syllable. Because I argue that metrical prominence is a property of trochaic foot heads in IsiXhosa, this means that there is a direct link between the positioning of high tone and the positioning of feet. The morphological constituency has a direct role to play as well, in that feet are right-aligned with stems (i.e., the verb root plus any suffixes). One important consequence of this approach is that tonal "domains" — i.e., the constituents within which only one high tone may be parsed — emerge for free in the form of phonological and morphological edges. This runs contrary to the claim advanced in Kisseberth (1993) that high tones project domain edges of their own accord, and therefore represents a considerable simplification of the grammar.

I also present evidence for a certain degree of flexibility in the constraint ranking, which manifests itself in three principal ways. First, I argue that the difference in the positioning of high tone in paradigms such as (1a) and (1b) is due to the relative ranking of two constraints on tonal association, and that this ranking is conditioned purely by the morphology. In other words, it is a lexically-specified property not of any particular

morphological constituent, but of the paradigms themselves. Second, I suggest that the optional nature of high tone spread in forms such as (2a) and (2b) is attributable to the unranked status of a different pair of constraints with regard to each other. Forms with and without spreading are equally good, since violating one of the relevant constraints is no worse than violating the other. And third, the presence of a single high tone in (3a) as opposed to the multiple high tones in (4b) is the result of a morphologically-conditioned reformulation of the scope of a single constraint identifying the prosodic or morphological constituent within which only one high tone may be parsed — again, a lexically-specified property of each paradigm. The presence of multiple high tones in (4a), on the other hand, will be attributed to the presence of more than one such tonal "domain."

In addition to accounting for the surface facts of IsiXhosa verbal tonology, the analysis presented below therefore makes two important predictions about the nature of Optimality Theoretic grammars. The first of these is that the morphology can assert itself directly through the organization of the constraint hierarchy; the second is that this type of morph-less morphology can assert itself in at least three ways — reranking, unranking, and reformulation.

This paper is organized as follows: §2 advances the proposal that although IsiXhosa generally makes use of syllabic trochees in assigning metrical prominence to the penultimate syllable, iambic feet are employed to this same end in the short perfect, a paradigm featuring a lexically long ultimate vowel. §3 illustrates how feet are aligned with morphological structure, how strict adherence to this alignment strategy often results in unfooted syllables, and how both feet and unfooted syllables are integrated into higher prosodic structure. §4 and §5 explore the relationship between prosodic structure and high tone, using the short present indicative (1a) and singular imperative (1b) as case studies; the difference between antepenultimate high tone in the former and penultimate high tone in the latter is attributed to the reranking of two constraints. §6 examines high tone spread as shown in (2), and relates its optional nature to the presence of two constraints unranked in relation to one another in the hierarchy. §7 explains the presence of a single high tone (despite the presence of more than one high-toned morpheme) in (3) with an extended version of the Obligatory Contour Principle (OCP), a reformulation of which also accounts for the presence of more than one high tone in examples like short perfect (4b). Finally, §8 attributes the presence of multiple high tones in examples such as long present (4a) to the presence of more than one tonal domain. A schematic analysis for each of the 43 verbal paradigms listed in Claughton (1983) follows in an appendix.

2 Metrical prominence[2]

Vowel lengthening is a common correlate of metrical prominence cross-linguistically, as pointed out by Hayes (1995: 4-20). This is especially the case in Bantu languages, many of which are characterized by penultimate vowel lengthening (see Clements and Goldsmith 1984; Goldsmith 1987). In this section, I show that IsiXhosa is no exception to this generalization: metrical prominence generally falls on the penult, which I suggest corresponds to the head of a trochaic foot. As we will see, however, the situation is complicated somewhat by the presence of lexicalized long vowels in word-final position in one paradigm, the short perfect. This calls for positing that IsiXhosa makes use of both trochaic and — in the case of the short perfect — iambic feet in assigning metrical prominence.

The examples of the short present indicative in (5) illustrate that penultimate lengthening applies to words of all sizes, and is in no way dependent on high tone — even completely toneless forms (marked here as 'Ø') feature a long penultimate vowel:

(5) SM-root-IND
Ø Ø Ø

a. ndii-lw-a	'I fight'
b. ndi-baal-a	'I count'
c. ndi-baliis-a	'I narrate'
d. ndi-shukumiis-a	'I shake (trans.)'
e. ndi-namatheliis-a	'I cement'

We can confirm that vowel length is not lexical here by examining (5b-c) more closely: (5c), *ndibaliisa*, is formed by adding the causative marker *-is-* to the right edge of the stem *-bal-* in (5b). Note that the penultimate vowel is lengthened in both cases, even though an extra syllable has been added to (5c).[3]

IsiXhosa does in fact have a few lexicalized long vowels, most notably in the noun class 2b prefix /o:-/ (e.g., *ootata*, 'fathers') and class 10 prefix /i:-/ (e.g., *iincwadi*, 'books'), as well as in two verbal paradigms — the short perfect (e.g., *ndibalée*, 'I have counted') and the remote past (*ndáábála*, 'I counted'). Note that penultimate lengthening

[2] A number of insightful suggestions central to the analysis developed in this section were provided by John Goldsmith and Marek Przezdziecki.

[3] Both the causative marker *-is-* as well as the applicative or benefactive marker *-el-* appear frequently in the examples cited in this paper. Because these morphemes are themselves toneless and induce no unusual tonological effects, I treat them as part of the verb root for the sake of simplicity.

occurs in all of these forms except the short perfect, but is omitted in these examples for clarity. It is the short perfect which provides a particularly informative contrast to the pattern of lengthening observed in (5). The short perfect is formed by adding long vowel /-e:/ to the right edge of the verb stem. In addition, the perfective morphology includes a high tone which docks on the penultimate mora only, resulting in a falling contour tone on the final vowel:

(6) SM-root-PERF
Ø Ø H

a. ndi-lw-ée	'I have fought'
b. ndi-bal-ée	'I have counted'
c. ndi-balis-ée	'I have narrated'
d. ndi-shukumis-ée	'I have shaken (trans.)'
e. ndi-namathelis-ée	'I have cemented'

Here, we see no penultimate lengthening parallel to that which occurs in the short present (5). Why might this be? One possibility is that the *penultimate* syllable is metrically prominent in the short present (5), but the *ultimate* syllable is metrically prominent in the short perfect (6). A second possibility is that the penultimate *syllable* is metrically prominent in the short present, but the penultimate *mora* — assuming that long vowels contain two moras — is prominent in the short perfect. Given that languages do not generally assign prominence at one level of prosodic structure in one form, and at another in the next (see, e.g., Hayes 1995), the first possibility seems much more likely, particularly if we assume — as I do here — that the long final vowel in the short perfect is not the result of an isolated case of ultimate lengthening, but instead is a lexicalized long vowel like those in noun classes 2b (*ootata*, 'fathers') and 10 (*iincwadi*, 'books').

Let us first turn to forms with lengthened penults such as the short present (5). This pattern is by far the most common; in fact, the short perfect (6) is the sole exception that I know of in IsiXhosa. Following this observation, I propose that IsiXhosa is basically a syllabic-trochaic language (Hayes 1987, 1995; McCarthy and Prince 1986) with feet in which the strong (prominent) syllable (S) is followed by the weak (W), as shown in (7):

(7) $(\sigma_S \sigma_W)_{Ft}$

I assume that feet in the shape of (7) are members of the prosodic hierarchy in (8), based on Selkirk (1986), Zec (1988), Hayes (1989), and McCarthy and Prince (1993):

(8)

Prosodic Word	PrWd
	|
Foot	Ft
	|
Syllable	σ
	|
Mora	μ

In terms of an analysis based on ranked, violable constraints, (7) is singled out in the majority of cases as the only type of well-formed foot by the following rhythmic grouping constraint:

(9) Foot Binarity(σ) (Prince and Smolensky 1993: 47)
Feet are disyllabic.

In addition, the constraint in (10) establishes trochaic quality, where the strong (head) branch of the foot (S) precedes the weak branch (W):

(10) FootForm(Trochaic) (adapted from Cohn and McCarthy 1994: 8)

S W
Feet are of the form $(\mu\ \mu)_{Ft}$, where |S| precedes |W|.

In tableau (11), we see that FootForm(Trochaic) and Foot Binarity(σ) (hereafter FtBin) conspire to select the syllabic trochee in (7) as the only well-formed foot type. Since we have no evidence at this point for the ranking of these two constraints relative to one another, they are separated by a dotted line in the tableau. Shaded boxes are irrelevant in determining the most harmonic output:

(11) FTFORM(T), FTBIN(σ)

Input: any string σ σ

candidates	FTFORM (T)	FTBIN(σ)
S W ☞ a. (σ σ)		
W S b. (σ σ)	*!	
S S c. (σ σ)	*!	
W W d. (σ σ)	*!	
S e. (σ)	*!	*!
W f. (σ)	*!	*!

The only well-formed candidate — and therefore the winner (☞) — is the one which obeys both constraints, namely (11a); violation (*) of either is fatal (*!). Note that (11a) is identical to the foot in (7).

Assuming that metrical prominence corresponds to the strong branch of the foot and that lengthened penultimate vowels occur in metrically prominent syllables, the examples of the short present in (5) minimally contain a foot of the shape (11a) at their right edges, as shown in (12) (see also Downing 1990). Metrically prominent syllables are underscored:

(12) SM-root-IND
Ø Ø Ø

a. (ndii-lw-a)	'I fight'
b. ndi-(baal-a)	'I count'
c. ndi-ba(liis-a)	'I narrate'
d. ndi-shuku(miis-a)	'I shake (trans.)'
e. ndi-namathe(liis-a)	'I cement'

Notice that the constraints in tableau (11) have nothing to say about the penultimate lengthening observed in (12). In the case of (12a), for example, (*ndii-lw-a*) with penultimate lengthening, and (*ndi-lw-a*) without it, perform equally well with regard to

FTBIN(σ) (8) and FTFORM (9), provided that the strong branch of the foot precedes the weak:

(13) FTFORM(T), FTBIN(σ)

Input: ndi-lw-a

candidates	FTFORM(T)	FTBIN(σ)
S W ☞ a. (ndii-.lw-a)		
S W ☞ b. (ndi-.lw-a)		
W S c. (ndii-.lw-a)	*!	

Because the weak branch of the foot precedes the strong in (13c), this candidate is eliminated by a violation of FTFORM(T). (13a) and (13b) tie for well-formedness here, since both obey FTFORM(T) as well as FTBIN(σ).

As shown by the examples in (12), however, what we consistently find in IsiXhosa is (13a), with a long penultimate vowel. In other words, we find a bimoraic (heavy) syllable in the strong branch of the foot followed by a monomoraic (light) syllable in the weak branch, as illustrated in (14):

(14) S W
$(\sigma_{\mu\mu}\ \sigma_{\mu})_{Ft}$

The shape of the foot in (14) runs against the prediction that both branches of the trochee are optimally of equal quantity, as suggested by Prince (1990), and subsequently by Hayes (1993), Prince and Smolensky (1993), and Mester (1994). This generalization is captured by the constraint in (15), where |S| and |W| represent the quantity of the strong and weak branches, respectively:

(15) TROCHAIC QUANTITY (Prince 1990: 359)
In a rhythmic unit (S W), |S| = |W|, preferably.

Note that this constraint appears to disprefer trochaic lengthening, since it results in a quantitative imbalance within the foot, as in (14). The fact that we find trochaic lengthening in IsiXhosa provides us with evidence that a higher-ranking constraint is

interfering with TROCHAIC QUANTITY. The source of this interference is, I suggest, the constraint given in (16), whose basic function is to ensure that metrically prominent vowels are long:

(16) WEIGHT-TO-PROMINENCE
The strong branch of the foot must be a heavy syllable.[4]

In the phonology, this means that if the lone mora of a lexically short vowel is metrically prominent, it receives extra weight in the form of an additional mora. In the phonetics, this extra weight translates into increased duration, and therefore greater salience. As shown in tableau (17), trochaic lengthening emerges from the dominance of WEIGHT-TO-PROMINENCE over TROCHAIC QUANTITY:

(17) WEIGHT-TO-PROMINENCE »TROCHAIC QUANTITY

Input: ndi-lw-a

candidates	WT-TO-PROM	TROCHAIC QUAN
☞ a. (ndi-.lw-a)		*
b. (ndi-.lw-a)	*!	

The winner here is candidate (17a), identical to (12a): even though its uneven trimoraic foot violates TROCHAIC QUANTITY (15), it crucially complies with WEIGHT-TO-PROMINENCE (16). Candidate (17b), on the other hand, has a bimoraic, quantitatively even trochee but fatally violates WEIGHT-TO-PROMINENCE because the prominent syllable is not heavy.

This result means that a mora not present in the input — i.e., in the lexical representation — is added to the optimal output form. Recall that the penultimate vowel in *ndibaala* ('I count') is not lexically long, as shown by the contrast with its causative from *ndibaliisa* ('I narrate'); the same holds for the vowel of the first singular subject marker *ndi-*

[4] This constraint is essentially the mirror image of the Weight-to-Stress Principle (Prince 1990), which prefers that heavy syllables be stressed. Instead of associating prominence to weight, the constraint in (16) prefers that weight be associated to prominence. Below, I argue that the Weight-to-Stress principle also has a role to play in determining foot well-formedness in IsiXhosa.

in *ndi̲i̲lwa* ('I fight'), which is long only in penultimate position (cf. *ndi̲baala, ndi̲baliisa,* etc.). Predictable lengthening of this type violates the DEPENDENCY constraint (see McCarthy and Prince 1995: 264) in (18), which mediates against moraic epenthesis:

(18) DEP-IO(μ)

Every mora in the output (O) has a correspondent in the input (I).

The fact that penultimate lengthening occurs in IsiXhosa means that the pressure to have a heavy syllable as the strong branch of a foot is relatively greater than the grammar's dispreference for epenthetic moras (μ). In other words, WEIGHT-TO-PROMINENCE must outrank DEP-IO(μ), as illustrated in tableau (19):

(19) WEIGHT-TO-PROMINENCE » DEP-IO(μ)

Input: ndi-lw-a

candidates	WT-TO-PROM	DEP-IO(μ)
☞ a. (ndi-.lw-a)		*
b. (ndi-.lw-a)	*!	

Here, candidate (19a) with its extra mora wins out over (19b), which remains faithful to the input as far as prosodic weight is concerned, but in the process fatally violates higher-ranking WEIGHT-TO-PROMINENCE.

At this juncture, we are left with the question of how FTBIN(σ) and FTFORM(T) are ranked in relation to WEIGHT-TO-PROMINENCE, which, as shown in tableaux (17) and (19), dominates DEP-IO(μ) and TROCHAIC QUANTITY. In order to answer this question, we must return to the short perfect forms in (6), repeated here as (20). Recall that we are assuming the final long vowel in these forms to be lexically long:

(20) SM-root-PERF
Ø Ø H

a. ndi-lw-ée	'I have fought'
b. ndi-bal-ée	'I have counted'
c. ndi-balis-ée	'I have narrated'
d. ndi-shukumis-ée	'I have shaken (trans.)'
e. ndi-namathelis-ée	'I have cemented'

The first point to be addressed is the foot structure of a disyllabic form such as (20a). If FTBIN(σ) is ranked highly enough that feet are *always* disyllabic, there are two possibilities: a trochaic foot in which the weak branch is quantitatively greater than the strong (21a), or a canonical iambic foot in which the weak branch precedes the strong (21b) (Hayes 1987, 1995; McCarthy and Prince 1986; Prince 1990; Mester 1994):

(21) a. S W
$(\sigma_{\mu}\ \sigma_{\mu\mu})_{Ft}$

b. W S
$(\sigma_{\mu}\ \sigma_{\mu\mu})_{Ft}$

There is in fact good evidence that FTBIN(σ) is so highly ranked as to be inviolable in the grammar of IsiXhosa. As shown in (22), the singular imperative simply consists of the verb stem (the root plus any suffixes) except when the stem is monosyllabic (22a). Only in this case, the epenthetic syllable *yi-* is added to provide the second syllable needed to satisfy FTBIN(σ). Note that an inflectional or "grammatical" high tone is added to all imperative forms, represented here as (H):

(22) root-IND
Ø Ø (H)

a. yíí-lw-á (*lw-á, *lw-áá)	'fight!'
b. báál-a	'count!'
c. balíís-a	'narrate!'
d. shukumíís-a	'shake!' (trans.)
e. namathelíís-a	'cement!'

Because the monosyllabic stem cannot stand alone — even if the vowel is lengthened — the presence of a monosyllabic but bimoraic foot at the right edge of forms in (22) appears to be ruled out as well (i.e., **ndi(lwée)*, **ndiba(lée)*, etc.).

If this line of reasoning is correct, the question for the short perfect then becomes whether the weak branch of a trochaic foot can be heavier than the strong branch, as in (21a). In IsiXhosa, I suggest that it cannot, due to the presence of a constraint which complements the requirement of WEIGHT-TO-PROMINENCE (16) that the strong branch of a foot must be a heavy syllable. This complementary constraint, defined in (23), requires that a syllable which is lexically heavy (i.e., bimoraic in the input) be the strong branch of a foot in the output. This is essentially the Weight -to-Stress principle of Prince (1990), which for reasons of clarity I rename here as PROMINENCE -TO-WEIGHT:

(23) PROMINENCE-TO-WEIGHT (equivalent to Prince's (1990) Weight-to-Stress Principle)
A heavy syllable must be the strong branch of a foot.

The combined effect of WEIGHT-TO-PROMINENCE (16) and PROMINENCE-TO-WEIGHT (23) is that a lexically light syllable in the strong branch of the foot is made heavy (see tableau (19)), but that a lexically heavy syllable is made the strong branch of the foot. We will see in the next section, however, that this effect is limited to the penultimate and ultimate syllables by a highly-ranked constraint on foot alignment.

As illustrated in tableau (24), if both PROMINENCE-TO-WEIGHT (23) and FTBIN(σ) (8) dominate FTFORM(T) (9), the result is that the most well-formed candidate features an *iambic* foot when the ultima is lexically long (see Prince and Smolensky 1993: 54-55 for other cases of rhythmic reversal):

(24) PROMINENCE -TO-WEIGHT, FTBIN(σ) » FTFORM(T)

μ μ μ
| V
Input: ndi-lw-e

candidates	PROM-TO-WT	FTBIN(σ)	FTFORM(T)
W S ☞ a. (ndi-.lw-ee)			*
S b. ndi-.(lw-ee)		*!	
S W c. (ndi-.lw-ee)	*!		

In candidate (24a), foot form is reversed in violation of FTFORM(T), but this is better than having a monosyllabic foot consisting of a single heavy syllable (24b), or a trochaic foot in which prominence (S) is assigned to a light syllable (24c).

