PRENASALIZATION IN NCHUFIE REDUPLICATION, AND THE POWER OF STRUCTURE PRESERVATION^{*} Daniel Silverman

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0. Introduction

In this paper I analyze a productive process of total segmental reduplication affecting Nchufie adjectives. We will see that a process of optional prenasalization which conditionally applies under reduplication is blocked when the stem begins with a voiceless fricative. We will attempt to motivate this patterning in the context of Structure Preservation (Kiparsky 1982, 1985).

In Section 1 I present the preliminaries: the consonant inventory, and relevant lexical segmental processes. In Section 2 I present the process of total adjectival reduplication. Then I present a syntactically-triggered phenomenon of optional prenasalization which conditionally affects the process. I consider the systematic gap in prenasalization: voiceless fricative-initial bases do not undergo the process. I will additionally discuss an instance of obligatory, across-the-board, prenasalization. In Section 3, Two approaches to Structure Preservation are discussed in an attempt to account for the patterning of both optional and obligatory prenasalization. I will ultimately embrace elements of both.

1. Preliminaries

1.1. Consonant Inventory

In (1) is the underlying consonant inventory of Nchufie.

(1)		р	t	t∫	cç		i	u	u
	ph	th	t∫ ^h		cçh	к ^ћ	e		0
	mb	nd	nd3		ր _յ		3	ə	ວ
	f	S	ſ		ç			e	
		Z				Y		a	
	m	n			n	ŋ			
		1			λ				
					j	w			

The status of /v/ is questionable, as it has been found in only one form. /c/ is the voiceless palato-alveolar affricate. /N/ is the nasal glide. As /k/ is missing from the inventory, we might interpret [$_{Y}$] as underlying /k/.

1.2 Relevant Segmental Processes

The relevant segmental phonology involves derived prenasalization. Both voiced and voiceless prenasalized plosives are attested, both in underived and derived environments. However, prenasalized fricatives are not attested in underived environments, though may be derived under certain circumstances (to be discussed in section 3). Plain plosives regularly voice upon prenasalization. Aspirated plosives do not. In (2) is a sampling of underived prenasalized forms, indicating that voiceless as well as voiced plosives may follow nasals.

(2)	ŋk ^h u	(back (body part))
	ŋgл	(go)
	ndugo	(glass)
	njor	(steal)
	ŋgwaε	(book)

Following Jun (1992) and Steriade (1992), I assume prenasalized plosives are underlying sequences. Nasals which are not underlyingly prevocalic acquire the place node of the following segment, and thus we may assume that these underlying nasals are the placeless glide (cf. Trigo 1988).

(3)	NP		NP
		->	\setminus
	[place]		[place]
	(where $N = na$	sal, P	= plosive)

Important for the present investigation is the process of post-nasal hardening. This occurs among the glides, the liquid, and the voiced fricatives. Moreover, when /z/ undergoes the process, it palatalizes as well, presumably so that Structure Preservation is maintained (Kiparsky 1982, 1985): the segment inventory possesses the post-alveolar affricate, while lacking its alveolar counterpart. Indeed, the structure preserving nature of this segmental process will be shown to play a crucial role in our discussion of reduplication vis-a-vis prenasalization. In (4) are some examples of post-nasal hardening.

(4)	zoŋHL	'dry'	-	n dzoŋ ^L	'was dry'
	$_{ m VP}$ HL	'cold'	-	ŋ gə ^L	'was cold'
	λε ^{HL}	'clean'	-	n je ^L	'was clean'
	wurLHL	'amazing'	-	$\mathfrak{gur}^{\mathbf{M}}$	'was amazing'

As already noted, we may assume that nasals acquire place features from the following consonant. Upon the acquisition of place features, the nasals harden to stops. Now, the nasals' stricture features spread to the following consonant. If further modifications are required in order to preserve structure, these now apply. Thus laterality is lost from

prenasalized /l/, and the derived alveolar affricate becomes post-alveloar. Informally, the patterns in (5) emerge.

