Phonological Processes of Shambaa

Anuarite Samwel Mndeme, Nestory Nyamwala Ligembe (PhD)

Department of Languages and Linguistics, St. Augustine University of Tanzania, Mwanza
E-mail: anuaritemndeme@yahoo.com & nligembe@yahoo.co.uk

Abstract— This study set out to describe the phonological processes of Shambaa and establish phonological rules governing the phonological processes of Shambaa. The study was done at Mlalo, Ubiri and Vuga villages found in Lushoto District Tanga Region-Tanzania. The target population of the study were adult native speakers of Shambaa. The study used a purposive sampling procedure to select 10 participants from whom data was collected through interviews, documentary review and observation. The data were presented and analyzed using phonetics and phonological rules. The findings of the study reveal that phonological processes which occur in Shambaa are glide formation, vowel lengthening, high vowel deletion, glide insertion, vowel nasalization, consonants deletion, epenthesis, voicing, homorganic nasal assimilation, aspiration and substitution. Finally, the study recommends, that other researchers conduct more research on the Shambaa language and come up with more theories and results.

Keywords— Phonological process, Underlying representation (UR), Surface Realization (UR), Compensatory vowel lengthening (CVL), Penultimate vowel lengthening (PVL), ____ Proceeds /exceeds.

I. INTRODUCTION AND BACKGROUND TO THE STUDY

Phonological processes are situations that happen in speech sounds and affect them during articulation. The affected sound reveals changes in the manner of articulation, the place of articulation and, or voicing. The speech sound is normally represented in two consecutive parts; that is the underlying representation and the surface realization. The underlying representation includes the speech sounds which every native speaker accommodates in his/her cognitive store or the written speech sounds, while the surface realization of sounds is the sounds articulated by the articulatory organs. Phonological processes occur when the surface realization appears to be different from its counterpart which is the underlying representation. This happens when some sounds are deleted during articulation or where there is a change of the original sound with a different sound. This again happens only in surface realization while the real sound segment remains as they are in the person's cognate and or, the underlying representation. Bowen (2011) calls these phonological

processes errors which children make when they are learning to speak like adults.

Shambaa is a Bantu language spoken in Lushoto District-Tanga region Tanzania. The origin of the Shambaa can be traced back to those dates when the Bantu people migrated from the west and southern part of Congo, then settled into heavy rainfall areas where they adopted the banana culture. Kimambo (1969) cited by Shekumkai (1990) states that by the end of the first millennium A. D., when Guthrie (1948) classified Bantu languages into geographic zones, Shambaa was given zone G20 number G23.

There are three main dialectal areas in Shambaa land: the north with Mlalo as the centre, the south based at Korogwe, and the central with Lushoto as the centre. The differences between the three dialects are minor, and most are into-national although some sound changes are going on which might eventually lead to a different restructuring of the phonologies of the dialects. Furthermore, Kiswahili is having quite a pronounced impact on the language, especially in the Lushoto and Korogwe dialect due to urbanization but Mlalo dialect remain conservative as it is

in a remote area. However, speakers understand each other and can switch from one dialect to another when the need arises, Besha (1993, p. 3).

Mberia (2002), discovered phonological processes in adults when he conducted research in Kitharaka. That is to say, phonological processes can happen to diverse age groups in human speech sounds and any language.

II.   STATEMENT OF THE PROBLEM

The concept of phonological processes has been generally defined as an individual's mental operations about phonological information, especially the use of the sound structure of one's spoken language in learning to decode written language (McBride-Chang 1996). Torgesen, et al. (1994), in their longitudinal research, came up with the idea that phonological awareness of individual differences in the development of reading skills is very important. This convinced the researcher to take a step of writing this dissertation because ethnic community languages rapidly change and hence lose their original underlying representation and therefore uncertainty to researchers of proto-language and language change.

III.   OBJECTIVES OF THE STUDY

The study focused on the Phonological Processes in Shambaa. The study pursued two main objectives as follows:

   i.   To identify the phonological processes of Shambaa.
   ii.   To examine the rules governing phonological processes of Shambaa.

IV.   SIGNIFICANCE OF THE STUDY

The study focused on the phonological processes of Shambaa, it is hoped that it will be an important source for reference to future researchers. Moreover, it contributes to linguistic literature in the understanding of the phonological processes of the Bantu languages. Furthermore, future researchers can use it as a source of knowledge. It is also beneficial for the future generation to appreciate their local languages for their developments. In other words, the study is a useful source of data to support linguistic theories as far as phonological processes in Bantu languages.

V.   LITERATURE REVIEW

Scholars analyzed and described the phonological processes of human speech sounds and most of them considered these processes as errors in the actual speech sound production. Chomsky and Halle (1968), in their book entitled *"Sound Patterns of English,"* analyzed many phonological

processes of English. They, for example, present cluster simplification as the deletion of two or more consonant sounds during the articulation. Their example of this is shown in Example (1):

	UR	PR/SR
(1)	/giraffe/	[ǰərǽf]

In Example (1), stress is placed on the final weak cluster. This can be exemplified by postulating the underlying lexical presentation 'giræffe'. Here according to Chomsky and Halle (ibid), the rule of stress placement assigns primary stress to the penultimate syllable.

Glide is another phonological process involving semi-vowel /y/ or semi consonant /w/, also known as non-syllabic voiced. It occurs when these consonants assume the roles of vowel /i/ /u/, respectively.

Hamann (2011) analyzed palatal glide in German. The author explains that German has no phonemic labiovelar glide [w], but phonetically this segment occurs as the second part of the falling diphthong [aw]. However, in some loan words, there is a change of the form /u/ to /w/. For example, the word like 'guava' [guˈa.və] can be realized as [ˈgwa.və] in fast speech. A syllabic high front tense vowel [i] in prevocalic position can be re-syllabified as the onset of the following syllable and realized as a glide. The examples are given below:

	UR	SR
(2)	/nation/	[na.ˈʦjo:n]
	/union/	[ʊ.ˈnjo:n]

Vowel nasalization is another process whereby a vowel acquires the nasal features of the adjacent nasal sound (Massamba, 2011). Examples from the English language are given in Example (3):

		UR	SR
(3)	(a)	/can/	[kæ̃n]
	(b)	/man/	[mæ̃n]

In the above examples, the vowels that are adjacent to nasal consonants become nasalized.

Coalescence is a type of assimilation in which two adjacent sound segments affect one another. The effect triggered by this kind of juxtaposition is twofold. On the one hand, the two segments are retained, but neither one of them retails all but only its original features. In other words, each one of the two segments either changes some of its features or acquires extra features. On the other hand, such a juxtaposition results in the disappearance of both segments. Whenever this happens, an entirely; new segment replaces the two segments acting as some sort of compromise. The first kind of coalescence usually involves consonants only. Schame

(1978), as cited by Massamba (2011), cites some examples of this type of coalescence from the Korean language as shown in Example (4):

(4(a) Nak "fall"   +hwa "flower" ⟶ Nak^{h}wa "fallen"

 (b) Kup "bend" +hila "cause" ⟶ Kup^{h}i "to bend"

In Example (4), the sounds [k], and [p], get aspirated as the sound [h] acquires aspiration characteristics.

Another phonological process is aphaeresis, whereby a sound or syllable in the initial position disappears during the articulation. Massamba (ibid) gives examples from English and German in the examples (5 and 6).

	UR	SR
(5)	I am going	I'm going
	I have no money	I've no money

German UR	SR	GLOSS
(6) Wiegehtes	wiegeht's	how are you?

In Example (5), the first sound in the word 'am' was deleted to remain with the sound [m], which then joins with [I] to make 'I'm'. A comma separates [me] and [m] to show that they are two words. It is also found that in the word 'have', the two initial sounds [h] and [a] have been deleted to realize the word 'I, ve'. In Example (6), the last word /es/, the initial sound [e], was deleted, and the sound 's' joins with the previous word to make the words [ghet's'].

Prothesis is another phonological process involving. the insertion of sounds during the articulation of words. Massamba provided examples in the English language as indicated in (7):

	UR	SR
(7)	/spasm/ ⟶	[spazəm]
	/cycle/ ⟶	[saykəl]

In the examples above, the sound schwa [ə] has been inserted in the surface realization. stand The reason here is that it is very hard to pronounce those words without inserting the schwa sound in the position. Epenthesis is a similar process whereby a sound is inserted in the initial position of a word. Hyman (1975) gives examples in Spanish in Example (8);

	UR	SR	GLOSS
(8)	/spana/ ⟶	[ɛspana]	Spanish
	/stufa/ ⟶	[ɛstufa]	stove

In the examples above, the vowel /ɛ/ is inserted in the initial position of all words with double consonants to conform to the language rule.