One way to potentially avoid the reversal of foot form in (24a) would be to lengthen the penultimate vowel, yielding a quantitatively even trochee consisting of two heavy syllables. This would satisfy FTBIN(σ), FTFORM(T) and TROCHAIC QUANTITY (15), but because we do not find penultimate lengthening in the short perfect in IsiXhosa, we can conclude that DEP-IO(μ) (18) must outrank FTFORM(T) and TROCHAIC QUANTITY as well. In other words, moraic epenthesis — represented here by the addtion of i̊ to the penultimate vowel — is worse than rhythmic reversal in this case:

(25) DEP-IO(μ) » FTFORM(T), TROCHAIC QUANTITY

μ μμ
| V
Input: ndi-lw-e

candidates	DEP-IO(μ)	FTFORM(T)	TROCH QUAN
W S ☞ a. (ndi-.lw-ee)		*	*
S W b. (ndi̊i̊-.lw-ee)	*!		

Candidate (25a) emerges as the winner because it obeys the prohibition against moraic epenthesis, even though this means having an iambic foot; otherwise, PROMINENCE-TO-WEIGHT would be violated, as in (24c). Candidate (25b) obeys both FTFORM(T) and TROCHAIC QUANTITY by lengthening the penult to produce an even trochee *(*ndii.lwee*), but must fatally violate DEP-IO(μ) in order to do so. This analysis predicts, therefore, that the short perfect forms in (6) minimally contain an iamb of the form (21b) aligned at the right edge of the word, as schematized in (26); as above, metrically prominent syllables are underscored:

(26) SM-root-PERF
Ø Ø H

a. (ndi-lw-ée) 'I have fought'
b. ndi-(bal-ée) 'I have counted'
c. ndi-ba(lis-ée) 'I have narrated'
d. ndi-shuku(mis-ée) 'I have shaken (trans.)'
e. ndi-namathe(lis-ée) 'I have cemented'

This is quite a different result from the effect illustrated in tableau (19), above, where WEIGHT-TO-PROMINENCE (16) forces penultimate lengthening in the most well-formed outputs generated for inputs with no lexically long vowels. As noted above, this situation is by far the most common in IsiXhosa. It appears, then, that PROMINENCE-TO-WEIGHT (23) and WEIGHT-TO-PROMINENCE (16) stand in an "elsewhere"-type relation (see Anderson 1969, Kiparsky 1973) in which the more general effect is blocked by the more specific. In terms of ranked, violable constraints, Prince and Smolensky (1993: 81-82) suggest that "elsewhere" effects arise when the weaker (i.e., less general) constraint dominates the stronger (i.e., more general). Following this line of argumentation for IsiXhosa, PROMINENCE-TO-WEIGHT (23) must dominate WEIGHT-TO-PROMINENCE (16), since a heavy syllable in the input attracts prominence:

(27) PROMINENCE-TO-WEIGHT »WEIGHT-TO-PROMINENCE »DEP-IO(μ) » FTFORM(T)

μ μμ
| V
Input: ndi-lw-e

candidates	PROM-TO-WT	WT-TO-PROM	DEP-IO (μ)	FTFORM(T)
W S ☞ a. (ndi-.lw-ee)				*
S W b. (ndiː-.lw-ee)			*!	
S W c. (ndi-.lw-ee)	*!			

In the case of the short perfect, PROMINENCE-TO-WEIGHT can be satisfied by assigning prominence to the syllable which is heavy in the input (27a), or to a syllable made heavy by moraic epenthesis (27b), but only the former option avoids a violation of DEP-IO(μ). Obeying FTFORM(T) regardless of the heavy ultima results in a fatal violation of highest-ranking PROMINENCE-TO-WEIGHT (27c).

If there is no heavy syllable in the input, PROMINENCE-TO-WEIGHT is vacuously satisfied, and WEIGHT-TO-PROMINENCE is left to decide the winner. The short present forms in (12) are representative of this "elsewhere" case in which the penult is made heavy in the most well-formed outputs:

(28) PROMINENCE-TO-WEIGHT »WEIGHT-TO-PROMINENCE »DEP-IO(μ) » FTFORM(T)

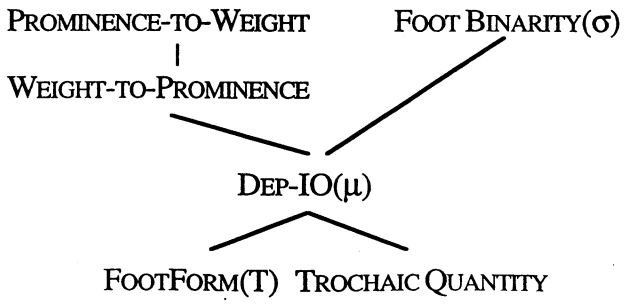
μ μ
| |
Input: ndi-lw-a

candidates	PROM-TO-WT	WT-TO-PROM	DEP-IO (μ)	FTFORM(T)
S W a. (ndi-.lw-a)		*!		
S W ☞ b. (ndiː-.lw-a)			*	

Here, PROMINENCE-TO-WEIGHT simply cannot be violated, since there is no heavy syllable present in the input.

To summarize the analysis developed in this section, the combined requirements of FTBIN(σ) (9) and FTFORM(T) (10) normally ensure that the most well-formed foot in IsiXhosa is a syllabic trochee of the form (7). The penultimate lengthening generally found in IsiXhosa emerges from the dominance of WEIGHT-TO-PROMINENCE (16), which requires prominent syllables to be heavy, over DEP-IO(μ) (18), which prohibits moraic epenthesis. In the rare event that the input contains a lexically long vowel, however, PROMINENCE-TO-WEIGHT (23), which dominates the more general WEIGHT-TO-PROMINENCE, forces a violation of FTFORM(T) in the short perfect (26), forcing rhythmic reversal to an iambic (W S) foot type. As shown in tableau (25), DEP-IO(μ) cannot be violated in order to maintain trochaic foot form or quantity in this case. The constraint ranking as it stands so far is summarized in (29):

(29)



In both the short present (12) and the short perfect (26), there appears to be only one prominent syllable — i.e., a syllable featuring either a lengthened or lexically long vowel. In the next section, we will account for this observation in terms of alignment constraints applying to prosodic and morphological constituents.

3 Footing in the prosodic word

Now that we have established the foot inventory for IsiXhosa, we must next account for the footing proposed in the previous section, whereby a single trochaic foot is laid at the right edge of the word. I propose in this section that the key to achieving this lies in the recognition of a direct and fundamental connection between prosodic and morphological constituents in the grammar of IsiXhosa. Specifically, I argue that this connection rests on the notion of edge-based alignment proposed in McCarthy and Prince (1993), such that the right edge of the morphological stem always coincides with the right edge of one of the optimal feet proposed in the preceding section.

To start, I take the set of relevant prosodic constituents to be those included in the prosodic hierarchy in (8), and the relevant morphological constituents to be those listed in the morphological hierarchy in (30), adapted from McCarthy and Prince (1993: 85):

(30) MWd → Stem
Stem → Stem, Affix
Stem → Root

Under this view, roots and affixes build stems, which in turn correspond to morphological words (MWd). I propose that there is a direct structural relationship between morphological and phonological constituents in the grammar of IsiXhosa which is responsible for building metrical structure. Specifically, the right edge of every stem — i.e., the root plus any affixes — is aligned with the right edge of one of the foot types in (14) or (21b), repeated here as (31a) and (31b), respectively:

(31) a. S W
$(\sigma_{\mu\mu}\ \sigma_{\mu})_{Ft}$

b. W S
$(\sigma_{\mu}\ \sigma_{\mu\mu})_{Ft}$

In order to formally capture this type of edge-to-edge correspondence, we turn to McCarthy and Prince (1993), who propose a family of constraints governing the alignment of phonological, morphological, and syntactic constituents with one another. These constraints take the general form of (32):

(32) Generalized Alignment (McCarthy and Prince 1993: 80)

Align (Cat1, Edge1, Cat2, Edge2) = $_{def}$
$\forall$ Cat1 $\exists$ Cat2 such that Edge1 of Cat1 and Edge2 of Cat2 coincide
Where
Cat1, Cat2 $\in$ PCat $\cup$ GCat
Edge1, Edge2 $\in$ {left, right}

Generalized Alignment, then, aligns the left or right edge of every Cat1 with the left or right edge of some Cat2; categories may be either prosodic (PCat) or grammatical (GCat). I assume the prosodic hierarchy in (8) as the inventory of possible PCats; GCat encompasses morphological or syntactic constituents (see McCarthy and Prince 1993: 80).

Given the general scheme in (32), we can now formulate the morphology-phonology interface in IsiXhosa as a constraint requiring that the right edge of every stem be aligned with the right edge of some foot:[5]

(33) ALIGN(FT)R
Align (stem, R; Ft, R)

As discussed in the previous section, the well-formedness of feet in IsiXhosa is determined by a conspiracy between FTBIN(σ) (9) and FTFORM(T) (10), although the latter can be violated under pressure from higher-ranking PROMINENCE-TO-WEIGHT (23) and DEP-IO(μ) (18) in the case of the short perfect, exemplified in (26). The fact that only well-formed feet are right-aligned with stem edges in the most well-formed outputs suggests that another conspiracy is at work in the grammar of IsiXhosa, namely between the constraints on foot structure in (29) and ALIGN(FT)R in (33).

[5] As pointed out by Mark Baker (p.c.), stem edges in the morphology may be the same thing as maximal projection edges in the syntax. The constraint in (33) therefore might alternatively be viewed as one which prefers that right edges of feet be aligned with the right edges of maximal projections.

To illustrate this point, we turn once again to the short present paradigm for toneless stems in (5), repeated here as (34). Note that under the morphological hierarchy we are assuming in (30), each form consists of a single root plus the indicative mood suffix, which combine to form a stem, and therefore a single MWd. I assume here that subject markers are clitics, i.e., affixes which select for a *prosodic* — not a morphological — category (Zec and Inkelas 1991; Anderson 1992: Ch. 8).[6] They are therefore not directly included in the stem, delineated here by vertical bars:

(34) SM-root-IND
Ø Ø Ø

a. ndii-llw-al 'I fight'
b. ndi-lbaal-al 'I count'
c. ndi-lbaliis-al 'I narrate'
d. ndi-lshukumiis-al 'I shake (trans.)'
e. ndi-lnamatheliis-al 'I cement'

The conspiracy of the constraints on foot structure and ALIGN(FT)R is illustrated in tableau (35) for (34b) *ndibaala* ('I count'):

(35) ALIGN(FT)R, WEIGHT-TO-PROMINENCE » FTBIN » DEP-IO(μ)

μ μ μ
| | |
Input: ndi-bal-a

candidates	ALIGN(FT)R	WT-TO-PROM	FTBIN	DEP-IO(μ)
☞ a. ndi-l(.baa.l-a)l			*	*
b. ndi-l(.ba.l-a)l		*!		
c. (ndii-l.ba).l-al	*!		*	*

Candidate (35a) is the most well-formed here — not only does it align a foot with the right edge of the stem, but the foot which it aligns obeys WEIGHT-TO-PROMINENCE since it is headed by a heavy syllable. Candidate (35b) likewise aligns a foot with the right edge of the stem, but is eliminated because it fails to also observe WEIGHT-TO-PROMINENCE. Candidate (35c) ties with optimal (35a) as far as foot structure is concerned, but its foot is

[6]This assumption is based primarily on the observation that agreement markers can never stand alone or be emphasized. IsiXhosa has a full set of disyllabic free-standing subject and object pronouns for this purpose (see Louw and Jubase 1963: 87-88).

fatally misaligned. The well-formedness of (35a) does not provide us with evidence that ALIGN(FT)R dominates the constraints on foot structure in (29). The prediction here is simply that obeying either constraints on foot shape or on foot alignment is not enough in IsiXhosa — compliance with both is prerequisite to well-formedness.

In conjunction with the prosodic hierarchy in (8), I assume the Strict Layering Hypothesis (Selkirk 1984, 1986) as a default situation whereby each prosodic constituent is properly included within the next higher level of structure — syllables contain moras, feet contain syllables, PrWds contain feet, and so on. However, I also follow Itô and Mester (1992) in assuming that not only the well-formedness of the prosodic constituents, but also the degree of implementation of the Strict Layering Hypothesis itself can differ from language to language as determined by ranked constraints.

As far as including feet — i.e., well-formed feet as determined by the constraints in §2 — in PrWds, there is no evidence that IsiXhosa fails to adhere to Strict Layering. This situation is presumably reflected by the high rank of the constraint in (36), adapted from Itô and Mester (1992):

(36) FT→PRWD

Every foot is included in some PrWd.

As shown in tableau (37), FT→PRWD ensures that the winner in tableau (35) includes its right-aligned foot in a PrWd (enclosed in square brackets):

(37) FT→PRWD, ALIGN(FT)R

μ μ μ
| | |
Input: ndi-bal-a

candidates	FT→PRWD	ALIGN(FT)R
☞ a. ndi-[l(.baa.l-a)l]		
☞ b. [ndi-(l.baa.l-a)l]		
c. [(ndiɬ-l.ba).l-al]		*!
d. ndi-l(.baa.l-a)l	*!	

Both (37a) and (37b) incorporate the right-aligned foot into a PrWd, resulting in a tie — the only difference between the two is that (37b) includes the unfooted SM *ndi-* in PrWd,

while (37a) does not. Candidate (37c) includes its foot in PrWd, but misaligns it with the stem edge; (37d) fails to include its foot in PrWd, violating Ft→PrWd.

I suggest that the tie in (37) is broken under the influence of the constraint in (38) which requires that every MWd, a member of the morphological hierarchy in (38), must be included in some PrWd, a member of the prosodic hierarchy in (8):

(38) MWd→PrWd

Every MWd is included in some PrWd.

This constraint is grounded in the assumption that all morphemes, and therefore all segments, must be integrated into some maximum level of prosodic structure in order to be realized phonetically (see, e.g., Anderson 1992: 201). In terms of our present discussion, it is sufficient to interpret this as meaning that all segmental material must be included in PrWd, although there is strong cross-linguistic evidence that the prosodic hierarchy in (8) extends upward beyond PrWd (see Selkirk 1984, 1986; Zec 1988; Hayes 1989). If MWd→PrWd dominates Ft→PrWd, more than just the foot must be included in PrWd, singling out (37b) as the winner:

(39) MWd→PrWd » Ft→PrWd

μ μ μ
| | |
Input: ndi-bal-a

candidates	MWd→PrWd	Ft→PrWd
a. ndi-[l(.baa.l-a)l]	*!	
☞ b. [ndi-(l.baa.l-a)l]		

We see here that the status of the SM as a clitic which cannot stand alone prosodically, but instead must be incorporated into surrounding prosodic structure, falls out of this ranking automatically.

This result implies that Strict Layering is not consistently maintained at the juncture between foot and syllable in IsiXhosa. Incorporating unfooted syllables into PrWd, as in (39b), constitutes a violation of the layering constraint in (41):

(40) σ→FT

Every syllable is included in some foot.

If both MWD→PRWD and ALIGN(FT)R dominate σ→FT, footing is always non-iterative, as illustrated in tableau (41) for quadrisyllabic (34c) *ndibaliisa*. This is an important consequence of the analysis developed here, since there is no indication of secondary stress in IsiXhosa, and therefore no evidence for the iterative footing characteristic of rhythm-based stress systems:

(41) MWD→PRWD, ALIGN(FT)R » σ→FT

μ μ μ μ
| | | |
Input: ndi-balis-a

candidates	MWD→PRWD	ALIGN(FT)R	σ→FT
☞ a. [ndi-l.ba (liĩ.s-a)l]			**
b. [(ndiĩ-l.ba)(liĩ.s-a)l]		*!	
c. ndi-lba[(liĩs-a)l]	*!*		**

Candidate (41a) emerges as the winner here: it has a single well-formed trochaic foot aligned with the right edge of the stem, and incorporates the remaining unfooted syllables directly into PrWd. Iteratively-footed (41b) is eliminated by a fatal violation of ALIGN(FT)R. Even though it foots all four syllables, misaligning even one of its feet is worse than multiple violations of σ→FT. Candidate (41c) strictly obeys ALIGN(FT)R, but fails to include the unfooted syllables in PrWd and thus fatally violates MWD→PRWD.

In summary, ALIGN(FT)R (33) along with the constraints on foot structure introduced in §2 conspire to align well-formed feet with the right stem edges. Furthermore, because ALIGN(FT)R dominates σ→FT (40), footing is optimally non-iterative, as we would expect in a prominence-driven metrical system. However, due to the relatively higher ranking of FT→PRWD (36) and MWD→PRWD (38), even unfooted syllables are incorporated into higher prosodic structure. The result is that right stem edges correspond to right foot edges, which in turn correspond to right PrWd edges, meaning that every PrWd in IsiXhosa contains a single foot. This situation is reflected by the partial constraint ranking in (42):

(42) MWd→PrWd ALIGN(Ft)R
| |
Ft→PrWd σ→Ft

For the short present forms in (34), this ranking yields the prosodic structure in (43), with footing identical to that proposed in (12). Note that even in a foot-sized form such as (43a), the stem and the SM combine to form a PrWd. This is because ALIGN(Ft)R requires only that the right edge of every foot be aligned with the right edge of some stem — not that a foot be contained within every stem:

(43) SM-root-IND
Ø Ø Ø

a. [(ndii-llw-a)l] 'I fight'
b. [ndi-l(baal-a)l] 'I count'
c. [ndi-lba(liis-a)l] 'I narrate'
d. [ndi-lshuku(miis-a)l] 'I shake (trans.)'
e. [ndi-lnamathe(liis-a)l] 'I cement'

As we proceed in the next section to short present paradigms in which one of the morphemes contributes a high tone to the input, we will see that the optimal prosodic structure generated by the constraint hierarchy proposed in (42) plays a central role in accounting not only for metrical prominence in IsiXhosa, but for tonal alignment as well.

4 The interaction of metrical prominence and tone

There are two principal varieties of interaction between tone and foot structure documented in the literature (see Zec 1994; Hayes 1995: Ch. 7) — those languages in which the distribution of tone is constrained by metrical structure, and those in which the metrical structure is governed by the distribution of tone. I propose in this section that IsiXhosa falls into the former category, and that the structure of the trochaic foot, right-aligned with the stem as described in the preceding section, plays a key role in determining where high tone is associated within the PrWd.

