P-Bearing Units: A Study of Kinande Vowel Harmony

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P-BEARING UNITS: A STUDY OF KINANDE VOWEL HARMONY*

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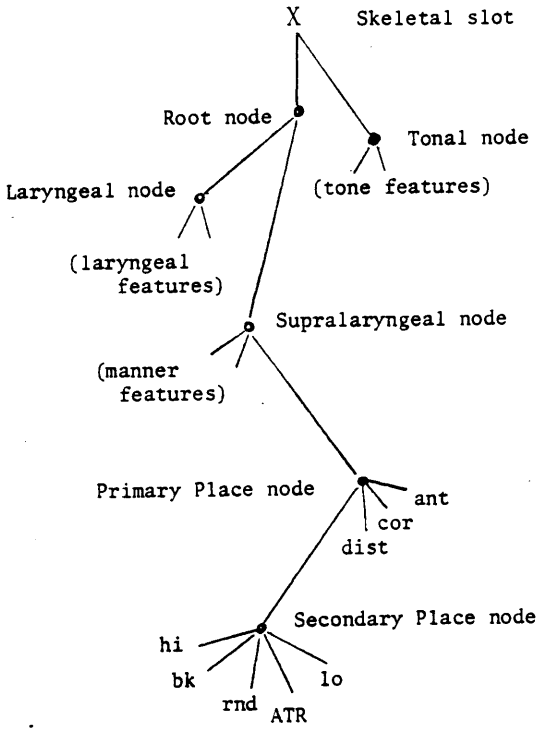
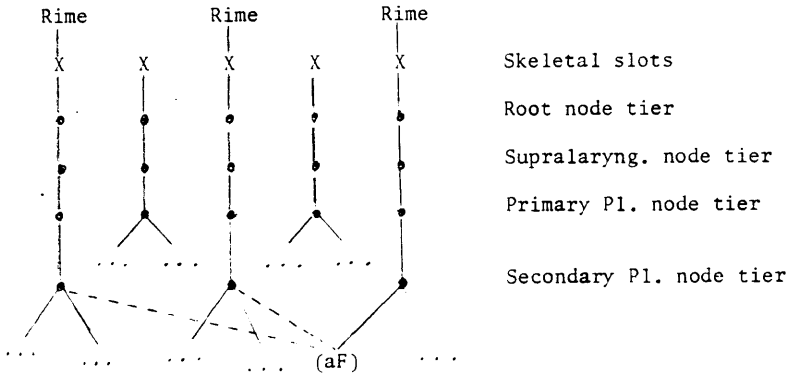
In this study, I am assuming a theory of phonological representation which recognizes a universally prescribed hierarchical node structure. The model of the segment that I am adopting, shown at right, is basically that which is presented in Archangeli and Pulleyblank (1986), which is an extended and revised version of the model presented in Clements (1985).



The features radiating from the Secondary Place node are familiar to us as the features characteristic of vowels. In many languages, their values are entirely redundant for consonants. If consonantal segments lack a Secondary Place node, due to underspecification, then vowel harmony processes can be described as the spreading of some Secondary Place feature, [aF], along the

Secondary Place node tier as in (1):

(1)



In (1), I have omitted representation of the Tonal node tier and the Laryngeal node tier for ease of exposition. Notice that the leftward spreading of aF in (1) does not give rise to any illicit crossing of association lines if we imagine that the features radiating from any given node are in three-dimensional space. Notice also that the Secondary Place node reports to a Primary Place node, that a Primary Place node reports to a Supralaryngeal node, etc., such that the feature specification of a Secondary Place node entails the presence of a Primary Place node, a Supralaryngeal node, and a Root node on its path to a skeletal slot, even though such supporting nodes may be unspecified for features. On the other hand, the feature specification of a Primary Place node does not entail the presence of a Secondary Place node. This is the essence of the hierarchical dominance relations expressed in the present model.

Now let us explore the notion of P-Bearing Unit (PBU) with respect to the feature [F]. In one sense, the Secondary Place node can be seen as the PBU for [F], as [aF] docks directly into that node. In another sense, however, a skeletal slot designated as syllabic rime (in another terminology, a skeletal V slot) can also be seen as the PBU for [F], since [aF] is a characteristic vowel feature. We may therefore follow Archangeli and Pulleyblank's (this volume) suggested minimal and maximal rule target distiction and identify for F both a minimal PBU--a Secondary Place node,--and a maximal PBU--a rime-designated skeletal slot. As Archangeli and Pulleyblank have pointed out, both concepts prove useful when it comes to defining the 'target' of vowel harmony rules spreading [aF].

