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Faith and Markedness in Esimbi Feature Transfer

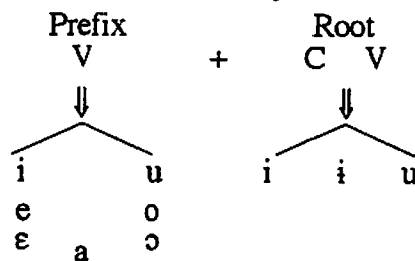
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This paper examines the implications of vowel height transfer in Esimbi for featural faith and positional markedness constraints. Esimbi is a Bantoid language spoken just outside the Cameroon Grassfields Bantu area. It is remarkable for its unusual surface distribution of vowels: a greater number of vowel height contrasts occur in prefixes than in roots. This distribution is produced by a transfer of vowel height features from root to prefix vowels (Stallcup 1980a, b; Hyman 1988), a phenomenon, I argue, that is driven by a word-initial licensing constraint for marked vowel height. The height shift offers an interesting case of non-tonal features behaving as true autosegments, independent of their segmental sponsors. I focus on two analytical points raised by this behavior. First, the features that undergo transfer act as autonomous structural elements, signalling a need to extend the correspondence relation to height features in Esimbi. This kind of relation does not fall under the usual IDENT[Feature] formulation of featural faith, which demands identical feature specification of segmental correspondents, rather it is expressed by a MAX[Feature] constraint, which evaluates correspondence between features themselves. Second, because the shifted features originate in a different location from the one in which they surface, the licensing constraint driving the transfer must be formulated as a requirement on the position of marked phonological structure — it cannot be expressed in terms of positional faith. These analytical consequences raise the more general issue of the extent to which non-tonal features should be understood as having “autosegmental” status in phonological structure.

1 Background: vowel height contrasts originate in the root

Esimbi presents a surprising asymmetry in the height distinctions displayed in root versus prefix vowels, namely, prefixes exhibit (at least) three degrees of vowel height, while root vowels are uniformly high. The surface distribution of vowels is shown in (1) (description and data are from Stallcup 1980a, b; Hyman 1988, drawing on the field notes of Stallcup; for previous analyses see these sources and Clements 1991, also Kenstowicz 1994).

(1) Surface distribution of vowel height:

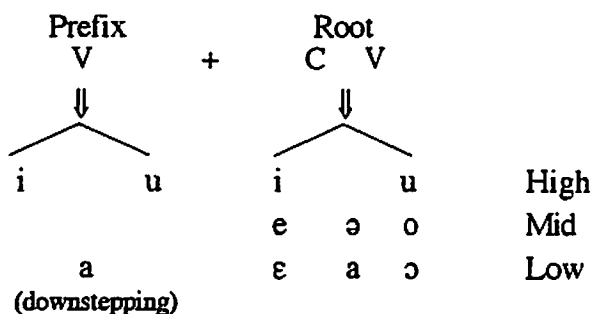


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The surface distribution in (1) is unusual, since contrasts in language are typically more robust in roots than in affixes, an observation expressed, for example, with the universal metaconstraint: Root Faith >> Affix Faith, proposed by McCarthy and Prince (1994, 1995: 364), building on the optimality-theoretic markedness metaconstraints of Prince and Smolensky (1993).

Careful examination of the data will reveal that McCarthy and Prince's metaconstraint is actually respected in Esimbi. This section presents evidence indicating that the full range of vowel height contrasts occur in the root underlyingly, and a reduced number originate in the prefix, as outlined in (2). Vowel height features are then transferred from root to prefix to produce the surface distribution in (1).¹

(2) Underlying distribution of vowel height:



Various data support the claim that a three-way height contrast occurs in the root in the underlying representation. The first set of data shows that roots condition alternations in prefix vowel height. A given prefix will exhibit a three-way variation in vowel height, with the surface height determined by the root to which it is affixed. This is illustrated in (3) for the infinitive prefix, with alternants [u-, o-, ɔ-]. The underlying vowel representations (after Hyman 1988: 256) appear at the right (assuming full specification).

(3) Infinitive prefix ([u-, o-, ɔ-]).

