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The Feature Pharyngeal in Rwaiili Arabic:
A Case for Long Distance Multiple Linking*

0. Introduction.

Rwaiili is a Bedouin dialect of Arabic spoken in Northern Saudi Arabia (Prochazka 1988) similar to those described by Al-Mozainy (1981) and Irsheid (1984). This dialect has a rule of Raising which raises the first of a sequence of two *a*'s provided it is in an open syllable. This accounts for underlying /katab/ surfacing as [kita**b**] 'he wrote.' But this rule has a number of exceptions which may be divided into two groups, those like [gaʕad] 'he sat' and [ħafar] 'he dug' in which the target vowel precedes or follows a guttural consonant, and those similar to [nzalan] 'she got down' where the following consonant is a coronal sonorant.

In this paper I will demonstrate that these forms are not exceptions, but are not predicted to undergo the dissimilatory process of Raising in accordance with the Linking Constraint as proposed by Hayes (1986). This analysis is dependent upon the specification of the vowel *a* as well as the group of consonants known as "gutturals" (McCarthy 1991) for the feature [pharyngeal]. In the [gaʕad] group of 'exceptions,' this feature is multiply linked by a language specific rule to both the potential target vowel and the neighboring guttural. For the [nzalan] group, the two vowels are multiply linked to each other. This analysis depends crucially upon the proposal of coronal transparency discussed by Paradis and Prunet (1989, and elsewhere). I will show, however, that in Rwaiili not all coronal consonants show transparency, only the sonorants are afforded this special status.

The organization of the paper is as follows: in §1 the phonology and morphology are described with particular attention paid to the processes accounting for vowel alternations. Discussion of the forms not undergoing Raising is provided in §2 as well as an outline of the Linking Constraint and coronal transparency. In §3 Paradis and Prunet's proposal of coronal transparency is reevaluated and some modifications suggested. Semitic root cooccurrence restrictions are outlined in §4 with discussion of their apparent incompatibility to coronal transparency.

1. Phonology of Rwaiili Arabic.

The phonemic inventory of Rwaiili contains six guttural consonants *x*, *g*, *ħ*, *ʕ*, *h*, and *ʔ*, three emphatics *t*, *ʕ*, and *ʕ*, as well as more common segments listed in (1) below. The

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only consonants which are both sonorant and coronal are *n*, *r*, and *l*. Rwaii also has the vowels *a*, *i*, and *u* and the glides *y* and *w*.

1. Consonants of Rwaii Arabic.

	labial	incidental	dental	alveolar	velar	uvular	pharyngeal	laryngeal
stops	b		t t	d	k g			ʔ
fricatives	f v	ð ð	s s	z		x ǧ	ħ ʕ	h
nasals	m		n					
liquids			l	r				

1.1 The Morphology of Rwaii.

The morphology of Rwaii is comprised of both affixes and nonconcatenative vowel alternations. Verbs consist of a consonantal root, a vocalic melody, and an optional affix depending on the binyan and the grammatical person. The third person masculine singular (3ms) form of ‘to write’ in the Active Perfective tense is [kitab] from the consonantal root of *ktb*, an underlying vocalism of /a/¹, and no affixes. The 3fs form of the same verb is [ktibat] from the same consonantal root and vocalism and the suffix *-at*. The deletion of the vowels as well as their alternation in quality are predictable by rules which will be discussed below.

2. Active Perfective of *ktb* ‘to write’

	singular	plural
3m	kitab	ktibam
3f	ktibat	ktiban
2m	kitabt	kitabtam
2f	kitabtay	kitabtan
1	kitabt	kitabna

From the forms in (2) the endings in (3) can be discerned. Those suffixes which are vowel initial pattern together and are called vocalic endings while those which are consonant initial or null, as the 3ms, are called consonantal endings. This distinction becomes important to rules which are sensitive to syllable structure as the vocalic endings will cause the stem final syllable to be ‘open’ while the consonantal endings will not affect the syllabification of the stem.

¹An underlying vocalism of /a/ will appear on the surface as a *C a* in accordance to McCarthy’s (1981) analysis of Classical Arabic.

3. Endings for the Active Perfective.

	singular	plural
3m	-∅	-am
3f	-at	-an
2m	-t	-tam
2f	-tay	-tan
1	-t	-na

There is some variation in these endings, most of which is phonological. For example, the final consonant in the 3mp suffix varies with *w* so that *ktūbam* alternates with *ktūbaw*. However, these variations are not within the scope of this paper. Within the active perfective, there is variation in the vocalism which is of interest. All verbs fall into one of two categories with respect to the active perfective, those which take *a a* as their underlying vocalic melody, and those which take *a i*. This distinction has traditionally been denoted with the terms *faʕala* and *faʕila*, respectively. The verb ‘to write,’ *ktb* is of the *faʕala* class while *smʕ*, ‘to hear,’ is a *faʕila* verb as illustrated in (4).

4.	faʕala ‘to write’	faʕila ‘to hear’
3ms	kitab	simiʕ
3fs	ktibat	samiʕat
3mp	ktibam	samiʕam
3fp	ktiban	samiʕan
2ms	kitabt	simiʕt
2fs	kitabtay	simiʕtay
2mp	kitabtam	simiʕtam
2fp	kitabtan	simiʕtan
1s	kitabt	simiʕt
1p	kitabna	simiʕna

1.2. *i* Deletion.

The *faʕala* vs *faʕila* distinction is most important for the process of *i* Deletion which is sensitive to syllable structure and vocalic quality. This process is motivated by the *i ~ ∅* alternation seen in (4) and will be discussed later. The *faʕala* vs *faʕila* distinction does not exist in the passive as shown in (5) below.

5. The Passive Perfective.

<i>ħ m l</i> ‘to carry’	<i>ʕ r b</i> ‘to tie’	<i>ʕ z m</i> ‘to invite’	<i>l b s</i> ‘to wear’
ħmil	ʕrib	ʕzim	lbs
ħmlat	ʕribat	ʕzimat	lbsat
ħmlaw	ʕribaw		
ħmlan	ʕriban	ʕzman	lbsan

The forms in (5) of the passive show no alternation in vowel quality; where the stem vowel surfaces, it is always *i*. It can be assumed, then, that the underlying vocalism is */i/*. The distinction between forms like [ħmil] in which the first stem vowel is deleted and those

like [ħim1at] where it is the second stem vowel that deletes, is that the former has a consonantal ending added where the latter has a vocalic ending added. This suggests that deletion is sensitive to syllable structure such that the vowel is lost in an open syllable.

It is not true that all vowels are lost in an open syllable as evidenced by the forms [kitab] and [simiʃ], in the active perfective. This can be explained if deletion is limited to the underlying vowel *i* since in both [ħmil] and [ħim1at] the deleted vowel is *i* underlyingly. If the deletion is restricted to the vowel *i*, then the initial vowel in [kitab] and [simiʃ] must be *a* underlyingly. This process, which will be called *i* Deletion, deletes the vowel *i* when it appears in an open syllable. This process applies from right to left since it is the rightmost *i* in an open syllable which is lost where two *i*'s appear in open syllables in the same word. This is shown in the derivation of the passive /ħim1at/ --> [ħim1at]. Similar alternations are seen in (6).

6. *i* Deletion and the Passive Perfective.

stem	3ms -ø	2ms -t	3fs -at	gloss
/ħimil-/	ħmil	ħmilt	ħim1at	'was carried'
/ħizim-/	ħzim	ħzimt	ħizmat	'was tied'
/ʃirib-/	ʃrib	ʃribt	ʃirbat	'was drunk'
/ʕizim-/	ʕzim	ʕzimt	ʕizmat	'was invited'
/ħifir-/	ħfir		ħifrat	'was dug'
/xizim-/	xzin		xiznat	'was stored'
/libis-/	libis		libsat	'was worn'

Since the second stem vowel is lost in active forms like [samʃat] and [samʃan] in (4 & 7) where a vocalic ending is added to the stem *smʃ*, it must be *i* in the underlying representation. This is supported by the fact that where the second stem vowel does surface for this verb, it is *i*. The first stem vowel alternates from *a* to *i*, but is never deleted. This indicates that the vowel cannot be *i* underlyingly since this vowel would be lost in open syllables as in [simiʃ]. Instead, the first stem vowel must be an *a* underlyingly, and the alternation of *a* to *i* is accounted for by another process which will be discussed below.

