

ASSIMILATION PHONOLOGICAL PROCESSES INVOLVING VOWELS IN TSHIVENḂA LANGUAGE

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ABSTRACT

This paper is a study of assimilation phonological processes involving vowels in TshivenḂa. The phonological processes presented in this paper are vowel nasalisation, vowel coalescence and vowel harmony in TshivenḂa. This serves to communicate that there is a paucity of studies on phonological processes involving vowels in TshivenḂa. This study offers new data that fills this gap in previous descriptions. A phonological fieldwork involving a wordlist was applied for the collection of data following a qualitative approach, a pure research paradigm and a descriptive research design. The International Phonetic Alphabet (IPA) was used for data analysis together with the Optimality Theory and Praat software in some instances.

Keywords: Key word: assimilation, phonological processes, vowel nasalisation, vowel coalescence, vowel harmony

1.0 INTRODUCTION AND BACKGROUND

Phonological processes are part and parcel of any language as such they have to be studied and understood for the growth of that particular language. TshivenḂa has many phonological processes involving both vowels and consonants, but only phonological processes involving consonants received more attention from a linguist point of view than those involving vowels. Therefore, it is important to have carried out an in-depth study of phonological processes in TshivenḂa. This paper would inevitably lead to the understanding of such processes in TshivenḂa and also help speakers of the language understand why they say certain things in certain ways. The study will also serve as reference material for further study on phonological processes in other African languages. The study employs rule based analytical techniques and analytical techniques from the Optimality Theory by Alan Prince and Paul Smolensky (1993).

TshivenḂa is spoken in the Northern parts of South Africa the Southern parts of Zimbabwe. Stayt (1968:13) asserts that, "VhavenḂa were originally from either the lower Congo or the Great Rift Valley, migrating across the Limpopo River during the Bantu expansion". Guthrie (1967, Vol.1) divided the Bantu language family into 15 zones of which TshivenḂa is one of

his classifications. By so doing Tshivenda is classified in zone S which is separated into five groups. Among the five numbered groups Tshivenda (Venda) is numbered S.20. However, according to Mesthrie (1995:45), Tshivenda is classified as S.21. This is the reason Bailey in Mesthrie (1995:32) classified Tshivenda (Venda) as S.20, S.21.

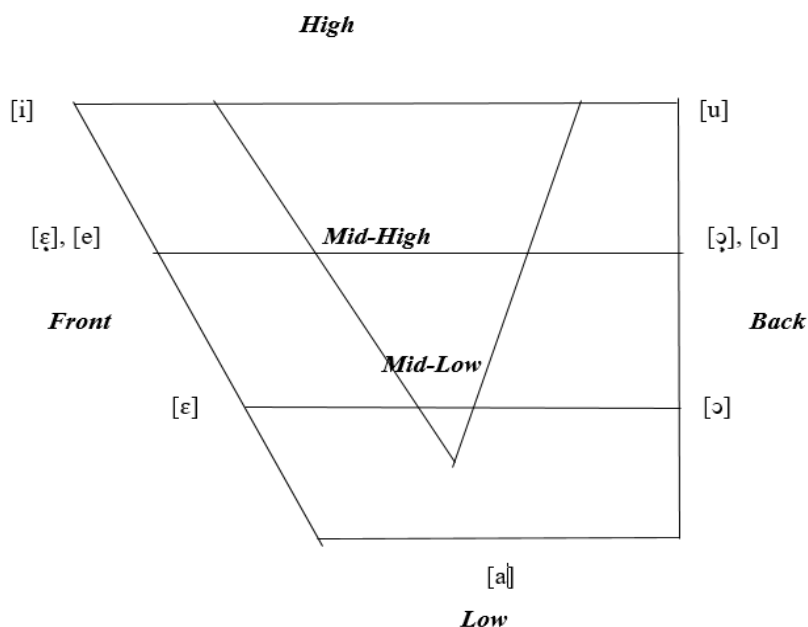
The study of vowels is essential in Tshivenda as well as other African languages. A vowel is a sound articulated with an open vocal tract, where the tongue does not touch the lips, teeth, or roof of the mouth or any other articulatory organ, (Roach, 2017). A vowel may be described in several ways, through the physiology of articulation (articulatory phonetics), through acoustic properties (acoustic phonetics), and through psychologically distinctive traits (phonemics), (Hitch, 2017). Vowels can be classified as open, close, open-mid, close-mid or front, high front, low front, central, back, high, high back, low, low back and round, (Hitch, 2017)

