Post-High Tone Shift in Venda Nominals*

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1. Introduction

This paper represents a reexamination of a well-documented phenomenon in the tonology of Venda (or, more correctly, Tshivenda) nouns when they are preceded by a high tone. The tone changes which occur in the noun under such conditions (as described more fully below in Section 2) have been described by various scholars, including Westphal (1962), Cassimjee (1986, 1992), and Poulos (1990). Here, however, the phenomenon is addressed for the first time from an Optimality Theoretic perspective (as discussed in Section 3).

This tonal behaviour of Venda nouns raises certain issues both for the study of tone in general and for Optimality Theory. I argue here, for example, for the necessity of a lexical and a postlexical morphological level, each with its own particular ranking of constraints, to account for the differing Obligatory Contour Principle ("OCP") effects (see Section 4). Additionally, an explanation is offered for certain apparent asymmetries in the distribution of underlying tonal melodies in Venda nominal forms (Sections 4 and 5). In Section 5, I argue for the necessity of distinct constraint rankings for post-low / isolation and post-high forms, due to morpho-syntactic and prosodic differences in the two environments. Finally, the problem of accounting for downstep (a common phenomenon in Bantu languages) within an Optimality framework is looked into for, I believe, the first time (Section 5.2).

2. The Problem

Venda is a Bantu language spoken chiefly in South Africa's Northern Province and in adjoining areas in Zimbabwe. Like many Bantu languages, Venda utilises only two tones underlyingly, high (here represented by an acute accent, ´) and low (represented by no overt diacritical marking). As is also typical of many Bantu languages, the tone-bearing unit in Venda is the mora, as represented by either a vowel or a syllabic nasal. All syllables of a prosodic word are monomoraic except for the penultimate, which is regularly lengthened, or bimoraic, on words in isolation or in phrase-final position and which thus is the only syllable that may support a contour tone (apparently always high-low or falling, represented here by the diacritic ˆ; but see Section 5.2).

The tonal alternations undergone by Venda nominal forms when immediately preceded in a phonological phrase by a high tone were first described (along with many other tonal alternations and patterns) by E.O.J. Westphal (1962), and receive

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mention as well in Poulos (1990). The first attempt to account for this behaviour from a theoretical perspective, however, is to be found in Cassimjee's (1986, 1992) autosegmental analysis.

The following patterns of tonal change are documented by Westphal:[1]

(1) *Words beginning with a low tone:*

Tonal Melody	Isolation / Post-Low	Post-High	
LL	mu-thu	mú-thu	'person'
LH	mu-rí	mú-ri	'tree'
LLL	mu-tuka	mú-tûka	'youth'
LLH	mu-rathú	mú-râthú	'brother'
LHL	mu-sélwa	mú-sêlwa	'bride'
LHH	mu-sádzí	mú-sâdzi	'woman'
LLLL	mu-kalaha	mú-kálaha	'old man'
LLLH	mu-tukaná	mú-túkaná	'boy'
LLHL	mu-bvuméla	mú-bvú!méla	'large tree'
LLHH	mu-taládzí	mú-tá!ládzí	'line'
LHLL	mu-tóngôma	mú-tóngoma	'type of shrub'
LHLH	mu-síwâná	mú-síwaná	'poor person'
LHHL	mu-d úhúlu	mú-d úhulu	'grandchild'
LHHH	mu-kégúlú	mú-kégulu	'old woman'

(2) *Words beginning with a high tone:*

HL	ndémwa	ndêmwa	'naughty child'
HH	t5hólí	t5hôli	'spy'

[1]Several observations are in order here. With regard to Venda orthography, C<h> represents an aspirated stop; <lw> is a labialised lateral; <bv> and <dz> are affricates; <t5> and <d > are dental stops; <ng> is the prenasalised stop [ ]; and <nø> is a velar nasal. The symbol ! is used to represent downstep, a topic to which we will return in due course. Most of the examples given here are taken from Cassimjee (1992). All of the nouns beginning with a low tone are, for convenience, taken from Noun Class 3 (prefix *mu-*); however, the post-high tonal alternations are the same for nouns of all classes (including prefixless stems).

Tonal melodies and alternation patterns were verified by two native Tshivenda-speaking informants, Victor Thenga (a Tshironga dialect speaker) and Lufuno Ramulondi (a native speaker of the standard or Tshiphani dialect). Poulos points out that "tonal variations have been noted with speakers of different dialects" (1990, p. 568); I found complete agreement between my two informants in this regard.

It is of interest that words which end in a tonal melody HLL (surface form HFL) are extremely rare in Venda; Cassimjee provides proper names for both the LHLL and the HLL examples (*Madíngwâne* and *Mádzhîe*, respectively), but omits the post-high pronunciation of the latter form on the grounds that "there seems to be a special phenomenon associated with personal names in the post-High environment" (1989, p. 46). A search of van Warmelo (1937) revealed only two common nouns meeting the tone melody LHLL, and one of these is listed as a variant form. I shall return to this apparent asymmetry in tonal patterns in Section 4.

HLL	(no example found)		
HLH	khókhôlá	khókholá	‘ankle-bone’
HHL	dákálo	dákalo	‘joy’
HHH	gónøóøó	gónøoøo	‘bumblebee’

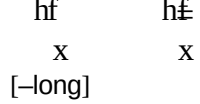
Cassimjee’s (1992) explanation for these alternations requires first that we accept an underlying representation in which (a) both high and low tones are present; (b) low tones are associated individually with TBUs[2] (i.e., singly linked); and (c) high tones are multiply linked. Given these assumptions, she accounts for all the above forms and their post-high alternations by means of four ordered rules:

(3) A. Low Deletion (L _ Ø / H # # __): Delete a low tone at the beginning of a word, if that word is preceded by a high tone.

B. Meeussen’s Rule (H _ L / H __): Change a high tone to a low tone if preceded by a high tone.

C. High Tone Spread: Spread a high tone iteratively to the right (with the stipulation that high may not spread to the ultimate syllable of a word; Cassimjee justifies this exception in terms of extraprosodicity).

D. Contour Simplification (H L _ H L): If a high and a low



tone are both linked to a short (monomoraic) TBU, delink the low tone.

Rule A (Low Deletion) is necessary (as opposed to positing underlyingly toneless nominal prefixes) because, as noted in footnote 1, prefixless nouns which begin with a low tone behave in exactly the same manner: The initial low must delete in order to set up the proper environment for the application of Rule B. Rule B itself (Meeussen’s Rule), which “has been shown to be operative in a number of Bantu languages” (Cassimjee 1992, p. 28), may be viewed as a means of avoiding OCP violations (although not the same means used to avoid OCP violations on the lexical level, where multiple linking or fusion of high tones seems to be preferred).

Cassimjee makes use of Rule C (High Tone Spread) to explain not only spreading across word boundaries but also the contour tones found in post-low / isolation environment in the case of underlyingly XHLX tonal melodies, such as *mutóngôma* and *khókhôlá*; thus this rule may apply word-internally as well (1992, pp. 26, 34). Rule D (Contour Simplification) ensures that contour tones can only associate to long syllables.[3] Additionally, however, the rule requires that the low tone be delinked rather than deleted; the resulting floating low tone, Cassimjee claims, is

[2]The Tone-Bearing Unit , according to Cassimjee, may be seen as either the vowel or the syllable; such matters, she claims, are language-specific, and it appears to make no difference to her analysis which interpretation is chosen for Venda (1992, p. 17).

[3]Suggesting, as I shall argue in Section 4, that the TBU in Venda (and indeed in Bantu languages generally) is the mora rather than the vowel or syllable.

responsible for the downstep found in post-high forms like *múbvú ꜜméla* and *mútá ꜜládzí* (1992, pp. 39-42).

Some sample derivations are shown below, to demonstrate how the correct tonal alternations are generated by application of these four rules.

