

PREDICTABILITY IN GARIFUNA VOWEL ALTERNATIONS: A PROBLEM FOR RADICAL UNDERSPECIFICATION

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0. Introduction

This paper discusses several vowel alternations in Garifuna, an Arawakan language spoken in Central America, which present a basic problem for Radical Underspecification theory, as developed by Archangeli (1984) and Archangeli and Pulleyblank (1986), among others. Rule-governed alternations in the high vowels of Garifuna will be shown to be incompatible with fundamental tenets of Radical Underspecification. While Radical Underspecification theory might be adapted to account for the Garifuna data, such adaptations considerably weaken the theory.

Under the present analysis, underspecification does not result from a requirement to reduce the amount of information allowed in the underlying representation, as in Radical Underspecification. For the Garifuna case, underspecified segments are restricted to certain "harmonic" morphemes or result from the epenthesis of melodically un(der)specified prosodic slots.

1. Radical Underspecification

A distinguishing characteristic of recent formulations of Radical Underspecification is the concept of Feature Minimization. Archangeli (1984) defines Feature Minimization as a condition on the relative economy and value of (potentially) competing grammars.

"A grammar is most highly valued when underlying representations include the minimal number of features necessary to make different the phonemes of the language." (Archangeli 1984, p. 50)

A corollary to Feature Minimization is that every grammar will have one completely underspecified segment, one whose features will be determined completely by context-free feature fill-in rules. These rules provide the complementary feature values to the underlyingly available feature values for those segments which remain unspecified for a given feature. This is in many ways similar to earlier conceptions of underspecification. Halle (1959) invoked underspecified representations to reduce the number of marks necessary to distinguish one form from another for purposes of efficient memory storage

in the lexicon. Halle's conception of underspecification immediately filled in all features prior to entering the phonological rule component. However, in Radical Underspecification, underspecified representations persist throughout the derivation for as long as possible.

Redundancy Rules, rules which fill in a value for some feature [F] in predictable environments, are universally preferred to be ordered last in the lexical phonology. However, in the versions of Radical Underspecification being discussed here, they must be reordered to occur immediately before the first 'real' phonological rule which mentions feature [F]. This is accomplished by the Redundancy Rule Ordering Constraint (Archangeli, 1984), which has the effect of obviating any difference between underlyingly specified and redundantly specified segments at every relevant level of representation.

In models where vowel epenthesis is a process in which a melodically unspecified vowel slot is inserted into a string, the default features of an epenthetic vowel must be specified by context-free fill-in (default) rules, which are also ordered as late as possible (although other surface realizations of such an unspecified vowel might result from the prior application of other phonological rules). In Radical Underspecification this completely unspecified epenthetic vowel will be equivalent to the completely featureless underlying segment predicted by Feature Minimization at every relevant level of representation. The default values of language-particular underspecified representations are therefore trivially recoverable from the positive evidence of epenthesis, and information about the available underlying feature values is freely available to the language learner.

2. Garifuna Vowel Alternations in a Radically Underspecified Phonology

2.1 *Background*

Garifuna is an Arawakan language spoken by some 30,000 speakers in Central America, particularly Guatemala, Honduras, and Belize (Taylor, 1987). Spoken originally on the island of St. Vincent by displaced Africans who intermarried with a native Arawakan population, the Garifuna were deported to Honduras in the late 18th century. Garifuna has a long history of contact with other languages, both colonial and native, many of which have different syllable structure requirements than Garifuna. The language has an extensive loan vocabulary of varying degrees antiquity and nativization.

Garifuna has 16 consonant phonemes and six vowel phonemes. Two of the phonemes (the voiced postalveolar affricate /ɟʒ/, written <j>, and the mid, back vowel /o/)

are restricted to loanwords. While words with <j> are quite rare and are always judged as foreign-sounding by the native speaker, words with phonemic /o/ are rather common and seem not to strike Garifuna speakers as unusual. The phonemes of Garifuna are presented in (1) in the UCLA orthography, which is based on one proposed by Cayetano (n.d.). Garifuna stress and vowel nasalization are phonemic.

(1) Phonemic inventory in UCLA orthography

Consonants:				Vowels:		
p,b	t,d	ch,j	k,g	i	u, ü (<ü> = IPA [ɯ])	
f	s			e	o	
m	n				a	
	l					
w	r	y	h	Additional orthographic conventions:		
				stress = $\acute{}$ (\acute{u} = \hat{u}) nasalization = Vn		

The standard featural representations (Chomsky and Halle, 1968) of the vowels are given in (2). In particular, note the presence of three high vowels in the inventory, indicated in bold italics in (2): front, unround [i]; back, round [u]; and back, unround [ɯ], written <ü>.