According to the literature of Tshivenda, there are five basic vowels in Tshivenda which are [a], [ε], [i], [ɔ] and [u]. Apart from these vowels there are also two other vowels which according to Milubi, are raised vowels while some linguists call them mid-high vowels. These are [ɛ̃]/[e] and [ɔ̃]/[o] (Milubi 1984, Van Warmelo 1989).

Vowel chart of Tshivenda

The vowel chart below (figure 1) shows the positions of Tshivenda vowels.

Figure 1 Tshivenda vowel Chart



This paper deals with some of the vowel problems encountered in Tshivenda during assimilation processes. All individual vowels in Tshivenda are oral which makes any degree of nasality on vowels a problem. Some of the problems include vowels hiatus. Mangoya

(2012) refers to vowel hiatus as the occurrence of adjacent phonologically independent vowels within a word within a word or morpheme, but more precisely at a morphological boundary. Orié and Pulleybank (2002) in Sabao (2009) define vowel hiatus as the arrangement of vowels across a syllable boundary or it can be referred to sequencing of vowels without placing a consonant between them. Sabao (2009) understands to vowel hiatus as the occurrence of two or more vowels that stand as individual syllables in a VV sequence. It should be noticed that in Tshivenḡa, not all adjacent vowels are problematic. Tshivenḡa is a complex language, it has CV syllables, V syllables and it accommodates VV sequences in some cases while in other cases it does not accommodate VV sequences. Previous descriptions of Tshivenḡa (Poulos 1990, Milubi 1984) do not offer a comprehensive set of data concerning assimilation processes involving vowels, hence, this study.

2.0 THEORETICAL FRAMEWORK / CONCEPTUAL FRAMEWORK

The theoretical framework underpinning this study is Optimality Theory. The major proponents of this theory in phonology are Prince and Smolensky (1993), Prince and McCarthy (1993) Optimality Theory proposes that a form is acted on simultaneously by a hierarchy of constraints that fall into the faithfulness constraints and markedness/well-formedness constraints. Faithfulness constraints are requiring that the element identified in the input must also be found in the output while markedness constraints require less violations on the output. According to McCarthy (2002:4), it is a general model which is concerned with structuring grammars. Historically, particularly in 1991, Alan Prince and Paul Smolensky began presenting their work on a new approach to language. According to McCarthy (2007) in 1993, the new approach was named the Optimality Theory and it spread through studies in Generative Grammar.

According to Blutner and Zeevat (2004) and Holt (2003), there are different elements of an Optimality Theory grammar (or language) and these include:

Input (Lexicon): The lexicon contains the lexical representations underlying forms of the morphemes and supplies the Input for the Generator (the phonological form of the morphemes is language-specific).

Generator: The Generator generates or create potentially a great number of Output candidates and passes them to the Evaluator for suitable evaluation.

Constraints: A Constraint is a condition, which can either be aligned to the Output-Form or it can be violated. The constraints are divided into three divisions which are: Faithfulness constraints, Markedness constraints and Alignment constraints.

Evaluator: The Evaluator consists of a set of ordered constraints and evaluates the Output candidates with regard to their "harmony values" (the degree to which they comply with the constraints). It selects the optimal candidate. Among the selection of different candidates, there should be one optimal candidate as Output.

Output: This states that if two candidates comply with several constraints, there must be further constraints which make the two different and select one candidate (actually, the optimal candidate). It is also possible to have two candidates that are identical. However, this

research work is in line with putting to use Optimality Theory principles as stated by McCarthy and Prince (1993) and Chacha (2009) which takes the following presentation:

- **Violability:** Constraints can be violated at a minimal extent.
- **Ranking:** Constraints are ranked according to the language-particular basis under study.
- **Inclusiveness:** The Constraints hierarchy explores two or more candidates that are accommodated by some general considerations following a well-formedness structure.