Phonological processes in Bantu languages also have been discussed by different scholars. Massamba analyzed

Coalescence in the Swahili language as seen in Example (9):

	UR	SR	GLOSS
(9)	/wa+ingine/ ⟶	[wɛːŋginɛ]	others
	/pa+ingine/ ⟶	[pɛːŋginɛ]	Somewhere

In the examples above, the low back vowel sound /a/ combines with the high front vowel sound /i/ and forms a new short, mid vowel sound segment /ɛ/which becomes lengthened (vowel lengthening) to compensate for the lost duration of the two vowels which have disappeared.

Ismail (2000) observed vowel nasalization in Makua. Examples extracted from his work is given in Example (10):

UR	SR	GLOSS
(10) /mura/ ⟶	[mũra]	bow
/nupa/ ⟶	[inũpa]	house

In the examples above, vowels that are adjacent to either the preceding or the following nasal consonants become nasalized.

In Kiha Nyanzira (2015) reported homorganic nasal assimilation. Kiha nasal sounds, for instance, :/m/, /Ŋ/ and /n/ are assimilated to bilabial /b/, velar /g/ and alveolar /d/. Example (11) demonstrates the process:

	UR	SR	GLOSS
(11)	/n + doza/ ⟶	[ndoza]	'will come'
	/n + golola/ ⟶	[ngolola]	'straight'
	/n + boge/ ⟶	[mboge]	'wind'

The above data show that homorganic nasal assimilation in Kiha takes place where nasal consonants precede stops, that is **[b],** [d], and **[g]**. The prefix ***n*** is the underlying representation that may be revealed in phonological representation by ***m, Ŋ***, and ***n,*** depending on the following stops ***b, d,*** and ***g***.

Mrosso (2016) reported anaptyxis in Chagga loan words from Kiswahili. This is a phonological process whereby an extra vowel is inserted between two consonants to break consonant sequences and simplify the articulation. Examples are given in (12):

(12)	**Kiswahili**	**Chagga Gloss**
	/almasi/	[alimasi] 'diamond'
	/kliniki/ ⟶	[kiliniki] 'clinic'

Shambaa has been studied by some scholars, the most extensive linguistic description being by Roehl in 1911. He described the tone-marked descriptive grammar of Sambaa

in German. During his time in Usambara, he described and analyzed the language and translated the New Testament into Sambaa. According to Odden, Roehl's grammar made Shambaa one of the first Bantu languages to have published information on tones (Odden, 1982). Roehl's book also included some traditional stories which are tone-marked and translated. Odden wrote about Shambaa tonal phenomena in 1978. Besha (1993) wrote the grammar and vocabulary of Shambaa. Riedel (2009) dealt with the syntax of object marking in Sambaa. Researchers studied Shambaa, but no one has written about Shambaa's phonological processes.

In all the research presented, no scholar focused on the phonological processes of the Shambaa language. That is, Steere (1867) dealt with Shambaa alphabets, vocabularies and numbers. Roehl (1911) wrote about tone-marked descriptive grammar. Odden (1978) wrote about Shambaa tonal phenomena. Besha (1993) wrote out the grammar vocabulary of Shambaa. Riedel (2009) dealt with the syntax of object marking in Sambaa. Saguti (2015) analyzed the verbal extension in Kishambaa. The gap thus prompted the current study to examine and realize knowledge on Shambaa phonological processes hence this study has bridged the gap.

VI.   METHODOLOGY

The study used interviews, documentary reviews and observation in collecting data. The researcher chose the approach due to its ability to better under phenomena. The researchers applied descriptive design whereby she observed and described the behaviour of speech sounds of the language in question. The design also entailed analyzing phonological processes, description of rules and interpreting data.

The study was done in Lushoto District in Tanga Region-Tanzania, where the native speakers of Shambaa are found. The target population of the study were adult native speakers of Shambaa. A non-probability sampling procedure was used to select 10 respondents who participated in the study. The researcher intended to use 9 respondents, 3 participants from each village but then snowball sampling added one more in Ubiri village following the advice from respondents. The snowball sampling was used to get the knowledgeable respondents for the study.

According to the nature of the study only 10 native speakers of Shambaa were used following the ideas Limponitugul (2009) who argues that it is not possible for the researcher to survey the whole population due to time and financial constraints especially when the population is very large, hence only few representatives. Therefore, the selected sample were used as the representatives of the entire

population of Shambaa speakers. The researcher selected these informants having in mind that the native speakers of the language are proficient to the language including the appropriate articulation of the words so as to get correct pronunciation of the language. The researcher used the same participants to verify the data collected through documentation.

The data were analyzed, transcribed and presented systematically employing a qualitative approach and the descriptive technique as Malande (2011) advises that once the linguist has collected enough data, she does a step-by-step analysis which covers the Phonological, Morphological and Syntax of the language if all these levels had not been analyzed before. The Shambaa words were analyzed and described by using phonetic rules and the rule order to discover which word would accept a certain rule, which rule comes first and which one could follow in its distributional relations among words of the language in question.

VII.   RESULTS AND DISCUSSION

7.1 Phonological Processes of Shambaa

The study focused on the Phonological Processes in Shambaa. The study intended to answer two major questions: the first one was, "What are the phonological processes of Shambaa?" This was the main objective used by the researchers in collecting data from Shambaa native speakers. Due to the nature of the study, the researchers couldn't request or interview the Shambaa native speakers and obtain directly the phonological processes from them. This is because the term or idea is more linguistically than mere language, the interview tool was used to collect raw materials (Shambaa sayings, songs, stories) and some words were obtained from Shambaa documentary reviews, then taken to respondents to be pronounced and the researchers observed their pronunciation and recorded the process of transcription to have their surface realization. For the collected data from Shambaa sayings and songs, the researchers selected only some words which suited the study, analyzed and transcribed them to get phonological processes found in the language and determined the rules that govern the processes. The analysis revealed the following phonological processes in the language: glide formation, vowel nasalization, vowel lengthening, vowel deletion, epenthesis, glide insertion, vowel coalescence, voicing vs. devoicing/ apocope, homorganic nasal assimilation, consonants aspiration, consonants deletion and substitution.

Glide Formation

Glide formation (GF) is a phonological process which has the effect of changing high vowel sound segments /u/ into

glide /w/ and /i/ into glide /y/ during the articulation of certain words with these sounds. This process does not affect identical vowel sequences since one of the identical vowels gets deleted and the remaining vowel lengthens in such sequence. The Glide formations of Shambaa are explained below. Consider the formation of glide sound /w/.

The Formation of /w/ Sound

A back glide /w/ is a half vowel and also a half consonant. Linguistically this is known as semi-vowel or semi-consonant or a glide. In identification processes, a glide has neither consonantal features nor vocalic features that is the reason for it to be called a glide. In glide formation, the high back vowel /u/ is articulated into glide sound segment [**w**] when it precedes a non-identical vowel. Examples and elaborations are given in (13).

(13)	UR		PR	GLOSS
(a)	/muae/	→	[mwa:e]	dirt smock
(b)	/muati/	→	[mwa:ti]	rain season
(c)	/muavi/	→	[mwa:vi]	wood spoon
(d)	/muitango/	→	[mwi:tango]	the call
(e)	/muomo/	→	[mwo:mo]	mouth
(f)	/fuo/	→	[fuwo]	foam
(g)	/muanga/	→	[mwa:nga]	smell of burnt food
(h)	/uanga/	→	[uwanga]	up
(i)	/u+a+dik+a/	→	[wa:dika]	You cooks
(j)	/mu+a+ja/	→	[mwa:ja]	Are you eating?

The process is not restricted to nouns only as it can also take place in infinitive verbs with stem-initial vowel sequences as in /a, e, i, and o/ as seen from the examples in (13). The data above, can be explained that, a high back vowel /u/ becomes a palatal sound or a glide sound /w/ in the environment where it was immediately preceded by another vowel sounds such as /a, e, i, or o/.

Formation of /y/ Sound

In Shambaa a front glide [y] is formed when a high front vowel /**i**/ is followed by a non-identical vowel. This takes place across the morpheme and/or word boundaries of nouns as seen in the examples below:

(14)	UR		PR/SR	GLOSS
(a)	/mi + oyo/	→	[myoyo]	heart
(b)	/mi + aka/	→	[myaka]	year
(c)	/mi + ao/	→	[miyao]	Wood reserve
(d)	/mi + undi/	→	[miyundi]	feet
(e)	/mi + embe/	→	[miyembe]	Mango trees
(f)	/mi + enge/	→	[mye:nge]	Uhuru torches
(g)	/mi+omo/	→	[myo:mo]	laws
(h)	/mi+avi/	→	[mya:vi]	Wood spoons
(i)	/mi+ongo/	→	[myo:ngo]	tens

From the examples in (14), the high front vowel /i/ has acquired glide feature [y], in the environment where it was immediately preceded other vowel sounds (a, e, o, i).