(2) Garifuna vowels, as fully specified SPE feature matrices

<u>Orthographic:</u>	<i>i</i>	e	a	o	<i>u</i>	<i>ü</i>
high:	+	-	-	-	+	+
low:	-	-	+	-	-	-
back:	-	-	+	+	+	+
round:	-	-	-	+	+	-

2.2 A Radically Underspecified account of stem final epenthesis

According to Radical Underspecification, by examining a productive rule of vowel epenthesis, a language provides positive evidence as to what feature values are provided by default rules and which are underlyingly present. Garifuna stem-final epenthesis is just such a rule.

Garifuna allows only open syllables and very few onset clusters in its native and nativized vocabulary. It tolerates certain consonant clusters word-medially in recent borrowings, but does not allow syllables to be closed word-finally. In recent borrowings and proper names with closed final syllables, [i] or [u] is epenthesized to the end of the stem.

When the stem-final consonant is labial, the epenthetic vowel is [u], as in (3). The labial consonants have the expected phonetic values -- [p], [b] and [m] are bilabial, [f] is labiodental, and [w] is labiovelar. These consonants behave as a class for purposes of several rules, including those discussed here (Hagiwara, 1992).

(3) Stem-final epenthesis after a labial

né <u>f</u>	[ne f _ɸ]	'nine'	< Fr. <i>neuf</i> 'nine'
Garí <u>f</u> una		'Garifuna'	cf. "Carib" + <i>-na</i> (attributive, 'from a place')
pásam- <u>m</u>		'possum'	< E. <i>possum</i>
Pam- <u>m</u>			(proper name)
Rob- <u>m</u>			(proper name)

When the stem-final consonant is not one of the labials, as illustrated in (4), the epenthetic vowel is [i].

(4) Stem final epenthesis after a non-labial

a-féind <u>i</u> -ha-t-i	[a f ^h éi di ha t _i]	'painter (m); he paints'	< E. <i>paint</i>
ingl <u>e</u> s-i	[i 'gle s _i]	'English, Briton'	< Sp. <i>inglés</i> 'English'
John- <u>i</u>		(proper name)	
Jonathan- <u>i</u>		(proper name)	
Shantel- <u>i</u>		(proper name)	

The generalization to be made is clear. The [u] quality of this vowel arises as a result of assimilation to the labiality of the adjacent consonant. A Redundancy Rule such as "[+round] → [+back]" will ensure the derivation of a back vowel when the epenthetic vowel is labial. The features of the [i] quality, minimally [+high, -back], will be filled in by late default rules. The features [-high] and [+back] are thus identified as the values expected in underlying representation. The addition of the feature [+round], allows Radical Underspecification to distinguish the six vowels of Garifuna, as demonstrated in (5).

(5) Garifuna vowels as Radically Underspecified feature matrices

Orthographic:	i	e	a	o	u	ü
high:		-	-	-		
back:			+			+
round:				+	+	

(5) again uses standard SPE feature values. The analysis would have to be altered slightly if [round] is taken to be privative or a phonetic reflex of a LABIAL class node in a vocalic segment, but this would not change the argument significantly. If low, central /a/ is taken to be neither front nor back (and therefore could not be considered [+back]), the feature [+low] would have to be added. However, Feature Minimization would disallow the use of four features to distinguish only six vowels, since only three should be necessary. Three binary features can, of course, distinguish up to eight categories; four binary features can distinguish sixteen categories. While gaps in inventories are not necessarily disallowed in Radical Underspecification, Feature Minimization would require the removal of a feature when doing so would reduce the number of gaps.

Given such a vowel system, Garifuna stem-final epenthesis would follow the sequence in (6).

- (6) Derivational steps in stem-final epenthesis
- a. epenthesize an empty vowel slot to satisfy lexical syllable structure constraints
 - b. spread [+round] (or LABIAL) to empty vowel slot
 - c. [+back] → [+low] (Redundancy Rule)
 - d. [+round] → [+back] (Redundancy Rule)
 - e. context-free default rules (to complete derivation of [u]; derive [i])

Radical Underspecification makes one further prediction for Garifuna. The status of [i] as the 'default' surface quality of a clearly epenthetic vowel suggests that underlying /i/ (or rather, melodically featureless vowel slots in morphemes which surface as [i]), while potentially the target of assimilations, cannot trigger or block assimilation rules precisely because it is featureless.

