SOME ASPECTS OF SISWATI PHONOLOGY

Cynthia Hlobsile Mkoko

1833115

School of Literature, Language and Media

University of the Witwatersrand, Johannesburg, South Africa

A dissertation submitted to the University of the Witwatersrand in fulfillment of the requirements for the Doctor of Philosophy in Linguistics Degree

Supervisor: Professor Maxwell Kadenge

April, 2021

PLAGIARISM DECLARATION

I hereby declare that this dissertation is my original work. All outside sources have been acknowledged. It has not been submitted, in part or its entirety, to any institution of higher learning.

____________	30 April, 2021
Signature	**Date**

ACKNOWLEDGEMENTS

I am grateful to Professor Maxwell Kadenge, my supervisor, without whose academic insights, the project would have never been a success. Thank you for sharing your expertise with me; this dissertation would not exist without your guidance.

I would also like to extend my sincere gratitude to the University of ESwatini for their support throughout this project. Through their staff development programme(s) that offer study leave with pay, I was able to dedicate enough time and finances to the successful completion of this dissertation. Access to the periodic staff leave offered by the institution enabled me to take writing and study breaks, which translated to less stress and increased productivity.

To Dr. Glory Malambe, thank you for being my sounding board throughout this journey; without your assistance and continued academic and moral support, this challenging journey would never have been a success. I will forever be indebted to you for your mentorship throughout my career.

I am grateful to Dr. Kabelo Sebolai, my early reader, for taking the time to plow through my work, offering valuable structural input and making relevant corrections that shaped the overall outlook of the dissertation. I also extend my sincerest gratitude to Ms Telamisile Mkhatshwa for editing and proofreading the final document. Thank you to Alyssa Vratsanos for being readily available when my computer skills in accessing phonological content failed me. Sometimes I would email to ask the most mundane of questions, and you would answer them all. Sometimes it is indeed the little things that matter. Thank you for everything and all the best in your PhD journey.

Many thanks to Ms. Qondile Mntshali and Mr. Njabuliso Mathobela for being there when I needed assistance with siSwati-English data translation – you were able to confirm the nuances that come with meaning conversion across languages. I am also grateful to Mrs. J. H. Nkosi and Dr. Makgolu Letsoela for their guidance and moral support throughout this project. I am thankful for their understanding and provision of timeous advice on balancing my day-to-day work responsibilities with my doctoral studies. *Kea leboga boMme*!!

Thank you to the Junction Running Club and Faith Smith, my gym buddy, for helping me find a balance between work and study. Our weekly runs made it possible to blow off steam, a pivotal aspect in keeping one's physical and mental health in check.

I am thankful for Leonard Mhlanga and Gugu Thwala, friends who became parents to my kids while I was away. May God richly enlarge their territories, and may I never forget the friendship and care afforded my family.

Finally, I would like to extend my sincere gratitude to my children, Fezile and Busiswa, for their support and understanding when I was away – physically and mentally – while working on this dissertation. They were the first people to bear the brunt of my financial strain and academic frustrations, but they never stopped supporting me. Thank you for encouraging me to take much-needed breaks from my work and for wandering into the wilderness on our timeless walks and hikes, trying to blow off (phonological) steam that was not even theirs.

May God richly bless you all for your support!

ABSTRACT

The study examines siSwati segmental phonology. It highlights how various phonological processes eliminate dispreferred phonological structures, as conditioned by the morphological domains in which they occur. I use hiatus resolution patterns, loanword adaptation, /mu/ reduction, and word minimality to present evidence for the siSwati syllable structure and permissible minimal word size.

Firstly, the study demonstrates how the selection of hiatus resolution patterns is contingent upon the morphological context in which they occur, displaying the intricate relationship in the phonology-morphology interface. The study also presents an analysis of loanword nativisation in siSwati to further account for how the siSwati grammar eliminates mismatched output forms. The analysis of /mu/ reduction provides evidence for single C-Slot and V-Slot specification in the siSwati grammar. Lastly, word minimality effects demonstrate the strategies that siSwati uses to maintain its preferred minimal word size.

Leaning on native speaker intuition, the analysis employs Optimality Theory (Prince & Smolensky, 1993/2004) to present a unified account of markedness and faithfulness constraint interaction in parsing CV syllables and minimally well-formed Prosodic Words. Analytical insights from Feature Geometry (Clements & Hume, 1995) are used to explain feature spreading in the epenthesis patterns attested in the language. The model is deployed to account for the representation of complex segments such as NCs and CGs in the grammar, displaying how they optimally fit into the preferred CV syllable structure.

The goal in each of the phonological processes under investigation is to ensure that all output forms are harmonious with the siSwati CV syllable template and word minimality restrictions in the grammar. The study places the syllable at the centre of phonological analysis, highlighting how markedness and faithfulness constraints in the various phonological processes under investigation conspire to eliminate ill-formed phonological structures in all surface forms. This thesis is motivated by the desire to ensure that siSwati grammar parses onsetful syllables and minimally well-formed Prosodic Words in all surface representations.

TABLE OF CONTENTS

CHAPTER 3 AN OVERVIEW OF SISWATI PHONOLOGY AND MORPHOSYNTAX ……………………………………………………………………………………………43

CHAPTER 4 VOWEL HIATUS IN SISWATI………………………………………75

LIST OF TABLES

LIST OF TABLEAUX

LIST OF FIGURES

LIST OF ABBREVIATIONS

ASSOC.	-	Associative
C	-	Consonant
CL	-	Class
CV	-	Consonant Vowel
C^w	-	Labialised consonant
C^j	-	Palatalised consonant
FG	-	Feature Geometry
FV	-	Final Vowel
INFL Stem	-	Inflectional Stem
LOC	-	Locative
MStem	-	Macro Stem
N	-	Nasal
^NC	-	Prenasalised consonant
NCs	-	Nasal + Consonant Sequences
OCP	-	Obligatory Contour Principle
OM	-	Object Marker
OT	-	Optimality Theory
PH	-	Prosodic Hierarchy
Pst	-	Past Tense
PStem	-	Prosodic Stem
PWord	-	Prosodic Word
RED	-	Reduplicant
SM	-	Subject Marker
TAM	-	Tense, Aspect, Mood

V_1	-	First Vowel (in a sequence)
V_2	-	Second Vowel (in a sequence)
*VV	-	Prohibited Vowel + Vowel sequence

CHAPTER 1

INTRODUCTION

1.1 Overview

Typological research in Bantu languages has indicated the importance of placing the syllable at the centre of phonological analysis. Studies by Sibanda (2009), Kadenge (2010, 2012, 2014, 2015), Mudzingwa (2010), Kadenge and Mudzingwa (2014), Kadenge and Chebanne (2017), Vratsanos and Kadenge (2017), Vratsanos (2018), amongst others, argue for the canonical CV syllable in Bantu, noting how phonological analyses relevant to the syllable and effects thereof bring about variation within and across various Bantu languages. In this vein, this thesis explores how siSwati phonology enforces phonotactic well-formedness and word binarity across all Prosodic Words (PWords) in surface representations.

This chapter presents a brief overview of this study, which includes the main objectives, sub-objectives, the theoretical framework the investigation is centred on, and the envisaged empirical and theoretical contributions of the study. In the last section, I provide the organisation of the dissertation.

1.2 Background

The current dissertation provides a comprehensive descriptive and theoretical analysis of siSwati segmental phonology. Previous theoretical and descriptive studies focused on various aspects of siSwati grammar. Zievorgel and Mabuza (1976), Dlamini (1979), Taljaard, Khumalo, and Bosch (1991) as well as Sibanda and Mthembu (1996), present a descriptive analysis of siSwati grammar. Other scholars dealt with the various morphophonemic aspects of the language, with Downing (1997, 1999) on verbal reduplication and minimality requirements, Herman (1999) on siSwati prosodic structure, Lee (1999) on vowel hiatus, Kockaert (1997) on vowel harmony, Malambe (2006) on palatalisation and its effects, and Harford and Malambe (2015; 2017) on high vowel elision as well as perfect imbrication. Each of these studies discussed the phonology of the language within specific domains. Notwithstanding all the previous research on siSwati, this study provides a comprehensive study of the phonology of the language, focusing on the various phonological aspects within the phonology and morphology interface in the language. The study places the syllable at the centre of phonological analysis, highlighting how markedness and faithfulness constraints in various phonological processes conspire to eliminate phonological complexities in all surface forms.

The aim of the current study is to demonstrate that most morphophonemic processes in siSwati occur to conform to the optimal CV syllable structure and the disyllabic Prosodic Word (henceforth PWord) minimality enforced by siSwati phonology requirements. The canonical CV syllable structure is attested as the optimal syllable type in most Bantu languages. As such, it is the motivation behind the occurrence of a range of phonological processes in siSwati and other Bantu languages. SiSwati enforces binarity on its PWord. This phonological restriction is the motivation behind the disyllabic minimality requirement on the siSwati PWord. The study explores how siSwati grammar enforces conformity to the preferred CV syllable structure and optimal word size using /mu/ reduction, vowel hiatus resolution, loanword phonology, and word minimality as the bases for analysis.

The first dispreferred construction in siSwati is the juxtaposition of tautosyllabic vowels triggered by morpheme concatenation. This calls for the language to employ various repair strategies within and across the PWord to harmonise the input structures with the preferred CV syllable I assume for the language. The motivation for the prohibition of vowel sequences results from siSwati's preference for syllables with onsets. According to Kager (1999), onsetless syllables are generally marked structures crosslinguistically. Languages employ various resolution strategies to ensure that output forms do not parse dispreferred onsetless syllables in surface representations. A preliminary investigation into the phonological processes governing syllable structures and vowels within morphological domains in siSwati reveals that the language selects Glide Formation (GF), Secondary Articulation, and vowel deletion in the sequence of morphemes between nominals. Nominals here refer to nouns and their modifiers (Downing & Mtenje, 2017). Selecting an optimal hiatus resolution strategy in verbs also hinges on whether the morpheme concatenation occurs within the Inflectional Stem (INFL Stem) or the Macro Stem (MStem). In INFL Stems, siSwati adopts GF, while with the MStem it adopts feature spreading. This process is common in other Bantu languages such as Karanga and Zezuru, both chiShona dialects, (Mudzingwa, 2010, 2013) as well as ciNsenga and chiShona (Simango & Kadenge, 2014). Consider the following examples on how siSwati resolves hiatus in nominals and verbs in various morphosyntactic contexts within the grammar:

1. /**ú**-étfù/ → [**w**étfù] (Glide Formation)
   CL1.OM-our
   'sɪhe is ours'

2. /l**ú**-**é**tfù/ → [**l**ʷétfù] (Secondary Articulation)
   CL11.OM-our
   'it is ours'

3. /úmùt**ì**-**á**nà/ → [ú.mù.t**á**.nà] (Elision)
   CL3-HOMESTEAD-DIM
   'small homestead'

4. /**ú**-**á**-**ì**-láɬà/ → [**w**á-**j**ì-láɬà] (Spreading/glide epenthesis)
   CL1.SM-PST-CL4.OM-throw
   's/he threw it'

In (1) to (3) GF, secondary articulation and deletion are used to resolve hiatus in nominals, while (4) GF and spreading operate in verbs. In /**ú**-**á**-**ì**-láɬà/, /u/ and /a/ appear within the INFL Stem while /i/ within the MStem, hence the selection of different resolution strategies. In each instance, the input VV sequence is parsed as output CV forms whereby V_1 converts into a glide, is deleted, or spreads its features onto the epenthetic site. The study aims to investigate hiatus resolution in siSwati, demonstrating how nominals and verbs predictably select resolution strategies based on the morphological structure of the language. The study also situates hiatus resolution in siSwati within the larger Bantu language family discourse, thus contributing to Bantu linguistic typology. I explore vowel hiatus in detail in Chapter 4.

Another phonological process necessitating syllable structure analysis in siSwati is /mu/ reduction in noun classes 1 and 3. This is a common morphosyntactic phenomenon in Bantu, as demonstrated in Chichewa (Downing, 2005; Downing & Mtenje, 2017), Kibena (Morrison, 2009), Swahili (Mwita, 2009), Shimakonde (Liphola, 2011), Shangwe and Zezuru (Kadenge, 2014), as well as chiNambya, isiZulu and siSwati (Khumalo, 1987; Harford & Malambe, 2015; Kadenge, 2015), and Nyakyusa (Perhson, 2019), amongst others. In these languages, the size of the PStem determines whether /mu/ reduction is triggered or blocked. For instance, if the PStem is monosyllabic or subminimal, /mu/ is blocked, but if the PStem is two or more syllables, then it is truncated since these are considered minimally well-formed. The current dissertation discusses /mu/ reduction and its effects across various morphological domains in siSwati. Through this investigation, I seek to add onto the debate on Nasal + Consonant sequences (NCs) in Bantu languages; whether derived NCs in siSwati are syllabified heterosyllabically (Mtenje, 2016), as unitary segments (Malambe, 2006), as clusters (Downing, 2005; Downing & Mtenje, 2017) or as prenasalised consonants (Malambe, 2006; Sibanda, 2009; Sabao, 2015; Kadenge, 2015). The current study aims to add to this debate by demonstrating that the distribution patterns of NCs in siSwati vary, with derived NCs being syllabic, while non-derived NCs are prenasalised and parsed as unitary segments. The examples below illustrate the variation in the syllabification of NCs derived from /mu/ reduction in Noun Classes 1 and 3, and non-derived NCs that are not the output of morpheme concatenation:

5. /úmù-fúlà/ → [ú.**m̩**.fú.là]
   CL1-river
   'river'

6. /úmù-sélè/ → [ú.**m̩**.sé.lè]
   CL3-trench
   'trench'

7. /úmù-ɬámbì → [ú.m̩.ɬá.**ᵐb**ì]
   CL3-herd
   'herd'

8. /úmù-ntfù/ → [ú.mú.**ⁿtf**ù]
   CL1-person
   'person'

In the above examples, the nasal in the derived NCs in (5) and (6) is realised as a syllabic and non-homorganic nasal, while in (7) and (8) the NC is prenasalised and shares the same place of articulation as the consonant it precedes. As evident in the above examples, the shape of the NC is determined by whether the NC is morphologically derived or non-derived, a variation which is in line with the arguments to be presented in this dissertation.

Furthermore, loanwords introduce dispreferred syllable structures such as consonant clusters, coda specification and diphthongs; phonological elements prohibited in siSwati. In keeping-up with syllable well-formedness in the language, siSwati employs a range of phonological processes to satisfy two optimal phonological requirements in the language: CV syllable structure and disyllabic PWord. In the nativisation of English loanwords, siSwati employs feature change, vowel epenthesis, segment deletion, and spreading to harmonise the borrowed words with the phonological restrictions imposed by siSwati grammar. The current study presents the rephonologisation of English loanwords into siSwati to harmonise all input forms with the preferred CV syllable structure. The examples below illustrate the rephonologisation of dispreferred input syllable structures in siSwati:

9. /plæn/	→	[íp**ù**l**á**n**ì**]	'plan'
10. /feil/	→	[fè**j**íl**à]**	'fail'

The example in (9) above utilises three of the repair strategies posited in the nativisation of English loanwords into siSwati. First, round vowel [u] breaks a cluster by assimilating to the labial feature of the onset, /æ/ is substituted with [a] that exists in the siSwati inventory of vowels, and [i] functions as the nucleus of the input coda. In (10), the dispreferred diphthong is split using corresponding glide [j], while [a], which functions as the obligatory final vowel (FV) for verbs, provides a nucleus for coda [l], to conform to the CV syllable structure permitted in siSwati. Note that the input in (9) is CCVC consisting of two dispreferred syllable structures: a consonant cluster and a closed syllable. SiSwati grammar eliminates these dispreferred syllable structures through vowel epenthesis, ensuring that the output form aligns with the preferred CV syllable template in siSwati.

In addition to syllabic well-formedness, siSwati enforces word binarity on its PWord. Studies on siSwati minimality concur that the two strategies to deal with minimality across the grammar of the language are the augmentation of subminimal forms and rule blocking in well-formed PWords (Downing, 1997; Malambe, 2006). Malambe (2006) briefly discusses the different grammatical categories under which minimality effects are evident in siSwati. She presents imperatives, pronouns, reduplication and monosyllabic stems as some of the morphosyntactic categories that have to conform to disyllabic minimality. The current study advances this argument by exploring each of the morphosyntactic domains in detail, focusing on how rule application and blocking operate in siSwati as seen in the following examples:

11. /úmù-fánà/ → [ú.**m̩**.fánà]
    CL1-boy
    'boy'

12. /úmù-tsì/ → [ú.**mù**.tsì]
    CL3-herb
    'herb'

In (11) above, /mu/ is contracted since it appears with a disyllabic noun stem, while in (12) the same operation is blocked to enforce binarity in siSwati. The above discussion is explored in line with the goals of the dissertation. The aim is to indicate that phonological processes within siSwati enforce optimal CV syllable well-formedness and prosodic minimality.

Investigating vowel hiatus patterns, /mu/ truncation, loanword nativisation, and word minimality in this thesis points to the importance of placing the syllable at the centre of phonological analysis, and further demonstrates how the various phonological processes conspire to parse output forms with structurally well-formed and minimally disyllabic Prosodic Words (PWords) in siSwati. The study further reveals the importance of exploring the intricate relationship between morphology and phonology in phonological analysis.

1.3 Research aim

The aim of the study is to present a comprehensive formal analysis of siSwati segmental phonology.

1.4 Objectives of the study

The study seeks to explore the following objectives:

- Investigate the phonological processes siSwati adopts to attain the preferred CV syllable structure in the language.
- Explore the repair strategies that siSwati adopts in dealing with subminimality across various structural domains in the language.

The study seeks to address the following research questions:

a) How does siSwati achieve its preferred CV syllable structure?
b) How does siSwati enforce prosodic minimality on the Prosodic Word?

In addressing these aims and objectives, as mentioned previously, I examine vowel hiatus, /mu/ reduction, loanword phonology, and word minimality in siSwati. I explore these in line with the two goals of the study: phonotactic well-formedness and satisfaction of the disyllabic minimality requirement of the language.

1.5 Methodology

In this section, I present sources of data and the theoretical framework adopted for this study.

1.5.1. Sources of Data

I am the primary source of the data presented in this thesis as I am a siSwati native speaker. I also source data from studies relevant to the current research such as, but not limited to, Downing (1997, 1999), Lee (1999), Malambe (2006), and Harford and Malambe (2015). Additional material comes from siSwati descriptive grammars (Zievorgel & Mabuza, 1976; Dlamini, 1979; Taljaard, Khumalo & Bosch 1991; Sibanda & Mthembu, 1996). Together with native speaker intuition, these descriptive and theoretical studies present a rich source of data for the current investigation.

1.5.2 Theoretical Frameworks

The theoretical frameworks within which this study is conceptualised draw from a range of interconnected hypotheses and phonological theories. The thesis employs analytical insights drawn from Optimality Theory (Prince & Smolensky, 1993/2004) and Feature Geometry (Clements & Hume, 1995). Both theories account for the interaction between various morphosyntactic domains and Optimality Theory constraints for optimal syllable well-formedness and minimal word size in siSwati.

1.5.2.1. Optimality Theory

Optimality Theory (henceforth OT) is a constraint-based phonological theory. Originally proposed by Prince and Smolensky (1993/2004), OT is a branch of generative linguistics that deals with the universality of linguistic properties accessible to all languages. The OT framework is built on three premises: a) that languages have access to the same set of universal constraints; b) that constraint violation is tolerated as long as it is minimal; and c) that hierarchically ranked constraints yield language-specific grammars, depending on permissible syllable structures in each language. These aspects of universality, violability, and language-specific constraint hierarchy help various languages attain optimal well-formed syllable structures. In essence, languages have access to the same set of universal constraints but different hierarchical rankings to account for crosslinguistic variation (Archangelli, 1997; Kager, 1999). Out of the different possible output forms that a grammar generates, optimal candidates have minimal constraint violations between the Input and the Output.

The concatenation of morphemes in agglutinative languages, such as Bantu languages, usually gives rise to potentially dispreferred surface forms that violate the syllabic requirements of individual grammars. Through the co-occurrence of different phonological rules, each grammar then conspires to make adjustments on the underlying forms. These conspiracies converge to adapt, delete, or epenthesise relevant segments to force illicit constructions to conform to the syllable structure of that language. As proposed by Kisseberth (1970) and Kiparsky (1976), the premise on which phonological conspiracies centre is the propensity for languages to eliminate illicit structures with the ultimate goal of attaining phonologically well-formed structures. In this study, I use Optimality Theory (Prince & Smolensky, 1993/2004), to account for a unified explanation on the adjustments of these conspiracies. In this section, I offer a brief overview of the basic tenets of Optimality Theory (OT), and then highlight the importance of universal Markedness and Faithfulness constraints for optimal syllabic well-formedness.

1.5.2.1.1 Markedness

According to Kager (1999), markedness theories denote two linguistic structure values: marked and unmarked. Marked linguistic structures are typically contrastive and avoided cross-linguistically, while unmarked constructions are 'crosslinguistically preferred and basic in all grammars' (Kager, 1999, p. 2). Syllable templates of various languages typically place restrictions on marked structures while unmarked linguistic structures are attested universally (Katamba, 1989; Archangelli, 1997, Kager, 1999). Concerning syllable structure, all languages parse open syllables in the output, whereas a limited set of languages with non-restrictive grammars parse closed syllables in their surface representations. For instance, CV syllables are preferred while CVC or CCV structures are marked, and therefore not widely distributed, crosslinguistically.

Markedness constraints such as NoCoda and $\text{COMPLEX}^{\text{ONSET}}$ conspire to eliminate surface codas and consonant clusters. Restrictive grammars would have these as high-ranking constraints to ban surface codas and complex onsets, while in non-restrictive syllable templates these constraints would rank low. In this dissertation, I use the markedness theory to demonstrate how the siSwati grammar conspires to eliminate dispreferred marked structures to ensure that all surface representations conform to the preferred CV syllable template I assume for siSwati.

