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A Morphophonological Analysis of the Applicability of Nasalisation Principles in Lungu, Mambwe and Namwanga Languages

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Abstract

The paper explores the similarities and variations in the applicability of nasalisation principles in Lungu, Mambwe and Namwanga (LuMaNa) languages. LuMaNa languages are spoken in Northern and Muchinga provinces of Zambia. Lungu is classified as M14, Mambwe as M15 and Namwanga as M22. The study used CV phonology and comparative Bantu morphophonological theories and qualitative methods. Results reveal that nasal homorganic assimilation depends on the consonant which follows the nasal, such as, a voiceless cluster /nk/ when a voiceless velar /k/ follows /n/ and a voiced cluster /ng/ when a voiced velar /g/ follows /n/. Nasal deletion before fricatives from singular to plural forms of nouns are not attested, instead the languages undergo nasal maintenance where /n/→/n/. Nasal deletion before fricatives is only possible during the reverse formation from plural to singular nouns where /m/→/l/ and /n/→/l/. The post-nasal stop voicing happens when converting singular to plural nouns where /l/→/n/. Post-nasal consonant hardening occurs when converting nouns from singular to plural using /l/→/d/, /n/→/m/ and /w/→/b/. Post-nasal stop aspiration only occurs in Namwanga when the voiceless consonant follows a nasal as in; /p/→/p^h/. There are more similarities than variations during nasalisation which shows that LuMaNa languages are at dialectal continuum.

Keywords: LuMaNa languages; morphophonological; nasalisation; variations; Zambia

1. Introduction

The paper accounts for nasalisation as a segmental phonological process in Lungu, Mambwe and Namwanga (LuMaNa) languages which are spoken in the Northern and Muchinga Provinces in Zambia. The LuMaNa languages are coded as Bantu languages and are classified as follows: Lungu as M14, Mambwe as M15 and Namwanga as M22 (Guthrie, 1948). To the knowledge of the researchers, no literature has been documented on the principles governing nasalisation for the above mentioned three languages. Nonetheless, literature shows that many studies have been conducted on Bantu phonology. Some studies focused on single languages and structural features of Bantu phonology such as; issues in the non-linear phonology of Chewa (Mtenje, 1986), phonology of verbal derivation of Bemba (Kula, 2002), the verbal phonology and morphology of Ndebele (Sibanda, 2004), and strong accent constituents in Tonga (Mkochi, 2014). Other studies focused on comparative Bantu phonology of languages, such as; vowel copying in Dciriku and Mwenyi languages (Kula & Marten, 2019), phonetics of intonation in South African Bantu languages (Zerbian and Barnard, 2008) and, segmental and suprasegmental variations in SuNdaLa languages (Mtenje, 2016). Studies such as, Mtenje-Mkochi (2018), Kadenge & Simango (2014), and Chiona (2005) focused on comparative Bantu morpho-phonology of two languages. Conversely, very few comparative Bantu phonology studies involving three genetically related languages are documented, such as, the SuNdaLa cluster (Mjenje, 2016). This paper rides on the scarcity of comparative Bantu phonological studies involving three genetically related languages and accounts for the applicability of nasalisation principles in LuMaNa languages.

As attested by other Bantu languages, nasalisation in LuMaNa languages involves consonants. Trask & Stockwell (2007) state that a consonant is a speech sound which is produced by significantly obstructing the flow of air. The LuMaNa languages have five types of consonantal segments which follow nasals, namely; plosives, fricatives,

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affricates, laterals and semi-vowels or glides or approximants. On the other hand, the three languages have four nasal segments which are; a voiced bilabial nasal /m/ as in: ***m****aama* [ma:ma] 'grandmother', a voiced alveolar nasal /n/ as in: *i****n****tusi* [intusi] 'insults', a voiced alveolar-palatal nasal /ɲ/ realised as [ny] in LuMaNa languages as in: *ukufu****ny****a* [ukufuɲa] 'to scratch' and a voiced velar nasal /ñ/ which is realised as [ng'] in LuMaNa as in: *i****ng'****anda* [iñanda] 'house'. Spitulnik & Kashoki (1996, 1998) argue that the sounds [dʒ] and [g] are always preceded by a homorganic nasal in nasal clusters in Bemba language and never occur at the initial position of words or between vowels which can be represented orthographically as [nj] and [ng] as in: *njeba* [ɲdʒeba] 'tell me' and *ngupa* [ŋgupa] 'marry me'. Mann (1999) argues that in Bemba, homorganic nasals precede other consonants in clusters. The above notion is in tandem with LuMaNa languages when it comes to nasal precedence in nasal clusters.