However, the analysis pinning this study involve the following constraints:

+ATR: Output must be articulated with an advanced tongue root.

+BACK: Output must be a back vowel.

+ROUND: Output must have lip-rounding.

MAX: Forbids deletion.

IDENT: Input and output should have the same value of an ATR feature.

UNIFORMITY (UNIF): No coalescence allowed.

The above constraints fit into two categories which are well-formedness (or markedness constraints) and faithfulness constraints. Well-formedness constraints deals with the extent to which forms are marked. Forms that are cross-linguistically avoided are considered marked. The other type of constraint is the faithfulness constraint, this focus on the output being trustworthy to the input thus having a link between the input and the output.

3.0 METHODOLOGY

A word list of Tshivenda basic words was constructed from Van Warmelo (1989) a dictionary of Tshivenda. Data was collected through phonological fieldwork. The methodology applied in the study was conducted to suit studies in linguistics and for assimilation phonological processes involving vowels in Tshivenda, the researcher followed the following methodological criteria:

3.1. Research paradigm

Dealing with the different research types in the field of linguistics, Brown (2007) talks of two major paradigms which are pure and mixed paradigms. The pure paradigm focuses on the exploratory interpretive information. The exploratory interpretive type requires a non-experimental design and results in qualitative data, while the analytical nomological type requires an experimental or quasi-experimental design and results in quantitative data (Alami 2015:1332). The research paradigm applied in this study is pure paradigm where the

researcher made use of exploratory interpretive because phonological processes are descriptive and need interpretations.

3.2. Research Approach

A qualitative approach was engaged for this study of assimilation phonological processes involving vowels in Tshivenda. A Qualitative research is related to comparing and contrasting different qualities, for example, the processes of learning new EFL/ESL vocabulary (Alami 2015:1332). In applied linguistics, qualitative data usually involves recorded spoken words or speech that is transcribed to textual form as well as written notes and documents of various types, (Dornyei 2007). In Nunan's view (2005:4), Qualitative research is concerned with understanding human behaviour from the actor's own frame of reference. Qualitative research encompasses a broad, expanding assortment of approaches including amongst others, narrative research, life history, content analysis, and so on (Duff 2002). This study has the features of narrative research and phonological processes have their roots in historical phonology, hence the need to apply a qualitative approach.

3.3. Research design

A descriptive research design was selected for the study of assimilation phonological processes involving vowels in Tshivenda. According to Atmowardoyo (2018), a descriptive research is defined as a research method used to describe the existing phenomena as natural as it could be. The word "existing phenomena" makes descriptive research contrary to experiment research which observes not only the existing phenomena, but also the phenomena after a certain period of treatment (Atmowardoyo 2018:198). A descriptive study focuses on conditions or relationships or connections that exist, opinions that are held, processes that are currently taking place, effects that are justifiable or trends that are developing, (Best and Kahn, 2003:114). Singh and Bajpai (2008:52) point out that, "Descriptive research uses qualitative methods to describe what is, describing, recording, analyzing, and interpreting conditions that exist." Grant (2010) differentiates between two main types of research in applied linguistics: experimental and descriptive. Experimental research refers to the carrying out of an experiment which requires investigating the areas which have anything to do with the assigned field of study. Descriptive research, by contrast, requires understanding and describing a research topic without having to respond with a field action. Descriptions and interpretations on assimilation phonological processes involving vowels in Tshivenda are indicated.

3.4. Population

The target population of the study was the native speakers of Tshivenda. Tshivenda speaking people are located Limpopo province of South Africa and Matabeleland South province of Zimbabwe (Beitbridge). The researcher was interested in the population which had little or no knowledge about linguistics in order to avoid bias when carrying out the research.

3.5. Sample

In linguistics, there is language data which involves language samples of various length, elicited from the respondent primarily for the purpose of language analysis (Alami 2015).