1.5.2.1.2 Faithfulness

Kager (1999) defines faithfulness, also known as the Input-Output Correspondence, as the combination of grammatical factors that preserve lexical contrast. Faithfulness principles dictate that underlying representations must be harmonious with surface representations: all input linguistic features must be represented in the output. In principle, any surface representation that has adapted the input by deleting or epenthesising linguistic features violates faithfulness. For instance, an underlying C_1VC_2 form, with a marked structure consisting of C_2 coda specification, may be parsed with an epenthetic vowel functioning as the nucleus of C_2 resyllabified as an onset in the output. In such instances, violating faithfulness trumps the preservation of input marked structures, creating syllable harmony, especially in languages whose syllable templates are optimally CV. Any violation of faithfulness constraints leads to variation between the input and the output. In this study, I demonstrate how siSwati grammar deletes, epenthesises, or alters vowel and consonant features to eliminate marked structures in all PWords in the grammar.

This study draws from the Correspondence Theory in OT that maps interaction between markedness and faithfulness constraints where the former prohibits marked or dispreferred structures such as codas and complex segments while the latter calls for Input/Output Correspondence. I use OT to account for how siSwati attains optimal CV well-formedness and disyllabic word minimality through markedness and faithfulness constraint ranking to account for rule application and blocking in the phonological processes under investigation. In the OT framework, constraint interaction provides evidence for possible and permissible output forms in the grammar of a language. Kager (1999) notes that faithfulness to the input increases the propensity to parse marked structures in the output, whereas eliminating phonological markedness requires that the grammar violates certain correspondence restrictions. In the current dispensation, I use OT to account for the repair of dispreferred underlying constructions through constraint interaction and demonstrate how siSwati grammar uses the interaction between markedness and faithfulness theories to attain syllabic well-formedness. The unified analysis demonstrates how harmonious surface forms incur minimal violations of some of the conflicting constraints in the grammar. I define and discuss the various markedness and faithfulness constraints in operation under relevant sections.

1.5.2.2 Feature Geometry

The study uses the Feature Geometry (FG) model proposed by Clements and Hume (1995). In this model, sounds are hierarchically grouped into natural classes: Labial, Coronal, Dorsal and Pharyngeal, based on their featural makeup. In FG terms, vowels and glides are phonetically and structurally similar as they share the same features. Furthermore, consonants and vowels form natural classes, with labial consonants grouped together with round vowels under LABIAL, coronal consonants with front vowels under the feature CORONAL, dorsal and pharyngeal consonants with low vowels under PHARYNGEAL, respectively (Clements & Hume, 1995). Their argument centres on the spreading of the labial and coronal features depending on adjacent segments, with round vowels selecting labial [w] while front vowels select coronal [j], respectively. This model is useful in the predictability of the epenthetic vowel and glide as repair strategies, whereby these are selected based on shared features with adjacent segments. The theory will be useful in accounting for feature spreading evident in hiatus resolution and loanword phonology. I expound on its application in relevant section in the analysis.

1.6 Theoretical contributions

The main contribution of this study is to provide evidence for the role of the syllable in phonological analysis. Syllable structure well-formedness is the motivation behind a range of phonological processes in Bantu, with several studies pointing to the tendency for linguistic structures to conspire to parse surface representations that align with the restrictions imposed on the Bantu CV syllable template (Paradis, 1992/2014; Mudzingwa, 2010; Kadenge, 2012; Vratsanos & Kadenge, 2017; Vratsanos, 2018). In this dissertation, I show that output syllable structures emanating from /mu/ reduction, hiatus resolution, loanword phonology, and word minimality conform to the optimal CV syllable structure and the disyllabic PWord minimality enforced by siSwati grammar. In this regard, the discussion develops a range of permissible syllable forms in siSwati grammar, and how these patterns with other Bantu languages, thereby contributing to Bantu syllable typology.

Secondly, the study presents evidence for the relationship between phonology and morphology in phonological analysis. Researchers have pointed out the importance of how phonological processes apply largely based on the morphological structure of the language under investigation (Downing, 1999; Kula, 2002; Mudzingwa, 2010; Kadenge & Mudzingwa, 2014; Simango & Kadenge, 2014; Downing & Kadenge, 2015; Downing & Kadenge, 2020). They argue that morphological constituents play distinct roles in phonological analysis, and as such advocate for the inclusion of these constituents as the basis for phonological analyses. For instance, Downing and Kadenge (2015, 2020) propose that the Prosodic Hierarchy (PH) must include the PStem as a phonological level immediately appearing after the PWord. This phonological domain accounts for constraint application and blocking in various phonological processes. In the discussion on word minimality in Class 1 and 3, for instance, the PStem and the PWord are targets for different binarity requirements, pointing to the distinct roles each sub-level plays in phonological analysis. In the current study, I provide evidence for the interplay between these sub-fields in siSwati, focusing on how morphological and phonological constituents condition the selection of hiatus repair strategies and the resultant shape of NCs in /mu/ reduction. I further demonstrate the link between these sub-fields in loanword phonology and word minimality, indicating how morphological constituents govern the phonology of the language.

Also, this study is the first comprehensive study focusing on siSwati segmental phonology, with focus on different phonological processes highlighting the role of the syllable in phonological analysis. Previous literature was either descriptive or theoretic, with the latter focusing on selected parts of the phonology of the language (Downing, 1997, 1998; Kockaert, 1999; Lee, 1999; Malambe, 2006; Harford & Malambe, 2015, 2017; Kadenge, 2015) amongst others. Each of these studies provides an independent investigation of individual phonological concepts. Downing (1997) exclusively focuses on reduplication, Kockaert (1999) on vowel harmony, Malambe (2006) on palatalisation and other non-local effects, Harford and Malambe (2015) on high vowel elision and perfect imbrication (2017) as well as Kadenge (2015) on /mu/ reduction in Bantu, a study that includes siSwati as one of the languages under investigation. The current study advances the investigation of siSwati grammar by focusing on various phonological processes, and then demonstrating how the language optimally achieves syllabic and PWord well-formedness.

The last area of theoretical interest is the syllabification of NC sequences in siSwati. Previous research on /mu/ truncation in siSwati (Harford & Malambe, 2011; Kadenge, 2015) claims that non-derived NCs are homorganic and prenasalised, if not then the nasal is specified as a coda. This study adds onto this debate by demonstrating that in siSwati the syllabification of NCs hinges on whether they are derived or non-derived.

1.7 Organisation of the dissertation

Chapter 1 provides an overview of the whole dissertation. It introduces the study, highlights the main aims and objectives, and then outlines the theoretical framework within which the study is centred. Chapter 2 presents a review of pertinent Bantu and siSwati literature, and then demonstrates how this study contributes to Bantu linguistic typology. Chapter 3 presents an overview of the phonology and morphological structure of siSwati nominals and verbs. Chapters 4 - 7 explore hiatus resolution, /mu/ reduction, loanword phonology and word minimality in relation to siSwati syllabic well-formedness and word binarity. Chapter 8 concludes and summarises the discussion. I begin my discussion by exploring various literature pertinent to the arguments I explore in this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents an overview of the literature pertinent to this study. The chapter starts off by briefly highlighting previous literature on the phonology and morphology interface and how this relationship informs phonological analysis. The chapter also reviews previous descriptive and theoretic siSwati literature that have, one way or another, influenced and motivated the current research. Furthermore, it presents an overview of literature on NCs and their syllabification challenges, hiatus resolution, loanword phonology and word minimality. The literature review chapter situates the current study within the larger discourse on Bantu and siSwati phonology in relation to the topics under investigation.

2.2 Previous research on the morphology and phonology interface

Goldsmith (2011) places the syllable at the core of phonological analysis. He establishes that the syllable is fundamental in determining permissible sound patterns crosslinguistically, with some languages allowing the vowel to be preceded and followed by more than one consonant in the onset and coda positions. He notes the propensity for sonants (glides, nasals, liquids) to syllabify differently, depending on whether they appear with or without a vowel tautosyllabically. In the absence of a vowel within that syllable, the syllabic consonant becomes the syllable peak, a phenomenon that is common in Indo-European languages. According to Goldsmith, these languages group their segments into consonants, vowels and sonorants, with the latter realised as either a consonant or a vowel depending on the context. On the same note, O'Connor and Trim (1953) place the syllable – a phonological structural unit – at the centre of phonological analysis. By extension, the same analysis can be applied in siSwati that has a preferred CV syllable structure.

One of the goals of this dissertation is to demonstrate that NCs syllabify the N as a syllabic segment in derived morphological environments. If one disregards Goldsmith's theory on the syllabification of vocalic consonants, proposing that the resultant nasal in derived NCs is syllabic that would situate the current argument outside of the CV syllable structure postulated for siSwati.

However, if we take into account this addition by Goldsmith, one can safely conclude that syllabic consonants, in this case, nasals, can well occupy the V-Place in the absence of a vowel. In siSwati, this would mean the proposition that nasals in derived contexts are syllabic aligns with crosslinguistic patterns where a nasal can occupy the V-slot in the absence of a vowel, in conformity with siSwati phonotactic requirements. Goldsmith's analysis places emphasis on the phonological position of a segment and the morphological context in which it appears. This proposition propels us to pursue the vital correlation between morphology and phonology in phonological theory.

Previous research established the correlation between phonology and morphology in phonological analysis (Downing, 1999; Kiparsky, 2000; Mudzingwa, 2010; Inkelas, 2011; Kadenge & Mudzingwa, 2014; Downing & Kadenge, 2015), amongst others. According to Downing and Kadenge (2015), phonological processes do not occur in isolation but within morphophonological structures of individual grammars. This is the premise that the current study adopts in its analysis of siSwati.

Downing (1999) and Downing and Kadenge (2020) provide evidence that the PStem and PWord play distinct roles in phonological analysis. In her investigation of prosodic minimality in siSwati and Kinande verbs, Downing (1999) posits that the application of various phonological processes is conditioned by whether the input involves a PStem or PWord. She postulates that these domains select different minimality requirements arguing that "phonological processes only take morpho-prosodic constituents as their domains" (Downing, 1999, p.75). In this discussion, she calls for the investigation of the intricate morphological structure of the language under investigation. Overall, she claims that it is morphological constituents and not morphosyntactic domains that are targeted by phonological processes. For instance, the reduplicant in Kinande copies the first two syllables of the verb stem. This analysis becomes problematic in derived and non-derived polysyllabic stems. Downing notes that derived polysyllabic verb stems copy the stem vowel while non-derived polysyllabic verbs parse the canonical final vowel [a] in the output. This disparity necessitates the separation of the verb into morphological domains to map the target for reduplication. In this regard, the Kinande grammar makes it clear which element within the morphological constituent of the verb is the target for reduplication. Downing's argument points to the importance of differentiation morpho-phonological constituents as they trigger different constraint interaction.

Downing and Kadenge (2015) and Downing and Kadenge (2020) explore the relationship between phonology and morphology in phonological analysis across various languages. They advocate for the inclusion of the PStem within the PH, a constituent that would appear just below the PWord as its subconstituent. Their motivation for this claim is that in Zezuru chiShona, the two PH categories – the PWord and PStem - trigger different phonological processes.

The systematic application of vowel hiatus resolution strategies and tonal processes hinges on the morphological context in which they occur, bringing about the contrast between PWord and PStem domains. The application of hiatus resolution strategies and tonal patterns is contingent upon their occurrence within or across the INFL Stem and MStem boundaries. Kadenge and Mudzingwa (2014) contribute to this debate by demonstrating that derivational morphology of Class 1 Shona nouns results in the disparity in the structure, behaviour and distribution of deverbal and non-deverbal nouns. Similarly, Inkelas (2011) notes that phonological requirements can potentially alter the shape of individual morphemes in different contexts.

Inkelas (2011) investigates how phonological requirements condition word formation through suppletive allomorphy in different languages. She notes that there are languages that choose whether to use an affix or a suppletive allomorph based on the number of syllables per PWord, thus giving rise to a mismatch in the grammars of those languages. One example is how English expresses comparison where the comparative marker -*er* normally attaches to monosyllabic adjectives (tall-*er*) while longer adjectives select a 'syntactic alternative' that blocks -*er* attachment (Inkelas, 2011, p. 83). Alternatively, polysyllabic stems select the periphrastic *more* (*more* beautiful).

Modern Western Armenian also displays a preference for phonotactic well-formedness. To express the definite article in Armenian, -*n* attaches to V-final nouns (katu-*n*) 'the cat' and -*ə* attaches to C-final nouns as in hat-*ə* 'piece', respectively (Inkelas, 2011, p. 83). In this regard, siSwati displays similar characteristics for CV syllable preference in word phonological processes across the grammar of the language. The current study situates this analysis with how the grammar selects the shape of an affix depending on the syllable size of the morphological stem. As discussed in Section 2.6, siSwati selects passive marker -*iw*- with monosyllabic stems while longer ones select -*w*-. Similarly, /mu/ truncation is conditioned by the size of the morphological stem, with the rule blocked in monosyllabic stems to satisfy minimality. In essence, this is evidence for a mismatch in the grammars of various languages crosslinguistically as demonstrated in word formation processes. I present detailed discussion on the shape of the passive and /mu/ reduction effects in siSwati and some Bantu languages in Chapter 7, where I examine minimality restrictions.

Coetzee and Pater (2011, p. 401) present the theory of phonological variation as the realisation of a single morpheme as one phonetic form in the same environment. Even though they point to the fact that some parts of phonological analysis are insensitive to morphology especially under Early Phonology, they agree that there is a recent shift towards incorporating morphology within phonology. One notable case is coronal stop deletion across dialects of English presented as a result of morphological variation. They argue that [t/d] deletion is conditioned by its morphemic variation, with the propensity to delete if the stops appear as final consonants in monomorphemic items (miss/land), rather than in bimorphemic ones where the stop appears as a past tense marker such as in missed/banned (Coetzee & Pater, 2011, p. 406). They also present NCs as phonological segments that are susceptible to morphological variation. They indicate the inability for the nasal in prefix *un*- in u**n**perturbed /ənpərtərbd/ to assimilate to */**əm**pərtərbd/ the same way 'imbalance' [*in*-baləns] becomes /**im**baləns/, not */**in**baləns/. This variation is attributed to *un*- falling outside of the PWord hence its invisibility to phonological processes like nasal place assimilation. In this proposed study, the concept of phonological variation can be extended to the realisation of NCs in siSwati, a process that hinges on whether they are morphologically derived or non-derived. The study proposes that the variable shape of siSwati NCs hinges upon the same phonological but different morphological variable, hence the realisation of the output nasal as either syllabified or prenasalised as will be discussed in Chapter 5.

Kiparsky (2000) stresses the importance of integrating morphology and phonology. He explores the disparity in stress attraction between words and phrases in Arabic. He presents epenthetic [i] and its contrasting phonological effects based on whether it appears within a word or phrase. He argues that at the word-level category, lexical epenthesis is visible to stress while it remains invisible at the post-lexical level. In his discussion, he notes that phonological processes apply depending on the hierarchical organisation of Stem, Word and Post-lexical levels into constituents that trigger different constraint rankings based on the Prosodic Hierarchy (PH). This thus points to the importance of integrating morphological distinction in phonological theory.

Other Bantuists follow on this close relationship between morphology and phonology. In his investigation of vowel hiatus in Shona, Mudzingwa (2010, p. 55) observes that "hiatus resolution strategies that apply within and across non-clitic words are different from those that apply across clitic words". His analysis focuses on the application of hiatus resolution strategies across the PStem, PWord and the Clitic Group. The nominal and verbal morphological structure posited for Bantu languages by Simango and Kadenge (2014, p. 108) and Downing and Mtenje (2017, p. 103) is argued to play a pivotal role in the selection of hiatus resolution strategies. For instance, strategies that apply within the INFL Stem in verbs are not the same as those that apply within the MStem. They demonstrate that hiatus resolution is conditioned by the morphological environment in which it occurs.

In view of all this previous research, the current study confirms the interplay between the two linguistic sub-fields. I present evidence on how the application of certain phonological processes in siSwati hinges upon the proposed intricate morphological structure of nominals and verbals, and how siSwati grammar determines rule application based on the morphological constituents involved.

2.3 Previous work on siSwati grammar

Numerous studies have focused on siSwati research, either individually or as part of the Nguni and Bantu language family. Previous accounts of siSwati descriptive grammars document the structure of the language, situating it within the larger Nguni language family (See Zievorgel and Mabuza, 1976; Dlamini, 1979; Taljaard, Khumalo & Bosch, 1991; Sibanda & Mabuza, 1996, amongst others. These studies provide some of the data that is utilised in this study.

Other studies that focused on various phonological aspects of the language include, *inter alia*, Downing (1997) on verbal reduplication and minimality requirements, Kockaert (1997) on vowel harmony, Lee (1999) on morphologically determined vowel hiatus resolution, Malambe (2006) on palatalisation and its effects, Sibanda (2009) on phonologically determined hiatus resolution in Nguni languages, as well as Harford and Malambe on the preprefix in Bantu (2011), high vowel elision in siSwati (2015) and siSwati perfect imbrication (2017).

Downing (1997) discusses verbal reduplication as conditioned by the size of the PWord. She notes that the size of the prosodic word determines the shape of the reduplicant, with polysyllabic verbs copying the first two syllables of the stem, while subminimal stems rely on augmentation to enforce constraints on the binarity of a reduplicant. This discussion is revisited under Section 2.7 on word minimality. The current study expands on this discussion on minimality by focusing on other phonological processes such as /mu/ reduction and segment deletion in loanword phonology in siSwati. I demonstrate how the language exhibits a mismatch in its selection of different augmentation strategies depending on the morphosyntax involved, with nominals using phonological epenthesis while verbs select morphological epenthesis to augment subminimal constructions (Ziervogel & Mabuza, 1976; Sibanda & Mthembu, 1996). In this regard, the study encompasses a broader context for analysis that Downing's studies did not capture.

Kockaert (1997) discusses vowel harmony in siSwati. He claims that mid vowels [e o] influence the height of a subsequent vowel provided the mid vowels appear in the penultimate syllable, a claim that Malambe (2006) disputes. Malambe (2006, 2015) notes that siSwati does not exhibit vowel harmony but has what she calls co-articulation. Malambe provides evidence against vowel harmony in siSwati, noting that the phonological changes affect part of the output vowel, a characteristic feature of co-articulation, not the whole vowel, a characteristic feature of vowel harmony. In co-articulation, siSwati non-phonemic vowels [ɛ ɔ] become phonemic /e o/ if preceding high vowel /i/ and before the syllabic nasal [m̩]. The formant value of 50ms proves that it is the phonetic value rather than the phonological value of the input vowel that changes; therefore, concluding that siSwati has no vowel harmony but co-articulation (Malambe, 2015). She presents an OT analysis to support her argument for co-articulation in siSwati using the value [±ATR] to determine whether the language harmonises mid vowels or not. Invoking markedness constraints 'No [+ATR] in high vowels' and 'No [-ATR] low vowels' yields a grammar that precludes high vowels from undergoing co-articulation while mid vowels are allowed to (Malambe, 2006, p. 17).

Malambe (2006) briefly discusses the five repair hiatus resolution strategies that the language adopts, namely; vowel deletion, labialisation (secondary articulation), coalescence and glide formation. In siSwati, only labial vowels trigger secondary articulation; the grammar blocks the palatalisation of any consonant the output of which yields a dispreferred $*C^j$ representation. In addition, Sibanda (2009) examines hiatus resolution in Nguni languages in general making reference to siSwati as one of the languages under investigation. He primarily focuses on isiNdebele hiatus resolution but points out how siSwati, isiXhosa and isiZulu relate to this language in as far as hiatus resolution is concerned. Apart from isiXhosa which triggers compensatory lengthening in some Noun Prefix + Noun Stem configurations, siSwati and isiNdebele adopt the same hiatus resolution strategies and constraint rankings to eliminate surface VV sequences. Sibanda adopts a phonological analysis to hiatus resolution, arguing that the position of the vowel within a VV sequence determines the repair strategy that the language selects, not the morphosyntactic domain. If the VV sequence is /a+i/, for instance, the grammar selects coalescence, but if reversed as /i+a/, GF is selected in line with syllabicity in the language. To emphasise the importance of phonology in hiatus resolution, Mudzingwa and Kadenge (2011, p. 230) state that "neither the quality of the vowel nor the nature of the morpheme in which the vowel is found matters: what is crucial is the position of the vowel in the hiatus context – whether it is V_1 or V_2". This study expands on this discussion by introducing the predictability of how siSwati grammar selects a repair strategy based on the interplay between morphology and phonology.

Another study on processes involving vowels in siSwati is by Lee (1999) who investigates morphologically determined hiatus resolution in contrast with Sibanda (2009) who opts for a phonological analysis. Lee (1999) provides a comprehensive analysis of siSwati hiatus repair strategies. He presents the interaction and ranking of markedness constraints that are at play in resolving a dispreferred sequence of vowels in siSwati. One of his arguments is that various domains adopt deletion, GF or vowel coalescence to resolve hiatus, depending on the morphosyntax involved. He further presents the various morphosyntactic domains in which hiatus occur, without paying particular attention to the morphological make-up of the domains he investigates. This study explores a different perspective by arguing that the dispreferred *VV structure emanating from morpheme concatenation is repaired due to siSwati's preference for CV well-formedness. It further focuses on the intricate interaction between the morphology of nominals and verbals and how siSwati grammar systematically selects repair strategies depending on where the hiatus occurs within the proposed intricate morphological structure of nominals and verbals as explored in other languages.

