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REANALYZING PRENASALIZED CONSONANTS

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1. Introduction[1]

The exact status and treatment to be accorded so-called "prenasalized consonants" which contrast in many languages with simple nasal consonants and simple oral consonants have puzzled linguists for decades. It has traditionally been assumed that those prenasalized consonants which are not morphologically complex are unitary segments because 1) the two components are homorganic, 2) they evidence surface length of "simple" consonants, and 3) they function within a single syllable. Detailed arguments for this latter claim are difficult to come by and are often based solely on the fact that native informants when asked to artificially break up words containing prenasalized consonants into smaller pieces (supposedly equivalent to syllables) will place the prenasalized consonant in a single unit. Thus, in Luganda:

(1)	lùgándà	lu-ga-nda	'Luganda'
	mùntú	mu-ntu	'(the) man'
	lyèmvû	lye-mvu	'ripe banana'

which syllabification corresponds nicely to the canonical Bantu syllable structure. However, such artificial syllabification is often learned and therefore of questionable linguistic value. Also, as I will define the term <u>syllable</u>, it refers to a type of organization severely different from that presented by such arguments. This will be expanded shortly.

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[1] This paper is a revised and expanded version of my paper presented at the 1974 Winter LSA meeting entitled "Prenasalized Consonants as Consonant Clusters." I am grateful to Amy Myers and Arnold Zwicky for their helpful comments on an earlier version of the paper and especially to Ilse Lehiste under whose guidance the research was carried out.

Various attempts have been made to classify "natural" segment sequences with reference to markedness theory (e.g., Chomsky and Halle [1968, Chapter 9]). This same goal is attempted by the various "sonority hierarchies" which have been proposed which purport that the internalness of a segment is a direct function of its sonorance, i.e., maximally sonorant segments are to be found in the center of the syllable with the sonorance of segments decreasing as the syllable margins are approached. Thus, Semiloff-Zelasko [1973:604] gives the following "typical" order from syllable margin to syllable margin:

(2) Obst-Nas-Liq-Glide-Syllabic-Glide-Liq-Nas-Obst

However, neither of these treatments attempts to specify which sequences may combine to form segments or at least to function as unit segments. In the latter case, it seems as if complex unitary segments are defined only when a violation of the sonority hierarchy would otherwise obtain, e.g., a nasal is more sonorant than an oral stop and should therefore be more internal. In the case of prenasalized consonants, this universal condition is not met, so a complex unit segment is defined.

(3) * [n d a] but [nd a]
$\quad\quad$ 1 2 3 $\quad\quad$ 1 2

This same type of reasoning is used by linguists who state that the canonical Bantu syllable is of a CV form and claim therefore that prenasalized consonants are to be analyzed as simple unit consonants.

2. Traditional Analyses

Chomsky and Halle [1968:316-7] suggest three possible alternatives for the treatment of prenasalized consonants within modern phonological theory. First, they suggest that it may be necessary to posit some feature which will govern the timing of different movements within a simple segment. For example, in the case of prenasalized consonants, we would need a feature to account for the raising of the velum prior to the release of oral occlusion. One advantage of this proposal is that it would allow us to extend the treatment of prenasalized consonants to postnasalized consonants (i.e., stops with nasal plosion) by means of a simple reversal of the feature specification. Thus, whatever the exact feature chosen, [ndo] and [dno] would have mirror-image specifications.[2] This analysis parallels the distinction between various other types of mirror-image distinctions, e.g., pre-aspiration vs. post-aspiration in Modern Icelandic, pre- vs. post- vs. simultaneous glottalization, release of doubly articulated consonants, and possibly voice-onset time.