Ten informants (five from Beitbridge district, Zimbabwe and five from T̄hohoyand̄ou, South Africa) were selected for this study.

3.6. Sampling techniques

The researcher engaged purposive or judgmental sampling technique because the study needed specific informants for a specific phonological phenomena. A purposive sample, also referred to as a judgmental or expert sample, is a type of nonprobability sample. The main objective of a purposive sample is to produce a sample that can be logically assumed to be representative of the population, (Lavrakas, 2008). The researcher has chosen the participants as per his/her own judgment, keeping back in mind the purpose of the study (Showkat, 2017). This kind of sampling has a generalizing effect in that a small number of participants said to represents the group or community claiming the correspondence of responses. For example, instead of interacting with the entire Venda tribe the researcher have selected (10) people.

3.7. Instrumentation

A wordlist of Tshivenḁa words was used to carry a phonological field-work. According to Chelliah and De Reuse (2011:7) Linguistic (or phonological) fieldwork is the investigation of the structure of a language through the collection of primary language data gathered through interaction with native-speaking consultants of the language under study. The researcher also engaged himself in library research. According to Dornyei (2007), "A library research, also called secondary or conceptual, necessitates examining what other researchers have said about a particular issue, and is considered an essential form of enquiry because it would be a waste of time to ignore other researchers' findings and recommendations."

3.8. Data gathering

A wordlist was presented to the informants who were linguistically not knowledgeable in order to avoid biasness. Stating in line with Hramiak (2005:82), Primary data is that information which is used empirically, that is, analysis of this data leads directly to particular themes or conclusions. The primary data is that firsthand information which was specifically sought for the purposes of the research, for example, interview data and discussion board messages". Data collected through the wordlist was audio recorded, then transcribed.

3.9. Data analysis

Data gathered through a wordlist of Tshivenḁa was analyzed through the application of phonetics transcription. The Tshivenḁa phonetic chart which has been adopted from the International Phonetic Alphabet (IPA) was used for the transcription of the data. The researcher used a descriptive analysis technique for analysing the collected data because in order to define, describe and illustrate how a certain phonological process occur in Tshivenḁa. Further data analysis was done through rule based analysis, Praat software and the Optimality Theory through setting relevant constraints to decide on the optimal candidate.

4.0 RESEARCH FINDINGS AND DISCUSSION

4.1. Vowel nasalisation

Phonetically, all individual vowels in Tshivenda are oral. However, from a different point of view one might be tempted to define a nasal vowel (NV) as a vowel produced with the velum at least partially lowered so that air may escape through both the mouth and the nose (Ruhlen, 1973:3). Tshivenda does not have nasal vowels which are standing as individual sounds, but it does not mean that there is no nasality on vowels at all. In Tshivenda, all vowels following nasal consonants become nasalized. Nasalisation can occur either progressively or regressively. In Tshivenda nasal spreading is progressive. The phonetic transcription symbol [̃] may be placed over any vowel to indicate that it is nasalized (Mackay, 1987:83, Ladefoged, 1993:228).