Prefix+root surface forms	Surface pattern: height contrasts in prefix	Underlying representation: height contrasts in root
u-ri 'eat'	<u>u</u> - i	/u - <u>i</u> / High
u-zu 'kill'	<u>u</u> - u	/u - <u>u</u> /
o-si 'laugh'	<u>o</u> - i	/u - <u>e</u> / Mid
o-tu 'insult'	<u>o</u> - u	/u - <u>o</u> /
o-dzi 'steal'	<u>o</u> - i	/u - <u>ə</u> /
ɔ-ri 'daub'	<u>ɔ</u> - i	/u - <u>ε</u> / Low
ɔ-hu 'knead'	<u>ɔ</u> - u	/u - <u>ɔ</u> /
ɔ-bi 'come'	<u>ɔ</u> - i	/u - <u>a</u> /

Although the prefix height depends on the root to which it is attached, there is nothing in the surface form of the root to condition the change. This is particularly clear from inspection of the near minimal triplets in (4) (Hyman 1988: 257; diacritics mark tones).

¹ Stallcup (electronic communication) does not recall finding any suffixes in his investigation of Esimbi.

- (4) Infinitive prefix + root
- | | |
|---|---|
| a. u-mu 'drink'
o-mu 'go up'
ɔ-mu 'sit' | b. u-wu 'uproot'
o-wũ 'burn' (intr.)
ɔ-wũ 'grind' |
|---|---|

While the vowel height of the infinitive prefix changes with the root base, the round and back qualities of the prefix vowel remain fixed. This prefix vowel is posited underlyingly as /u-/, that is, [+round], [+back], [+high] ([+high] being the unmarked vowel height; under Hyman's assumptions of underspecification this prefix is the archiphoneme /U-/ — just specified [+round]). Prefix vowels may also be fixed front and unrounded, as in the case of the class nine nominal prefix with alternants [i-, e-, ε-] (Hyman 1988: 258). This prefix vowel is underlyingly /i -/ ([-round], [-back], [+high]).

- (5) Singular class 9 prefix ([i-, e-, ε-]).

Surface: prefix+root	Surface pattern:	Underlying representation:
ì-bì 'goat'	<u>i</u> - i	/i - <u>i</u> / High
ì-sù 'fish'	<u>i</u> - u	/i - <u>u</u> /
è-gbì 'bush fowl'	<u>e</u> - i	/i - <u>e</u> / Mid
è-sù 'hoe'	<u>e</u> - u	/i - <u>o</u> /
è-bì 'cane rat'	<u>e</u> - i	/i - <u>ə</u> /
è-jìsi 'hole'	<u>ε</u> - i	/i - <u>ε</u> / Low
è-zù 'snake'	<u>ε</u> - u	/i - <u>ɔ</u> /
è-tlì 'place'	<u>ε</u> - i	/i - <u>a</u> /

A third kind of prefix vowel alternates in height at one step below the /i/ and /u/ prefix vowels; this kind of height alternation is termed "downstepped" by Hyman. An example occurs in the plural class 6 prefix (Hyman 1988: 259). For comparison, forms of a singular prefix /u-/ (identical to the infinitive) on the same nouns are shown at the right.

- (6) Plural class 6 prefix ([o-, ɔ-/ε-, a-]).

Surface: Pl. /a-/ +root	Surface pattern:	Underlying vowels:	cf. Sg. /u-/ +root
o-tili 'end'	<u>o</u> - i	/a - <u>i</u> / High	<u>u</u> -tili
ó-ku 'death'	<u>o</u> - u	/a - <u>u</u> /	<u>ú</u> -ku
é-ki 'tail'	<u>ε</u> - i	/a - <u>e</u> / Mid	<u>ó</u> -ki
ó-tu 'ear'	<u>ɔ</u> - u	/a - <u>o</u> /	<u>ó</u> -tu
ɔ-tì 'spear'	<u>ɔ</u> - i	/a - <u>ə</u> /	<u>o</u> -tì
a-simi 'grain'	<u>a</u> - i	/a - <u>ε</u> / Low	<u>ɔ</u> -simi
á-bu 'hand'	<u>a</u> - u	/a - <u>ɔ</u> /	<u>ɔ</u> -bu
á-bi 'broom'	<u>a</u> - i	/a - <u>a</u> /	<u>ɔ</u> -bi

The “downstepped” prefix vowel is analytically problematic: it raises questions about how to capture scalar height effects and about the height of [a] in relation to the other low vowels. It also presents unexpected rounding and backness alternations (compare /a-/→[o] conditioned by root vowel /i/ with /a-/→[ɛ] conditioned by /e/). Downstepping is discussed by Hyman (1988) and Clements (1991), and it will not be the subject of analysis here. I will simply characterize this prefix vowel as /a-/, a vowel bearing a downstepping property; in Hyman’s analysis, this vowel has an [-ATR] specification that depresses vowel height.