(5)		underlying	assimilation	hardening	<u>S.P.</u>
	Y :	Ny	ŋγ	ŋg	ŋg
	z :	Nz	nz	ndz	nj
	1:	Nl	nl	ndl	nd
	w :	Nw	ŋw	ŋgw	ŋgw

See Jun (to appear) for a fully formalized account of these processes.

2. Adjectives and Adjectival Reduplication

2.1 Tone Classes

The tonal patterning of Nchufie adjectives falls into two classes. On the surface, adjectives possess either a High-Low tonal pattern (Class A), or a Low-High-Low tonal pattern (Class B). examples follow.

(6)	Class A (HL))	Class B (LHL)
	1EHL	'split'	$_{j\epsilon}LHL$	'tall'
	wurHL	'short'	wurLHL	'amazing'
	рщ ^Н дшL	'red'	p ₂ L _{go} HL	'good'

The minimal pairs in (6) confirm the existence of an underlying tonal contrast.

2.2 Adjectival Reduplication

Adjectival reduplication occurs in adjectives which modify predicate nominals:

(a)	<mark>a^L k^haːHL</mark> it-small	'it is small'
	aH jeL kharHL-kharHL it-one-small-small	'it is a small one'
(b)	a ^L fuHL aH jeL fuHL-fuHL	'it is white' 'it is a white one'
(c)	aL _{zəŋ} HL aH jɛL _{zəŋ} HL-zəŋHL	'it is dry' 'it is a dry one'
	a ^L _{YƏ} HL a ^H jɛ ^L _{YƏ} HL _{-YƏ} HL	'it is cold' 'it is a cold one'
(d)	piːLH _{nt∫u} M _{հε} HL piːLH _{nt∫u} M mεL հεHL-հεHL	'Pinchu is clean' 'Pinchu is a clean child'
(e)	a ^L wurHL aH ŋɔL wurHL-wurHL	'it is short' 'he is a short man'

I have arranged the data so that the initial segment of the adjective increases in sonority as the list progresses, thus providing tokens of each distinct manner type, if attested. In (a) we see voiceless stop-initial adjectives undergoing the process. In (b) we see voiceless fricatives. In (c) we see the voiced velar fricative as well as the voiced coronal fricative. (d) shows a liquid-initial adjective, and (e) shows a glide-initial adjective. There thus far seems nothing peculiar about the process: any adjective of any segmental shape appears to be able to reduplicate freely, suggesting the input undergoes an ordinary process of full reduplication.

2.3 Optional Prenasalization

The reduplication story becomes somewhat more complicated when considering overtly tensed constructions. The Past and Future morphemes consist of nasality lexically associated with tonal material: High for Future ("^H"), SuperHigh for Past ("^H"). We thus observe the following patterns:

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(7)

aL thunHL (8) 'he kicks' he-kick arL Hn thunM 'he will kick' he-FUTURE-kick $a_{L} \underline{H}_{n t} h_{u_{1}} L$ 'he kicked' he-PAST-kick a^L k^har^{HL} 'he runs' $a_{I}^{L} H_{IJ} k^{h} a_{I}^{M} M$ 'he will run' $a_{i}L \underline{H}_{ij} k^{h}a_{i}L$ 'he ran'

Now observe how tense marking influences the process of reduplication.

(9)	$a_{I}L \underline{H}_{m} b_{\partial}L j_{\mathcal{E}}L j_{\mathcal{I}} + HL j_{\mathcal{I}} + HL j_{\mathcal{I}}$	'it was a cold one'
	it-PAST-copula-one-AGRcold-AGRcold	
	$a_{i}L \underline{H}_{m b a}L_{j \epsilon}L_{\gamma a}HL_{\gamma a}HL$	'it was a cold one'
	$_{a_i}L \stackrel{H}{=}_{m} _{b \ominus}L _{j \epsilon}L _{\underline{\eta}k}h_{a_i}HL _{\underline{\eta}k}h_{a_i}HL$	'it was a small one'
	arL Hm bəL jeL kharHL-kharHL	'it was a small one'
	arL Hm bəL jeL pjeHL-pjeHL	'it was a clean one'
	$a_{i}L \underline{H}_{m} b_{\partial}L j_{\mathcal{E}}L \Lambda_{\mathcal{E}}HL \Lambda_{\mathcal{E}}HL$	'it was a clean one'
	$_{a:}L H_{m b \Rightarrow}M _{j \in}L _{\underline{m} b \nearrow}L_{go}L_{\underline{m} b \curlyvee}L_{go}HL$	'it will be a good one
	$a_{i}L H_{m b} M_{je}L_{p2}L_{g0}L_{p2}L_{g0}HL$	'it will be a good one
	$a_{I}L \stackrel{H}{=} m b_{\partial}L j_{\mathcal{E}}L \frac{n}{n} d_{30\eta}HL - n d_{30\eta}HL$	'it was a dry one'
	$a_{r}L \xrightarrow{H}{m} b_{\partial}L j_{\epsilon}L z_{o\eta}HL z_{o\eta}HL$	'it was a dry one'