Malambe (2006) presents an extensive comparative analysis on palatalisation and other non-local effects in siSwati and other Southern Bantu languages. She presents a phonological approach to palatalisation in siSwati, Xitsonga, Tshivenda, Sesotho and Setswana where she demonstrates the effects of the palatal and other relevant suffixes in each language. She advocates for a floating coronal feature that is not restricted to its locality, but is capable of triggering palatalisation across adjacent labials and alveolar consonants. According to her, there is the interaction of faithfulness and alignment constraints that control the target and realisation of all output palatalised segments. Here are a few examples on palatalised output forms in various Bantu languages (Malambe, 2006, p. 10):

13. SiSwati :	/łe**ɓ-iw-**a/	→	[łe**tʃ**ʷa]	'gossip'
14. Tshivenda:	/bo**p-iw**-a/	→	[bo**tʃ**ʷa]	'be moulded'
15. Sesotho :	/łoni**p**ʰ**-iw**-a/	→	[łoni**tʃ**ʷa	'honour'
16. Setswana :	/ta**p'-iw**-a/	→	[ta**p**ʲa]	'flick'

Harford and Malambe (2015) discuss high vowel elision in connected speech. They demonstrate how siSwati typically elides interconsonantal high vowels [i u] in non-prominent phonological and morphological environments. Their discussion centres on how siSwati optionally deletes high vowels when they appear adjacent to /s/ and /k/ or in a non-prominent phonological position – which is slated as any position other than the penultimate syllable. These vowels also delete when they occur in a function word. The grammar presented represents a disparity of how the re-ranking of markedness constraints Max-V [⁺high] and *V [⁺high] determines whether the high vowel elides or not, with the higher ranked *V [⁺high] permitting [i u] deletion in connected speech. Consider the following examples from Harford and Malambe (2015, p. 347):

17. /s**i**-łała/ → [s'łała]
Cl7.tree
'tree'

18. /s**i**-tulo / → [s'tulo]

Cl7.chair
'chair'

19. /k**u**-ha^{m}ba/ → [k'ha^{m}ba]
INF.marker-go
'to go'

The examples in (17) and (18) above demonstrate how high vowel [i] deletes when it appears before [s] and is in a non-prominent position. The same applies to [19] where [u] is susceptible to deletion since it appears in a non-penultimate syllable.

Harford and Malambe (2011) also investigate NC syllabification in siSwati. They provide evidence on how nasal noun classes (Classes 1, 3, 4 and 9) typically appear with a preprefix while other classes have since omitted it, with the nasal occurring immediately adjacent to the consonant it precedes. Their argument builds on what others have said regarding NC syllabification in Bantu (See Kula, 2002; Downing, 2005; Kadenge, 2015), among others, with one school of thought viewing NCs as a unitary segment while others regard them as heterosyllabic. The basis for their line of thought is that the vowel before the NC blocks vowel lengthening to compensate for the lost nasal mora in prenasalisation contexts. They conclude that the N in siSwati NCs belongs to a separate syllable, where it appears as a coda of the preprefix as illustrated in the data below (Harford & Malambe, 2011, p. 9).

20. u***m***.fati 'woman'
21. u***m***.fula 'river'
22. i***m***.fula 'rivers'
23. i***n***.tfombi 'girl'

In his discussion of NCs in three Bantu languages (chiNambya, isiZulu and siSwati) Kadenge (2015) follows on the above discussion. Where chiNambya and Zulu syllabify NCs as prenasalised in chiNambya [^{N}C] and non-assimilatory but syllabic N [N.C] in isiZulu, he argues for a non-assimilatory, non-syllabic specification of the nasal in siSwati. He opts for coda specification where the nasal is syllabified as a coda of the previous vowel [VN.C].

The most recent work on the phonology of siSwati is on perfect imbrication (Harford & Malambe, 2017). They examine the perfective suffix *-il-* to account for its occurrence and its subsequent morphophonological influence on the verb it fuses with. The discussion contrasts the long perfect that appears phrase medially with the short perfect which appears phrase finally. In siSwati, imbrication application and blocking is contingent upon the shape of the verb stem and some verb roots such as the 'frozen' verbal extension, as observed in other Bantu languages. In contrast with Chibemba where perfect imbrication systematically applies with disyllabic verb stems, siSwati does not consider word size as a factor in the application of this morpheme. They propose that the siSwati perfective is purely morphological since its application is primarily determined by the type of morpheme it attaches to rather than prosodic constraints resulting from morpheme ordering of the verb stem and verbal suffix. In instances where imbrication applies, we primarily observe metathesis which results in a sequence that triggers coalescence of the stem-final vowel with the perfective -*i*- followed by consonant deletion to enforce syllabic well-formedness as seen in (12) below (Harford & Malambe, 2017, p. 283):

24. ngi-phaphama-***<u>il</u>***-e [*metathesis*]
25. ngi-phaph***a-i***m-e [*coalescence*]
26. ngi-phapheme 'I have awoken'

The above examples illustrate how /a+i/ coalesce to [e] in (24), consistent with hiatus resolution patterns in siSwati. The resultant -ml- triggers deletion of the functional material -*l*- of the suffix rather than the lexical -*m*-, respectively.

Notwithstanding all this previous research on siSwati, the current study presents a comprehensive analysis of siSwati segmental phonology, focusing on various phonological aspects within and across the PWord in the language. This study draws insights from and advances some of the arguments presented in these previous studies, thus making a contribution to siSwati phonology and linguistic typology as a whole. It highlights how the phonology and morphology interface influences phonological analyses in ensuring that the grammar eliminates dispreferred VV sequences.

2.4 /mu/ reduction and its syllabification effects

A characteristic feature that is common in Bantu languages, and possibly other languages of the world, is nasal place assimilation where nasals assimilate to the place of articulation of an adjacent consonant, usually the one it precedes. This has been a subject for many debates especially in how nasal + obstruent sequences are syllabified crosslinguistically. Typically, the nasal + consonant sequence (henceforth NC), can be analysed as either a cluster, syllabic N, coda N, or prenasalised C. Tucker-Childs (2003, p. 32) posits prenasalisation as a unique phonological process where the "nasal cavity remains open until midway into the production of the stop, thus producing a short nasal stop before the oral stop itself". Beddor and Ansuwan (2003) differentiate iKalanga ^{N}Cs from canonical nasals in that the former have a post-nasal closure in its articulation, and can only appear word medially. Batibo (2002), Mwita (2009) as well as Downing and Mtenje (2017) treat NCs and consonant + glides (CGs) as clusters rather than unitary segments. In a language that allows complex codas such as English, a complex NC structure as NC is optimal because the N would be syllabified as a coda of the preceding syllable, and the C as an onset of the following syllable, except word finally where both consonants will be syllabified as branching codas, respectively.

As evident in the above discussion, emerging debates point to the realisation of NCs as one of four distributions: a) prenasalisation b) syllabic nasal c) coda nasal or d) as an NC cluster, depending on the phonotactic constraints of individual languages (Hubbard, 1995; Cahill, 1998, 1999; Mberia, 2002; Beddor & Onsuwan, 2003; Sibanda, 2004; Downing, 2005; Morrison, 2009; Negash, 2014; Kadenge, 2010, 2015; Harford & Malambe, 2015). Rather than treating NCs as unit segments, Downing (2005) advocates for cluster analysis and coda specification in prevocalic distribution as a simpler analysis for NCs. Some Bantuists advocate for a unitary treatment of NCs, presenting them as distinct phonemes in their respective languages, Fwe (Gunnink, 2018), Zezuru (Kadenge 2010) and isiNdebele (Sibanda, 2004). They propose that prenasalised consonants are independent phonemes rather than clusters.

Downing (2005) discusses the dynamics of NCs and their segmental status in Bantu languages. Downing debates the syllabification of homorganic nasals; whether they should be considered as surface clusters, heterosyllabic or monosegmental. She disputes using syllable markedness and pre-NC compensatory vowel lengthening to support claims on NCs as unitary segments as per the ongoing debate on Bantu languages and their preference for open syllables. She, however, postulates that NCs are the exception to the largely CV Bantu syllable structure. She posits coda specification for prevocalic NCs while those that appear word initially or morpheme-initial are syllabified as homorganic clusters. She attributes these to the misalignment of the prosodic and segmental properties of the nasal. Downing concludes that in cases where the nasal is preceded by a vowel [VNC], the nasal shares the same moraicity as the vowel therefore functioning as a coda of that syllable.

Some Bantuists adopt positional distribution, where syllabification of the nasal depends on the morphological environment in which it appears. Cahill (1999) argues that the manifestation of NCs in Konni, a language spoken in Ghana, is conditioned by the specific environment in which they appear – whether word initially or word medially. He first argues that NCs in Konni are always homorganic, and syllabic if they appear word initially, but unitary segments word medially as seen in the examples below (Cahill, 1999, p.127) below:

27. **ṃ**.bali-já 'I have told'
28. **ṇ**.dogi.já 'I have carried'
29. **ŋ̣**.kali-já 'I have sat'

30. tí^{ŋ}gbáŋ 'floor'
31. bi^{ŋ}kpìán 'shoulder'

On the same note, Jin-Young (2011) presents a comparative study of phonologically and morphologically conditioned NCs, with varying degrees of representation from language to language. He notes that there is a relatively high propensity for phonologically derived NCs to be realised as single prenasalised segments while morphologically determined ones are typologically realised as a syllabic nasal followed by a homorganic consonant. For instance, Gur and Kwa languages of the Niger-Congo language family typically syllabify NCs as [Ṇ.C] where all nasals can surface as syllabic segments in the grammar. He further presents four crosslinguistic distributional domains of prenasalised consonants summarised as follows (Jin-Young, 2011, p. 127):

32. a) Phonemic prenasalised consonants as in Fiji

    b) Derived prenasalised consonants that behave as a unitary segment as in Kikuyu

    c) Derived prenasalised consonants that behave as complex segments as in Japanese

    d) Phonetically enhanced prenasalised consonants in Southern Barasano.

Similarly, Jin-Young (2011) argues that in Bantu languages such as Luganda NC distribution varies according to their morphological environment. If these appear word initially, they are realised as non-homorganic and syllabic but prenasalised morpheme internally as seen in Luganda below (Jin-Young, 2011, p.133):

33. /mu-ntu/ → [mu.ⁿ**t**u] *[mu.**n̩**.tu]
CL1-person
'person'

34. /N-kuba/ → [**n̩**.ku.ba] *[ᵑ**k**u.ba]
CL9-rain
'rain'

As evident in the above examples, word initial prenasalisation and word medial homorganic representation of the NC would be considered ill-formed, as seen in (33) and (34) respectively.

One representation of the treatment of NCs in Bantu languages is evident in /mu/ reduction, a morphological process that contracts Class 1 and 3 noun prefix /mu/. This truncation yields varied phonological effects, whereby the resultant derived NC is a cluster or unitary segment. Most derived non-homorganic NC sequences are attested in different Bantu languages as seen in Chichewa (Downing, 2005; Downing & Mtenje, 2017), Zezuru (Kadenge, 2010), Shangwe and Zezuru (Kadenge, 2014), chiNambya, isiZulu and siSwati (Harford & Malambe, 2015; Kadenge, 2015), Shimakonde (Liphola, 2011) and Kibena (Morrison, 2009), amongst others. These studies present the varied phonological effects of /mu/ truncation in different Bantu languages.

Kadenge (2010) discusses the distribution and realisation of NCs in Zezuru. He provides phonological and morphological evidence that Zezuru NCs are "complex onsets that occupy a single C-slot," thus advocating for their treatment as unitary segments rather than clusters (2010, p. 393). This means that Zezuru NCs are syllabified as single consonants, albeit complex, in line with the permissible CV syllable structure in the language. Kadenge (2014) develops his (2010) argument by demonstrating the asymmetrical syllabification of /mu/ derived NCs in Zezuru and Shangwe, where both dialects of Shona realise a syllabic [m̩] resulting from /mu/ reduction. The only difference is that in Zezuru the nasal is moraic but non-homorganic, thus ranking faithfulness to input/output identity over place assimilation. In Shangwe, however, the nasal becomes homorganic thus re-ranking homorganicity over input/output faithfulness. In their discussion of the same phenomenon in Chichewa, a Bantu language spoken in Malawi, Downing and Mtenje (2017) note that the prefix is truncated in minimally disyllabic and onsetful PStems but is blocked in monosyllabic ones (Downing & Mtenje, 2017, p. 100). They note that the resulting nasal is a syllabic and tone-bearing unit just like in Shangwe and Zezuru. Consider the following Zezuru (35) to (36) and Shangwe (37) to (38) examples (Kadenge, 2014, p. 54-56) where the resultant nasal in Zezuru remains non-homorganic while Shangwe NCs assimilate:

35. /mu-ʃuku/ → [**m̩**.ʃu.ku]
CL3-indigenous fruit
'indigenous fruit'

36. /mu-gʷagʷa/ → [**m̩**.gʷa.gʷa]
CL18-road
'road'

37. /mu-síkána/ → [**n̩**.sí.ká,na]
CL1-girl
'girl'

38. /mu-kádzi/ → [**ŋ̍**.ká.dzi]
CL1-woman
'woman'

The /mu-/ reduction patterns discussed above seem to be a common phenomenon in Bantu languages, where the resulting NC is syllabic and homorganic or remains heterosyllabic (See Morrison 2009, Mwita, 2009). In this study, I demonstrate that in siSwati the shape of NCs is morphologically motivated in that it hinges on whether the resultant NC is derived or non-derived. This study demonstrates that derived NCs are syllabic and non-homorganic, while non-derived ones are prenasalised and homorganic. I provide evidence against coda specification in siSwati (See Harford & Malambe, 2015; Kadenge, 2015). In his analysis of /mu/ reduction in siSwati and other Bantu languages, Kadenge (2015), following on Harford and Malambe (2015), argues that the derivative phonological process allows codas. For instance, Kadenge (2015, p. 100) syllabifies /umu+fula/ "river" as [u***m***.fu.la] instead of [u.***m̩***.fu.la], presupposing coda specification in siSwati. The study aims to contribute to linguistic typology by presenting an intralinguistic analysis of nasal-obstruent sequences and their effects on the prosodic and minimality requirements in siSwati, depending on whether they are derived or non-derived. This in turn confirms the interconnectedness between phonology and morphology.

2.5 Hiatus resolution

Various studies have investigated vowel hiatus as a phonologically disfavoured process in several languages of the world, amongst which are the Nguni languages of the Bantu language family (Casali, 1996, 1997; Rosenthall, 1997; Lee, 1999; Orie & Pulleyblank, 2002; Sibanda, 2009; Mudzingwa & Kadenge, 2011; Kadenge & Simango, 2014; Gunnink, 2018), amongst others. Each of these world languages that do not tolerate a sequence of vowels tautosyllabically employs at least one of various repair strategies within and across word boundaries. To break the unacceptable *VV sequence, strategies that have been posited include Glide Formation (GF), vowel deletion, vowel coalescence, secondary articulation and segment epenthesis. However, these researchers adopt varied approaches in the analysis of hiatus resolution within the various languages under investigation.

To begin with, there are those languages like Fwe that allow flexibility in their treatment of hiatus resolution. Even though the language prohibits vowel concatenation tautosyllabically, there are instances where it is allowed to have a sequence of vowels in spite of its monophthongal vowel inventory. For example, in CV verbal prefixes followed by vowel initial suffixes, Fwe retains both vowels especially if they are not identical as seen in /ndà-kà-úr-ì/ → [ndà.kà.ú.rì] 'I bought there' (Gunnink, 2018, p. 56). However, this flexibility maintains only if the offending vowels are syllabified heterosyllabically since Fwe does not have diphthongs in its phoneme inventory. Casali (1997) adds that other languages that select a different approach to hiatus resolution adopt heterosyllabification such as Modern Greek or diphthongisation in Ngiti as seen in the examples below (Casali, 1997, p. 497):

39. **Modern Greek:**

/oloena erxome/	→	[o.***lo.e***.n***a.er***.xo.me]
'continually I come'		'I come continually'

40. **Ngiti**

/izo-ɔkʊ/ → [i.z***oɔ***.kʊ]
'reed sugarcane' 'type of sugarcane'

As evident above, Modern Greek resyllabifies the offending vowels heterosyllabically while Ngiti diphthongises the concatenation, demonstrating linguistic variation amongst world languages in dealing with hiatus resolution. These two resolution strategies would not, nevertheless, apply in siSwati because it does not have diphthongs in its vowel inventory and prefers onsetful syllables.

Furthermore, Rosenthall (1997) presents the distribution of prevocalic vowels where she makes crosslinguistic generalisations about the behaviour of high and low vowels in hiatus resolution. She notes that in instances where prevocalic high vowels form glides, low vowels typically delete. Her argument on prevocalic distribution demonstrates sensitivity to vowel height in the choice of resolution strategy. For instance in Luganda, a Bantu language spoken in Uganda, high vowels surface as corresponding nonmoraic glides whereas low vowels are deleted. She concludes that the selection of either GF or deletion results in compensatory lengthening of V_2 in Luganda since the language attempts to preserve all input moras or V-Slots. Casali (1995) also advances the argument on vowel height sensitivity. He presents disparity in whether both high and mid vowels in individual languages trigger GF or only high vowels glide. Both Casali (1995) and Rosenthall (1997) point to the relationship between prevocalic vowel height and the selection of hiatus resolution strategies in various languages crosslinguistically.

Casali (1997) also adopts a position-sensitive analysis to vowel elision as a resolution strategy. He notes that V_1 is usually the most common target for elision crosslinguistically, especially between prefixes and roots but not as prominent between roots and affixes. He proposes that the vowel that gets deleted must be word initially, in a root morpheme or a content word. His argument centres on MAXLEX, a faithfulness constraint that favours "preference for maintaining phonological material belonging to elements that typically encode greater semantic content" (Casali, 1997, p. 501). For instance, in Igede /da eɲi/ becomes [deɲi] '*to rain'* after the /a/ gets deleted since it is part of the prefix and therefore non-lexical, in keeping with Casali's analysis of the target for elision. This analysis will be important to the current investigation in determining which vowel siSwati targets for hiatus resolution across various morphological constituents.

I have provided evidence of various repair strategies across different languages where they apply based on what each language permits in its syllable structure. Another resolution strategy that languages adopt, with varying degrees of asymmetry, is segment epenthesis. Empirical evidence reveals that world languages adopt various epenthetic segments to resolve hiatus. Glides, glottal stops, and in rare cases, coronal consonants such as /t/, are listed as possible epenthetic segments (Casali, 1996; Rosenthall, 1997). According to Casali, vowel hiatus requires that glides share the same featural makeup of the adjacent vowels. For instance, round vowels would glide to a [w] while front vowels would glide to a [j], respectively. Some languages use glottal stops to break the sequence of offending vowels. Consider the following examples from Malay (Casali 1996, p.10):

41. /di-ubah/ → [di**ʔ**ubah]
    ‘to change’ (passive)

42. /di-aŋkat/ → [di**ʔ**aŋkat]
    ‘to lift’ (passive)

43. /se-indah/ → [se**ʔ**indah]
    ‘to be as beautiful as’

As evident in Malay, there is the insertion of the glottal stop to break a sequence of vowels. SiSwati exhibits the same pattern, but only in onsetless loanwords that are rephonologised to the language. For instance, the English adoptive “iron” is rephonologised as /ajini/. I illustrate this epenthesis pattern in the siSwati examples below:

44. /í-ájìnì/ → [í.**ʔ**à.jí.nì]
    CL9-iron
    ‘iron’

45. /lí-ódà/ → [lí.**ʔ**ó.dà]
    CL5-order
    ‘order’

The examples above demonstrate glottal stop epenthesis in siSwati, in line with crosslinguistic patterns, and different from what indigenous siSwati words exhibit. I revisit this section under loanword phonology in Section 2.6 below.

Mudzingwa and Kadenge (2011) present a comparative analysis of hiatus resolution in Karanga and Nambya, Bantu languages spoken in Zimbabwe. Their argument focuses on phonological processes driven by the intricate morphological structure of nominals. They propose that morpheme interaction between [prefix + nominal stems + affix] results in dispreferred VV sequences that have to be resolved by either glide formation or secondary articulation, however, if these two cannot apply, then deletion is triggered. In these two languages, given the quality of V_1 and the morphological context in which hiatus occurs, in this case between the nominal stem and its affixes, one can predict the repair strategy the grammar selects, with GF as the default strategy. If it cannot apply then the grammar selects secondary articulation followed by deletion. This predictability of the repair strategy points to the close link between morphology and phonology in phonological analysis.

Worth noting are the similarities and differences exhibited by Bantu languages when it comes to hiatus resolution. As evident in the above discussion, the phonotactics of each language determine the interaction and output of segments in adjacent syllables. For instance, *VV is a markedness constraint that ranks high in Nguni languages (Sibanda, 2009), while in Shangani and other Bantu languages, the same constraint does not rank as high (Mabaso, 2013). Similarly, the *VV repair strategies differ across languages ranging from deletion, gliding and insertion, each process driven by the syllable structure restrictions of the language under investigation. For example, Luganda turns both front vowels /i e/ to corresponding glide [j] and the back vowels [o, u] to [w] respectively. Consider the following examples from Nash (1992, p. 10) where both front vowels undergo glide formation:

46. /li-a/	→	[ljaa…]	'eat'
47. /ke-a/	→	[kjaa…]	'dawn'

SiSwati, on the other hand, does not glide [e] instead it deletes or undergoes other changes depending on the adjacent segments as will be illustrated in Chapter 4.

2.6 Loanword phonology

Because of constant political and sociolinguistic factors, languages come into contact and as such, borrow lexical items from each other. This crosslinguistic borrowing introduces syllable sequences that may be characterised by complex onsets and codas, patterns prohibited in recipient languages. The introduction of dispreferred syllable structures and segments from the donor language to the recipient language calls for a range of repair strategies to harmonise the borrowed words to the syllable structure and segment inventory of the borrowing language. For instance, Tsvetkov, Ammar and Dyer (2015) present borrowing between Arabic and Swahili where the donor language, Arabic, brings forth prohibited syllable structures such as CVV, CVC, CVCC and CVVC and as such have to undergo a range of phonological adaptations to conform to the largely CV structure attested in Swahili. The repair strategies adopted in the rephonologising of loanwords depends largely on the phonotactic structure of the recipient language. Segment epenthesis, consonant deletion, spreading, and feature change are some of the strategies that different researchers have posited for loanword adaptation universally.

Further, Adler (2006) examines contributing factors behind the retention, deletion, and featural adaptation of segments, from the source language. He postulates that there are asymmetries in how different languages opt to preserve ‘salient’ features of the source language over syllabic well-formedness enforced by the borrowing language. His argument centres on the premise that articulatory similarities, rather than phonological closeness, contribute to how a segment gets selected as a substitute for an input segment. For instance, he presents the absence of voiced stops [b, t, d, g] and fricatives in Hawaiian as a challenge in the English/Hawaiian borrowings as these are sometimes preserved, something that violates the phonotactic structure of the recipient language. In his analysis, he notes that English segments that do not exist in the Hawaiian consonant inventory undergo featural adaptation, while those in violation of phonotactic constraints get deleted or epenthesise a vowel to harmonise them with Hawaiian open syllables. Based on the Hawaiian evidence above, Adler (2006) concludes that it is both the native’s speaker’s perception and production that determines the nature of the repair strategy, thus discounting phonological influence in the adaptation of loanwords. In this research, I demonstrate how siSwati phonology, rather than phonetics, influences the retention, deletion or adaptation of an input segment.