(4)

H L H g g g V muri	H L L H g g g g V murathu	H L H L L g g g g g V mutongoma	
H H g g V muri	H L H g g g V murathu	H H L L g g g g V mutongoma	Low Deletion
H L g g V muri	*inapplicable*	H L L L g g g g V mutongoma	Meeussen's Rule
H L gu g V muri	H L H g g g V murathu	H L L L g g g g V mutongoma	High Tone Spread
inapplicable	*inapplicable*	H L L L g g g V mutongoma	Contour Simplif.
H L L H g g g *f* V mutaladzi	H H L g g g V ndemwa	H H L g *f* g V dakalo	
H L H g g *f* V mutaladzi	*inapplicable*	*inapplicable*	Low Deletion
inapplicable	H L L g g g V ndemwa	H L L g *f* g V dakalo	Meeussen's Rule
H L H g g *f* V mutaladzi	H L L gug g V ndemwa	H L L gy *f* g V dakalo	High Tone Spread
H L H g *f* V mutaladzi	*inapplicable*	H L L gy g g V dakalo	Contour Simplif.

3. Optimality Theory

While Cassimjee's approach quite adequately accounts for the facts of high spread in Venda nominals, it suffers from certain drawbacks on a theoretical level. These drawbacks are in large part due to its grounding in a rule-based, tier-mapping approach; however, there are certain more specific objections that one could make as well. These latter include a lack of explanation for the fact that only the penultimate

syllable may bear contour tones (a problem which derives from regarding the syllable or vowel as the tone-bearing unit in Venda, rather than the mora) and an inability to account for different OCP effects on the lexical and the postlexical levels.

On a more general level, the more traditional rule-based approach to tone has several theoretical disadvantages. Rules are generally language-specific, and thus often appear stipulatory; Cassimjee's Low Deletion rule is a good example.[4] High Tone Spread is not in itself a language-specific rule, but here it requires the extra stipulation that the final syllable of a word is "extraprosodic" and hence immune from the rule's application — despite the fact that this syllable already bears a tone at the point in the derivation where extraprosodicity takes effect. Even Meeussen's Rule must be defined in a language-specific manner, since its operation in Venda is not the same as in other Bantu languages (here it must operate from left to right and not iteratively). In fact, OCP effects in general are problematic for rule-based phonology; as Myers has pointed out,

> while the passive interpretations of the OCP … can be applied in the same way to all languages, it is not possible to generalize the active instantiations. One cannot predict on any general basis *how* the OCP violation will be resolved in a given language; one can only predict that it will be. It is very common for authors to say that a rule of dissimilation is "triggered" by the OCP, but nobody has yet shown what this means.

(1994, p. 3.) Thus, in a rule-based approach, the rules themselves must be regarded as "language-particular statements of phonotactic truth,"[5] rather than "simple and general" linguistic universals (Prince & Smolensky 1993, p. 5).

Additionally, ordered rules necessarily imply intermediate representations (in this case, a total of five representations is required in cases where all four rules are applicable). The more rules and intermediate representations, the more likely it is that the underlying representation will be opaque from an examination of the surface form; this presents obvious problems for learnability. And rule-driven systems must of necessity rely on ordering — specifically on bleeding and counterfeeding — to account for the non-application of certain rules in certain instances. When these processes fail, the phonologist must resort to various repair strategies — an undesirable result, since it basically assumes that the speaker must first *try* to apply the rules as stated; then, if for one reason or another a particular rule does not work, he/she is forced to backtrack and somehow *unapply* that rule.

Optimality Theory ("OT") (Prince & Smolensky 1993; McCarthy & Prince 1993a, 1993b, 1994, 1995; McCarthy 1995, *inter alia*) offers a solution to these and other problems inherent in rule-driven approaches. In OT, the focus does not lie on deriving a particular surface form by means of ordered rules from an invariant

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[4]The fact that low tones are singly linked and high tones multiply linked might also be regarded as stipulatory. However, as Cassimjee argues (1992, p. 31), one can get around this problem by claiming that there are no underlying low tones, and toneless syllables acquire a low tone by default at the end of the lexical level.

[5]If indeed they can be regarded as "true," given that in the course of a derivation one more often than not encounters rules whose outcome bears little or no obvious relation to the actual surface form.

underlying representation; rather, it emphasises constraints on the well-formedness of the output. Constraints are universal in nature; languages differ only according to how such universal constraints are ranked. All possible output forms are *generated*, or mapped to the input, by a component referred to as GEN; these candidates are then *evaluated* in parallel, by the component EVAL. Thus there are no intermediate representations (with the possible exception of different constraint rankings applying at different morphological levels; see Sections 4 and 5). Furthermore, all constraints are, in principle, *violable*. Thus an optimal surface form may violate certain constraints, as long as such violations are less serious than those incurred by the other candidates.[6]

Optimality Theoretic approaches to tonal phenomena which incorporate these theoretical advantages have also been prevalent in recent years. Among the works that I shall draw heavily upon here are Myers (1994) and the Optimal Domains Theory ("ODT") approach developed by Cole and Kisseberth (1995) and by Cassimjee (1995) herself. A particular advantage of the latter approach is that it does not rely upon (although it does not exclude the use of) a representational autosegmental approach to tone.[7] The approach advocated in this paper towards Venda tonology assumes a non-representational approach as well, though this is not crucial to the analysis.

Both of the above approaches assume that, for Bantu languages in general, only high tones play a rôle in either underlying representations or the generation of surface candidates. Myers uses the term "tone span" to describe a series of adjacent TBUs associated to a single high tone; Cassimjee uses "domain" to refer to such a series, although in ODT a domain is indicated by bracketing rather than by means of association lines. The tone-bearing unit in Myers' analysis is the syllable, while for Cassimjee it is the mora. In each approach, (at least) one TBU within a domain is the "head" (Myers) or "anchor" (Cassimjee) of the high tone within that domain. A head is assumed to be marked lexically as such (before domains are assigned), and in the unmarked case, heads appear to be aligned with the left edge of a domain. Here, I follow Cassimjee in using a non-associational approach (bracketed domains) with the mora as the TBU (for reasons already cited), and Myers in using the term "head" (rather than "anchor") and in marking domain heads by means of underlining the appropriate TBU.

Constraints may be of various types or "families". For example, there are the so-called Faithfulness constraints which demand that the surface form be identical to the underlying form. If all Faithfulness constraints were undominated in a given language, we would expect each winning output form to correspond exactly to its underlying representation. Faithfulness constraints which I shall make use of in this analysis include:

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[6]Optimality Theory has been well documented in the works cited here, among many others, and I will not attempt to provide a complete explanation of its workings in this paper; readers who are unfamiliar with the interpretation of tableaux and constraint rankings are referred to these papers for further clarification.

[7]For arguments that representations are unnecessary for (and possibly inimical to) an Optimality Theoretic phonology, see, *inter alia*, Padgett (1995, 1996).

(5) PARSE(HD): Heads must be parsed into domains. (In other words, a TBU which is lexically marked as "high" must be phonetically realised as high, through incorporation into a tonal domain. (This is the equivalent of Cassimjee's INCORPORATE(H_{anchor}) constraint.)

PARSE(T): For each head there is a corresponding tonal domain. (This constraint does the work of Myers' PARSE(T) as well as *FLOAT, there being nothing to distinguish the two in a non-representational approach.)

A constraint requiring domain correspondence will also be utilised; this is discussed in Section 5. Other proposed Faithfulness constraints, such as Myers' *STRUCTURE and FILL(σ), will not play a rôle in this analysis.

The family of Alignment constraints governs the relation between certain prosodic and / or morphological categories by means of aligning their edges. Two constraints of this type will prove to play a crucial rôle in the analysis of Venda tonal alternations:

(6) LEFTHD: Align the left edge of a domain with the left edge of a head. (This is in line with the previously noted observation that the unmarked case for Bantu languages is for domains to be left-headed.)