However, not everywhere when the sound /y/ is found is said to be a glide as some vocabularies can have all conditions but yet are not glide. The data in (15) elaborate this:

(15) UR   **PR/SR**   **GLOSS**

UR		PR/SR	GLOSS
/myayu/	→	[myayu]	Yawns
/pyenkua/	→	[pyenkua]	remove chaff from grain
/myagha/	→	[myagha]	Spricle
/mpya/	→	[mpʰya]	New
/hya/	→	[hya]	Be burnt
/vyala/	→	[vya:]	Give birth
/fyosa/	→	[fyosa]	Sack
/nyungu/	→	[nyungu]	Pot
/nyama/	→	[nyama]	Meat
/nyoa/	→	[nyoa]	Peel
/fyoghosha/	→	[fyoghosha]	Crush with hands

Therefore, the speaker especially the linguist who is not familiar with Shambaa should be careful in this so as not to mislead.

Vowel Nasalization

Another phonological process discovered was vowel nasalization. Vowel Nasalization is a process whereby a vowel sound acquires some nasal features due to its being adjacent to a nasal sound. In Shambaa this situation occurs when a vowel sound is adjacent to bilabial nasal sound /**m**/ and or an alveolar nasal sound /**n**/. Examples in (16) show how bilabial nasal sounds and alveolar nasal sounds affect vowels sounds, adjacent to them.

(16) UR   **PR/SR**   **GLOSS**

	UR		PR/SR	GLOSS
(a)	/mẹsho/	→	[mẹsho]	Eyes
(b)	/mishi/	→	[mĩshi]	Days
(c)	/moshi/	→	[mõshi]	Smock
(d)	/nange/	→	[nãnge]	Calabash
(e)	/nongo/	→	[nõngo]	Dirty
(f)	/mazi/	→	[mãzi]	Water
(g)	/mee/	→	[mẹe]	Milk
(h)	/mangaa/	→	[mangã:]	A kind of fish

From the examples in (16) above, we note that the vowels that preceded the nasal consonant sounds were nasalized, the vowels immediately followed after nasal consonant sounds were nasalized and the vowels that come between nasal consonant sounds were all nasalized.

High Vowel Deletion

Vowel Deletion is a process whereby a high vowel gets deleted in a certain environment. In Shambaa, two high vowels have been discovered as victims of this process. The high vowel sounds /u/ and /i/ get deleted when they occur immediately following a consonant. The process is accompanied by the syllabification of the preceding nasal consonant. In Shambaa the study has discovered the following:

Deletion of /u/ Sound

In Shambaa language, a high back vowel sound /u/ deletes when attached as a prefix syllable preceded by a bilabial

nasal sound /mu/ to the singular noun class. The examples below explain more:

(17)	UR		SR	GLOSS
(a)	/mu+ghoshi/		[Mghosh]	Man
(b)	/mu+bavi/	→	[M'bavi]	Thief
(c)	/mu+vyele/	→	[nvye:]	woman
(d)	/mu+ ndele/	→	[mnde:]	a girl
(e)	/mu + bwanga/	→	[m'bwanga]	a boy

From the above examples, the study has discovered that **u** is deleted when it is preceded by bilabial nasal sound **m** as in (17) (a)-(e) above. In (17) example c, it can be said that after the deletion of the high vowel sound /u/, the bilabial nasal sound /m/ is assimilated to labial dental fricative sound /v/ and changes itself as it has acquired alveolar nasal sound [n] in surface representation.

Deletion of the high Vowel Sound /i/

When it is attached as a prefix syllable, the Shambaa language deletes a high front vowel proceeded by an alveolar nasal sound /**n**/ to noun class. The data in (18) elaborate this:

(18)	UR		PR/SR	GLOSS
(a)	/ni + bogha/	→	[m'mbogha]	Its vegetable
(b)	/ ni + kweli/	→	[n'kwei]	It's true
(c)	/ni + tate /	→	[n'tate]	Its father
(d)	/ni + mame/	→	[m'mame]	Its mother
(e)	/ni + baba	→	[m'baba]	It is grandfather

Epenthesis

Epenthesis is the process whereby a segment is inserted in a position other than the initial. It may be in between or in the final position. In Shambaa the discovered epentheses are Vowels and Glide insertion.

Vowel Insertion

Vowel insertion (VI) is a process which inserts a vowel in a consonant cluster. In Shambaa loan words, vowels are inserted in order to block the consonant sequence not acceptable in Shambaa linguistic rules.

(19) Vowel Insertion (Data from the English language)

(19)	English		Shambaa	Gloss
(a)	/Blanket/	→	[bwa:ngeti]	Blanket
(b)	/Israel/	→	[Isilayeli]	Israel
(c)	/Mary/	→	[Maliya]	Mary
(d)	/Christ/	→	[Kilisito]	Christ

From the examples in (19) above, it was discovered that a vowel is inserted between consonant clusters in order to block the sequence of consonants which violates the sequential of Shambaa, and in the final position because Shambaa does not allow closed syllables. That is to say, a

vowel is inserted between two consonants or at the final position where consonant sounds put the boundary. This happens in order to block the system of **CC** which is not acceptable in Shambaa. Data from Kiswahili (20).

(20)	**Swahili**		**Shambaa**	**Gloss**
(a)	Israeli	⟶	[Isilayeli]	Israel
(b)	Maria	⟶	[Maliya]	Mary
(c)	Yeremia	⟶	[Yeremiya]	Jeremiah
(d)	Gabrieli	⟶	[Gabuliyeli]	Gabriel
(e)	Zakaria	⟶	[Zakaliya]	Zachariah

From the examples above it is noted that in each name ,there is more than one process taking place. In (20) (a), the vowel insertion has taken place in the second syllable to cancel the CC system which is not allowed in Shambaa and created CV system which is acceptable in this language. In the same noun, the sound /r/ is deleted, and its gap is compensated with a lateral /l/ sound to make the noun acceptable in Shambaa.

Glide Insertion

Glide Insertion is a process which inserts a glide in a certain environment. In Shambaa a glide is inserted in order to block the occurrence of two vowels sequence. There are two types of glide insertion in this language, namely:

(21) (a) /w/ Insertion
(b) /y/ Insertion

/w/ Insertion

A back glide /w/ is inserted between the beginning and ending points of diphthongs oe, au, ao, uo, and ua. The data in (22) confirm this:

/w/ Insertion

(22)	**UR**		**PR/SR**	**GLOSS**
(a)	/uanga/	⟶	[uwa:nga]	Up
(b)	/uongo/	⟶	[uwo:ngo]	Lies
(c)	/maua/	⟶	[mauwa]	Flowers
(d)	/miua/	⟶	[miuwa]	Kinds of trees

The data in (22) above show that glide sound /w/ has been inserted to break the diphthongs to separate vowels as in (a) and (b) above. It has also been discovered that, without breaking the diphthongs, the gliding sound /w/ has been inserted in order to make the possibility of articulating the word easier as explained in (c) and (d) above.

/y/ Insertion

Another case of glide insertion in Shambaa occurs when a front glide /y/ is inserted where the non-identical vowel comes to meet with a high front vowel /i/ such as; /ia, ai, ae, and io. This is done especially in the loan words from Kiswahili. The data in (23) were examined to get the gist of the argument:

(23)	**Swahili**		**Shambaa**	**Gloss**
(a)	Maria	⟶	[Maliya]	Mary
(b)	Miriamu	⟶	Miliyamu	Miriam
(c)	Raimondi	⟶	Layimondi	Raymond
(d)	Liliani	⟶	Liliyani]	Lilian
(e)	/maembe/	⟶	[mayembe]	Mangoes

(f)	Eliakimu	⟶	[Eliyakimu]	Eliachim
(g)	Eleazari	⟶	[Eleyazali]	Eliazar

From the above data, a front glide /y/ has been inserted between ai, ea, ia, and io, in words which are borrowed from standard Kiswahili.