2.3 *A problem for Radical Underspecification: possessive prefix alternation*

Garifuna marks possessed nouns with a prefix which surfaces either as [i] or [u]. The possessed noun is generally then prefixed again with a person marker which identifies the possessor. On occasions when the person, number, and gender features of the possessor are unavailable, such as in WH-forms exemplified in (7), the prefix appears on the noun by itself. This vowel is thus identified as a morpheme rather than the result of epenthesis between a consonant-initial stem and a consonantal prefix.

(7) Possessive prefix in WH-constructions

ká i-gárada	'whose book?'	cf. <i>ká gárada</i>	'what book, which book?'
ká u-péni	'whose pen?'	cf. <i>ká péne</i>	'what pen, which pen?'

The alternation of the final vowel in *péne* 'pen' when possessed is part of a process described by Taylor (1956), in which possessed nouns are distinguished from unpossessed nouns by several processes that effect the final vowel of the noun stem. The fact that this alternation occurs will be of some importance in Section 3 of this paper, but the details of this and other phonological alternations in the data which do not directly bear on the discussion of underspecification will not be commented on. Many are discussed in Hagiwara (1992).

As (7) suggests, the conditions which determine the surface quality of the possessive prefix vowel are similar to those which determine the quality of stem-final epenthetic vowel. When the following (stem) consonant is labial (8), [u] surfaces. If the stem consonant is not labial (9), then [i] surfaces. In most of the examples which follow, the possessive prefix is preceded by the first person singular prefix, *n-*.

(8) Possessive prefixation before a labial

nupéni	'my pen'	< péne	'pen' (< E. <i>pen</i>)
nubésina	'my neighbor'	< besína	'neighbor' (< Sp. <i>vecino</i>)
nufáluma	'my coconut'	< fáluma	'coconut' (< Sp. <i>palma</i> 'palm')
numúrisi	'my murisi (palm)'	< murísi	'murisi palm'
nuwéyali	'my man'	< wéyali	'man'

(9) Possessive prefixation before a non-labial

niléma	'my wood/my fire'	< léma	'wood/fire'
niháti	'my (special) month'	< háti	'month, moon'
ninádiri	'my plant'	< nádiri	'plant'
nigárada	'my book'	< gárada	'book' (< Sp. <i>carta</i> 'letter')

However, there is an additional twist to the possessive prefix alternations. When the stem consonant is labial but it is followed by an underlying /i/, the surface quality of the prefix vowel is not [u], but [i]. This is illustrated in (10).

- (10) Possessive prefixation before a labial which is followed by /i/

nibímena	'my banana'	<	bímena	'banana'
nimíbi	'my vine'	<	míbi	'vine'
nifíyadü	'my dollar'	<	fíyádaü	'dollar' (< Sp. <i>fiado</i> 'credit')

This presents a dilemma for Radical Underspecification. On the one hand, the strongest form of Radical Underspecification requires that no "underlying /i/" should be more fully specified than any other surface [i] at any level of representation. In particular, the /i/ of the stem should not have any features that the underspecified prefixal vowel (ultimately [i]) does not have.

On the other hand, the /i/ in the stem seems to bleed assimilation or spreading of the labial features from the consonant onto the prefixal vowel. The obvious way to block the association of labiality features from the stem consonant onto the prefix is to first have assimilated the prefix to some feature of the stem vowel with which [+round] is incompatible, perhaps [-back]. By invoking Structure Preservation (Kiparsky, 1985) or otherwise disallowing [+round, -back] segments, labial assimilation will fail to take place, and the default features of [i] will be filled in.

This requires /i/ in a stem have feature specifications other than the [i] of the prefix. If this is so, then underlying /i/ cannot be featureless, and thus neither the [i] quality of the possessive prefix nor the stem-final epenthetic vowel provide any explicit clues as to the underlying features available in lexical entries. This directly violates a very basic assumption of Radical Underspecification theory.

3. Underspecification Is Restricted to Certain Morphemes

Retreating from Radical Underspecification, the question remains how best to deal with the Garifuna data. The concept of Feature Minimization must certainly be abandoned. Certain other assumptions made in Radical Underspecification should be preserved. These include assimilation as spreading of features, assimilation as feature-filling rather than feature-changing, and Structure Preservation.