ALIGNRT: Align the right edge of a domain with the right edge of a syllable.

High tone spreading is also analysed by Cassimjee as being motivated by the relative ranking of Alignment constraints (1995, pp. 9-10), although in Myers' approach, spread "is motivated by FILL(σ) [a syllable / TBU must be incorporated within a tonal domain], which assigns a '*' for each toneless syllable" (1994, p. 17). I shall return to this question in Sections 4 and 5.

Various other constraints tend to play an important part in the evaluation of surface forms in tone languages. Among these, one finds the following three (or variants thereof) mentioned frequently in the literature:

(7) OCP: Domain edges may not abut. (Referred to by Cassimjee as the NO ADJACENT EDGES constraint.)

*OVERLAP: Domains may not overlap. (Serves much the same function as Goldsmith's familiar well-formedness condition, "Association lines do not cross" (1976, p. 27).)

*COMPLEX(T): A TBU may not belong to more than one tonal domain (in Myers' terms, "must not be associated with more than one tone" (1994, p. 19)).

These three constraints are undominated in Venda, and, except for OCP, will not be discussed further.

Other constraints as well play a crucial part in this analysis of Venda nominal tone alternations. These will be defined and discussed in the sections that follow.

4. The Lexical Level

In order to accommodate the difference in both OCP effects and permissible tonal domain lengths found in Venda within prosodic words and phonological phrases, I argue here for distinct constraint rankings at the lexical and postlexical levels (in the sense that such terms are used by Kiparsky 1982, 1985). Such an approach is not inherently inimical to OT, and has in fact been utilised in several analyses to date.

Lamontagne and Sherer (1993) have argued that the concept of levels in the lexical component of English are unnecessary and can be adequately handled by means of constraints on the alignment of the prosodic word, on the one hand, and the suffix, syllable, and lexical word, on the other. Other authors have tacitly assumed that effects previously attributed to cyclicity, levels, and the distinction between lexical and postlexical rules actually result "from constraints on alignment between morphemes and metrical constituents," based in part "on the tacit assumption that all cyclic effects occur at morpheme junctures" (Orgun 1993, p. 1 of handout). Orgun, however, presents evidence for the necessity of cyclicity and level ordering in analysing certain Turkish voicing alternations. McCarthy and Prince (1993a) assume separate levels for prefixation and suffixation in their analysis of Axininca Campa,[8] and their treatment of reduplication entails both a new subset of constraints and a (potentially) different ordering of existing constraints from that used to evaluate the base. Further, in their discussion of stress and "velar glide loss" in Axininca Campa, they specifically call for a system of level ordering, where the output of one level serves as the input representation for the next (1993a, pp 146-173). Yip (1993a) has also proposed a lexical and a postlexical component within Optimality Theory; in her discussion of onsetless syllables in Cantonese, she posits the same constraints in each component, but ordered differently (although she appears to have since abandoned this approach; see Yip 1993b).

In tonal phonology, Myers notes that OCP effects may be different for different morphological levels, noting that "whether Fusion [of heads into a single tonal domain] occurs depends on level" (1994, p. 25). His treatment of level distinctions differs from that of McCarthy and Prince, however: Myers posits that each constraint may have its own "domain", whereby if "constraint C has a domain D, a violation of C is only assessed if D is the smallest domain including the whole violating structure" (p. 25). Without discussing the merits of Myers' solution (which he claims to be "more in the nonderivational spirit of the optimality model" (p. 25)), I shall rely here on the approach advocated by McCarthy and Prince, according to which it is the *ranking* of constraints that is dependent on level.

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[8]They do not commit themselves to this approach, however, noting that it "may well be that there is no Prefix level in the phonology, and that all of its alternations are consequences of allomorph selection, which can just as well be done in parallel with the Suffix level phonology and morphology" (1993a, p. 26).

Cassimjee's (1992) analysis, as noted previously, makes no specific mention of levels of application for the rules she postulates. It is evident, however, that the four rules necessary to derive the post-high surface forms must be postlexical, since they are triggered by a final high tone in the preceding word. There is ample evidence that penultimate lengthening is also a postlexical phenomenon in Southern Bantu languages in general. It typically appears (as is the case in Venda) only in phrase-final position, and is often conditioned by other syntactic considerations (often occurring phrase-finally, for example, in indicative clauses but not in interrogatives). As for word-internal high spreading (or, more accurately, tone doubling) in the post-low / isolation environment, it is impossible to tell from the surface forms whether it occurs lexically or postlexically. I shall argue here that the optimal output at both levels will have high domains which optimally incorporate at least one non-head; this approach appears justified given that the same constraints are applicable at both levels, and it also has the desirable result (as I shall show) of helping to account for the asymmetry in underlying tonal melodies mentioned in footnote 1.

As noted above, the constraint OCP appears to be undominated in Venda. The different ways that potential OCP violations are dealt with demands that OCP crucially outrank Faithfulness constraints such as PARSE(HD) and PARSE(T). The latter constraint militates against fusion, and will consequently be violated frequently at the lexical level. We would therefore expect it to be ranked lower than PARSE(HD) — and in fact, it appears that PARSE(HD) is never violated at this level. On the other hand, PARSE(T) must be ranked highly enough (specifically, higher than MIN-BIN; see below) to prevent non-adjacent heads from being incorporated into a single domain.

The *location* of a domain is determined chiefly by the Alignment constraint LEFTHD, which appears to be undominated at the lexical level. An additional constraint regulates the minimal *size* of a domain:

(8) MIN-BIN: Domains are minimally bimoraic and include at least one non-head (the equivalent of Cassimjee's EXTEND, which requires a TBU other than the "anchor" within a domain (1995, p. 11)).

The interaction of MIN-BIN with other constraints at the lexical level crucially allows winning candidates with bimoraic (or longer) high domains to emerge, thus accounting for word-internal high-tone doubling. Since tone doubling is not attested in words which are underlyingly of the form (X)(X)HL, however, we must assume that a further constraint prevents the incorporation of a word-final mora into a high domain headed by the penultimate mora:

(9) NON-FINALITY (NON-FIN): Do not align the right edge of a prosodic word with the right edge of a domain.

Furthermore, NON-FIN must dominate MIN-BIN if this result is to be achieved.

The appropriate ranking of relevant constraints at the lexical level, then, can be expressed as follows:

(10) OCP, PARSE(HD), LEFTHD >> PARSE(T), NON-FIN >> MIN-BIN >> all other constraints

This can be demonstrated by a few representative tableaux. First, the assignment of any domain structure to an underlying form with no heads will result in a fatal violation of LEFTHD:

Tableau 1: *muthu*

UR: mu thu μ μ	OCP	PARSE(HD)	LEFTHD	PARSE(T)	NON-FIN	MIN-BIN
F mu thu μ μ						
mu thu μ [μ]			*!		*	*
mu thu [μ] μ			*!			*
mu thu [μ] [μ]	*!		**!		*	**
mu thu [μ μ]			*!		*	

For words with a single underlying head in penultimate position, PARSE(HD) ensures that the head is included in a domain, while NON-FIN prevents the word-final non-head from being incorporated (at the expense of MIN-BIN):

Tableau 2: *ndemwa*

UR: ndem wa μ μ	OCP	PARSE(HD)	LEFTHD	PARSE(T)	NON-FIN	MIN-BIN
ndem wa μ μ		*!		*		
ndem wa μ [μ]		*!	*!		*	*
F ndem wa [μ] μ						*
ndem wa [μ] [μ]	*!		*!		*	**
ndem wa [μ μ]					*!	