On the other hand, Zemba (2015) argues that approximants in Kunda language combine with nasals, but never precede them. In LuMaNa languages, all obstruent are preceded by nasals although they are never preceded by approximants as can be seen in the most common consonant combinations: *mb, mbw, mp, mpw, mf, mfw, fw, fy, nd, ndw, nt, ntw, ng, nk,* nkw,*vw, nw, nz, nzw, ns, nsw, nsh, sy, sw, nj, lw, ch, nch, ny, zy* and *zw.* For this reason, all consonants in LuMaNa languages can take nasals and approximants during consonant combinations.

2. Methodology

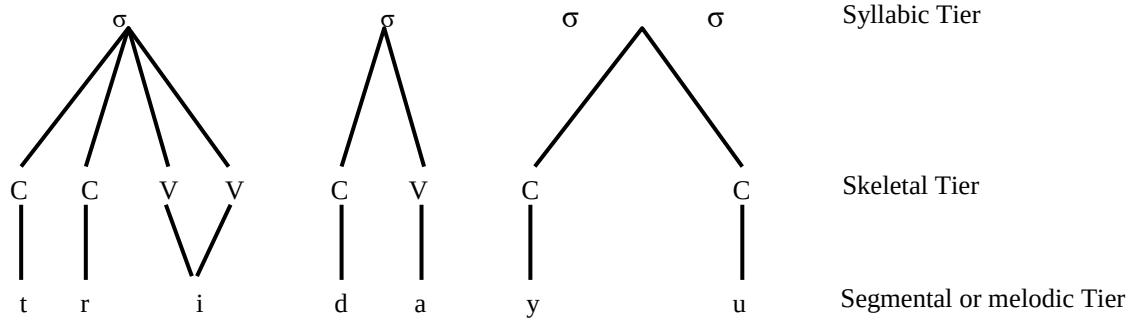
In this paper, the qualitative descriptive design has been applied. The qualitative descriptive design enables a holistic, non-numerical, inductive, subjective and process-oriented studies to understand, describe and interpret phenomenon on which subsequent theories may be developed (Burns & Grove, 1997). The qualitative design also enables the research findings to be reported descriptively using words and sentential expressions as used by mother tongue speakers of languages being investigated such as the LuMaNa languages (cf. Mutch, 2005). The data used in this paper were elicited through oral interviews with six key informants, all of whom are mother tongue speakers of Lungu, Mambwe and Namwanga languages. Each language had two key informants who also worked as data verifiers in their respective languages. Data were collected from Northern Province in Mpulungu, Mbala and Senga districts as well as Muchinga Province in Isoka and Nakonde districts of Zambia where LuMaNa languages are spoken. Data analysis went hand in hand with data collection (cf. Mugenda & Mugenda, 1999). Since the lead author of this paper is a mother tongue speaker of LuMaNa languages, his knowledge, intuitions and introspections were critical in scrutinizing the relevant information valid for a comparative analysis of the nasalisation processes and principles in the three genetically related languages. The analysis of the applicability of nasalisation processes and principles was also subjected to meaning based on the researchers' perceptions (cf. Merriam, 1998).