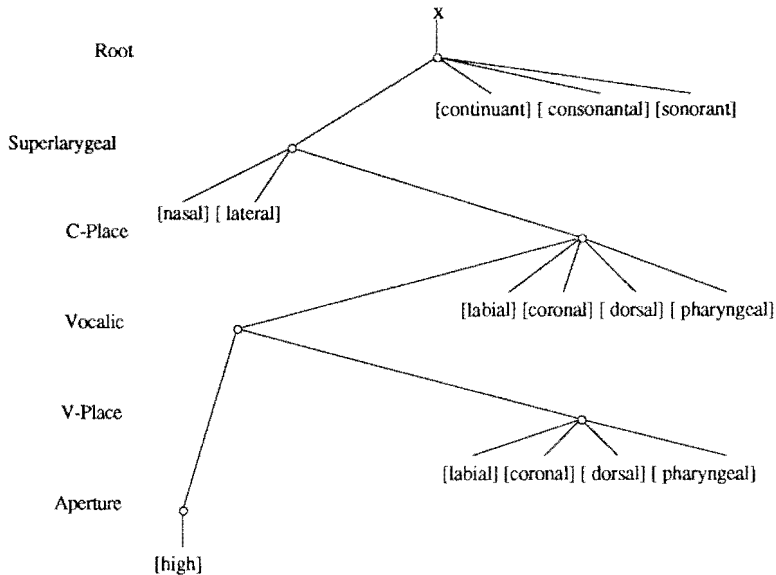
7. The Active Perfective of *faʕila* Verbs.

stem	3ms -ø	2ms -t	3fs -at	gloss
/samiʃ-/	simiʃ	simiʃt	samʃat	'heard'
/ʃarib-/	ʃirib	ʃiribt	ʃarbat	'drank'
/labis-/	libis	libist	labsat	'wore'
/zaʕil-/	ziʕil	ziʕilt	zaʕ1at	'became upset'
/gadir-/	gidir	gidirt		'was able to'
/cabir-/	cibir		cabrat	'became big'

For each form in (7), the first stem vowel is not lost because it is not /i/ underlyingly. In those cases where a vocalic ending is added to the root, the second stem syllable is opened. Since the second stem vowel is /i/, it is deleted in these instances. Otherwise, the second stem syllable remains closed so that deletion does not occur.

I assume a model of feature organization similar to that developed in the work of Clements (1989, 1991), Herzallah (1990), and Hume (1992). Within this framework, vowels are exclusively characterized by the Vocalic node. This node dominates both V-Place and Aperture which designate the place of articulation and height of the vowel, respectively. Here, [high] corresponds to [-open] in the Clements framework.

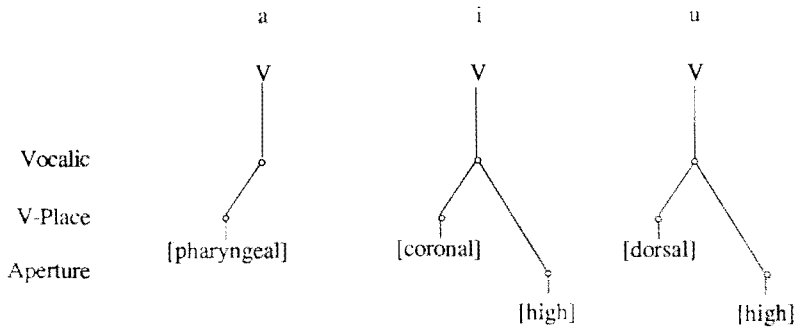
8. Universal Feature Geometry



The vowels *a*, *i*, and *u* are represented in (9) where the vowel *a* is characterized by the feature [pharyngeal] beneath the V-Place node and is not specified by the feature [high]. The remaining vowels are both characterized by [high] beneath the Aperture node, and are distinguished by their place of articulation under V-Place.

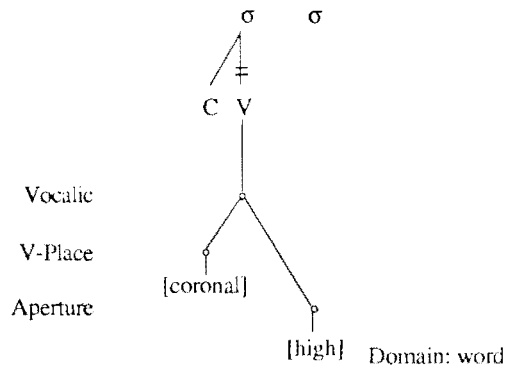
There are language specific redundancy rules which ensure that all dorsal vowels also have a labial (i.e. round) articulation, and that all pharyngeal vowels have a secondary coronal articulation so that they are actually pronounced [æ]. These secondary articulations do not play a role in the phonology, and are beyond the scope of this paper.

9.



i Deletion is formalized in (10). When a vowel characterized by the features [coronal] under the V-Place node and [high] under the aperture node occurs in an open syllable, the structure is delinked from its syllable node. This results in the loss of the vowel. This rule is sensitive to the absence of any following consonant linked to the same syllable node as the target vowel. Such a consonant would close the syllable and prevent the application of *i* Deletion.

10. *i* Deletion.



The inclusion of the following syllable within the same word in (10) is crucial to correctly deriving forms like [nisi] ‘he forgot’ and [diri] ‘he knew’ from /nasi/ and /dari/ respectively. These forms lack a final consonant so that the final syllable, headed by *i*, is open but does not undergo *i* Deletion.

Underlying *a* in forms like /samiS/ does not undergo *i* Deletion since it is specified for [pharyngeal] rather than [coronal] beneath the V-Place node. The stipulation of [coronal] in (10) restricts its application to *i*.

11. Derivations.	a.	b.	c.	d.
UR	/samiʃ/	/samiʃ-at/	/ħimil/	/ħimilat/
<i>i</i> Deletion	---	samʃat	ħmil	ħimlat
<i>a</i> to <i>i</i>	simiʃ	---	---	---
	'he heard'	'she heard'	'he was carried'	'she was carried'

Some derivations are provided in (11) where *i* Deletion fails to apply to underlying /samiʃ/ (11a) since the *i* occurs in an closed syllable in contrast to underlying (11b) /samiʃ-at/ where the *i* appears in an open syllable and is lost. The process which changes *a* to *i* will be discussed below. The process of *i* Deletion applies in each of the two passive forms (11c, d), each time to the rightmost open syllable.

1.3. Coronal Spread.

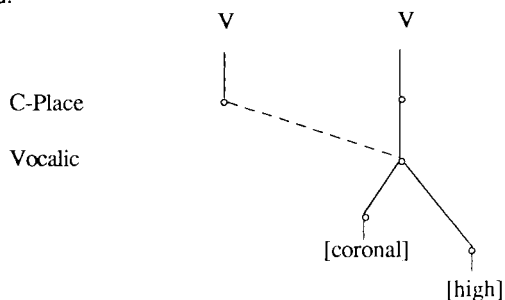
In deriving /samiʃ/ --> [simiʃ] (11.a) an additional process is required which changes *a* to *i*. This process does not occur in forms like [samʃat] in which *i* Deletion has taken place. This pattern is seen in (12) below.

12.	<i>a</i> Changes to <i>i</i>	No Change Takes Place
3ms	/samiʃ/ --> simiʃ	3fs /samiʃ-at/ --> samʃat 'hear'
2ms	/samiʃt/ --> simiʃt	3mp /samiʃ-am/ --> samʃam "
3ms	/ʃarif/ --> ʃirif	3fs /ʃarif-at/ --> ʃarfat 'know'
3ms	/racib/ --> riʕib	3fs /racib-at/ --> racbat 'ride'
3ms	/ʃarib/ --> ʃirib	3fs /ʃarib-at/ --> ʃarbat 'drink'

This might lead one to suspect that the process involves syllable structure such that the process does not apply in closed syllables. This would explain its application in [simiʃ] and non-application in [samʃat]. However, this fails to explain the occurrence of the stem initial *i* in the form 'he heard him' in which the suffix *-ih* is added to the stem, /samiʃ-ih/ --> [simʃih]. In this case, a vocalic ending is added so that the second stem vowel is lost, closing the first syllable, but the process applies anyway.

The crucial generalization is that the process applies whenever an *i* occurs to the right of the target *a*. This suggests an assimilation which spreads [coronal] from *i* leftward to *a*. This rule is not sensitive to syllable structure as it applies both in an open syllable, [simiʃ], and a closed syllable, [simʃih]. The process of [coronal] Spread is formalized in (13) below.

13. Coronal Spread.



The derivations in (13) demonstrate that Coronal Spread must be ordered after *i* Deletion since the deleted coronal vowel in [samʕat] does not trigger the process, establishing a bleeding relationship.

13. Derivations.

	UR	/samiʕ/	/samiʕ-at/	/samiʕ-ih/
<i>i</i> Deletion	---	---	samʕat	samʕih
Coronal Spread	---	simiʕ	---	simʕih

So far, the vocalism for the passive has been established as /i/ and the deletion of the stem vowel for these forms has been accounted for by the process of *i* Deletion in which the coronal vowel is deleted in a non-final, open syllable. Similarly, the vocalic melody for *faʕila* verbs was shown to be *a i* and the second stem vowel is again susceptible to *i* Deletion. The change of the initial stem vowel to *i* is accounted for by the process of Coronal Spread which raises an *a* when followed by an *i*.