Consider the hypothetical system shown in (2), consisting of five basic vowels, /i/, /e/, /a/, /o/, and /u/, of which /a/ is the completely unspecified vowel, along with a floating [+ATR] feature which is a property of morphemes, and suppose there to be an iterative right-to-left spreading rule which is responsible for the

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initial association of [+ATR] to the rightmost [+hi] vowel of its host morpheme as well as for its subsequent leftward spreading to other vowels just as long as they are also [+hi]:

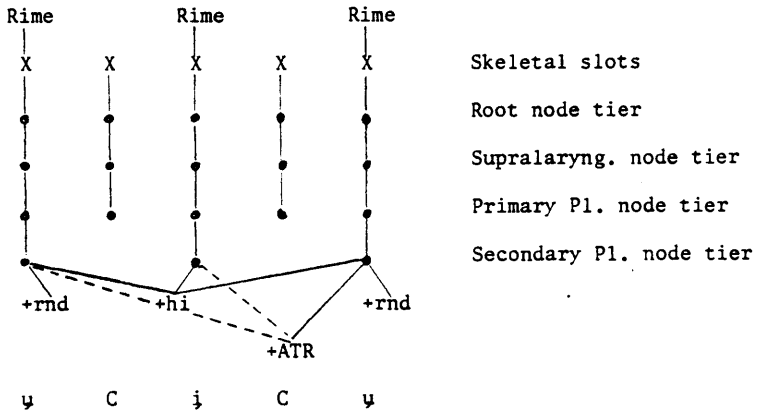
(2)

	i	e	a	o	u
high	+				+
round				+	+
low		-			

(Secondary Pl. node)

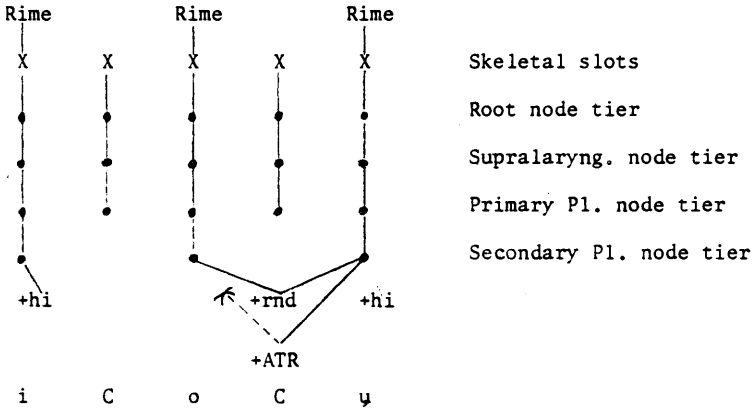
Iterative application of this spreading rule is shown in (3):

(3)



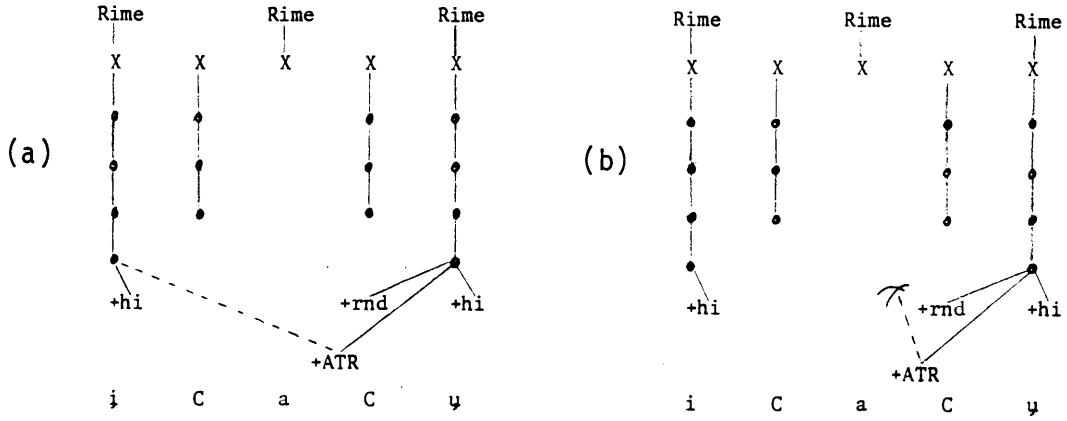
In (4), we see the blocking effect of a mid vowel. The absence of a [+hi] specification on the mid vowel in (4) disqualifies it from being spread to by [+ATR]:

(4)



Now, if consonants lack a Secondary Place node due to the fact that features such as [hi], [lo], [bk], etc. may be entirely predictable and assigned by redundancy rules, then the vowel /a/ in our hypothetical system, whose features are likewise redundant, should also be expected to lack a Secondary Place node. In fact, since /a/ is not underlyingly specified for any features, it should have no node structure at all. In (5) are illustrated two possibilities of what may happen when the vowel /a/ intervenes between two high vowels:

(5)



In (5a), /a/ exhibits the behavior of a 'neutral' vowel. This is what results if minimal PBUs, that is, Secondary Place nodes, are defined as targets by our [+ATR] spreading rule. The Secondary Place node tier is scanned for adjacent potential [+ATR] anchors. Since the first PBU encountered in leftward scansion is the Secondary Place node of the vowel /i/, and since its [+hi] specification qualifies it as an eligible [+ATR] landing site according to the structural description of our rule, [+ATR] will spread to it.

In (5b), /a/ exhibits the behavior of an 'opaque' vowel. This is what results if maximal PBUs, that is, rime-designated skeletal slots, or V slots, are defined as targets by our [+ATR] spreading rule. Here, the skeleton is scanned for potential [+ATR] anchors. Since the first PBU encountered during leftward scansion of the skeleton is the skeletal slot of the vowel /a/, and since the absence of a [+hi] specification on /a/ disqualifies it as an eligible [+ATR] landing site under the terms of our rule's structural description, [+ATR] harmony is blocked.