3. Theoretical Framework

This paper adopts the CV phonology theory and the comparative Bantu morphophonological theories. The CV phonology theory has been used to account for syllabic, skeletal and segmental tiers of the principles governing nasalisation phonological processes in LuMaNa lexical items. CV phonology introduces a new approach to syllable representation minimally extending the hierarchical approach developed by D. Kahn in his MIT dissertation. Amongst the existing theories of syllable structure, the generative CV phonology model of syllable structure (cf. Clements & Keyser, 1983) appears to be the most appropriate for this study. CV phonology model was developed exclusively to deal with the syllable and syllable related processes (cf. Katamba, 1989) such as nasal clusters (Cs) [CC] before a vowel (V) under nasalisation processes being accounted for in this paper. As Clements & Keyser (1983) observed, syllable is an end product component of generative phonology that cannot be simply ignored. This stems from the notion that the formulation of many phonological rules is based on the syllable. CV phonology is a theory of syllable representation which characterizes the syllable as a three-tiered structure that has the formal properties of auto-segmental system (Clements & Keyser, 1983). The theory claims that the terminal elements of syllable trees are not vowels and consonants themselves, but rather the units of the CV-tier which defines positions in syllable structure that particular consonants and vowels may occupy. The independence of the CV-tier and the segmental tier is linked to the idea that phonological rules may apply independently to the members of either tier (such as, CC or VV), or may affect the manner in which the elements of these two tiers are associated with each other (such as, CCV or CVV). The phonological rules may be sensitive to the difference between identical syllable trees which differ in the composition of the CV-tier.

CV phonology theory advocates that syllable trees consist of three-tiered representations and each tier has a certain vocabulary associated with it. The vocabulary of the first, or σ-tier, consists of the single element σ. The vocabulary

of the second, or CV-tier, consists of the two elements C and V; and the vocabulary of the third, or segmental tier also called a 'nucleus tier', consists of single-column phonetic matrices characterizing consonants and vowels in usual manner. The theory outlines that well-formed strings on each tier consist of concatenations of the members of the alphabet defined on that tier. For example, the syllabic, skeletal and segmental tiers in {tridayu} can be illustrated as follows:



Source: *Durand & Katamba, (1995 p.122)*

Figure 1. CV Model

The figure 1 illustration is interpreted as follows:

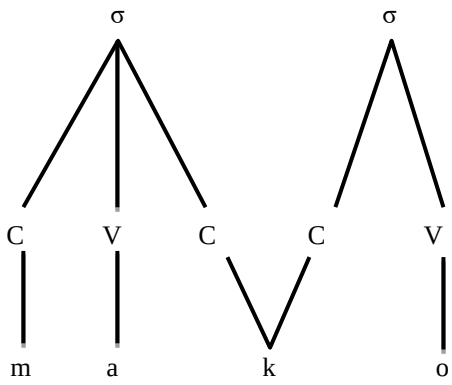
(i) An I linked to a V slot syllabic and is realised as [i]

(ii) An I linked to C slot is non-syllabic and is realised as the semi-vowel

(iii) In a CV phonology framework, a long segment is represented as a single unit on the segment or melodic tier, linked to two units under the CV tier where a long vowel is linked to two vowels (Vs) [VV] and a long consonant to two consonants (Cs) [CC]. The above illustration shows that CV tier can be considered as a timing tier and the two Cs represented by nasal followed by a consonant [NC] in the present paper are tolerated in the syllable as can be observed in{tridayu} in Figure 1 which is in tandem with the NC in *impasa* 'axe' in LuMaNa languages.

The second example of the application of CV phonology in the representation of 'makko' where the consonants kk = long k is presented on figure 2.

The CV-tier, as an aspect of CV phonology, defines the syllabicity of the onset and marginal elements; hence, it captures insightfully the complexities of distinctive features and syllable patterns of words which are important components of this article (cf. Durand & Katamba, 1995). The CV phonology provides a structural interpretation of phonological changes between the consonantal environments, as it regulates the combination of segments by considering the prominence and the precedence factors. In the present paper, the nasal must have prominence and precede other consonants during nasalisation as a phonological process. The CV phonology theory is enlightening and useful for describing syllable behaviour in LuMaNa languages. For instance, two consonants can make a cluster to fit in the C slot where a following consonantal segment must be tied to the preceding nasal segment either at the beginning, middle or end of the word. Data presentation is easy when using the CV rule notation because it shows the inputs and outputs of the syllable structure. The CV phonology theory also examines various patterns of consonant-vowel combinations, universal principles governing syllable structure or the syllable structure typology. This paper focuses on the applicability of nasalisation principles involving a nasal and a following consonant (NC) [CC] using the sound pattern of the cluster in a syllable and thus adopts the CV-Phonology model to be the guiding principle. On the other hand, the comparative Bantu morphophonological theory is adopted to back the CV phonology theory during the determination of similarities and variations in the applicability of nasalisation processes and principles in LuMaNa languages in order to establish the genetic relatedness of the three Bantu languages under discussion in this paper (cf. Bleek, 1862/1869; Guthrie, 1948, 1967-71 and 1971; Doke, 1931, 1945 and 1960; Greenberg, 2001).