1.4. Syncope.

In forms like [kitab] ‘he wrote,’ the underlying vocalic melody cannot be /i/ since the second stem vowel is not deleted in forms containing a vocalic ending such as [ktibat] ‘she wrote.’ In this case, the first stem vowel is lost. If the vocalism were the same as in *faʕila* verbs, then the same pattern of alternations would be expected and the 3fs form would be *[katbat] which does not occur.

Nor could the first stem vowel be *i* since this vowel is not lost in the 3ms form [kitab]. If this vowel were *i* in the underlying representation, it would be lost due to *i* Deletion yielding *[ktab] which is also incorrect. This leaves only the vocalism *a a* for *faʕala* verbs. Positing this underlying vocalism makes the prediction that neither vowel will be lost to *i* Deletion. However, since the first stem vowel is lost in forms to which vocalic endings are

added, there must be another process which deletes that vowel to derive /katab-at/ --> [ktibat].

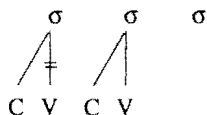
In (15) it appears that this process, Syncope, applies when a vocalic ending is suffixed to the root. For each form in (15.a) the vowel initial suffix opens the second stem syllable creating a sequence of two open syllables. In this environment, the nucleus of the first open syllable is lost. In (15.b), the ending is consonantal, so the syllable structure of the root is unaffected and no deletion takes place.

15.a.	Syncope Applies			
	/katab-a/	-->	ktibat	3fs
	/katab-an/	-->	ktiban	3fp
	/katab-am/	-->	ktibam	3mp

15.b.	Syncope Fails			
	/katab-ʔ/	-->	kitab	3ms
	/katab-t/	-->	kitabt	2ms
	/katab-na/	-->	kitabna	1p

Syncope is formalized in (16) below where in a sequence of two consecutive open syllables the first vowel is delinked from its syllable and thus lost to stray erasure. This rule is insensitive to the vowel quality of either syllable.

16. Syncope.



The third syllable stipulated in (16) to prevent the application of Syncope on forms such as [nisi] ‘he knew’ and [miša] ‘he went’ which are bisyllabic. Since both syllables are open in these forms, Syncope would apply if the third syllable were not mentioned in the structural description of the rule.

Syncope must apply after *i* Deletion to correctly derive forms like [simʕat] ‘she heard.’ The underlying representation meets the structural description of both rules since there is both a sequence of two, non-final open syllables, and an *i* in an open syllable /samiʕ-at/. Since it is the *i* which is lost and not the *a*, it is clear that *i* Deletion applies.

17.	a.	UR	/samiʕ-at/	b.	UR	/samiʕ-at/
		Syncope	smiʕat		<i>i</i> Deletion	samʕat
		<i>i</i> Deletion	---		Syncope	---
		Coronal Spread	---		Coronal Spread	---
			*[smiʕat]			[simʕat]

The two possible orders are given in (17) above. Where Syncope precedes *i* Deletion (17.a), the incorrect form *[smiʕat] is derived. The derivation in (17.b) illustrates that the proper ordering correctly derives the surface form [simʕat].

1.5 Raising.

The form [kitab] which is derived from /katab/ demonstrates that there is another rule of Raising which changes underlying *a* to *i*. The process applies in each form in (18) as well as /ðabah/ --> [ðibah] 'he killed' and /sakatat/ --> [skitat] 'she stopped talking' showing this process to be pervasive. This change cannot be attributed to Coronal Spread since there is no coronal vowel in the underlying representation to which the stem initial *a* may assimilate.

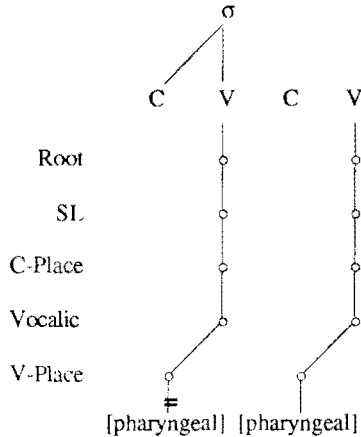
18.		singular			plural		
	3m	/katab/	-->	kitab	/katab-am/	-->	ktibam
	3f	/katab-at/	-->	ktibat	/katab-an/	-->	ktiban
	2m	/katab-t/	-->	kitabt	/katab-tam/	-->	kitabtam
	2f	/katab-tay/	-->	kitabtay	/katab-tan/	-->	kitabtan
	1	/katab-t/	-->	kitabt	/katab-na/	-->	kitabna

In the form [kitabtan] which is derived from /katab-tan/, it is observed that neither stem vowel is deleted. *i* Deletion cannot apply as there are no coronal vowels in the stem underlyingly, and Syncope cannot apply since a consonantal ending is added, rendering the stem final syllable closed and blocking the application of (16). Of interest here is that of the two stem vowels, the first is raised, and the second is not.

It would be incorrect to assume that the stem initial vowel is always raised since it is deleted in those forms to which a vocalic ending has been added, and in those same forms it is the second root vowel which is raised. Instead, the generalization is that the pharyngeal vowel is raised in an open syllable, when followed by another *a*. This explains why the first, but not the second *a* raises in /katab-tan/ --> [kitabtan] as well as why the final vowel in [kitabna] does not raise in spite of appearing in an open syllable.

While the process of Coronal Spread is assimilatory, Raising (19) is a process of dissimilation. Here, the occurrence of two pharyngeal vowels triggers the raising of the first. This is accomplished by the delinking of the feature [pharyngeal] from the first vowel which is later filled in by default with the value [coronal]. This default rule is independently motivated below in §1.6.

19. Raising.



The two processes also differ in sensitivity to syllable structure such that Coronal Spread raises a vowel in an open or closed syllable as the derivations in (20) demonstrate. In /samiʃ/ → [simiʃ] the target vowel is in an open syllable and in /samiʃ-ih/ → [simʃih] it appears in a closed syllable, yet undergoes the rule. In the forms [kitabtay] and [kitabtan], there appear two adjacent syllables headed by *a*, yet there is no dissimilation as the target vowel appears in a closed syllable.

20.	UR	/samiʃ-ih/	/katab-tan/	katab-at
	<i>i</i> Deletion	samiʃih	---	---
	Syncope	---	---	kitab
	Coronal Spread	simʃih	---	---
	Raising	---	kitabtan	kitab

So while the two processes of Coronal Spread and Raising have the same effect of changing an *a* to an *i*, they are distinct in their implementation. This is clear from the environments in which they may apply since Coronal Spread is insensitive to the syllable structure of the target while Raising applies only to open syllables. The two also differ in that Coronal Spread (13) is assimilatory, spreading the Vocalic node of *i* to a vowel to its left. The formalization makes no mention of the quality of the target vowel. In Raising, which is a process of dissimilation, the occurrence of identical, adjacent Vocalic nodes is avoided by delinking the first if it appears in an open syllable. Raising requires the stipulation in the formalism, (19), that both target and trigger be [pharyngeal].

1.6. Epenthesis and Default [coronal].

In the previous section, a default rule was assumed which fills in the value [coronal] for a vowel with no V-Place specification. In this section, it will be shown that independent evidence exists for postulating such a default rule. This evidence comes from the Active Imperfective in which an epenthetic vowel breaks up unsyllabifiable clusters. The epenthetic vowel is coronal, a value assigned by the same default rule necessary for Raising.

Forms for the Active Imperfective of ‘to write’ are listed in (21). This paradigm is formed by adding suffixes and prefixes to the root *ktb*. Note that while both the 3fs from [taktíbín] and 2fs [taktbín] end in *-in* on the surface, only the latter contains the suffixal vowel in its underlying representation. It will be argued that the presence of *i* in the former is the result of epenthesis.

21.	3ms	/ya-ktib/	-->	yaktíb
	3fs	/ta-ktib/	-->	taktíb
	3fp	/ya-ktib-n/	-->	yaktíbín
	2fp	/ta-ktib-n/	-->	taktíbín
	2fs	/ta-ktib-in/	-->	taktbín

In the 2fp form [taktíbín] the presence of the stem vowel indicates that no deletion has applied, whereas the absence of a stem vowel in 2fs [taktbín] is due to the application of *i* Deletion. In order for *i* Deletion not to apply in the case of [taktíbín], the stem vowel must not appear in a non-final open syllable. Since syllabification of the surface form is such that the stem vowel appears to meet the structural description of *i* Deletion: *tak.tí.bin*, an underlying representation in which the stem vowel is not in an open syllable must be assumed. The derivations in (22) make this point clear.

22.		3fs	2fp	2fs
		ta-ktib	ta-ktib-n	ta-ktib-in
	<i>i</i> Deletion	---	---	taktbín
	Syncope	---	---	---
	Stress	taktíb	taktíbín	taktbín
	Epenthesis	---	taktíbín	---

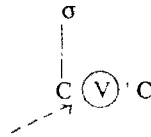
In the derivation of [taktbín], the stem vowel is deleted since the structural description of *i* Deletion is met. The different surface forms of the two verbs, [taktbín] and [taktíbín], results from the absence and presence of the suffixal *i*. This is predicted since the vocalic ending *-in* will make the stem syllable while the affixation of the consonantal ending *-n* allows the stem syllable to remain closed. This suggests that the second *i* in [taktíbín] was inserted by epenthesis after *i* Deletion would have applied.