Chomsky and Halle's second alternative makes reference to their already motivated feature [delayed release]; the difference between ordinary nasal and prenasalized consonants would be an instance of instantaneous vs. delayed release. Thus, the treatment accorded prenasalized consonants would be similar to that accorded affricates. Chomsky and Halle see no way to argue the phonetic validity of this proposal. Upon close examination, however, it seems clear that some process very different from a simple delayed release of stricture is at work. Timing of release of stricture has no relevance for velic closure. Even if we interpret this proposal to mean only that timing considerations are involved, I will demonstrate that this weaker proposal is itself insufficient. The last of Chomsky and Halle's alternatives, which they attribute to J. McCawley (p. 317 fn.), is that prenasalized consonants be regarded as obstruent nasals (and hence [-sonorant]) as opposed to the more familiar type of nasals which are [+sonorant]. This proposal must be rejected since the nasal component of prenasalized consonants is indeed sonorant as is evidenced by the fact that in many languages

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[2]The use of such a feature makes predictions of possible changes which are, as far as I know, unattested. That is, if we posit a single feature with reverse specifications to account for the difference between [nd] and [dn], the claim is inherent that a possible change would make use of this feature, e.g., [nd] → [dn] or [dn] → [nd] in some environment. The same question arises for all the other mirror-image distinctions, e.g., aspiration. However, a possible example of the use of such a feature comes from the distribution of nasal consonants in Kaingáng, a language of Brazil:

$$\begin{aligned} n &\ /\ \tilde{V}\underline{\qquad}\tilde{V} \\ nd &\ /\ \tilde{V}\underline{\qquad}V \\ dn &\ /\ V\underline{\qquad}\tilde{V} \\ dnd &\ /\ V\underline{\qquad}V \end{aligned}$$

in initial position it forms a separate syllable, is tone-bearing, and hence [+sonorant]:

(4)	ǹjúkì	ɲ-ju-ki	'(the) bee'
	m̀pâ	m-pa	'give me'
	ŋ̀kúbà	ŋ-ku-ba	'rain'

This same piece of evidence argues against the validity of the artificial syllabification analysis presented earlier.

A more recent proposal is that of Campell [1974] wherein he argues that complex units, e.g., affricates, labialized and palatalized consonants, and, I assume, prenasalized consonants as well, be described by means of multi-columned matrices, e.g.,

(5) [ns]
$$\begin{array}{c} \mathrm{C} \\ \begin{bmatrix} +\mathrm{nas} & -\mathrm{nas} \\ +\mathrm{voi} & -\mathrm{voi} \\ -\mathrm{cont} & +\mathrm{cont} \\ +\mathrm{tone} & -\mathrm{tone} \\ +\mathrm{cor} & \end{bmatrix} \end{array}$$

Constraints on what features can co-occur will be stated as universal redundancy or marking constraints although exactly how this is to be accomplished is still unclear. Campbell notes that complex symbols do not necessarily refer to non-unit segments since they are treated as unit segments in many languages. Rules may refer to either or both columns of matrices with no restrictions.

Amy Myers [1974] opts for a "vector feature", representing a changing, vectoring value over the duration of the segment, to account for the prenasalized consonants of Kikuyu. This feature, termed [early velar closure], is in spirit identical to Chomsky and Halle's first proposal for a movement feature. It refers to complex derived prenasalized consonants as units partaking of qualities of both components. Myers notes that other vector features are already motivated and are by no means characteristic of segments only. For example, Leben [1971] has demonstrated that two tones can be compressed onto a single segment and behave as a single unit. The problem with such an analysis is that it can account only for the most common sort of prenasalized consonants, i.e., prenasalized voiced plosives:

(6) mb nd ɲj ŋg

which are, in fact, the only prenasalized consonants in Kikuyu since nasals are obligatorily deleted before continuants and a voiceless plosive after a nasal assumes the voicing specification of the nasal. Myers' rule for deriving prenasalized consonants from morphologically complex sequences of nasal + consonant is:

$$(7)\quad \underset{1}{\begin{bmatrix} +\text{nas} \\ +\text{cons} \end{bmatrix}} \; \underset{2}{\begin{bmatrix} -\text{nas} \\ -\text{cont} \end{bmatrix}} \rightarrow \underset{[+\text{e.v.c.}]}{1} \quad \emptyset$$

which now treats prenasalized consonants as a special subclass of nasal consonants with which they pattern in certain phonological rules.