In the case of words with two heads separated by a single non-head, OCP and PARSE(HD) prevent the non-head from being incorporated into a bimoraic domain (again at the expense of MIN-BIN), while PARSE(T) disallows its incorporation into a single, two-headed domain:

Tableau 3: *khokhola*

UR: kho kho la μ μ μ	OCP	PARSE(HD)	LEFTHD	PARSE(T)	NON-FIN	MIN-BIN
kho kho la μ μ μ		**!		**		
kho kho la [μ] μ μ		*!		*		*
kho kho la [μ μ] μ		*!		*		
kho kho la [μ μ] [μ]	*!				*	*
kho kho la [μ] [μ μ]	*!		*!		*	*
F kho kho la [μ] μ [μ]					*	**
kho kho la [μ μ μ]				*!	*	

On the other hand, the fact that PARSE(T) is outranked by both OCP and PARSE(HD) requires fusion of all adjacent heads into a single domain:

Tableau 4: *mukegulu*

UR: mu ke gu lu μ μ μ μ	OCP	PARSE(HD)	LEFTHD	PARSE(T)	NON-FIN	MIN-BIN
mu ke gu lu μ [μ] μ μ		**!		**		*
mu ke gu lu μ μ [μ μ]		*!		**	*	*
mu ke gu lu μ [μ] μ [μ]		*!		*	*	**
mu ke gu lu [μ μ] μ [μ]		*!	*!	*	*	*
mu ke gu lu μ [μ μ] [μ]	*!			*	*	**
mu ke gu lu μ [μ] [μ] [μ]	**!				*	***
F mu ke gu lu μ [μ μ μ]				**	*	*

Let us now turn our attention to a situation first noted in footnote 1: that words with an underlying tonal melody ending in HLL appear to be virtually non-existent in Venda. We are now in a position to partially explain this asymmetry. First, we must consider the fact that lexical entries in dictionaries of Venda are isolation forms; in other words, they are the equivalent of phrase-final surface forms, rather than underlying representations. However, it must be noted that even phrase-medially, one simply does not come across -HLL tonal patterns in nominals. Rather than assume that such underlying forms are themselves impossible, however, we

can look at the problem from another perspective: namely, that such forms are never allowed to surface in a post-low / isolation environment in the manner that Cassimjee's model predicts (i.e., with a falling contour on the penultimate syllable) because such an output is never optimal.

We can begin to see why this is the case (even at the lexical level), by examining the candidate competition for a hypothetical noun whose underlying form is CV′.CV.CV (for simplicity's sake I shall ignore potential candidates which would violate any of the undominated constraints OCP, PARSE(HD), and LEFTHD):

Tableau 5

UR: CV CV CV μ μ μ	OCP, PARSE(HD), LEFT(HD)	PARSE(T)	NON-FIN	MIN-BIN
CV CV CV [μ] μ μ				*!
☞ CV CV CV [μ μ] μ				
CV CV CV [μ μ μ]			*!	

The winning candidate, then, is the one which contains a bimoraic tonal domain. Thus the output at the lexical level is phonectically indistinguishable from that for an underlyingly -HHL form such as *dákálo*:

Tableau 6: *dakalo*

UR: da ka lo μ μ μ	PARSE(HD)	PARSE(T)	NON-FIN	MIN-BIN
da ka lo [μ] μ μ	*!	*		*
☞ da ka lo [μ μ] μ		*		*
da ka lo [μ μ μ]		*	*!	

The only difference lies in the fact that for *dakalo*, the surface high domain has two heads rather than one. And as we shall see in Section 5.1, at the postlexical level this difference will prove to be insufficient: The winning output candidates for underlyingly -HLL and -HHL forms will have identical tonal domain patterns.

The current analysis (as well as by Cassimjee's autosegmental model, although she does not make explicit mention of it) in fact predicts that one will *never* find instances of a single high tone followed by two or more low tones. Although Cassimjee does not provide examples of longer nominal forms where such a situation might arise in non-final position, a search of van Warmelo reveals approximately thirty nouns of this type (although there are large numbers of verbs which follow this pattern). Of these thirty, ten can be eliminated as reduplicated forms, such as

lunzháanzháa 'weaver finch' and *makúmbukúmbu* 'maize that has gone bad'. I presented the remaining twenty forms to my informant, Lufuno Ramulondi (who, as I have already noted, is a native speaker of the standard dialect of Venda); apart from four words she had never heard of (one of which was classified as obsolete by van Warmelo in 1937), her evidence indicated that all but one of these nouns (all of which are presented by van Warmelo as HLLL or LHLLL) actually surface in isolation as HHFH / LHHFH. The one noun which actually *was* pronounced with a HLLL tonal pattern in isolation, *dísheleni*, is a borrowing from Afrikaans *tien shillings* 'ten shillings'. This prediction, then, appears to be well borne out.

5. Postlexical Level

At the postlexical level, the analysis must account for the effects of all four of Cassimjee's rules, and for both the post-low / isolation and the post-high environment outcomes. Penultimate lengthening must occur in prosodic words which are phrase-final, and high-tone doubling must also take place word-internally where such syllable lengthening provides the environment for it to occur. The OCP constraint must lead to optimal outcomes where domains are separated by at least one mora, rather than to fusion, in post-high environments. Additionally, if an OT approach is to be regarded as at least as viable as the autosegmental model, it must provide a natural explanation for downstep.

To achieve these goals, we must require some degree of integrity with regard to tonal domains for both post-low and post-high output candidates. This type of Faithfulness constraint was naturally irrelevant within the lexical level, as there were no underlying domains for the surface forms to correspond to. However, at the postlexical level, we must provide for such an optimal correspondence between surface domains and those found in the input forms. Such correspondence could be measured in several ways. For example, we can require that there be a surface domain for each underlying domain, or that there be an underlying domain for each surface domain; we could look at correspondence in terms of the left and / or right boundary or in terms of length. In Venda noun forms, a subset of these types appears to be crucial in deciding between potential outputs:

(11) DOMAIN INTEGRITY (DOM-INTEG): For each tonal domain in UR there must be a corresponding domain in the surface form.

RIGHT EDGE CORRESPONDENCE (DOM-RIGHT): For each right-edge domain boundary in UR there must be a corresponding boundary in the surface form. (A penalty is assessed for each right domain boundary in UR for which there is no right boundary in the same location in the output candidate.)

DOMAIN SIZE CORRESPONDENCE (DOM-SIZE): Each domain must correspond to an underlying domain of equal size. (A penalty is assessed for each mora within an output candidate's domain(s) which is greater or less than the number of moras in the corresponding UR domain. Note that while this constraint penalises the addition of a new domain in the output, it does *not* imply a penalty for non-parsing of an underlying domain.)

There must also, of course, exist some sort of undominated constraint — common to Southern Bantu languages in general — which requires lengthening of a penultimate syllable in words in phrase-final position. Without further discussion, I propose the following constraint to deal with this phenomenon straightforwardly:

(12) PENULT(μμ): The penultimate syllable of prosodic word whose right edge corresponds with the right edge of a phonological phrase must contain exactly two moras.

Another constraint which was irrelevant at the lexical level is ALIGNRT, which (as noted in (6) above) aligns the right edge of a domain with the right edge of a syllable. This constraint obviously could not be violated by *any* output candidate, since at the lexical level all syllables are monomoraic. Given postlexical penultimate lengthening, however, the possibility of violating ALIGNRT exists and must be taken into consideration.

Finally, for post-high forms, the obligatory spread of a high tone / domain from the final mora of a word into a following noun must itself be taken into account. I shall inquire into what sort of constraint (or constraints) is needed to handle the extension of a high domain across word boundaries in Section 5.2.