Confirmation of this analysis is found in stress assignment for these forms. Stress is predictable in Rwaii, falling on the rightmost closed syllable. In this way, ‘he wrote’ will

have stress on its final syllable, [kitáb], and similarly in 'she wrote,' [ktibát]. The stress in the word [taktíbin] appears to violate this generalization since the rightmost, closed syllable is unstressed with stress falling on the second from last syllable. If we assume that stress is assigned after *i* Deletion and Syncope but before Epenthesis as in (22), then the stress pattern of [taktíbin] is accounted for. In this case, the *i* of the final syllable is not present when stress is assigned, and therefore leaves the stem vowel as the rightmost vowel and receives stress.

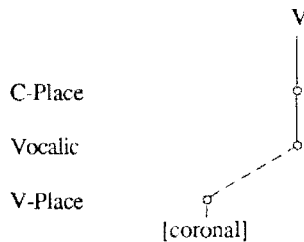
The process of Epenthesis (23) is triggered by the presence of an unsyllabified element. In forms like /ya-ktib-n/, the final *n* cannot be syllabified to the syllable *tib* since the coda *-bn* would violate a stipulation that the more sonorous *n* be nearer the nucleus than the obstruent *b*. Since this renders the *n* unsyllabified, an epenthetic vowel is inserted to resolve the conflict.

23. Epenthesis.



The quality of the epenthetic vowel is determined by Default which ensures that the inserted vowel is *i*. This rule, (24), instantiates the value [coronal] to a Vocalic node which lacks a specification for V-Place. An additional redundancy rule states that all coronal² vowels also be specified for [high] beneath the Aperture node.

24. Default Coronal.



In deriving a verb like [yaktíbin] 'they (f) write' from /ya-ktib-n/, syllabification would license the syllables *ya* and *ktib*, but would render the final *n* extrasyllabic. In this case, Epenthesis would provide a V-slot which would serve as a syllabic nucleus to which *n*

² Since the vowel /a/ surfaces with a coronal specification (c.f. §1.2), we must assume that this redundancy rule applies before /a/ -> [æ], or that it applies to vowels specified *only* for coronal beneath V-Place.

could syllabified yeilding /yakatibVn/. The rule of Default Coronal would then fill in a value for the empty V-slot so that *i* will surface in [yaktibin].

1.7. Backing.

The surface form [ʃumal] contains an *u* while neither the *faʃala* nor *faʃila* paradigms contain this vowel. It is incorrect to assume that the *u* exists in the underlying representations of forms like [ʃumal] since it can be predicted from neighboring consonants.

25.a.	wuɣaf	'he stopped'	ɾubax	'he cooked'
	ʃubar	'he waited'		
	ʃumal	'he was steadfast'	wuʃil	'he arrived'
b.	rubat	'he tied'	wɣufat	'she stopped'
	rubʃat	'she was tied'	ʃrubat	'she hit'

In each form in (25.a) the *u* surfaces adjacent to an emphatic or *w*. However, this is not true for the forms in (25.b) where another consonant intervenes between the emphatics and the target vowel, yet *u* surfaces anyway.

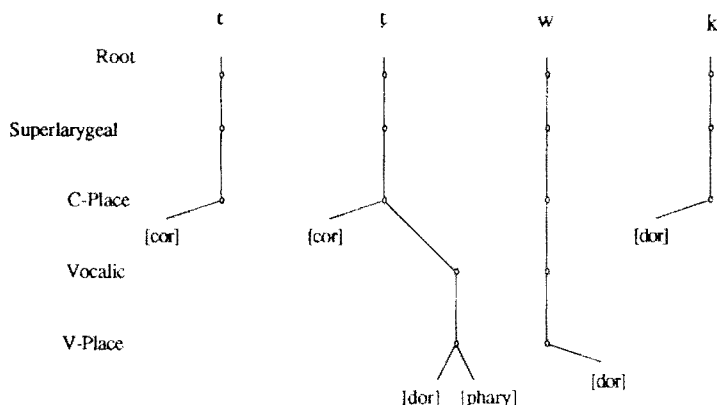
Prochazka (1988:20) states that labials *b, f, m*, and the liquids *l* and *r* are phonetically emphatic when a true emphatic, *ɾ, ʃ,* or *ʒ,* or a velar consonant occurs in the same root. This predicts the pronunciation of [ʃubar] to be [ʃuɸar] when more narrowly transcribed. The forms [rubat] and [rubʃat] indicate that these 'derived' emphatics may also trigger the occurrence of *u* since there are no 'true' emphatics adjacent to the target vowel.

The structure of an emphatic consonant is such that it has both primary and secondary specifications. The primary specification is dominated by C-Place and is determined by the primary place of articulation. In this way, *ɾ* is characterized by a primary specification of [coronal] beneath the C-Place node. The secondary specification for all emphatics is [dorsal] and [pharyngeal] beneath the V-Place node as seen in (26).

In the universal geometry presented earlier in (8), emphatics are characterized as in (26). Both the emphatics and gutturals are characterized by the feature [pharyngeal] as discussed in §2.1 below. The emphatics differ from gutturals in that their specification of [pharyngeal] is dominated by V-Place while the gutturals are so specified under the C-Place node. The dorsal glide *w* is specified for a secondary dorsal.

26.

Rwaili Arabic



The emphatics are also specified for secondary dorsal. Velars are also specified for dorsal, but under the C-Place node. Since the emphatics and *w* act as a natural class in triggering the occurrence of *u*, they must share some structure. The structure they share is the specification of [dorsal] beneath V-Place. For this reason, this process, which we shall call Backing, must involve the feature dorsal under V-Place.

In addition to occurring only near a consonant with a secondary dorsal specification, Backing affects only the vowel *i*. The data in (28) illustrate this as in each of these forms, the *u* appears where *i* is expected as the product of Raising. Additionally, the form [waʃlat] from /waʃilat/ indicates that where the underlying *a* remains, Backing does not apply.

28.	UR	deletions	Raising	Backing	
	ʃamal	---	ʃimal	ʃumal	'he was steadfast'
	ʃarabat	ʃrabat	ʃribat	ʃrubat	'she hit'
	wazan	---	wizan	wuzan	'he weighed'
	rabaʃ	---	ribaʃ	rubat	'he tied'
	rabaʃat	rbaʃat	rbiʃat	rbuʃat	'she tied'

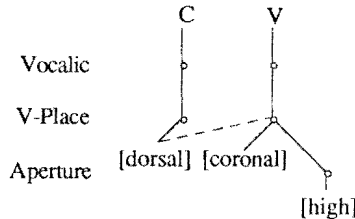
It is a coincidence that there does not exist a form in which Backing occurs which does not also contain a labial. This might lead to the conclusion that it is the feature [labial] which is being spread to derive *u*. This cannot be correct as the data below demonstrate. Here, labials occur without the appearance of *u*.

27.	ʃimiʃ	'he heard'	*ʃumiʃ
	ʃirib	'he drank'	*ʃurib
	ʃrib	'it (m) was drunk'	*ʃrub
	libis	'he wore'	*lubis

Backing is formalized in (29) where a V-Place specification for [dorsal] is spread to a vowel, if specified for [high] under the Aperture node. The existing specification for V-

Place is lost when [dorsal] is spread. This delinking occurs automatically following the principle of structural preservation as no vowel in Rwailli can be both coronal and dorsal.

29. Backing.



1.8. Summary.

To this point, the processes of *i* Deletion, Syncope, Coronal Spread, Epenthesis, Default Coronal, Raising, and Backing have been described and motivated. Crucial ordering stipulations require *i* Deletion to apply before Syncope, and that *i* Deletion applies before Coronal Spread. It is also necessary that Raising apply before Backing. Some sample derivations are provided in (30).

30.	katab	katabat	samiʃ	samiʃat	ʃarab	ʃarabat
	he wrote	she wrote	he heard	she heard	he hit	she hit
<i>i</i> Deletion	---	---	---	samʃat	---	---
Syncope	---	ktabat	---	---	---	ʃrabat
C-Spread	---	---	simiʃ	---	---	---
Raising	kitab	ktibat	---	---	ʃirab	ʃribat
Backing	---	---	---	---	ʃurab	ʃrubat

2. Exceptions to Raising.

There are a large number of forms in which an *a* appears in a non-final open syllable. The forms included in the representative list in (31) would seem to be exceptions to Raising, but are in fact accountable by appealing to established phonological principles.