However, although other types of prenasalized consonants are less common, they do indeed occur in the languages of the world. Luganda, a Bantu language of East Africa, for example, evidences not only the more common prenasalized voiced plosives but prenasalized voiceless plosives and prenasalized voiced and voiceless continuants:

(8) Luganda: mb nd ɲj ŋg
mp nt ɲc ŋk
mv nz
mf ns

Obviously, a simple movement feature such as that proposed by Chomsky and Halle and utilized by Myers will not be able to account for these segments. Campbell's complex symbol proposal would give us feature specifications like that in (5) which seem intuitively ad hoc, unnatural, and, it will be argued, largely useless for phonological analysis.

3. Phonetic Evidence for a Cluster Analysis

For unit segment analyses in general, there is the problem posed by the fact that the nasal component of prenasalized consonants, in Luganda and many other languages, is syllabic in initial position in that it comprises a separate syllable. I will demonstrate that for purposes of syllabification and timing, the two components are indeed always members of separate syllables and are, therefore, not to be treated as comprising unitary (complex or not) segments.

3.1 Syllables and Timing. It is important to state how the term syllable will be utilized in this paper. Syllable refers to an abstract unit of organization which underlies the timing system of the language. It has been demonstrated by Slis [1968], Kozhevnikov and Chistovich [1965], Lehiste [1970], and Shockey, Gregorski, and Lehiste [1971] for diverse languages that the duration of a multisegmental string of speech is fairly rigidly determined, i.e., that speech is programmed at some unit higher than individual segments. Whether this unit be the syllable, word, phonological phrase, or sentence is not at issue here. The duration of the higher unit is predetermined; the durations of individual segments may vary only as long as their sum equals approximately the duration of the higher unit. If speech is programmed at a level higher than single segments, we expect negative correlations (temporal compensations) between the subparts: if one part is longer than average, another will be shorter than average. Temporal compensation at the level of the syllable in Luganda forces us to regard prenasalized consonants as consonant clusters which superficially present the combined length only slightly greater than units, but, at all times, the nasal and non-nasal components maintain their individual integrities.

3.2 Method. For purposes of this investigation, recordings of the speech of Mr. Henry Ssali, a native of Kampala, were made in an I. A. C. sound-treated chamber. The recordings were a series of about 150 polysyllabic words uttered in a single sentence frame:

(9) Ñjogera _____ omulundi gumu. 'I am saying _____ once.'

with the informant asked to read at "a normal rhythm." The first and last tokens produced were discarded since these would be expected to evidence the most deviation rhythmically. The recordings were analyzed by means of broad-band spectrograms produced on a Voiceprint 700 Spectrograph and were also processed through a Frøkjer-Jensen Transpitch meter and recorded in the form of duplex oscillograms by an Elema-Schönander mingograph at a speed of 100 mm/sec. Segmentation of the oscillograms was performed according to the standards set forth in Naeser [1969].

3.3 Results and Discussion. It was early established that there is a constant durational ratio, approximately 1:2, between short and long (not lengthened) vowels in Luganda.[3] This ratio is based on an analysis of some 275 tokens and holds true for syllables such as:

(10) /a/ vs. /aa/; /ka/ vs. /kaa/

In fact, syllables such as:

(11) /aa/ and /ka/

will evidence the same surface length, which is one-half the surface length of:

(12) /aa/ and /kaa/

This suggests that temporal compensation for the absence of a consonant onset occurs at the level of the syllable in Luganda.

There is a rule in Luganda:

(13) $V \rightarrow [+long] \quad / \ \underline{\quad} \ NC$

The problem presented by this rule is that vowels lengthened by it are longer than underlying short vowels and not as long as underlying long vowels. How then do these phonologically lengthened vowels fit into the timing system of Luganda and what specifically is the motivation for vowels lengthened before prenasalized consonants?

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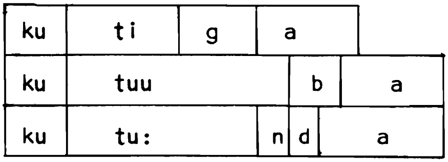
3 The surface vowel system includes five qualities and two quantities. The actual mean ratio for length differentation is 1:1.925. Measurements of vowels were taken only in medial position. Tone was shown to have no effect on vowel quantity (cf. Lehiste [1970]).