The most common repair strategy in loanword adaptation involves vowel epenthesis to break complex clusters and resyllabify input consonants in coda position (Kager, 1999; Uffmann, 2004, 2006; Mwita, 2009; Kadenge, 2012; Tsvetkov *et al*, 2015). The quality of the epenthetic vowel has been the subject of many studies. Kager (1999, p. 96) calls [i] an "obligatory epenthetic vowel" and this is evident in various languages of the world such as Chichewa (Downing & Mtenje, 2017), chiShona (Uffman, 2006; Kadenge, 2012), Kikerewe (Odden, 1996), Yoruba, Kikuyu, Samoan, and Fijian (Uffmann, 2006), Sesotho (Rose & Demuth, 2006). Some languages like Japanese use [u] as its default epenthetic vowel (Uffman, 2006). [i] is argued to possess salient features, hence its accessibility as a default epenthetic vowel. Uffman (2006) further posits default insertion, onset assimilation as well as vowel harmony as the three vowel epenthesis processes that languages of the world adopt. He argues against [i] insertion as the obligatory vowel for insertion, noting that adjacent segments sometimes contribute to the quality of the epenthetic vowel.

Another vowel epenthesis strategy adopted in loanword adaptation is onset feature assimilation (Batibo, 2002; Rose & Demuth, 2006; Uffmann, 2006). Rose & Demuth (2006, p. 1115) argue that "while [i] represents the epenthetic vowel in Sesotho, it does not act as the default vowel in loanwords. Rather, phonological material coming from surrounding vowels or consonants serves to fill the epenthetic site". In his crosslinguistic vowel epenthesis model, Uffman (2006) argues for the predictability of the epenthetic vowel in loanword phonology. He notes that it is coronal and labial consonants that spread their features onto the vowel they precede. In other words, the nature of an epenthetic vowel follows on the featural makeup of the input onset consonant. Mudzingwa (2010) and Kadenge (2012) call this the spreading of either V-Place or C-Place features from adjacent segments. If labial, then the recipient language will select labial vowel [u] or [o] but if coronal, then the epenthetic vowel is either [i] or [e], respectively (Batibo, 2002; Uffman, 2006; Mwita, 2009; Kadenge, 2012; Tsvetkov *et al*, 2015). For example, the Arabic word *kitta**ba*** "book" is realised as [kita<u>**bu**</u>] and not *[kita***ba***] with the final [u] having adopted the labial feature of the onset consonant [b], which is labial (Tsvetkov et al, 2015, p. 600). Mwita (2009, p. 55) offers more examples where vowels are epenthesised to break complex clusters as well as provide PEAK for coda consonants that appear word finally:

	Arabic		***Swahili***	
48.	/ahd/	→	[a.h**a**.d**i**]	'promise'
49.	/milk/	→	[mil**i**k**i**]	'milk'

50. /taab/ → [taab**u**] 'trouble'

The examples above are an illustration of how Swahili breaks complex syllables in (48) and (49) while (50) provides a PEAK for the coda [b]. The word final /b/ has inserted a round vowel [u] in (50), while the other examples – which are coronal /d/, /s/ and dorsal /k/ have inserted [i], in line with the predictability of the epenthetic vowel being governed by the featural makeup of the input consonant. This predictability ties with the tenets of the FG theory which argues for the spreading of features across adjacent segments.

In as much languages of the world typologically break complex clusters using default vowel insertion between the two illicit consonants, there are those languages that deviate from this trend. Broselow (2015) posits two possible positions for vowel insertion:

51. C***V***.CV – the canonical insertion of epenthetic vowels
52. ***V***C.CV – the vowel is inserted before the cluster.

For this variation, Broselow argues that the pre-cluster insertion is common in some languages that have coda specification in its syllable structure. Consider the following Hindi examples (Broselow, 2015, p. 296):

53. [f***ɪ***rut] 'fruit'
[p***ɪ***lɪz] 'please'

54. [***ɪ***skul] 'school'
[***ɪ***spɛliŋ] 'spelling'

The examples in (53) and (54) above demonstrate intralinguistic variation in Hindi vowel insertion whereby the /s/ initial clusters in (54) employ pre-cluster insertion as posited in (52) above, while (53) inserts the vowel in the canonical epenthetic site as posited in (51) above.

In addition to vowel epenthesis, other strategies that have been adopted in previous studies and across typologically diverse languages are consonant deletion (henceforth segment deletion, to account for diphthongal vowel deletion in siSwati), cluster tolerance and feature change (Mwihaki, 1998; Batibo, 2002; Mwita, 2009; Mwaliwa, 2014; Broselow, 2015). According to Mwita (2009), segment deletion only applies where the underlying representation has germinates, in which case one of the germinate consonants is lost as seen below (Mwita, 2009, p. 56):

55. /hadd/	→	[hadi]	‘until’
56. /saffa:/	→	[safa]	‘becomes clear/clean’
57. /budd/	→	[budi]	‘alternative’

For optimal preservation of the underlying representation, there are instances where loanword rephonologization either deletes or preserves segments in the source language. In such cases, the choice to delete or retain illicit structures hinges on universal markedness constraints. Batibo (1996, 2002) argues that segment deletion affects extra-syllabic segments, that is, those that would optimally be syllabified out of the canonical CV syllable structure. This would mean that deletion targets those consonants specified as codas in the donor language as in (51), provided they do not conform to the universally unmarked complex consonant sequence where C_1 is a stop consonant and C_2 a liquid. If they conform, the cluster is preserved for optimal input faithfulness. He advocates for the syllabification of these sequences as clusters rather than splitting them into a coda and onset as in (46), respectively. Consider the following examples (Batibo, 2002, p. 4):

58. /nadra/	→	[na.dra]	* [nad.ra]	‘rare’ in Arabic
59. /blauzi/	→	[blau.zi]		‘blouse’ in English
60. baptize	→	[ba.ti.ze]	*[ba***p***.ti.ze]	‘baptise’
61. contract	→	[kɔ.ntra: ti]	*[kɔ.ntra***k***.ti]	‘contract’

The last repair strategy posited for loanword adaptation is altering the feature of an underlying segment, also known as segment substitution (Bojcic & Braovic, 2012; Khan, 2016), provided the recipient language does not have that segment in its vowel and consonant inventory. For example, Indonesian either replaces the input segment with a native one or incorporates the new sound into the phoneme inventory of the recipient language (Batibo, 2002; Nurul, 2018). Paradis & LaCharité (2011) postulate that ‘malformed’ input structures are sometimes introduced into the grammar of the adoptive language. They also argue that loanwords follow the orthography of the source language, noting that “segmental information is maximally preserved, within the constraint conflicts” (2011: 764). For instance, Swahili does not have the voiceless uvular plosive /q/ in its consonant inventory, and thus replaces it with the velar plosive /k/ whenever it appears in a loanword. The word */as**q**afu/ *bishop* is realised as /as**k**afu/ because of the absence of /q/ in

Swahili. However, the same language is argued to have since incorporated [Θ, ð, ɣ, r] into the Swahili inventory of consonants, as a result of language contact and influence (Batibo, 2002; Mwaliwa, 2014).

Against this background, this study, first, identifies the various repair strategies that siSwati adopts in line with the broader loanword nativisation research. I follow on this argument by demonstrating that siSwati employs these strategies to satisfy the two tenets of the dissertation: CV syllable structure conformity as well as prosodic minimality. I demonstrate that rule application and interaction in various morphosyntactic domains in the analysis of siSwati loanwords hinges on these two premises.

2.7 Word minimality

Numerous studies have examined minimality in Bantu and world languages (See Park, 1995, 1997; Harford, 1999; Downing 1999, 2005 & 2006; Zerbian, 2002; Rose & Demuth, 2006; Mkochi 2009; Mudzingwa, 2010; Selkirk & Lee 2015; Downing & Kadenge 2015; Kadenge & Mathangwane, 2017) amongst others. Selkirk and Lee (2015) advocate for a minimally disyllabic PWord, proposing that markedness constraints in Optimality Theory (OT) require that a prosodic constituent of type ω be prosodically binary.

Languages that enforce binarity typologically apply augmentation and rule-blocking to satisfy minimality requirements crosslinguistically (Park, 1997; Marten, 2012). Swahili is one such language which favours disyllabic minimality of the PWord. In the formation of the perfect aspect Swahili requires the insertion of what Downing and Kadenge (2015) term a 'morphologically empty segment' *ku*- to augment monosyllabic verbs. The augmentation of an already well-formed PWord is blocked as evident in how the grammar blocks *ku*- insertion in verbs that are two or more syllables. In addition, onsetless disyllabic verbs such as *isha* (finish), *enda* (go), *iba* (steal) and *oga* (bathe) (Marten, 2012) follow the rules for monosyllabic verbs in some phonological processes. Marten (2012) and Park (1997) demonstrate that segment deletion is contingent upon the size of the PStem. He presents a case where the Swahili grammar either deletes or retains nasals in [nasal + voiceless consonant] concatenation in diachronic nouns. Stems that are two syllables or more are said to delete the nasals, whilst monosyllabic ones retain them (Park, 1997, p. 247):

62. /mpaka/ → [**pʰ**a.ka] 'cat'
63. /nsimba/ → [**s**i.mba] 'lion'

64. /nta/ → [**n̩**.ta] 'wax' *tʰa
65. /nswi/ → [**n̩.**swi] 'fish' *swi

Instead of deleting the nasal like in (62) and (63), the examples in (64) and (65) parse the nasal as a syllabic segment, thus indicating that the language prefers minimally disyllabic PWords over monosyllabicity. Zerbian (2002) presents Setswana as another language that blocks deletion of nasals in monosyllabic adjectives, yet their polysyllabic counterparts delete them. These examples are evidence that some Bantu languages trigger different repair strategies to enforce the binary requirement of the PWord.

Another Bantu language that disallows monosyllabic PWords is Yoruba. This language exhibits the interaction between word minimality requirements and vowel hiatus resolution in verb phrases, where the grammar selects vowel elision as an optimal repair strategy depending on the size of the PWords. Orie and Pulleyblank (2002, p. 104) propose that "CV verbs are subminimal while longer verbs satisfy constraints on prosodic minimality". In keeping with Casali's (1997) discussion on the determining factor for vowel elision or modification, Orie and Pulleyblank argue that in a V_1 + V_2 sequence resulting from a monosyllabic verb preceding an onsetless noun, V_1 is deleted leading to a minimally disyllabic, therefore a permissible verb phrase. However, the same process blocks vowel deletion if the input verb is two syllables or more. In the first instance, the Yoruba grammar blocks the monosyllabic verbs from appearing in isolation by combining them with the noun, while in verb phrases where the input verb forms are disyllabic or polysyllabic, the grammar blocks merging and the subsequent deletion of a dispreferred sequence of vowels. Consider the following examples (Orie & Pulleyblank, 2002, p. 102 - 103):

66. /j<u>ó</u>-<u>è</u>wù/ → [j**è**wù] 'burn clothing'
67. /s<u>e</u>-<u>o</u>lú/ → [s**o**lú] 'cook mushrooms'
68. /r<u>a</u>-<u>ò</u>gèdè/ → [r**ò**gèdè] 'buy bananas'

69. /tàsé ènú/ → *tas**e**nu 'miss one's mouth'
70. /fòró èmí/ → *for**e**mi 'vex one's spirit'

Examples in (66) to (68) represent subminimal verbs appearing before onsetless nouns. As evident, V_1 is elided resulting in surface constructions that satisfy prosodic minimality. However, deletion of the same V_1 is blocked in examples (69) and (70), since the input verb is already disyllabic, thus satisfying constraints on prosodic minimality. Evidence shows that while Yoruba deletes the offending vowel only to satisfy prosodic minimality constraints, siSwati disallows a sequence of vowels regardless of whether the input forms are subminimal or not. I revisit this disparity in Chapter 4 where I explore hiatus resolution patterns in siSwati.

An interesting observation is that there are languages that typologically allow the existence of Co-phonologies where PWords do not have the same minimality requirement in their grammar. Kadenge and Mathangwane (2017) discuss iKalanga which presents an intralinguistic variation of PWord minimality requirements. IKalanga minimally accepts monomoraic or monosyllabic nouns and adjectives, but prohibits the same in imperatives and pronouns. A case like iKalanga presents intralinguistic variation in constraint ranking, in that the same grammar imposes different prosodic minimality requirements. For instance, M_{IN}-W_D outranks DEP-IO in imperatives and pronouns, but DEP-IO trumps M_{IN}-W_D in nouns and adjectives. The iKalanga grammar therefore allows epenthetic [i] in imperatives and pronouns, but blocks augmentation in nouns and adjectives. Consider the following examples (Kadenge & Mathangwane, 2017, p. 133 &139):

	Imperatives			***Pronouns***		
71.	/i- já/	'eat!'		/i-mí/	'I'	
72.	/i- dwá/	'go out'		/i-wé/	'you'	
73.	/i- dá/	'love'		/i-swí/	'we'	
	Nouns			***Adjectives***		
74.	/ndá/	'lice'	***i.nda**	/psa/	'new'	***i.psa**
75.	/dzu/	'eagle'	***i.dzu**	/bi/	'ugly'	***i.bi**
76.	/ví/	'grey hair'	***i.vi**	/tshu/	'black male cattle'	***i.tshu**

Kadenge and Mathangwane (2017) use the Co-phonologies theory to explain this intralinguistic variation. A case like iKalanga provides evidence that the same grammar imposes different prosodic minimality requirements, where some categories can be monosyllabic but minimally well-formed; while in other contexts monosyllabic PWords are subminimal and require augmentation. In (71) through to (73), imperatives and pronouns make use of epenthetic [i] to augment minimal constructions to be binary and therefore acceptable in the language. However, the same grammar prohibits [i] augmentation in nouns and adjectives, where augmentation yields ill-formed constructions as seen in (74) to (76). IKalanga is an example of a language that has co-phonologies with varied restrictions on the minimality of its prosodic word. The language does not have a default [i] insertion for augmentation of all monosyllabic constructions, but the word category matters in the rule application. This dissertation, therefore, investigates the position of the various prosodic words in siSwati, assessing whether an intralinguistic variation evident in other languages exists.

Unlike the languages discussed above, where the number of syllables determines the processes to apply to make prosodic words minimally acceptable, Chitonga, a language spoken in Malawi, exhibits bimoraic binarity (Mkochi, 2009; 2017). Mkochi argues that it is the mora, and not the syllable, that determines prosodic minimality in Chitonga. For instance, monosyllabic and monomoraic verbs are considered subminimal, whereas monosyllabic but bimoraic constructions are considered well-formed. Mkochi notes that long vowels are considered bimoraic hence are counted as minimally well-formed. Consider the following examples of monosyllabic verbs in Chitonga (Mkochi, 2009, p. 278-279):

77. /swa/	→	[**i**.swa]	'break'
78. /wa/	→	[**i**.wa]	'fall down'
79. /fwa/	→	[**i**.fwa]	'die'

80. /to:/	→	*[i.to:]	'take'
81. /ko:/	→	*[i.ko:]	'subdued'
82. /po:/	→	*[i.po]	'get cold'

The above data demonstrates the different restrictions on the size of the PWord within the same word category in Chitonga. For instance, the examples in (77) through (79) require prosthetic [i] augmentation to meet prosodic minimality, whereas the second set of examples, even though monosyllabic as well, block augmentation because long vowels are considered bimoraic and therefore well-formed. Most researchers advocate for bimoraic constructions as a determining factor for prosodic minimality (See Clements & Humes, 1995; Harford, 1999).

Previous research on siSwati word minimality has made various claims about minimality effects in the language. Malambe (2006) postulates that prosodic minimality requirements condition the shape of the siSwati passive morpheme. She notes that the size of the prosodic word determines the form that the passive takes. If the root is monosyllabic, the grammar of the language inserts epenthetic [i] to augment the subminimal root. For minimally well-formed roots, which she postulates at two or more syllables, augmentation is blocked. Consider the following examples (Malambe, 2006, p. 7-8):

83. /hámbà/	→	[hánʤʷà]	‘go’
84. /sèɓéntà/	→	[sètʃ’éntʷà]	‘work’
85. /pʰá/	→	[pʰ**íw**á]	‘give’
86. /ɮá/	→	[ɮ**íw**à]	‘eat’

The above examples demonstrate the variation of the passive marker in siSwati. Where the verb root is two syllables or more, the passive marker is realised as /-w-/, but as augmented [-iw-] in (85) and (86) where the verbs are subminimal and therefore ill-formed. Malambe argues that subminimality of the verb root triggers augmentation while prosodic well-formedness blocks it.

As mentioned earlier, extensive work on Bantu reduplication exists (See Downing, 1994, 1997, 1998, 2003, 2005). Downing (1997) argues that reduplication in Bantu languages is subject to prosodic constraints on the size of the reduplicant (RED). Downing demonstrates that the RED only copies part of the first two syllables, a phonological process that is guided by foot binarity. She proposes a “fixed bisyllabic length” in siSwati guided by foot binarity (FtBin), a Correspondence Optimality theoretic constraint that forces reduplicants to be minimally and maximally disyllabic (2003, p. 3). Downing (1999) further establishes the relationship between the size of the PWord and augmentation of monosyllabic and onsetless verb stems in siSwati imperatives. In subminimal verbs stems, the language inserts *–ni* after the verb, while it epenthesises [j] before onsetless verbs to provide an onset for the onsetless syllable.

SiSwati is no exception to RED binarity in that it also enforces disyllabic minimality on its reduplicants. Downing (1997) demonstrates how morphosyntax conditions the output of a reduplicant in siSwati. She notes that in certain morphological contexts, the RED copies the same

V_2 of the verb stem while in others, it duplicates the default Final Vowel (FV), even when it is absent in the input. She proposes that Inflectional Stems copy the FV, whereas derivational stems duplicate the input vowel and not the default. Consider the following examples[1]:

Inflectional Stems (Downing, 1997, p. 27)

87. /u-ya-p^{h}up^h**u**tsa/ → [u-ya-p^{h}up^h**u**-p^{h}up^{h}utsa]
CL1.2nd. TAM-blow
'you are blowing'

Derivational Stems (Downing, 1997, p. 25)

88. /u-ya-lindz-**e**l-a/ → [u-ya-lindz**a**-lindz-el-a]
CL1.OM.2ndPers.TAM.wait
'you are waiting for'

In (87) the polysyllabic stems duplicate the input vowel of the inflectional stem by copying the first two syllables as they are, as expected in minimally well-formed verbs. The derivational examples with verbal extensions /-el/ and /-is-/ in (88), however, copy the default FV [a], even though the input vowels are [e] and [i] respectively. This is an illustration of how morphosyntax in siSwati determines correspondence between the input and output.

The current study expands the discussion on minimality, by exploring the close and complex link between morphology and phonological analysis. I focus on how different morphosyntactic environments deal with augmentation and rule blocking as governed by the PWord binarity enforced by siSwati. This discussion is in line with how siSwati attains disyllabic minimality across various PWords, which is one of the goals of this dissertation.

2.8 Summary of the chapter

Chapter 2 has discussed the literature pertinent to the current study. The chapter started out by mapping out the close relationship between morphology and phonology, highlighting how the intricate morphological structure of nominals and verbs influence phonological analysis crosslinguistically. The literature also identified key research in siSwati that not only informed but

[1] Examples have been sourced from Downing (1997, p. 27) without tone markings.

will contribute to the current dissertation. Lastly, I explored the relevant topics under investigation demonstrating how various languages deal with vowel hiatus, NCs, loanword phonology and word minimality. In higlihting the various studies on the syllable and morpho-phonology, this study demonstrates that phonological restrictions are contingent upon the morphological contexts in which they occur, a claim that is explored in detailed in subsequent chapters. The next chapter provides a brief overview of siSwati phonology and morphosyntax underpinning the current dispensation.

CHAPTER 3

AN OVERVIEW OF SISWATI PHONOLOGY AND MORPHOSYNTAX

3.1 Introduction

This chapter discusses siSwati phonology and its morphosyntax. I first discuss the siSwati segmental inventory, focusing on siSwati monophthongs and the various types of consonants in this language. I also discuss the preferred siSwati syllable structure, highlighting the contentious syllabification of labialised (C^w) and prenasalised (^NC) consonants. Lastly, I present a brief overview of how various phonological processes are conditioned by the siSwati syllable structure. I utilise the FG theory (Clements & Hume, 1995) to account for the surface realisation of consonants occupying a single C-slot, thereby conforming to the CV syllable restrictions, in line with the goals of the dissertation.

The chapter further discusses the morphosyntactic structure of nominals and verbs. The morphosyntax of the language provides the context which conditions most phonological processes in Bantu. Since siSwati is an agglutinative language (Doke, 1950; Katamba, 1978; Mchombo, 2001), morpheme concatenation yields potential illicit sequences emanating from the combination of morphemes thus creating a rich context for phonological analysis. This chapter presents the morphological structure of nominals and verbals as presented by other Bantuists such as Downing (2005), Mudzingwa (2010), Mudzingwa and Kadenge (2014), Braver and Bennett (2016), Downing and Mtenje (2017), and van de Velde (2019), amongst others. This morphosyntactic structure provides a platform to analyse the predictability of how various dispreferred constructions are repaired within the confines of siSwati grammar restrictions.

3.2 SiSwati sociolinguistic classification

SiSwati is recognised in the *Constitution of ESwatini (formerly Swaziland)* as one of ESwatini's two official languages, alongside English, and is spoken in ESwatini and some parts of South Africa, specifically the Mpumalanga province. The siSwati spoken in ESwatini has two dialects emanating from the influence of other languages spoken in neighbouring countries, one known as *kuyeyeza*, largely spoken in the southern part of ESwatini, and another spoken on the Mozambican border, informally known as *siShewula*. These two dialects have, to some extent, linguistic influences of the languages spoken in these neighbouring countries. This study focuses on the siSwati spoken in the central part of ESwatini, which is believed to be devoid of major linguistic influences of either Mozambique or South Africa (Ziervogel & Mabuza, 1976; Malambe, 2006).

