2. NC and Place Assimilation in Zulu

Nasal place assimilation is a common phenomenon throughout Bantu, typically occurring at a morpheme boundary when a nasal segment from a noun class marker or agreement morpheme abuts the initial consonant of a noun or verb stem (Meinhof 1932, Kerremans 1980, Herbert 1986). Zulu exhibits some of the canonical effects of Bantu nasal place assimilation, such as postnasal hardening, as well as some more novel ones, such as postnasal deaspiration (Doke 1969). In this section, I will give an overview of the behavior of NC sequences in Zulu, both in assimilating and non-assimilating contexts at morpheme boundaries as well as in stem-internal position. As the Zulu data will show, the effects on the trigger associated with place assimilation are clearly the result of the place assimilation, and not simply an aspect of NC phonology in Zulu.

2.1. Background

Zulu has the following consonant inventory:

Table 1. Zulu consonants

	labial	alveolar	post-veolar	palatal	velar	glottal	labial-velar
plosive	p' p^h b ɓ	t' t^h d			k k' k^h g		
nasal	m	n		ɲ	ŋ		
fricative	f v	s z ɬ ɮ	ʃ			h ɦ	
affricate		ts dz tɬ dɮ	tʃ dʒ				
approx.		l		j			w

click consonants	dental ǀ	lateral ǁ	alveolar ǃ
aspirated	ǀ^h	ǁ^h	ǃ^h
voiced	ɡǀ	ɡǁ	ɡǃ
nasalized	ŋǀ	ŋǁ	ŋǃ

Syllables in Zulu are typically open, glide insertion occurs to prevent hiatus, and the only consonant sequences found are NC sequences (Doke 1969).[1] NC sequences, homorganic and heterorganic, arise both stem-internally and at morpheme boundaries. I list in Table 2 the attested stem-internal sequences found in Zulu.[2]

Table 2. Stem-internal Clusters

Homorganic Clusters

mp'	nt'	ŋk'
mb	nd	ŋg
mpf mbv	nts ntʃ ndz	
	ntɬ ndɮ	ɲdʒ
mm mw		ɲj

Heterorganic Clusters

mt' mt^h	mk' mk^h	tw kw
md		dw gw
ms mʃ mtʃ		sw ʃw tʃw
mz mɬ mɮ		zw ɬw ɮw
mn mɲ mj	mŋ	nw ɲw

What is striking about this distribution is that /m/ is the only nasal to appear in heterorganic nasal-obstruent sequences; all other nasals only appear with following homorganic consonants or a labial glide. As we will see, this stem-internal NC distribution mirrors what we find in NC sequences occurring at morpheme boundaries.

1. Whether homorganic NC sequences of this sort should be analyzed as consonant clusters or single prenasalized segments has been debated in the literature. While such Bantu clusters have often been analyzed as single segments (cf. Herbert 1986), phonetic evidence shows little to no difference in duration, timing, and syllabification between NC sequences typically analyzed as single segments and those considered to be a two-segment cluster (Browman and Goldstein 1986; Ladefoged and Maddieson 1986; Downing 2005). For the purposes of this analysis, the status of these NC sequences is perhaps not crucial; for ease of comparison, I have included all NC sequences, both homorganic and heterorganic in a single table of "consonant clusters," and will set aside the issues of whether some of the sequences belong in the consonant inventory and whether there exists two types of homorganic NC in Zulu–prenasalized single segments and homorganic NC clusters.
2. Based on a survey of stem initial clusters found in Doke et al. 1990. A further search of sequences inside stems is needed to ensure that there are no gaps.