31. Apparent Exceptions to Raising.

a.	gʃadat	3fs	'sit'	b.	ʃalab	3ms	'kill'
	gaʃad	3ms	'sit'		gʃalat	3fs	'catch'
	ʃbaʃat	3fs	'kill'		nxalat	3fs	'sift'
	ʃbaxat	3fs	'cook'		nzalan	3fp	'get down'
	naxal	3ms	'sift'		ʃfarat	3fs	'dig'
	gʃasal	3ms	'catch'		ʃarab	3ms	'hit'
	hadaf	3ms	'return'		ʃbarat	3fs	'wait'
	ʃazam	3ms	'milk'		wzanat	3fs	'weigh'
	ʃafar	3ms	'dig'				

These forms can be divided into two groups, one (31.a) in which a consonant adjacent to the target vowel is a guttural, like [naxal], and one (31.b) where the consonant between

the two vowels is a coronal sonorant like [nzaɪan]. The basis for this grouping will be shown to provide an account for the failure of these forms to undergo Raising.

2.1. The Gutturals and the Feature [pharyngeal].

The first stem vowel in the forms in (31.a) is *a* where *i* is expected. In this group, each *a* which fails to undergo Raising is adjacent to a uvular consonant as in [naxal] ‘he sifted’ and [ɟasal] ‘he caught,’ a pharyngeal as in [qʕadət] ‘she sat’ and [ħamal] ‘he carried,’ or a laryngeal as in [ħadaf] ‘he returned in the evening.’ When the target vowel is not adjacent to a guttural, the same verb will undergo Raising as the form [ħdɪfat] ‘she returned in the evening’ indicates.

McCarthy (1991) motivates the grouping of uvular, pharyngeal, and laryngeal consonants into a natural class, which he calls gutturals. He demonstrates that the segments *x*, *ɟ*, *ħ*, *ʕ*, *ʔ*, *ħ*, and *a* function as phonological class in Semitic languages as well as showing that they share some phonetic properties. The SPE system of distinctive features (Chomsky and Halle 1968) and many models of feature geometry such as the model proposed by Sagey (1986) cannot characterize all and only these segments into a natural class. For this reason, McCarthy proposes the feature [pharyngeal] be used to denote the natural class of gutturals.

Others have also recognized the need to group the gutturals into a natural class. Clements (1989) does so by specifying these segments with the feature [radical]. Clements includes this feature under both the C-Place and V-Place nodes so that the feature [radical] (i.e. pharyngeal) may characterize both consonants and vowels. In this approach, the vowel *a* would be included in the natural class of gutturals.

Herzallah (1990) also provides X-Ray evidence which suggests that the gutturals and *a* share the place of articulation, rather than an articulator. She also argues against the feature [+low] for *a* since the tongue body is actually raised and backed in producing this vowel. Instead, she posits the feature [pharyngeal] to characterize both *a* and the guttural consonants in her account of Palestinian Arabic.

Hume (1992) groups the gutturals and *a* into a natural class denoted by the feature [pharyngeal] in her account of Maltese Arabic. The guttural consonants act as a phonological class in the process of Guttural Assimilation where *i* becomes *a* in the vicinity of a guttural. In her account, this is accomplished by spreading the feature [pharyngeal] from the consonant to the vowel so that /iħiʔ/ becomes [taħaʔ] ‘he reached’ (1992:224-26).

In Rwaili, the guttural consonants also act as a natural class in blocking Raising. This is accomplished by a language specific rule which fuses the feature [pharyngeal] between a guttural consonant and a neighboring *a*. The resulting structure contains a single occurrence of [pharyngeal] which is multiply linked to both the vowel and the consonant.

This structure becomes resistant to certain types of processes as predicted by the Linking Constraint.

2.2. Inalterability and the Linking Constraint.

Hayes (1986a and 1986b), as well as others (e.g. Schein and Steriade (1896)), recognize geminates as special structures. Generally, two segments which share some or all of their features are called geminates. These pairs of segments then behave differently than a single segment bearing the same features in that geminates resist several types of processes such as epenthesis. Hayes accounts for this by proposing the Linking Constraint by which a given phonological process is restricted in its application to apply only to structures which share the number of association lines specified in the rule.

32. The Linking Constraint.

Association lines in structural descriptions are interpreted as exhaustive. (Hayes 1986b:331)

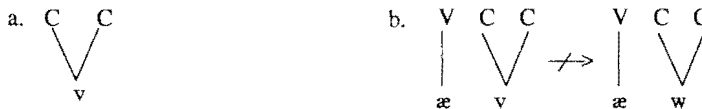
Hayes (1986b) provides an example of this phenomenon where the Linking Constraint blocks the application of *v* Weakening (33.a) in Persian. This process will change *v* to *w* when preceded by a vowel. The application of *v* Weakening, illustrated in (33.b), accounts for the consonant alternation in the derivation of /*boɾæv*/ to [*boɾow*] ‘go.’

33.



This rule does not apply to structures in which the target *v* is a geminate as in [*marovvæt*] ‘generosity’. Here, a single specification for *v* is multiply linked to two C slots as in (34.a) Since the structural description of the rule (33.a) mentions only a single association line, *v* Weakening can not apply to this form (34.b)

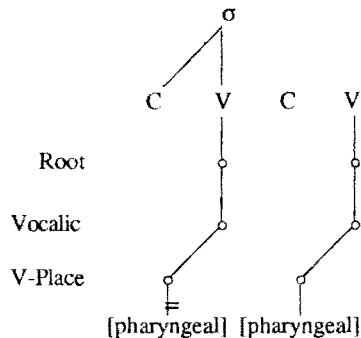
34.



The Rwailli words like [*naxa1*] listed in (31.a) where an adjacent guttural blocks Raising are examples of the Linking Constraint restricting the application of a process to structures

identical to those mentioned in the rule. The rule of Raising (repeated in 35) shows the feature [pharyngeal] linked to a single vowel. The structure of the forms in (31.a) do not meet the structural description for Raising as will be explained below.

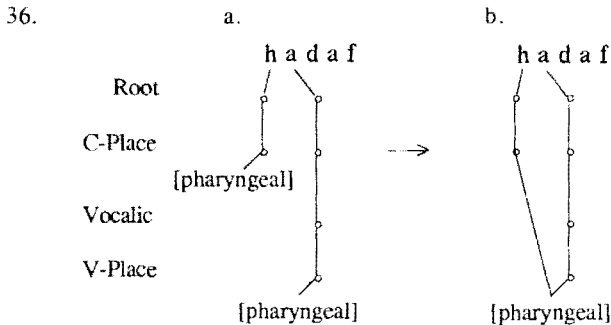
35. Raising (cf.18).



2.3. Adjacent Gutturals and the Linking Constraint.

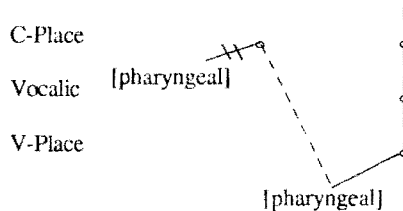
The grammar of Rwaili contains a language specific process which creates a structure which would render the feature [pharyngeal] multiply linked and having the effect of blocking Raising as shown in (31). This process fuses the C-Place [pharyngeal] specification of a consonant to the same specification under V-Place in a vowel when the two are adjacent. This forms a partial geminate in a guttural -a sequence which resists the process of Raising in accordance with the Linking Constraint.

This process of fusion takes a structure like that in (36.a) for the word [hadaf] 'he returned' where a guttural consonant is adjacent to *a*, and fuses them so that the structure in (36.b) results. The partial geminate consisting of *h* and *a* resists the process of Raising so that the first *a* does not raise to *i* in spite of appearing in an open syllable before another pharyngeal vowel.



A similar account can be provided for all the forms in (31.a). It is unimportant whether the guttural appears to the right or left of the target vowel as the forms [qʕʕadat] ‘she sat’ and [qʕʕad] ‘he sat’ indicate. The forms [qʕʕas] ‘he caught,’ [tʕaxat] ‘she cooked,’ [ħafar] ‘he dug,’ and [ħadaf] ‘he returned’ show that all the gutturals trigger CV Fusion. Finally, the forms in (38) demonstrate the the guttural must be adjacent to the target vowel for CV Fusion to take place.

37. CV Fusion.



CV Fusion is formalized in (37). If a pharyngeal vowel is adjacent to a consonant specified for pharyngeal under C-Place, the specifications of [pharyngeal] fuse. The result is a structure in which the guttural consonant and *a* are both linked to a single specification of [pharyngeal].

38.

a. CV Fusion Applies.	b. Raising Applies.
ʕazam 3ms ‘invited’	ʕzimat 3fs
ħalab 3ms ‘milked’	ħlibat 3fs
ðbaħat 3fs ‘killed’	ðibaħ 3ms

It is also clear that in order to block Raising, Fusion must take place before *a* dissimilates to *i*. Where Fusion applies, Raising cannot. The ‘exceptions’ in (31.a) are actually structures which have been altered by CV Fusion so that they may not undergo Raising. So too may the forms in (31.b) be accounted for as obeying the Linking Constraint and therefore not raising the first vowel.