5.1. Isolation / Post-Low Forms

The question naturally arises at this point as to whether a single constraint ranking can choose the correct output candidate for both isolation / post-low and post-high forms. The answer (perhaps unfortunately) appears to be "no." In isolation or post-low environments, the only changes which a Venda noun may undergo are penultimate lengthening and high-tone doubling which such lengthening motivates. This implies that OCP, PENULT(μμ), LEFTHD, and PARSE(HD) are never violated by the winning candidate. The domain integrity constraints DOM-INTEG, DOM-RIGHT and DOM-SIZE must dominate PARSE(T) (preserving multiple-head domains established at the lexical level); DOM-INTEG appears to be undominated, while the latter two can be violated in order to satisfy a higher-ranking MIN-BIN. DOM-RIGHT itself must dominate NON-FIN (in order to maintain word-final domain boundaries) as well as DOM-SIZE (since domain boundaries are maintained in the surface form even when an extra mora is added to the domain via penultimate lengthening). And a winning candidate can violate ALIGNRT only when necessary to prevent a fatal violation of undominated OCP, PARSE(HD) or DOM-INTEG, or of MIN-BIN.

The constraint ranking necessary to achieve the attested surface forms for nouns in isolation or following a low tone, then, is as follows:

(13) OCP, PENULT(μμ), LEFTHD, PARSE(HD), DOM-INTEG >> MIN-BIN >> ALIGNRT >> DOM-RIGHT >> NON-FIN, DOM-SIZE >> PARSE(T)

As we shall see in Section 5.2, however, this particular hierarchy will not select the optimal outputs in a post-high environment. Yet the need for distinct constraint rankings in these two environments should not surprise us unduly, and is in fact justifiable on both morphological and prosodic grounds.

First, consider that the constraint rankings applicable in isolation / post-low environments relate only to *nominal* forms in Venda; we do not, for example, necessarily get tone doubling in verbs, as mentioned in Section 4. When we come to the post-high environment forms, however, we are dealing not only with the nouns themselves, but also the preceding word, which may of course belong to any part of speech (so long as it ends in a high tone). Since the nature of the phenomenon we are dealing with is extension of a high domain from any such lexical item into a nominal, it is not unusual to find that different constraint rankings may apply. Second, even though both environments are clearly postlexical (being dependent upon position within the phonological phrase as well as certain syntactic factors), the fact that the post-high forms entail the extension of a domain across a prosodic word boundary is in keeping with Myers' distinction with respect to the phonological "domains" at which constraints apply (1994, p. 25). That is, constraints which determine the optimal output in isolation or a post-low environment, though postlexical, nonetheless operate at the prosodic word level, while those determining post-high outputs are at the level of the phonological phrase.

The simplest case is one in which no domains are present in the input form. For such words, PENULT(μμ) will ensure lengthening, while LEFTHD excludes any candidate where a domain is proposed:

Tableau 7: *muthu*

UR: mu thu μ μ	OCP	PENULT(μμ)	LEFTHD
mu thu μ μ		*!	
☞ mu thu μ μ μ			
mu thu [μ μ] μ			*!
mu thu [μ μ μ]			*!
mu thu [μ μ] [μ]	*!		*!

(Henceforth I shall not consider candidates which violate PENULT(μμ).)

In words where the input form contains a single (left-headed) high domain, certain obviously flawed candidates will always be ruled out by the undominated constraints OCP (adjacent domains), LEFTHD (domain contains no head or head(s) only in non-initial position), and PARSE(HD) or DOM-INTEG (failure to parse a head or a domain). In the following case, for example, these constraints alone are sufficient to pick a winning candidate which itself violates lower-ranking MIN-BIN and NON-FIN:

Tableau 8: ***muri***

UR: mu ri μ [μ]	OCP	LEFTHD	PARSE(HD)	DOM-INTEG
mu ri μ μ μ			*!	*!
F mu ri μ μ [μ]				
mu ri μ[μ μ]		*!		
mu ri [μ μ μ]		*!		
mu ri [μ μ][μ]	*!	*!		

Where the input domain contains two or more heads that are broken up by the addition of the extra mora in the penultimate syllable, MIN-BIN rules out the possibility of splitting up the domain (here, obvious OCP-violating candidates are not considered):

Tableau 9: ***tʂholi, gomønoø***

UR: tʂho li [μ μ]	PARSE (HD)	MIN-BIN	ALIGN RT	DOM-RIGHT	NON-FIN	DOM-SIZE
tʂho li [μ] μ μ	*!	*	*	*		*
tʂho li [μ μ] μ	*!			*		
F tʂho li [μ μ μ]					*	*
tʂho li [μ] μ [μ]		**!	*		*	**
UR: go nøo nøo [μ μ μ]						
go nøo nøo [μ] μ μ [μ]	*!	**			*	***
go nøo nøo [μ μ] μ [μ]		**!	*		*	**
go nøo nøo [μ μ μ] μ	*!			*		
F go nøo nøo [μ μ μ μ]					*	*

The winning candidate, then, like the input form, must *always* contain a single, left-headed domain; it then falls to the lesser-ranked constraints to determine the size of that domain. Specifically, thanks to MIN-BIN and ALIGNRT, any domain whose right edge aligns with the right edge of the penultimate syllable in the input form *must* incorporate the additional mora which that syllable acquires due to lengthening:

Tableau 10: ***ndemwa, dakalo***

		MIN-BIN	ALIGN RT	DOM-RIGHT	NON-FIN	DOM-SIZE
UR:	nde mwa [μ] μ					
	nde mwa [μ]μ μ	*!	*			
☞	nde mwa [μ μ] μ			*		*
	nde mwa [μ μ μ]			*	*!	**!
UR:	da ka lo [μ μ] μ					
	da ka lo [μ μ]μ μ	*!	*			
☞	da ka lo [μ μ μ] μ			*		*
	da ka lo [μ μ μ μ]			*	*!	**!

And now we can fully explain the contention raised in Section 4 that the winning output for underlyingly -HLL forms will be the same as that for -HHL forms such as *dakalo*:

Tableau 11

		MIN-BIN	ALIGN RT	DOM-RIGHT	NON-FIN	DOM-SIZE
UR:	CV CV CV [μ μ] μ					
	CV CV CV [μ μ]μ μ		*!			
☞	CV CV CV [μ μ μ] μ			*		*
	CV CV CV [μ μ μ μ]			*	*!	**!

The scenario for our hypothetical -HLL form is exactly the same as for *dakalo* except for the fact that the first candidate does not violate MIN-BIN; rather, its fatal violation is of ALIGNRT. It is for this reason that we do not find isolation forms with a surface melody of -(L)HFL.

Note, however, that according to the forms presented in (1) and (2) above, there is one situation where we *must* select a winning candidate which, in violation of ALIGNRT, allows a contour tone on the penultimate syllable. This result will occur with a form such as *khokhola* or *musiwana*, whose underlying tonal melody is -HLH. In such a case, ALIGNRT must be violated by the winning candidate; any other choice must be in fatal violation of either OCP, PARSE(HD), DOM-INTEG, or MIN-BIN, all of which are higher ranked constraints:

Tableau 12: *musiwana*

UR: mu si wa na μ [μ] μ [μ]	OCP	PARSE (HD)	DOM-INTEG	MIN-BIN	ALIGN RT	DOM-RIGHT	NON-FIN	DOM-SIZE
mu si wa na μ [μ] μ μ [μ]				**!			*	
F [μ] mu si wa na μ [μ μ] μ				*	*	*	*	*
mu si wa na μ [μ μ μ] [μ]	*!			*		*	*	**
mu si wa na μ [μ μ μ] μ		*!	*!			**		**
mu si wa na μ [μ μ μ μ]			*!			*	*	***

5.2. Post-High Forms

Finally we come to the behaviour of Venda nominals in post-high position, and thus to the very phenomenon which Cassimjee (1992) sought to characterise by means of a rule-based autosegmental approach — that of high spreading across word boundaries in the postlexical environment. For ease of reference, I repeat in (14) the changes undergone by these forms, as listed in (1) and (2), *supra* (omitting those unattested or rarely attested forms ending in the tonal melody -HLL):