To review, we have seen that prefix vowels come with one of three sets of fixed properties, corresponding to the underlying forms /i-, u-, a-/, and height variation is conditioned by the root. The underlying representations that have been assumed attribute the height variations to a transfer of height from root to prefix. Yet it would also be conceivable to claim that the prefix height alternations are not due to a phonological property of the root; instead, the lexical entry for a root could contain a list of the prefix forms it takes, with a separate listing for each prefix. However, this approach is not adequate for the data. Importantly, the height of prefix vowels attaching to a given root is not random: it is consistent across prefixes. This is illustrated in (7) with the singular and plural class 7/8 prefixes (Stallcup 1980b: 142). The same kind of generalization across regular and downstepped prefixes can be seen in comparison of the singular and plural forms in (6), where the plural is predictably downstepped by one level from the singular.

(7)	Sg.+root	Pl.+root	(class 7/8)	Underlying vowels:
	k _i -ku	b _i -ku	‘bone’	/i-u/ High
	k _e -h _i	b _e -h _i	‘bundle’	/i-ə/ Mid
	k _ɛ -s _i	b _ɛ -s _i	‘comb’	/i-a/ Low

The conclusion that may be drawn from the uniformity of prefix vowel height for each root is that prefix height is a synchronic phonological property of the root that is transferred to the prefix; unlike spreading, height actually shifts from one vowel to another. Roots then distinguish three levels of vowel height in the underlying representation, corresponding to the three levels of height exhibited in prefix alternations. Prefix vowels contribute an inherent two-way height contrast: high (/i-/ , /u-/) versus downstepped (/a-/), which determines whether the prefix alternates at the regular or downstepped level. Assuming full specification and binary features, I have posited the higher prefix vowels as [+high]. Other theories of vowel height features or underspecification may handle this specification somewhat differently, but this is not crucial to the main analytical point of this paper.

The transfer of height features from root to prefix is expressed schematically in (8). This informally illustrates the descriptive generalization that has been established.

(8)	/V - C V/ → [V - C V]
	[αhigh] [αhigh]

Diachronic evidence indicates that a height transfer developed in the history of Esimbi, that is, underlying root vowel height contrasts once actually surfaced within the root.

(9)	Proto-Bantu	Surface Esimbi	Esimbi underlying
	*bá-	ɔ-mi ‘to be’	/ú-ma/
	*tánɣ-	ɔ-tiŋi ‘to count’	/u-taŋa/
	*gàb-	ɔ-gibi ‘to divide’	/u-gaba/

Upon synchronic transfer of vowel height, root vowels in Esimbi are neutralized to high. They retain their underlying backness and rounding specification, as outlined in (10)

for infinitive forms. Note that the occurrence of only mid and low prefix vowels with the root surface vowel [i] indicates that underlying central vowels are only mid and low.

(10)a.	Front root vowels surface as [i]			
	/u-ri/	→	[u-ri]	'eat'
	/u-se/	→	[o-si]	'laugh'
	/u-rɛ/	→	[ɔ-ri]	'daub'
b.	Central root vowels surface as [i]			
	/u-dzə/	→	[o-dzi]	'steal'
	/u-ba/	→	[ɔ-bi]	'come'
c.	Back root vowels surface as [u]			
	/u-zu/	→	[u-zu]	'kill'
	/u-to/	→	[o-tu]	'insult'
	/u-hɔ/	→	[ɔ-hu]	'knead'

The resulting underlying root inventory contains three heights (eight vowels), as anticipated in (2). Comparing this to the reduced inventory for prefixes (high + downstepping, three vowels), it is apparent that the generalization that roots exhibit at least as many contrasts as affixes do is maintained in the underlying representations of Esimbi. The next section explores why height is transferred from root to affix to give a different surface distribution.

2 Analysis of feature transfer

2.1 Featural faith independent of sponsoring segments

Esimbi height feature transfer has implications for the kinds of featural faith constraints needed in Optimality Theory. Because vowel height features originate in the root but surface in the prefix, it provides a case in which features are maintained in the output independent of their input-affiliated segments. In correspondence theory, featural faith is usually captured with IDENT[Feature] constraints, formulated as in (11) (McCarthy and Prince 1995: 264).

- (11) IDENT[F(eature)]
 Let α be a segment in S_1 (an input) and β be any correspondent of α in S_2 (an output). If α is [γ F], then β is [γ F]. (Correspondent segments are identical in F).

IDENT[F] does not posit a correspondence relation between input and output features but rather evaluates the faithfulness of featural *properties* of input and output *segment* correspondents. This conception of featural faith reflects the typical dependency of features on their input segment sponsors. Interestingly, the preservation of transferred root height features in Esimbi prefixes cannot be captured directly with this kind of constraint.