We first consider the short present indicative, a paradigm in which high tone is generally associated with the antepenultimate syllable. Recall from (43) that the short present consists of a SM plus a verb stem containing the root and the indicative mood marker *-a*. In this section we will consider both the case of a high-toned SM followed by a

toneless verb root (H Ø Ø) and the case of a toneless SM followed by a high-toned verb root (Ø H Ø). The third logical possibility — Ø Ø H — is excluded here, since the indicative marker does not introduce high tone into the paradigm.

We begin our examination of the distribution of tone with the H Ø Ø pattern by replacing the toneless SM in the short present indicative examples in (43) with the high-toned third person plural SM *bá-*. The high tone introduced by the SM appears on the metrically prominent penult in the di- and trisyllabic cases (44a-b); otherwise it appears on the antepenult:

(44) SM-root-IND
H Ø Ø

a. [(bá<u>á</u>-llw-a)l]	'they fight'
b. [ba-(lbá<u>á</u>l-a)l]	'they count'
c. [ba-lbá(l<u>ii</u>s-a)l]	'they narrate'
d. [ba-lshukú(m<u>ii</u>s-a)l]	'they shake (trans.)'
e. [ba-lnamathé(l<u>ii</u>s-a)l]	'they make slippery'

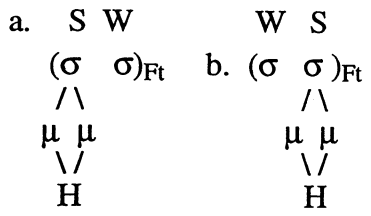
The most general constraint on high tone is that it be parsed. In representational terms, I assume this means that the high tone must be linked to a tone bearing unit (TBU) by an association line (see Goldsmith 1976, Leben 1978), and I take the mora to be the TBU in IsiXhosa.[7] The MAXIMALITY constraint (see McCarthy and Prince 1995: 264) in (45) requires that every high tone in the input correspond to at least one high tone in the output:

(45) MAX-IO(H)
All high tones present in the input must also be present in the output.

Next, the constraint in (46) requires that every high tone present in the input be parsed on the head branch of some foot. For IsiXhosa, this means that high tone is optimally associated with the head branch (S) of one of the foot types in (31):

[7]My assumption that the mora is the relevant TBU in IsiXhosa is grounded in the observation that long (i.e., bimoraic) vowels in some cases feature falling contour tones, indicating that only the leftmost mora of the bimoraic long vowel bears high tone (e.g., short present ***ndibulisée***, 'I have greeted'; remote past ***ndáabulûsa***, 'I greeted').

(46) Tone-to-Foot (adapted from Zec 1994: 231; see also Bickmore 1995)
Associate every H to some foot head, i.e.:



In tableau (47), we see that Max-IO(H) must be at least as high-ranking as Tone-to-Foot, because otherwise the requirement for parsing high tone on the foot head could be circumvented simply by not including high tone in the output. As above, metrically prominent syllables are underscored:

(47) Max-IO(H), Tone-to-Foot
Input: ba-lw-a
H

candidates	Max-IO(H)	Tone-to-Ft
☞ a. [(<u>báá</u>-llw-a)l] H		
b. [(<u>baa</u>-llw-á)l] H		*!
c. [(<u>baa</u>-lw-a)l]	*!	

Candidate (47a) is the optimal one because it associates the high tone to the foot head as in (46a), violating neither constraint. Even though the high tone is parsed in (47b), it is not associated with the head branch of the foot, and is consequently ill-formed. (47c) fails because the input high tone is not present in the ouput, violating Max-IO(H). The same effect is evident in trisyllabic (44b) — [*ba*-l(<u>*báál*</u>-*a*)l] — in which the high tone introduced by the SM is associated to the prominent syllable.

The remaining examples in (44) are not compatible with the analysis we have developed so far, however, because tone falls on the *antepenultimate* vowel, not on the *penultimate*

foot head. This must mean that a constraint which outranks TONE-TO-FOOT, but whose effects are blocked by the dominance of MAX-IO(H) in smaller forms, is interfering with the association of tone to prominence. The source of this interference is, I suggest, the constraint in (48), adapted from Kisseberth (1993: 5):

(48) AVOID PROMINENCE
Tone is not associated to metrically prominent TBUs.

When allowed to apply unchecked, the effect of this constraint is to free the tonology from any dependence on metrical structure. The tension between AVOID PROMINENCE and TONE-TO-FOOT predicts two possible outcomes in a language with mobile tones, depending on their relative ranking — one in which high tone is always associated to a footed TBU, and one in which this is never the case (provided, of course, that no higher-ranking constraints interfere).

As noted at the beginning of this section, it is far more common that high tone is attracted to a metrically prominent syllable or vice versa; this is taken to an extreme in so-called "pitch-accent" languages, where high tone always accompanies metrical prominence (see Hayes 1995: 43). One particularly interesting observation about IsiXhosa is that it features *both* types of association patterns, depending on the verbal paradigm. In the short present paradigm in (44), for example, high tone avoids foot structure wherever compliance with MAX-IO(H) allows, whereas high tone is consistently associated with the metrically prominent syllable in the short perfect paradigm in (26), regardless of word size. We will return to a detailed discussion of this second type of paradigm in the next section.

The dominance of AVOID PROMINENCE over TONE-TO-FOOT in paradigms such as the short present does not leave the latter without any influence, however. As illustrated in tableau (49), even though high tone cannot be associated to the strong branch of the prominent syllable in the most well-formed output, it is nevertheless parsed as close as possible to the foot head:

(49) MAX-IO(H) » AVOID PROMINENCE » TONE-TO-FOOT

Input: ba-shukumis-a
H

candidates	MAX-IO(H)	AVOID PROM	TONE-TO-FOOT
☞ a. [ba-lshukú(miis-a)l] H			*
☞ b. [ba-lshuku(miis-á)l] H			*
c. [ba-lshúku(miis-a)l] H			**!
d. [ba-lshuku(míís-a)l] H		*!	
e. [ba-lshuku(miis-a)l]	*!		

Candidates (49a) and (49b) tie here for the most optimal output: they both obey AVOID PROMINENCE by keeping high tone off the prominent syllable, and at the same time minimally violate TONE-TO-FOOT by associating high tone as close as possible to the prominent syllable — (49a) one TBU to the left on the antepenult, and (49b) one TBU to the right on the ultima. Candidate (49c) also obeys AVOID PROMINENCE, but registers one additional violation of TONE-TO-FOOT by parsing high tone two TBUs away from the prominent syllable. The crucial assumption here is that TONE-TO-FOOT is gradiently violable in terms of distance in TBUs from an unfilled foot head. (49d) complies with TONE-TO-FOOT but fatally violates higher-ranked AVOID PROMINENCE in the process. (49e) is eliminated because it fails to associate the high tone present in the input to any TBU.

The key to breaking the tie between (49a) and (49b) lies in the recognition that edges — usually right edges — are typically characterized by a lack of structure. Prince and Smolensky (1993) explore this point in depth for prosodic structure (pp. 51-58), but I propose that in IsiXhosa, it is not prosodic constituents, but tone which is subject to this type of constraint:

(50) NON-FINAL(H)
High tone is not associated to the final μ in PrWd

As shown in tableau (51), if NON-FINAL(H) and AVOID PROMINENCE dominate TONE-TO-FOOT, the final mora remains toneless in the most well-formed output:

(51) NON-FINAL(H), AVOID PROMINENCE » TONE-TO-FOOT

Input: ba-shukumis-a
H

candidates	NON-FINAL(H)	AVOID PROM	TONE-TO-FOOT
☞ a. [ba-lshukú(miis-a)l] H			*
b. [ba-lshuku(miis-á)l] H	*!		*

Now, candidate (51a) — identical to (49a) and also to (44d) — is correctly singled out as the winner.

We might next wonder how the presence of NON-FINAL(H) and AVOID PROMINENCE affects the di- and trisyllabic examples considered above. For the disyllabic case (44a), compliance with both MAX-IO(H) and NON-FINAL(H) forces high tone to be associated with the foot head, providing us with evidence for the dominance of NON-FINAL(H) over AVOID PROMINENCE:

(52) MAX-IO(H), NON-FINAL(H) » AVOID PROMINENCE

Input: ba-lw-a
H

candidates	MAX-IO(H)	NON-FINAL(H)	AVOID PROM
☞ a. [(bá<u>á</u>-llw-a)l] H			*
b. [(ba<u>a</u>-llw-á)l] H		*!	
c. [(ba<u>a</u>-llw-a)l]	*!		

The winner here — (52a) — is identical to the winner in tableau (47), and demonstrates that NON-FINAL(H) must dominate AVOID PROMINENCE. If NON-FINAL(H) were ranked below AVOID PROMINENCE, we would expect to see (52b) emerge as the winner here, since keeping high tone off the metrically prominent syllable would be more important than keeping it off the final mora in PrWd.

For trisyllabic (44b), the ranking as it now stands incorrectly predicts that high tone should be associated only to the initial TBU in the most well-formed output, as shown in tableau (53). The incorrectly predicted winner is indicated by the bomb icon (M):

(53) NON-FINAL(H) » AVOID PROMINENCE » TONE-TO-FOOT

Input: ba-bal-a
H

candidates	NON-FINAL(H)	AVOID PROM	TONE-TO-FOOT
M a. [bá-l(ba<u>a</u>l-a)l] H			*
b. [ba-l(bá<u>á</u>l-a)l] H		*!	
c. [ba-l(ba<u>a</u>l-á)l] H	*!		*

Candidate (53b) is the actual output form — corresponding to (44b) — but it is beaten out here by candidate (53a), which crucially does not violate either NON-FINAL(H) or AVOID PROMINENCE. I propose below that this discrepancy is rooted in paradigmatic leveling across present tense paradigms. As this relation crucially relies on several forms yet to be discussed, we will return to this issue in more detail in §8.

It is important to note that aside from (44b), the analysis developed here applies to any inflection paradigm featuring one high tone in the input which docks to the antepenultimate vowel in quadrisyllabic and larger forms. This includes the Ø H Ø pattern in the short present indicative illustrated in (54). Here, high-toned verb roots are coupled with the toneless first person singular SM *ndi-* in the short present indicative:

(54) SM-root-IND
Ø H Ø

a.	[(ndii-lty-á)l]	'I eat'
b.	[ndi-l(béék-a)l]	'I put'
c.	[ndi-lbú(liis-a)l]	'I greet'
d.	[ndi-lboní(siis-a)l]	'I show clearly'
e.	[ndi-lnyinyithé(kiis-a)l]	'I make slippery'

The only form requiring special explanation here is disyllabic (54a), in which high tone is associated to the weak (right) branch of the trochaic foot. Given the interaction of MAX-IO(H) and TONE-TO-FOOT in foot-sized PrWds illustrated in tableau (47), we would expect *[(*ndíí*-l*ty-a*)l] , with high tone associated to the strong (left) branch of the foot.

One possible explanation for ultimate high tone in this case lies in a strong dispreference for associating high tone to lexically toneless SMs in IsiXhosa. This is motivated by the observation that the second and third person singular SMs are differentiated by tone alone: only the latter contributes high tone to the input — cf. ***u-bal-a*** ('you (sg.) count') vs. ***ú-bal-a*** ('he/she counts'). Though the other toneless SMs have no high-toned counterpart, it is conceivable that preservation of tonelessness may have become generalized from the second and third singular distinction.

This dispreference can be captured formally by the following morphological IDENTITY constraint (McCarthy and Prince 1995: 264):

(55) IDENT(SM, TONE)[8]

The tonal status (high-toned, toneless) of SM is maintained from input to output.

This constraint requires that lexically toneless SMs remain toneless in the most well-formed outputs. There is no evidence, however, that it also requires lexically high-toned SMs themselves to be associated with high tone. Simply associating the high tone sponsored by the SM somewhere within the same word is evidently sufficient to make its source recoverable, as reflected by the examples of the short present in (44).

If IDENT(SM, TONE) is ranked at least as highly as MAX-IO(H) and above NON-FINAL(H), the result is ultimate high tone in words like (54a):

(56) MAX-IO(H), IDENT(SM, TONE) » NON-FINAL(H)

Input: ndi-ty-a
H

candidates	MAX-IO(H)	ID(SM,TONE)	NON-FINAL(H)
☞ a. [(ndii-lty-á)l] H			*
b. [(ndíí-lty-a)l] H		*!	
c. [(ndii-lty-a)l]	*!		

Candidate (56a), which associates high tone to the weak branch of the foot in order to comply with MAX-IO(H) and IDENT(SM, TONE), is evaluated as the most optimal. (56b) also obeys MAX-IO(H) by associating high tone with the penult, but obeying NON-FINAL(H) in this manner comes at the cost of fatally violating IDENT(SM, TONE). Candidate (56c) is eliminated because it fails to associate the high tone sponsored by the verb root with any TBU at all.

We see a similar faithfulness effect in trisyllabic (54b), *ndibééka*, this time providing evidence that IDENT(SM, TONE) also dominates AVOID PROMINENCE:

[8] The insight behind the constraint in (55) is due to Lee Bickmore (p.c.).

(57) IDENT(SM, TONE) » AVOID PROMINENCE » TONE-TO-FOOT

Input: ndi-bek-a
H

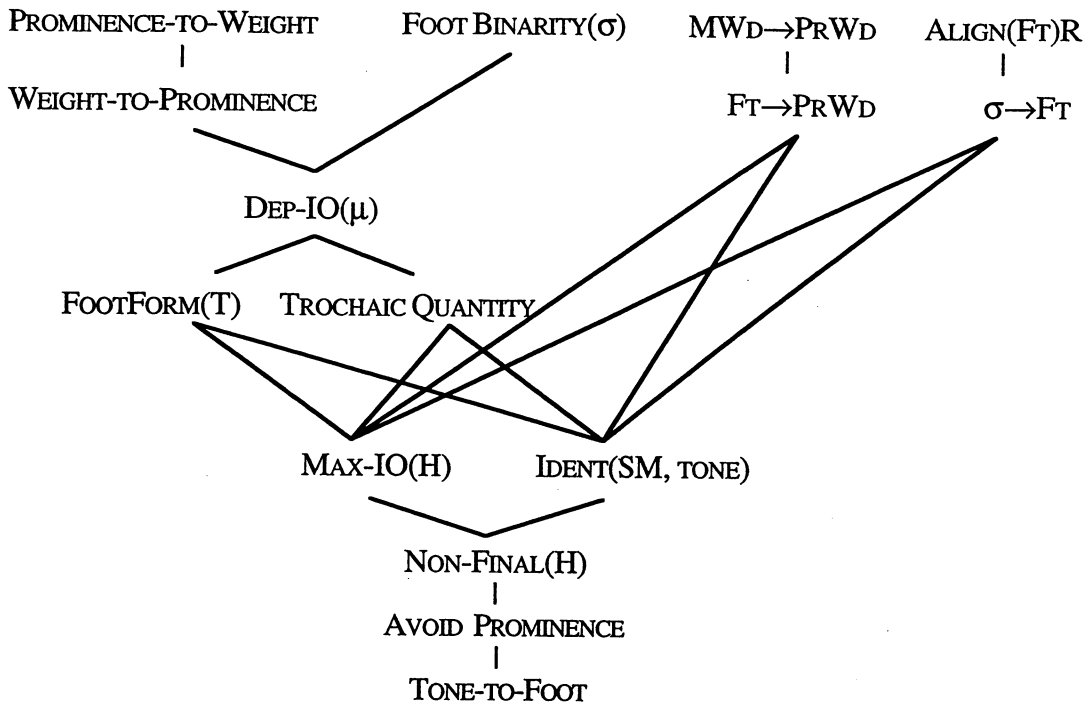
candidates	ID(SM,TONE)	AVOID PROM	TONE-TO-FOOT
☞ a. [ndi-l(béék-a)l] H		*	
b. [ndí-l(beek-a)l] H	*!		*

The optimal candidate here is (57a), because it avoids associating high tone to a lexically toneless SM, even at the cost of violating AVOID PROMINENCE. In (57b), AVOID PROMINENCE is obeyed, but only by fatally violating higher-ranking IDENT(SM, TONE).

The analysis of the remaining forms in (54) follows that presented for the forms in (44), above: MAX-IO(H) requires that high tone present in the input be associated with some TBU in the output; the dominance of AVOID PROMINENCE over TONE-TO-FOOT prevents high tone from being associated with footed TBUs, but minimal violation of the latter constraint keeps high tone as close to the prominent syllable as possible. NON-FINAL(H) ensures that high tone is associated to the antepenult in these cases.

None of the constraints on the association of high tone introduced here appear to be directly interleaved with the metrical constraints ranked in (29) and (42). Instead, high tone is associated relative to the non-iterative right-aligned trochaic foot parse laid out in §§2-3. Theoretically, it should be possible to achieve a well-formed association of tone to virtually any foot type aligned in any fashion with the constraints proposed in this section. This means that the constraints on metrical structure in (42) must dominate the tonal parsing and alignment constraints as a unit:

(58)



This ranking accounts for those paradigms in which high tone is generally associated to the antepenultimate syllable — and therefore for 18 of the 43 paradigms listed by Claughton (1983) where this is the case (see appendix). Some refinements to (58) are still needed to account for forms with multiple high tones in the input, as well as for those which I analyze as containing more than one PrWd. We will return to these issues in §§7-8, respectively.

Next, however, we need to account for why all IsiXhosa verbal paradigms do not follow the general pattern outlined in this section as far as alignment of high tone is concerned. In a number of cases, high tone is consistently associated to either the penultimate or the ultimate syllable. In the section which follows, I will suggest that penultimate and ultimate high tone are reflexes of a second alignment strategy, and that we can account for this strategy with a single, morphologically-conditioned reranking of two adjacent constraints.

5 Penultimate high tone and morphological reranking

Although the antepenultimate tonal alignment discussed in the previous section is by far the most widely discussed in the literature (e.g., Goldsmith, Peterson and Drogo 1986, Downing 1990), 23 of the 43 inflection paradigms listed by Claughton (1983) in fact never feature a lone high tone on the antepenult. Instead, high tone consistently appears on either

the penultimate — e.g., singular imperative *bonisíísa* ('show clearly!') — or in a few cases the ultimate syllable — e.g., short perfect *ndibonisisée* ('I have shown clearly'). In this section, I suggest that penultimate and ultimate high tone are two reflexes of a single alignment strategy. This strategy emerges from the prosodic structure laid out in §§2-3, from the non-finality effect proposed in (50), and from a constraint ranking which differs from that in (58) in one crucial regard — AVOID PROMINENCE (48) is subordinate to TONE-TO-FOOT (46). The result is that high tone consistently associates to the metrically prominent syllable in the most well-formed outputs.