(14)

Tonal Melody	Isolation / Post-Low	Post-High	
LL	mu-thu	mú-thu	‘person’
LH	mu-rí	mú-ri	‘tree’
HL	ndémwa	ndêmwa	‘naughty child’
HH	tɔhólí	tɔhôli	‘spy’
LLL	mu-tuka	mú-tûka	‘youth’
LLH	mu-rathú	mú-râthú	‘brother’
LHL	mu-sélwa	mú-sêlwa	‘bride’
LHH	mu-sádzí	mú-sâdzi	‘woman’
HLH	khókhôlá	khókholá	‘ankle-bone’
HHL	dákálo	dákalo	‘joy’
HHH	gónøóøó	gónøoøo	‘bumblebee’
LLLL	mu-kalaha	mú-kálaha	‘old man’
LLLH	mu-tukaná	mú-túkaná	‘boy’
LLHL	mu-bvuméla	mú-bvú!méla	‘large tree’
LLHH	mu-taládzí	mú-tá!ládzí	‘line’
LHLH	mu-síwâná	mú-síwaná	‘poor person’
LHHL	mu-d úhúlu	mú-d úhulu	‘grandchild’
LHHH	mu-kégúlú	mú-kégulu	‘old woman’

Here, then, we must account for the effects of Cassimjee’s four rules — including not only the extension of a preceding high domain into the following noun itself, but the

location of the right edge of that domain within the noun and the consequent readjustments to the preexisting domain(s) within the noun. Additionally, we must account for the fact of downstep preceding the penultimate syllable in forms with the underlying tonal melodies LLHL and LLHH.

The spread of a high tone / domain from the end of one word into a following noun can be regarded as an effect of the interaction of several constraints. Examining the post-high forms in (14), some clear patterns emerge. First, extension is obligatory whenever the right edge of the preceding word is aligned with the right edge of a high domain. The NON-FIN constraint alone, however, is insufficient to obtain this result in all cases. For example, suppose that the word preceding the noun ends in a trimoraic high domain, as in (15):

(15) Ndi-kho-ú-vhóna mu-kégúlú mú-lá!mbóni — 'I am seeing an old woman at the river'

Here, the high domain of *mukegulu* extends into the nominal form *mulamboni* (underlying tonal melody LLHL). Yet NON-FIN (as well as MIN-BIN) would be equally well satisfied by excluding the final TBU of *mukegulu* from the high domain; in fact, such a result would actually be *more* optimal, as it would incur only one violation of DOM-SIZE (as opposed to two with extension). Additionally, it is clear (from post-high forms such as *múrâthú* and *mútá !ládzí*) that NON-FIN, as defined, is a violable constraint in the post-high environment. Finally, extension into the following word is an optimal solution for all parts of speech (but only in prenominal position), while NON-FIN's place in the constraint hierarchy is, we must assume, valid only for nominal forms.

The post-high forms in (14) yield other patterns as well. Extension of a high domain into nouns whose initial TBU does *not* lie within a high domain (i.e., nouns beginning with a low tone) always includes exactly the first two TBUs (or moras) of that noun.[9] Before nouns beginning with a domain head (i.e., a high tone), however, only the initial mora is incorporated.

To account for all of these facts about high domain extension, then, I propose a group of constraints which apply only to such extension: i.e., only in the case of a prosodic word that immediately precedes a nominal form and whose right edge corresponds to the right edge of a high domain. Spreading itself, rather than being motivated by NON-FIN, may be seen as the result of a gradiently violable alignment constraint (along the same lines proposed by Cassimjee 1995):

(16) ALIGNRT(PP): Align the right edge of a prenominal high domain with the right edge of the phonological phrase which contains it.

[9]This pattern is obscured in Cassimjee's analysis by her use of the syllable, rather than the mora, as the TBU in Venda. Thus disyllabic forms appeared to undergo incorporation of only a single TBU (or syllable). To explain this, she must resort to declaring the final syllable of the word "extraprosodic" (despite the fact that that syllable already bears a tone, and continues to do so throughout the derivation).

According to this constraint, one violation is incurred for each mora intervening between the right edge of such a domain and the end of the phonological phrase.

To limit domain extension, the following three constraints must outrank ALIGNRT(PP):

(17) MAX-EXT: An extended domain incorporates maximally two moras within the nominal form.

MAX-HD: An extended domain incorporates maximally one head within the nominal form.

RIGHTHD: Align the right edge of an extended domain with the right edge of a head within the nominal form.

Like OCP and PENULT(μμ), the constraints MAX-EXT and MAX-HD must be undominated. RIGHTHD, on the other hand, will be violated whenever there is no head within the first two moras of the noun.

Thus we have a partial constraint ranking as follows:

(19) OCP, PENULT(μμ), MAX-EXT, MAX-HD >> RIGHTHD >> ALIGNRT(PP)

This partial ranking is in and of itself sufficient to predict the correct output candidates for the first two forms listed in (14), assuming all other relevant constraints to be ranked lower than ALIGNRT(PP) (as before, candidates that violate PENULT(μμ) are not considered):

Tableau 13: ***muthu, muri***

UR: mu thu] μ μ	OCP	MAX-EXT	MAX-HD	RIGHT HD	ALIGN RT(PP)
mu thu] μ μ μ				*	***!
mu thu μ] μ μ				*	**!
F mu thu μ μ] μ				*	*
mu thu μ μ] [μ]	*!			*	*
mu thu μ μ μ]		*!		*	
UR: mu ri] μ [μ]					
mu ri μ] μ μ				*	**!
mu ri μ] μ [μ]				*	**!
F mu ri μ μ] μ				*	*
mu ri μ μ] [μ]	*!			*	*
mu ri μ μ μ]		*!			

Already, we can see that the ranking of constraints for post-high forms cannot coincide with that for isolation / post-low forms: If all other constraints are ranked lower than ALIGNRT(PP), then LEFT HD, PARSE(HD), PARSE(T), and DOM-INTEG can no longer be regarded as undominated. In fact, it appears that LEFT HD, DOM-INTEG, MIN-BIN, and ALIGNRT, far from occupying a prominent position in the hierarchy, are actually so lowly ranked as to be irrelevant to the selection of output candidates.

That PARSE(HD) is ranked lower than ALIGNRT(PP) is demonstrated by the tableau for *muri* presented above; the winning output also violates DOM-RIGHT and PARSE(T), as well as incurring two violations of DOM-SIZE — any one of which would be fatal if these constraints ranked above ALIGNRT(PP). There is no case which allows us to order PARSE(HD) with respect to DOM-RIGHT. However, in the tableaux that follow, we shall find evidence that DOM-SIZE crucially outranks both of these constraints (as can be seen in the cases of *t5hoḽimusadzi*, *gon∅oxo*, and *mukegulu*); that PARSE(HD) and DOM-RIGHT in turn dominates NON-FIN (*mutukana*, *mutaladzi*); and that NON-FIN dominates PARSE(T) (*ndemwa*, *muselwa*, *dakalo*, and *mud uhulu*).DOM-INTEG is obviously ranked at the bottom of the hierarchy, as it is violated by all but two of the forms listed in (14). Finally, the tableau presented for *mubvumela* assumes that PARSE(T) outranks both LEFT HD and MIN-BIN. (The exact ranking of ALIGNRT is not clear; I shall assume that it also lies at the bottom, since, like LEFT HD, DOM-INTEG, and MIN-BIN, it appears to play no crucial rôle in

determining the winning candidates.) Thus the complete constraint hierarchy for post-high nominal forms in Venda will be shown to be as follows:

(20) OCP, PENULT(μμ), MAX-EXT, MAX-HD >> RIGHTHD >> ALIGNRT(PP) >> DOM-SIZE >> PARSE(HD), DOM-RIGHT >> NON-FIN >> PARSE(T) >> LEFTHD, DOM-INTEG, MIN-BIN, ALIGNRT

The following tableaux, for post-high *ndemwa* and *t5holi* demonstrate the efficacy of the ordering MAX-EXT, MAX-HD >> RIGHTHD >> ALIGNRT(PP), thus allowing extension to incorporate only the first mora of a following nominal if that mora is a head. (From here on I shall ignore candidates which incur violations of either OCP or PENULT(μμ), as well as those for which there is no extension into the noun (as such forms will always incur a fatally high number of violations of ALIGNRT(PP). I also ignore the bottommost constraints — LEFTHD, DOM-INTEG, MIN-BIN, and ALIGNRT — since, as I have already mentioned, these constraints play no active rôle in deciding the winning output. Note also the use of a vertical line to separate violations of DOM-SIZE and DOM-RIGHT which relate to the extended domain (one or more of which a winning candidate must necessarily incur) from those which relate to domains within the input form of the noun itself.)