The problem is illustrated in (12). Let us assume that an undominated constraint requires that marked vowel height features occur only in the initial syllable (the precise nature of this constraint will be examined in the next section). Marked height is characterized descriptively as [-high], independent of specific theories of vowel height features which are not the concern here. Because of the undominated constraint on marked height position, a [-high] feature specification originating in a prefixed root cannot surface on its underlying sponsoring segment. The [-high] feature specification could either be transferred to the initial syllable (12a) or it could be lost altogether (12b). (12a), which preserves but displaces the underlying root vowel height, is the candidate that wins in

Esimbi (marked by the hand pointing to the right); however, the IDENT constraints select candidate (b) instead (marked by the reverse pointing hand). Since (b) incurs a subset of the violations that (a) does, no reranking will serve to select (a) over (b).

(12) IDENT cannot drive feature preservation under transfer:

	V - C V [+hi] [-hi]	IDENT[-high]	IDENT[+high]
☞	(a) V - C V [-hi] [+hi]	*	*!
☜	(b) V - C V [+hi] [+hi]	*	

IDENT[F] fails to capture feature transfer because featural faith is evaluated in terms of the identity of correspondent segments. Losing a root feature specification incurs one IDENT violation, but moving that specification to a prefix at the cost of the underlying prefix vowel specification, incurs two violations, one for the root vowel and one for the prefix.

An IDENT[F] analysis cannot be rescued by positing violations of UNIFORMITY, which penalizes output segments with multiple input correspondents (McCarthy and Prince 1995: 370). Under this approach, the surface prefix vowel is placed in correspondence with the underlying root vowel, explaining the transferred [-high] feature by a relation between its originating and surface positions. Yet we have seen that the prefix vowel retains rounding and backness features of its own, as does the root vowel. This gives the picture in (13a) where the surface prefix vowel must correspond with the underlying prefix vowel and root vowel, and the surface root vowel must correspond to the underlying root vowel (subscripted numbers mark correspondents). Comparing (13b), which uniformly posits root vowel in correspondence with root vowel and prefix with prefix, it is evident that again the winning outcome eliminates rather than transfers the root height feature.

(13) IDENT also fails under multiple correspondence:

	V ₁ - C V ₂ [+hi] [-hi]	IDENT[-high]	UNIFORMITY	IDENT[+high]
☞	(a) V _{1,2} - C V ₂ [-hi] [+hi]	*	*(!)	*(!)
☜	(b) V ₁ - C V ₂ [+hi] [+hi]	*		

IDENT[-high] is relevant for surface correspondents of the root vowel. Since the input root vowel is still in a correspondence relation with the surface root vowel, a violation is incurred by both candidates for the [+high] root vowel. The multiple correspondence posited in (a) thus fails to resolve the problem in (12), because it does not incur fewer violations of IDENT[-high]. Candidate (13a) loses on the basis of either a UNIFORMITY or an IDENT[+high] violation. No reranking of the constraints can make (a) come out as the winner — this is an undesirable result.

The problem presented by IDENT for Esimbi calls for a re-examination of the level at which faith for transferred features is evaluated. In the Esimbi height shift, it is the root height feature itself that must be retained in the output, even under transfer to another segment. This kind of faithfulness relation is expressed by MAX[F], which evaluates correspondence between features directly (extending the segmental MAX family of constraints proposed by McCarthy and Prince 1995).

- (14) MAX-IO [γF]
Every occurrence of a feature specification [γF] in the input has a correspondent in the output.

McCarthy and Prince (1995: 265) anticipate that floating feature phenomena may require extending the correspondence relation to features. Other cases used to argue for this kind of featural correspondence relation are discussed by Lombardi (1995) and Causley (1996) (cf. also Lamontagne and Rice 1995).

MAX[-high] straightforwardly expresses the demand of retaining [-high] in the output for the kind of input we have been considering. Notice that [-high] feature specifications are now themselves marked as correspondents in (15). Candidate (a) respects MAX[-high] by shifting but preserving the feature specification, while (b) violates MAX by losing [-high] entirely; this achieves the desired outcome.

- (15) MAX[-high] selects (a), with transferred feature:

	V - C V [+hi] [-hi] ₁	MAX[-high]
(a)	V - C V [-hi] ₁ [+hi]	
(b)	V - C V [+hi] [+hi]	*!

Esimbi feature transfer thus provides a clear case requiring a MAX[F] formulation rather than an IDENT[F] one; it is a case where satisfying featural correspondence is more important than satisfying featural identity of segment correspondents.