2.2. NC at morpheme boundaries

Due to the V or CV nature of most Zulu syllables, nearly all morpheme boundaries are CV, VC, or VV. However, four noun class prefixes end in a nasal that creates an NC sequence when prefixed to C-initial stems. Two of the noun class prefixes end in a nasal that undergoes place assimilation with the initial consonant of the noun root, class 9 *iN-* prefixes (singular) and class 10 *iziN-* prefixes (plural). In contrast, classes 1 and 3 (both singular), which are both marked by an *um-* prefix, do not undergo nasal place assimilation in Zulu:

(2) Classes 9 & 10

iN/iziN+ . . .

a. izi**ŋ**-k'ek'e 'lopsided objects'
b. izi**n**-t'wa 'chasms'
c. izi**m**-p'otʃo 'enemas'
d. izi**ɲ**-yememe 'stampedes'

(3) Classes 1 & 3

um+ . . .

a. u**m**-k'ik'ilizo 'insinuation'
b. u**m**-t'ek'et'e 'weakling'
c. u**m**-p'aso 'a slap'
d. u**m**-yeni 'husband'

Assessing the identity of the underlying nasal in the assimilating prefixes is not straightforward. Elsewhere in Bantu, the underlying nasal in assimilating prefixes is described as /n/ or /ɲ/ based on patterns found with vowel-initial stems. In Zulu, vowel initial stems are rare. In at least some of the vowel-inital cases, N in *iN/iziN* disappears altogether, in contrast to the nasal in the *um-* prefix[3]:

(4) Vowel-initial noun stems

a. iziN + -aluk'o → iz-aluk'o 'grass mats'
b. iN + -anɬuk'ano → i-yanɬuk'ano 'quarrel'
iziN + -anɬuk'ano → iz-anɬuk'ano 'quarrels'
c. um + -abi → u**m**-abi 'executor'

3. There is historical evidence that other roots in Zulu, including *ɲoka* 'snake' and *ɲoni* 'bird' came from vowel-initial Bantu stems (-oka and -oni), with arising through place assimilation. Currently, Zulu speakers seem to interpret these stems as being ɲ-initial (Doke et al. 1990).

For the purposes of this paper, I will remain agnostic about the underlying identity of the assimilating nasal (but see Padgett 1995 for an argument that the assimilating nasal is underlyingly velar). For my analysis, it is sufficient to note that the behavior of the assimilating nasal contrasts with the behavior of /m/ in the um- prefix.

In addition to the occurrence of place assimilation of N in class 9/10 *iN/iziN*, the trigger segment, C, of NC sequences at the morpheme boundary exhibits a number of additional changes, first noted by Doke (1969). These changes are all absent in unassimilating mC sequences. Most of these effects fall into two categories: loss of laryngeal features and postnasal hardening.[4]

2.2.1. Loss of laryngeal features

While Zulu contrasts implosive /ɓ/ with non-implosive /b/, this contrast is lost after an assimilating nasal: underlying /ɓ/ becomes [b]. After um-, the contrast is maintained:

(5) a. iN + ɓali → imbali 'truth' cl. 9
b. um + ɓali → umɓali 'color' cl. 3

Additionally, underlyingly aspirated consonants become unaspirated after an assimilating nasal, but not after um-:

(6) a. iN + tʰando → int'ando 'free will' cl. 9
b. um + tʰando → umtʰando 'love, desire' cl. 3

That these aspirated consonants become ejectives, and not plain stops, is an issue I will address in the analysis in the following sections. Underlyingly ejective consonants, as seen in (2), undergo no laryngeal changes.

2.2.2. Postnasal hardening

Postnasal affrication, a common cross-linguistic hardening effect (cf. Padgett 1994), is found in assimilating Zulu NC sequences, but not unassimilated mC:

(7) a. iN + **s**indiso → in**ts**indiso 'salvation'
b. iziN + ʃaŋgane → izint**ʃ**aŋgane 'wanderers'
c. iN + **f**ene → im**pf**ene 'baboon'
d. um + ʃikisho → um**ʃ**ikisho 'friction'

4. One effect, postnasal voicing of non-nasal clicks, doesn't fit clearly either category. I will set this effect aside for the analysis here. While it will not be addressed in this work, one potential way to analyze the voicing of the non-nasal clicks in assimilating NC that is compatible with the analysis developed here is that the voicing is necessary to be faithful to the nasal-oral sequence of the NC.