The hypothetical system just described is similar in significant respects to the vowel phonology of Kinande, an intralacustrine Bantu language spoken in eastern Zaire. At surface structure, Kinande contains the nine vowels shown in (6a). In underlying representations, we find only five vowel phonemes, plus a floating [+ATR] feature. A [+ATR] specification, when present, can

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be considered a property of the Kinande morpheme as a whole, since its initial association to the rightmost [+hi] vowel and its subsequent rule-governed leftward spreading are entirely predictable. The five underlying vowel phonemes of Kinande are given in (6b), where they are stripped of all redundant feature specifications:1

(6)

(a) Kinande surface vowel inventory

-ATR vowels		+ATR vowels	
i	u	ɨ	ʉ
e	o	ɛ	ɔ
a			

(b) underlying Kinande vowel phonemes

	i	e	a	o	u
high	+				+
round				+	+
low		-			

Within words, [+ATR] spreads leftward to high and mid vowels. For example, the verb suffix ɨre, shown in (7), is lexically specified as a [+ATR] morpheme. The verb roots imb 'sing' and solom 'harvest' are not lexically specified for [+ATR], nor are any of the verbal prefixes. As can be seen in (7a-c), [+ATR] spreads leftward within the fully concatenated verb to both high and mid vowels, but for reasons which will become apparent later, does not affect the vowels of the prefixal morphemes which are added on the final lexical stratum:

(7)

(a) mo-tu-a-imb-ɨre ⇒ motwɨmbɨre
'we sang'

(b) mo-tu-a-solom-ɨre ⇒ motwasɔlɔmɨre
'we harvested'

(c) mo-tu-a-solom-an-ɨre ⇒ motwasɔlɔmanɨre
'we harvested each other'

roots:
/-imb-/ 'sing'
/-solom-/ 'harvest'
prefixes:
/mo-/ past tense
/tu-/ 1pl Subject
/a-/ past tense
suffixes:
/-an/ reciprocal
/-ire(+ATR)/ past tense

That the vowel /a/ is neutral to harmony in (7c) suggests that the rule responsible for leftward [+ATR] spread targets minimal PBUs. That is to say, the Secondary Place node tier is scanned for potential [+ATR] anchors, and as /a/ contains no Secondary Place node, it is, in effect, invisible. Since other vowels undergo harmony regardless of what their features are, we assume that the structural description of this rule imposes no particular eligibility conditions on target PBUs. In (8) are outlined the characteristics of this [+ATR] spreading rule:

(8)

ATR Spread I

right-to-left, iterative

scans Secondary Pl. node tier (targets minimal PBUs)

affects high and mid vowels alike

Kinande [+ATR] harmony does not typically cross word boundaries. In other words, the rule or rules responsible for leftward [+ATR] spreading belong to the lexical component of the grammar, where their final application occurs at the X^0 level. The only place where we find [+ATR] harmony crossing word boundaries is in noun-adjective concatenations. It thus appears that when nouns and adjectives are combined, they are resubmitted to the word-level lexical stratum as compounds.[2] In figure (9) we see [+ATR] harmony affecting noun-adjective compounds:

(9)

(a) +ATR

ẹ-ki-tiri ki-kuhi

'short basket'

(b) +ATR

ẹ-ŋ-gẹtsi ŋ-guhi

'short lake'

(c) +ATR

ọ-mu-tahi mu-kuhi

'short branch'

noun stems:

/-tiri/ 'basket

/-ketsi/ 'lake'

/-tahi/ 'branch'

prefixes:

/ki-/ cl 7

/N-/ cl 9

/mu-/ cl 3

adjective stem:

/-kuhi (+ATR)/ 'short'

Note that in isolation, the vowels of the nouns ekitiri, engetsi, and omutahi would all surface as [-ATR] because their stems are not lexically specified for a [+ATR] feature.

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What makes Kinande vowel harmony especially interesting is the peculiar behavior of [+ATR] harmony within the noun-adjective compound. Observe that in the examples in (10), [+ATR] does <u>not</u> spread from the adjective into the noun:

(10)

(a) +ATR
e-hi-buno hi-kuhi
'short bottoms'

(b) +ATR
o-ku-boko ku-kuhi
'short arm'

(c) +ATR
e-mi-sohe mi-kuhi
'short shawls'

noun stems:
/-buno/ 'bottom'
/-boko/ 'arm'
/-sohe/ 'shawl'
prefixes:
/hi-/ cl 19
/ku-/ cl 15
/mi-/ cl 4
adjective stem:
/-kuhi (+ATR)/ 'short'

[+ATR] harmony is also blocked in the examples shown in (11):

(11)

(a) +ATR
o-mu-kira mu-kuhi
'short tail'

(b) +ATR
a-ka-huka ka-kuhi
'short maggot'

(c) +ATR
a-ka-bundu ka-kuhi
'short cat'

noun stems:
/-kira/ 'tail'
/-huka/ 'maggot'
/-bundu/ 'cat'
prefixes:
/mu-/ cl 3
/ka-/ cl 12
adjective stem:
/-kuhi (+ATR)/ 'short'