Source: *Durand & Katamba (1995 p.122)*

Figure 2. Representation of makko

4. Results and Discussions

The paper presents the nasalisation processes and principles which are attested in LuMaNa languages. Nasalisation is a phonological process that involves a nasal and a following consonant which is referred to as Nasal Consonant (NC) sequence (cf. Mtenje, 2016; Odden, 2013; and Kula, 2002). Nasalisation should be seen as a phonological process which governs what type of consonants should follow nasals to determine the output of the syllable where the cluster can either be voiced or voiceless. The following nasalisation processes are analysed comparatively in this article: homorganic nasal assimilation, nasal deletion before fricatives, post-nasal stop voicing, post-nasal stop aspiration and post-nasal consonant hardening.

4.1 Homorganic Nasal Assimilation

Mtenje (2016) shows that homorganic nasal assimilation is a phonological process in Bantu languages where a nasal copies the place of articulation features of a following consonant and thus becomes homorganic with that consonant. To account for this phenomenon, Mtenje (2016) uses an abstract nasal consonant as the underlying sound that changes according to the place of articulation of the following consonant in a particular word. To justify the above claim, Mtenje provides examples below for nouns in Cl.9 with a nasal as the prefix in Cisukwa and Cindali languages: *í-m-bepo* 'wind' and *í-n-dondwa* 'star' and in Cilambya language: *í-m-p^{h}epo* 'wind' and *i-n-t^{h}óndwa* 'star'.

Homorganic nasal assimilation is attested in LuMaNa languages and is expressed using the nasal prefixes [n] and [m] in Cl.9 in which the nasal copies the place of articulation characteristics of a following permissible consonant of the noun stem which can either be voiceless or voiced and consequently becomes homorganic with that consonant as illustrated below:

(1) Lungu and Mambwe: *i-**n**-kwi* [inkwi] 'firewood'
(2) Namwanga: *i-**n**-k^{h}uni* [ink^{h}uni] 'firewood'
(3) Lungu and Mambwe: *i-**m**-penzu* [impenzu] 'cockroaches'
(4) Namwanga: *i-**m**-p^{h}enzu* [imp^{h}enzu] 'cockroaches'
(5) LuMaNa: *i-**n**-guzi* [inguzi] 'rivers'
(6) Lungu and Mambwe: *i-**m**-bezu* [imbezu] 'seeds'
(7) Namwanga: *i-**m**-beyu* [imbeyu] 'seeds'

Example (1) shows that in Lungu and Mambwe languages, the voiced velar nasal [n] takes the place of articulation features of the voiceless velar stop [k] which follows it where the nasal becomes voiceless due to the following consonant stop in [nk]. Example (3) shows that in Lungu and Mambwe languages, a voiced bilabial nasal [m] takes the place of articulation features of the noun stem initial sound of the voiceless bilabial stop [p] and the nasal gets assimilated and copies the voiceless characteristics of the following consonant [p] in [mp]. In examples (2) and (4), Namwanga language uses aspiration on voiceless consonants which follow the nasal such as [k] and [p] respectively.

In example (5), the voiced velar nasal [n] takes the place of articulation characteristics of the voiced velar stop [g] which follows it and consequently, the nasal becomes voiced in [ng]. Examples (6-7) reveal that in LuMaNa languages, a voiced bilabial nasal [m] takes the place of articulation features of the noun stem initial sound of the voiced bilabial stop [b] and the nasal gets assimilated and copies the voiced characteristics of the following consonant [b] in [mb]. We argue that homorganic nasal assimilation in LuMaNa languages is influenced by either the voiceless sounds of the initial stem consonant following the nasal such as the velar [k] and the bilabial [p] to produce voiceless nasal clusters or the voiced consonantal sounds following the nasal such as the velar [g] and the bilabial stop [b] to have the voiced nasal cluster in the output.