It is clear that V:NC sequences (where V: represents a phonologically lengthened vowel) are realized as V:N$_{\$}$C (where $ represents the syllable boundary). The strongest evidence in support of this analysis is that syllables of the shape CVV (where VV represents an underlying long vowel) are durationally equivalent to sequences CV:N$_{\$}$. This pattern is schematized below:[4]

(14) CVV = CV:N$_{\$}$

kùtígá
'to handle'
kùtúúbá
'to arrive early'
kùtú:ndá
'to sell'



where two examples of negative correlations are to be observed: the vowel /u/ in kutunda lengthens before the prenasalized consonant and in the same form /a/ lengthens to account for the shortness of its syllable onset. Both lengthenings have as their goal the maintenance of a certain syllable weight. Since the combined durations of the two components of prenasalized consonants are only slightly longer than unitary consonants, we have a natural explanation why lengthened vowels (V:) are not as long as underlying long vowels (VV). We want to consider the nasal component of prenasalized consonants as a member of the syllable to its left and the non-nasal component a member of the syllable to its right.

I propose that there exists a distinction between two basic syllable weights in Luganda: light and heavy. A <u>light</u> syllable is one which is composed of a single mora:

(15) CV, V, C̩

<u>Heavy</u> syllables are composed of two or more morae and therefore show a good deal more typological variation:

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[4] The duration of each segment was measured from the oscillogram with an accuracy estimated to be to the nearest 1/2 mm. or 5 msec. This schema is based on an analysis of some 25 such pairs.

(16) a) compound (i.e., long) vowel nucleus
b) a CG onset
c) a C offset
d) both b and c

Further evidence for this basic two-fold distinction in syllable length comes from the fact that heavy syllables other than CVV and CV:N evidence the same surface length. Thus, we might extend the schema above to include CGV: sequences since there is another compensatory rule in Luganda:

(17) $V \rightarrow [+\text{long}] / CG \_\_\_$

so that:

(18) CVV = CV:N = CGV:

kùtáámá 'to grow fierce'	ku	taa		m	a
kùtá:ndá 'to betray'	ku	ta:	n	d	a
kùtyâ:bá 'to go collect'	ku	tya:		b	a

It is possible to have syllables of the shape CGV:N in Luganda which, according to traditional mora-counts, would be said to be composed of three morae: a complex onset, short vowel nucleus, and consonant offset. This might be termed an "extra-heavy syllable." However, syllables in Luganda are only either light or heavy, and reference to morae is really superfluous. Thus, the root vowel in kutyanka theoretically has two reasons to lengthen: once by the CG onset and once by the following prenasalized consonant. In fact, both lengthenings do not occur or, if they do, one applies vacuously since a 3-morae syllable has the same length as a 2-morae syllable:

(19) CVV = CV:N = CGV: = CGV:N

kùtáámá 'to grow fierce'	ku	taa		m	a
kùtá:ndá 'to betray'	ku	ta:	n	d	a
kùtyâ:bá 'to go collect'	ku	tya		b	a
kùtyá:ŋká 'to hoax'	ku	tya:	ŋ	k	a

Additional evidence for this analysis is presented by a casual speech process whereby prenasalized consonants are replaced by simple nasal consonants. Thus, kutwanga may be either [kutwã:ŋga] or simply [kutwã:ŋa]. Of course, the CG onset still works for vowel lengthening, but it is clear that the nasal originates in the left-most syllable since that vowel may be heavily nasalized and nasalized vowels are not to be found before simple nasal stops. This will be expanded shortly. It is clear that the non-nasal component is deleted and not nasalized since we would in that case expect a geminate nasal. Thus, even as late as casual speech rules, the two components do not function as a unit segment.