The examples in (10) demonstrate that [+ATR] cannot spread across a compound boundary to a mid vowel, and the examples in (11) show the vowel /a/ behaving as 'opaque' in just this context. Therefore, in addition to ATR Spread I, we find evidence of a distinct [+ATR] spreading rule applying in the X^0 level lexical stratum. In (12) I outline the characteristics of ATR Spread II. I also include the

previously outlined description of ATR Spread I for comparison:

(12)

ATR Spread II

right-to-left

scans skeleton (targets maximal PBUs)

spreads to (+hi) vowels only

ATR Spread I

right-to-left, iterative

scans Secondary Pl. node tier (targets minimal PBUs)

affects high and mid vowels alike

The opaque behavior of the vowel /a/ in the examples in (11) demonstrates that ATR Spread II scans the skeleton rather than the Secondary Place node tier. The failure of ATR Spread II to spread [+ATR] to mid vowels in (10) suggests that the structural description of this rule requires that the target PBU be specified for [+hi].

While ATR Spread II applies freely across a compound boundary, provided its structural description is met, ATR Spread I clearly cannot bridge a compound boundary. Were ATR Spread I able to bridge a compound boundary, it would have the effect of harmonizing the nouns in (10) and (11). But turning back to (9) we find, surprisingly, that once the rule of ATR Spread II has succeeded in carrying an [+ATR] feature across a compound boundary, ATR Spread I can once again take over and spread [+ATR] leftward to mid vowels, as in (9b), and over a 'neutral' /a/, as in (9c). What we see from (9) is that in the final rule cycle (i.e. the rules of the X^0 level lexical stratum) ATR Spread II feeds ATR Spread I. [3]

The puzzle that remains to explain is this: if both rules spreading [+ATR] are available in the final lexical stratum, how come ATR Spread I does not apply to cause harmonization of the nouns in (10) and (11) or harmonization of the final stratum prefixes of the verbs in (7)?

I believe the answer to this puzzle can be discovered if we consider the phonological geometry of morpheme concatenation and the concept of Bracket Erasure as Tier Conflation.

Let us first examine the derivation of the adjectives built on the stem /kuhi [+ATR]/, meaning 'short':

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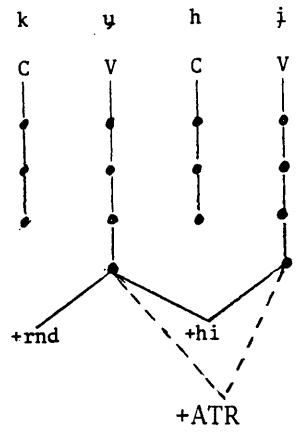
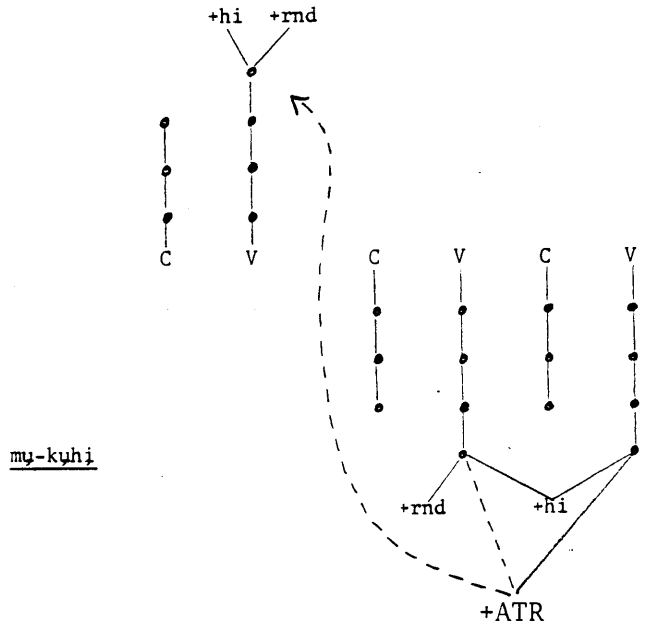
(13)