We begin by examining the singular imperative forms in (59). These simply consist of a root — here, the same high-toned roots exemplified in (54) — plus the indicative marker *-a*. High tone is associated to the penultimate foot head in all cases but the monomoraic stem in (59a), which is preceded by the epenthetic syllable yi̊-:[9]

(59) root-IND
H Ø

a. [(y i̊ i̊-lty-á)l]	'eat!'
b. [l(béék-a)l]	'put!'
c. [lbu(líís-a)l]	'greet!'
d. [lboni(síís-a)l]	'show clearly!'
e. [lnyinyithe(kíís-a)l]	'make slippery!'

We could perhaps account for the penultimate high tone in *bééka* in the same way we accounted for high tone in disyllabic short present *báálwa* ('they fight') in tableau (52) — i.e., with the dominance of MAX-IO(H) over AVOID PROMINENCE. This approach clearly fails for trisyllabic and larger forms, however. As illustrated in tableau (60), the constraint hierarchy as it stands in (58) predicts the incorrect result for (59c-e):

[9]As noted in §2, the epenthetic syllable yi̊- is regularly attached to monomoraic forms such as *lw-a* which are unable to stand alone as well-formed PrWds. In all of the examples of which I am aware, however, yi̊- cannot bear high tone.

(60) Non-Final(H) » Avoid Prominence » Tone-to-Foot

Input: bonisis-a
H

candidates	Non-Final(H)	Avoid Prom	Tone-to-Foot
M a. [lboní(siis-a)l] H			*
b. [lboni(siis-á)l] H	*!		*
c. [lboni(síís-a)l] H		*!	

Just as for the short present [l*ba-shukú(miis-a)*l] in tableau (51), the constraints as ranked in §4 pick out (60a) — the form with antepenultimate high tone — as the winner. In fact, the optimal candidate should be (60c), but it is eliminated here by a fatal violation of Avoid Prominence.

This problem is overcome, however, if Avoid Prominence is demoted one notch in the ranking to a position immediately subordinate to Tone-to-Foot. This reranking means that associating high tone to the metrically prominent foot head is more important than segregating the tonology from metrical structure. The result, as shown in tableau (61), is penultimate high tone in the most well-formed output. Under this alternative ranking, (60c) emerges as the winner:

(61) NON-FINAL(H) » TONE-TO-FOOT » AVOID PROMINENCE

Input: bonisis-a
H

candidates	NON-FINAL(H)	TONE-TO-FOOT	AVOID PROM
a. [lboní(siis-a)l] H		*!	
b. [lboni(sii-sá)l] H	*!	*	
☞ c. [lboni(síís-a)l] H			*

This difference in ranking implies that there is more to IsiXhosa morphology than just the constituents of the morphological hierarchy in (30). The prediction of the Optimality Theoretic view of grammar being advanced here is that the morphology is able to extend its influence beyond the grouping of roots and affixes to the constraint ranking itself. The result is that inflectional classes emerge from variations in dominance relations within the hierarchy — verbal paradigms in IsiXhosa which generally associate high tone to the antepenult differ from those which associate high tone to the penult because the well-formedness criteria for each are not the same. Along similar lines, Inkelas, Orgun and Zoll (1994) as well as Itô and Mester (1995) suggest that grammars may determine well-formedness for core members of the lexicon with one constraint ranking, and for peripheral members with another. For IsiXhosa, however, I contend that the morphological classes which arise from the two possible rankings of TONE-TO-FOOT and AVOID PROMINENCE have equal standing in the grammar.

It is important to note that the reranking proposed here can also account for high tone on the ultimate syllable throughout the short perfect paradigm. When a toneless SM and the set of toneless stems first introduced in §2 combine with the high-toned perfective suffix *-éé*, high tone consistently appears on the ultimate syllable, but only on the initial mora of the long vowel.[10] As we see in (62), the result is a word-final falling tonal contour:

[10] As noted in §2, I assume that the short perfect marker *-ee* is a lexicalized long vowel (along with class 2a prefix *oo-* and class 10 prefix *ii-*). It is unlikely that *-ee* is the result of synchronic hiatus resolution, since

(62) SM-root-PERF

H

a. [(ndi-l<u>lw-ée</u>)l] 'I have fought'
b. [ndi-l(ba<u>l-ée</u>)l] 'I have counted
c. [ndi-lba(li<u>s-ée</u>)l] 'I have narrated'
d. [ndi-lshuku(mi<u>s-ée</u>)l] 'I have shaken (trans.)'
e. [ndi-lnamathe(li<u>s-ée</u>)l] 'I have cemented'

In tableau (63), we can see that the ultimate falling tone in these forms is attributable to two principal factors. The first of these is the dominance of TONE-TO-FOOT over AVOID PROMINENCE, which ensures that high tone is associated to the metrically prominent syllable — in this case, the final heavy syllable (see §2). The second is higher-ranking NON-FINAL(H), which disprefers the association of high tone to the final mora in PrWd:

(63) NON-FINAL(H) » TONE-TO-FOOT » AVOID PROMINENCE

Input: ndi-shukumis-ee

H

candidates	NON-FINAL(H)	TONE-TO-FOOT	AVOID PROM
☞ a. [ndi-lshuku(mi<u>s-ée</u>)l] H			*
b. [ndi-lshuku(mi<u>s-éé</u>)l] H	*!		*
c. [ndi-lshuku(mí<u>s-ee</u>)l] H		*!	

Although candidates (63a) and (63b) both obey TONE-TO-FOOT, only (63a) represents the optimal output here because it also obeys NON-FINAL(H) by leaving the final mora in PrWd toneless. Candidate (63c) leaves the entire prominent syllable toneless and therefore complies with AVOID PROMINENCE, but fatally violates higher-ranking TONE-TO-FOOT in the process.

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this never results in long vowels — cf., e.g., *indoda* ('man'), but *na* + *indoda* → *n<u>e</u>ndoda* ('and/with the man').

This leaves us, then, with two constraint rankings which differ only in the relative ranking of two constraints in an immediate dominance relation, AVOID PROMINENCE and TONE-TO-FOOT. As discussed in detail in §4, paradigms such as the short present which typically associate high tone to the antepenultimate syllable are characterized by the ranking in (64), where AVOID PROMINENCE dominates TONE-TO-FOOT. A complete listing of these paradigms is provided in the appendix:

(64) MAX-IO(H) IDENT(SM, TONE)

NON-FINAL(H)

AVOID PROMINENCE

TONE-TO-FOOT

For those paradigms which regularly associate high tone to the prominent syllable — whether this is the penult as in the singular imperative (59), or the ultima as in the short perfect (62) — TONE-TO-FOOT dominates AVOID PROMINENCE:

(65) MAX-IO(H) IDENT(SM, TONE)

NON-FINAL(H)

TONE-TO-FOOT

AVOID PROMINENCE

It is important to keep in mind that these two rankings define autonomous morphological inflection classes: paradigms cannot alternate between one and the other, but instead must be specified in the lexicon for which ranking determines their well-formedness. Note that this approach obviates the need for positing that the difference between the two tonal patterns is due to the shifting around of an abstract accent which is separate from metrical prominence, as suggested by Goldsmith, Peterson and Drogo (1986) and Downing (1990). In the next section, we will see a rather different type of ranking variability associated with another phenomenon in IsiXhosa tonology, namely optional high tone spread.

6 Optional tone spread and unranked constraints

Further evidence for a certain degree of flexibility in the constraint hierarchy in IsiXhosa comes from optional high tone spread. In all of the examples considered in the previous two sections, a single high tone associates to a single TBU in the most well-formed outputs. Thus for the high-toned root *-bonisis-* we have seen, for example, *ndibonísiisa* ('I show clearly') in the short present (§4) and *bonisíísa* ('show clearly!') in the singular imperative (§5). Each of these inflections includes an alternate form in which high tone spreads from the left edge of the morpheme which sponsors it in the input — here, the root — to the antepenult or the penult, depending on the paradigm, viz. ***ndibónísiisa*** and ***bónísíísa***. In this section, I propose that the optional nature of high tone spread is driven by two constraints unranked in relation to one another. We will see that the nature of optional spread differs crucially from the contrast in antepenult versus penult or ultimate high tone discussed in the previous section — under the view adopted here, the former is due to *no* ranking and yields optionality effects, while the latter is attributable to a morphologically conditioned *re*-ranking and yields systematic paradigmatic differences.

The result of optional spreading for the short present forms in (54) consisting of the toneless SM *ndi-* and a high-toned verb stem is shown in (66). In (54), only one syllable bears high tone in each member of the paradigm; these single high-toned syllables are italicized here for ease of comparison:

(66) SM-root-IND
Ø H Ø

a. [(ndii-l*ty-á*)l]	'I eat'
b. [ndi-l(*béé*k-a)l]	'I put'
c. [ndi-l*bú*(liis-a)l]	'I greet'
d. [ndi-lbó*ní*(siis-a)l]	'I show clearly'
e. [ndi-lnyínyí*thé*(kiis-a)l]	'I make slippery'

Here we see that although examples (66a-c) are identical to (54a-c), (66d-e) crucially differ from (54d-e) in that high tone is associated to every TBU from the left edge of the verb root rightward to the antepenult. The forms in (54) show a consistent one-to-one relation between high tone and TBU; clearly, this relation does not hold for the forms in (66). Spreading of high tone is a matter of stylistics and speaker choice; it does not appear to induce any difference in meaning. My native speaker consultant normally volunteered

the reflexes with single high tones as discussed in §§4-5, but found the alternate forms with multiple high tones to be equally acceptable, and readily produced them upon request.

The constraints governing the association of high tones to TBUs introduced in the preceding two sections account only for the optimal position of a single high tone — i.e., on the antepenultimate, penultimate or ultimate syllable; they have nothing to say about the well-formedness of the multiple linking we see in (66). I therefore propose that the optional spreading effect emerges from the interaction of two additional constraints. The first of these, given in (67), requires that high tone be aligned with the leftmost TBU (i.e., mora) of the morpheme which sponsors it in the input (abbreviated here simply as "source"):

(67) ALIGN(H)L

Align high tone with the left edge of its lexical source, i.e.: $\overset{H}{|}$ $_{source}[(C)V$

The second is the linking constraint in (68), based in part on the Universal Association Convention proposed in Goldsmith (1976):

(68) ONE-TO-ONE

Multiple linking is dispreferred.

I suggest that (68) is responsible for the consistent one-to-one associations between high tones and TBUs observed in the examples in §§4-5. ONE-TO-ONE, if ranked below TONE-TO-FOOT but above ALIGN(H)L, has the effect of blocking proper left alignment in forms like (54d) *ndibonísiisa*. All candidates in tableau (69) obey AVOID PROMINENCE, which in the short present dominates TONE-TO-FOOT:

(69) AVOID PROMINENCE » TONE-TO-FOOT » ONE-TO-ONE » ALIGN(H)L

Input: ndi-bonisis-a
H

candidates	AVOID PROM	TONE-TO-FOOT	ONE-TO-ONE	ALIGN(H)L
☞ a.[ndi-lboní(siis-a)l] H		*		*
b. [ndi-lbóni(siis-a)l] H		**!		
c. [ndi-lbóní(siis-a)l] H		*	*!	

Candidate (69a) — corresponding to (54d) — is the most well-formed here, because it violates TONE-TO-FOOT by only one TBU, while at the same time complying with ONE-TO-ONE; (69b) also complies with ONE-TO-ONE but violates TONE-TO-FOOT by two TBUs in order to fulfill the requirement of ALIGN(H)L; (69c) fatally violates ONE-TO-ONE by multiply linking in order to align high tone with the left edge of its lexical sponsor.

Notice that candidate (69c) is identical to (66d) *ndibónísiisa* — it represents an alternate well-formed parse ruled out by the dominance of ONE-TO-ONE over ALIGN(H)L. Since no additional high tones are present in the input, something in the hierarchy as it stands in (69) must give in order to allow for the many-to-one linking which manifests itself as high tone spread in (66d-e). If ALIGN(H)L is ranked above ONE-TO-ONE in the dominance hierarchy, it becomes more important to properly left-align high tone than to maintain one-to-one associations. As we see in tableau (70), a switch in the ranking of these two adjacent constraints selects (69c) as the optimal output:

(70) AVOID PROMINENCE » TONE-TO-FOOT » ALIGN(H)L » ONE-TO-ONE

Input: ndi-bonisis-a
H

candidates	AVOID PROM	TONE-TO-FOOT	ALIGN(H)L	ONE-TO-ONE
a.[ndi-lboní(siis-a)l] / H		*	*!	
b. [ndi-lbóni(siis-a)l] | H		**!		
☞ c. [ndi-lbóní(siis-a)l] V H		*		*

Candidate (70a) — the optimal output in (69) — is eliminated here because it fails to comply with ALIGN(H)L, which now outranks ONE-TO-ONE. (70b) complies with ALIGN(H)L, but is ill-formed because it violates TONE-TO-FOOT by two TBUs. Candidate (70c) is the most well-formed output: it complies as best it can with TONE-TO-FOOT given the higher ranking of AVOID PROMINENCE and also satisfies ALIGN(H)L, even though this means multiple linking of high tone.

Notice that since AVOID PROMINENCE and TONE-TO-FOOT dominate ALIGN(H)L and ONE-TO-ONE, the effect of even higher-ranking constraints such as MAX-IO(H) (45) and IDENT(SM, TONE) (55) retain their power to force ultimate or penultimate high tone in forms such as *ndiityá* (66a) and *ndibééka* (66b). Likewise, the dominance of AVOID PROMINENCE over TONE-TO-FOOT in this paradigm prevents high tone from spreading to the metrically prominent penult in (66c) *ndibúliisa* (see §4).

Optional tone spread and left-alignment effects are not restricted to high tones contributed by roots, as shown in (71).[11] Here, the high toned third person plural SM *bá-* combines with lexically toneless roots followed by the indicative mood marker *-a*:

[11]Object markers, all of which are high-toned in IsiXhosa, exhibit exceptional behavior with regard to Align(H)L by left-aligning their high tone with the root instead of with themselves. This is the case in only some inflection paradigms, however (see appendix for a complete list). In the short present, for example, adding an object marker to an otherwise completely toneless form results in left-alignment with the stem when tone spread is opted for (*ndi-wa-**shúkúmiis-a***, 'I shake them [noun class 6]'). In contrast, the object marker's high tone aligns with the object marker itself in, for instance, the long form of the negative infinitive ***ú-kú-nga-wá-shúkúmíís-i*** ('not to shake them [noun class 6]'). In terms of the analysis developed in this section, this discrepancy can be accounted for if ALIGN(H)L is unpacked into two

(71) SM-root-IND
H Ø Ø

a. [(*bá́á*-llw-a)l]	'they fight
b. [bá-l(*bá́á*l-a)l]	'they count'
c. [bá-l*bá*(liis-a)l]	'they narrate
d. [bá-lshú*kú*(miis-a)l]	'they shake (trans.)'
e. [bá-lnámá*thé*(liis-a)l]	'they cement'

The result is that high tone spreads from the SM rightward to the antepenult, or when this fails for reasons discussed in §4, to the penult.

It is also important to point out that optional high tone spread is not limited to paradigms in which high tone is preferably not associated to the right of the antepenult. This is exemplified by the singular imperative paradigm in (72), made up of the same high-toned roots in (66) plus the indicative marker *-a*. Here, high tone is associated on every TBU from the left edge of the root to the penult as the result of optional spreading (except in (72a), where epenthetic syllable yi- cannot bear high tone):

(72) root-IND
H Ø

a. [(yiii-l*ty-á*)l]	'eat!'
b. [l(*béé*k-a)l]	'put!'
c. [lbú(*líí*s-a)l]	'greet!'
d. [lbóní(*síí*s-a)l]	'show clearly!'
e. [lnyínyíthé(*kíí*s-a)l]	'make slippery!'

Just as is the case in the short present example in tableau (70), tone spreading occurs in the most well-formed output when ALIGN(H)L dominates ONE-TO-ONE. The only difference here is that TONE-TO-FOOT dominates AVOID PROMINENCE, which means that high tone normally falls on the metrically prominent syllable. This is illustrated for (72c) *búlíísa* in

related subcomponents: a more general requirement as defined in (67), and a more specific requirement that high tone from the object marker be left aligned with the stem. In paradigms like the long negative infinitive, the more specific requirement must dominate the more general (in other words, this is an "elsewhere effect" as described by Kiparsky 1973); but in paradigms like the short present, the opposite relation must hold. We have already seen evidence in §5 that changes in constraint rankings are morphologically conditioned in some cases. The difference in alignment of object marker high tone from paradigm to paradigm therefore has parallels elsewhere in the grammar.

tableau (73), where all candidates again obey NON-FINAL(H) by not associating high tone to the final mora — here equivalent to the final syllable — in PrWd:[12]

(73) TONE-TO-FOOT » AVOID PROMINENCE » ALIGN(H)L » ONE-TO-ONE

Input: bulis-a
H

candidates	TONE-TO-FOOT	AVOID PROM	ALIGN(H)L	ONE-TO-ONE
a. [lbu(líís-a)l] H		*	*!	
b. [lbú(liis-a)l] H	*!			
☞ c. [lbú(líís-a)l] H		*		*

Candidate (73a) and (73c) tie for well-formedness as far as TONE-TO-FOOT and AVOID PROMINENCE are concerned, but (73c) emerges as the winner because it also left-aligns high tone with its lexical source (the root). This comes at the cost of violating ONE-TO-ONE, but it is better than not left-aligning, as demonstrated by the failure of (73a). Candidate (73b) complies strictly with ALIGN(H)L — and consequently does not associate tone to the metrically prominent syllable, incurring a fatal violation of TONE-TO-FOOT.

The alternate well-formed outcome, under which only the italicized syllables in the forms in (72) bear high tone, is also possible if ONE-TO-ONE dominates ALIGN(H)L:

[12] A question arises here as to whether associating high tone to lengthened penultimate vowels involves a violation of ONE-TO-ONE (even in the parse without optional spreading), since this involves the linking of one high tone to two moras. Under the non-derivaitonal view of phonology adopted here, we cannot assume a scenario whereby the penultimate vowel is first lengthened and then associated with high tone, or vice versa. Instead, the output candidate which happens to do both (simultaneously) emerges as the winner, making it unclear whether linking high tone to a lengthened penultimate vowel necessarily involves association of one high tone to two TBUs in the same sense as linking one high tone to both moras of a lexically long vowel. Interestingly, we never find lexically long vowels in IsiXhosa which bear high tone on both moras. What we find instead is a falling contour tone, as in short present *ndi-bulis-ée* ('I have greeted') or remote past *nd-áa-bulíís-a* ('I greeted'), where perfect marker *-ée-* and remote past marker *-áa-* appear to be lexically long. I leave this question open, but for present purposes assume that association of high tone to lengthened penultimate vowels does not constitute a violation of ONE-TO-ONE.