Tableau 14: *ndemwa, t5holi*

UR: nde mwa] [μ] μ	MAX-EXT	MAX-HD	RIGHT HD	ALIGN RT(PP)	DOM-SIZE	PARSE (HD)	DOM-RIGHT	NON-FIN	PARSE (T)
F nde mwa μ] μ μ				**	*		*		*
nde mwa μ] μ [μ]				**	*		*	*!	
nde mwa μ μ] μ			*!	*	**		*|*		*
nde mwa μ μ μ]	*!		*	*	***		*|*	*	*
UR: t5ho li] [μ μ]									
F t5ho li μ] μ μ				**	*	*	*|*		**
t5ho li μ] μ [μ]				**	*|*!		*	*	*
t5ho li μ μ] μ			*!	*	**	*	*|*		**
t5ho li μ μ μ]	*!	*!			***		*	*	**

As noted above, we see that NON-FIN >> PARSE(T) (so that the winning candidate is *ndêmwa* rather than *ndêmwá*) and that DOM-SIZE >> PARSE(HD), DOM-RIGHT (similarly ensuring that *t5hôli* wins out over *t5hôlí*).

Let us look next at trisyllabic nouns which begin with a domain head. *Khokhola* provides us with the first instance where a domain in the input form actually survives into the surface form:

Tableau 15: *khokhola*

UR:] [μ] μ [μ]	MAX-EXT	MAX-HD	RIGHT HD	ALIGN RT(PP)	DOM-SIZE	PARSE (HD)	DOM-RIGHT	NON-FIN	PARSE (T)
F kho kho la μ] μ μ [μ]				***	*		*	*	*
kho kho la μ] μ [μ μ]				***	* | *!		*	*	*
kho kho la μ] μ μ μ				***	*	*!	* | *!		**
kho kho la μ μ] μ [μ]			*!	**	**		* | *	*	*
kho kho la μ μ μ μ]	**!	*!			****		* | *	*	**

Here, as with *t5holi*, the constraints MAX-EXT and MAX-HD are equally effective in ruling out candidates which extend past the first mora of head-initial forms. In the following tableaux for *dakalo* and *gon∅oro*, however, we see the need for a separate undominated MAX-HD constraint:

Tableau 16: ***dakalo, gonøonøo***

UR: da ka lo] [μ μ] μ	MAX-EXT	MAX-HD	RIGHT HD	ALIGN RT(PP)	DOM-SIZE	PARSE (HD)	DOM-RIGHT	NON-FIN	PARSE (T)
F da ka lo μ] μ μ μ				***	*	*	*|*		**
da ka lo μ] μ [μ μ]				***	*	*	*|*	*!	*
da ka lo μ] μ [μ] μ				***	*|*!	*	*|*		*
da ka lo μ] μ μ [μ]				***	*|*!	*	*|*	*	*
da ka lo μ μ] μ μ		*!		**	**		*		**
da ka lo μ μ μ] μ	*!	*!	*	*	***		*|*		**
UR: go nøo nøo] [μ μ μ]									
F go nøo nøo μ] μ μ μ				***	*	**	**		***
go nøo nøo μ] μ [μ μ]				***	*|*!	*	*	*	**
go nøo nøo μ] μ [μ] μ				***	*|**!	**	**		**
go nøo nøo μ] μ μ [μ]				***	*|**!	*	*	*	**
go nøo nøo μ μ] μ μ		*!		**	**	*	**		***
go nøo nøo μ μ μ μ]	*!	*!			****		*	*	***

Having now satisfied ourselves that the block of constraints governing extension will ensure that the correct number of moras from the noun are incorporated into the preceding high domain in all cases — i.e., regardless of whether either of the first two moras of the noun is a head or a non-head — we may proceed to examine low-initial forms of more than two syllables in the post-high environment, without bothering to consider those candidates which incorporate more or fewer moras than these constraints would allow. For convenience, then, I shall henceforth collapse these four constraints under a single heading, EXTEND. I shall consider EXTEND to be unviolated so long as exactly two non-heads or one head is incorporated into the extended domain.

For three- and four-syllable low-initial forms, then, we expect to find that the extended domain will always incorporate exactly the first two moras of the noun — and indeed, according to the list in (14), this is the case. For the trisyllabic forms, this means that the first two syllables of the optimal surface forms will all be HF; such an outcome is an inevitable result of the EXTEND block of constraints. The only option left to be determined by lower-ranking constraints is whether the final syllable is high or low. A glance at (14) shows that, with the exception of *murathu*,

the final syllable should surface with a low tone. The following tableaux demonstrate that these are indeed the optimal results, according to our constraint hierarchy:

Tableau 17: ***mutuka, murathu, muselwa, musadzi***

UR:]	mu tu ka μ μ μ	EXTEND	DOM-SIZE	PARSE (HD)	DOM-RIGHT	NON-FIN	PARSE (T)
☞	mu tu ka μ μ]μ μ		**		*		
	mu tu ka μ μ]μ [μ]		**|*!		*	*	
UR:]	mu ra thu μ μ [μ]						
	mu ra thu μ μ]μ μ		**	*!	*|*!		*
☞	mu ra thu μ μ]μ [μ]		**		*	*	
UR:]	mu se lwa μ [μ] μ						
☞	mu se lwa μ μ]μ μ		**		*		*
	mu se lwa μ μ]μ [μ]		**		*	*!	
UR:]	mu sa dzi μ [μ μ]						
☞	mu sa dzi μ μ]μ μ		**	*	*|*		**
	mu sa dzi μ μ]μ [μ]		**|*!		*	*	*

Turning our attention to the four-syllable low-initial forms in (14), we again find incorporation of the first two moras into the extended domain in all instances in the post-high environment — i.e., the first two (in this case monomoraic) syllables of the noun are inevitably HH. Except for the two forms which exhibit downstep, the third syllable (bimoraic) appears to be low in all cases, while the final syllable again varies between low and high. Let us look first at the three items with a post-high tonal pattern of HHLL:

Tableau 18: ***mukalaha, mud uhulu, mukegulu***

UR:]	mu ka la ha μ μ μ μ	EXTEND	DOM-SIZE	PARSE (HD)	DOM-RIGHT	NON-FIN	PARSE (T)
F	mu ka la ha μ μ] μ μ μ		**		*		
	mu ka la ha μ μ] μ [μ] μ		** | *!		*		
	mu ka la ha μ μ] μ μ [μ]		** | *!		*	*	
	mu ka la ha μ μ] μ [μ μ]		** | **!		*	*	
UR:]	mu d u hu lu μ [μ μ] μ						
F	mu d u hu lu μ μ] μ μ μ		**	*	* | *		**
	mu d u hu lu μ μ] μ [μ] μ		** | *!	*	* | *		*
	mu d u hu lu μ μ] μ μ [μ]		** | *!	*	* | *	*	*
	mu d u hu lu μ μ] μ [μ μ]		**	*	* | *	*!	*
UR:]	mu ke gu lu μ [μ μ μ]						
F	mu ke gu lu μ μ] μ μ μ		**	**	* | *		***
	mu ke gu lu μ μ] μ [μ] μ		** | **!	**	* | *		**
	mu ke gu lu μ μ] μ μ [μ]		** | **!	*	*	*	**
	mu ke gu lu μ μ] μ [μ μ]		** | *!	*	*	*	**