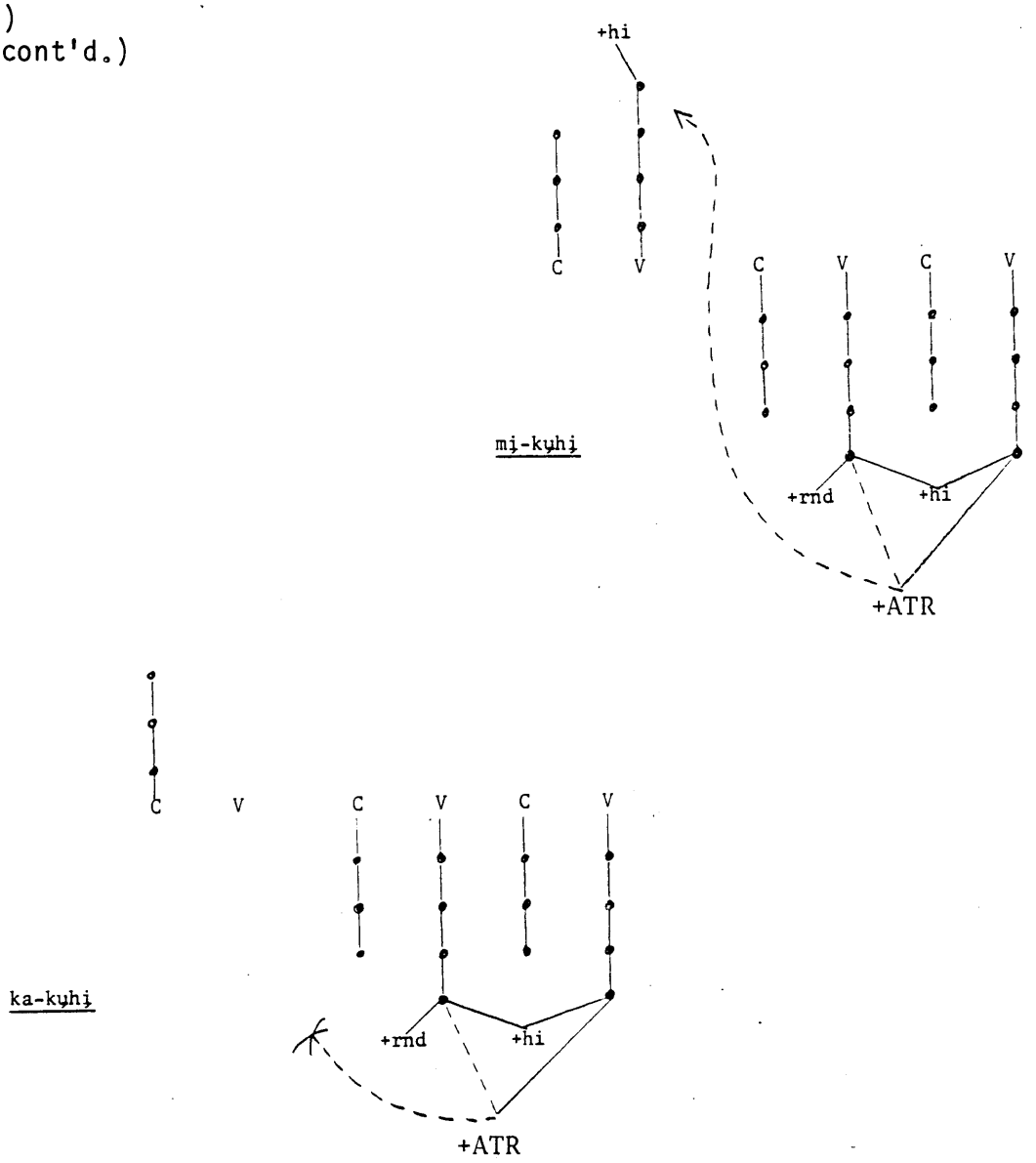
In the X^{-1} level lexical stratum, application of ATR Spread II links the floating [+ATR] feature to the rightmost [+hi] vowel of its host morpheme--the vowel /i/. Application of ATR Spread I then spreads the [+ATR] feature leftward to the vowel /u/.[4]

In the X^{0} level lexical stratum, the noun-class agreement prefixes are adjoined to the adjective stem. As McCarthy (1986) has argued, the difference in behavior between heteromorphemic geminates and tautomorphemic geminates with respect to inalterability, geminate integrity, and antigemination leads us to conclude that the autosegmental tiers of concatenatively adjoined morphemes enter a phonological representation in misalignment:

(14)



(14)
(cont'd.)



The dotted lines show the application of ATR Spread II within this stratum spreading [+ATR] to the [+hi] vowels of the class 3 and class 4 noun-class agreement prefixes. ATR Spread II succeeds in spreading [+ATR] across the morpheme juncture because it targets maximal PBUs--skeletal V slots. Since morphemes are conjoined at the skeleton, resulting in heteromorphemic skeletal alignment, the V slot of the prefixal morpheme is visible during leftward scansion of the skeleton.

In (15) we see the results of Tier Conflation, which operates so as to align the node structure of these adjective forms upon their exit from the lexicon and to merge features in accordance with the OCP:

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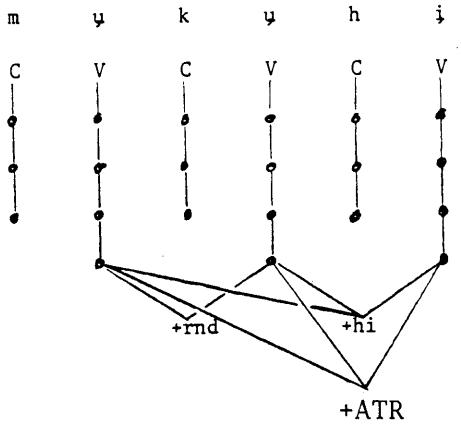
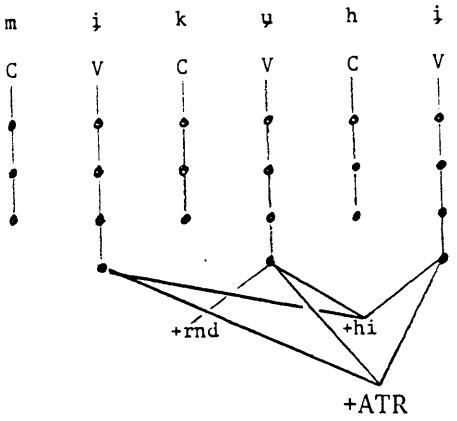
(15)