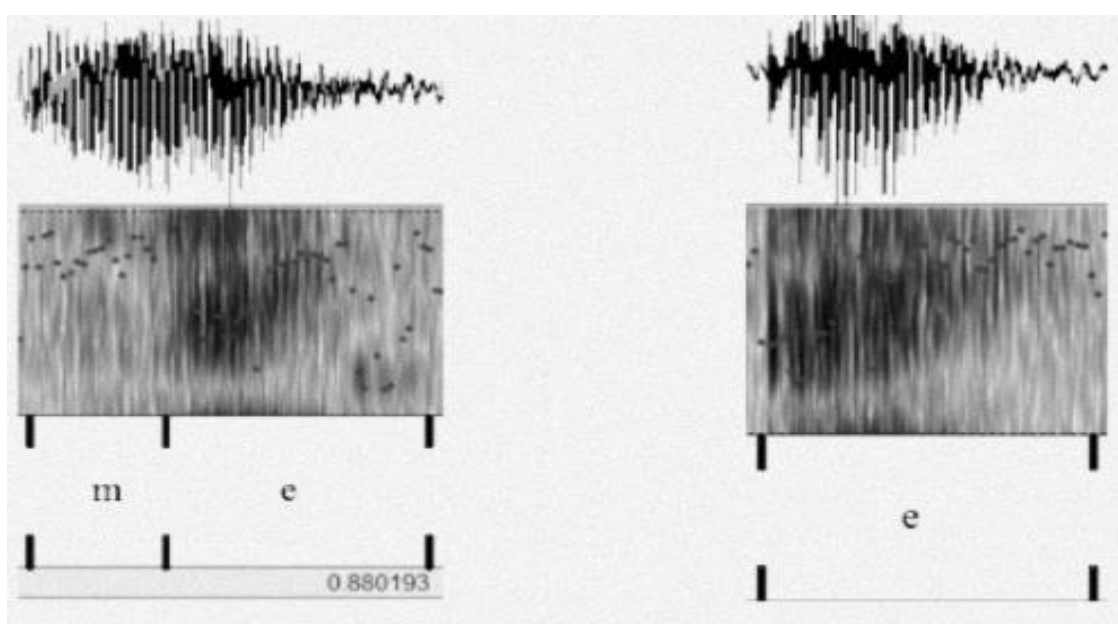
Table 1: Vowel Nasalization in Tshivenda

Vowels	Nasal words	IPA	Meaning
[a]	/mbaḁo/	[mbãḁo]	Axe
	/ngala/	[ŋgãfa]	Branch
	/mala/	[mãfa]	Marry
	/nyala/	[nãfa]	Antelope
	/langa/	[fanḡã]	Control
[ɛ]	/neta/	[nẽta]	Tire
	/mela/	[mẽfa]	Germinate
	/meme/	[mẽmẽ]	lip/lips
	/lembe/	[fembẽ]	Hoe
	/ngei/	[ŋgẽi]	There
[i]	/mila/	[mĩfa]	Swallow
	/miṭa/	[mĩṭa]	Families
	/rini/	[rinĩ]	Alveoli
	/ḁongi/	[ḁoŋgĩ]	Donkey
	/dindi/	[dindĩ]	Pit
[ɔ]	/ngowa/	[ŋgõwa]	Mushroom
	/bono/	[bõnõ]	Vision
	/moḁoro/	[mõḁoro]	Car
	/mboho/	[mbõho]	Bull
	/ndovhedzo/	[ndõβedzo]	Baptism
[u]	/nguluvhe/	[ŋgũfuβe]	Pig

/nyuga/	[nũ ga]	Unit
/muri/	[mũ ri]	Tree
/mbudzi/	[mbũ dzi]	Goat
/nukha/	[nũ kha]	Smell

Every vowel which follows or which is preceded by a nasal sound becomes nasalized in Tshivenḡa. This leaves the flow of nasal spreading progressive and becomes the assurance that there are no individual vowels which are nasals. From table 1 above, all bold vowels with a symbol [̃] are nasalized. According to Singhal & Das (2013:307), “The analysis of the spectrums of nasalized and non-nasalized vowels clearly verifies that there are indeed extra resonances present in case of nasalized vowel near the first formant region. There is also a lowering in the amplitude of the first formant.” Nasals have some formant structure, but are better identified by the relative areas of little (reduced) or no spectral energy”, (<https://home.cc.umanitoba.ca/~robh/howto.html>). The figure below illustrates the praat analysis of vowel [ɛ] in the word /meme/ when it is preceded by the nasal [m] and when it is articulated as an individual sound.

Figure 2: Spectrograms illustrating nasal spreading on Tshivenḡa vowels



The first formant (F1) of the individual vowel [ɛ] in the illustration above is 1778Hz while the first formant (F1) of the vowel [ẽ] which is preceded by a nasal sound [m] is 1221Hz, hence the lowering of the first formant (F1) when vowel ẽ has acquired nasal feature, (Singhal & Das, 2013).