The classification of Bantu languages, especially within the Niger-Congo language group, has been the focus of diverse research (Guthrie, 1948, 1967; Doke, 1954; Cope, 1971). Tucker-Childs (2003, p. 32) advocates for grouping African languages based on whether they "share linguistic properties and items which cannot have been borrowed, thereby demonstrating that they have a common 'parent'". SiSwati (S43) is a Nguni language alongside three other mutually intelligible languages, namely: isiXhosa (S41), isiZulu (S42) and isiNdebele (S44) (Guthrie, 1967; Poulos & Msimang, 1998; Creissels, 1999). Typologically, these languages are characterised by, amongst other linguistic features, a system of nominal classes denoting singular and plural nouns marked through affixes (Greenberg, 1963). These noted similarities that siSwati shares with other Nguni languages transcend beyond this language family. Typological similarities exhibited across Bantu languages point to their propensity to select similar phonological repair strategies in phonological analysis, as is discussed in subsequent chapters.

3.3 The siSwati vowel system

SiSwati has the canonical five phonemic vowel system attested in many Bantu languages within and across the Nguni language family (See Lee, 1999; Hyman, 2003; Malambe, 2006; Sibanda, 2009; Kadenge, 2011; Simango & Kadenge, 2014). This system is devoid of phonemic diphthongs and long vowels as is demonstrated in the subsequent discussions on the elimination of VV sequences in vowel hiatus and the adaptation of diphthongs in loanword phonology.

Table 1 below presents a brief summary of the five vowels in siSwati. The grouping of vowels into place features (LABIAL, CORONAL, PHARYNGEAL), corresponds with the FG theory (Clements & Hume, 1995) where vowels are categorised under the same natural classes as consonants with shared place features, as discussed in Chapter 1. Vowel height is a contributing factor to the discussion of labial and coronal feature spreading in hiatus resolution (Chapter 4) as well as high vowel elision in /mu/ reduction (Chapter 5).

Table 1: **SiSwati phonemic vowels**

	Labial	**Coronal**	**Pharyngeal**
Mid	**[o]**	**[e]**	
High	**[u]**	**[i]**	
Low			**[a]**

3.4 The siSwati consonant system

This section discusses siSwati consonants which comprise a system of simple and complex segments inclusive of aspirated and unaspirated plosives, implosives, ejectives, fricatives, affricates as well as clicks. I begin with a discussion of siSwati simple consonants, which are, according to Clements and Hume (1995), produced with a single constriction in the vocal tract. Similar to vowels, siSwati consonants are categorised under the [LABIAL], [CORONAL], [DORSAL], and [PHARYNGEAL] features. I represent the inventory of siSwati simple consonants in Table 2 below.

Table 2: SiSwati simple consonants (Chen & Malambe, 1998 p. 138; Malambe, 2006, p. 37)

	Bilabial	**Labio-dental**	**Alveolar**	**Palatal**	**Velar**	**Glottal**
Plosives	p^h b		t^h d		k^h g	
Implosives	ɓ				ɠ	
Ejectives	p´		t´	tʃ´	k´	
Nasals	m		n	ɲ	ŋ	
Fricatives		f v	s z	ʃ *ʒ		h ɦ
Lateral Fricatives			ɬ ɮ			
Approximants	w		l	j		

*denotes segments of limited use

3.4.1 Orthographic representations of consonant phonemes in siSwati

In this section, I present examples of the orthographic representations of all the simple consonants in siSwati. Orthographic representations are a guide on the letter-to-sound correspondence in the grammar. I group the sounds into natural classes (labials, coronals, dorsals, and pharyngeals) in line with the theoretical framework and analysis of the data presented in the study. Dental clicks have been included in this list even though they do not appear in Table 2 above. I have also excluded complex segments ^{N}Cs and C^{G}s as they form part of the formal analysis of the CV syllable structure of complex segments in Section 4.5.3.

3.4.1.1 Labials

Labials are produced with one or both lips as active articulators. This category includes all bilabial and labiodental segments.

89. [p´]	[p´áɠìʃà]	**p**akisha	‘pack’
90. [pʰ]	[pʰéɠà]	**ph**eka	‘cook’
91. [bʰ]	[bʰémà]	**bh**ema	‘smoke’
92. [ɓ]	[ɓéɠà]	**b**eka	‘put’
93. [f]	[fùlà]	**f**ula	‘harvest’
94. [v]	[vùlà]	**v**ula	‘open’
95. [m]	[mélà]	**m**ela	‘await’
96. [w]	[wélà]	**w**ela	‘cross’

3.4.1.2 Coronals

Coronal sounds are produced with the front of the tongue as an active articulator. This category includes all alveolar and palatal sounds.

97.	[tʰ]	[tʰándàzà]	**th**andaza	‘pray’
98.	[t´]	[t´álà]	**t**´ala	‘give birth’
99.	[d]	[dálà]	**d**ala	‘create’
100.	[l]	[lálà]	**l**ala	‘sleep’
101.	[ɬ]	[ɬálà]	**hl**ala	‘sit’
102.	[ɮ]	[ɮálà]	**dl**ala	‘play’

103.	[n]	[nátsà]	[**<u>n</u>**atsa]	'drink'
104.	[ʃ]	[ʃúɓà]	**<u>sh</u>**uba	'take everything'
105.	[j]	[jálà]	**<u>y</u>**ala	'refuse'
106.	[ɲ]	[ɲáɲà]	**<u>ny</u>**anya	'hate/dislike'

3.4.1.3 Dorsals

Dorsals are produced with the body of the tongue as an active articulator. All velar segments are classified as dorsal consonants.

107.	[kʰ]	[kʰálà]	**<u>kh</u>**ala	'cry'
108.	[k]	[k´álà]	**<u>k</u>**ala	'measure'
109.	[g]	[gálà]	**<u>g</u>**ala	'prepare to sow'
110.	[ŋ]	[ᵑgénà]	**<u>ng</u>**ena	'enter'

3.4.1.4 Pharyngeals

These consonants are produced in the region of the pharynx and are usually referred to as "gutturals" (Hoberman, 1985; Goldstein, 1994; McCarthy, 1994). The only pharyngeal consonants in siSwati are the glottal fricatives.

111.	[h]	[húlà]	**<u>h</u>**ula	'drag'
112.	[ɦ]	[ɦúlà]	**<u>hh</u>**ula	'shave'

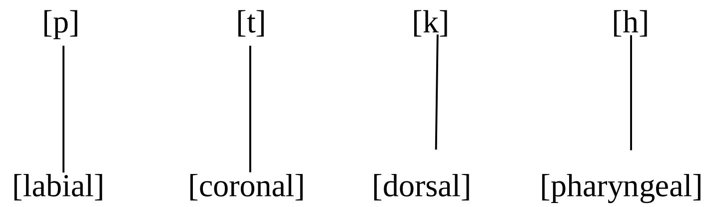
3.4.1.5 Dental clicks:

The last set of segments is that of the siSwati dental clicks.

113.	[ǀ]	[ǀínà]	**<u>c</u>**ina	'be strong'
114.	[ǀʰ]	[ǀʰínà]	**<u>ch</u>**ina	'braid'
115.	[ǀg]	[ǀgìnà]	**<u>gc</u>**ina	'keep'
116.	[ᵑǀ]	[ᵑǀòlà]	**<u>nc</u>**ola	'strip'
117.	[ᵑǀg]	[ᵑǀgòlà]	**<u>ng</u>**cola	'get dirty'

Clements and Hume (1995, p. 253) note that simple consonants are characterised by a single root node as represented in the examples below.

118.



Notably, each of the above examples is a representation of the siSwati simple consonants as discussed above. Each illustration consists of a single, non-branching root node, respectively.

The next section discusses the preferred syllable structure in siSwati. This discussion also highlights the contentious parsing of ^{N}Cs and C^{w}s in Bantu, and then presents evidence of the parsing of these segments as unitary elements to conform to the syllabic restrictions in siSwati.

3.5 The siSwati syllable and structure of complex consonants

In their crosslinguistic investigation of syllable forms, Clements and Keyser (1983, p. 30) classified languages according to the following syllable types:

119. Type I: CV syllables.

120. Type II: CV, V.

121. Type III: CV, CVC

122. Type IV: CV, V, CVC, VC

Clements and Keyser note that Type I and II languages consist of open syllables while enforcing a ban on marked structures such as complex clusters and coda specification. Type III and IV languages, on the other hand, allow the existence of closed syllables, with the possibility to contain a sequence of consonants and vowels, as guided by restrictions on the syllable template of individual languages. Based on this classification, Nguni languages fall under the Type 2 category that prefers open syllables (Khumalo, 1987). In the same vein, I concur with previous researchers such as Khumalo (1987) and Malambe (2006), amongst others, that SiSwati favours open syllables, a system that is largely characteristic of most Southern Bantu languages. The representation of various syllable surface forms allowed by languages dictates the application of markedness constraints that conspire to eliminate input marked structures such as vowel sequences, consonant clusters, and coda specification. The phonological processes discussed in this study are therefore motivated by the need for siSwati grammar to enforce conformity to the Type II syllable surface form.

The possible syllable shapes found in siSwati fall under V, CV, ^{N}C, C^{G}, N̩ as discussed below. All these syllable types can fit into the CV template. I discuss the syllabification of nasals (N̩) in Chapter 5.

3.5.1 Word initial V

Vowel initial syllables are common in the language. However, these are restricted to the word-initial position, an indication that the language favours onsetful syllables. A [.] between syllables indicates syllable breaks. Consider the examples below:

123.	/ulele/	→	[u.le.le]	-	V.CV.CV	‘s/he is sleeping
124.	/ik^{h}ona/	→	[i.k^{h}o.na]	-	V.CV.CV	‘it is here’
125.	/u-ami/	→	*[u.a.mi]	-	VV.CV	‘my’

The examples in (123) and (124) above are perfect examples of permissible V-initial syllables at the word-initial boundary of a siSwati phonological word. However, (125) presents a case where the initial object marker /u/ is followed by a vowel initial possessive marker /-ami/ ‘my’. This consequently yields an illicit VV sequence that falls outside the CV structure permissible in siSwati, therefore calling for the resyllabification of V$_1$ as corresponding glide [w]. This resyllabification is discussed in detail in Chapter 4.

3.5.2 Basic CV

Most phonological words in siSwati typically consist of open CV syllables. This is to be expected as this is the preferred syllable type attested in siSwati and other Bantu languages. Consider the examples in (12) below depicting CV syllables in nominals and verbals:

126.	caphela	-	[ǀà.p^{h}é.là]	-	CV.CV.CV	‘beware’
127.	sihlahla	-	[sí.ɬà.ɬà]	-	CV.CV.CV	‘tree’
128.	lidladla	-	[lí.ɮà.ɮà]	-	CV.CV.CV	‘kitchen’

3.5.3 Complex segments

In FG terms, prenasalised segments, labialised consonants and affricates are classified under contour segments. I in turn discuss these individually in the following sections.

3.5.3.1 SiSwati Nasal-Consonant sequences and their syllabification

The syllabification of complex segments, NCs (nasal and consonant), has been subject for debate in previous research, yielding degrees of varied dispensations. The complexity emanates from the articulation and subsequent syllabification of these segments. This crosslinguistic variation in Bantu languages yields a twofold manifestation of NCs: some scholars advocate for a cluster analysis (Downing, 2005; Mtenje, 2016; Downing & Mtenje, 2017), while others opt to maintain the CV syllable template by arguing for prenasalisation and unitary analysis of the nasal and the following consonant (Sibanda, 2004; Morrison, 2009; Kadenge, 2010; Kadenge & Chebanne, 2017; Gunnink, 2018).

Clements and Humes (1995) define contour segments as ones that contain different feature specifications. They argue that contour segments can be typically categorised as either one-root in (a) or two roots in (b)

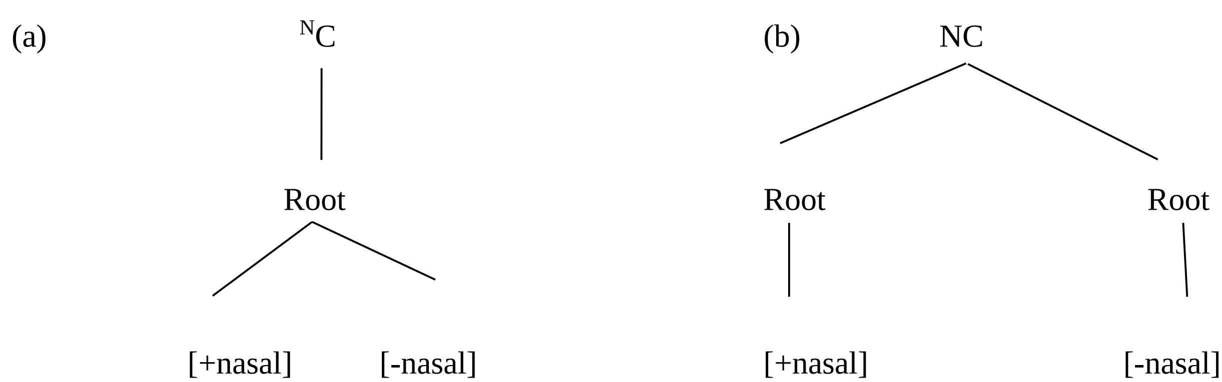


Figure 1: The representation of contour segments (Clements & Humes, 1995)

Clements and Hume (1995) advocate for a one-root analysis such as affricates and prenasalisation in (a). (b) places the N and the C on separate root nodes, a representation depicting a non-branching cluster analysis. For instance, Clements & Hume syllabify the homorganic NC [mb] as prenasalised [^{m}b] in (a) but cluster [mb] in (b), respectively.

The segmental status of homorganic NCs across Bantu languages has been a subject for many studies. Some scholars utilise syllable timing to map the difference between prenasalised onsets and simple onsets (See Hubbard, 1995; Beddor & Onsuwan, 2003, Morrrison, 2009; among others). Hubbard (1995) postulates that prenasalised onsets are considerably longer than simple onsets, and thus cannot be considered simple onsets. In addition, Downing (2005) discards the notion of using phonetic evidence, and the inconsistencies thereof, to account for the segmental status of NCs. She concludes that these ambiguous segments should be treated as clusters rather than prenasalised onsets. She contends that citing structural markedness such as the preferred Bantu open syllables and pre-NC vowel lengthening is not evidence enough to categorise NCs as non-branching onsets.

Further, Downing and Mtenje (2017) provide evidence for homorganic NCs and their syllabification in Chichewa. They agree that there has not been enough compelling phonetic and phonological evidence for a unitary analysis of NCs, hence the ongoing debate. They propose a twofold syllabification of NCs in Chichewa: a cluster analysis for root initial NCs and coda specification for postvocalic nasals provided the nasal is homorganic with the onset it precedes. Mudzingwa (2010) opts to use the term ‘combinations’, thus referring to NCs as Nasal-Consonant combinations. He, however, notes that even though these are phonetically complex, they are phonologically simple onsets.

In this study, I adopt the term ‘complex’ segments – rather than contour – as a blanket term for all segments with no simple articulatory features. I present a unified account of the manifestation of the various siSwati complex segments resulting from various morpheme sequences as is demonstrated in Chapter 4 (vowel hiatus resolution) and Chapter 5 (/mu/ reduction). I treat siSwati NCs as unitary segments occupying a single C-slot, in line with the CV syllable template I posited earlier for siSwati. However, their syllabic ramifications are determined by the morphological environment in which they occur. Malambe (2006), for instance, adopts a unitary representation of NCs in siSwati, with the exception of Classes 1 and 3 output nasals which are parsed as syllabic segments.

I demonstrate that the distribution pattern of siSwati NCs is twofold: the output nasal in derived NCs is non-homorganic and syllabic, while non-derived NCs are homorganic and prenasalised.

Similar accounts of non-homorganic NCs have been posited in other Bantu languages such as Kimatuumbi (Odden, 1998) and Kibena (Morrison, 2009), where NCs derived from /mu/ contraction are different from their non-derived counterparts. This is in contrast with Shimakonde (Liphola, 2001) where nasal assimilation is morphologically conditioned. Shimakonde notably depicts different realisations of the output sequence with some nasals spreading their features onto the consonant it precedes yielding a homorganic [nasal/nasal] sequence. In addition, both types of NCs are attested word initially or word medially in siSwati, therefore discounting positional distribution as a factor in their segmental status.

In this study, I suggest that the variable shape of siSwati NCs hinges upon the phonological process as well as the morphological environment in which they occur, hence the realisation of the output nasal as either syllabified or prenasalised. These findings point to the morphological environment and the role it plays as a contributing factor in the syllabification process. Below I present the distribution and representation of the two types of NCs in siSwati:

129.	/úmù-bédzè/ CL3-bed 'bed'	→	[ú.**m̩**.bé.dzè]
130.	/úmù-lé^{n}tè/ CL3-leg 'a leg'	→	[ú.**m̩**.lé.^{n}tè]
131.	/í-mp^{h}ép^{h}ò/ CL9-tap 'incense'	→	[í**^{m}p^{h}**ép^{h}ò]
132.	/lí-ǀá^{n}dzà/ CL5-egg 'an egg'	→	[lí.ǀá.**^{n}dzà**]

The examples in (129) and (130) demonstrate the syllabification of nasals derived from /mu/ contraction. I note that in this derived NC, the nasal is non-homorganic and syllabic, while those sequences that occur in the language without any derivation (131) and (132) are homorganic and tautosyllabic with the consonant they precede. Consonant moraicity is not a feature unique to siSwati as previous researchers (Batibo, 1996; Odden, 2015) have noted that other Bantu languages such as Setswana and Swahili have nasals and liquids occupying a V-Slot in their syllabification.

Consider the following examples highlighting the existence of syllabic consonants in Bantu languages:

Setswana (Batibo, 1996, p. 34)

133. [**r̩.**ra] 'father'
134. [**m̩**.ma] 'mother'
135. [**l̩**.la] 'cry'
136. [**n̩**.na] 'I/me'

Swahili (Batibo, 1996, p. 34)

137. [**n̩**.ta] 'wax'
138. [**m̩**.bu] 'mosquito'
139. [a.**m̩**.ka] 'wake up'
140. [**m̩**.to.to] 'child'

The examples above indicate how some Bantu languages have non-derived syllabic consonants, with nasals and liquids in Setswana, and nasals in Swahili, respectively.

Observations on the syllabification status of derived NCs in Bantu point to the emergence of an additional syllable structure: that of non-derived syllabic nasals similar to those in Setswana and Swahili, as well as those emanating from /mu/ truncation, as seen in isiZulu and siSwati (Khumalo, 1987; Poulus & Msimang, 1998; Kadenge, 2015). Further, syllabic nasals in Bantu are argued to be tone bearing units (Hyman, 2003; Odden, 2015; Kadenge & Chebanne, 2017), where the mora of the truncated high vowel transfers onto the syllabic nasals while other languages such as siSwati, delete both the high vowel and its mora, making the resultant syllabic nasal a non-tone bearing unit.

3.5.3.2 SiSwati Consonant-Glide (CGs) sequences and their syllabification

In addition to ^{N}C sequences, SiSwati has Consonant and Glide (CG) combinations in their consonant inventory. Rosenthall (1997) defines secondary articulation as the realisation of V_1 in a VV sequence, where V_1 surfaces as a corresponding glide attached to the preceding consonant to satisfy syllabic well-formedness in monophthongal languages such as siSwati. In these monophthongal languages, the occurrence of tautosyllabic vowels is outlawed, necessitating the need to phonologically eliminate one of the offending vowels though hiatus resolution. One of the repair strategies that some Bantu languages adopt to repair the illicit dispreferred VV construction is secondary articulation (See Liphola, 2001; Kula, 2002; Kadenge, 2010; Sibanda, 2009; Kadenge & Simango, 2014; Downing & Mtenje, 2017), among others. The bone of contention crosslinguistically, nevertheless, is whether CG sequences should be considered a cluster or be syllabified as a single complex segment.

Kula (2002) observes that CGs in Bemba are contour segments that follow from vowel hiatus resolution where post-consonantal high vowels /i/ and /u/ in a VV sequence form glides. In her analysis, she characterises Bemba as a language that has no branching onsets and presents CGs as "onset-nuclear sequences, where the glide is part of the nucleus" (Kula, 2002, p. 37). This argument follows on two syllabification standpoints: a) that Bemba CGs are reconstructed from hiatus resolution, and b) that they are always followed by lengthened vowels, an effect of V_1 mora reassignment in gliding. She concludes that Bemba CGs are not unitary segments but independent segments parsed as branching onsets.

Other phonologists assume a similar position regarding the syllabification of CGs in Bantu. Odden (2015), as well as Downing and Mtenje (2017) contend that labialised consonants should be treated as clusters and not unitary segments. Their standpoint follows on their treatment of NCs, where they argued for cluster representation, citing inconsistencies and lack of adequate evidence in support of syllabifying them as simple onsets.

A separate school of thought considers C^ws as a representation of labialised consonants that occupy a single C-slot. In his investigation of Zezuru complex consonants, Kadenge (2010) presents phonetic, phonological, and distributional evidence in support of the unitary treatment of C^ws. He first provides phonetic evidence that C^ws are velarized consonants with two articulatory features – one primary mapped onto the C-slot and the other secondary, mapped onto the V-slot. He further notes that the durational properties of C^ws are relatively similar to simple onsets, an indication that they should be syllabified similarly. The proposed analysis and syllabification of Zezuru velarized consonants should also conform to the CV syllable template of the language. Morphologically, their distributional evidence points to their occurrence word-initially and word-medially, indicating their unitary status. Secondly, the two segments are never separated by a morpheme boundary, thus cementing their unitary analysis. Kadenge concludes that these segments should be treated as phonologically complex segments that occupy a single C-slot. It is worth noting that Zezuru is similar to siSwati in that the language appears to have both the reconstructed form as seen in [mu-ana] → [m^wànà] 'child,' as well as the native form as in [g^wárà] 'sit' (Kadenge, 2010, p. 404).