2.4. Vowel Raising in Kera.

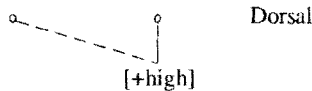
Kera, a Chadic language, also has two rules of raising as discussed by Ebert (1979) and Odden (1989). A comparison can be drawn between the two rules which change *a* to *i* in Rwaili to the raising rules in Kera. There is a height harmony rule in Kera which raises a non high vowel to a high vowel when followed by another high vowel as the forms in (39) illustrate.

39. Height Harmony in Kera.

hool-on	-->	hool-on	'warms me'	seen-n	-->	séen-ń	'my brother'
hool-i	-->	huul-i	'warms you'	seen-a	-->	séen-á	'her brother'
hool-u	-->	húul-u	'warms him'	seen-i	-->	siin-i	'your (f) broth.'
kass-n	-->	káas-ń	'my hand'	korm-on	-->	korm-on	'my son'
kass-i	-->	kəəs-i	'your (f) hand'	korm-iyi	-->	kurm-iyi	'your (f) son'
kass-u	-->	kəəs-u	'his friend'	kormuyu	-->	kurm-uyu	'his son'

Odden (1989) accounts for this as the result of spreading [+high] from the following high vowel. Note that in Ebert's (as well as in Odden's) account, *a* is a high, back, unrounded vowel so that *a* will change to *ə* as a result of this harmony, but *o* will raise to *u*. It should be noted that this spreading will apply in a closed syllable as /korm-iyi/ changes to [kurmiyi]. It is also noteworthy that this process will also apply when *a* is preceded by a [+low]³ consonant as seen in /hool-i/ --> [huuli]. Odden formulates Height Harmony as in (40).

40.



In addition, Kera contains a rule of dissimilation in which *a* in an open syllable will raise *ə* when followed by another *a* provided that the first vowel is not preceded by the low consonants *h* or *ʔ*. This accounts for the alternations in (41) in which we see the application of Dissimilation and its nonapplication when preceded by a [+low] consonant.

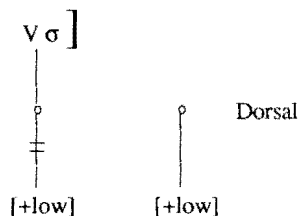
41.	bàl-àn	-->	bəl-an	'loves me'
	fal-am	-->	fəl-am	'finds you'
	nar-am	-->	nər-am	'your (m) aunt'
	hàm-àm	* həm-àm	'eats you'	

Odden formulates this rule as in (41) where the feature [+low] (which could be reanalyzed as [pharyngeal]) is delinked from a low vowel in an open syllable which is also followed by an *a*. This process does not apply to /hàm-àm/ since the vowel preceding the

³ I would like to note, as does Odden, that the feature [pharyngeal], and not [+low] is a better specification for the segments *ʔ*, *h*, and *a*, but I use [+low] here to be consistent with Ebert's analysis.

target vowel is adjacent to another [+low] consonant. Odden attributes this to the multiple linking of [+low] to both the *h* and the *a*.

41.



The two rules of raising in Kera have a similar distribution to their counterparts in Rwaii. The assimilatory rule of spreading is insensitive to multiple linking while the dissimilatory rule of delinking is prohibited by the Linking Constraint to apply to geminates.

2.5.1. Intervening Coronal Sonorants

The forms in (43 (repeated from 31.b)) do not necessarily contain gutturals, but do resist Raising. These examples have in common only a coronal sonorant which separates the two pharyngeal vowels. The account for these forms must make reference to a coronal sonorant in this position.

43.	ħalab	3ms	'kill'	ħfarat	3fs	'dig'
	ġsalat	3fs	'catch'	ðarab	3ms	'hit'
	nɣalat	3fs	'sift'	ʃbarat	3fs	'wait'
	nɣalan	3fp	'get down'	wɣanat	3fs	'weigh'

The forms in (44.a) demonstrate that a coronal sonorant which precedes the vowel targeted by Raising will not block the process. From this, it can be concluded that the blocking effect does not involve multiple linking between the coronal sonorant and *a*. If this were the case, fusion would be expected to occur on either side of the vowel as it does for the adjacent pharyngeals.

44.a.	ðrubat	'she hit'	b.	nizal	'he got down'
	ħlibat	'she milked'		wuzan	'he weighed'
	rubat	'he tied'		kitab	'he wrote'
	xrubat	'she became ruin'		wuʃaf	'he described'
				gidar	'he was able'

The forms in (44.b) show that intervening coronal obstruents do not block the process of Raising so that the analysis which explains the exceptional forms in (40) must refer only

to coronal sonorants. Forms like [ʃumaɪ] ‘he was steadfast’ indicate that an intervening labial sonorant also allows Raising to apply.

2.6. Coronal Transparency

Paradis and Prunet (1989) propose that coronal consonants are special in that they lack a place node in their underlying representations which makes them ‘transparent’ to certain phonological processes. Paradis and Prunet (1989) cite evidence from Guere which illustrates this special behavior of coronal consonants. Guere has a height constraint that prevents two non high vowels from appearing in the same stem. This correctly predicts that forms like *[beo], *[kɛ̃mɛ̃], *[kɔ̃mɛ̃], and *[kɛbo] cannot occur in this language.

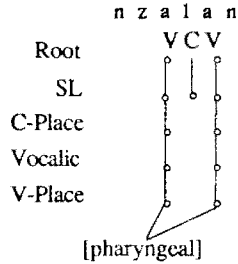
While it is true that no bare stems exist with two non high vowels, suffixation may create forms which are in violation of the height constraint. For example, the stem /bɪɛ/ meaning ‘sing’ has a single mid vowel, and is not in violation of the height constraint. If the object pronoun /-ɔ/ is added, the resulting structure of /bɪɛ-ɔ/ is in violation of the height constraint. Guere has a rule which corrects such illformed structures by raising the stem vowel so that the surface form of /bɪɛ-ɔ/ is [bɪiɔ].

Paradis and Prunet also note that in forms in which two identical, adjacent vowels occur in a stem, they may be non high. Since these forms are not excluded by the height constraint, it can be assumed that the two vowels share a single specification for [-high]. In this way, words such as [sɔɔ] ‘lose weight!’ are permitted since there is only a single occurrence of the feature [-high].

But there are forms in Guere which do seem to violate the height constraint as they contain two non high, non adjacent vowels. These include [beɔe] ‘to hang,’ and [wɔɔ] ‘wash!.’ What makes these forms permissible in Guere is that the two non high vowels are separated only by a coronal consonant. Paradis and Prunet propose that all unmarked coronals will be unspecified for place in their underlying representation and later in the derivation, a redundancy rule will fill in the value coronal to the empty place node.

In this way, /beɔe/ has the underlying structure in (45.a). Paradis and Prunet argue that this structure is then altered to that in (45.b) in which there is a single specification of [-high] shared by both vowels. This is possible in words like [beɔe] in which the intervening consonant is a coronal and lacks a place node. In a word like *[bɔgɔ] (45.c), the intervening consonant is specified as velar in its underlying representation, and therefore, the two vowels may not fuse their [-high] specification into one, and so are ruled out by the height constraint.

47.



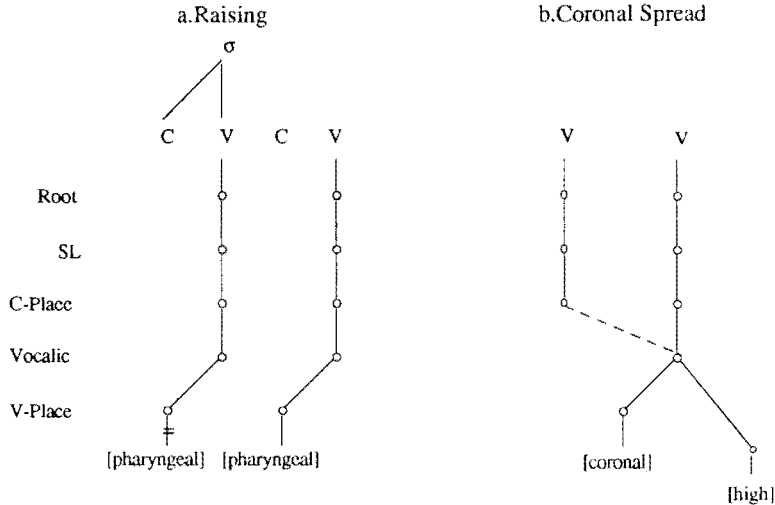
2.7. Multiple Linking and Coronal Spread.