4.2. Vowel coalescence

Coalescence is a particularly fascinating phenomenon because it exhibits properties found in other phonological processes, (Key, 2008:1). It is a process by which two input segments are merged into a single output segment that is distinct in at least one feature from the segments to which it corresponds. Coalescence in many (different) languages occur as a result of the influence of any or all of the three basic forms which are; (i) the two vowels which are different merging into an intermediate quality vowel or (ii) the merging of identical short vowels into a long vowel, or else (iii) the two vowels are replaced by a single instance of them, either short or long, (Sabao, 2012, 2013). The pairs of vowels which merge to form one vowel in Tshivenḡa are as follows: [a+u=ɔ], [a+i=ɛ], [i+i=i], [a+ɔ=ɔ], [a+a=a]. This takes place when merging vowels are adjacent or at a long distance where the first vowel on the next word follows a word ending with another vowel.

i. Coalescence which occur with [a] of the form /zwa/ + vowel [u]

Among various forms by which sound changes occur, there is coalescence of vowels [a] and [u] of the form /zwa/ + the concord /u/. From a coalescence perspective, the form /zwa/ is part of an adjective clause. Table 2 below is showing coalescence of [a] and [u] which occur with adjective clauses of the form /zwa/.

Table 2

Mergers	Construction	IPA and meaning
[a+u = ɔ]	zwa + u-ḡaho > zwo ḡaho	[zwɔ ḡaho] which came
	zwa + u-tsaho > zwo tsaho	[zwɔ tsaho] which is dropped
	zwa + u-nakaho > zwo nakaho	[zwɔ nakaho] which is beautiful

The vowel [a] of the form /zwa/ has coalesced with the vowel [u] which is a concord and formed the vowel [ɔ].

ii. Coalescence of [a] and [u] of verb phrases

There is coalescence of vowels [a] and [u] which involves verb phrases with one or two single syllabled verbs in Tshivenḡa. For instance, the vowel [a] of the form /ya/ which is a verb /go/ and the vowel [u] which is a concord connecting two verbs /ya/ and /ḡa/ (eat) in a phrase. The table below shows good examples of the coalescence of vowels [a] and [u] in verb phrases containing two verbs.

Table 3

Mergers	Constructions	IPA and meaning
[a + u = ɔ]	i ya + u-ḡa > i yo ḡa	[i jɔ ḡa] go, eat
	i ya + u-dzhia > i yo dzhia	[i jɔ dzhia] go, take
	i ya + u-vhona > i yo vhona	[i jɔ vhona] go, see

	ḁa + u > ndzhiela > ḁo ndzhiela	[ḁo ndʒiefa] take for me
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As an end result of the above constructions, the coalescence of vowels [a] and [u] led to the formation of vowel [ɔ].

iii. Coalescence which occur with vowels [a] and [i]

The coalescence of vowels [a] and [i] occurs mostly with demonstratives in Tshivenda. The vowel [a] of the forms /nga/ or /kha/ merge with the initial vowel [i] of demonstratives whose first segment is always [i]. The table below shows constructions of the forms /nga/ and /kha/ on demonstratives leading to coalescence of vowel [a] and [i].

Table 4

Mergers	Construction	IPA and meaning
[a+i= ɛ]	nga + izwi > ngezwi	[ŋgezwi] here they are
	kha + iyi > kheyi	[kheji] here it is
	kha + izwi > khezwi	[khezwi] here they are

The vowel [a] of the forms /nga/ and /kha/ coalesce with vowel [i] when they precede demonstratives whose initial segment is vowel [i] and as a result they lead to the formation of vowel [ɛ].

iv. Coalescence which occur with vowels [i] and [i]

The vowel coalescence which occur with vowels [i] and [i] takes place with some of the nouns whose first segment is the vowel [i] and which belongs to class prefix 20 which is /ḁi-/. When this process takes place the vowel [i] of the noun prefix /ḁi-/ coalesce with the first segment of the nouns which in this case is the vowel [i]. The table below shows constructions where vowels [i] and [i] merge together to form a single vowel.