With regards to secondary articulation and the phonological properties of syllables, Khumalo (1987) proposes three restrictions on the syllabification of Zulu CGs:

i. Admissible labial gliding where C^2 can only be a labial glide. In FG terms, this means that only the labial glide [w] can form consonantal offglide in Zulu.

ii. Inadmissible labial gliding where Zulu grammar blocks secondary articulation if C^1 is labial. This constraint enforces a ban on the labialisation of labial segments *[LABIAL][LABIAL]

iii. Inadmissible palatal gliding which blocks the occurrence of palatal [j] as C^2 across all contexts. This means that Zulu does not allow the occurrence of palatal off-glides (*C^j) in its grammar.

Moreover, Sibanda (2009) postulates that Nguni languages permit labial off-glides (C^w), except in cases where the input consonant is also labial. However, these languages typically drop palatal off-glides since the languages enforce a ban on C^j surface forms. On the same note, Malambe (2006) acknowledges the lack of phonetic evidence to support the representation of CGs as labialised (C^w) rather than cluster specification (CW) in siSwati. She, instead, uses phonological evidence to account for labialisation rather than branching onsets, therefore in support of labialised consonants in siSwati. In this study, I adopt the same argument and analysis proposed by Khumalo (1987), Malambe (2006) and Sibanda (2009) for C^ws in Nguni languages. I treat these consonant and glide combinations as unitary segments that occupy a single C-Slot. I provide a complete list of these unitary segments in Table 3 below. Despite their contentious segmentation in various Bantu literature, I show that the glide is not a separate segment but a secondary articulation of the previous consonant. I also show that C^w sequences are not clusters but unitary segments for two reasons: a) siSwati has native words that have this combination as their onset and b) loanwords adopted into the language do not split the sequence, yet other CC sequences are simplified using relevant vowels as exemplified below:

141. [lú.**s**^{w}è.t´í]
CL11-eagle
'eagle'

142. [lú.**s**^{w}á.nè]
CL11-infant
'infant'

143. [lú.s^{w}à.jì]
CL11-salt
'salt'

144. /swit/ → [lí.**s**^{w}í.dì]
CL5-sweet
'sweet'

145. /gwavə/ → [lí.**g**^{w}à.và]
CL5-guava
'guava'

146. /skweə/ → [sí.**k**´^{w}é.lè]
CL7-square
'square'

The examples in (141) to (143) represent native words with the C^{w} sequence and the English loans in (144) to (146) have the same combination. In (141) and (142), both consonant-glide sequences have been retained. In (146), the first illicit /sk/ cluster is simplified by inserting the vowel [i] between the two consonants, as expected. Notably, the example in (146) provides a link between phonology and morphology in that the epenthesised [i] phonologically simplifies the /sk/ cluster but morphologically functions as the Class 7 noun prefix /si/ (I revisit this interplay in the discussion on loanword nativisation in Chapter 6). Further, the language retains the second CC combination /kw/. Instead of it being another cluster simplified through spreading, the glide is realised as a secondary articulation of [s]. Because of the retention of C^{w} sequences in the language, I propose that these segments occupy the same C-Slot in siSwati. Previous accounts on siSwati

C^Gs also allude to their treatment as unitary segments in conformity to the syllable template proposed for the language (Malambe, 2006).

As indicated above, the only permissible CG combinations in siSwati are C^w. Palatalisation (C^j) of any consonant is outlawed. While most simple consonants undergo labialisation, siSwati bans the labialisation of labialised consonants. Output forms such as [m^w], [p^w], [f^w], [v^w] and [ɓ^w] are dispreferred in siSwati. This is in contrast with other languages such as chiShona (Simango & Kadenge, 2014, p.115), Ndau (Mutonga, 2017, p. 5) SuNdala varieties (Mtenje, 2016, p. 42), Luganda (Rosenthall, 1997, p. 139), and Chichewa (Downing & Mtenje, 2017, p. 92), where labial [m] is optimally labialised. Table 3 below presents examples of these labialised labials in various Bantu languages:

Table 3: Labialisation of labials in Bantu

Language		Underlying Representation	Surface Representation
147.	Ndau	/mu – ega/ CL1-one ‘only you’	[m^wega]
148.	Shona	/mu – eni/ CL1-visitor ‘visitor’	[m^weni]
149.	Chichewa	/mu – ana/ CL1-child ‘child’	[m^wana]
150.	SuNdala	umu – fuile/ CL1-widow ‘widow’	[umuf^wile]
151.	Luganda	/mu – ojo/ CL3-soul ‘soul’	[m^wo:jo]

Just like NCs, the same obtains for the realisation of labialised consonants in siSwati: these are divided into derived and non-derived C^ws. Derived C^ws are those that are phonologically derived though glide formation in vowel hiatus resolution as shown below in (152) to (154), while their non-derived, native counterparts appear in the language without any derivative input in (155) to (157). Consider the examples below:

152. /lú-ák^{h}è/ → [**l^w**á.k^{h}è]
CL11-his/her
'his/hers'

153. /kú-áɓò/ → [**k^w**á.ɓò]
CL14-their
'theirs'

154. /kú-étfù/ → [**k^w**é.tfù]
CL14-our
'ours'

155. /lú-s^{w}ánè/ → [lú.**s^w**á.nè]
CL11-infant
'infant'

156. /lú-t^{w}ànè/ → [lú.**t^w**à.nè]
CL11-toe
'toe'

157. /úmù-tf^{w}álò/ → [ú.ṃ.**tf^w**á.lò]
CL3-load
'load'

Even though siSwati has both native and reconstructed C^w sequences, their syllabification is the same and they are diagrammatically similar. Figure 2 below exemplifies the C^w sequence in siSwati:

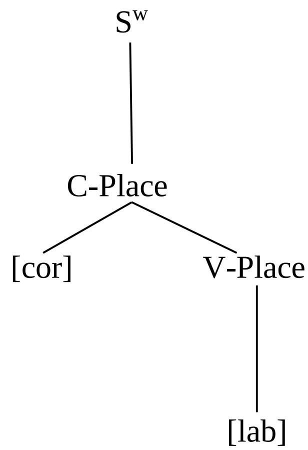


Figure 2: A Feature Geometric representation of [s^w] in siSwati (Kadenge, 2010, p. 404)

3.5.3.3 SiSwati affricates and their syllabification

Affricates are complex segments produced with a combination of a stop closure followed by a fricative release. Due to their articulatory gestures, affricates tend to fall under what researchers such as Clements and Hume (1995, p. 253) term contour segments, describing them as “a root node characterised by at least two different oral articulator features, representing a segment with two or more simultaneous oral tract constrictions.” Despite affricates displaying complex articulatory tendencies, they are usually parsed as single segments rather than clusters. In this section, I provide both phonetic and phonological evidence to support the representation of affricates as complex segments syllabified as simple onsets.

Katamba (1989) and Lombardi (1990) note that affricates such as [pf], [tʃ], and [ʤ] are best represented as non-branching segments characterised by [-CONTINUANT] [+CONTINUANT] features branching from a single root node. Clements (1999) advances the same argument on the unitary representation of affricates. He uses their ability to occur where simple stops are permitted as well as their inability to trigger cluster reduction, as would be expected with complex onsets, in support of their unitary analysis. He further notes the emergence of unique ‘corono-labial’ affricates [tf] and [dv], particularly in Bantu languages where the stop closure is followed by a labial-like fricative release. Notably, these two segments are argued to preferably occur before labial vowel [u] (Clements, 1999). Kadenge (2010) compares Zezuru affricates with their stop and fricative counterparts, noting that affricates are also contrastive in the language. He further notes that affricates are never separated by a morpheme boundary, indicating their unitary representation rather than branching onsets in Zezuru.

For the representation of siSwati affricates, I adopt the one-root analysis. I argue that siSwati affricates are parsed as complex but simple onsets, in line with the CV syllable template of the language. SiSwati grammar has alveolar and palatal affricates in its consonant inventory. These are classified under coronals as exemplified below:

158.	[dv]	[dvú.là]	**dv**ula	'beat severely'
159.	[tf]	[tfú.là]	**tf**ula	'offload'
160.	[ts]	[tsè.là]	**ts**ela	'pour'
161.	[dz]	[dzé.là]	**dz**ela	'abandon'
162.	[tj´]	[tj´á.là]	**tj**ala	'sow'
163.	[ʤ]	[ʤù.ɓà]	**j**uba	'cut'

The siSwati affricates occur both word-initially as indicted in the above examples, as well as word-medially, as illustrated in examples (164) through (167).

Even though [tf] and [dv] are a combination of different place specifications, that is, a combination of a coronal and labial sound, I classify them as coronals rather than labials because of their behaviour in phonological contexts. For instance, in environments where [tf] appears with a homorganic nasal, it is realised as [^{n}tf] and not *[^{m}tf]. Consider the following examples:

164. /íN-tfúlò/ → [í.$^{\mathbf{n}}$**tf**ú.lò] **i*^{m}*tfulo*
CL9-bluehead
'blue-headed lizard'

165. /íN-tfò/ → [í.$^{\mathbf{n}}$**tf**ò] **i*^{m}*tfo*
CL9-thing
'thing'

166. /íN-dvúnà/ → [í.$^{\mathbf{n}}$**dv**ú.nà] **i*^{m}*dvuna*
CL9-Chief's headman
'Chief's headman'

167. /tíN-dvóngà/ → [tí.$^{\mathbf{n}}$**dv**ó.ŋà] **ti*^{m}*dvoŋa*
CL10-wall
'walls'

The above examples indicate that [tf] and [dv] are coronals because of their surface representation. Lastly, siSwati affricates are not susceptible to phonological processes such as vowel epenthesis that require cluster reduction and coda elimination in loanword phonology. Consider the examples below:

168. /dʒʌdʒ/ → [lí.**dʒ**á.**dʒ**ì]
CL5-judge
'judge'

169. /dʒeɪl/ → [lí.**dʒ**é.lè]
CL5-jail
'jail'

170. /bentʃ/ → [lí.bé.^{n}**tʃ'**ì/
CL5-bench
'bench'

Where input clusters and codas trigger cluster reduction as a diagnostic tool to repair illicit syllable structures, the siSwati affricates [tʃ'] and [ʤ] do not simplify. For instance, (170) provides evidence that the affricate [tʃ'] and the prenasalised segment [^{n}tʃ'] are unitary segments, not branching onsets since they do no resyllabify through epenthesis. The only epenthetic vowel [i] provides a PEAK for the word-final coda.

In view of the above examples and discussion, I conclude that siSwati affricates are phonetically complex but phonologically unitary segments, occupying a single C-Slot. A summary and inventory of complex segments in siSwati, adopted from the iKalanga consonant inventory (Kadenge & Chebanne, 2014) is presented in Table 4 below.

Table 4: SiSwati complex segments

	Bilabial	**Alveolar**	**Palatal**	**Dorsal**	**Glottal**
Affricates		tf[2] dv	tj′ dʒ		
		ts dz			
Prenasalised segments					
Stops	^{m}p ^{m}b	^{n}t ^{n}d		^{ŋ}k ^{ŋ}g	
Affricates		^{n}tf ^{n}dv	^{n}tʃʼ ^{n}dʒ		
		^{n}ts ^{n}dz			
Fricatives	^{m}f ^{m}v	^{n}s ^{n}z	^{n}ʃ		
Lateral fricatives		^{n}ɬ ^{n}ɮ			
Labialised segments					
Stops (aspirated)				k^{hw} g^{w}	
Nasals		n^{w}		ŋ^{w}	
Affricates		tf^{w} dv^{w}	tʃʼ^{w} dʒ^{w}		
Fricatives		s^{w} z^{w}	ʃ^{w}		h^{w} ɦ^{w}
Lateral fricatives		ɬ^{w} ɮ^{w}			
Prenasalised/Labialised					
Stops		^{n}t^{w}		^{n}k^{hw} ^{n}g^{w}	
Affricates	^{n}pf^{w} ^{n}bv^{w}	^{n}s^{w}	^{n}tʃʼ^{w} ^{n}dʒ^{w}		
Fricatives		^{n}ɬ^{w} ^{n}ɮ^{w}			
Lateral fricatives					

The discussion of the siSwati syllable has so far highlighted the various syllable structures attested in the grammar of the language. I have indicated that the grammar allows word-initial onsetless syllables (V) as well as the prevalent Consonant and Vowel sequences (CV). The study revealed that the C-Slot can be occupied by labialised consonants (C^{w}), prenasalised segments (^{N}C), as well

[2] In siSwati, [tf] and [dv] are marked segments and occur in an allophonic distribution with [ts] and [dz]. The marked segments are of limited use, since they appear only before the labial vowels [o] and [u] while the latter are evenly distributed.

as labialised and prenasalised segments ($^{N}C^{w}$). The evidence provided has indicated that despite their diverse representations, all these syllables conform to the siSwati CV template, aligning the discussion on the syllable with the goals of the dissertation. The aim of the study set out to demonstrate that all siSwati syllables conform to the CV syllable requirement.

In view of the above discussion on siSwati syllable structure, I consider ^{N}Cs, C^{G}s, and affricates unitary complex segments that form simple onsets. In this study, I assume that all siSwati syllables conform to the canonical Bantu CV syllable template presented in Figure 3 below. In my discussion, I further postulate that the language permits vowel-initial syllables as well as the syllabic nasal [m̩]. As such, the V-Slot can be occupied by either a word-initial vowel or a moraic nasal following from a truncated morpheme [mu] as demonstrated in Figure 4:

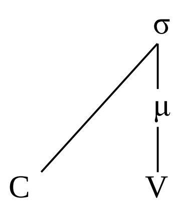


Figure 3: The Canonical Bantu CV syllable structure (Mudzingwa, 2010, p. 47; Kadenge & Chebanne, 2017, p. 175)

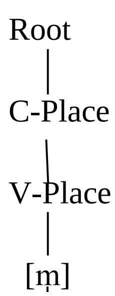


Figure 4: A Feature Geometric representation of the siSwati Syllabic Nasal [m̩]

Figures 3 and 4 are a representation of the different syllable types permissible in siSwati. However, given the various phonological processes discussed in the current study, the optimal syllable template in siSwati allows the occurrence of syllabic nasals that occupy the V-slot [m̩], labialised consonants (C^{w}), and prenasalised segments (^{N}C). Optimally, the syllable siSwati can be maximally parsed as [^{N}C^{w}] where the C-Slot is occupied by a consonantal segment that is both prenasalised and labialised. I exemplify the siSwati optimal syllable below:

171. /iN-dvwángù/ → [í.^{n}**dv**^{w}á.ŋù]
CL9-cloth
'cloth'

172. /tíN-tfwálà/ → [tí.^{n}**tf**^{w}á.là]
CL10-lice
'lice'

173. /lí-ntjwélè/ → [lí.^{n}**tʃ'**^{w}é.lè]
CL5-chick
'chick'

174. /iN-ʤwajelo/ → [i.^{n}**ʤ**^{w}a.je.lo]
CL9-habit
'habit'

175. /si-nkhwa/ → [si.^{ŋ}**k**^{hw}a]
CL7-bread
'bread'

176. /iN-gweɲa/ → [i.^{ŋ}**g**^{w}e.ɲa]
CL9-crocodile
'crocodile'

The evidence presented above points to the optimal representation of the siSwati syllable. For instance, in (176), the longest representation of the syllable consists of a prenasalised and labialised affricate [^{n}ʤ^{w}]. The next section of the dissertation explores the siSwati morphosyntax.

3.6 SiSwati Morphosyntax

This section presents the morphological structures of the siSwati noun and verb as background to the current study. It presents how the various morphosyntactic components of nouns and verbs combine to provide a rich context for phonological analysis. I begin with the morphological structure of the noun.

3.6.1The morphological structure of the siSwati noun

One characteristic feature of Bantu languages is the classification of noun prefixes marked by singular and plural noun pairings, with odd numbers denoting singular and even numbers denoting plural (Odden, 1995). I adopt the system of siSwati noun classification used in previous siSwati studies (Sibanda & Mthembu, 1996; Malambe, 2006). In other Bantu languages such as Chichewa (Downing & Mtenje, 2017), isiXhosa (Braver & Bennett, 2016), isiZulu (Poulus & Msimang, 1998), and chiShona (Mudzingwa & Kadenge, 2014) nouns use a similar classification gleaned from Meinhof (1932). Notably, Chichewa has a total of 18 noun classes while chiShona has 21 classes. Both languages have retained some of the locative and diminutive Proto-Bantu noun classes that are no longer present in siSwati. Similarly, isiXhosa, which is a sister language to siSwati, has a total of 15 noun classes. In Table 5 below, I present the siSwati noun class system:

Table 5: SiSwati noun class prefixes (Sibanda & Mthembu, 1996, p. 23; Malambe, 2006, p. 102)

CLASS	PREFIX	EXAMPLE	GLOSS
1	[umu-]	[**úmù-**^{n}tfú]	‘person’
2	[ɓa-]	[**ɓá-**^{n}tfù]	‘people’
1a	-	[gògò]	‘granny’
2a	[ɓo-]	[**ɓó**-gògò]	‘grannies’
3	[umu-]	[**úmù**-t´í]	‘homestead’
4	[imi-]	[**ími**-t´í]	‘homesteads’
5	[li-]	[**lí**-gálà]	‘branch’
6	[ema-]	[**émaá**-gálà]	‘branches’
7	[si-]	[**sí**-ɬàɬà]	‘tree’
8	[ti-]	[**t´i**-ɬàɬà]	‘trees’
9	[iN-]	[**íŋ**-gùlùɓé]	‘pig’
10	[t´iN-]	[**t´íŋ**-gùlùɓé]	‘pigs’
11	[lu-]	[**lú**-p^{h}ó-^{n}dvò]	‘horn’
10	[t´iN-]	[**t´ím**-p^{h}ò^{n}dvò]	‘horns’
14	[ɓu-]	[**ɓú**-ɬálù]	‘bead(s)’
15	[ɠu-]	[**kú**-ɮà]	‘food’

Typically, the noun in siSwati consists of a /prefix + stem/ as diagrammatically represented in Figure 5. Sometimes, the noun appears with affixes that may appear either before or after the stem as /prefix + stem + affix/. The prefix in each noun class denotes class agreement, a phenomenon that is common in many Bantu languages.

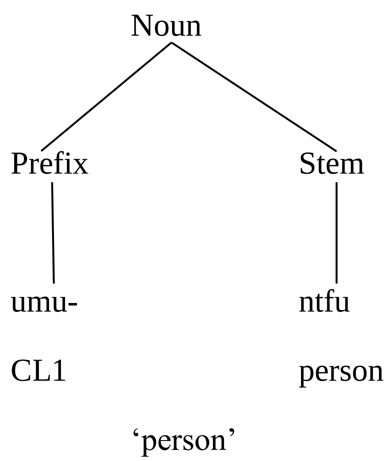


Figure 5: The SiSwati Nominal Structure (Kadenge & Simango, 2014, p. 108)

It is worth noting that the siSwati noun can optimally occur with other affixes in morphosyntactic constructions, such as the formation of diminutives and locatives. In the formation of diminutives, the noun suffixes the diminutive morpheme /-ana/ to denote a smaller version of that particular noun. Consider the following examples:

177. /úmùntf**ú-à**nà/ → [ú.m̩.**^{n}tf^{w}à.**nà]
CL1.person-Dim
'child'

178. /lúsúk**ù-à**nà/ → [lú.sú.**k^{w}à.**nà]
CL11.day-Dim
'short day'

179. /sánɮ**à-à**nà/ → [sá.^{n}ɮ**à**.nà]
CL7.hand-Dim
'small hand'

180. /síɬáɬ**à-à**nà/ → [sí.ɬá.**ɬà.**nà]
CL7.tree-Dim
'small tree'

181. /úmùt'**í-à**nà/ → [ú.mù.t'**à**.nà]
CL3.homestead-Dim
'small homestead'

182. /úmùlént'**é-à**nà/ → [ú.m̩.lé.^{n}t'**à**.nà]
CL3.leg-Dim
'small leg'

The examples on diminutive formation demonstrate how combining the noun and suffix /-ànà/ yields a sequence of vowels that is outlawed in the language.

In locative formation, siSwati uses locative morphemes /e-/, /ku-/, /ka-/ and /e…ini/ each denoting a location of the noun under discussion (Ziervogel & Mabuza, 1976; Sibanda & Mthembu, 1996; Malambe, 2006). Of primary importance to this study is the locative morpheme /e...ini/ as it creates a suitable platform for phonological analysis. In the locative surface form, most of the noun prefixes are omitted, although this deletion does not form part of the formal analysis in this dissertation. Consider the following examples:

183. /é-úmùntf**ú-ínì**/ → [é.m̩.^{n}tf^{w}**í.**nì]
CL1.person-Loc
'on/ with the person'

184. /é-lúsùk**ù-í**nì/ → [é.su.**k^{w}í.**nì]
CL11.day-Loc
'on that day'

185. /é-sánɮ**à-í**nì/ → [é.sa.^{n}ɮé.nì]
CL7.hand-Loc
'on the hand'

186. /é-síɬàɬ**à-í**nì/ → [é.sí.ɬà.ɬé**.**nì]
CL7.tree-Loc
'on the tree'

187. /é-úmùt'**i-í**nì/ → [e.m̩.t'**í**.nì]
CL3.homestead-Loc
'at the homestead'

188. /é-úmùlént′**è-í**nì/ → [é.m̩.lé.^{n}t′**è**.nì]
CL3.leg-Loc
‘on the leg’

Similar to the diminutive formation, the concatenation of the noun and locative morpheme yields a sequence of vowels that siSwati grammar blocks. These dispreferred sequences are resolved through deletion, secondary articulation, or coalescence. For instance, the bolded sequence in (183) is resolved though secondary articulation, while (185) is resolved through coalescence. This attests to the argument that the phonological environment determines the repair strategy that the language selects.

The rationale for including diminutive and locative formation in the current discussion is to demonstrate how siSwati grammar eliminates illicit underlying VV sequences emanating from concatenated morphemes, thus ensuring that output vowel forms are monophthongal. In the study, I explore the phonological processes that occur to ensure that output syllable structures conform to the V and CV syllable restrictions I proposed earlier. A formal hiatus resolution analysis is discussed in detail in Chapter 4. Next, I consider the morphological structure of the verb in siSwati.