The phonology of Rwaili contains two rules which change underlying *a* to *i*: Coronal Spread and Raising. The rules differ in that Coronal Spread is a process of regressive assimilation in which *a* raises when followed by a coronal vowel. This is accomplished by spreading the specification of [coronal] beneath V-Place leftward to another vowel and will apply in an open or closed syllable. Raising on the other hand is a process of dissimilation in which an *a* in an open syllable dissimilates to *i* when followed by another pharyngeal vowel. This is accomplished by delinking the specification of *a* from the supralaryngeal node when the above conditions are met, and filling in the value of *i* by Default.

It was shown that a large number of apparent exceptions exist to Raising which are accounted for by appealing to the Linking Convention which prevents the process from applying as it would require two association lines to delink where the rule specifies only one. In this way, the exceptional forms were shown to be exceptions which do not require extra stipulations to be placed on the grammar, but rather fall out naturally from the behavior of geminates and the nature of the rule of Raising.

The existence of forms similar to /ʕarif/ --> [ʕirif] suggests that neither adjacent gutturals nor intervening coronal sonorants will block the application of Coronal Spread. Some explanation is required to account for the Linking Constraint affecting the application of Raising but not of Coronal Spread. An examination of the two rules makes clear that while Raising is subject to the Linking Constraint, Coronal Spread is not within the domain in which inalterability effects are predicted to exist.

48.



The process of Raising, (repeated in 44.a) involves delinking an association line to affect the change of *a* to *i* as the value of coronal is filled in by default. Since the structural change of the rule involves the delinking of an association line, it is predicted that the linking constraint be in effect and prevent the application of this process on geminates.

Coronal Spread (repeated in 44.b) spreads the value the vowel on the right leftwards. The delinking of the existing specification comes from a structural preservation stipulation that prohibits the specification of [pharyngeal] for a vowel that is also specified as [high] under Aperture. Since Coronal Spread is a rule of spreading and does not delink an association line, the Linking Constraint is not predicted to affect the application of this process. The Linking Constraint, then, provides an elegant account for both the existence of 'exceptions' to Raising and for the absence of such forms for Coronal Spread⁴.

2.8. Long Distance Geminates.

Hayes (1986b) includes many examples from a variety of languages which show the effects of the Linking Constraint, but all involve geminates which are adjacent on the timing tier. In a footnote, Hayes (1986b:328) states that long-distance geminates which show inalterability effects can exist, but cites no examples.

⁴ It is also true that the Linking Constraint would not play a role in the application of Coronal Spread if CV Fusion is ordered after Coronal Spread but before Raising. No other part of the analysis depends upon this ordering, nor is there any evidence suggesting that CV Fusion applies before Coronal Spread.

The analysis provided here of the forms in (43) makes crucial reference to the number of association lines attached to a pharyngeal vowel *a*. This makes the forms in which the two occurrences of *a* are separated by a coronal sonorant an example of long distance geminates. The multiple linking which blocks Raising exists between two segments which are not adjacent on the timing tier but has the same effect as multiple linking among adjacent segments as is the case with the adjacent gutturals discussed in §2.4.

3. Obstruents and Coronal Transparency Reevaluated.

In addition to providing an example of a long distance geminate, the ‘placeless coronal’ account for the [nzalan] type exceptions to Raising also challenges certain aspects of Paradis and Prunet’s (1989) proposal for coronal transparency. Paradis and Prunet propose that all unmarked coronals will show transparency effects which include obstruents as well as sonorants. It will be argued here that the general principle of coronal transparency is limited to sonorants.

To illustrate their proposal for coronal transparency, Paradis and Prunet provide evidence from Fula, Guere, and Mau in which coronals exhibit transparency effects. Yet Paradis and Prunet note in their analyses of Guere and Mau that only the sonorants show transparency in these languages (1989:340, 1990; 1989:341). Coronal obstruents are only considered in the analysis of Fula, and it will be shown that this analysis does not adequately demonstrate that obstruents should be included in the special class.

There are three processes which are said to exhibit transparency in Paradis and Prunet’s analysis of Fula: vowel spreading in verbal inflection, vowel spreading in nominal markers, and spreading of epenthetic vowels. In the case of vowel spreading in nominal markers, the spreading takes place only over *r* for morphological reasons, and therefore does not demonstrate that obstruents are transparent. Spreading of epenthetic vowels is also limited to the implosive [ɗ] since only a single form is provided in which the spreading may take place (1989:335). In this form [ɓuttɗɗit] ‘become fat again’ an epenthetic vowel is inserted to break up the consonant cluster /ttɗ/ so that underlying /ɓuttɗ/ becomes /ɓuttɗt/.

A second epenthesis is required to break up the /ɗt/ cluster so that /ɓuttɗt/ becomes /ɓuttɗit/. In this second epenthesis, an empty V slot is said to be inserted to which the quality of the first epenthetic vowel is spread to the second. It is not clear how the first epenthesis obtains its value when the second must receive its quality from the first. Moreover, the single form provided by Paradis and Prunet may surface as the alternate form [ɓuttɗtu] (1989:335). In the latter form, which Paradis and Prunet note is less preferred than the former, the second epenthetic vowel receives a different quality than the first without appealing to spreading in spite of the intervening consonant’s transparency as

coronals. Even if we accept the spreading analysis, it fails to provide evidence of obstruent transparency since Paradis and Prunet consider implosives, such as [ɖ], to be sonorants.⁵

The strongest argument for the transparency of coronal obstruents is in the analysis of vowel spreading in verbal inflection. Paradis and Prunet argue that in the suffixes listed in (49) the identity of the vowels on both sides of *t* in suffixes like *otoo* is due to spreading of one vowel quality to empty V slots to its right. This is possible if *t* lacks a place node and is therefore transparent. The Passive 4 suffix *-eteē* is said to be derived from the underlying form /-etVV/ with the quality of the first vowel spread to the remaining two. The identity of the two vowels in the suffix *amaa* is attributed to coincidence (1998:324).

49. Verbal Suffixes in Fula.

	Active	Middle	Passive
Perfect			
1	-	i	a
2	i	ii	aa
3	ii	iima	amaa
Imperfect			
1	-	o	e
2	a	oo	ee
3	at	oto	ete
4	ata	otoo	eteē

Since no other consonants occur in this context, it is impossible to test whether only coronals are transparent to this spreading (1989:329). It seems unlikely that any consonant would fail to be transparent to such a spreading since the empty V-slots to the right of the consonant must obtain features. For example, if one were to assume that a suffix had the underlying form /ekVV/ and that only coronals were transparent to this process, there would be no way to assign the final vowels of this suffix any value since *k* would block the necessary spreading. Therefore, it would seem necessary that all consonants be transparent to this particular spreading process, which then fails to provide evidence that obstruents are transparent.⁶

There does not appear to be any evidence for the transparency of coronal obstruents, while the transparency of sonorants has been demonstrated in Guere and Mau (Paradis and Prunet 1989) as well as in the present analysis of Rwaii Arabic. Rwaii does provide a counter example for the transparency of coronal obstruents since they do not allow the same long-distance linking that the sonorants *r*, *l*, and *n* do. For this reason, the claim that coronals are universally unspecified, and ultimately transparent, must be modified so that only sonorants are included in the special class of segments.

⁵ The sonority of [ɖ] is based in part on an alternation between [ɖ] and [l].

⁶ If only coronals were transparent, then the hypothetical suffix /ekVV/ could only obtain a specification for the final vowels from a default rule which seems to be otherwise unmotivated in Fula.

4. Root Cooccurrence Restrictions and Coronal Transparency.

It is widely accepted that among Semitic roots, there is a tendency to avoid combinations of segments of the same place of articulation. Greenberg (1950) analyzed 3775 trilateral verbal roots from Classical Arabic charting the occurrence of each consonant with every other consonant. His conclusions are summarized in (50).

50. 1. In the first two positions, not only identical, but homorganic consonants are excluded.
2. Homorganic consonants are likewise excluded from positions two and three, though not quite as rigorously as the first two positions.
3. In positions one and three, there is a marked, but less rigorous exclusion of homorganic, including identical consonants, than in the other combinations of positions. (Greenberg 1950:162)

Greenberg's first conclusion is not as absolute as it is stated in (50.1) since it predicts that combinations such as $r n _$ never occur since they are homorganic, yet there are five roots which begin with this sequence in his survey (1950:164). The statements in (50.1-3) are best considered tendencies rather than precise statements of occurrence exclusion. Greenberg himself weakens each claim by stating that the restriction for II and III positions is 'less rigorous' than that of I and II while the restriction for I and III is less rigorous than for the other two permutations. Consequently, it is difficult to state precisely what the cooccurrence restriction predicts beyond a tendency to avoid similar segments in a root. McCarthy (1991:14) makes the following statement regarding the cooccurrence restriction, 'The basic observation is that the consonants within a root are not homorganic with one another (within certain manner classes).'

An active, absolute exclusion on the cooccurrence of similar consonants in a root would pose a problem for the analysis of Rwaili presented here since a morphological restriction sensitive to consonant quality in the underlying representation is incompatible with underspecification. Since the present analysis depends upon the underspecification of place underlyingly for coronal sonorants, some account must be provided to reconcile the predictions of the root cooccurrence restriction and the underspecification of coronal sonorants.