2.2 Height displacement as licensing

The next question to examine is what motivates the height displacement from the root to the prefix vowel. The vowel height shift moves marked height features to the word-initial syllable. This parallels other phenomena which restrict marked phonological structure to a privileged position, often the initial syllable (see, for example, Steriade 1995; Beckman 1995, 1996, to appear; Zoll 1996a, b). I propose to characterize this positional restriction with a licensing constraint. Informally, this constraint demands the requirement in (16).

- (16) LICENSE ([-high], σ_1)
“[-high] must be linked to the first syllable.”

(16) can be expressed more formally as a constraint of the COINCIDE family (after Zoll 1996a, b; recent applications appear in Walker 1996; Ringen & Vago 1997):

- (16') COINCIDE ([-high], Leftmost(σ , word))
 $\forall x (x = [-high] \rightarrow \exists y (y = \text{Leftmost}(\sigma, \text{word}) \wedge \text{Coincide}(x, y)))$.
Coincide (x, y) is true iff y dominates x or x dominates y.

This COINCIDE constraint requires of all [-high] feature specifications in a representation that they coincide with the leftmost (initial) syllable of a word. The relation *coincide* holds between two elements if one element dominates the other. For our purposes, the relevant structure satisfying coincidence will be one in which the word-initial syllable dominates the [-high] feature.

Together with a MAX[F] constraint, licensing drives marked height features to move to the initial syllable. This outcome is illustrated in (17). The input here contains a high prefix vowel and a root vowel with marked height. The winning candidate in (a) shifts the marked height feature to the initial syllable, satisfying both licensing and MAX[-high]. The alternative in (b), which fails to shift the marked height, loses on licensing, and (c), which eliminates the underlying root height feature, loses on MAX.

(17) Marked vowel height transfer to the initial syllable:

	V - C V [+hi] [-hi] ₁	LICENSE ([-hi], σ ₁)	MAX[-high]
☞	(a) [-hi] ₁ [+hi]		
	(b) [+hi] [-hi] ₁	*!	
	(c) [+hi] [+hi]		*!

Interestingly, the licensing effect in Esimbi is one of *positional markedness* and not one of *positional faith*, that is, it can be captured with only one of two recent approaches to expressing positional limitations on feature distribution. Crucially, the licensing constraint must express a surface condition on where marked phonological structure may occur, the positional markedness line taken by Zoll (1996a); because the licensed height feature does not originate in the initial syllable, it cannot be expressed in terms of a parametrized faith constraint for the initial licensing position (after Beckman 1995, 1996, to appear).

With licensing driving the vowel height shift, it emerges that marked height is not a special property of prefixes per se, but rather it is drawn to the initial position, regardless of whether it falls in a root or prefix. This raises the question of what takes place in unprefixated forms. The occurrence of unprefixated roots in Esimbi words is rare, but Stallcup (electronic communication) notes a few forms in the native vocabulary which exceptionally occur without a singular prefix. Some examples are given in (18).

(18) Singular class 1/2 (unprefixated)

bami	'lake'
gwogu	'duck'

The exceptional roots in Stallcup's sample are not fully understood, as they behave in unusual ways in various inflectional classes. However, the unprefixated forms are consistent with the licensing analysis in that they exhibit marked vowel height in the initial syllable and high vowels non-initially.

2.3 Root Faith versus Affix Faith

The status of the Root-Affix Faith metaconstraint proposed by McCarthy and Prince (1994, 1995) may now be evaluated in relation to Esimbi. Given "richness of the base" (Prince and Smolensky 1993: 191), which hypothesizes that all inputs are possible, we must ensure that the analysis produces appropriate outputs for Esimbi for any input root and prefix vowel height specifications.²

McCarthy and Prince propose a universal fixed ranking of Root Faith over Affix Faith. The specific ranking that will be relevant is the one in (19), where [height] refers to vowel height features (e.g. [±high]).

² Of course, given Lexicon Optimization (Prince and Smolensky 1993: 192), not all possible inputs for a given output will correspond to underlying representations (inputs) the learner actually posits, but this is a separate matter.

(19) MAX-ROOT[height] >> MAX-AFFIX[height]

The ranking in (19) derives the result that root height features are always maintained at the cost of prefix ones, for example, when a root feature shifts to the initial syllable, the prefix height feature is lost. Taking into consideration MAX violations for any vowel height, licensing and MAX-ROOT[height] both force violations of affix faith. This is shown in (20) for an input with a [-high] root vowel and a [+high] prefix vowel.

(20) LICENSE([-high], σ1), MAX-ROOT[height] >> MAX-AFFIX[height]

	V - C V [+hi] ₁ [-hi] ₂	LICENSE([-hi], σ1)	MAX-RT[height]	MAX-AFX[height]
a.	[-hi] ₂ [+hi] ₃			*
b.	[+hi] ₁ [+hi] ₃		*!	
c.	[+hi] ₁ [-hi] ₂	*!		