3.6.2 The morphological structure of the siSwati verb

Bantu languages have a rich verbal morphology that is largely agglutinative, with the verb having the propensity to be segmented into a series of ordered and structured morphemes, siSwati being no exception. (Kula, 2002, p. 33) provides a representative template of a Bantu verb as illustrated in Bemba verb morphology presented in (189) below:

189. TAM1 - NEG1 – SM – NEG2 – TAM2 - OM – Root extensions – D-Suffixes – I-Suffixes - FV

As per the template, the Bantu verb consists of tense, aspect and mood (TAM) slots, negation, subject and object markers, derivational and inflectional suffixes. The last slot in the verb is filled by the final vowel (FV) which conspires to ensure that all syllables are open. The default FV is usually [a] but varies depending on TAM. Kula (2002) stipulates that these verbal elements cannot, however, co-occur.

Typical of the Bantu verb, the siSwati verb consists of the verb stem to which various prefixal and suffixal morphemes are added. In my analysis, I adopt the Inflectional Stem (henceforth INFL Stem) hypothesis that is used to represent the Bantu verb (See Kula, 2002; Mudzingwa, 2010; Mudzingwa & Kadenge, 2014; Downing & Mtenje, 2017) inter alia. These Bantuists present a hierarchical representation of the Bantu verb consisting of the Inflectional Stem (henceforth INFL Stem), Macro Stem (MStem) and the Inflected verb stem, each of which encompasses various elements of the verb. The INFL Stem is argued to consist of any derivational prefixes preceding the object marker (OM), while the MStem consists of the OM and other derivational markers up to and including the inflected verb stem, which is also part of the MStem. The inflected verb stem (IVS) comprises the verb root, verb extensions, and the final vowel.

According to Downing and Mtenje (2017, p. 19), the verb stem is the verb root "optionally followed by one or more derivational suffixes, which are then obligatorily followed by the final vowel". The verb root, on the other hand, is the bare stem of the verb with no derivative material attached to it. Motivation for the verb constituent in Bantu is that the different aspects within the verb are domains for various phonological and morphological processes such as hiatus resolution, vowel harmony, tone patterning, reduplication among others (Downing & Mtenje, 2017).

Following the discussion on the Bantu verb structure, Figure 6 below is the hierarchical and diagrammatic representation of the Bantu verb. The siSwati verb follows a similar representation of the verb. Note that bolded elements are obligatory.

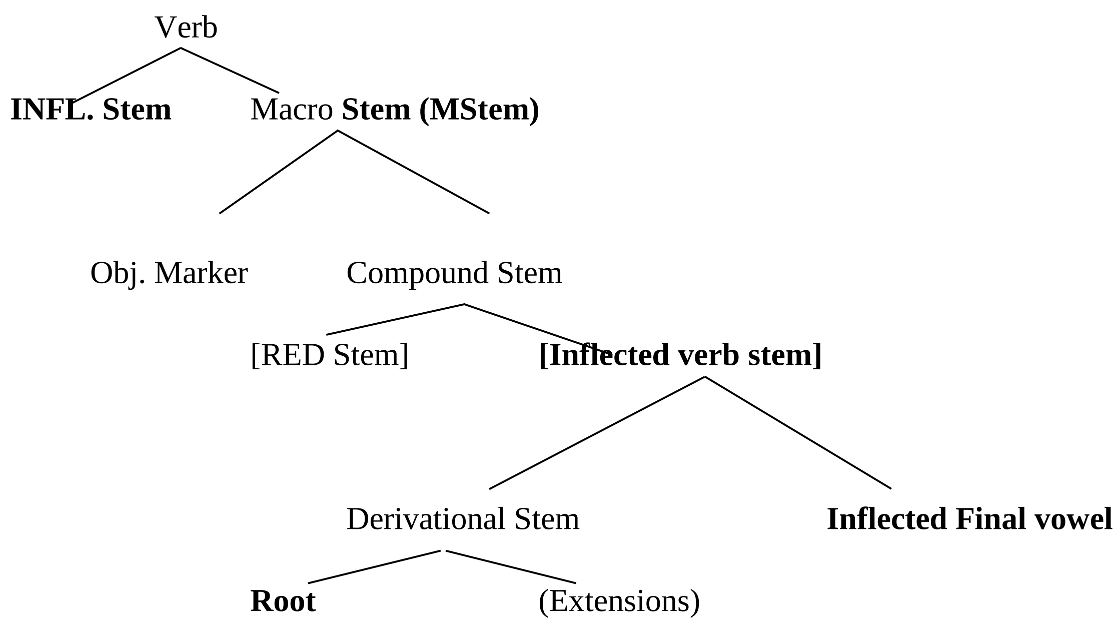


Figure 6: The Bantu Verb (Downing & Mtenje, 2017, p. 21; Mudzingwa & Kadenge, 2014, p. 135)

Further, siSwati verb roots are canonically CVC, with a limited set of monosyllabic and polysyllabic roots. Below are some of the verb roots found in siSwati:

3.6.2.1 Monosyllabic (C-) verb roots

190.	/f-a/	[fá]	'die'
191.	/ph-a/	[p^há]	'give'
192.	/v-a/	[và]	'hear'
193.	/ɮ-a/	[ɮá]	'eat'
194.	/w-a/	[wá]	'fall'
195.	/j-a/	[já]	'go'
196.	/t´-a/	[t´á]	'come'
197.	/lw-a/	[l^wá]	'fight'
198.	/n-a/	[ná]	'rain'
199.	/ʃ-a/	[ʃá]	'burn'
200.	/ʃ-o/	[ʃò]	'say'

The monosyllabic verb stems represented above typically appear with other morphemes since the siSwati grammar enforces a ban on monosyllabic prosodic words. This minimality restriction on the prosodic word is discussed in detail in Chapter 7 of the dissertation.

3.6.2.2 Representative set of disyllabic (CVC-) verb roots

201.	/vum-a/	[vú.mà]	‘agree’
202.	/tsel-a/	[tsé.là]	‘pour’
203.	/tj´el-a/	[tʃ˝e.là]	‘tell’
204.	/gez-a/	[gé.zà]	‘bath’
205.	/pheɠ-a/	[p^{h}é.ɠà]	‘cook’

3.6.2.3 Representative set of roots longer than CVC-

206.	/ɬoniph-a/	[ɬò.ní.p^{h}à]	‘respect’
207.	/giɓel-a/	[gí.ɓé.là]	‘climb’
208.	/huʃul-a/	[hú.ʃú.là]	‘pour everything out’
209.	/ɓukel-a/	[ɓú.ké.là]	‘watch’
210.	/ɓuket´-a/	[ɓú.ké.t´à]	‘review/revise’
211.	/ʃumajel-a/	[ʃú.mà.jé.là]	‘preach’
212.	/ɬukuɓet-a/	[ɬù.kù.ɓé.t´à]	‘illtreat’
213.	/guguɓul-a/	[gù.gù.ɓú.là]	‘unearth’
214.	/phakamis-a/	[p^{h}á.ká.mí.sà]	‘lift’

SiSwati has a limited set of vowel initial verb stems, as illustrated below:

3.6.2.4 Representative set of vowel initial verb stems

215.	/akh-a/	[á.k^{h}à]	‘build’
216.	/os-a/	[ó.sà]	‘roast’
217.	/ong-a	[ó.^{ŋ}gà]	‘save’
218.	/oph-a/	[ó.p^{h}à]	‘bleed’
219.	/om-a/	[ò.mà]	‘be dry/thirsty’
220.	/on-a/	[ó.nà]	‘sin’
221.	/at´-i/	[á.t´ì]	‘know’
222.	/ats-i/	[á.tsì]	‘say’
223.	/eɓ-a/	[é.ɓà]	‘steal’
224.	/endz-a/	[é.^{n}dzà]	‘marry’
225.	/elus-a/	[é.lú.sà]	‘herd’
226.	/ewel-a/	[é.wé.là]	‘cross’
227.	/ent-a/	[é.^{n}tà]	‘do’

3.6.3 SiSwati subject concords

Like many Bantu languages, siSwati uses subject markers to denote the entity being referred to. The subject marker (henceforth SM) obligatorily occurs with all verb forms except in infinitives and imperatives. As indicated in Figure 6 above, these markers fall under the INFL Stem and must precede the MStem. Table 6 presents SMs for all noun classes in siSwati:

Table 6: SiSwati Subject Markers (Sibanda & Mthembu, 1996, p. 86)

Classes	Subject concord	Example
1	u-	Umuntfu **u**-hambile 'A person left'
2	ba-	Bantfu **ba**-hambile 'The people have left'
3	u-	Umuti **u**-shile 'The home burnt down'
4	i-	Imiti **i**-shile 'The homes burnt down'
5	li-	Licandza **li**-phekiwe 'The egg has been cooked'
6	a-	Emacandza **a**-phekiwe 'The eggs have been cooked'
7	si-	Sihlahla **si**-jutjiwe 'The tree has been cut'
8	ti-	Tihlahla **ti**-jutjiwe 'The trees have been cut'
9	i-	Imbuti **i**-file 'The goat is dead'
10	ti-	Timbuti **ti**-file 'The goats are dead'
11	lu-	Luhlanya **lu**-dla 'The lunatic is eating'
12	ti-	Tinhlanya **ti**-yadla 'The lunatics are eating'
14	bu-	Buhlalu buphotsiwe 'The beads have been threaded'
15	ku-	Kudla **ku-**phekiwe 'The food has been cooked'

3.6.4 SiSwati object concords

As indicated in Figure 6 (The Bantu Verb) above, OMs appear immediately before the verb, forming part of the MStem. It is necessary to make the distinction between the INFL Stem and MStem specifically in this thesis because previous studies have shown how the variation between these two constituents trigger different repair strategies based on whether the illicit construction appears in either of the two. This discussion on how siSwati grammar selects a repair strategy based on whether the illicit construction occurs either within the INFL Stem or the MStem will be revisited in Chapter 5 (Vowel hiatus).

Table 7: SiSwati Object Markers (Sibanda & Mthembu, 1996, p. 87)

Classes	Object concord	Example
1	-mu-	Ngiya-**m**-tsandza umuntfu 'I like a person'
2	-ba-	Ngiya-**ba**-tsandza bantfu 'I like people'
3	-wu-	Ngiya-**wu**-tsandza umuti 'I like homesteads'
4	-yi-	Ngiya-**yi**-tsandza imiti 'I like homesteads'
5	-li-	Ngiya-**li**-tsandza likhekhe 'I like cake'
6	-wa-	Ngiya-**wa**-tsandza emakhekhe 'I like cakes'
7	-si-	Ngiya-**si**-tsandza sinkhwa 'I like bread'
8	-ti-	Ngiya-**ti**-tsandza tinkhwa 'I like slices of bread'
9	-yi-	Ngiya-**yi**-tsandza inkomishi' 'I like a cup'
10	-ti-	Ngiya-**ti-**tsandza tinkomishi 'I like cups'
11	-lu-	Ngiya-**lu-**tsandza luphondvo 'I like a horn'
12	-ti-	Ngiya-**ti**-tsandza timphondvo 'I like horns'
14	-bu	Ngiya-**bu**-tsandza buhlalu 'I like beads'
15	-ku	Ngiya-**ku**-tsandza kudla 'I like food'

3.7 Summary of the chapter

Chapter 3 presented a discussion of the vocalic and consonantal inventory of siSwati. I further discussed permissible syllable structures, highlighting the various arguments raised by other Bantuists on the syllabification of ^{N}Cs, C^{w}s, and affricates with varying degrees of representation. I suggested that for conformity to the CV syllable structure of the language; these sequences should be considered unitary segments. I also contend that the V-Slot in the language can be occupied by the derivative bilabial nasal [m̩]. The relevance of the syllabication of C^{w}s is revisited in Chapter 4 while, ^{N}Cs are discussed in Chapter 5. The chapter also presented the morphosyntactic structure of nominals and verbs, highlighting the various components in each grammatical category. These components play crucial roles as domains for the selection of varied repair strategies in phonological processes such as hiatus resolution. Next, I turn to Chapter 4 where I demonstrate how siSwati grammar handles tautosyllabic vowels in nominals and verbals for optimal output forms that conform to the phonotactics of the language. In this regard, the discussion revisits hiatus resolution and how the selection of differet resolution strategies hinges on their occurrence within the various constituents within the nominal and verbal morphological structure.

CHAPTER 4

HIATUS RESOLUTION IN SISWATI

4.1 Introduction

Vowel hiatus, which is the illicit parsing of tautosyllabic vowels in surface representations, is a dispreferred phenomenon in siSwati (Lee, 1999; Malambe, 2006; Sibanda, 2009). Often when morphemes are underlyingly concatenated, the resultant morphosyntactic structures sometimes give rise to a dispreferred sequence of vowels, a surface configuration that violates the siSwati syllable structure. As noted in Chapter 3, the siSwati vowel system consists of only five monophthongs and is devoid of long vowels and diphthongs. In addition, the language permits the occurrence of onsetless vowels word-initially. SiSwati grammar dictates that any surface realisation of VV sequences emanating from the concatenation of morphemes across various morphosyntactic contexts must, therefore, be optimally monophthongal and onsetful. This results in the resolution of any underlying VV sequences to enforce conformity to the preferred monophthongal vowel template in siSwati.

In dealing with hiatus resolution, languages tend to enforce either a partial or complete ban on VV sequences, with each resolution strategy motivated by the morphosyntactic contexts in which the dispreferred configurations occur (Siptár, 2005; Mudzingwa, 2010, 2013; Kang, 2010; Casali, 2011; Kadenge & Simango, 2014; Downing & Kadenge, 2015; Ondondo, 2020). For instance, ciNsenga and Ndau demonstrate disparity in their hiatus resolution, with nouns completely banning the output realisation of VV sequences while verbs permit the occurrence of tautosyllabic vowels if V_2 is verb stem-initial (Kadenge & Simango, 2014; Mutonga, 2017). Where languages such as ciNsenga and Ndau demonstrate variation in hiatus resolution patterns, no such asymmetries exist in siSwati. In this study, I demonstrate how siSwati typologically bans hiatus across all morphosyntactic and phonological contexts. Languages that block surface VV sequences generally employ various repair strategies to harmonise hiatus configurations with permissible output forms. Languages vary in their selection of repair strategies, with some utilising two or more of the hiatus repair strategies attested crosslinguistically, namely, glide formation, vowel deletion, coalescence, secondary articulation, spreading, and resyllabification through diphthong formation (Rosenthall, 1997; Casali, 1995; 1996, 1997, 2011).

SiSwati employs almost all the strategies attested crosslinguistically, but differs in how these apply across various morphosyntactic and phonological domains within the PWord, a common occurrence in other Nguni languages (Sibanda, 2009). Through investigating the illicit parsing of VV sequences in siSwati, the current study seeks to make a typological contribution to hiatus resolution patterns and their effects on the Bantu syllable. To this end, I demonstrate that the intricate morphosyntax of nominals and verbs plays a crucial role in the selection of hiatus resolution strategies. I confirm that in the concatenation of morphemes in nominals, glide formation, secondary articulation, elision, and coalescence are selected. Verbs select a strategy depending on whether the dispreferred sequence occurs within the INFL Stem or MStem. If within the INFL Stem, glide formation, secondary articulation, and elision are selected, but if within the MStem, spreading is triggered. Coalescence, on the other hand, is triggered if the dispreferred configuration occurs post-lexically (Harford, 1999; Sibanda, 2009; Sabao, 2015). The discussion will also highlight the morphosyntactic domain in which coalescence is selected. I discuss each of these strategies in subsequent sections, beginning with glide formation. I consider evidence from various morphosyntactic domains to demonstrate how each resolves the dispreferred sequencing of vowels. I further present a formal OT analysis on hiatus resolution patterns in siSwati. I conclude the chapter with a summary of the discussion.

4.2 Glide formation in siSwati

Glide formation, argued to be the default repair strategy, is a height sensitive phonological process that occurs when underlying [+high] vowels /i/ and /u/ in the V_1 slot are converted to corresponding glides [j] and [w] in the surface forms (Rosenthall, 1997; Sibanda, 2009; Mudzigwa, 2010; Kadenge, 2010; Casali, 2011; Mudzingwa, 2013; Kadenge & Simango, 2014; Sabao, 2015). The output glides then function as onsets for the $V_{2.}$ In siSwati, both nominals and verbs employ glide formation as I demonstrate below.

4.2.1 Glide formation in siSwati nominals

The first siSwati context demonstrating how glide formation applies within nominals is when the Subject Marker (SM) in Classes 1, 3, 4 and 9, consisting of only high vowels, is juxtaposed with possessive markers /-etfu/ *'ours'*, /-enu/ *'yours'*, /-ami/ *'mine'* and /-ak^{h}o/ *'yours'* to denote possession. Consider the examples below:

228. /**ú-é**tfù/ → [**w**é.tfù]
CL1.SM-ours
's/he is ours'

229. /**í-é**tfù/ → [**j**é.tfù]
CL4.SM-ours
'it is ours'

230. /**ú**-àmì/ → [**w**à.mì]
CL1.SM.mine
's/he is mine'

231. **/í-à**mì/ → **[j**à.mì]
CL9.SM.mine
'it is mine'

In the formation of possessive pronouns, the Class 1 and 3 SM /u/ becomes corresponding glide [w] and is resyllabified as the onset of V_2 to avoid hiatus, while high vowel /i/ in Classes 4 and 9 becomes the corresponding coronal glide [j].

Further, the quantitative morphemes /-odv^{w}a/ '*only*', and /o^{n}k^{h}e/ '*all'* are underlyingly V-initial bound morphemes that require the prefixation of the SM to form a PWord. When prefixed with the vowel-only subject markers of Classes 1, 3, 4 and 9[3], these morphemes trigger glide formation. I illustrate this in the examples below:

232. /úmùtí **ú-ó**dv^{w}à/ → [ú.mù.tí **w**ó.dv^{w}à]
CL3-homestead CL1.SM-only
'the only homestead'

233. /úmùtsì **ú-ó**dv^w à/ → [ú.mù.tsì **wó**.dv^{w}à]
CL3-herb CL3.SM-only
'the only herb'

[3] Even though the Class 6 Subject Marker also consists of a vowel-only, it does not trigger glide formation since it does not have a corresponding glide in the language. The quantitative form in this Class is therefore [o^{n}k^{h}e] and [odv^{w}a] in both the underlying and surface representations.

234. /úmù^{n}tfú **ú-ó**^{n}k^{h}è/ → [ú.mù.^{n}tfú **w**ó.^{n}k^{h}è]
CL1-person CL1.SM-all
'the whole person'

235. /ímìsítì **í-ó**^{n}k^{h}è/ → [í.mì.sí.tì **j**ó.^{n}k^{h}è]
CL4-soot CL4.SM-all
'all the soot'

236. /í^{ŋ}k^{h}òmó **í-ó**^{n}k^{h}è/ → [i.^{ŋ}k^{h}o.mo **j**ó.^{n}k^{h}è]
CL9-cow CL9.SM-all
'the whole cow'

The quantitative form displays similar output forms as the possessive markers, where the high vowels become their corresponding glides, respectively. In all instances, the output glide functions as an ONSET. The next section discusses glide formation within the siSwati verb.

4.2.2 Glide formation in siSwati verbs

Glide formation in the siSwati verb is conditioned by its occurrence within the Bantu verb structure (as discussed in Chapter 3). As indicated earlier, the selection of any repair strategy in hiatus resolution within the verb is contingent upon the position of the illicit sequence within the morphological structure of the verb. If the prohibited sequence occurs within the INFL stem and V_1 is not preceded by a consonant, then glide formation is triggered. Previous Bantu literature proposed that the INFL stem consists of any derivational morphemes preceding the object marker (OM) such as tense and aspect markers, subject marker (SM) as well as negation markers (Kula, 2002; Mudzingwa, 2010; Mudzingwa & Kadenge, 2014; Downing & Mtenje, 2017). The first instance of glide formation within the INFL Stem occurs when the SM is juxtaposed with vowel-initial verb stems, a common phenomenon across all Nguni and some Bantu languages (Sibanda, 2009; Kadenge & Simango, 2014; Sabao, 2015). I illustrate glide formation in the examples below:

237. /**ù-é**^{n}tà/ → [**w**é.^{n}tà]
CL1.SM-do
's/he is doing'

238. /**ù-é**lùsà/ → **[wé**.lù.sà**]**

CL1.SM-herd
's/he is herding livestock'

239. /**ù-á**k^{h}à**/** → **[wá**.k^{h}à**]**
CL1.SM.-build
's/he is building'

240. /**í-é**^{n}t-à/ → [**jé**.^{n}tà]
CL4.SM-do
'it is doing'

241. /**í-é**lùsà**/** → **[jé**.lù.sà**]**
CL1.SM-herd
'it is herding livestock'

242. /**í-ó**p^{h}à**/** → **[jó**.p^{h}à**]**
CL9.SM.-bleed
'it is bleeding'

Since the dispreferred sequences appear within the INFL Stem, the grammar triggers glide formation. In each instance, the input high vowel has become a corresponding glide in the surface realisation. As illustrated, V_1 is not preceded by a consonant, making it a conducive phonological context for glide formation to occur.

The second morphosyntactic context is in the formation of the past tense, where the SM is juxtaposed with the past tense marker /á/ and the verb stem. I illustrate this below:

243. /**ú-á**-lándzà/ → [**wá.**lá.^{n}dzà]
CL1.SM-PST-fetch
's/he fetched'

244. /**í-á**-lándzà/ → [**já.lá**.^{n}dzà]
CL3.SM-PST-fetch
'it fetched'

Similar to the other phonological contexts discussed above, vowel /i/ has converted to corresponding glide [j] and the labial vowel /u/ has converted to labial glide [w], respectively.

As indicated above, the siSwati grammar triggers hiatus resolution to provide an ONSET for onsetless syllables within the PWord. ONSET, a high ranking markedness constraint, accounts for the ban on onsetless syllables, (Archangeli, 1997; Kager, 1999; Siptár, 2005). According to (Kager, 1999), the presence of onsets is relatively unmarked crosslinguistically. This means that languages typologically prefer syllables that have onsets over onsetless ones. As indicated in the above discussion on the siSwati syllable, the language does not permit onsetless syllables, except word-initially. In the grammar I suggest for vowel hiatus resolution in siSwati, sequences that appear with tautosyllabic vowels violates ONSET, as defined in (241) below.