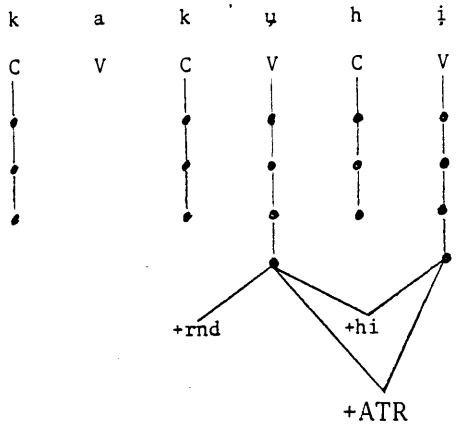
mụkụhị

'short (cl 3)'



mịkụhị

'short (cl 4)'



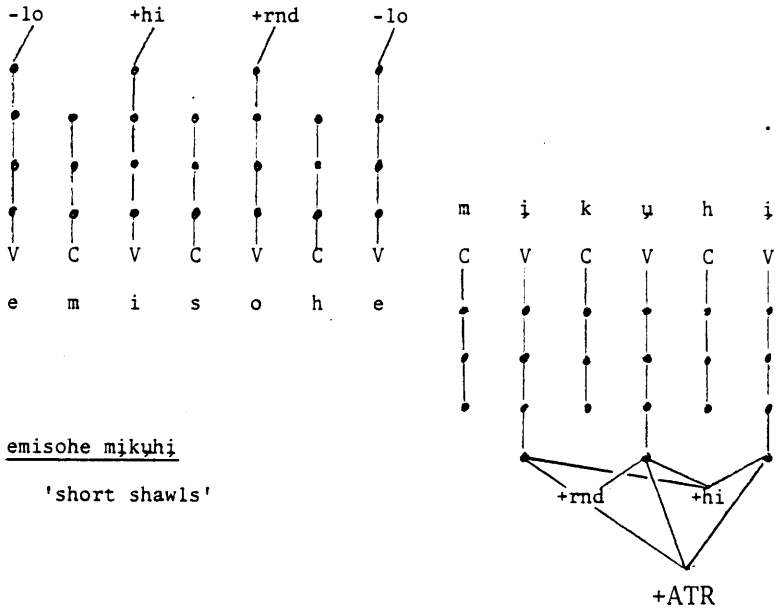
kakụhị

'short (cl 12)'

Adjectives built upon the stem /kuhi [+ATR]/ thus all emerge from the lexicon fully harmonized for [+ATR]. On the other hand, the nouns cited in (9) through (11) emerge from the lexicon devoid of any [+ATR] specification, since none of the noun stems on which these words are built carries a floating [+ATR] feature in its underlying representation.

For our first example of what happens when noun-adjective combinations are looped back into the X^0 level lexical stratum as compounds, we combine the class 4 noun emisohe 'shawls' with the class 4 agreeing adjective mɨkʉhɨ 'short' (cf. (10c)). The phonological rules of the X^0 level stratum encounter a form whose geometrical representation resembles what I have drawn in (16):

(16)



emisohe mɨkʉhɨ

'short shawls'

ATR Spread II targets maximal PBUs, and fails to apply to this form since the first maximal ATR-Bearing Unit encountered in leftward scansion is the V slot of the mid vowel /e/ (the final vowel of emisohe) which does not carry the necessary [+hi] specification required by the rule's structural description. The next spreading rule, ATR Spread I, targets minimal ATR-Bearing Units, and therefore scans the Secondary Place node tier, rather than the skeleton, for potential [+ATR] anchors. Even though ATR Spread I does not require that targets be specified for a [+hi] feature, it nevertheless fails to spread [+ATR] from the adjective into the noun, due to the misalignment of heteromorphemic node tiers. The Secondary Place node tier of the noun is not encountered during leftward scansion from the Secondary Place node tier of the adjective.

For our second example, we run through the final stage of derivation of the compound omukira mʉkʉhɨ 'short tail' (cf. (11a)). When this noun-adjective combination is resubmitted to the X^0 level lexical stratum as a compound, its geometrical representation resembles what I have drawn in (17):