Here I assume that the [+high] (default) specification in the surface root vowel is the result of featural epenthesis rather than transferred from the prefix vowel, as indicated by the index <3>. Featural epenthesis (incurring a violation of DEP[F]) is required in any case to handle inputs in which both the prefix and root vowel are [-high]. Further, although feature displacement is possible (e.g. when driven by licensing), features do not freely scramble from input to output. Under a MAX[F] conception of featural faith this can be constrained by LINEARITY (McCarthy and Prince 1995: 371), which enforces consistency of precedence structure in input and output.

For polysyllabic roots it is reasonable to question which root vowel determines the prefix height — all root vowels are neutralized to [+high] in the output. On this matter, Beckman's positional faith offers some insight (1995, 1996, to appear). Beckman proposes that faith constraints may be position-specific, placing greater demands on faith in phonologically strong positions. One privileged position is the root-initial syllable; a faith constraint for height in this position requires that height features occurring in the root-initial syllable in the input have a correspondent feature in the output: MAX-ROOTσ1[F]. Ranking MAX-ROOTσ1[F] over the more general constraint, MAX-ROOT[F] yields an outcome in which height features of the root-initial syllable are preserved over features of post-initial syllables. Following this analysis, I tentatively posit the root-initial feature as the one that shifts to the prefix, but further evidence is needed to verify this hypothesis for Esimbi.³

3 Markedness and underlying high root vowels

So far only inputs with high prefix vowels and marked height in the root have been considered. I now turn to forms in which the root vowel is underlyingly [+high]. Since [+high] is not a marked feature in need of licensing, we must explain why prefix vowels are always high when the root vowel is underlyingly high. That is, why does an input such as that in (21) with a [-high] specification in the prefix come out with two high vowels rather than with a completely faithful output? Assuming richness of the base, inputs such as this must be accounted for. I propose that the prefix vowel surfaces as [+high] in this

³ Esimbi root vowels exhibit neutralization beyond just vowel height. Hyman (1988: 256) notes that all vowels in a root are in fact identical, that is, in addition to all surfacing as [+high], they agree in color (rounding and backness). For example, *o-jihiri* 'learn', *o-yuwuru* 'hear', *o-nimini* 'think'. The height neutralization is explained by word-initial licensing, but vowel color does not shift from the root. Agreement for rounding and backness may be attributed to a color harmony in the root, a vowel harmony attested in many languages, such as Turkish and Mongolian.

case as a consequence of a markedness constraint, *[-high]. Ranking this constraint above MAX-AFFIX[height] results in the loss of [-high] affix features.⁴

(21) *[-high] >> MAX-AFFIX[height]

	V - C V [-hi] ₁ [+hi] ₂	LIC([-hi], σ ₁)	MAX-RT[height]	*[-high]	MAX-AFX[height]
☞	a. [+hi] ₃ [+hi] ₂				*
	b. [-hi] ₁ [+hi] ₂			*!	

*[-high] must itself be outranked by root faith to derive the shift rather than deletion of marked features originating in the root. Comparing (22) to (21) shows unambiguously that Root and Affix Faith must be differentiated. A single MAX constraint is insufficient to produce different outcomes for marked height features originating in roots versus prefixes.

(22) MAX-ROOT[height] >> *[-high]

	V - C V [+hi] ₁ [-hi] ₂	LIC([-hi], σ ₁)	MAX-RT[height]	*[-high]	MAX-AFX[height]
☞	a. [-hi] ₂ [+hi] ₃			*	*
	b. [+hi] ₁ [+hi] ₃		*!		

This analysis finds that prefix agreement with underlying root vowel height is by feature transfer when the root height is marked ([-high]) and by default agreement when the root height is unmarked ([+high]). It would be conceivable to try to analyze both cases as involving initial linking of the height feature. For example, another approach to handling a [-high] prefix and [+high] root input (see (21)) might be to analyze the [+high] root feature as linked to both root and prefix vowel in the output rather than having separate [+high] specifications on each surface vowel. I assume that this representation is not optimal, because it violates a featural tautosyllabicity constraint, TAUTSYLL[height], which prohibits linkage of height features across syllables (after Walker 1997 extending the notion of Crisp Edges of Itô and Mester in press; Merchant 1995). If multiply-linked height features were permitted, so that a feature could at once be licensed by membership to the initial syllable and also belong to its underlying root segment, then [-high] specifications would also be expected to surface in both prefix and root vowels. The elimination of this outcome is illustrated in (23).⁵ Satisfaction of featural tautosyllabicity is at the cost of DEP[+high] (violated by the epenthesis feature).