Another two forms have an optimal surface tonal pattern of HHLH:

Tableau 19: ***mutukana, musiwana***

UR:]	mu tu ka na μ μ μ [μ]	EXTEND	DOM-SIZE	PARSE (HD)	DOM-RIGHT	NON-FIN	PARSE (T)
	mu tu ka na μ μ] μ μ μ		**	*!	* | *!		*
	mu tu ka na μ μ] μ [μ] μ		**	*!	* | *!		
☞	mu tu ka na μ μ] μ μ [μ]		**		*	*	
	mu tu ka na μ μ] μ [μ μ]		** | *!		*	*	
UR:]	mu si wa na μ [μ] μ [μ]						
	mu si wa na μ μ] μ μ μ		**	**!	* | *!		**
	mu si wa na μ μ] μ [μ] μ		**	**!	* | *!		*
☞	mu si wa na μ μ] μ μ [μ]		**	*	*	*	*
	mu si wa na μ μ] μ [μ μ]		** | *!	*	*	*	*

Now we turn to the final two forms — *mubvumela* and *mutaladzi* — each of which show evidence of downstep between the antepenultimate and penultimate syllables. Recall that according to Cassimjee, downstep is the result of a floating low tone (delinked due to Contour Simplification) between two high tones. Obviously, in a nonrepresentational OT model there are no underlying low tones or association lines to be delinked. However, the constraint ranking postulated in (20) — which has been shown to predict the correct output candidates in the post-high environment for all other input forms — provides us with an interesting alternative solution:

Tableau 20: ***mubvumela, mutaladzi***

UR:]	mu bvu me la μ μ [μ̲] μ̲	EXTEND	DOM-SIZE	PARSE (HD)	DOM-RIGHT	NON-FIN	PARSE (T)
	mu bvu me la μ μ] μ̲ μ μ̲		**	*	*|*		*!
F	mu bvu me la μ μ] μ̲ [μ] μ̲		**	*	*|*		
	mu bvu me la μ μ] μ̲ μ [μ]		**	*	*|*	*!	
	mu bvu me la μ μ] μ̲ [μ μ̲]		**|*!	*	*|*	*	
UR:]	mu ta la dzi μ μ̲ [μ μ̲]						
	mu ta la dzi μ μ̲] μ̲ μ μ̲		**	**!	*|*!		**
	mu ta la dzi μ μ̲] μ̲ [μ] μ̲		**|*!	**	*|*		*
	mu ta la dzi μ μ̲] μ̲ μ [μ̲]		**|*!	*	*	*	*
F	mu ta la dzi μ μ̲] μ̲ [μ μ̲]		**	*	*	*	*

In the case of *mubvumela*, we find the constraints PARSE(HD) and DOM-RIGHT are violated equally by all the candidates presented — and indeed, any candidate not in violation of these two constraints would necessarily violate either OCP or EXTEND. Thus, in a classic instance of what McCarthy and Prince (1994) refer to as "the emergence of the unmarked," it is the low-ranking constraints NON-FIN and PARSE(T) which determine the winning candiate. With regard to *mutaladzi*, it is the constraints DOM-SIZE, PARSE(HD) and DOM-RIGHT which determine the optimal output. What is unique to the winning candidates in both cases is that they violate LEFT HD in order to satisfy the higher-ranking constraints OCP and EXTEND, and in so doing they provide us with a fourth logical alternative tonal pattern for phrase-final penultimate syllables — a rising contour.

To my knowledge, no other analysis of tone in Venda has made allowance for the possibility of LH contour tones on the penult. Yet there is no reason not to expect rising as well as falling tones to occur on bimoraic syllables, other than the fact that they are not actually attested. The obvious implication of this analysis is that they are not attested simply because they are not *realised* as rising tones — that is, the initial low of a rising tone is not realised phonetically as a low tone. Its presence, however, is felt nonetheless: Like any other low tone that separates two high domains, the result is *downdrift*, an automatic process of phonetic lowering of the pitch of the highs which follow such a low tone. Thus the OT approach (albeit in a somewhat different manner) leads to the same conclusion as Cassimjee's autosegmental analysis: that "downstep in Venda is indeed just downdrift" (1992, p. 40).

6. Conclusion

I have shown how an Optimality Theoretic model of tonal domains can easily account for all of the variations in tonal melodies of post-low/isolation and post-high nouns in Venda which were previously analysed by means of a representational, autosegmental approach by Cassimjee (1992). These include not only the spread of a high domain from the preceding word into the noun, but also word-internal high spreading and the occurrence of downstep in certain forms. Furthermore, the OT model is preferable on several counts:

(1) By regarding the Obligatory Contour Principle as a constraint on the well-formedness of the surface form, the different effects it incurs at different levels of the phonology (fusion at the lexical level; avoidance of adjacent domains at the postlexical level) can be seen to derive directly from different rankings of constraints. A rule-based approach offers no means of explaining why the same constraint should be met by multiple linkage of high tones on the one hand and Meeussen's Rule on the other; indeed, it is difficult to say just what rôle a "constraint" is supposed to play in a rule-based phonology in the first place.

(2) The rules provided by Cassimjee to derive the correct output forms are largely language-specific and to some degree stipulative. In Optimality Theory, all constraints are considered universal and are stated quite generally; languages differ only in how they order these constraints. Further, constraints can be violated minimally so as to produce an optimal surface form; a rule-based system does not have this flexibility and must often rely on repair strategies to "unapply" a rule in cases where it simply should not apply.

(3) Cassimjee's approach relies crucially on the assumption that low tones are singly linked while highs are multiply linked; it also assumes extratonality of final syllables in certain circumstances, even though such syllables are associated with a tone throughout the derivation. Finally, after assigning low tones at the lexical level, it arbitrarily assumes deletion of lows in certain instances (word-initially after a high) and delinking in others (contour simplification). An Optimality approach, by relying on universal constraints, obviates the need for such idiosyncratic measures.

(4) The OT approach offers a coherent explanation for an apparent asymmetry in the inventory of isolation-form tonal melodies found in Venda which the representational model cannot provide. It also explains another apparent asymmetry: the lack of rising contour tones on penultimate syllables.

(5) Finally, an advantage of the current analysis (although unrelated to its status as a constraint-based approach) is that it regards the mora, rather than the syllable or vowel, as the tone-bearing unit. This allows a natural explanation for otherwise puzzling facts — in particular, why only the penultimate syllable can bear a contour tone, and why the extension of a

tonal domain into a following noun appears to incorporate only a single syllable of a disyllabic form but two syllables in longer forms.

There still remain other avenues for future research. Cassimjee (1986) discusses also the occurrence of downstep in verbal forms; it remains to be seen whether the analysis of downstep presented here is in accord with the patterns found in such forms. Additionally, I have examined only a limited number of underlying tonal melodies and have looked at the postlexical properties of nominals only when they are in phrase-final position. Longer forms, as well as forms which do not undergo penultimate lengthening, need to be examined and may call for readjustment of some of the constraint rankings presented here. There are also other noticeable asymmetries in isolation tonal melodies in longer words which need to be accounted for. By examining in detail a narrowly defined set of tonal phenomena, however, I hope to have at least demonstrated the superiority of an Optimality Theoretic approach to tone, and to phonology in general.

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