Table 5

Mergers	Construction	IPA and meaning
[i+i= i]	ḁi + iḁo > ḁiḁo	[ḁinɔ] tooth
	ḁi + iḁo > ḁiḁo	[ḁitɔ] eye
	ḁi + ifa > ḁifa	[ḁifa] inheritance

The vowel [i] of the noun class prefix /ḁi-/ and the initial vowel which is [i] of the noun merge together into a single vowel [i]. This must not be confused with vowel deletion. In this case and from a coalescence point of view the vowel [i] is not deleted, but it merged with the other [i]. In other words, it is possible to have two processes happening simultaneously in one

processes. Talking of Vowel hiatus resolution through coalescence in Bantu languages (Doke, 1943) talks of the coalescence of identical vowels merging such as /a+a=a/. Although vowel deletion is an alternative process which may have occurred with identical vowels, coalescence has an equal standing on the other hand.

v. Coalescence which occur with vowels [a] and [ɔ]

‘The coalescence of vowels [a] and [ɔ] occurs with adjectives which denote loneliness in Tshivenda, for example, he is alone. The process takes place when the adjective /-oṭhe/ which means alone/lone is added to a class 2 noun prefix /vha-/ which denotes plurality of people. The vowel [a] of class 2 noun prefix /vha-/ coalesce with the initial vowel [ɔ] of the adjective /-oṭhe/. This is illustrated by the table below.

Table 6

Mergers	Construction	IPA and meaning
[a+ɔ= ɔ]	vha + oṭhe > vhoṭhe	[βɔṭhɛ] alone

NB: just like the case with the coalescence of vowels [i] and [i], it is also possible that another process other than vowel coalescence may have simultaneously taken place with the adjacency of vowels [a] and [ɔ]. Identical vowels can become one vowel since they have same features, (Doke, 1943).

vi. Coalescence which occur with vowels [a] and [a]

The coalescence of vowels [a] and [a] occur with adjectives denoting own as in /they did it on their own/. Actually, the process takes place when the adjective which denotes own /-aṅe/ is added to class 3 noun prefix /ma-/. For example, in /ma-/ + /-aṅe/ the vowel [a] of the class 3 noun prefix /ma-/ merge with the initial vowel [a] of the adjective /-aṅe/ to become a single vowel [a]. Illustrations of such constructions are in the table below.

Table 7

Mergers	Construction	IPA and meaning
[a+a= a]	ma- + aṅe > maṅe	[maṅɛ] their own (as in things)
	vha- + aṅe > vhaṅe	[βaṅɛ] their own (as in people)

NB: Like in table 2 and 3, it is also possible to say vowel [a] may be deleted.

4.3 Vowel harmony

A process by which vowels in adjacent syllables in some domain (typically a word) agree with each other in terms of some distinctive feature(s) (Bakovic, 2002:1). Vowel harmony is a phonological pattern in which vowels within some domain – typically the word – share one or more phonological features, like lip rounding or tongue position (Katamba, 1989: 211).

Vowel harmony occurs in various ways and in Tshivenda there is rounding harmony where an unrounded vowel becomes round, backing harmony where a non-back vowel becomes a back vowel and height harmony where a vowel is pronounced a bit higher than its normal position. The rounding and backing harmony in Tshivenda occur with vowel [a] which phonetically is a lower and mid vowel. This kind of vowel harmony takes place with some of reconstructed forms of Tshivenda. What happens is that when the old form was changed, the vowel [a] became vowel [ɔ] because of a back high vowel [u].

Rounding harmony and backing harmony occur with the vowel [a], when it is harmonized by a back-round and high vowel [u] it becomes a back-round vowel [ɔ] which is also characterized by a raising feature.