Nasality optionally—though preferably—appears on the adjective. As nasality occurs in both base and copy, I conclude that it attaches before reduplication. We may thus preliminarily posit the following partial derivation:

(11)	1. 2.	input prenasalization	CV N-CV \/ [place]		
	3.	reduplication	N-CV N-CV \/ \/ [place][place]		

2.4 The Exception

Despite nasality's optional though preferred appearance on predicate nominal-modifying adjectives in overtly tensed constructions, there is a systematic exception in the data, exemplified in (11).

(11)	a:L Hm bəL jeL fwoHL-fwoHL it-PAST-copula-one-bright-bright	'it was a bright one'
	$*_{ai}L \xrightarrow{H}_{m} b_{\partial}L_{j\epsilon}L_{\underline{m}fwo}HL_{\underline{m}fwo}HL$	
	a:L <u>H</u> m bəL jɛL fuHL-fuHL *a:L <u>H</u> m bəL jɛL mfuHL-mfuHL	'it was a white one'
	aːL <u>H</u> m bəL jɛL ʃɯL-ʃɯHL *aːL <u>H</u> m bəL jɛL nʃɯL-nʃɯHL	'it was a tall one'
	a [,] L <u>H</u> m bəL jeL 1eHL-çeHL *a [,] L <u>H</u> m bəL jeL <u>nçe</u> HL- <u>nçe</u> HL	'it was a split one'

Otherwise optional prenasalization is disallowed in all instances of voiceless fricative-initial adjectives.

2.5 Obligatory Prenasalization

Note that in the following forms voiceless fricative-initial adjectives and verbs regularly *do* take prenasalization when its presence is obligatory.

(12)	aːL <u>H</u> ŋ çɛL it-PAST-split	ʻit was split'	$(*a:^{L} \underline{H}_{c} \underline{c}^{L})$
	ar ^L <u>H</u> p çe ^L	'it was tall'	$(*ar^{L} \underline{H} ce^{L})$
	a ^L H _m fuoL	'it will be bright'	$(*a_{L} H fuo^{L})$
	ar ^{L H} m fu ^L	'it will be white'	$(*ar^{L} H fu^{L})$

These data indicate that the prenasalization of voiceless fricatives is *not* disallowed categorically. It seems that in morphological operations which are required either by the grammar, or by a recoverability requirement, as in tense marking in predicate adjective constructions, prenasalization may indeed result in a non-structure-preserving output.

3 Approaches to Structure Preservation

In this section I will attempt to explain the asymmetry between optional prenasalization and obligatory prenasalization by invoking Structure Preservation in the context of Lexical Phonology (Kiparsky 1982, 1985).

Lexical rules are claimed to be structure preserving, in that their application may not produce new segments, or, under certain analyses, new sequences of segments (Borowski 1986). Thus throughout the lexical phonology, the output of rules may only result in segments and sequences present in the underlying inventory. Structure Preservation does not hold in the post-lexical phonology, however. Post-lexical rules may create novel segments, i.e., segments not found in the underlying inventory, and non-underlying sequences of segments.

There are, however, different possible ways to invoke Structure Preservation. The first approach to the process we will discuss might be termed Static Structure Preservation, as the principle holds blindly within the lexical phonology: any lexical process that produces a non-structure-preserving output is blocked from applying, presumably through feature co-occurence, or, as in the case at hand, phonotactic constraints. These are traditionally referred to as *constraints* or *filters* (Clements and Keyser 1983, Borowsky 1986, Myers 1991).