Vowel Coalescence

Coalescence is the phonological process that affects sounds through assimilating two adjacent sound segments. There is only one type of vowel coalescence discovered in Shambaa, that is /**a+i**/**.** When a vowel segment /**a**/ is immediately followed by a segment /i/ they merge and form a new segment by changing some of their features and acquiring new features which result in a sound segment /**e**/. This segment is then lengthened to compensate for the lost segments into [e]. Let us consider the following examples in (24):

Vowel Coalescence of /a+i/

(24)	UR		PR/SR	GLOSS
(a)	/ma +(z) isho/	⟶	[meesho] [mesho]	Eyes
(b)	/ma + ino/	⟶	[meeno] [meno]	Teeth
(c)	/ma + iza/	⟶	[meeza] [meza]	Table

From the above data, it has been discovered that, when vowel sounds /**a**/ and /**i**/ come together, they form coalescence. After they form this coalescence, they both change into another different vowel sound /ee/ which is then lengthened to compensate for the two vowels. However, the lengthened vowels are not acceptable in Shambaa in those kinds of vocabularies, for this case, another process called **vowel deletion** takes place whereby one vowel was deleted to form an acceptable form as seen in the examples above.

Voicing versus Apocope

Apocope is a loss of a sound segment at the end of a word during articulation (devoicing). Many Bantu languages devoice the last high back vowel /u/ especially in words borrowed from the standard Kiswahili originating from the Arabic words. In an interesting way, Shambaa though being among Bantu languages, it lacks this habit of silencing the final high vowel sound /u/, instead, the sound is articulated louder. The data from standard Kiswahili to Shambaa in (25) below explain more about this situation:

(25)	Swahili		Shambaa	Gloss
(a)	/mwalimu/	⟶	[mwaimu] /[ŋgw'aimu]	Teacher
(b)	/kalamu/	⟶	[ka:mu]	Pen
(c)	/salimu/	⟶	[saimu]	Salim

Homorganic Nasal Assimilation

Homorganic Nasal Assimilation is a phonological process whereby a nasal consonant sound assimilates to the position of an adjacent consonant. In Shambaa, this can be confirmed using the following data:

(26)	UR		SR	GLOSS
(a)	/N + buzi/	⟶	[mbuzi]	Goat
(b)	/N + goma/	⟶	[ŋgoma]	Drum
(c)	/N + dama/	⟶	[ndama]	Calf
(d)	/N + goto/	⟶	[ŋgoto]	Sheep
(e)	/N + dema/	⟶	[nde:ma]	vegetable

From the above data, a nasal prefix /N/ is articulated at the same point as the consonant that immediately follows it.

Consonants Aspiration

Aspiration is the strong burst of breath that accompanies either the release or the closure of some obstruent. In Shambaa when a bilabial nasal sound or an alveolar nasal sound immediately precedes a voiceless plosive consonant sound such as /**p**/, /**t**/, and /**k**/, they produce aspiratory sounds [**ʰ**]. This is well explained in data (27) below:

(27) Shambaa Consonant Aspiration

(27)	UR		PR/SR	GLOSS
(a)	/mpeho/	⟶	[mpʰeho]	Cold
(b)	/mpome/	⟶	[mpʰome	Blood
(c)	/humpa	⟶	[humpʰa]	Disease
(d)	/nkambaku/	⟶	[nkʰambaku]	A bull
(e	/nkuhe/	⟶	[nkʰuhe]	mouse
(f)	/nkazu/	⟶	[nkʰazu	Died
(g)	/ntuhu/	⟶	[ntʰuhu]	another
(h)	/ntana/	⟶	[ntʰana]	Nice
(i)	/ntembo/	⟶	[ntʰembo]	elephant
(j)	/sinku/	⟶	[sinkʰu]	Cow-dang
(k)	/ntondwe/	⟶	[ntʰondwe]	Altars

From the above data, it has been discovered that in Shambaa when the nasal sound is articulated in the same point with voiceless consonant sound /**p, t,** or **k** /, they both form aspiration.

Consonant Deletion

Consonant deletion (CD) is a phonological process whereby a consonant gets deleted in certain environments. In Shambaa some consonants delete when violating the Shambaa linguistic rules of consonant vowel system. In borrowed words especially, it has been discovered that some consonants delete. When these consonants delete, other different consonants suitable in holding the meaning take over and replace the gap of the deleted one though not every time. We shall observe this in /r/ and /l/ deletion.

/r/ Deletion

From the consonant inventory of Shambaa, the language has no sound /r/ at all. Whenever it happens to borrow some words from languages with trill sound such as Kiswahili or English, the sound /r/ deletes and its gap can be replaced by the lateral sound /l/ or without any replacement. The data in (28) and (29) below from standard Kiswahili explain this clearly.

(28) /r/ Deletion in Shambaa

(28)	UR		PR/SR	GLOSS
(a)	/barabara/	⟶	[baabaa]	Road
(b)	/birika/	⟶	[biika]	Cattle
(c)	/kibiriti/	⟶	[kibiiti]	Match box

From the above examples, we have observed that sound /r/ is deleted, as a result the deleted sound is not compensated by any other sound.

However, there are some words which the /r/ sound delete and sound /l/ replaces the deleted part. Consider the data in (29) below;

(29)	Swahili		Shambaa	Gloss
(a)	/rangi	⟶	/langi/	Color
(b)	/Yairo/	⟶	[Yailo]	Jairus
(c)	/Yerusalemu/	⟶	[Yelusalemu]	Jerusalem

This process of /r/ deletion in borrowed words does not consider any condition. In that case, it can be explained that the process is unconditioned hence it needs no rule for representation as it has no specific condition to cause it to occur.

/l/ Sound Deletion

In Shambaa the sound /l/ is deleted, especially in the dialect of Lushoto central, while in Mlalo dialect, the sound /l/ is maintained. However, it is used by all dialects in compensation of the deleted /r/ sound from the borrowed words of languages with sound /r/ such as Kiswahili examples in (30) below explain more:

(30)	**Swahili**		**Shambaa**	**Gloss**
(a)	/kalamu/	→	[kaamu]	Pen(s)
(b)	/suruali/	→	[swa:e]	Trousers
(c)	/glasi/	→	[giyasi]	Glass
(d)	blangeti	→	[buangeti/bwa:ngeti]	Blanket

The examples above show that, sound /l/ deletes from the borrowed words when becomes among Shambaa vocabulary. It is deleted in order to conform to Shambaa rules. However, it should be understood that not only from the borrowed words but also the Shambaa dialect of the central Lushoto deletes sound /l/ in normal Shambaa words while the Mlalo and the part of Mtae maintain the sound. The vivid examples are given in (31) data below from Shambaa of Mlalo and that of Lushoto central:

(31)	**Mlalo Speakers**		**Lushoto Speakers**	**Gloss**
(a)	Mulungu	→	Muungu	God
(b)	Mbeleko	→	Mbeeko	Baby sling

However, there are some words which both of the two dialects conform and maintain sound /l/ in them, otherwise when you delete the sound segment /l/ we form an ill-formed vocabulary. Examples of these are given in (32)

(32)	**UR**		**PR/SR**	**GLOSS**
(a)	/makulija/	→	[makulija]	Uncountable/ a lot
(b)	/Kubulwa/	→	[kubulwa]	To lose interest/ to be tired
(c)	/Kuleha/	→	[Kuleha]	To be long
(d)	/ulazi/	→	[ulazi]	Baldness
(e)	/ulimi/	→	[ulimi]	Tongue
(f)	/ulaka/	→	[ulaka]	Lower jaw
(g)	/holwe	→	[holwe]	Sugar cane juice
(e)	/kukolwa	→	[kukolwa]	To be drunker
(f)	/kulasha/	→	[kulasha]	To shoot with a bow
(g)	Kuloa	→	[kuloa]	To fish with a line
(h)	Halala	→	[halala]	Grasshopper

From the data above, it can be observed that, both dialects are articulated in the same way without any deletion of /l/ sound. That means the rules are exclusive. Therefore, it should not be taken for granted that in every word where there is a sound /l/, it should be deleted.

Substitution

Substitution is a phonological process in which, one sound class replaces another class of sounds. In Shambaa, substitution happens to Shambaa sounds and in borrowed Kiswahili words.

Substitution of Sound /r/ to /l/

	Swahili		Shambaa	Gloss
(33)	/Arusha/	⟶	[Alusha]	Arusha
	/roma/	⟶	[loma]	Rome
	/raisi/	⟶	[laisi]	president

The examples above show that trill sound /r/has been changed with lateral sound /l/ to make the word pronounceable in Shambaa.

Substitution of Sound /k/ to /g/

	Swahili		Shambaa	Gloss
(34)	/msikiti/	⟶	[msigiti]	mosque

Looking at the example above you will discover that the voiceless velar sound /k/ has been replaced with the voiced velar sound [g].

Substitution of Sound /v/ to /z/

	Swahili		Shambaa	Gloss
(35)	/ubavu/	⟶	[ubazu]	rib
	/mbavu/	⟶	[mbazu]	ribs
	/kovu/	⟶	[nkozu]	scars

The examples above show that, the voiced labio-dental fricative sound /v/ has been changed with voiced dental fricative /z/.