<i>ta + u</i>	> <i>tou</i>	[tɔu]	‘(I) do’
<i>Ɂola + u</i>	> <i>Ɂolou</i>	[tɔɁu]	‘always’
<i>soka + u</i>	> <i>sokou</i>	[sɔkɔu]	‘just’
<i>kha + u</i>	> <i>khou</i>	[khɔu]	‘(I) am’
<i>Ɂoda + u</i>	> <i>Ɂodou</i>	[tɔdɔu]	‘want to’

From the above illustration, the vowel [a] changed to the vowel [ɔ]. The features acquired are lip rounding, a shift from the position of low vowels to the position of back and high vowels, hence the advanced tongue root (ATR). The phonetical symbol (·) was use to the output to indicate that there has been a change in height. Advanced tongue root refers to the features of a sound made by drawing the root of the tongue forward. This feature distinguishes between tense vowels as [+ATR] and lax vowels as [-ATR] (Burquest and Payne 1993:18). All high vowels in Tshivenda are produced with an advanced tongue root, therefore, they are tense vowels. The analysis below focuses on four main constraints:

- i. +ATR: Raised vowels have an advanced tongue root.
- ii. MAX: Forbids deletion.
- iii. IDENT: Input and output should have the same value of an ATR feature.
- iv. UNIFORMITY (UNIF): No coalescence allowed.

Table 8: Tableau illustrating analysis of vowel harmony in Tshivenda

/sokau/	[+ATR], [+round], [+back]	MAX	IDENT(+lo)	UNIF
a. [sɔkɔu]	*!			
b. [sɔkɔu]			*	
c. [sɔkɔ]	*![+ATR]	*!	*	*!

After carrying out an Optimality Theory analysis, (b) is the optimal candidate, it has less violations compared to other candidates. Candidate (a) has no correspondence with the expected output, thus it violates markedness constraints. Candidate (c) has higher violations, it cannot become the optimal candidate.

5.0 CONCLUSIONS AND RECOMMENDATIONS

In line with this study, assimilation phonological processes involving vowels in Tshivenda are vowel nasalisation, vowel coalescence and vowel harmony, hence, the scope of this paper. The simple generalization below summarizes phonological processes involving vowels according to this study.

Table 9: Generalization of data

	Underlying Representation	IPA	Meaning	Note
a.	/ngala/	[ŋgãfa]	‘a tree brunch’	Nasalization
b.	/langa/	[fanɡã]	‘control’	Nasalisation
c.	/khaizwo/	[khezwo]	‘here they are’	Coalescence
d.	/ngaizwo/	[ŋgẽzwo]	‘here they are’	Coalescence
e.	/khau/	[khɔu]	‘am’	Harmony
f.	/toḁau/	[tɔḁou]	‘want to’	Harmony

As a result of nasal assimilation, nasal features spread to vowels only progressively and every vowel preceded by a nasal sound becomes nasalized in Tshivenda. The acquisition of nasal feature by vowel sounds in Tshivenda involves manner of articulation. It is impossible for nasalized vowels to stand as individual vowels since it could also be a problem of positioning them on the vowel chart of Tshivenda. It is recommended that there is a possibility of co-articulation between nasals preceding vowels and vowels that acquire nasal feature because those vowels may be affecting nasal sounds to a certain degree.

With coalescence assimilation affects both manner and place articulation. The output vowel has a different place of articulation from either of the two vowels which influenced it, hence a different manner of articulation. However, this phenomenon occurs with the three sets of vowel coalescence in Tshivenda except for identical vowels /i+i=i/ and /a+a=a/. in a nutshell, [a+u>ɔ], [a+i>ɛ], [i+i>i], [a+ɔ>ɔ] and [a+a>a] are the only vowel pairs which cause vowel coalescence in Tshivenda. One of the recommended knowledge is that vowel hiatus is not always a problem in Tshivenda because there are certain forms that accommodated it as it is.

For example, the following vowel sequences are not problematic: /aa!/ (the women way of salutation 'hello'), /hai/ (no), /ndau/ (lion).

Vowel harmony occur simultaneously with the vowel [a] where it is harmonized to be a round, back vowel [ɔ] with an advanced tongue root (ATR). Assimilation that occurs with vowel harmony involves both place and manner of articulation in that the output vowel [ɔ] is a mid-high back vowel. As a result the output vowel [ɔ] was formed from the low-center vowel [a] which was dominated by the features of a high vowel [u].

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