(23) Ruling out multiply-linked features:

	V - C V [+hi] ₁ [-hi] ₂	TAUT-SYLL[height]	DEP[+high]
☞	a. [-hi] ₂ [+hi] ₃		*
	b. [-hi] ₂	*!	

Still on the subject of feature transfer, if an active licensing effect were posited to drive shift of *all* height feature specifications, the resulting predictions are problematic.

⁴ I assume that *[-high] does not eliminate the height-depressing property of the downstepping prefix vowel. This is consistent with Hyman's analysis of this vowel as [-ATR].

⁵ Tautosyllabicity constraints for other features may be ranked separately. For example, color harmony in the root will produce violations of TAUTSYLL for backness and rounding features.

Because root vowels in Esimbi always come out as [+high], there is no licensing distribution in evidence for [+high] in Esimbi. Otherwise an underlying [-high] root feature would not shift to the prefix, as the surface high root vowel would still fail on licensing. This is illustrated in (24) replacing the constraint LICENSE ([-high], σ1) with LICENSE ([height], σ1).

(24) LICENSE ([height], σ1) produces wrong result.

	V - C V [+hi] ₁ [-hi] ₂	LIC([height], σ1)	MAX-RT[height]	MAX-AFX[height]
☞	a. [-hi] ₂ [+hi] ₃	*		*!
☞	b. [+hi] ₁ [-hi] ₂	*		

Both of the candidates in (24) incur a licensing violation. Candidate (a) is the desired winner, but it loses to the completely faithful rival in (b) by virtue of a MAX violation. A problem will also arise for /[-high] - [+high]/ inputs which will surface faithfully under the constraints in (24). The correct outcome for these forms: [[+high] - [+high]] is obtained with the markedness constraint *[-high], as was shown in (21).

4 Conclusions and further research

To conclude, a summary of the constraint structure needed for the transfer of vowel height in Esimbi is given in (25).

(25) Summary of rankings:

- a. Faith: MAX-ROOT[height] >> *[-high] >> MAX-AFFIX[height], DEP[+high]
- b. Licensing: LICENSE([-high, σ1]) >> MAX-AFFIX[height], DEP[+high]
- c. Tautosyllabicity: TAUT-SYLL[height] >> DEP[+high]

Underlying the constraints and their rankings are three key points of analytical interest. First, Esimbi respects the Faith Root >> Faith Affix metaconstraint, although it at first appears to counter-exemplify this generalization; in fact, the MAX-ROOT[height] >> MAX-AFFIX[height] ranking plays a critical role in the analysis. Second, Esimbi vowel height transfer requires a MAX[F] formulation of featural faith — IDENT[F] is insufficient to characterize this phenomenon. And lastly, the shift of height features in Esimbi from one vowel in the input to another in the output finds support for formal positional licensing constraints as a means of characterizing positional neutralization effects; this kind of transfer cannot be captured with positional faith.

This discussion has focused on the kind of analysis required for featural faith and licensing in the Esimbi height transfer. From a broader theoretical perspective these findings contribute to the continuing investigation into the characterization of these kind of phenomena. Esimbi shows that features can behave autonomously, providing an argument for a correspondence view of features; however why non-tonal features do not consistently exhibit the same range of segment-independent processes as tonal features remains to be fully understood. It is conceivable that there is a connection between the autosegmental status of the height features and the demand of positional markedness, that is, perhaps the MAX[F] over IDENT[F] status for height is somehow linked to the status of positional markedness over positional faith. This is a matter for future research.

This paper examines only one of many interesting phonological and morphological phenomena in Esimbi. An issue connected to the height shift concerns the occurrence of

multiply-prefixed forms. No data with multiple prefixes are supplied in any of the sources, although according to Hyman (personal communication), such forms do occur in Esimbi. Hyman reports that in these forms, each of the prefixes displays the underlying root vowel height — not just the first prefix. If initial-syllable licensing were the only factor in vowel height realization, this distribution would be unexpected, as root vowel height should only occur in the initial syllable of the word. It is conceivable that what is at work in the non-initial prefixes of multiply-prefixed forms is a kind of paradigm uniformity, that is, for a given root, the form of each prefix it takes remains consistent. Paradigm uniformity effects have been analyzed with Output-Output constraints (see, e.g., Benua 1995; McCarthy 1995; cf. Burzio 1997, also Kenstowicz 1995 on Uniform Exponence), and this provides a promising avenue for explaining the forms of post-initial prefixes, a subject which deserves further descriptive and analytical investigation.