It is interesting to note that before geminate consonants, vowels obligatorily shorten in Luganda. I claim that both prenasalized and geminate consonants are clusters derived synchronically by a single phonolgogical rule. Thus, the distinction:

(20) V → [+long] / ___NC

(21) V → [-long] / ___CC

is a perplexing one, but I believe there is a phonetic motivation for it. In the case of geminate clusters, the only distinction between single and geminate consonants is the duration of stricture. This is again a simple durational contrast on the order of 1:2. The perception of geminates is reinforced in certain cases by vowel shortening:

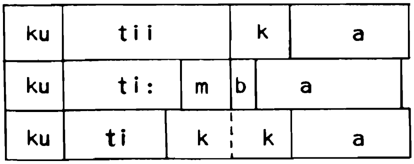
(22)	/ba-naa-ta/	banaata omulenzi	'they will set the boy free.'
	/ba-naa-tta/	banatta omulenzi	'they will kill the boy.'

where consonant and vowel length work together for perception. In the case of prenasalized consonants, the opposition between simple and prenasalized consonants is not remotely related to duration. It is a distinction based exclusively on velar closure during production.[5]

Further evidence for this analysis is presented by the schema:

(23) CVV = CV:N = CVC

kùtííká
 'to fancy'
kùtí:mbá
 'to bind'
kùtìkká
 'to lift'



where, although no clear acoustic cues for segmentation of the geminate cluster are present, it appears appropriate to segment on the basis of an already established syllable weight. The vowel before the geminate shortens since each component of the geminate has normal consonant length; it lengthens before prenasalized clusters since the cluster as a whole presents normal consonant length.

3.4 <u>Implications</u>. Analyses claiming that the mora, strictly defined, is the unit of timing in Modern Luganda (cf. Stevick [1969]) clearly miss an important generalization when they report that sequences such as:

(24) CGV:CGV:NCV

CVCVCVCVCVCV

would both be composed of six morae; they do not evidence the same surface length. It seems more accurate to refer to the first as

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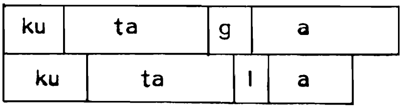
[5] It is interesting to note that sequences of nasal + nasal are treated as geminates in Luganda and are therefore always preceded by short vowels. In Runyankore, a very closely related language, however, nasal + nasal sequences are accorded the same treatment as prenasalized consonants. It is clear that a movement feature would be insufficient to describe these consonants since the relative timing of articulatory movements is not involved.

a sequence of two heavy and one light syllables and the second as a sequence of six light syllables. It is clear that linguists who speak in terms of moric organization are not referring to the same level of organization that I am here.

It is, of course, also necessary to speak in terms of timing at a level higher than the syllable since contiguous syllables evidence influence one upon the other. For example, Luganda retroflex flap or continuant /l/ has an average phonetic duration of about 20 msec. for the flap and 40 msec. for the continuant, both substanially shorter than other surface consonants. In words containing this /l/, not only the vowel of the syllable in which it functions lengthens, but compensation is evident in the words as a unit:

(25) kùtágá
'to be embarrassed'
kùtálà
'to line up'



This is in keeping with Lehiste [1972] where it is claimed that words are programmed as whole units.

4. Phonological Evidence

4.1 Prenasalized [f] and [v]. I have claimed elsewhere [Herbert 1974b] that [f] and [v] do not occur as underlying segments in Luganda, but rather they are derived from sequences of /ku/ and /gu/. This change from velar to surface labial might seem like an extreme one on a synchronic level where several intermediate stages cannot be postulated, but in terms of an acoustic theory of sound change, it is exactly what one might expect. Simply, contiguous round vowels have been demonstrated to cause F_2 transitions of velar consonants to fall in a way that is characteristic of labials.[6]

[6] The change from velar to labial is not uncommon and is found in a wide variety of languages (see Campbell 1974:53-4). For example, in Rumanian, Latin [k] > [p], in Finnish [k] > [v], and in Luganda [k] > [f]. Some linguists have seriously tried to posit intermediate stages for these changes in order to maintain the principle of gradualness of sound change. Thus, for example, Hyman [1974] in his discussion of the

This explanation explains why these segments are normally followed by [w]-glide usually described as inherent rounding of the segments.