Substitution of Sound /p/ to /h/

	Swahili		Shambaa	Gloss
(36)	/kutapika/	⟶	[kutahika]	to vomite
	/kupamba/	⟶	[kuhamba]	to decorate

From the data in (36) above, it can be explained that, the bilabial voiceless plosive sound /p/ has been replaced with the glottal sound [h]

Substitution of Sound /d/ to /g/

	Swahili		Shambaa	Gloss
(37)	/sindano/	⟶	[singano]	needle

Considering the example above, it has been discovered that, the voiced alveolar consonant sound /d/ is replaced with the voiced velar consonant sound [g] to make a word correlate with Shambaa vocabulary.

Substitution of Sound /f/ to /v/

	Swahili		Shambaa	Gloss
(38)	/mafuta/	⟶	[mavuta]	oil

From the above data (38), words from Kiswahili borrowed to Shambaa, we find that the voiceless labiodental fricative consonant sound /f/ from Kiswahili word, has been changed to the voiced labiodental fricative consonant sound [v] and makes the word a Shambaa word.

As discussed already about Shambaa lacking sound /r/, when it happens that it has borrowed words from a language with sound /r/, the sound can either be deleted or replaced by sound /l/. Examples are given from loan words of the standard Kiswahili below:

7.2 Phonological Rules Governing Phonological Processes of Shambaa

After discussing about different phonological processes affecting Shambaa human speech sounds in articulation of words, as it has been suggested by Chomsky and Halle (1968) that, it is important to represent clearly the rules governing the formation of phonological processes, it is now the time to represent the rules for the phonological processes explained above.

Formal and Informal Rules for the Formation of Glide Sounds /w/ and /y/.

As explained already in glide formation that glide sound /w/ in Shambaa is formed when the high back vowel sound /u/ precedes any other non-identical vowel in Shambaa vowel system, and examples given were such as: /muomo/, /muaja/, /muitango/ and many more which then in surface form change to be [mwo:mo], [mwa:ja], and [mwi:tango], refer examples in (13, 14, and 15) above. This situation has been represented informally in the following rule.

(39)

$$/u/ \longrightarrow [w] \Big/ \underline{\quad} \# \begin{Bmatrix} e \\ o \\ i \\ a \end{Bmatrix}$$

That is to say, the sound segment /**u**/, changes to glide [**w**] in the environment where it immediately comes before a non-identical vowel. The vowel sound /u# stands as independent syllable followed by any other vowels. Thus the /**u**/ to [**w**] rule is formally stated in (40):

(40)

$$\begin{bmatrix} + \text{back} \\ +\text{tens} \\ +\text{round} \\ +\text{voc} \\ -\text{cons} \\ +\text{high} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{high} \\ + \text{back} \\ +\text{round} \\ +\text{sonor} \\ +\text{cont} \\ +\text{voice} \end{bmatrix} \Big/ \underline{\quad} \begin{Bmatrix} \begin{bmatrix} +\text{low} \\ +\text{back} \\ +\text{syll} \\ +\text{sonor} \end{bmatrix} \\ \begin{bmatrix} +\text{nonor} \\ +/-\text{back} \\ +\text{syll} \end{bmatrix} \\ \begin{bmatrix} +\text{sonor} \\ +\text{syll} \\ -\text{back} \\ +\text{high} \end{bmatrix} \end{Bmatrix}$$

That is to say, a high back vowel sound /**u**/ becomes a back glide [**w**] in word or morpheme boundary before non-identical vowels. We exemplify [**w**] glide formation to derive the surface realization of the word /**mu+itang+o**/, step by step to see the arrangement of these rules as shown in (41).

(*41*)*/w/ Formation Derivations*

/mu + itang + o/	the call
/Mu+ itang + o/	UR
Mwitango	GF
mwi:tango	CVL
[mwi:tango]	PR/SR

In these derivations, glide formation (GF) and compensatory vowel lengthening (CVL) are crucial orders in the way that the former rule feeds the latter. If the order was inversed, incorrect results such as *[mwi: ta: ngo] or *[mwita: ngo] would be formed. It is very important to note also that, the ordering of glide formation and compensatory vowel lengthening before penultimate vowel lengthening, is important because segmental rules have to apply before auto-segmental rules.

It should be noted here that, glide formation and compensatory vowel lengthening rules, are in feeding relationships whereby the former feeds the later. Together with this proof, it should be remembered that not every high back vowel /u/ change into [w] when preceding the non-identical vowel, but some though fulfilling the requirements they still never change into glide but remain unchanged. With the example of noun /muamu/→ [muamu] in which Besha (1993) is of the view that this noun remains unchanged otherwise it forms incorrect vocabulary.

Another kind of glide formation explained is the formation of glide sound /y/. It is said that in Shambaa, the glide /y/ sound is formed when a high front vowel sound, is followed immediately by a non-identical vowel coming immediately after it. Examples given were /mioyo/ [myoyo], /miaka/, to [myaka], /miomo/, [myomo] and many others restricted to plural nouns.

This was then be presented informally using the following rule:

$$(42) \qquad i \longrightarrow y \quad / \underline{\quad} + \begin{bmatrix} \alpha \\ e \\ o \\ u \end{bmatrix}$$

From the above rule we find that, a high front vowel /**i**/ is articulated as glide [**y**] in the environment where it immediately precedes other Shambaa vowels in plural nouns. Thus, [**y**] formation can be formally stated by the following rule.

$$(43) \qquad \begin{bmatrix} +high \\ +tens \\ \\ +syll \\ -cons \end{bmatrix} \longrightarrow \begin{bmatrix} +voice \\ -cons \\ +sonor \\ \\ +high \\ +back \\ +cont \end{bmatrix} \Bigg/ \underline{\quad}\# \left\{ \begin{bmatrix} +back \\ -round \\ +low \\ +back \end{bmatrix} \begin{bmatrix} +low \\ +tense \end{bmatrix} \begin{bmatrix} +low \\ +back \\ +tense \end{bmatrix} \right\}$$

That is to say, a high front vowel /**i**/, becomes a front glide [**w**], in morpheme boundary before a non- identical vowel. The rule above can be used to drive /mioyo/

(44): Derivations in GF /w/

/mioyo/	**Hearts**
/mi + oyo/	UR
Myoyo	GF
Myo: yo	CVL &PVL
[myo:yo]	PR

In this derivation, glide formation (GF) and compensatory vowel lengthening (CVL) are in feeding relationships. That means the former feeds the later. CVL, takes place in order to compensate for the lost duration of the underlying syllable. On the other hand, GF and PVL rules apply independently. Then, PVL is rendered superfluous since the vowel in the penultimate position is already lengthened by the CVL rule.

Rule for Vowel Nasalization

In this process the vowel sound is nasalized when it is adjacent to a nasal sound. The consonant sound can either comes before or after the vowel sound. The examples discovered were such as: /mesho/ 'eyes' /nange/ 'calabash' /mazi/ 'water'. In these, it is said that, the vowel that is adjacent to a nasal sound acquires nasal feature sound, (see examples in 16 above). The processes can be formally expressed as follows:

$$(45) \begin{bmatrix} \text{-nas} \\ \\ \text{-cons} \\ \text{+syll} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+nas} \end{bmatrix} \Big/ \underline{\quad} \left\{ \begin{bmatrix} \text{+nas} \\ \text{+nas} \end{bmatrix} \underline{\quad\quad} \\ \begin{bmatrix} \text{+cons} \\ \text{+nas} \end{bmatrix} \underline{\quad} \begin{bmatrix} \text{+cons} \\ \text{+nas} \end{bmatrix} \right\}$$
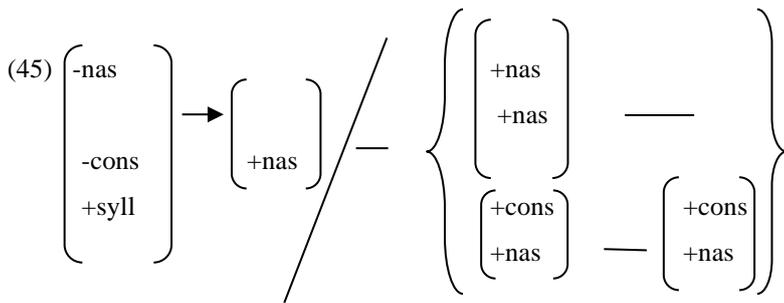
That is to say, a non-nasal vowel acquires nasal sound features, when preceded by the nasal consonant sound, or followed by a nasal consonant sound, or comes between a nasal consonant sound.