Since rounding of the prefixal vowel and the stem-final epenthetic vowel is assimilatory, the natural solution is to spread the relevant feature ([+round] or a LABIAL class node), in a feature filling manner, and to allow this to guide the remaining feature-filling rules. Further, because the condition in which rounding does not apply is exactly the case where the stem vowel is identical to the ultimate surface quality of the prefix, it is fair to assume that this too is due a kind of assimilation -- a non-local assimilation, or harmony.

as in Contrastive Underspecification (Steriade, 1987). In Garifuna, [o] is of indeterminate status phonemically, and does not alternate with [e]; neither appears in prefixes. The alternations expressed in (11) and (12) may thus be restricted to high vowels. In general, the mid vowels do not appear as prefixes, except as the result of some other phonological rule (Hagiwara, 1992).

(11) and (12) are not the only possible formulations of these rules. This discussion is primarily intended to demonstrate the feasibility of such an approach. The precise formulations, including feature values, conditions and filters are not of primary concern to this paper, as they do not bear on the question of underspecification, but on feature geometry, privativity, and other issues.

When neither rule applies, the prefix vowel remains underspecified. Thus recourse to some kind of 'default' rule, specifying the features of [i] just in the case when no other features are available, is still necessary. This is not necessarily an undesirable result, since additional evidence suggests that in fast or casual speech, other high vowel qualities may 'spread' over a dorsal consonant onto the underspecified vowel (13).

(13) 'Unexpected' vowel qualities in fast speech

[n <u>u</u> 'gu sɪ ʃũ]	<	nigúsiyun	'my knife'	(< Sp. <i>cuchillo</i>)
[n <u>u</u> 'guĩ wi]	<	nigûnwi	'my fish hook'	

(13) is explained by adopting the view of Keating (1988), that some forms of underspecification persist not only through the phonology, but into the phonetic component as well. It is only in the case when neither of the rules in (11) or (12) can apply to a possessive prefix when forms such as in (13) surface.

It might also be noted that the Rounding rule in (12) need not be directional. In the case of stem-final epenthesis, when the blocking rule in (11) has never been observed to apply, Rounding applies left-to-right. Rounding does not apply left-to-right, however, on the cycle which prefixes the person marker to the possessed form. In particular, the second person singular prefix, *b-*, does not trigger Rounding on an otherwise unspecified possessive prefix, that is, one to which neither Fronting nor Rounding could apply on an earlier cycle, as in (14).

(14) Second person singular possessives

binádiri	'my plant'	<	<i>b + V + nádiri</i>	'plant'	cf. *bunádiri
bigárada	'my book'	<	<i>b + V + gárada</i>	'book'	cf. *bugárada

This does not pose a problem for this analysis. Fronting and Rounding are likely to be early lexical rules (Hagiwara, 1992). The person markers, being inflectional, are likely to be affixed at a later lexical level than the one at which Fronting and Rounding apply. The WH-constructions in (7) suggest that marking a noun as possessed may be derivational in Garifuna. Possessed nouns appear to undergo a number of phonological rules (Taylor, 1956; Sands, 1991), which may be explained by possessive prefixation occurring relatively early in the lexicon. If this is so, assigning the possessive prefix to a higher morphological level than the person markers explains why Rounding may not be triggered by the second person singular prefix. Similarly, stem-final epenthesis probably occurs relatively early in the lexicon, since it is presumably the result of lexical syllable structure conditions.

4.0 Conclusion

This paper has presented data which require an analysis in which an underlying vowel must be more fully specified than an epenthetic vowel of the same surface quality, contrary to the assumptions of Radical Underspecification (Archangeli, 1984; Archangeli and Pulleyblank, 1986). Setting the assumptions of Radical Underspecification aside, an analysis has been proposed which nonetheless makes use of underspecified representations, but ones which do not result from an arbitrary requirement to reduce the number of marks in the lexicon.

In Garifuna, a melodically underspecified segment may be introduced by epenthesis to satisfy independently motivated requirements of syllable structure. Additionally, at least one particular morpheme, the possessive prefix, is lexically "harmonic"; it is the target of assimilatory spreading of features because it comprises a melodically underspecified segment. Whether this kind of underspecification is cross-linguistically specific to particular morphemes or morpheme classes, or can be derived from lack-of-contrast concerns or co-occurrence constraints for given segments, morphemes, prosodic positions, etc., as suggested by Contrastive Underspecification (Steriade, 1987), remains to be seen.

Underspecified morphemes become the targets of assimilations. The assimilation rules associated with alternations in such morphemes may be general, as in the case of Garifuna, specifying not only harmonic features in underspecified morphemes, but default features in unspecified segments produced by prosodic structure (i.e. epenthetic vowels).

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