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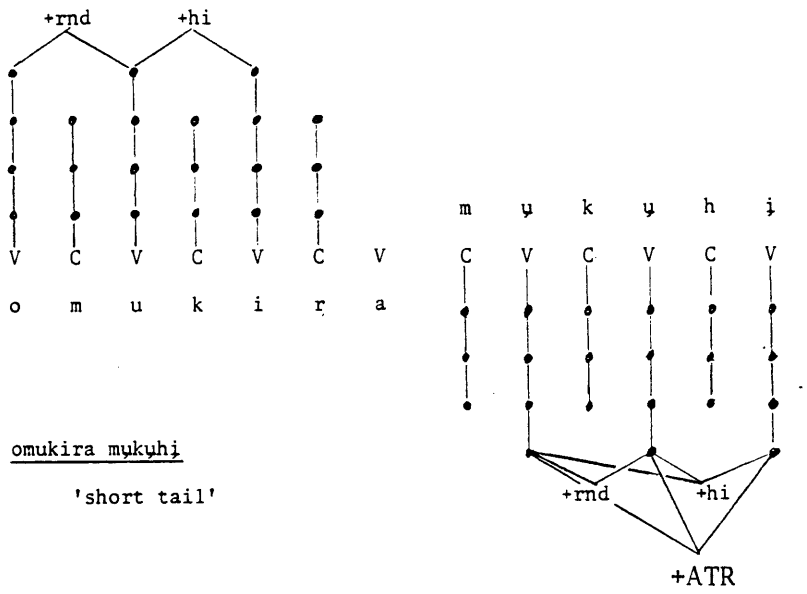
(17)

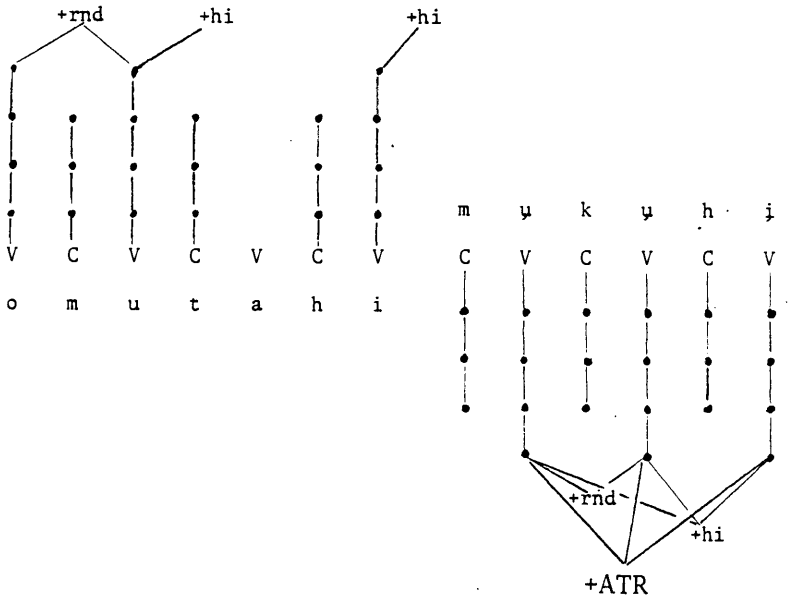


In (17), the targeted PBU for the rule of ATR Spread II is the V slot of the vowel /a/, which is not an eligible landing site for [+ATR] as it does not carry the [+hi] specification demanded by the structural description of this rule. ATR Spread II is thus blocked by an 'opaque' /a/. ATR Spread I cannot apply either, due to the misalignment of heteromorphemic node tiers. The noun remains unharmonized.

The examples which make this whole exercise worthwhile are the compounds that do undergo full harmonization. These are the compounds whose surface structure realizations are described in (9). Let us run through the final stages of derivation of omụtahị mụkụhị 'short branch' (cf. (9c)).

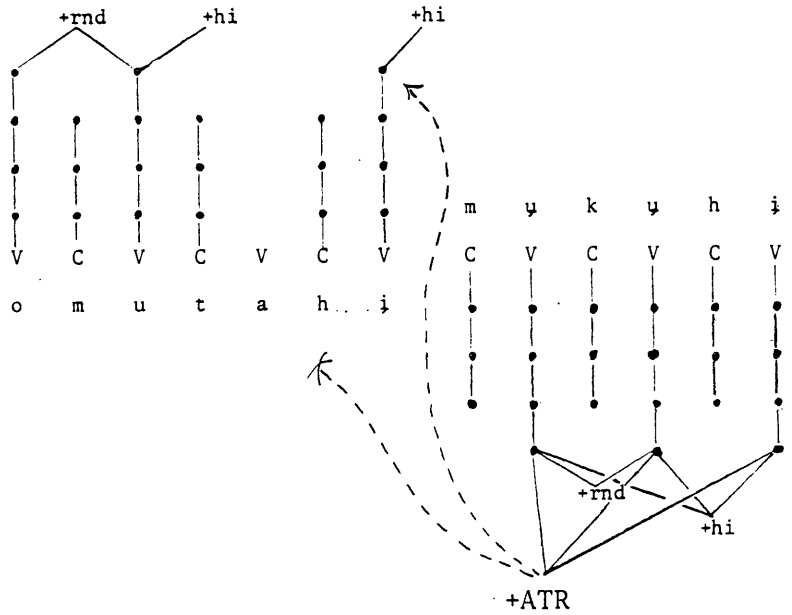
When the noun and the adjective are resubmitted to the X^0 level lexical stratum as a compound, the phonological rules of this stratum encounter a form whose geometrical representation resembles what I have drawn in (18):

(18)