References

- Beckman, Jill N. 1995. Shona height harmony: markedness and positional identity. In Beckman, Jill N., Laura Walsh Dickey, and Suzanne Urbanczyk, eds. *UMOP: Papers in Optimality Theory* 18, pp. 53-75.
- Beckman, Jill N. 1996. *Positional faithfulness*. Doctoral dissertation, University of Massachusetts, Amherst.
- Beckman, Jill N. To appear. Positional faithfulness, positional neutralization and Shona vowel harmony. To appear in *Phonology*.
- Benua, Laura. 1995. Identity effects in morphological truncation. In Beckman, Jill N., Laura Walsh Dickey, and Suzanne Urbanczyk, eds. *UMOP: Papers in Optimality Theory* 18, pp. 77-136.
- Burzio, Luigi. Multiple correspondence. Ms., Johns Hopkins University.
- Causley, Trisha. 1996. Featural correspondence and identity: the Athapaskan case. Paper presented at *NELS 27*, McGill University.
- Clements, G. N. 1991. Vowel height assimilation in Bantu languages. In Kathleen Hubbard, ed., *BLS 7*, 25-63.
- Hyman, Larry. 1988. Underspecification and vowel height transfer in Esimbi. *Phonology* 5, 255-273.
- Itô, Junko and Armin Mester. In press. Realignment. In R. Kager, H. van der Hulst, and W. Zonnefeld, eds., *Proceedings of the Utrecht Workshop on Prosodic Morphology*. Mouton: The Hague.
- Kenstowicz, Michael. 1994. *Phonology in generative grammar*. Blackwell.
- Kenstowicz, Michael. 1995. Base-identity and uniform exponence: Alternatives to cyclicity. In J. Durand and B. Laks, eds., *Current Trends in Phonology: Models and Methods*. CNRS, Paris -X and University of Salford Publications.
- Lamontagne, Greg and Keren Rice. 1995. A correspondence account of coalescence. In Beckman, Jill N., Laura Walsh Dickey, and Suzanne Urbanczyk, eds. *UMOP: Papers in Optimality Theory* 18, pp. 211-223.
- Lombardi, Linda. 1995. Why place and voice are different: constraint interactions and featural faithfulness in Optimality Theory. Ms., University of Maryland, College Park.
- McCarthy, John. 1995. Extensions of faithfulness: Rotuman revisited. Ms., University of Massachusetts, Amherst.
- McCarthy, John and Alan Prince. 1994. Prosodic morphology: an overview. Talks presented at the OTS/HIL Workshop on Prosodic Morphology, University of Utrecht.
- McCarthy, John and Alan Prince. 1995. Faithfulness and reduplicative identity. In Beckman, Jill N., Laura Walsh Dickey, and Suzanne Urbanczyk, eds. *UMOP: Papers in Optimality Theory* 18, pp. 249-384.

- Merchant, Jason. 1995. Deriving cyclic syllabification effects: fricative assimilation and final devoicing in German. Ms., University of California, Santa Cruz.
- Prince, Alan and Paul Smolensky. 1993. Optimality Theory: constraint interaction in generative grammar. Ms., Rutgers University and University of Colorado at Boulder.
- Ringen, Catherine E. and Robert M. Vago. 1997. Hungarian vowel harmony in optimality theory. Ms., University of Iowa and Queens College and the Graduate Center, CUNY.
- Stallcup, Kenneth L. 1980a. A brief account of nominal prefixes and vowel harmony in Esimbi. In Luc Bouquiaux, ed., *L'expansion bantoue*. Vol. 2. Paris: Société d'Etudes Linguistiques et Anthropologiques de France, 435-441.
- Stallcup, Kenneth L. 1980b. Noun classes in Esimbi. In Larry Hyman, ed., *Noun classes in the Grassfields Bantu borderland*. *SCOPIL* 8, 139-153.
- Steriade, Donca. 1995. Positional neutralization. Ms., UCLA.
- Walker, Rachel. 1996. Prominence driven stress. Ms., University of California, Santa Cruz. [Available on the Rutgers Optimality Archive, ROA-171-0197.]
- Walker, Rachel. 1997. Round harmony and featural tautosyllabicity. To appear in the proceedings of the Canadian Linguistics Association, Calgary Working Papers in Linguistics.
- Zoll, Cheryl. 1996a. *Parsing below the segment in a constraint-based framework*. Doctoral dissertation, University of California, Berkeley.
- Zoll, Cheryl. 1996b. Coincidence, licensing and suprasegmentals: license-driven tone mapping. Talk presented at the University of Massachusetts, Amherst.