(74) Tone-to-Foot » Avoid Prominence » One-to-One » Align(H)L

Input: bulis-a
H

candidates	Tone-to-Foot	Avoid Prom	One-to-One	Align(H)L
☞ a. [lbu(líís-a)l] H		*		*
b. [lbú(liis-a)l] H	*!			
c. [lbú(líís-a)l] H		*	*!	

Here, violation of One-to-One causes candidate (74c) — the winner in tableau (73) — to lose out to (74a), which fails to obey Align(H)L but crucially associates the high tone sponsored by the root only with the metrically prominent penult. As above, (74b) obeys both One-to-One and Align(H)L, but fatally violates Tone-to-Foot in the process.

Ideally, cases of optionality or variability should be explainable under Optimality Theory as the effect of adjacent constraints which are unranked in relation to one another (Paul Smolensky, p.c.). The result of such a situation is that two possible immediate dominance relations emerge which are equally well formed — in this case, Align(H)L » One-to-One and One-to-One » Align(H)L. Under this view, language change is presumably ascribable to local reshufflings in the constraint hierarchy, and it seems reasonable to assume that these reshufflings are initially accompanied by a period of variability as the new ranking settles out. We are possibly witnessing such a change in progress in IsiXhosa, with the singly-linked forms in (54) and (59) varying more or less freely with the multiply-linked forms in (66) and (72).[13]

As we have seen in this section, Align(H)L and One-to-One are outranked by every other constraint discussed so far. Specifically, compliance with either of these two

[13]A handful of inflection paradigms allow only for the one-to-many pattern of tonal association (i.e., Align(H)L » One-to-One). This phenomenon has no relation to the relative rankings of Tone-to-Foot and Avoid Prominence — it occurs, for example, in the remote past continuous (***ná-ndí-bóníís-a*** but ****nandi-bonísiis-a***, 'you were not showing clearly') as well as in the negative present continuous (***a-ndi-sá-bónísíís-i*** but ****a-ndi-sa-bonisíís-i***, 'you are still not showing clearly'). This seems to indicate that the Align(H)L » One-to-One ranking is stratified in some cases (see appendix for further examples).

constraints cannot force violations of TONE-TO-FOOT, AVOID PROMINENCE or NON-FINAL(H); moreover, penultimate or ultimate high tone forced by compliance with even higher-ranking constraints such as MAX-IO(H) and IDENT(SM, TONE) remains unchanged regardless of whether ALIGN(H)L dominates ONE-TO-ONE or vice versa. This is illustrated in the updated hierarchies for both the penultimate/ultimate-type paradigms (75a) and the antepenultimate-type paradigms (75b). Because the ranking of ALIGN(H)L relative to ONE-TO-ONE appears to be in limbo, they are depicted here as unranked:

(75) a. MAX-IO(H) IDENT(SM, TONE)
NON-FINAL(H)
|
TONE-TO-FOOT
|
AVOID PROMINENCE
|
ALIGN(H)L ~ ONE-TO-ONE

b. MAX-IO(H) IDENT(SM, TONE)
NON-FINAL(H)
|
AVOID PROMINENCE
|
TONE-TO-FOOT
|
ALIGN(H)L ~ ONE-TO-ONE

It is crucial to make clear at this point that the alternation in ranking between ALIGN(H)L and ONE-TO-ONE proposed in this section differs in an important way from the alternation in ranking between AVOID PROMINENCE and TONE-TO-FOOT proposed in §5. As shown above, optional tone spread is possible in paradigms conforming to well-formedness according to the rankings in (75a) — e.g., singular imperative ***bónísíísa*** next to *bonisíísa* — as well as in (75b) — e.g., short present *ndibónísiisa* next to *ndibonísiisa*.

In contrast, there is no parallel pattern of free alternation between, say, antepenultimate and penultimate high tone within the same form in the short present — e.g., *ndibonísiisa* but not **ndibonisíísa*. I take this result to mean that ALIGN(H)L and ONE-TO-ONE in effect have no fixed relative ranking in the grammar of IsiXhosa, but that that the ranking of TONE-TO-FOOT relative to AVOID PROMINENCE in the two hierarchies in (75) is completely static. Whether a paradigm must rely on (75a) or (75b) for its well-formedness evaluations is determined as part of the morphological information accompanying that paradigm in the lexicon. In the next section, we will turn to another piece of evidence for morphologically-conditioned differences in the constraint hierarchy — and thereby formally define the tonal domain in IsiXhosa as shaped by the edges of phonological and morphological constituents.

7 Multiple high tones and tonal domains

We have so far treated examples with only one high tone, but these in fact constitute a minority case — most verbal paradigms involve at least two morphemes which sponsor high tone in the input. In this section, I examine how this situation is optimally resolved by the grammar of IsiXhosa. As we will see, the result in many paradigms is that only one of the high tones appears in the most well-formed candidates, due to the high ranking of the Obligatory Contour Principle (OCP). In some cases, however, more than one high tone appears in the optimal outputs.

In order to account for forms with multiple high tones, I suggest here that the OCP in IsiXhosa appears not only to disprefer the presence of two autonomous high tones on immediately adjacent TBUs, but also the presence of more than one high tone within a given phonological (PrWd) or morphological category (stem), thus establishing tonal domains. Because stems are always contained within PrWds, but not vice versa, multiple high tones are tolerated in forms where the stem serves as the tonal domain — as long as only one of the high tones is parsed within the stem itself. Where PrWd serves as the tonal domain, however, multiple high tones are not tolerated. I propose that variations in the shape of tonal domains from paradigm to paradigm emerge in this case from a morphologically conditioned reformulation of a single constraint (the OCP), not a reranking of two constraints as proposed for Avoid Prominence and Tone-to-Foot in §5.

Let us consider first the short present paradigm in (76) consisting of the third-person plural high-toned SM *bá-* and a high-toned verb root followed by the indicative mood marker. Recall from previous sections that the short present generally associates high tone to the antepenult, meaning that Avoid Prominence dominates Tone-to-Foot (see §5). Note that although two high tones are present in the input for each form, only one of them appears in the output (optional spreading is omitted here for clarity):

(76) SM-root-IND
H H Ø

a. [(bá<u>á</u>-lty-a)l] 'they eat'
b. [ba-l(b<u>é</u>é</u>k-a)l] 'they put'
c. [ba-lbú(l<u>ii</u>s-a)l] 'they greet'
d. [ba-lboní(s<u>ii</u>s-a)l] 'they show clearly'
e. [ba-lnyinyithé(k<u>ii</u>s-a)l] 'they make slippery'

As shown in tableau (77), the constraint ranking as it stands in (58) and (75b) makes the wrong prediction about well-formedness for (76a) *báátya*:

(77) MAX-IO(H) » NON-FINAL(H) » AVOID PROMINENCE » TONE-TO-FOOT

Input: ba-ty-a
H H

candidates	MAX-IO(H)	NON-FIN(H)	AVOID PROM	TONE-TO-FT
M a. [(bá<u>á</u>-lty-á)l] H H		*	*	*
b. [(bá<u>á</u>-lty-a)l] | H H	*!		*	
c. [(b<u>aa</u>-lty-a)l] H H	*!*			

Based on the dominance of Max-IO(H) over all of the other constraints governing the distribution of tone, (77a) is judged the optimal candidate here because both high tones present in the input are associated to some TBU in the output. (77b) fails to parse one of the high tones and fatally violates MAX-IO(H); (77c) is ill-formed because it leaves both high tones unparsed.

But as we see from (76a), it is not (77a), but (77b), which should emerge as the most well-formed candidate. This result can be achieved with the help of a somewhat expanded version of the Obligatory Contour Principle (OCP) proposed in (78). Not only does OCP! prohibit immediately adjacent identical specifications of a given feature (78a), but it also prohibits the parsing of identical features within a given domain (78b). The feature of interest here is of course high tone, and the relevant domain is a member of the prosodic hierarchy in (8), PrWd:

(78) OCP!(PRWD) (adapted from Myers 1994: 28)

a. *μ μ
| |
H H

b. *[...μ...(μ)...μ...]$_{PrWd}$
| |
H H

The crucial assumption here is that (78a) disprefers the association of autonomous high tones to adjacent TBUs across the board, but that (78b) operates only within a given prosodic or morphological constituent.

As illustrated in tableau (79), if OCP! dominates MAX-IO(H) in (77), this — coupled with the effect of NON-FINAL(H) — changes the outcome of the evaluation and gives us the attested output in (76a):

(79) OCP!(PRWD) » MAX-IO(H) » NON-FINAL(H)

Input: ba-ty-a
H H

candidates	OCP! (PRWD)	MAX-IO(H)	NON-FINAL(H)
a. [(báá-lty-á)l] H H	*!		*
☞ b. [(báá-lty-a)l] H		*	
c. [(baa-lty-á)l] H		*	*!

Candidate (79a) fails here because it violates OCP!(PRWD) on both counts — not only are the high tones adjacent, but they also occur within the same PrWd; (79b-c) both obey OCP!(PRWD) and therefore tie with one violation of MAX-IO(H). The tie is resolved by NON-FINAL(H): because (73b) avoids associating high tone to the final mora in PrWd, it emerges as the optimal output.

But what about examples (76b-e), which are large enough that both high tones present in the input can be associated to TBUs which are not immediately adjacent? These forms can provide us with conclusive evidence that the relevant domain of OCP! in (78b) is in fact PrWd and not a morphological constituent such as the stem, at least for the short present.[14]

[14] (76b) *babééka* ('they put'), like its trisyllabic short present counterpart (44b) *babáála* ('they count') built around a lexically toneless stem, patterns exceptionally here in associating high tone to the prominent penult instead of the antepenult. Antepenultimate high tone would seem to be required by the dominance of AVOID PROMINENCE over TONE-TO-FOOT (see tableau (53)), however. Both examples will be dealt with in §8 as examples of paradigm leveling.

Consider the situation in tableau (80), where both candidates obey NON-FINAL(H) and AVOID PROMINENCE:

(80) OCP!(PRWD) » MAX-IO(H) » NON-FINAL(H) » AVOID PROMINENCE

Input: ba-bonisis-a
H H

candidates	OCP!(PRWD)	MAX-IO(H)	NON-FIN(H)	AVOID PROM
☞ a. [ba-lboní(siis-a)l] H		*		
b. [bá-lboní(siis-a)l] H H	*!			

Both candidates perform equally well with regard to NON-FINAL(H) and AVOID PROMINENCE, but (80a) is the most well-formed because it parses only one of the two high tones within PrWd. Candidate (80b) is eliminated because it parses more than a single high tone within one PrWd, violating the domain clause of OCP!(PRWD) (78b). Take particular note of the fact that (80b) is ill-formed even though only one high tone is parsed within the stem (delineated by vertical bars); this observation will become important later in this section.

We might next wonder what evidence motivates the assumption in tableaux (79) and (80) that the lone high tone appearing in the most optimal output is in fact the one contributed by the SM. Optional high tone spread can shed considerable light on this question. Recall from (71), repeated here as (81), that in short present paradigms in which the only high-toned morpheme is the SM, high tone spreads from the SM rightward:

(81) SM-root-IND
H Ø Ø

a. [(báá-llw-a)l] 'they fight
b. [bá-l(báál-a)l] 'they count'
c. [bá-lbá(liis-a)l] 'they narrate
d. [bá-lshúkú(miis-a)l] 'they shake (trans.)'
e. [bá-lnámáthé(liis-a)l] 'they cement'

We find precisely the same pattern of spreading in (82), where both the SM and the root are high-toned:

(82) SM-root-IND
H H Ø

a. [(báá-lty-a)l] 'they eat'
b. [bá-l(béék-a)l] 'they put'
c. [bá-lbú(liis-a)l] 'they greet'
d. [bá-lbóní(siis-a)l] 'they show clearly'
e. [bá-lnyínyíthé(kiis-a)l] 'they make slippery'

Since the forms in (82) pattern exactly after the forms in (81), it seems reasonable to conclude that it is indeed the root high tone which is lost under pressure from OCP!(PrWd) in the most well-formed outputs. Even though this effect is transparent only in forms with optional spreading, I suggest that it can be extended to the paradigm in (76) as well. Although it is impossible to know with certainty which high tone survives OCP!, I assume here that it is always the leftmost, based on the spreading facts discussed above. Ultimately, however, the lexical source of the high tone preserved from input to output is not crucial to the analysis developed here; the important point is that only one high tone survives in the most well-formed outputs.

In the short perfect paradigm in (83), built around lexically high-toned stems, we see a nearly identical pattern. In addition to the SM and the root, the perfective marker is also high-toned, meaning that a total of three high tones are present in the input here. Besides this, the only important difference is that high tone in the short perfect spreads from the SM all the way to the ultima in every form, due to the dominance of Tone-to-Foot over Avoid Prominence (see §5):

(83) SM-root-PERF
H H H

a. [(bá-lty-ée)l] 'they have eaten'
b. [bá-l(bék-ée)l] 'they have put'
c. [bá-lbú(lís-ée)l] 'they have greeted'
d. [bá-lbóní(sís-ée)l] 'they have shown clearly'
e. [bá-lnyínyíthé(kís-ée)l] 'they have made slippery'

The alternate forms without optional spreading in (84) confirm that only one of the three high tones is parsed in the most well-formed outputs. Because of the left-alignment effect in (83), I assume once again that the surviving high tone is that sponsored by the SM:

(84) SM-root-PERF
H H H

a. [(ba-lty-ée)l] 'they have eaten'
b. [ba-l(bek-ée)l] 'they have put'
c. [ba-lbu(lis-ée)l] 'they have greeted'
d. [ba-lboni(sis-ée)l] 'they have shown clearly'
e. [ba-lnyinyithe(kis-ée)l] 'they have made slippery'

Just as in tableau (80), only one of the input high tones appears in the output due to the high ranking of OCP!(PRWD), which in this case forces two violations of MAX-IO(H) in the most well-formed candidate. This is illustrated for (84b) *babekée* in tableau (85):

(85) OCP!(PRWD) » MAX-IO(H) » NON-FINAL(H) » TONE-TO-FOOT
Input: ba-bek-ee
H H H

candidates	OCP!(PRWD)	MAX-IO(H)	NON-FIN(H)	TONE-TO-FOOT
☞ a. [ba-l(bek-ée)l] H		**		
b. [bá-l(bek-ée)l] H H	*!	*		
c. [bá-l(bék-ée)l] H H H	*!*			

Candidate (85a) complies fully with OCP!(PRWD) by not parsing autonomous high tones on adjacent TBUs (85a) and by not parsing more than one high tone within PrWd (85b). Candidate (85b) incurs one less violation of MAX-IO(H) by parsing two of the three high tones present in the input, but this results in a fatal violation of OCP!(PRWD). Here again, we see that parsing only a single high tone within the stem is not enough — the tonal domain selected by OCP! ranges over the entire PrWd, i.e., the stem and the SM clitic. Candidate (85c) complies fully with Max-IO(H), violating OCP! not only by parsing more than one high tone within PrWd, but also by associating each of them to contiguous syllables. It is important to keep in mind that (85c) is not the same as (83b) *bábékée* with optional spreading; we are assuming that spreading involves *one* high tone which left-

aligns with its morphological source and at the same time complies as best it can with Tone-to-Foot (see §6).

When we substitute lexically toneless roots into the short perfect paradigm in (83), we find a strikingly different pattern of tonal distribution. As shown in (86), two high tones appear in all but the smallest (disyllabic) form:

(86) SM-root-PERF
H Ø H

a. [(ba-lw-ée)l] 'they have fought'
b. [bá-l(bal-ée)l] 'they have counted'
c. [bá-lba(lis-ée)l] 'they have narrated'
d. [bá-lshuku(mis-ée)l] 'they have shaken (trans.)'
e. [bá-lnamathe(lis-ée)l] 'they have cemented'

The analysis developed so far in this section makes the incorrect prediction about well-formedness for this paradigm. As depicted in tableau (87), OCP!(PrWd) picks out the candidate which parses only one of the two high tones as optimal:

(87) OCP!(PrWd) » Max-IO(H) » Non-Final(H) » Tone-to-Foot

Input: ba-bal-ee
H H

candidates	OCP!(PrWd)	Max-IO(H)	Non-Fin(H)	Tone-to-Foot
M a. [ba-l(bal-ée)l] H		*		
b. [bá-l(bal-ée)l] H H	*!			
c. [bá-l(bal-ee)l] H		*		*!*

The actual output — candidate (87b) — parses more than one high tone within PrWd and is therefore eliminated by a fatal violation of OCP!(PrWd). Candidates (87a) and (87c) tie by both obeying OCP!(PrWd), but (87c) fatally violates Tone-to-Foot by associating high tone two TBUs away from the metrically prominent syllable, thereby leaving (87a) as the

winner. Notice, however, that (87b) parses only one high tone within the stem (i.e., the root plus any suffixes).

This discrepancy calls for defining a second formulation of OCP! which selects a morphological constituent — the stem — as the domain in which no more than one high tone may associate to one or more TBUs:

(88) OCP!(STEM) (adapted from Myers 1994: 28)

a. *μ μ
| |
H H

b. *|...μ...(μ)...μ...|stem
| |
H H

Unlike the morphologically conditioned alternation in ranking of TONE-TO-FOOT relative to AVOID PROMINENCE proposed in §5, I suggest that the difference between paradigms which allow only one high tone per PrWd and those which allow only one per stem is one involving the reformulation of the scope of a single constraint, OCP!. This reformulation is also morphologically conditioned, in that it is triggered only in paradigms where TONE-TO-FOOT dominates AVOID PROMINENCE *and* which are built around lexically toneless stems (see appendix).

Tableau (89) shows that the difference between the paradigms in (84) and (86) cannot be due to the reranking of two separate OCP! constraints in a relation of immediate dominance. Because the stem is always contained within PrWd (see §3), obeying OCP!(PRWD) would always be better than not doing so, even if it were ranked below OCP!(STEM):

(89) OCP!(STEM) » OCP!(PRWD) » MAX-IO(H)

Input: ba-bal-ee
H H

candidates	OCP!(STEM)	OCP!(PRWD)	MAX-IO(H)
M a. [ba-l(bal-ée)l] H			*
b. [bá-l(bal-ée)l] H H		*!	

Once again, (89a), identical to (87a), is incorrectly predicted to be the most well-formed candidate, here because it obeys both versions of OCP!.