Any alternative presented here must be evaluated on the basis of its ability to account for the same phenomena as the cooccurrence restriction. However, since this restriction has never been formalized so that it holds for the facts for which it is said to account, such an evaluation is impossible.

One alternative is to state the cooccurrence restriction so that for any trilateral root, only one member may lack a place node in its underlying representation. This would ensure that all roots must have at least two place nodes. In this way, a limit is placed upon the number

of coronal sonorants which may occur in a root since they are the only underspecified consonants in Rwaii. Since Greenberg groups *r*, *n*, and *l* into a single place of articulation, the same predictions can be made by both accounts. The weakness in this account is that the absence of a feature is given a value, which is undesirable. This is similar to the criticism directed to underspecification theory which allows a ternary contrast among [+], [-], and [ø] for a given feature (see Mohanan 1991).

A second alternative is to state the cooccurrence restriction so that two sonorants may not cooccur in a root. This would prevent *r*, *n*, and *l* from cooccurring since they are all sonorants. This account is problematic since *m* is also a sonorant, yet is classified as a labial. Greenberg cites 38 roots which begin with *mr_*, *ml_*, or *mn_*. This account is unworkable since *m* violates the cooccurrence predictions made by restricting sonorants.

51. Cooccurrence of Coronal Sonorants.

r ___	29/288	12.7%	___ r	26/335	7.76%
n ___	43/283	15.1%	___ n	26/188	13.8%
l ___	10/160	6.25%	___ l	32/249	12.8%
			total	166/1443	11.5%

Where I and III are coronal sonorants.

A third alternative is to make coronal sonorants exceptions to the cooccurrence restriction so that they are equally likely to occur in a root containing another coronal sonorant as a root without *r*, *n*, and *l*. Greenberg records that of 1443 roots containing coronal sonorants, 166 are roots containing two occurrences of *r*, *n*, or *l*. These 166 roots comprise 11.5% of all the roots containing coronal sonorants as shown in (51). The segments *r*, *n*, and *l* represent 10.7% (3 of 28) of the consonantal inventory included in Greenberg's survey. Thus one would expect cooccurrence in approximately 10.7% of the roots containing one coronal sonorant which is slightly less than the proportion which actually exists. Thus, there is some evidence that the cooccurrence restriction does not apply for *r*, *n*, and *l*. This is more evident in comparison to the class of labials *b*, *f*, and *m* which one would expect to occur in the same proportion as coronal sonorants since each group contains three members.

52. Cooccurrence of Labials.

b ___	6/152	3.9%	___ b	1/240	0.04%
f ___	12/181	6.6%	___ f	1/185	0.05%
m ___	0/171	0.0%	___ m	16/243	6.5%
			total	36/1172	0.02%

Where I and III are labials.

The labials, in contrast to the coronal sonorants, occur far less frequently than 10.7% as would be expected from a set of three consonants. The bilabial nasal, for example, never occurs root-initial in a root containing another labial. The fricative *f* occurs most often in roots with other labials, but fewer than 7% of the roots which begin with *f* contain another labial in position III. Since labials cooccur far less frequently than expected while coronal sonorants occur as frequently as expected, the proposal that *r*, *n*, and *l* are not subject to the cooccurrence restriction is plausible.

The coronal obstruents also occur far less frequently than do coronal sonorants. While the obstruents *s*, *z*, *ʃ*, *t*, *d*, *ʈ*, *θ*, *ð*, *q*, *ʕ* comprise 39.3 % (11 of 28) of the segments in Greenberg's survey, only 20% (203 of 1012) of roots that have a coronal obstruent initially will have another coronal obstruent in the second or third consonant position. In addition, 50% of roots which begin with *t* or *d* also have a coronal sonorant in the root. This suggests that coronal sonorants are different from coronal obstruents both in the way they pattern among themselves and the way pattern with each other. Among themselves, a root containing one coronal sonorant is as likely to have another coronal sonorant in the same root as any other consonant. Coronal obstruents, however, show a stronger tendency not to cooccur in the same root. The two groups show no tendency to avoid the other in roots so that a root containing a coronal obstruent is not restricted from containing a coronal sonorant in the same root.

It could be argued that cooccurrence restrictions do not play an active role in synchronic Arabic phonology, but the tendency for similar segments to avoid cooccurrence is the result of a historic restriction. In this view, it is an anomaly of morphology that there is the systematic gap in consonantal distribution and the phonology is independent of this constraint. If the cooccurrence plays no part in the phonology of Rwaili, then the underspecification of coronal sonorants is no longer incompatible with the restriction. Support for this view lies in loan words which Greenberg documents such as [sada:b] 'rue' which do not adhere to the restriction since as coronal fricatives, *s* and *ʕ* should not occur in the same root. The weakness of this view is that it provides no synchronic explanation for the limited distributions of certain consonants as is found for the labials in (52).

It is suggested here that the third alternative, that coronal sonorants are special in that they are not subject to the cooccurrence restrictions to which the remaining consonants must adhere in varying degrees, is most plausible. This is supported by the data in (51), but cannot be confirmed nor denied until a precise statement of the cooccurrence restriction is formulated. Until such a formalization is posited, it will be suggested that coronal sonorants are outside the domain of the cooccurrence restriction .

5. Conclusion.

The phonology of Rwaiili has two rules which change underlying *a* to *i*, Raising and Coronal Spread. While the assimilatory rule of Coronal Spread appears to be exceptionless, Raising has a large number of exceptions. Within that group of forms which do not undergo Raising there are two types of verbs, those like [gaʕad] ‘he sat’ and [gʕadat] ‘she sat’ in which the target vowel is adjacent to a guttural, and those like [nzalat] ‘she got down’ in which the target vowel is followed by a coronal sonorant and another *a*.

Previous accounts of this phenomenon in similar dialects have accounted for these exceptions by allowing Raising to apply universally, but correcting the problematic forms with an additional rule of Lowering which lowers *i* to *a* in the environments described above; when the target *i* is preceded or followed by a guttural and *a* appears in the following syllable as well as when followed by a coronal sonorant and *a*. Al-Mozainy (1981) formulates this rule as in (53) in his account of a Bedouin dialect of Jordan. But this sort of account is undesirable for a number of reasons. Foremost among these is that this account fails to provide any relationship between the process and its structural description. The formulation in (53) does not reveal that the vowel following the target triggers dissimilation. In (53), the following vowel is as likely to be *i* as *a*.

53.

$$\begin{bmatrix} +\text{syl} \\ +\text{hi} \end{bmatrix} \rightarrow [-\text{hi}] / \begin{matrix} \text{C} \\ [+L] \end{matrix} \text{ — } \begin{matrix} \text{C} \\ \left\{ \begin{matrix} [+L] \\ [+cor] \\ [+son] \end{matrix} \right\} \end{matrix} \text{ V} \\ [+low]$$

Al-Mozainy’s account provides no explanation as to why Lowering should apply to //giʕad// (the product of applying Raising to /gaʕad/), but does not apply in [ʕirif]. This disparity falls out naturally from the account proposed here. Raising, which delinks an association line, is subject to the Linking Constraint and fails to apply to geminates, whether involving a guttural and *a*, or two pharyngeal vowels multiply-linked over a coronal sonorant.

While the rule in (53) offers some explanation of why lowering should apply adjacent to a guttural, it provides no account of why Lowering should apply to a vowel followed by a coronal sonorant. An adjacent guttural could explain the effects of Lowering as a process of assimilation just as it triggers a similar process in Maltese discussed in Hume (1992). There is nothing about the structure of a coronal sonorant which would trigger Lowering. In the account provided here, the structure of a coronal sonorant permits VV Fusion which

in turn creates a long distance geminate that resists Raising based upon the Linking Constraint.

The account provided here of the forms that do not undergo Raising is superior to traditional accounts like that in (53) since it relates the structure of forms like [gaʕad] and [nzalat] to their failure to raise. The adjacent guttural and *a* form a partial geminate and the two pharyngeal vowels form a complete geminate over the intervening coronal sonorant, both of which show inalterability effects. Since Raising is a process which delinks the feature [pharyngeal], it is expected to fall within the domain of the Linking Constraint while Coronal Spread does not.

This account provides another example of a process in which the uvular, pharyngeal, and laryngeal consonants act as a natural class of gutturals as they alone fuse with *a* to block Raising. This blocking of Raising also provides another example of inalterability governed by the Linking Constraint. The account of forms like [nzalat] provide an example of a long distance geminate which hitherto was only a theoretical possibility. The part of the analysis that involves long distance geminates is consistent with the proposal of coronal transparency provided by Paradis and Prunet (1989) insofar as only coronal sonorants exhibit the transparency effects: the analysis of Raising shows that only sonorants have special status in Rwaili.

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