The second approach to Structure Preservation we might call Active Structure Preservation, as the principle may itself be the trigger of particular phonological rules. Specifically, Active Structure Preservation may not have the power of preventing rules from applying when their output is non-structure-preserving. However, the principle may re-impose Structure Preservation on such an output by triggering further phonological processes. Myers' (1991) refers to such processes as *persistent rules*.

Having presented these two conceivable approaches to Structure Preservation, let us recall the prenasalization facts from Nchufie. First, recall the morpheme-internal segment sequencing constraints of Nchufie presented in Section 1. While nasals may precede any plosive, they may not precede fricatives. Now recall the prenasalization facts from adjectival reduplication: nasality optionally though preferably appears on both copies of object modifying adjectives in the Past and Future. Voiced fricative-initial adjectives harden upon prenasalization, while voiceless fricative-initial adjectives may not be prenasalized.

Let us now consider the two approaches to Structure Preservation, and see if either can account for the facts.

Static Structure Preservation forbids lexical rules from applying if their output violates Structure Preservation. This approach will obviously fail to account for the data, as the process of optional prenasalization—more often than not—obviously results in an intermediate violation of Structure Preservation. Consider the attested alternations alongside those predicted to obtain with Static Structure Preservation:

(13)			Predicted	Attested
	i.	N+p	*mp	mb
	ii.	N+s	*ns	nd
	ii.	N+z	*nz	nj
	iii.	N+y	*ŋ ɣ	ŋg
	iv.	N+1	*nl	nd
	iv.	$\mathbf{N} + \mathbf{w}$	*ŋw	ŋgw

Only in the case of voiceless fricative-initial forms does Static Structure Preservation make the right prediction. In all other cases, the process is able to apply, though in every successful application are there additional rules required in order that Structure Preservation is re-achieved. These facts would strongly indicate that it is Active Structure Preservation that may successfully account for the data.

Unfortunately, Active Structure Preservation would additionally predict that voiceless fricative-initial forms should be able to undergo the process of prenasalization, resulting in an intermediate violation which is subsequently repaired by rules triggered by the principle:

(14)		Predicted	Attested
	i.	mf	f
	ii.	Ns	S

Active Structure Preservation predicts that voiceless fricative-initial forms should just as readily optionally take prenasalization as other forms do.

It thus seems that neither Static nor Active Structure Preservation will fully account for the data. We might preliminarily investigate a third alternative, something falling in-between the two aforementioned approaches. It might be the case that Structure Preservation possesses reparative powers on an intermediate violation, but only to a limited extent. That is, if an intermediate lexical violation requires the application of X number of rules, or type Y rule, Structure Preservation may trigger their application. However, if an intermediate violation requires X+1 number of rules, or type Z rule, in order for Structure Preservation to be re-achieved, the entire process fails. While the data from Nchufie are seemingly insufficient to confidently zero in on the value of X, or rule type Z, a quick glance at the data would suggest that such a hypothesis is tenable. Specifically, attested prenasalized forms are far less distinct from their underlying forms than those otherwise predicted to surface in unattested forms.

4 Conclusion

Optional prenasalization in Nchufie suggests that two types of Structure Preservation may play a role within a single phonological system.

Still, the above scenario yet remains rather speculative. Perhaps further research will yield both more compelling evidence for the dual nature of Structure Preservation, and a formal account of the observed phenomena.

Class A		Class B	
wurHL	'short'	wurLHL	'amazing'
larHL	'sticky'	çεLHL	'long/tall'
lwi ^{HL}	'bitter'	zoLHL	'itchy'
λε ^{HL}	'clean'	purLHL	'left over'
zəŋHL	'dry'	p ₂ L _{go} HL	'good'
_{Yə} HL	'cold'	puLpuHL	'spoiled'
γογοHL	'foolish'		
fufuHL	'white'		
fwoHL	'bright'		
∫iHL	'black'		
1eHL	'split'		
թա ^H ցաL	'red'		
phurHL	'ugly'		
kharHL	'small'		

Appendix: Elicited Adjectives

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