If, however, OCP!(PRWD) in (78) is reformulated as OCP!(STEM) as in (88), the predicted output and the actual output are the same:

(90) OCP!(STEM) » MAX-IO(H) » NON-FINAL(H) » TONE-TO-FOOT

Input: ba-bal-ee
H H

candidates	OCP!(STEM)	MAX-IO(H)	NON-FIN(H)	TONE-TO-FOOT
a. [ba-l(bal-ée)l] H		*!		
☞ b. [bá-l(bal-ée)l] H H				

Both (90a) and (90b) obey OCP!(STEM) by not parsing more than one high tone within the stem, but (90a) fails to parse both high tones, fatally violating Max-IO(H). Candidate (90b), identical to (87b) and (89b), is the winner because it parses both high tones — and does so by associating only one of them to the stem. The crucial point to keep in mind here is that we are taking the SM to be a clitic (i.e., a prosodic affix) incorporated into PrWd, not a morphological affix which forms part of the stem.

Note also that the ban on autonomous high tones associated to adjacent TBUs is not weakened or suspended by the reformulation of OCP! proposed in (88). This is demonstrated by the fact that in the short perfect paradigm for toneless stems in (86), optional high tone spread is a well-formed possibility only in (86a):

(91) SM-root- PERF
H Ø H

a. [(bá-llw-ée)l] 'they have fought'
b. *[bá-l(bál-ée)l] 'they have counted'
c. *[bá-lbá(lís-ée)l] 'they have narrated'
d. *[bá-lshúkú(mís-ée)l] 'they have have shaken (trans.)'
e. *[bá-lnámáthé(lís-ée)l] 'they have cemented'

As illustrated in tableau (92), high tone spread is allowed in (91a) because it is the only form in which parsing both high tones would mean associating them to adjacent TBUs:

(92) OCP!(STEM) » MAX-IO(H) » ALIGN(H)L » ONE-TO-ONE
Input: ba-lw-ee
H H

candidates	OCP!(STEM)	MAX-IO(H)	ALIGN(H)L	ONE-TO-ONE
☞ a. [(bá-llw-ée)l] H		*		*
b. [(bá-llw-ée)l] H H	*!			
c. [(ba-llw-ée)l] H		*	*!	

Candidate (92b) obeys MAX-IO(H) by parsing both high tones, but fatally violates OCP!(STEM) by associating them to adjacent TBUs. Candidates (92a) and (92c) perform equally well with respect to OCP!(STEM) and MAX-IO(H), but (92a) emerges as the most well-formed since ALIGN(H)L must take priority over ONE-TO-ONE in order for optional spreading to occur (see §6).

As shown in tableau (93), spreading is blocked in all other forms in (91), because it would mean violating MAX-IO(H) by failing to parse one of the two high tones present in the input (93a), or violating OCP!(STEM) by associating more than one high within the stem (93c):

(93) OCP!(STEM) » MAX-IO(H) » NON-FINAL(H) » TONE-TO-FOOT

Input: ba-bal-ee

H H

candidates	OCP!(STEM)	MAX-IO(H)	ALIGN(H)L	ONE-TO-ONE
a. [bá-l(bál-ée)l] H H		*!		**
☞ b. [bá-l(bal-ée)l] H H				
c. [bá-l(bál-ée)l] H H	*!			

The most well-formed candidate is therefore (93b) because it parses both high tones within PrWd, but only one within the domain set forth by OCP! — in this case, the stem.

In summary, we have seen in this section that the distribution of high tone across verbal paradigms can be accounted for as a function of whether OCP! selects for a prosodic (PrWd) or a morphological category (stem) — no additional structures are needed. This is a parsimonious result, since prosodic and morphological edges already serve a number of independent purposes in the analysis developed here: feet — and therefore PrWds — align to stem edges (§3), and high tones align to foot edges (§§4-6), for example. Whether OCP! takes scope over the PrWd or the stem is conditioned by the paradigm itself. In this case, OCP!(STEM) coincides with the presence of lexically toneless stems in paradigms where TONE-TO-FOOT dominates AVOID PROMINENCE, and which therefore consistently associate high tone to the prominent syllable (see §5). The domain effect is robust in IsiXhosa because, as has been demonstrated here, OCP! dominates MAX-IO(H) along with all of the other constraints on tonal association listed in (75).

The first consequence of this proposal is that every member of every verbal inflection paradigm contains both of the relevant domains, whether or not any of their constituent morphemes introduce high tone into the input. This means that tonal domains are not a

property of the tones themselves in IsiXhosa — as suggested by Kisseberth (1993) — but of the prosodic and morphological structure of the words within which they are associated. The second consequence is that not all high tones must be associated within a tonal domain. Specifically, we have seen that when the stem is selected as the relevant domain, TBUs outside the stem but inside PrWd may bear additional high tones, as in the short perfect paradigm listed in (86). In the next section, we will consider a final example of paradigms which associate more than one high tone in the most well-formed outputs, but the presence of multiple tones in these cases will be ascribed to the presence of multiple tonal domains.

8 Multiple tonal domains and leveling effects

This section offers an analysis for paradigms which can contain more than one high tone in the output, but which pattern in ways significantly different from similar cases examined in the previous section. In short perfect forms built around toneless roots, for example, high tone is parsed as close to the stem edge as possible when high-toned subject and object agreement markers are both present — cf. *ba-wá-shukumis-ée*, but **bá-wa-shukumis-ée* ('they shake them [noun class 6]'). In contrast, we do not find the same type of tonal migration to the stem edge in paradigms like the long form of the present indicative, formed by adding the present tense marker *-ya-* after the SM — cf. *bá-ya-bonísiis-a*, but **ba-yá-bonísiis-a* ('they show clearly').

I argue in this section that verbal inflections like the long present which do not show tonal migration to the stem edge involve more than one morphological root, and therefore more than one stem. Since feet are aligned with right stem edges, this means that there is at least the potential for multiple feet — and consequently for multiple PrWds — in these paradigms. Movement of high tone to the stem edge in the short perfect is attributed to a strategy aimed at minimal violation of TONE-TO-FOOT while at the same time respecting the stem as the tonal domain. Lack of movement in the long present is ascribed to the presence of more than one tonal domain. Our discussion of forms consisting of multiple tonal domains will also lead us to explore the issue of leveling within and across paradigms to explain a handful of cases for which the analysis developed here makes the wrong predictions about well-formedness.

The long form of the present indicative is morphologically identical to the short form with one important exception — the addition of the present tense marker *-ya-* immediately following the SM. Although previous studies of the long present indicative (Goldsmith, Peterson and Drogo 1986, Downing 1990, Kisseberth 1993) treat *-ya-* on a par with affixes such as the indicative marker *-a*, I suggest here that this approach is on the wrong

track. Instead, I propose that *-ya-* is an auxiliary verb (from root *y-*, infinitive *ukúúya*, 'to go') — and therefore a stem in its own right — which combines with a main stem to form the long present. In fact, if we take a number of verbal morphemes which also function as free-standing verbs or prepositions to be stems, this takes us a long way in accounting for the surface complexity of IsiXhosa verbal tonology (see appendix for a complete account).

Pursuing the idea that *-ya-* is a stem leads us to an interesting conclusion. Following the analysis developed in §§2-3 whereby stem edges are right-aligned with feet, and these feet and any unfooted syllables are in turn incorporated into PrWd, the result is that the long present indicative consists of two PrWds in the default case. We begin as we did in §§2-3 by examining a paradigm consisting exclusively of lexically toneless morphemes:

(94) SM-AUX-root-IND
Ø Ø Ø Ø

a. [ndi-l(y-aal-llw-a)l]	'I fight'
b. [(ndi-ly-a)l]-[l(baal-a)l]	'I count'
c. [(ndi-ly-a)l]-[lba(liis-a)l]	'I narrate'
d. [(ndi-ly-a)l]-[lshuku(miis-a)l]	'I shake (trans.)'
e. [(ndi-ly-a)l]-[lnamathe(liis-a)l]	'I cement'

In every form but (94a), right stem edges correspond to right foot edges, which themselves coincide with right PrWd edges. The fact that no robust lengthening of the vowel in the head syllable of the leftmost PrWds is not surprising, given the observation by Louw and Jubase (1963: 21) that this phenomenon is generally limited to words in phrase-final position, or to words in isolation.[15] The explanation for the exceptional patterning of (94a) lies in the monomoraicity of the main stem *-lw-a* ('fight'). Based on the observation first made in §3 that foot-to-stem alignment crucially makes reference to right edges, I assume here that when two consecutive right syllable edges correspond to two consecutive right stem edges — as is the case in (94a) — a foot is optimally aligned with the rightmost of these:

(95) RIGHTMOST(STEM)
Given two consecutive right stem edges, align a foot with the rightmost of the two.

[15] In terms of the analysis developed here, this means that WEIGHT-TO-PROMINENCE (16), which is responsible for penultimate lengthening, must only hold when the foot head in question falls at the end of a prosodic constituent larger than PrWd, e.g., the phonological phrase (see Selkirk 1984, 1986; Zec 1988; Hayes 1989).

If RIGHTMOST(STEM) dominates ALIGN(FT)R (33), and if equally high-ranking FTBIN(σ) (9) allows only disyllabic feet , the result is that (94a) emerges as the winning candidate:

(96) FTBIN(σ), RIGHTMOST(STEM) » ALIGN(FT)R

Input: ndi-y-a-lw-a

candidates	FTBIN(σ)	R-MOST(STEM)	ALIGN(FT)R
☞ a. [ndi-(lyaal-llw-al)]			*
b. [(ndii-ly-a)l]-llw-al		*!	*
c. [(ndii-ly-a)l]-[(llw-aal)]	*!		

(96a) obeys RIGHTMOST(STEM) at the cost of violating ALIGN(FT)R, thereby outperforming all other candidates. (96b) violates both RIGHTMOST(STEM) and ALIGN(FT)R by failing to align a foot with the rightmost stem edge. (96c) aligns feet with the right edge of both stems, but violates FTBIN(σ) in the process.

As shown in (97), substituting lexically high-toned roots for the toneless roots in the rightmost PrWds in (94) reveals antepenultimate high tone in trisyllabic and larger stems. This means that the long present — like the short present — must belong to the class of paradigms for which AVOID PROMINENCE dominates TONE-TO-FOOT (see §5):

(97) SM-AUX-root-IND
Ø Ø H Ø

a. [ndi-l(y-aal-lty-á)l] 'I eat'
b. [(ndi-ly-a)l]-[l(béék-a)l] 'I put'
c. [(ndi-ly-a)l]-[lbú(liis-a)l] 'I greet'
d. [(ndi-ly-a)l]-[lboní(siis-a)l] 'I show clearly'
e. [(ndi-ly-a)l]-[lnyinyithé(kiis-a)l] 'I make slippery'

(97b) is a particularly interesting form, since it associates the high tone contributed by the main verb root to the penult, even though AVOID PROMINENCE dominates TONE-TO-FOOT. The reason for this is made clear in tableau (98); under the structure of the long present proposed here, the two TBUs in (97b) which are not the heads of feet are final in their respective PrWds. As first discussed in §4, NON-FINAL(H) (50), which disprefers associating high tone to the final mora in PrWd, outranks AVOID PROMINENCE. The result

here is that (98a) is the winner, since it avoids violating NON-FINAL(H) — albeit at the cost of violating AVOID PROMINENCE:

(98) NON-FINAL(H) » AVOID PROMINENCE » TONE-TO-FOOT

Input: ndi-y-a-bek-a

H

candidates	NON-FINAL(H)	AVOID PROM	TONE-TO-FOOT
☞ a. [(ndi-ly-a)l]-[(lbéék-a)l] H		*	
b. [(ndi-ly-a)l]-[(lbeek-á)l] H	*!		*
c. [(ndi-ly-á)l]-[(lbeek-a)l] H	*!		*

There is one remaining possibility which must be eliminated, namely **ndíyabeeka*, which associates the high tone introduced by the main verb root in the rightmost PrWd with the head of the foot in the leftmost PrWd. As demonstrated in tableau (99), this candidate is ill-formed due a violation of IDENT(SM, TONE) (55), which disallows the association of high tone to a lexically toneless SM:

(99) IDENT(SM, TONE) » NON-FINAL(H) » TONE-TO-FOOT

Input: ndi-y-a-bek-a

H

candidates	IDENT(SM, TONE)	NON-FINAL(H)	TONE-TO-FOOT
☞ a. [(ndi-ly-a)l]-[(lbéék-a)l] H			
b. [(ndí-ly-a)l]-[(lbeek-a)l] H	*!		

This account together with the analysis developed in §§4-5 make the correct predictions about the location of high tone in all forms in (97) except (97a) [*ndi*-l(*y-aa*l-l*ty-á*)l], the only

member consisting of a single PrWd. Given the constraint ranking in (99), we expect penultimate tone here — i.e., *[*ndi*-|(*y-áá*l-|*ty-a*)|]. This is because associating high tone to the toneless SM in the antepenult would violate IDENT(SM, TONE), and associating it to the ultima would violate NON-FINAL(H), both of which outrank AVOID PROMINENCE. We will return to (97a) later in this section, where I will suggest that the unexpected appearance of ultimate high tone here is attributable to paradigm leveling.

Although high tone originating in the right PrWd does not cross into the left PrWd in the forms in (97), the same does not hold when the situation is reversed. As we see in (100), when the toneless SM *ndi-* in (97) is replaced by the high-toned SM *bá-*, and the high-toned roots are replaced by the toneless roots in (94), the high tone contributed by the SM in the left PrWd appears on either the penult or the antepenult of the right PrWd:

(100) SM-AUX-root-IND
H Ø Ø Ø

a.	[bá-|(y-aa|-|lw-a)|]	'they fight'
b.	[(ba-|y-a)|]-[|(báá|-a)|]	'they count'
c.	[(ba-|y-a)|]-[|bá(liis-a)|]	'they narrate'
d.	[(ba-|y-a)|]-[|shukú(miis-a)|]	'they shake (trans.)'
e.	[(ba-|y-a)|]-[|namathé(liis-a)|]	'they cement'

This rightward shift of high tone follows automatically from the constraint rankings proposed in this analysis. Because TONE-TO-FOOT is outranked by both NON-FINAL(H) and AVOID PROMINENCE in the long present, the best way to avoid violating the latter two constraints is to associate the high tone sponsored by the SM to the antepenult, situated inside an altogether different PrWd:

(101) NON-FINAL(H) » AVOID PROMINENCE » TONE-TO-FOOT

Input: ba-y-a-balis-a
H

candidates	NON-FINAL(H)	AVOID PROM	TONE-TO-FOOT
☞ a. [(ba-ly-a)l]-[lbá(liis-a)l] H			*
b. [(ba-ly-á)l]-[lba(liis-a)l] H	*!		*
c. [(bá-ly-a)l]-[lba(liis-a)l] H		*!	
d. [(ba-ly-a)l]-[lba(líís-a)l] H		*!	

The winner is (101a), because it is the only candidate which obeys both NON-FINAL(H) and AVOID PROMINENCE. Candidate (101b) avoids associating high tone to a prominent syllable, but violates higher-ranking NON-FINAL(H) in the process. Both candidates (101a) and (101b) incur one violation of TONE-TO-FOOT each (calculated here from the nearest foot head), but while (101c) and (101d) comply with this constraint, this necessarily involves a fatal violation of higher-ranking AVOID PROMINENCE.

In (102), we see the result of having a lexically high-toned morpheme in both the left and the right PrWds — in this case, the high-toned SM *bá-* on the left, and one of the same high-toned verb roots as in (97) on the right:

(102) SM-AUX-root-IND
H Ø H Ø

a. [bá-l(y-aal-lty-á)l] 'they eat'
b. [(bá-ly-a)l]-[l(béék-a)l] 'they put'
c. [(bá-ly-a)l]-[lbú(liis-a)l] 'they greet'
d. [(bá-ly-a)l]-[lboní(siis-a)l] 'they show clearly'
e. [(bá-ly-a)l]-[lnyinyithé(kiis-a)l] 'they make slippery'

Here we see that both of the high tones present in the input are also present in the output. Given the analysis of inputs containing multiple high tones in §7, this means either that the

forms in (102) contain two tonal domains demarcated by OCP! (PrWd or stem, depending on inflection type), or that one of the two high tones falls outside of a single domain. I argue that what we in fact find in (102) is two separate tonal domains.

As demonstrated above, the long present belongs to the set of verbal inflections in IsiXhosa characterized by the dominance of AVOID PROMINENCE over TONE-TO-FOOT (see §5). Since there are evidently no other inflection types characterized by this ranking which select the stem as their tonal domain (see appendix), it seems safe to assume that the long present is no exception in this respect — OCP! (78) defines the PrWd as the grammatical constituent within which not more than one high tone may be parsed.

A particularly informative contrast to the tonal pattern in (102) is provided by the short perfect forms in (103), based on the paradigm in (86), but with the addition of the high-toned object agreement marker (OM) for class six nouns *-wá-*. Recall from §7 that under the present analysis, the short perfect consists of a single PrWd and belongs to a class of verbal inflections which select the stem as their tonal domain for paradigms built around lexically toneless stems. In (103), we have such a paradigm, preceded by the SM and OM clitics, and followed by the perfective marker *-éé*:

(103) SM-OM-root-PERF
H H Ø H

a. [ba-(wa-lw-ée)l]	'they have fought them'
b. [ba-wá-l(bal-ée)l]	'they have counted them'
c. [ba-wá-lba(lis-ée)l]	'they have narrated them'
d. [ba-wá-lshuku(mis-ée)l]	'they have shaken them'
e. [ba-wá-lnamathe(lis-ée)l]	'they have cemented them'

Recall also from §7 that high tones sponsored by morphemes outside the stem may also be associated outside the stem without violating OCP!(STEM), as long as no two high tones occur on immediately adjacent TBUs. In (103), both the SM and OM are high-toned and are situated outside the stem, but only the leftmost of the two high tones is parsed in order to avoid precisely this type of OCP! violation. At the same time, the remaining high tone associates to the TBU *nearest the stem edge* in order to comply as best it can with TONE-TO-FOOT (ranked above AVOID PROMINENCE for the short perfect). TONE-TO-FOOT violations are given for each high tone parsed in the output, and are separated by a slash:

(104) OCP!(STEM) » NON-FINAL(H) » TONE-TO-FOOT

Input: ba-wa-balis-ee
H H H

candidates	OCP!(STEM)	NON-FINAL(H)	TONE-TO-FOOT
☞ a. [ba-wá-lba(lis-ée)l] H H			***/✓
b. [bá-wa-lba(lis-ée))l] H H			****!/✓
c. [ba-wa-lbá(lis-ée))l] H H	*!		**/✓

Candidate (104a) emerges as the winner because it obeys OCP!(STEM) both by not associating autonomous high tones to contiguous TBUs and by not associating more than one high tone within the stem. Candidate (104b) also obeys both facets of OCP!(STEM), but fails to perform as well with respect to TONE-TO-FOOT, positioning its leftmost high tone four — instead of the winner's three — TBUs from the foot head. The leftmost high tone in candidate (104c) misses the foot head by only two TBUs, but this comes at the cost of associating more than one high tone within the root, fatally violating OCP!(STEM). Note the rightmost tone in all three candidates is fine with respect to TONE-TO-FOOT, as indicated by the use of the check (✓) in the tableau.