The earliest spreading rule to apply is ATR Spread II. ATR Spread II scans the skeleton for an adjacent V slot which is specified for a [+hi] feature. The first V slot that it comes upon is the V slot of the high vowel /i/ of omutahi. Spreading is thus activated and [+ATR] bridges the boundary between the two halves of the compound, linking to the Secondary Place node of the [+hi] vowel, as shown in (19):

(19)



If ATR Spread II is iterative, then it continues its leftward

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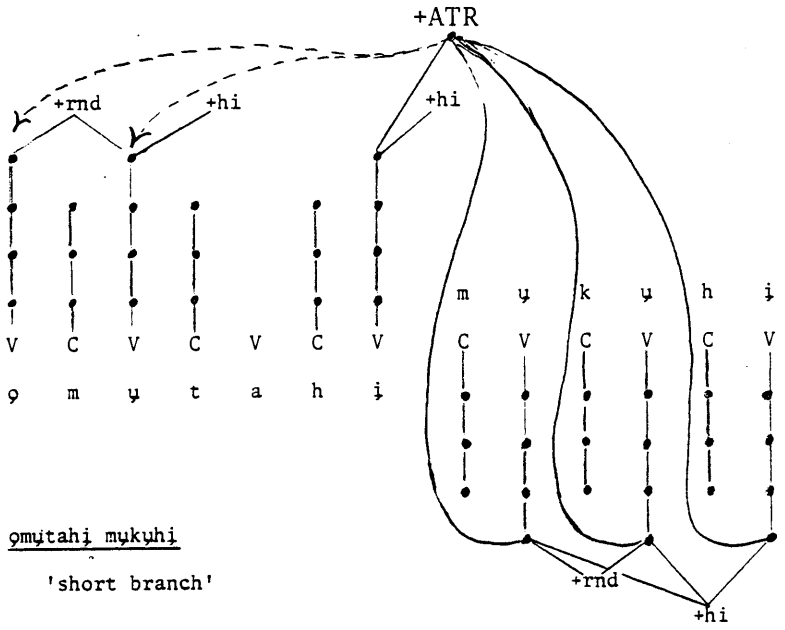
scansion of the skeleton for another adjacent syllable rime specified for [+hi]. However, the next adjacent V slot is that of the vowel /a/, which does not carry a [+hi] feature specification, so further spreading of [+ATR] by ATR Spread II is stopped.

The next spreading rule to kick in is ATR Spread I. ATR Spread I targets minimal ATR-Bearing Units, and so scans leftward not along the skeleton, but along the Secondary Place node tier. Notice now the effect of the previous rule's success in having linked [+ATR] to the rightmost vowel of the noun member of the compound. The association of [+ATR] to the Secondary Place node of the rightmost vowel of the noun means that [+ATR] now belongs to the noun's own Secondary Place node tier. Therefore, when ATR Spread I is given a chance to apply, its leftward scansion is not thwarted by the misalignment of node tiers.[5] In (20) we see the rule of ATR Spread I accomplishing an uninterrupted leftward spreading of [+ATR] to all Secondary Place nodes in its purview:

(20)



Within this final phonological rule cycle, the successful application of ATR Spread II has, in a very non-trivial manner, fed the subsequently ordered rule of ATR Spread I.

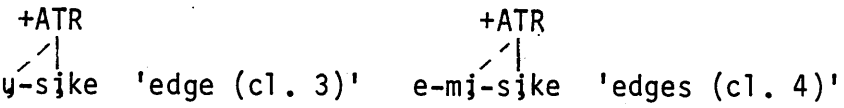
FOOTNOTES

*I wish to thank José Hualde, Larry Hyman, Doug Pulleyblank, and Pat Schneider for very useful discussion on the contents of this paper, and to express my appreciation to Mutaka Ngessimo, a linguist and native speaker of Kinande, without whose patient and generous assistance this study would not have been possible.

[1]Ngessimo (1986) argues that vowel coalescence phenomena provide evidence that Kinande /a/ is maximally underspecified.

[2]Pat Schneider (p.c.) comments that the linear adjacency of Kinande nouns and adjectives can never be interrupted by other constituents within the NP, contrary to what the basic word order tendencies of this language would lead us to expect were the noun-adjective combination not an N^0 compound.

[3]In fact I would suggest that the relative ordering ATR Spread II, ATR Spread I holds in the X^{-1} level lexical stratum also. This would account for the initial association of a floating [+ATR] feature to the rightmost [+hi] vowel of its host morpheme and never to a righthand mid vowel. A typical example of this is the noun root sike 'border, edge', which carries a floating [+ATR] specification in its underlying representation. This [+ATR] feature does not link to the mid vowel /e/ on the righthand edge of its morpheme host. Instead it links to the [+hi] vowel /i/, and from there spreads leftward into the noun-class prefix:



[4]If ATR Spread II is an iterative rule, then it will have spread [+ATR] to the vowel /u/ and ATR Spread I will apply vacuously. I have been unable to determine whether or not ATR Spread II is iterative.

[5]This phenomenon is more accurately portrayed as the pre-Tier Conflation alignment of the node tiers of the noun to the node tiers of the adjective. That is to say, the assimilation of a phonological feature across a morpheme boundary forces heteromorphemic tier alignment (as in Schlindwein (1986)).

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