Rules for High Vowel Deletion

In (17) above, it is explained that high vowels /u/ and /i/ become deleted when immediately followed by consonant sounds. It is further explained that the high back vowel sound /u/, deletes when attached as the prefix syllable preceded by the bilabial nasal consonant sound /mu/, to the singular noun class and the high front vowel deletes when attached as the prefix syllable preceded by an alveolar nasal sound /n/ to a noun class. Examples given there, were nouns such as /mughoshi/ changing to [mghoshi], /mughoshi/ changing to [mghoshi] for bilabial and /ni mbogha/ which changes to [m'mbogha]. This kind of phonological process can be represented informally as shown here:

(46) (a) u $\longrightarrow$ ø $\big/$ m-+ C

(b) i $\longrightarrow$ ø $\big/$ n- + C
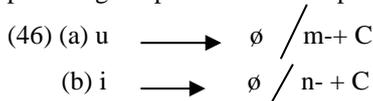
That is to say, in (46) (a) the high back vowel sound /u/ deletes [ø] when it is between the bilabial nasal sound and a non-nasal consonant. In (46) (b), the high front vowel /i/ deletes [ø] when it is between an alveolar nasal sound and a non-nasal consonant sound. Thus, the representation for HVD can formally be represented as follows:

(47) **/u/ Deletion**

$$\begin{bmatrix} \text{-cons} \\ \text{+ syll} \\ \text{+ back} \\ \text{+ high} \end{bmatrix} \rightarrow [\text{ø}] \Big/ \begin{bmatrix} \text{+cons} \\ \text{+ant} \\ \text{-syll} \\ \text{+nas} \end{bmatrix} \underline{\quad} \begin{bmatrix} \text{+cons} \\ \text{-nas} \\ \text{-syll} \end{bmatrix}$$
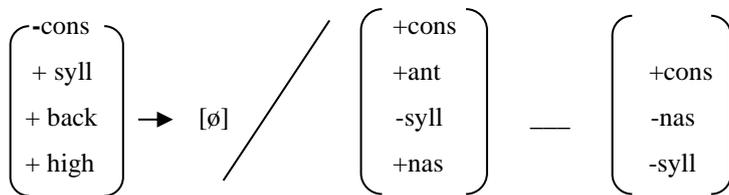
That is to say, a high back vowel deletes when it appears between an anterior nasal and a non- syllabic consonant across a formative boundary.

(48*). /i/ Deletion*

$$\begin{bmatrix} \text{+Voc} \\ \text{+ high} \\ \text{+back} \end{bmatrix} \longrightarrow [\text{ø}] \Big/ \begin{bmatrix} \text{+nas} \\ \text{- syll} \\ \text{- cor} \end{bmatrix} \underline{\quad} \begin{bmatrix} \text{+cons} \\ \text{-nas} \\ \text{- syll} \end{bmatrix}$$
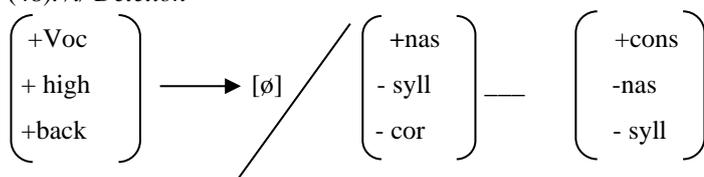
That is to say, a high front vowel deletes when it appears between an alveolar nasal and a non-syllabic consonant across a formative boundary.

Not that, high vowel deletion is followed by the syllabification of the preceding nasal consonant. That means that, after the deletion of [i] and [u], the remaining nasal segment conspires to preserve the same syllable structure. Therefore, the rule to account for such process will be nasal consonant syllabification. This rule can be stated informally in the following way:

(49).   (a) m $\longrightarrow$ m̩ $/$ __+C

(b) n $\longrightarrow$ n̩ $/$ __+C
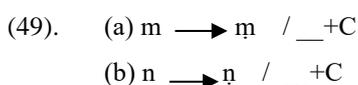
That means, in (49) (a), the bilabial nasal consonant sound /m/ becomes a syllable when it is immediately followed by a non-nasal consonant sound. And in (49) (b), the alveolar nasal consonant sound become syllable, when immediately followed by a non- nasal consonant sound. By formal rules, these can be represented in the following way:

(50) **/m/ syllabification**

$$
\begin{bmatrix} +nas \\ +ant \\ -cor \end{bmatrix} \longrightarrow \begin{bmatrix} +syll \end{bmatrix} \Big/ \underline{\quad} \begin{bmatrix} +cons \\ -nas \\ -syll \end{bmatrix}
$$
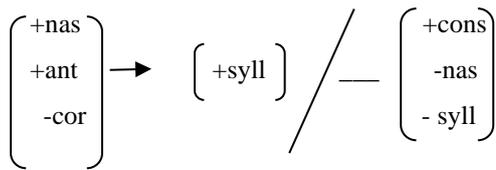
That is to say, bilabial nasal consonant syllabifies when followed by a non- syllabic consonant across the formative boundary.

(51) */n/ syllabification*

$$
\begin{bmatrix} +nas \\ +ant \\ +cor \end{bmatrix} \longrightarrow \begin{bmatrix} +syll \end{bmatrix} \Big/ \underline{\quad} \begin{bmatrix} +cons \\ -syll \\ -nas \end{bmatrix}
$$
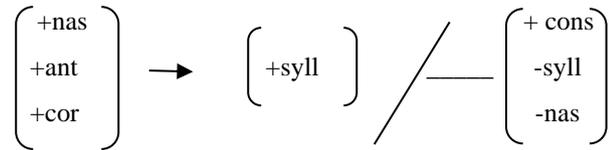
That is to say, the bilabial nasal consonant syllabifies when followed by a no-syllabic consonant across a formative boundary. Furthermore, since the bilabial nasal [m] and the alveolar nasal [n] share the feature [+anterior], and since the high front vowel [i] and the high back vowel [u] share the feature [+high], this should then be collapsed as in (52) and (53) below:

(52)
$$
\begin{bmatrix} +syll \\ +high \\ -Cons \end{bmatrix} \longrightarrow [\Theta] \Big/ \begin{bmatrix} +nas \\ -cons \\ -syll \end{bmatrix} \underline{\quad} \begin{bmatrix} +cons \\ -syll \\ -nas \end{bmatrix}
$$
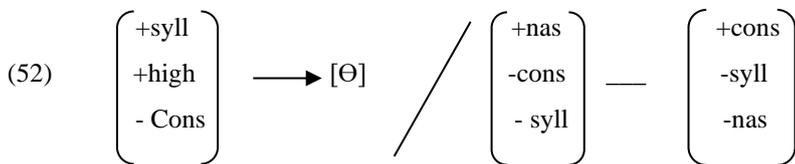
That is to say, a high vowel deletes when it appears between an anterior nasal consonant and a non-syllabic consonant across a formative bound. And the formal nasal syllabification below:

(53)
$$
\begin{bmatrix} +nas \\ +sonor \\ +ant \end{bmatrix} \longrightarrow \begin{bmatrix} +syll \\ -syll \end{bmatrix} \Big/ \underline{\quad} \begin{bmatrix} +cons \\ -nas \\ +co \end{bmatrix}
$$
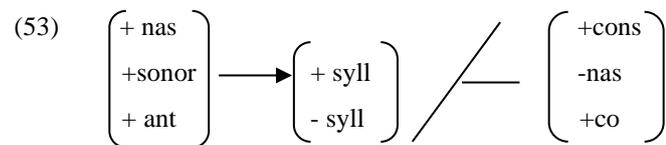
That is to say, an anterior nasal consonant syllabifies when followed by a non- syllabic consonant across a formative boundary.

However, in some cases this prediction may, superficially at least, not seem to hold truth, as it can be seen in the following data:

(54) *Words which do not delete high vowel sound /u/*

	UR		PR/SR	GLOSS
(a)	/muku/	⟶	[muku]	Extreme fatigue
(b)	/muhuye/	⟶	[muhuye]	Steam/breath
(c)	/misa/	⟶	[misa]	Sneeze

In (55) there are two successive occurrences of /**mu**/. The /**u**/ of the first /**mu**/ does not delete but in the /**u** / of the second /**mu**/ deletes and the nasal sound syllabifies. In (56), there are syllables; /**mu**/ and /**ni**/. The /**u**/ of the /**mu**/ that comes first, does not delete but the /**i**/ of the /**ni**/ that follows after /**mu**/ deletes and /**n**/ syllabifies. Note what would happen if both high vowels were to delete:

(55) *Incorrect High Vowel Deletion*

/**mu+mu+vik+ie**/	**Pray for her/him**
/mu+mu+vik+ie/	UR
M m vikie	HVD
M m viki:ye	GF
*[m m viki:ye]	PR/SR

Clearly these yield incorrect results. Therefore, [mum̩vikiye] has the following derivation:

(56*) Correct High Vowel Deletion*

/mu+mu+vik+ie/	**Pray for her/him**
/mu+mu+vik+ie/	UR
M um vikie	HVD
Mu m viki:ye	GF
[mu n' viki:ye]	PR/SR

We can make the following generalization: A high Vowel that follows a [ant] nasal, will delete if followed by a [-nas] consonant.