This example provides us with crucial evidence for the morphological and prosodic structure of the long present argued for in this section, since we see no parallel migration of high tone to the edge of the main verb stem in (102). If the long present consisted of a single stem contained in a single PrWd, and if OCP! selected PrWd as its domain, then the presence of multiple high tones should be ruled out. This is the case, for example, in the short present (see §7). If OCP! instead selected the stem as its domain within a single PrWd, then there is no way to explain the fact that we do not see the SM high tone moving to the stem edge in order to comply as best it can with TONE-TO-FOOT, as in (103).

If, on the other hand, we adopt the proposal advanced in this section that the long present is in fact two PrWds, the leftmost (SM) high tone has no reason to move towards the left edge of the main verb stem. As shown in tableau (105), doing so results in a fatal violation of NON-FINAL(H):

(105) OCP!(PRWD) » NON-FINAL(H) » TONE-TO-FOOT

Input: ba-y-a-bonisis-a
H H

candidates	OCP!(PRWD)	NON-FINAL(H)	TONE-TO-FOOT
☞ a. [(bá-ly-a)l]-[lboní(siis-a)l] H H			✓/*
b. [(ba-ly-á)l]-[lboní(siis-a)l] H H		*!	*/*

Associating the high tone introduced by the SM beyond the weak branch of the leftmost foot would also fail, since it would mean the presence of more than one high tone within the rightmost PrWd, in fatal violation of OCP!(PRWD).

Finally, it is worth pointing out that optional tone spread (see §6) is possible in the long present. Recall from §6 that optional high tone spread occurs when ALIGN(H)L (67) dominates ONE-TO-ONE (68), allowing for multiple associations between a single high tone and a string of consecutive TBUs. In paradigms where two high tones are present in the input, one contributed to the leftmost PrWd by the SM, and to the rightmost PrWd by the verb root (102). As shown in (106), we never find spreading in the leftmost PrWd, and we find it in the rightmost only when there are at least two TBUs between the left edge of the root and the antepenult imate syllable (106d-e):

(106) SM-AUX-root-IND
H Ø H Ø

a. [bá-l(y-aal-lty-á)l] 'they eat'
b. [(bá-ly-a)l]-[l(béék-a)l] 'they put'
c. [(bá-ly-a)l]-[lbú(liis-a)l] 'they greet'
d. [(bá-ly-a)l]-[lbóní(siis-a)l] 'they show clearly'
e. [(bá-ly-a)l]-[lnyínyíthé(kiis-a)l] 'they make slippery'

The tonal pattern in these examples arises from the satisfaction of OCP!(PRWD) (78), MAX-IO(H) (45) and NON-FINAL(H) (50), as illustrated in tableau (107):

(107) OCP!(PRWD) » MAX-IO(H) » NON-FINAL(H)

Input: ba-y-a-bonisis-a
H H

candidates	OCP!(PRWD)	MAX-IO(H)	NON-FINAL (H)
☞ a. [(bá-ly-a)l]-[lbóní(siis-a)l] H H			
b. [(bá-ly-á)l]-[lboní(siis-a)l] H H			*!
c. [(bá-ly-á)l]-[lbóní(siis-a)l] H		*!	*/✓
d. [(bá-ly-á)l]-[lbóní(siis-a)l] H H	*!		*/✓

Candidate (107a) obeys all three constraints, and is therefore singled out as most well-formed. (107b) also avoids associating the two high tones to adjacent TBUs, but spreads high tone within the leftmost PrWd, violating NON-FINAL(H). Candidate (107c) leaves one of the high tones present in the input unassociated, violating MAX-IO(H), and (107d) violates OCP!(PRWD) by associating autonomous high tones to neighboring syllables.

The exception to the general pattern in (102) — and in (106) — is (102a) [*bá*-l(*y-aa*l-l*ty-á*)l], which appears to parse two high tones within a single PrWd, in violation of high-ranking OCP!(PRWD). I propose that the explanation for this — as well as for the discrepancies noted for (53) and (97a), above — lies in the notion of leveling, both within and across verbal inflection paradigms. This idea is not at all incompatible with the constraint-based, non-derivational view of the grammar taken here. In fact, one particularly interesting aspect of the correspondence model for Optimality Theoretic grammars proposed in McCarthy and Prince (1995) is that well-formedness evaluations may take place between an input and a set of outputs, or between an output and a set of other outputs. This latter possibility is of interest to us here, since it has the potential for explaining such wide-spread linguistic processes as leveling and analogy. Although it is beyond the scope of this paper to take on such a broad topic, a brief sketch is presented below of how leveling, driven by correspondence among sets of outputs, might work for the IsiXhosa verbal inflections discussed here.

As a beginning, let us consider once again the form in (102a) and (106a) [*bá*-(|*y-aa*|-|*ty-á*)|], which unexpectedly parses two high tones within the same PrWd, one of them on the ultimate TBU. Examined in isolation, this form violates three constraints — OCP(PRWD), NONFINAL(H), and TONE-TO-FOOT — and its well-formedness is a puzzle. Examined in the company of other larger members of the same paradigm, however, (106a) becomes less of a mystery. As a look back to (102) and (106) will confirm, all other members of the paradigm feature high tone within each PrWd: one on the SM, and one on some TBU within the main stem. The tense auxiliary *-ya-* is toneless in every case. As shown in (108), the appearance of two high tones in (106a) simply reflects conformity to this surface pattern. Conforming is evidently more important than complying with OCP!(PRWD) and NON-FINAL(H) for this form (and others like it):

(108) input: ba-y-a-ty-a
H H
actual output: [bá-(|y-aa|-|ty-á)|]
expected output: [bá-(|y-aa|-|ty-a)|]
constraints overridden: OCP!(PRWD), NON-FINAL(H)

a. bá-y-a-béék-a
b. bá-y-a-búliis-a
c. bá-y-a-bonísiis-a
d. bá-y-a-nyinyithékiis-a ⟶ bá-yaa-tyá

Optional spreading is also possible in long present paradigms made up of a toneless SM and a high-toned main verb root (97), shown here with spreading in (109). If ALIGN(H)L (67) dominates ONE-TO-ONE (68), high tone appears on all TBUs between the left edge of the verb stem and the antepenult in the rightmost PrWd:

(109) SM-AUX-root-IND
Ø Ø H Ø

a.	[ndi-|(y-aa|-|ty-á)|]	'I eat'
b.	[(ndi-|y-a)|]-[|(béék-a)|]	'I put'
c.	[(ndi-|y-a)|]-[|bú(liis-a)|]	'I greet'
d.	[(ndi-|y-a)|]-[|bóní(siis-a)|]	'I show clearly'
e.	[(ndi-|y-a)|]-[|nyínyíthé(kiis-a)|]	'I make slippery'

In (109a), high tone cannot spread leftwards since the root is contained within the ultimate syllable (we return to this case immediately below). In (109b), high tone cannot spread to the ultima due to the high rank of NonFinal(H) (50), which disallows high tone on the ultimate mora. Spreading is also not possible in (109c), where high tone is restricted to the antepenult by Avoid Prominence (48) and NonFinal(H) (50) (see tableaux (49) and (51), above).

We find much the same type of pattern for (97a) — equivalent to (109a) — [*ndi*-(|y-*aa*|-|*ty-á*)|], as in (106a) [*bá*-(|y-*aa*|-|*ty-á*)|], with high tone docking on the ultima. We expect penultimate high tone in (109a) in order to avoid violations of Ident(SM, tone) (55) and Non-Final(H) (50). Instead we find that Non-Final(H) is violated. If we consider the larger members of (97) and (109), we see that only the main verb stem in the right PrWd bears high tone throughout the paradigm. Again, conformity to the surface tonal pattern of other paradigm members appears to take precedence:

(110) ndi-y-a-ty-a
H
actual output: [ndi-(|y-aa|-|ty-á)|]
expected output: [ndi-(|y-áá|-|ty-a)|]
constraints overridden: Non-Final(H)

a. ndi-y-a-béék-a
b. ndi-y-a-búliis-a
c. ndi-y-a-bonísiis-a
d. ndi-y-a-nyinyithékiis-a ⟶ ndi-y-aa-ty-á

Lastly, for long present paradigms consisting of a high toned SM and a toneless main verb root as in (100), repeated here with spreading as (111), high tone appears on all syllables between the SM at and the antepenult — or, as in (111b), the penult (we return to this form below):

(111) SM-AUX-root-IND
H Ø Ø Ø

a. [bá-l(y-aal-llw-a)l] 'they fight'
b. [(bá-ly-á)l]-[l(báál-a)l] 'they count'
c. [(bá-ly-á)l]-[lbá(liis-a)l] 'they narrate'
d. [(bá-ly-á)l]-[lshúkú(miis-a)l] 'they shake (trans.)'
e. [(bá-ly-á)l]-[lnámáthé(liis-a)l] 'they cement'

The constraint ranking as developed in §§4-6 predicts, however, that spreading in this case should not be well-formed, since both NON-FINAL(H) and AVOID PROMINENCE must be violated in the leftmost PrWd in order to satisfy lower-ranking ALIGN(H)L (67). Tableau (112) illustrates this incorrect result (see also tableau (101) in this regard). Keep in mind, however, that (112a) *is* the attested output in non-spreading cases; the problem here is that it should be the only well-formed option, given the analysis proposed so far:

(112) NON-FINAL(H) » AVOID PROMINENCE » ALIGN(H)L

Input: ba-y-a-balis-a
H

candidates	NON-FINAL(H)	AVOID PROM	ALIGN(H)L
M a. [(ba-ly-a)l]-[lbá(liis-a)l] H			*
b. [(bá-ly-á)l]-[lbá(liis-a)l] H	*!	*	

One way to resolve this problem in terms of the constraint ranking proposed here would simply be to stipulate that ALIGN(H)L outranks NON-FINAL(H) in just this case. ALIGN(H)L cannot be so highly-ranked otherwise: if this were the case, we would expect to see strict adherence to left-alignment overriding total or near-total compliance with TONE-TO-FOOT (46). What we find instead is that in cases without optional spreading — i.e., where ONE-TO-ONE dominates ALIGN(H)L as laid out in §6 — high tone is located either on the penultimate foot head (singular imperative [l*nyinyithe(kíís-a)*l], 'make slippery!', or on the antepenult (short present [*ba-*l*nyinyithé(kiis-a)*l], 'they make slippery' , but never at the left edge of the stem (**nyínyithekiis-a*,* *ba-nyínyithekiis-a*). Moreover, since we have seen that NON-FINAL(H) must dominate AVOID PROMINENCE and TONE-TO-FOOT (see tableau (53),

below), the dominance of ALIGN(H)L over NON-FINAL(H) in this case would require a leap over several intervening constraints, giving us a considerably less constrained picture of IsiXhosa grammar than one in which all constraint rerankings or unrankings must occur locally (i.e., between constraints in a relation of immediate dominance).

Instead, I suggest that the answer once again lies in correspondence among outputs. As we have seen, all other paradigm types in the long and short present feature a high tone on the SM, as shown in (113). In the case of the short present (113a-b), this is because the SM is not located within a foot, and may therefore bear high tone without violating AVOID PROMINENCE. Violations of these two constraints are allowed in long present forms with both a high-toned SM in the leftmost PrWd and a high-toned verb root in the rightmost PrWd, since not parsing one of the two high tones violates higher-ranking MAX-IO(H) (see tableau (107), above). Given these observations, then, it seems likely that left alignment in the forms in (111) is the result of conformity to the surface tonal distribution in other paradigm types for the present indicative:

(113) input: ba-ya-shukumis-a
H
actual output: [(bá-ly-ál)]-[lshúkú(miis-a)l]
expected output: [(ba-ly-al)]-[lshúkú(miis-a)l]
constraints overridden: NON-FINAL(H), AVOID PROMINENCE

a. bá-shúkúmiis-a
b. bá-bónísiis-a
c. bá-y-a-bónísiis-a ⟶ bá-y-á-shúkúmiis-a

One remaining form which does not follow purely from the analysis presented in this and previous sections is short present (44b) [*ba*-(l*báál-a*)l] in §4 and (76b) [*ba*-(l*béék-a*)l] in §7. Given that the short present — like the long present — is characterized in part by the dominance of AVOID PROMINENCE over TONE-TO-FOOT, we expect high tone to avoid prominence by associating to the antepenult in these case (see, e.g., tableau (53)). Since the SM is lexically high-toned, IDENT(SM, TONE) should present no obstacle to doing so, yet high tone associates to the prominent penult.

To understand why, it is necessary in this case to first examine other reflexes of the present indicative built around the high-toned stem *-beka*. As shown in (114a), high tone is forced onto the prominent TBU by IDENT(SM, TONE) when the stem is preceded by a lexically toneless SM in the short present (see tableau (57)). As we see in (114b) and

(114c), the same is the case in the long present, this time because associating with the antepenult would violate NON-FINAL(H) (see tableaux (98) and (99)). The result is that in every other present indicative example containing a high-toned disyllabic stem like *-beka*, high tone is associated to the penult. It seems plausible, then, that penultimate high tone in (76b) [*ba-*(|*bééék-a*)|] may well be copying the pattern found in (114a-c):

(114) input: ba-bek-a
H H
actual output: [ba-(|bééék-a)|]
expected output: [bá-(|beek-a)|]
constraints overridden: AVOID PROMINENCE

a. ndi-béék-a
b. ndi-y-a-béék-a
c. bá-y-a-béék-a ⟶ babééka

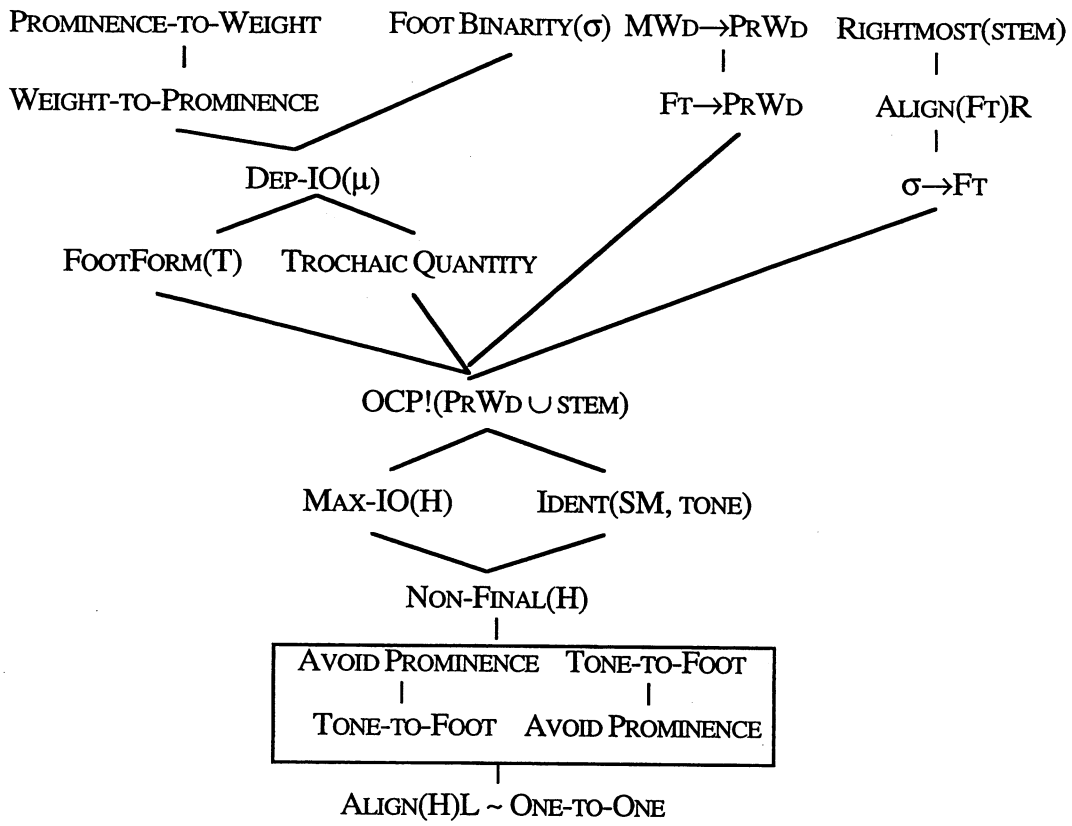
If it is in fact the case that leveling can take place across as well as within paradigms, then the step from [*bá-*(|*baal-a*)|] to [*bá-*(|*báál-a*)|] is a small one, following the model of [*ba-*(|*bééék-a*)|] in (114). Note that the same can be said for the unexpected penultimate high tone in [(*ba-ya*)]-[(*báál-a*)] in (100b), as well as for its counterpart with optional spreading, [(*bá-yá*)]-[(*báál-a*)], in (111b).

The type of interparadigmatic leveling proposed here must hold across tight groups of paradigms in IsiXhosa (the long and short present indicative, for example), since the tonology of its verbal inflections are for the most part characterized by such a high degree of surface complexity (see appendix). What the presence of leveling even within highly restricted groups of paradigms suggests, however, is that well-formedness is more than just an issue of minimal constraint violation in going from input to output. More specifically, groups of well-formed outputs with similar surface distributions of a certain feature — tone, for example — may exert a type of paradigmatic gravity which is strong enough to override the results of individual input-output evaluations when these lead to deviations from the predominant surface pattern.

9 Summary and conclusion

Finally, in order to sum up the major claims made by this study, let us return briefly to input-output evaluations and the full constraint hierarchy proposed here in (115):

(115)



What appears on the surface to be an extremely complex system of verbal tonology (see appendix) is reduced to a number of closely related variations on a central theme — namely that well-formedness is a collaborative affair, dependent on the interworkings of foot structure and metrical prominence, of morphological and prosodic structure, and of tone and with both the phonology and the morphology. Optimality Theory allows us to bring all of these elements together into an integrated analysis, principally because it gives us the formal vocabulary necessary to explain well-formedness as a relative property.

A central claim of this paper is that constraint rankings can be flexible, but that this flexibility can express itself in only a limited number of ways. Under the view advanced here, the broad surface diversity in the tonology of IsiXhosa verbal inflection paradigms boils down to four variables, three of which are determined directly within the constraint hierarchy.