4.2 Nasal Deletion before Fricatives

Mkochi (2005) and Kula (2002) posit that nasal deletion before fricatives is a phonological process in Bantu languages which allows a nasal to delete when it is followed by a fricative. Mtenje (2016) observes that in Cindali and Cisukwa, a nasal is deleted when it is followed by a fricative, hence nasal consonant sequence (NCs) of a nasal and a fricative never occur in these varieties such as in: /í-**n**-fula/→ *íí-fula* ‘rain’.

Nasal deletion before fricatives from singular to plural forms are not attested in LuMaNa languages. LuMaNa languages only undergo nasal maintenance in both singular and plural nouns in which /n/→/n/. However, nasal deletion before fricatives in LuMaNa languages is only possible when the reverse formation of nouns is applied in which a plural noun is converted to singular form as shown below:

(8)	Lungu and Mambwe:	*i-**n**-zovu* [inzovu] ‘elephant’(SG)→*i-**n**-zovu* [inzovu] ‘elephants’(PL)
(9)	Namwanga:	*i-**n**-zoovu* [inzo:vu] ‘elephant’(SG)→*i-**n**-zoovu* [inzo:vu] ‘elephants’(PL)
(10)	LuMaNa:	*i-**m**-fumu* [imfumu] ‘chief, king, lord’ (SG)→*i-**m**-fumu* [imfumu] ‘chiefs, kings, lords’ (PL)
(11)	LuMaNa:	*i-**m**-fine* [imfine] ‘pimples’ (PL)→ *u-**lu**-fine* [ulufine] ‘pimple’ (SG)
(12)	LuMaNa:	*i-**n**-swi* [inswi] ‘fish’ (PL) →*u-**lu**-swi* [uluswi]‘fish’(SG)

Examples (8-10) show that nouns with the nasal prefixes [n] and [m] in LuMaNa languages in Cl.9 for singular and Cl.10 for plural forms do not allow nasal deletion before fricatives in noun stems whether voiced or voiceless such as [z] and [f] when converting them from singular to plural forms. In examples (8-9), a nasal is not deleted when it follows the fricative [z] in both the singular and plural form of the noun, but undergoes form retention in the plural state. We argue that LuMaNa languages undergo nasal maintenance in both singular and plural nouns as evidenced in examples (8) and (9). We also argue that there is a variation in Namwanga language which uses vowel length after the voiced alveolar fricative [z] in (9) whereas Lungu and Mambwe use a short vowel in example (8). On the other hand, examples (11-12) reveal that a nasal can only be lost in LuMaNa languages during a reverse formation when converting a noun from a plural to singular form before voiceless fricatives [f] and [s] respectively. The findings of the present study counter the results of earlier studies on Bantu languages such as Tonga and Bemba languages where nasal deletion is attested in nominal stems when they are converted from singular to plural nouns (cf. Mkochi, 2005; Kula, 2002).

4.3 Post-nasal Stop Voicing

Mtenje (2002), Kula (2002) and Ngunga (2000) refer to post-nasal stop voicing as a process where a voiceless stop becomes voiced when it follows a nasal. Mtenge (2016) shows that Cisukwa and Cindali have voiced stops after nasals in the nouns such as in: *u-lu-tondwa* ‘star’ where the voiceless alveolar stop /t/ in the stem *tondwa* becomes a voiced alveolar /d/ in *i-n-dondwa* ‘stars’ when the plural nasal noun class prefix [n-] in Cl.10 is attached to it.