That [f] and [v] need to be accorded special status is further indicated by their behavior in NC clusters. Although NC clusters exhibit only slightly more surface length than is characteristic of underlying single consonants, the ratio between the relative duration of the nasal component and the following oral consonant varies systematically depending on the voicing specification of the oral consonant. That is, in a sequence of nasal + voiced consonant, it is the nasal which undergoes the lesser reduction. Likewise, in an analysis of a great number of English pairs such as <u>bend-bent</u>, <u>build-built</u>, Lehiste found that the resonant is systematically shorter before the voiceless plosive. For the voiced series, the only change involved in going from nasal to oral consonant is raising of the velum whereas for the voiceless series raising of the velum must be coordinated with cessation of vocal fold vibration. This must be clearly perceivable since it is the state of non-vibration which distinguishes the two series. This explanation claims that lengthened vowels before prenasalized voiced consonants should be slightly shorter than lengthened vowels before prenasalized voiceless consonants. This corresponds to the phonetic data available.[7]

However, in the case of prenasalized [f] and [v], the nasal greatly reduces (occasionally disappearing entirely) before both consonants. Since prenasalized [s] and [z] follow the pattern set by the plosives, it is not possible to explain away the extraordinary behavior of [f]

Luganda change posits:

$$*k > k^{h} > k^{f} > p^{f} > f \,/\, \underline{\quad\quad} *\c{y}$$

The intermediate stages here are unattested. This represents a misapplication of the general principle of gradualness of sound change. It is much more "natural" and correct to make reference to an empirically tested acoustic explanation for this interchange of labialized velars and labials (operating in both directions).

[7]For example, in one token of kutanda, the nasal had a duration of 90 msec. and the plosive following 30 msec. In kutanta, the nasal was 60 msec. long and the following voiceless plosive 70 msec.

and [v] by reference to their continuance. I believe it is necessary here to refer to their status as derived segments. The reason the nasal severely reduces in both cases is that [f] and [v] are themselves complex segments: consonant and non-syllabic [ų].[8] This same analysis explains the systematic absence of [fy] and [vy] sequences in the lexicon; the gap follows from the fact that sequences of two glides are impermissible.

4.2 Nasalized Vowels. As I have already mentioned, additional evidence in support of the analysis that nasal components of prenasalized consonants function in the syllable to their left comes from the distribution of nasalized vowels.[9] Nasalized vowels occur only--though not always--before prenasalized and geminate nasal consonants, never before simple nasal consonants. This implies that vowel nasalization does not occur across syllable boundaries. Nasalized vowels are therefore to be explained as an optional anticipatory lowering of the velum within a single syllable as would be expected on universal grounds.[10]

4.3 Meinhof's Law. The final evidence in support of the cluster analysis comes from a late phonological rule in Luganda known as Meinhof's Law:

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[8] Patrick Bennett (personal communication) while accepting my analysis of [f] and [v] claims that there should be similar reduction of the nasal in [mbw] and other such sequences. Of course, the basic claim of my argument is that the relationship between [ų] and the consonant in such sequences is not the same as one finds in [f] and [v].

[9] The term nasalized vowel is used here to refer only to those vowels evidencing nasalization greater than 20 msec. This is to exclude cases which might result from a slight non-coordination of the velum with the other articulators. This latter type is sometimes referred to by the misnomer inherent nasalization.

[10] The facts of nasalization are not quite so simple. For example, vowels may nasalize between two simple nasal consonants as in kutãnnãma. Again, this is what one might expect on universal grounds.

(26) $$\begin{bmatrix} \text{C} \\ \text{+voice} \\ \text{-cont} \end{bmatrix} \rightarrow [\text{+nasal}] \;/\; \text{N}\ \_\_\_\ \text{V(V)N}$$

Some examples are:

(27) a. /n-bumba/ m̀mʊ̂mbá 'I mould clay' (cf. ɔ̀bʊ̂mbá 'you mould clay')

/n-linda/ ǹnɪ́ndá 'I wait' (cf. ɔ̀lɪ́ndá 'you wait') (n-l > nd > nn)

/n-gendo/ ŋ̀ŋéndó 'journeys' (cf. lʊ̀géndó 'journey')

b. /n-bala/ m̀bálá 'I count'
/n-leeta/ ǹdéètá 'I bring'
/n-gula/ ŋ̀gʊ́lá 'I buy'

Although the segment affected might be termed a prenasalized consonant, the output of the rule is clearly a long, i.e., geminate, nasal consonant. Thus, even at the level at which this rule applies, we are dealing with two distinct segments. If we assume the rule affects unitary segments of any sort, it becomes much more complex:

(28) $$\underset{1}{\text{NC}} \rightarrow \underset{1\ 2}{\text{N N}} \;/\; \_\_\_\_\ \text{V(V)N}$$

It is interesting to note that in Kikuyu Meinhof's Law is more restricted, but that when it does apply the non-nasal components of the cluster is deleted so that the output is a simple nasal as the following examples from Myers [1974] demonstrate:

(29) /ñ-rem-eet-ɛ/ nemeetɛ 'I had cultivated'
/ñ-gan-eet-ɛ/ ŋaneetɛ 'I had recounted'

/ñ-dug-eet-ɛ/ ndugeetɛ 'I had cooked'
/ñ-gor-eet-ɛ ngoreetɛ 'I had bought'

Here too, it is not clear if a rule could delete half of a complex segment, but the loss of a movement feature is a tenable analysis for Kikuyu.

However, the operation of Meinhof's Law in Holoholo [Coupez 1955: 14] makes the complex segment analysis even less tenable, Here the output of the rule is a simple nasal as in Kikuyu, but the deletion of the non-nasal consonant is accompanied by a lengthening of the preceding vowel.

(30) /ku-n-lond-a/ kuunonda 'to follow me'

There is no way to explain this vowel lengthening under the complex segment analysis or by the loss of a movement feature since there is no change in the number of segments involved under these analyses. However, under the cluster analysis, simplification of the nasal + nasal cluster results in a lightening of the initial syllable, i.e., CVN becomes CV; to maintain its status as a heavy syllable, compensatory vowel lengthening occurs. The correctness of this analysis is demonstrated by the fact that nasal + nasal clusters which are not derived by Meinhof's Law evidence the same behavior:

(31) /ku-mon-a/ kumona 'to see'
/ku-n-mon-a/ kuumona 'to see me'

This clearly demonstrates the incorrectness of the loss of a movement feature analysis for the Meinhof's Law cases, i.e., in kuunonda above, there is a second intermediate form *kunnonda which provides the input to nasal cluster simplification.

5. Conclusion

The evidence I have presented clearly supports the hypothesis that the nasal component and the non-nasal component of the so-called prenasalized consonants of Luganda function in separate syllables until very late in the application of phonological rules. This is true not only of the prenasalized consonants transparently analyzeable as morphologically complex but also for morpheme-internal prenasalized consonants. There is no distinction made in the treatment of the two. This supports an abstract phonological analysis in which all prenasalized cnsonants in Luganda are sunchronically derived from a sequence of nasal + consonant.[11]

[11] I have elsewhere argued for the analysis of prenasalized consonants in a sequence of NVC. This is not crucial to the issue at hand, and it is therefore not discussed here.

In fact, it is only under such an analysis that we can explain their identical behavior in syllabification and timing. Underlying unitary segments do not function in two syllables. Although more "natural" phonological treatments would have us enter the non-alternating prenasalized consonants as such in the lexicon, the acoustic evidence strongly suggests that it may be incorrect to do so.

It is not claimed that prenasalized consonants are barred from appearing at a deep level of phonological organization especially in languages where there exists a purported contrast between medial $VN_{\$}CV$ and $V_{\$}NCV$ syllabification, e.g., Fulani [Bell 1970:45] and Sinhalese (Amy Myers, personal communication). However, it has been shown that they do not occur as such in at least one language where they have been traditionally so analyzed, Luganda. An accurate theory of linguistic description will have to account for both types of NC sequences if they do indeed exist. It appears that even in languages very closely related to Luganda such as Bravanese Swahili and Kikuyu (M. Goodman and A. Myers respectively, personal communications) the prenasalized consonants function very differently than those in Luganda. However, the instrumental verification of these claims remains to be done. The evidence from Luganda is at least suggestive that more traditional analyses of these consonants, even in languages which do not evidence the complete series, and perhaps of all the so-called "apparent violations of the sonoritiy hierarchy," may be missing what is really a significant generalization and that the decisive evidence in such cases will be provided by analyses of the timing systems of the languages involved.

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