First, we have seen that two constraints in a relation of immediate dominance — Avoid Prominence and Tone-to-Foot — can rerank to define two broad inflectional classes: one consisting of those paradigms which generally associate high tone to the metrically

prominent syllable, and one consisting of those which generally do not (see §5). This is indicated by the box enclosing the two possible rankings in (115).

Second, we have seen that this split corresponds to a difference in whether OCP! allows no more than one high tone within the confines of a prosodic (PrWd) or morphological constituent (see §7).

Third, we have seen that the optional nature of high tone spread available to most inflection paradigms is due to the unranked status of two constraints — ALIGN(H)L and ONE-TO-ONE — relative to one another (see §6). This is also reflected by their placement on the same level in the hierarchy in (115). Notice in particular that all three of these proposed sources of flexibility are strictly local in nature. This is an important result, since it represents the maximally parsimonious view of constraint mobility and interaction within the grammar. If constraint mobility were not confined to a local level, with each slot in the hierarchy potentially open to interaction with all others, we would be dealing with a considerably less constrained system.

The fourth variable is the number of PrWds words contained in each inflection, but this is less a property of the constraint hierarchy, and more a property of the lexicon — provided, of course, that the morphological constituents are integrated into well-formed prosodic structure as described in §§2-3. The appendix listing all 43 of Claughton's (1983) inflection paradigms is organized in terms of these four parameters.

The broader claim advanced here is, therefore, that the morphology in IsiXhosa — and presumably of other languages — can extend its influence directly into the constraint hierarchy itself. As we have observed here, the consequence of this is that inflectional classes within the grammar are definable in terms of differences in the rank or scope of the constraints governing well-formedness.

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Appendix: classification of IsiXhosa verbal inflections

In terms of the analysis developed in the body of this paper, the 43 verbal inflection paradigms listed by Claughton (1983) differ along the four principal parameters enumerated in the conclusion of §8: (1) by the number of PrWds which they contain; (2) by whether AVOID PROMINENCE dominates TONE-TO-FOOT (see §4) or vice versa (see §5); (3) by whether ALIGN(H)L and ONE-TO-ONE are allowed to vary freely in their ranking — i.e., whether optional spread is permitted (see §6); and (4) by whether OCP! selects PrWd or stem as the constituent in which no more than one high tone may be parsed (see §7). Two of the 43 paradigms pattern as exceptional in their basic tonal distribution, and are treated separately here. All verbal inflection paradigms are broken down in (116) in terms of the number of PrWds they contain, as well as in terms of the relative ranking of AVOID PROMINENCE and TONE-TO-FOOT. Inflections marked with an asterisk appear as two paradigms in Claughton (1983):

(116) a. One PrWd, AVOID PROMINENCE » TONE-TO-FOOT

short infinitive	present potential
short present indicative*	present continuous*
present participial	past subjunctive
long perfect*	present potential participial
near past continuous*	remote past continuous
present temporal	

b. Two PrWds, AVOID PROMINENCE » TONE-TO-FOOT

long infinitive

long present indicative*

c. One PrWd, TONE-TO-FOOT » AVOID PROMINENCE

singular imperative	negative present continuous
plural imperative	negative remote past
short perfect*	negative present indicative
short perfect participial	negative present potential
long perfect participial	negative present potential participial
present continuous participial	remote past

d. Two PrWds, TONE-TO-FOOT » AVOID PROMINENCE

negative long infinitive	negative near past continuous
negative perfect participial	negative continuous participial
negative present participial	negative recent past continuous
negative 'not yet' present	negative 'not yet' present participial
negative remote past continuous	negative temporal

f. Exceptional paradigms

negative past subjunctive
present subjunctive

All examples in this appendix make use of the toneless root *shukumis-* ('shake') and the lexically high-toned root *bonisis-* ('show clearly'). Additional auxiliary roots appearing in the paradigms which follow also include: *ku* in infinitives; *ya* in the long present indicative; *nga~nge* in several negative inflections; and *ka* in the negative continuous. All other morphemes besides clitic agreement markers are analyzed here as affixes. As in the body of this paper, metrically prominent syllables are underscored, feet are enclosed in parentheses, stems in vertical bars, and PrWds in brackets. Morphemes are separated by dashes. In addition, invariable high tone — i.e., high tone which appears regardless of whether optional spreading takes place or not — is marked with an acute accent; variable high tone resulting from optional spreading is marked with a dieresis. Claughton's (1983) paradigm numbers appear in brackets:

Group A:
- one PrWd
- AVOID PROMINENCE » TONE-TO-FOOT
- both ALIGN(H)L » ONE-TO-ONE and ONE-TO-ONE » ALIGN(H)L allowed
- OCP! selects PrWd as its domain

(117)	short infinitive [1]	('...to V')
	a. [lkul-lshuku(miis-a)l]	b. [lkul-lböní(siis-a)l]
(118)	short present indicative [4, 5]	('you (pl.) V...')
	a. [ni-lshuku(miis-a)l]	b. [ni-lböní(siis-a)l]
(119)	present participial [15]	('you (pl.) V-ing')
	a. [nï-lshükú(miis-a)l]	b. [nï-lböní(siis-a)l]
(120)	long perfect [11, 12]	('you (pl.) have V-en')
	a. [ni-lshukumí(s-iile)l]	b. [ni-lbönïsí(s-iile)l]
(121)	near past continuous [33, 34]	('you (pl.) were V-ing')
	a. [be-ni-lshükú(miis-a)l]	b. [be-ni-lböní(siis-a)l]

Group B:
- one PrWd
- AVOID PROMINENCE » TONE-TO-FOOT
- ONE-TO-ONE » ALIGN(H)L disallowed in lexically high-toned roots
- OCP! selects PrWd as its domain

(122)	present potential [27]	('you (pl.) can/may V')
	a. [ni-nga-lshükú(miis-a)l]	b. [ni-nga-lbóní(siis-a)l]
(123)	present continuous [23, 24]	('you (pl.) are (still) V-ing')
	a. [ni-sa-lshükú(miis-a)l]	b. [ni-sa-lbóní(siis-a)l]
(124)	past subjunctive [19]	('you (pl.) would have V-en')
	a. [nä-lshükú(miis-a)l]	b. [ná-lbóní(siis-a)l]

Group C:
- one PrWd
- AVOID PROMINENCE » TONE-TO-FOOT
- ONE-TO-ONE » ALIGN(H)L disallowed
- OCP! selects PrWd as its domain

(125) present potential participial [42] ('you (pl.) being able to V')
a. [ní-ngá-lshúkú(miis-a)l] b. [ní-ngá-lbóní(siis-a)l]

(126) remote past continuous [37] ('you (pl.) were V-ing')
a. [ná-ní-lshúkú(miis-a)l] b. [ná-ní-lbóní(siis-a)l]

Group D:
- one PrWd
- AVOID PROMINENCE » TONE-TO-FOOT
- ONE-TO-ONE » ALIGN(H)L disallowed
- OCP! selects stem as its domain

(127) present temporal ('while you (pl.) are V-ing')
a. [náa-ku-lshuku(miis-a)l] b. [náa-ku-lböní(siis-a)l]

Group E:
- two PrWds
- AVOID PROMINENCE » TONE-TO-FOOT
- both ALIGN(H)L » ONE-TO-ONE and ONE-TO-ONE » ALIGN(H)L allowed
- OCP! selects PrWd as its domain

(128) long infinitive [2] ('to V')
a. [(ü-lkü)l]-[lshükú(miis-a)l] b. [(ú-lku)l]-[lböní(siis-a)l]

(129) long present indicative [6, 7] ('you (pl.) V')
a. [(ni-lya)l]-[lshuku(miis-a)l] b. [(ni-lya)l]-[lböní(siis-a)l]

Group F:
- one PrWd
- TONE-TO-FOOT » AVOID PROMINENCE
- both ALIGN(H)L » ONE-TO-ONE and ONE-TO-ONE » ALIGN(H)L allowed
- OCP! selects PrWd as its domain for lexically high-toned roots, stem for lexically toneless roots

(130) singular imperative [21] ('(you (sg.)) V!')
a. [lshuku(míís-a)l] b. [lbönï(síís-a)l]

(131) plural imperative [22] ('(you (pl.)) V!')
a. [lshukumi(s-áá-ni)l] b. [lbönï(s-áá-ni)l]

(132) short perfect [9, 10] ('you (pl.) have V-en.../V-ed yesterday')
a. [ni-lshuku(mis-ée)l] b. [ni-lbönï(sïs-ée)l]

(133) short perfect participial [30] ('you (pl.) having V-en...')
a. [ní-lshuku(mis-ée)l] b. [nï-lbönï(sïs-ée)l]

(134) long perfect participial [16] ('you (pl.) having V-en')
a. [ní-lshukumi(s-ííle)l] b. [nï-lbönïsï(s-ííle)l]

Group G:
- one PrWd
- Tone-to-Foot » Avoid Prominence
- One-to-One » Align(H)L disallowed
- OCP! selects PrWd as its domain for lexically high-toned roots, stem for lexically toneless roots

(135) present continuous participial [26] ('you (pl.) (still) V-ing')
a. [ní-sá-lshuku(míís-a)l] b. [ní-sá-lbóní(síís-a)l]

(136) negative present continuous [25] ('you (pl.) are not (still) V-ing')
a. [a-ni-sá-lshuku(míís-a)l] b. [a-ni-sá-lbónísí(síís-a)l]

(137) negative remote past [14] ('you (pl.) did not V')
a. [a-ní-lshukumi(s-áál-lnga)l] b. [a-ni-lbónísí(s-áál-lnga)l]

Group H:
- one PrWd
- Tone-to-Foot » Avoid Prominence
- both Align(H)L » One-to-One and One-to-One » Align(H)L allowed
- OCP! selects PrWd as its domain for lexically high-toned roots, stem for lexically toneless roots, but adjacent Hs are allowed

(138) negative present indicative [8] ('you (pl.) do not V')
a. [a-ní-lshuku(míís-i)l] b. [a-ní-lbönï(síís-i)l]

(139) negative present potential [28] ('you (pl.) cannot/may not V')
a. [a-ni-ngé-lshuku(míís-i)l] b. [a-ni-ngé-lbönï(síís-i)l]

(140) negative present potential participial [43] ('you (pl.) not being able to V')
a. [ní-ngé-lshku(míís-i)l] b. [ní-ngé-lbönï(síís-i)l]

(141) remote past [13] ('you (pl.) V-ed (long ago)')
a. [náa-lshuku(míís-a)l] b. [náa-lbönï(síís-a)l]

Group I:
- two PrWds
- TONE-TO-FOOT » AVOID PROMINENCE
- both ALIGN(H)L » ONE-TO-ONE and ONE-TO-ONE » ALIGN(H)L allowed
- OCP! selects PrWd as its domain for lexically high-toned roots, stem for lexically toneless roots

(142) negative long infintive [3] ('not to V')
a. [ü-(lkúl-lnga)l]-[lshuku(míís-i)l] b. [ü-(lkúl-lnga)l]-[lbönï(síís-i)l]

(143) negative perfect participial [17] ('you (pl.) not having V-en')
a. [(ní-lnga)l]-[lshukumi(s-áál-lnga)l] b. [(ní-lnga)l]-[lbönïsï(s-áál-lnga)l]

(144) negative present participial [29] ('you (pl.) not V-ing')
a. [(ní-lngal)]-[lshuku(míís-i)l] b. [(ní-lnga)l]-[lshuku(míís-i)l]

(145) negative 'not yet' present [40] ('you (pl.) do not yet V')
a. [a-(ní-lka)l]-[lshuku(míís-i)l] b. [a-(ní-lka)l]-[lbönï(síís-i)l]

(146) negative near past continuous [35] ('you (pl.) were not (recently) V-ing')
a. [be-(ní-lnga)l]-[lshuku(míís-i)l] b. [be-(ní-lnga)l]-[lbönï(síís-i)l]

Group J:
- two PrWds
- TONE-TO-FOOT » AVOID PROMINENCE
- ONE-TO-ONE » ALIGN(H)L disallowed
- OCP! selects PrWd as its domain for lexically high-toned roots, stem for lexically toneless roots

(147) negative continous participial [39] ('you (pl.) still not V-ing')
a. [(ní-lnga)l]-[sá-lshuku(míís-i)l] b. [(ní-lnga)l]-[sá-lbóní(síís-i)l]

Group K:
- two PrWds
- TONE-TO-FOOT » AVOID PROMINENCE
- ONE-TO-ONE » ALIGN(H)L disallowed in leftmost PrWd only
- OCP! selects PrWd as its domain for lexically high-toned roots, stem for lexically toneless roots

(148) negative recent past continous [36] ('you (pl.) were not V-ing (yesterday)')
a. [bé-(ní-lnga)l]-[lshuku(míís-i)l] b. [bé-(ní-lnga)l]-[lbönï(síís-i)l]

(149) negative 'not yet' present participial [41] ('you (pl.) having not yet V-en')
a. [ní-(lngél-lka)l]-[lshuku(míís-i)l] b. [ní-(lngél-lka)l]-[bönï(síís-i)l]

(150) negative remote past continuous [38] ('you (pl.) were not V-ing')
a. [ná-(ní-lnga)l]-[lshuku(míís-i)l] b. [ná-(ní-lnga)l]-[lbönï(síís-i)l]

(151) negative temporal [32] ('you (pl.) are not yet V-ing')
a. [náa-(lkul-lnga)l]-[lshuku(míís-i)l] b. [náa-(lkul-lnga)l]-[lbönï(síís-a)l]

Group L: exceptions

The negative past subjunctive in (152) exhibits obligatory high tone on the final two TBUs only. With the exception of the ultimate high tone, this paradigm appears to fall into under the TONE-TO-FOOT » AVOID PROMINENCE ranking. The special status of the subjunctive marker *-á* here may be due to the fact that it differs from the indicative marker *-a* only in its high tone; in order to keep the two semantically distinct, faithfulness to the subjunctive high tone is valued highly enough by the grammar that both OCP! (78) and NON-FINAL(H) (50) can be ignored:

(152) negative past subjunctive [20] ('you (pl.) would not have V-ed')

a. [a-náa-lshuku(míís-á)l] b. [a-náa-lbönï(síís-á)l]

The present subjunctive exhibits antepenultimate high tone when no object agreement marker (OM) is present (153a), but penultimate when an OM is included (153b) — here noun class 6 *-wá-*. In this paradigm, the subjunctive marker is no longer distinguished from the indicative marker by tone alone, but nevertheless maintains its special ability to parse high tone on the final mora in PrWd, albeit only in the absence of an OM:

(153) a. present subjunctive [18] without OM ('you (pl.) V')

[nï-lshükú(miis-é)l] [nï-lböní(siis-é)l]

b. present subjunctive [18] with OM ('you (pl.) V them [noun class 6]')

[nï-wá-lshuku(míís-e)l] [ní-wa-lbönï(síís-e)l]

Not only in (153) does the presence of the OM make a difference in the distribution of high tone. In fact, adding an OM to each of the paradigms listed in (117-137) reveals a further split having to do with the availability of the ONE-TO-ONE » ALIGN(H)L ranking (see §6). Not surprisingly, the split is handled in a somewhat different way according to whether AVOID PROMINENCE dominates TONE-TO-FOOT (see §5). In one subset of those paradigms in which AVOID PROMINENCE dominates TONE-TO-FOOT (154a), the addition of the OM has no effect on the availability of both possible rankings of ALIGN(H)L and ONE-TO-ONE, e.g., short present *ndi-wa-shukúmiisa* beside *ndi-wa-**shúkúmiisa*** ('I shake them [noun class 6]'). In another subset (154b), the addition of the OM excludes the possibility of one-to-one association, e.g., present *continuous ndi-**sá-wá-shúkúmiisa*** but **ndi-sa-wa-shukúmiisa* ('I am still shaking them [noun class 6]'):

(154) Avoid Prominence » Align(H)L

a. Align(H)L » One-to-One and One-to-One » Align(H)L when OM is present:

(117) short infinitive [1]
(118) short present indicative [4], [5]
(119) present participial [15]
(127) present temporal [31]
(128) long infinitive [2]
(129) long present indicative [6], [7]

b. One-to-One » Align(H)L disallowed when OM is present:

(122) present potential [27]
(123) present continuous [23], [24]
(124) past subjunctive [19]
(125) present potential participial [42]
(126) remote past continuous [37]

In both cases, the high tone contributed to the input by the OM is left-aligned with the root, assuming that OCP! allows it to be parsed.

Two quirky paradigms — the long perfect (120) and the near past continuous (121) — seem to straddle the two groupings in (154). If the SM is toneless, the paradigms belong to subgroup (154a) in that they allow optional spread (Claughton's [11] and [33]); if, on the other hand, the SM is high-toned, only Align(H)L » One-to-One is permitted (Claughton's [12] and [34]).

When Tone-to-Foot dominates Avoid Prominence, the articulation of the split triggered by the presence of the OM is slightly more complex. Here, some paradigms require that the high tone introduced by the OM be left-aligned with the leftmost TBU of the root, as in (154), while others require that the OM's high tone be left-aligned with the OM itself. Those paradigms which left-align the OM's high tone with the root permit both possible rankings of Align(H)L and One-to-One (155a), e.g., *wa-shukumíísa* beside wa-***shúkúmíísa*** ('shake them [noun class 6]!'). Those paradigms in which the OM aligns its high tone with itself disallow the One-to-One » Align(H)L ranking (155b), e.g., remote past ***ndáa-wá-shúkúmíisa*** but **ndáa-wa-shukumíisa* ('I shook them [noun class 6]'):

(155) TONE-TO-FOOT » AVOID PROMINENCE

a. • ALIGN(H)L » ONE-TO-ONE and ONE-TO-ONE » ALIGN(H)L when OM is present
• high tone contributed by OM left-aligns with stem

(130) singular imperative [21]
(131) plural imperative [22]
(132) short perfect/'yesterday' past [9], [10]
(133) short perfect participial [30]
(134) long perfect participial [16]
(137) negative remote past [14]
(138) negative present indicative [8]
(139) negative present potential [28]
(140) negative present potential participial [43]
(143) negative perfective participial [17]

b. • ONE-TO-ONE » ALIGN(H)L disallowed when OM is present
• high tone contributed by OM left-aligns with itself

(135) present continuous participial [26]
(136) negative present continuous [25]
(124) negative present participial [17]
(141) remote past [13]
(142) negative long infinitive [3]
(144) negative present participial [29]
(145) negative 'not yet' present [40]
(146) negative near past continuous [35]
(147) negative continuous participial [39]
(148) negative recent past continuous [36]
(149) negative 'not yet' present participial [41]
(150) negative remote past continuous [38]
(151) negative temporal [32]