In LuMaNa languages, post-nasal stop voicing is not attested after voiceless stops, but only occurs when noun stems that are originally voiced come after the nasal prefix in plural formation. The above argument shows that post-nasal stop voicing as a nasalisation process does not make a voiceless initial segment in the stem to adopt the voiced features from a nearby voiced nasal segment through feature copying as shown in the examples below:

(13)	LuMaNa:	*u-**lu**-kusa* [ulukusa] ‘fibre’(SG) → *i-**n**-kusa* [inkusa] ‘fibres’(PL)
(14)	LuMaNa:	*u-**lu**-tanda* [ulutanda] ‘star’(SG) → *i-**n**-tanda* [intanda] ‘stars’ (PL)

Example (13) shows that LuMaNa languages in Cl.10 in the plural noun ***in****kusa* ‘fibres’ uses the nasal /n/ followed by a voiceless velar stop /k/ which is the initial sound in the stem and forms a voiceless cluster /nk/ instead of the voiced

NC /ng/ which the post nasal voicing principle propagates. In (14), a similar phenomenon happens in Cl.10 in the plural noun *i**n**tanda* ‘stars’ where the voiceless alveolar stop /t/ maintains its voiceless status when preceded by a nasal /n/ and forms the voiceless cluster /nt/ as opposed to taking on /d/ to form the voiced cluster /nd/. The above findings in LuMaNa languages counter the applicability of the post-nasal voicing principle where a voiceless consonant changes to a voiced one when it follows a nasal as proposed by other Bantuist scholars such as; Mtenje (2002), Kula (2002) and Ngunga (2000).

4.4 Post-nasal Stop Aspiration

Mtenje (2016) argues that post-nasal stop aspiration is a phonological process where a stop is aspirated when it comes after a nasal in a particular word. Mtenje shows that post-nasal stop aspiration is attested in Cilambya language in the SuNdaLa cluster in Malawi such as in: *u-lú-paso* ‘fence’→*íí-m-p^{h}aso* ‘fences’ where the voiceless stop [p] is aspirated [p^{h}]. Similarly, in the LuMaNa cluster, only Namwanga language uses post-nasal stop aspiration in the plural as demonstrated below:

(15) Lungu and Mambwe: *u-**lu**-penzu* [ulupenzu] ‘cockroach’(SG) → *i-**m**-penzu* [impenzu] ‘Cockroaches’ (PL)

(16) Namwanga: *u-**lu**-penzu* [ulupenzu] ‘cockroach’(SG) → *i-**m**-p^{h}enzu* [imp^{h}enzu] ‘Cockroaches’ (PL)

(17) Lungu and Mambwe: *u-**lu**-tanda* [ulutanda] ‘star’(SG) → *i-**n**-tanda* [intanda] ‘stars’ (PL)

(18) Namwanga: *u-**lu**-tanda* [ulutanda] ‘star’(SG) → *i-**n**-t^{h}anda* [int^{h}anda] ‘stars’ (PL)

Examples (15) and (17) show that Lungu and Mambwe languages do not aspirate stops such as [p] and [t] in plural nouns after the nasal. We argue that only Namwanga language aspirates the voiceless stops after a nasal in the plural nouns in example (16) where [p] becomes [p^{h}] as in *u-lu-penzu* ‘cockroach’→ *i-m-p^{h}enzu* ‘cockroaches’ and in (18) where [t] aspirates to [t^{h}] as in *u-lu-tanda* ‘star’→ *i-n-t^{h}anda* ‘stars’.

4.5 Post-nasal Consonant Hardening

Mtenje (2016) posts that post-nasal consonant hardening is a phonological process in Bantu languages which changes voiced continuants into non-continuants. Kula (2002) adds that a number of Bantu languages such as Kikuyu and Bemba apply the post-nasal consonant hardening rule. For instance, in Bemba, *ulu**l**imi* ‘tongue’ changes to *in**d**imi* ‘tongues’ in the plural. Spitulnik & Kashoki (2014) argue that the bilabial fricative /β/ in Bemba sounds like a cross between [b] and [w] which partially explains why LuMaNa languages use the velar glide /w/ instead of the bilabial fricative /β/ in singular nouns. For this reason, LuMaNa languages apply the post-nasal consonant hardening principle by converting /l/→/d/, /n/→/m/ and /w/→/b/ in the plural formation of nouns as shown below:

(19) Lungu and Mambwe: *u-lu-**l**imi* [ululimi] ‘tongue’(SG)→*i-n-**d**imi* [indimi] ‘tongues’ (PL)

(20) Namwanga: *u-lu-**l**ímí* [ululímí] ‘tongue’(SG)→*i-n-**d**ímí* [indímí] ‘tongues’ (PL)

(21) LuMaNa: *i-**n**-bwele* [i*n*bwele] → *i-**m**-bwele* [imbwele] ‘should I come back?’