Therefore, we need to formulate the rule for HVD in the following way:

(57)
$$\begin{bmatrix} +back \\ +high \\ -nas \end{bmatrix} \rightarrow [\Theta] \Big/ \begin{bmatrix} +nas \\ +ant \end{bmatrix} \underline{\quad} \begin{bmatrix} +con \\ -syll \end{bmatrix}$$

That is to say, a high vowel deletes when preceded by an anterior nasal consonant and followed by a non-nasal consonant across a formative boundary.

Furthermore, the nasal consonant syllabification rules can be reformulated in the following:

(58)
$$\begin{bmatrix} +nas \\ -syll \end{bmatrix} \longrightarrow [+syll] \Big/ \underline{\quad} \begin{bmatrix} +cons \\ -syll \end{bmatrix}$$

That is to say, the non-syllabic nasal sound syllabifies when immediately follows the non-syllable consonant sound.

Rules for Coalescence

Coalescence phonological process was analyzed and discovered that, two non-identical vowel sounds is Shambaa assimilate and then, change to form another different sound. The examples given were 'maino', 'maisho' 'maiza' in which, they assimilated and formed new words such as 'meno', 'mesho' and 'meza' respectively. This process can informally be represented as in (59) below;

(59) /a/ + /(z)/ + /i/ $\longrightarrow$ [ee] $\longrightarrow$ [e]

That is to say, when a vowel /a/ combine with a vowel /i/ they produce ill-formed vocabulary *[ma (z) isho/ma (z) ino and /maize/]. In order to form an acceptable vocabulary, they change their original form and forms a new feature segments double [ee] so as to compensate the lost two vowels /a, i/, and because the double /ee/ are not acceptable in Shambaa to those words, the deletion process take over and remove one vowel to form correct and acceptable words such as: [mesho], [meno], and [meza]. This can then formally be represented as shown in (60):

(60)
$$\begin{bmatrix} +low \\ +back \\ -round \end{bmatrix} + \begin{bmatrix} +high \\ +front \\ -round \end{bmatrix} \longrightarrow \begin{bmatrix} +mid \\ +front \\ -long \end{bmatrix}$$

That is to say, when a low back and unrounded vowel is connected with a high front unrounded vowel, they change to be a mid-front un-lengthened vowel. These can be exemplified to derive the phonetic realization as shown in the word /mazisho/ below:

(61) Vowel Coalescence rule ordering

/mazisho/	**Eyes**
/ma +(z) isho/	UR
Meesho	VL
Mesho	VC &D
[mesho]	PR/SR

In these derivations we find that consonant deletion, coalescence, vowel lengthening and vowel deletion, are crucially ordered in the way that, the former feeds the later.

The Rule of Voicing

In the borrowed words especially from standard Kiswahili, loaned from Arabic, with final high back vowel sound /u/ such as 'kalamu', 'Salimu', and many others mentioned, which many Bantu speakers devoice this final vowel. In Shambaa it becomes different in the sense that, instead of devoicing the final sound, the Shambaa voices it. This can informally be represented as shown below:

(62) /m/ + /u̥/   ➔   [u]   /___ #

That is to say, the silent sound /u̥/ changes to be louder [u] in the environment where it follows immediately after the nasal sound /m/ in the borrowed word from the standard Kiswahili language. This can then formally be represented by the following rule:

(63)
$$
\begin{bmatrix} \text{-cont} \\ \text{-ons} \\ \text{+syll} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+cont} \\ \text{+syll} \\ \text{-cons} \end{bmatrix} \Big/ \underline{\quad} \begin{bmatrix} \text{+cons} \\ \text{+nas} \\ \text{-syll} \end{bmatrix}
$$
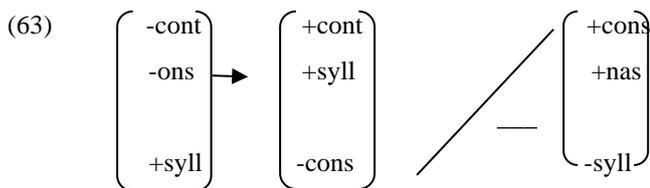
That is to say, the silent non-continuant vowel sound /u̥/ changes to a voiced continuant vowel sound [u] in the environment where it immediately comes after the nasal sound [m] in the borrowed Swahili words. However, we have to bear in mind that although Shambaa articulates this high vowel sound [u] which in many languages it is a silent one, they then delete consonant sound /l/ in these kinds of words before they come to maintain sound [u].

Homorganic Nasal Assimilation Rule

In (26) it was found that in this phonological process the nasal consonant sound assimilates or picks some features from the adjacent consonant. The process informally can be presented as follows:

(64) /N/   ➔ $\left\{\begin{matrix} m \\ n \\ ŋ \end{matrix}\right\}$ ___ $\left\{\begin{matrix} b \\ d \\ g \end{matrix}\right\}$
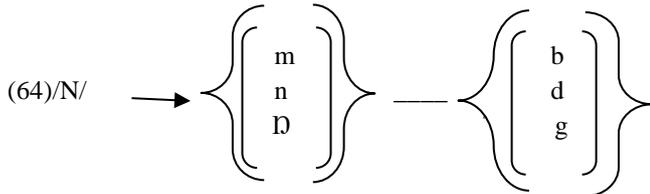
That is to say, the voiced nasal consonant sound /N/becomes a bilabial nasal-voiced consonant sound [m] as it immediately preceded the bilabial voiced plosive sound /b/. It also becomes a voiced alveolar nasal sound [n], as it immediately preceded the alveolar nasal plosive sound /d/. The nasal sound /N/ also changed to a velar sound [ŋ], as it preceded the velar voiced plosive sound /g/. The informal HNA can be formalized in the following manner:

(65)
$$
\begin{bmatrix} \text{+voice} \\ \text{+cons} \\ \text{+nas} \end{bmatrix} \rightarrow [\alpha \text{ place}] \Big/ \underline{\quad} \begin{bmatrix} \text{+voice} \\ \text{+cons} \end{bmatrix}
$$
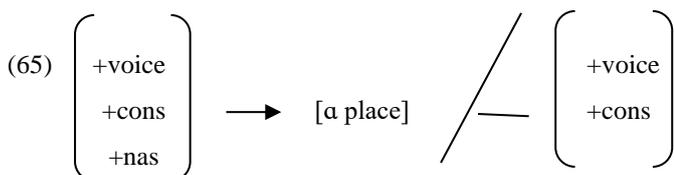
That is to say, the voiced nasal consonant is articulated at the same point of articulation with the following voiced consonant stop. This can be illustrated by showing how the word '**ndema**' (66), could be derived from its underlying structure:

(66) Rule ordering in Homorganic Nasal Assimilation

/ Ndema/	Vegetable
/N + dema/	UR
Ndeema	HNA
nde:ma	PVL
[nde:ma]	PR/SR

In the above derivation rules, homorganic nasal assimilation (HNA) and penultimate vowel lengthening (PVL), are not crucially ordered. Any of them could apply before first and correct results would be obtained.

Consonant Aspiration Rule

From (27) above, it was discussed that when Shambaa nasal sound precedes the voiceless sounds such as (p, t, k), they form aspiratory feature sounds [ʰ]. This process can informally be represented using the rule as in (67) below:

$$(67) \quad N/ \longrightarrow \begin{bmatrix} h \end{bmatrix} \Big/ \underline{\quad} \left\{ \begin{bmatrix} p \\ t \\ k \end{bmatrix} \right\}$$

The above informal rule can be explained that a nasal sound produces an aspiratory sound when it is immediately followed by the voiceless consonant sound /**p**, or **t**, or **k**/ which are articulated in the same point of articulation in the Shambaa language.

Formally the process is represented in the following way:

$$(68) \quad \begin{bmatrix} +nas \\ +cons \\ +son \\ +voiced \end{bmatrix} + \begin{bmatrix} +cons \\ +ant \\ -cont \\ -voc \end{bmatrix} \longrightarrow [\alpha \text{ place}^h] \Big/ \underline{\quad} \begin{bmatrix} +cons \\ +ant \\ -cont \\ \_\ strident \end{bmatrix}$$

That is to say, when a consonant nasal sound is articulated at the same place of articulation with the following voiceless stop, it produces an aspiration sound [ʰ] which was not there in the underlying representation of the speech sound.