(22) LuMaNa: *u-lu-u-anzi* [ulu**w**anzi] ‘rafter’ (SG)→ *i-m-**b**anzi* [imbanzi] (PL)

Examples (19-20) reveal that the stem-initial consonant /l/ in the singular form changes to [d] in the plural formation in all LuMaNa languages causing the non-continuant consonant [d] to be hardened after a nasal [n]. We argue that in (20), Namwanga language uses high tone in the stem both in singular and plural nouns. We also argue that in example (21), the non-continuant consonant [b] in LuMaNa languages only occurs when preceded by the homorganic nasal [m] which is derived from [n-] (the 1st person singular), [-bwel-] (the verb root), and [-e] (the subjunctive); where [n] becomes [m] in homorganic harmony with the following consonant [b] thereby rendering it to be hardened. We further argue that in example (22), there is no equivalence or overt occurrence of the fricative [β] in LuMaNa languages hence there is a phonetic shift in direction of the organs of speech in singular form from the bilabial fricative [β] continuant to a velar glide [w] in *ulu**w**anzi* ‘rafter’ instead of [*u-lu-**β**anzi*] as attested in many other Bantu languages. The above occurrence in LuMaNa languages causes the attested non-continuant voiced bilabial [b] to be hardened in the plural form after the nasal [m] in *im**b**anzi* ‘rafters’. In addition, we argue that example (22) shows that the realisation of the second vowel /u/ as /w/ in the singular noun *ulu**w**anzi* [u-lu-**u**-anzi] ‘rafter’ signifies that LuMaNa languages employ gliding as a morphophonological process to resolve vowel hiatus sequences where /w/ acts as a variance of [β] in other Bantu languages such as the SuNdaLa cluster in Malawi (cf. Mtenje, 2016).

5. Conclusion

The paper has accounted for nasalisation in Lungu, Mambwe and Namwanga languages using CV phonology theory with particular attention to two Cs realised as NC. The paper has also used the comparative Bantu morphophonological principles to account for similarities and variations in the application of nasalisation principles in LuMaNa languages. The analysis shows that nasal homorganic assimilation, post-nasal stop voicing and post-nasal consonant hardening are attested in LuMaNa languages while post-nasal stop aspiration is only present in Namwanga language. Nasal deletion before fricatives from singular to plural forms are not attested in LuMaNa languages except in situations where the nasal undergoes zero modification in both singular and plural nouns where /n/→/n/ or the application of the reverse formation of nouns in which a plural noun is converted to singular form which only occurs in the reverse formation from plural to singular in all the three languages.

We conclude that nasal homorganic assimilation in LuMaNa languages occurs when a nasal is assimilated depending on the consonant which follows it such as, voiceless cluster which is formed when the nasal /n/ is followed by a voiceless velar /k/ in /nk/ and a voiced cluster when the nasal /n/ is followed by a voiced velar /g/ in /ng/. The post-nasal stop voicing happens when converting singular to plural nouns using the /l/→/n/ principle. We also conclude that nasal deletion before fricatives from singular to plural forms are not attested in LuMaNa languages. LuMaNa languages only undergo nasal maintenance in both singular and plural nouns in which /n/→/n/. We further conclude that nasal deletion before fricatives in LuMaNa languages is only possible when the reverse formation of nouns is applied in which a plural noun is converted to singular form using /m/→/l/ and /n/→/l/. We establish that post-nasal consonant hardening occurs when converting nouns from singular to plural using /l/→/d/, /n/→/m/ and /w/→/b/. On the other hand, we note that post-nasal stop aspiration only occurs in Namwanga language when the voiceless consonant follows a nasal, such as; /p/→/p^h/ and /t/→/t^h/. Finally, the analysis of the present study shows that the phonotactics and syllable structure of LuMaNa languages are at dialectal continuum.

Acknowledgements

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