Consonant Deletion Rules

Also, the study described the deletion of sounds /r/ and sound /l/ in the Shambaa language. We were told that the sound /r/ becomes deleted in borrowed words because this sound is not there in the Shambaa consonant inventory. For this reason, the Shambaa articulatory organs are unable to pronounce it, as a result, it is deleted or sometimes replace with the sound /l/. The examples were given in (28) above whereby the borrowed words from Swahili language such as (/Barabara/, /birika/, and /kibiriti/) are articulated in Shambaa as: ([ba:ba:], [bi: ka] and [kibi:ti]). From these examples, we find that the trill sound /r/ is deleted.

The deletion of lateral sound /l/, is also found in (29) (a) whereby the example of the word like /kalamu/ was changed to [ka: mu], removing /l/ sound. This can informally be represented as follows:

(69)   /r/ $\longrightarrow$ [ø] / V___V

         /l/ $\longrightarrow$ [ø] / V ___V

This means that consonant sounds/r/ or /l/ delete simply when it comes between two vowel sounds. This can formally be represented as in (70) below:

/r/ deletion rule

(70)

$$\begin{bmatrix} +cons \\ +voc \\ +cor \\ +sonor \\ +voice \\ -syll \end{bmatrix} \longrightarrow [\emptyset] \Big/ \begin{bmatrix} +voc \\ \\ -cons \end{bmatrix} \underline{\hspace{2cm}} \begin{bmatrix} +sonor \\ \\ -cons \end{bmatrix}$$
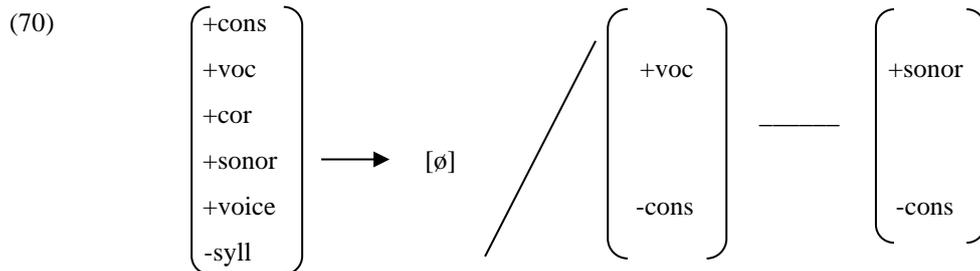
That is to say, the vocalic coronal sonorant voiced consonant sound is deleted, in the environment when articulated between vowels and leaves the two vowels joined together.

/l/ deletion rule

(71)

$$\begin{bmatrix} +cons \\ -syll \\ +cor \\ +lat \\ +voice \end{bmatrix} \longrightarrow [\emptyset] \Big/ \begin{bmatrix} +voc \\ \\ -cons \end{bmatrix} \underline{\hspace{2cm}} \begin{bmatrix} +voc \\ \\ -cons \end{bmatrix}$$
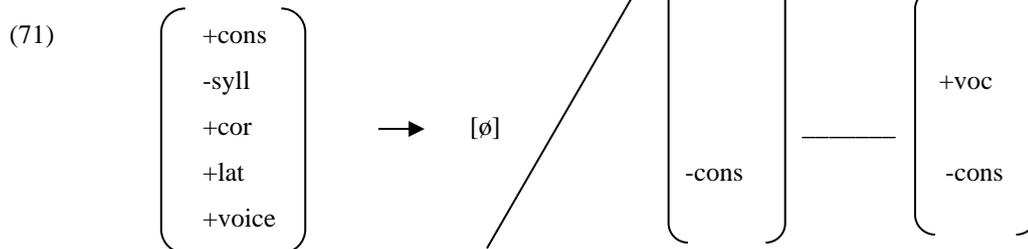
That is to say, the vocalic coronal sonorant voiced anterior lateral continuant consonant sound, deletes in the environment when articulated between vowels and leaves the two vowels joining to form vowel lengthening.

VIII. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusion

The study was done to find out the effect of phonological processes on Shambaa speech sounds. By using Shambaa phonemes, the analysis uncovered that some Shambaa speech sounds are affected by assimilatory and non-assimilatory phonological processes that cause changes in the place of articulation, manner and or voicing in their phonetic surface realization. The study identified phonological processes such as glide formation, vowel nasalization, vowel lengthening, high vowel deletion, epenthesis, vowel coalescence, voicing, homorganic nasal assimilation, consonants aspiration, consonants deletion, and substitution. These processes trigger changes such as lengthening, deletion, and insertion. Using phonological rules and rule ordering processes, formal and informal rules, the environment triggered changes from phonemic to phonetic realization were discovered and elaborated using linear and nonlinear phonological theories. However, some of the discovered phonological processes, their phonological rules are not discussed in this article.

8.2 Recommendations

This study has shown the way forward for other researchers who wish to conduct further research on Shambaa phonology, Shambaa dialects and language change.

The discovering of phonological processes in adult speech is a sign that phonological processes are not the case of human speech organs disorder or the inability to articulate speech sounds correctly. For this case, further study should be conducted in this area to come out with reasons for this situation.

Further research should focus on discovering phonological processes in adults' phonetics and proposition of a new suitable term rather than naming similarly to those made by children.

REFERENCES

[1] Besha, R. M. (1993). *A classified vocabulary of the Shambala language with outline grammar* (Vol. 10). Institute for the Study of Languages and Cultures of Asia and Africa, Tokyo University of Foreign Studies.

[2] Bowen, C. (2011). *Children's Speech Sound Disorder*. Oxford: Wiley-Blachwell.

[3] Chomsky, N. & Halle M. (1968). *Sound Patterns of English*. New York: Harper & Row.

[4] Gardner, W. L. (2010). *Toward transcultural training in phonological processes for Bantu language mother tongue translators* (Doctoral dissertation, Fuller Theological Seminary, School of Intercultural Studies).

[5] Guthrie, L. (1948). *The Classic of Bantu Languages*. Landon: Eoup.

[6] Hamann, S. (2011). *Bloomsbury Companion to Phonology*. Landon: Continuum.

[7]   Hyman, L. M. (1975). Phonology Theory and Analysis. New York: Rinehart & Winston.

[8]   Ismail, J. H. (2000). *A Tonological Study of Meto-Makua of Southern Tanzania.* The University of Dar es Salaam. Unpublished.

[9]   Limpamtugul, T. (2009). Methodological Consideration in Quantitative Study Examining the Relationship Between Job and Citizenship Behaviors. (Unpublished Thesis). Cardiff: Cardiff University.

[10] Mcbride-Chang. (1996). "Review of Chomsky and Halle: *The Sound Patterns of English*." In IJALA.

[11] James, M. & Malande, O. (2011). *An Introduction to Language and Linguistic Theory, with insight from African Languages.* Mwanza: Serengeti Educational Publishers (T) Ltd.

[12] Massamba, D. P. B. (2011). *Phonological Theory, History and development*. Dar es Salaam University Press.

[13] Mberia, K. (2002). *Nasal Consonant Process in Kitharaka.* Nairobi: University of Nairobi Kenya.

[14] Mrosso, D. (2016). The Effects of Phonological Processes of Chagga. Master of Arts (Linguistics) Unpublished Dissertation, St. Augustine University of Tanzania.

[15] Nyanzira, L. (2015). *The Phonological Processes in Kiha Language of Tanzania*: A Case Study of Kibondo District: MAL Dissertation of St. Augustine University of Tanzania. Unpublished.

[16] Odden, D. (1982). Tonal phenomena in Kishambaa. *Studies in African Linguistics*. Philadelphia: University of Pennsylvania Press.

[17] Riedel, K. (2009). *The syntax of object marking in Sambaa. A comparative Bantu perspective*. Netherlands: Graduate School of Linguistics.

[18] Roehl, K. (1911). Tonal Phenomena in Shambaa. Studies in African Linguistics.Netherland: LOT, Janskerkhof.

[19] Saguti, E. V. (2015). *The Analysis of Verbal Extension in Kishambaa.* St. Augustine University of Tanzania Faculty of Education (Unpublished).

[20] Schame, S. A. (1978). *The Treatment of Phonological Exceptions*. New York: Cambridge University Press.

[21] Shekumkai, R. B. (1990). Blessing Rituals among the Shambaa of Tanzania. Nairobi: Kenya. (Not published

[22] Torgesen, J. K. et al. (1993). Longitudinal Studies of Phonological Processing and Reading. New York: University Press.