245. ONSET

Syllables must have onsets

(Archangeli, 1997, p. 8; Kager, 1999, p. 93)

Further, OT constraint interaction and ranking account for the structural well-formedness of all surface forms (Prince & Smolensky, 1993/2004). In this regard, all constraints in hiatus resolution conspire to yield monophthongal output vowels, as per the restrictions on the siSwati syllable. To align with its simple vocalic system, the siSwati grammar bans long vowels and diphthongs in the output. Compensatory lengthening is, therefore, not optimal in the elimination of VV sequences. This means that siSwati prohibits output vowel lengthening that compensates for the lost mora when V_1 converts to a glide. No long vowel (NLV), a markedness constraint that bans syllables with long vowels, comes into effect to militate against the parsing of long vowels in the output (Rosenthall, 1997). Diphthongisation is not a viable option. Even though diphthong formation is sometimes optimal in languages such as Hungarian (Siptar, 2005) and Ngiti (Casali, 2011), where diphthongisation aligns with their syllable restrictions, siSwati blocks the occurrence of diphthongs in all output forms. No diphthong (N_OD_{IPH}) blocks diphthongisation (Rosenthall, 1997). NLV and N_OD_{IPH} optimally rank high in siSwati to ensure that all output configurations consist of simple vowels. I formalise the two constraints as follows:

246. No long vowel (NLV)

Syllables must not have long vowels

(Rosenthall, 1997, p.141)

247. N_OD_{IPH}

Syllables must not have diphthongs

(Rosenthall, 1997, p.142)

As already discussed, the grammar converts high vowels into corresponding semivowels to enforce conformity to the siSwati syllable template. This phonological conversion violates MAX-IO (μ) – which I simplify as MAX-μ, a faithfulness constraint that guards against mora loss. This is what Kang (2010, p.175) terms vowel weakening since the vowel loses 'its nucleus status in syllable structure'. In siSwati, deleting any of the input vowels in the ill-formed sequence is less optimal. Any deletion of the two vowels in the VV sequence violates MAX-IO (R_T), a faithfulness constraint that guards against deleting input segments. I formalise the two faithfulness constraints as follows:

248. MAX-μ
All input moras must have correspondents in the output
(Rosenthall, 1997, p. 146)

249. MAX-IO (R_T)
All root nodes in the input must have correspondents in the output
(Simango & Kadenge, 2014, p. 114)

In the glide formation grammar, ONSET, NLV and N_OD_{IPH} outrank MAX-IO(R_T) and MAX-μ to account for the surface realisation of the high vowels /i/ and /u/ as their nonmoraic counterparts, [j] and [w]. I present this constraint interaction in the Tableau below:

Tableau 1: Glide formation in siSwati

/ú-óŋkʰè/	ONSET	NLV	N_OD_{IPH}[4]	MAX-IO(R_T)	MAX-μ
a) ú.ó.ᵑkʰè	*!				
☞b) wó.ᵑkʰè					*
c) wó:.ᵑkʰè		*!			
d) úó.ᵑkʰè			*!		
e) ú.ᵑkʰè				*!	
f) ó.ᵑkʰè				*!	

[4] Long vowels and diphthongs are never optimal in siSwati since the language does not have contrastive vowel length and diphthongs. I henceforth exclude these two markedness constraints from my analysis on hiatus resolution in siSwati.

The grammar in Tableau 1 bans word-medial onsetless syllables, long vowels, and diphthongs. ONSET, NLV, and $N_OD_{IPH,}$ thus eliminating candidates (a), (b), and (c) for parsing dispreferred syllables structures in the output. The grammar further eliminates candidates (e) and (f) for incurring a fatal violation of MAX-IO(R_T), a constraint that prohibits deleting any of the input vowels in the VV sequence. Candidate (b), which is the winner, eliminates the input VV sequence by converting /u/ to a labial glide, violating MAX-μ, a low-ranking constraint in the siSwati grammar.

Various Bantu literature accounts for the typological similarities and differences in the hierarchical constraint ranking in hiatus configurations (Sibanda, 2009; Mudzingwa, 2010; Kadenge & Simango, 2014; Kadenge & Chebanne, 2017) amongst others. For instance, Mudzingwa (2010) explores hiatus resolution in two chiShona dialects: Karanga and Zezuru. He notes that both dialects enforce a ban on hiatus constructions and utilise glide formation as one of their pair strategies. I illustrate glide formation in Karanga and Zezuru (Mudzingwa, 2010, p. 127)[5] in the examples below:

250. /mùtí **ù**-ósé/ → [mùtí **w**ósé]

251. /mìtí **ì**-ósé/ → [mìtí **j**ósé]

In each of these examples, both high vowels surface as corresponding glides functioning as V_2 onsets. Evidently, Karanga and Zezuru treat VV sequences as dispreferred configurations and select glide formation as a repair strategy. Further, both dialects consider NLV and N_OD_{IPH} as indomitable constraints thus blocking diphthongisation and compensatory lengthening (Mudzingwa, 2010). In this regard, the two chiShona dialects have the same constraint interaction and ranking as siSwati and other Nguni languages in that ONSET, NLV and N_OD_{IPH} optimally outrank MAX-IO(R_T) and MAX-μ to allow the parsing of onsetful syllables.

SiSwati and chiShona differ from Luganda (Rosenthall, 1997; Casali, 2011), Cilubà (Lukusa, 1997), Fwe (Gunnink, 2018), and Kisa (Ondondo, 2020) where glide formation triggers compensatory lengthening. These languages present a variation in the surface vowel, in contrast

[5] I have adapted the examples to only include a representation of glide formation. For a detailed discussion of glide formation and the examples thereof, see Mudzingwa (2010).

with the optimal forms in siSwati and Shona (Lukusa, 1997; Ondondo, 2020). These languages allow long vowels, but not diphthongs, in their output forms. Unlike siSwati and chiShona, the grammar of the three languages accounts for mora loss through lengthening the output vowel since long vowels are bimoraic (Rosenthall, 1997). Luganda, Cilubà, Fwe and Kisa would therefore rank ONSET, N$_{O}$D$_{IPH,}$ and MAX-μ hierarchically higher than NLV. Tableau 2 formalises this constraint hierarchy.

Tableau 2: Glide formation in Luganda, Cilubà, Fwe and Kisa

/li-oto/	ONSET	MAX-μ	N$_{O}$D$_{IPH}$	MAX-IO(R$_{T}$)	NLV
a) li.o.to	*!				
☞b) l^{j}o:.to[6]					*
c) l^{j}o.to		*!			
d) lio.to			*!		
e) li.to				*!	
f) lo.to				*!	

Luganda, Cilubà, Fwe, and Kisa ban VV sequences hence the elimination of Candidates (a) and (d) for parsing an onsetless vowel as well as a diphthong in the output. The difference is that where siSwati blocks long vowels, these languages permit [V:] in the surface, to account for all input moras. This means that re-ranking MAX-μ higher than NLV allows Candidate (b) to surface as the winner, in line with the grammar of the three languages.

So far, the study has focused on the elimination of VV sequences through glide formation. I have demonstrated that this repair strategy is triggered when the input VV sequence consists of a [+high] V$_1$ that is not preceded by a consonant. On the nature of the surface form, I have made two generalisations: first, that the siSwati syllable typology bars the output form to be parsed as either a long vowel or diphthong, and second; that gliding the first vowel in the sequence provides an ONSET for the onsetless V$_2$. This aligns with findings from other investigations on the Bantu

[6] Even though /li-ato/ → [l^{j}ato] ‘boats’ illustrates Secondary Articulation, its usage in this context exemplifies vowel lengthening as an output form. The data presented in Rosenthall (1997) and Casali (2011) do not have a representative set of examples with glide formation as discussed in the current study.

syllable structure and phonological processes that harmonise input structures with the canonical Bantu CV syllable structure. On the contrary, the syllable template in Luganda, Cilubà, Fwe, and Kisa permits the surface realisation of long vowels in their grammar, presenting variation in hiatus resolution patterns in Bantu.

Table 8 below presents a representative summary of glide formation in the languages explored in the current study.

Table 8: A representative summary of glide formation in Bantu

LANGUAGE	COSTRAINT RANKING
SiSwati	ONSET, NLV, N_OD_{IPH} outrank MAX-IO(R_T), MAX-μ
Shona (Zezuru and Karanga)	ONSET, NLV, N_OD_{IPH} outrank MAX-IO(R_T), MAX-μ
Luganda	ONSET, N_OD_{IPH}, MAX-μ outrank MAX-IO(R_T), NLV
Cilubà	ONSET, N_OD_{IPH}, MAX-μ outrank MAX-IO(R_T), NLV
Kisa	ONSET, N_OD_{IPH}, MAX-μ outrank MAX-IO(R_T), NLV

The next section discusses the second repair strategy: secondary articulation.

4.3 Secondary articulation

When the phonological context does not permit glide formation, siSwati grammar selects secondary articulation, which is also known as gliding or labialisation (Lee, 1999; Sibanda, 2009). Secondary articulation refers to the surface realisation of prevocalic vowels as their corresponding glides to satisfy syllable structure constraints (Rosenthall, 1997; van de Weijer, 2011). The co-articulated semivowel is superimposed to the preceding consonant as per the dictates of individual grammars. As mentioned earlier, complex onsets are not permissible in siSwati. In contexts where V_1 is preceded by a consonant, glide formation would yield a dispreferred [CG] output form that violates structural restrictions in siSwati grammar. Secondary articulation is therefore selected as the next repair strategy.

4.3.1 Secondary articulation in siSwati

Secondary articulation applies when the labial vowels /u/ and /o/ in V_1 position are preceded by a consonant (Rosenthall, 1997; Sibanda, 2009). On the relationship between glide formation and secondary articulation within the nominal and verbal domains, Mudzingwa (2013) argues that the two repair strategies occur in the same morphological contexts but 'phonologically conditioned complementary distribution' (p. 1). Also, Mudzingwa (2010, 2013) proposes that the input vowel in V_1 position is deleted, and the floating labial V-place feature attaches to the preceding consonant as a labial off-glide realised as secondary articulation (Mudzingwa, 2010, 2013). In some languages such as Luganda (Rosenthall, 1997), front vowels in V_1 position attach the coronal V-Place feature to the preceding consonant, parsing a [C^{j}] segment in the output. SiSwati phonotactic restrictions exclude coronal vowels [i] and [e] from participating in secondary articulation. In the next sections, I present the morphosyntactic contexts that create a hiatus configuration resolved through secondary articulation. I begin with VV sequences within the INFL Stem where the Class 15 SM is juxtaposed with vowel initial verb stems to form infinitives. Consider the following examples:

252.	/**kú-à**k^{h}à/ CL15.SM-build 'to build'	→	[**k**^{w}á.k^{h}à]
253.	/**kú-é**ɓà/ CL15.SM-herd 'to steal'	→	[**k**^{w}é.ɓà]
254.	/**kú-é**lùsà/ CL15.SM-herd 'to herd livestock'	→	[**k**^{w}é.lù.sà]
255.	/**kú-é**^{n}dza/ CL15.SM-wed 'to wed'	→	[**k**^{w}é.^{n}dzà]
256.	/**kú-é**wélà/ CL15-cross	→	[**k**^{w}é.wé.là]

‘to cross’

257. /**kú-é**múkà/ → [**k**ʷé.mú.kà]
CL15-drown
‘to drown’

In each of the above secondary articulation instances, vowel /u/ converts to the corresponding labial glide [w] linked to the preceding consonant and parsed as [C^w].

The second morphosyntactic context that demonstrates secondary articulation is when the SM is juxtaposed with siSwati possessive markers in the formation of the possessive pronoun. I illustrate possessive formation below:

258. /**lú-á**mì/ → [**l**ʷá.mì]
CL11.SM-mine
‘it is mine’

259. /**kú-á**mì/ → [**k**ʷá.mì]
CL15.SM-mine
‘it is mine’

260. /**lú-á**khò/ → [**l**ʷá.khò]
CL11.SM-yours
‘yours’

261. /**kú-á**khò/ → [**k**ʷá.khò]
CL15.SM-yours
‘yours’

In the above data, the grammar selects secondary articulation to eliminate the dispreferred VV sequence in the output. Note that in each configuration, V_1 is deleted and the labial V-Place feature attaches to the preceding consonant, to avoid a marked CG configuration in the output. In each instance, deleting the illicit vowel is less optimal.

Diminutives also provide a rich context for secondary articulation. In diminutive formation, the diminutive marker /-ànà/ is suffixed to nouns to denote ‘a smaller version of’ as illustrated in the examples below:

262. /úmk^{h}ú**k^{h}ù-à**nà/ → [ú.m̩.k^{h}ú.**k^{hw}à**.nà]
CL3-shack-Dim
‘small shack’

263. /ú mù^{n}**tfú-à**nà/ → [ú.m̩.^{n}**tf^{w}à**.nà]
CL1-person-Dim
‘baby’

264. /sí**sù-à**nì/ → [sí.**s^{w}à**.nà]
CL7-stomach-Dim
‘small stomach’

265. /í^{n}**ɮù-à**nà/ → [í.^{n}**ɮ^{w}à**.nà]
CL9-house-Dim
‘small house’

266. /úmù**nó-à**nà/ → [ú.mù.**n^{w}à**.nà]
CL3-finger-Dim
‘small finger’

267. /sígó**gò-à**nà/ → [sí.gó.**g^{w}à**.nà]
CL7-hide-Dim
‘small hide’

268. /lútsá**ŋò-à**nà/ → [lú.tsá.**ŋ^{w}à**.nà]
CL11-fence-Dim
‘small fence’

269. /ɓú**sò-à**nà/ → [ɓú.**s^{w}à**.nà]
CL14-face-Dim
‘small face’

270. /líló**ɠò-à**nà/ → [lí.ló.**ɠ^{w}à**.nà]
CL5-dress-Dim
‘small dress’

Instead of parsing consonant clusters in the output forms in (262) to (270), the grammar triggers secondary articulation where the labial glide attaches to the preceding consonant. In this regard, a /CG/ configuration becomes a [C^{w}], a surface form that aligns with the siSwati syllable template.

Another instance that creates a context for hiatus resolution is locative formation using the locative marker /e….ini/. As noted in Section 3.5.1, the noun can be juxtaposed with various locative morphemes such as /ka-/, /ku-/ /e-/ /ŋa-/, amongst others. I illustrate how locative formation creates a context for hiatus resolution below:

271. /é-sí**sù-i**ni/ → [é.sí.**sʷ**ì.nì]
LOC-CL7-stomach-LOC
'in the stomach'

272. /é-sí|ú**ɠù-ì**nì/ → [é.sí.|ú.**ɠʷì**.nì]
LOC-CL7-crowd-LOC
'in the crowd'

273. /é-lít′ú**lù-ì**nì] → [é.t′u.**lʷ**ì.nì]
LOC-CL5-rain-LOC
'in the rain'

274. /é-émé ɬo-ini/ → [é.mé.**ɬʷ**è.nì]
LOC.CL6-eyes-LOC
'in the eyes'

275. /é-síválò-ini/ → [é.sí.vá.**lʷ**è.nì]
LOC-CL7-door-LOC
'on the door'

276. /é-úmtfwálò-ìnì/ → [é.m̩.tfʷá.**lʷ**è.nì]
LOC-CL3-load-LOC
'in the load'

277. /é-úmlílò-ìnì/ → [é.m̩.lí.**lʷ**è.nì]
LOC-CL3-fire-LOC
'in the fire'

The above examples show that where the labial vowels /u/ and /o/ occur before the locative suffix morpheme /-ìnì/, secondary articulation applies to eliminate the VV sequence. Note that the class prefix in instances such as (273) is sometimes deleted in locative formation; however, this deletion and the reasons thereof are not the focus of this thesis. Focus is only on the hiatus context created between the noun stem and the locative suffix /-ìnì/.

Other Nguni languages display similar hiatus resolution effects as those in siSwati. Sibanda (2009) and Sabao (2015) note that isiNdebele, a sister language to siSwati, adopts secondary articulation within the same context. Previous grammars posited for other Bantu languages, which I adopt for the current study, allow the output glide to dock onto the preceding consonant in what Rosenthall (1997) terms secondary articulation. This violates the co-articulation constraint I define as:

278. Secondary Articulation (SECARTIC)
Input segments must not have secondary articulation.
(Rosenthall, 1997, p. 147)

Since secondary articulation is pervasive in siSwati and other Bantu languages such as Luganda (Rosenthall, 1997), isiZulu and isiNdebele (Sibanda, 2009; Sabao, 2015), chiShona (Mudzingwa, 2010, 2013; Kadenge & Simango, 2014) SECARTIC appears as a low-ranking constraint to satisfy high ranking structural constraints.

In addition to the restrictions on the environments that may trigger secondary articulation, hiatus resolution output forms must not contain complex structures to avoid a violation of $\text{COMPLEX}^{\text{ONSET}}$. This is a markedness constraint that restricts the existence of consonant sequences parsed as branching onsets. In my hiatus resolution analysis, I include this high-ranking syllable structure constraint to account for the syllabic well-formedness of output candidates. This constraint dictates that all surface forms must not consist of consonant clusters and is defined as follows:

279. $\text{COMPLEX}^{\text{ONSET}}$
Complex onsets are prohibited.
(Kager, 1997, p. 97; Kadenge, 2015, p. 97)

Candidates that parse consonant clusters in their surface representations violate this constraint.

To satisfy syllable structure restrictions in siSwati, the vowel hiatus resolution grammar involving secondary articulation is typologically represented as ONSET, COMPLEX^{ONSET} >> MAX-IO(RT) >> MAX- μ, SECARTIC, where onsetless syllables, clusters and long vowels are banned. Moreover, deleting any of the input vowels in the VV sequence is also not a viable diagnostic tool. This means that MAX-IO(RT) must not be violated. The goal of this constraint ranking is to eliminate prevocalic vowels, consonant clusters, diphthongs and long vowels with the aim of having surface monophthongal vowels and consonants that occupy a single C-Slot, in line with the goals of the dissertation. I present the secondary articulation constraint hierarchy in Tableau 3 below:

Tableau 3: Secondary articulation in siSwati

/kú-ámì/	ONSET	COMPLEX^{ONSET}	MAX-IO(RT)	MAX-μ	SECARTIC
a) kú.á.mì	*!				
b) kwá.mì		*!			
☞c) k^wá.mì				*	*
d) ká.mì			*!		

The siSwati grammar blocks word-medial onsetless syllables; candidate (a) is eliminated for violating ONSET. Despite forming a glide, Candidate (b) is eliminated for its violation of COMPLEX^{ONSET}, a constraint that bans the surface realisation of consonant clusters. The optimal candidate (c) has incurred non-fatal violations of MAX-μ and SECARTIC by deleting the labial vowel and further linking its V-Place features onto the preceding consonant [k]. As indicated, the optimal candidate must have a monophthongal vowel and a consonant occupying a single C-Slot, to align with the goals of this dissertation. [k^w] is therefore optimal.

In FG terms, the surface representation of the output complex consonant in the secondary articulation process in Tableau 3 demonstrates how the semi-vowel is linked to the preceding consonant. I present this representation in Figure 7 below (Clements & Hume, 1995, p. 288):

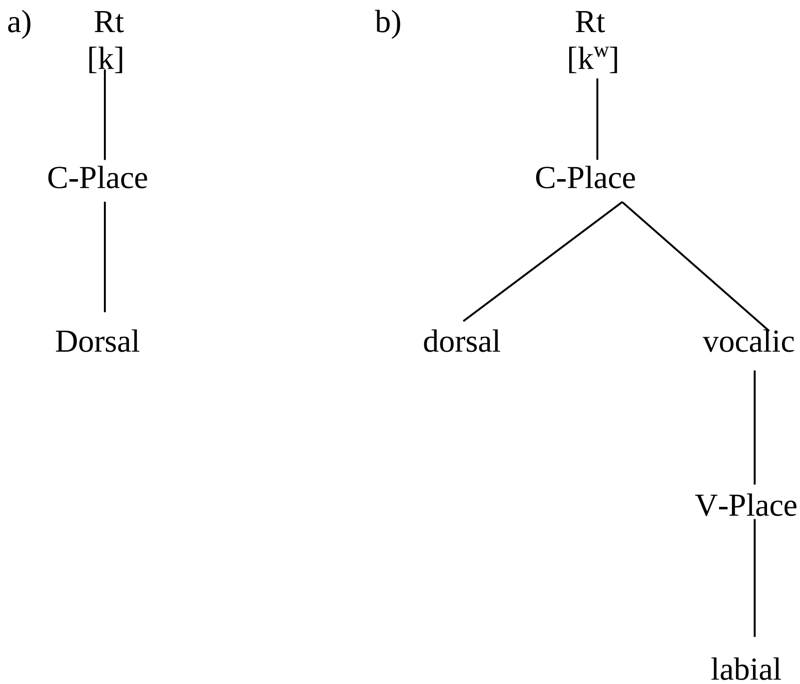


Figure 7: The representation of simple and labialised dorsal consonants in siSwati

In the above featural representations of the permissible consonant structures in siSwati, (a) illustrates the simple dorsal consonant [k], while (b) represents its labialised counterpart consisting of a dorsal and labial co-articulation. As evident, both consonants occupy a single C-Slot, in alignment with the preferred syllable structure of the language. This further aligns with the goals of the current study on syllable structure restrictions.

This realisation of secondary articulation is found in other Bantu languages such as isiNdebele and isiZulu (Sibanda, 2009; Sabao, 2015), Shona (Mudzingwa, 2010, 2013; Kadenge & Simango, 2014), and iKalanga (Mathangwane, 1999; Kadenge & Chebanne, 2017). The goal in each language is to eliminate VV sequences without parsing a diphthong, long vowel, or consonant cluster in the output forms. This grammar would be typologically different in Luganda and Cilubà, where vowel length is contrastive. In such cases, the optimal candidate would optimally parse a long vowel to account for lost moraicity in the output. In the grammar of these languages, NLV and MAX-μ are low ranking constraints to allow long vowels in the surface, where every input mora is represented. This different constraint ranking demonstrates that even though the target is to eliminate VV sequences in Bantu languages, the effects thereof are different. This ranking also highlights that the southern Bantu languages have different secondary articulation effects from their central African counterparts. I revisit this discussion on secondary articulation effects in Bantu in later sections. I next discuss the morphosyntactic and phonological contexts in which siSwati grammar blocks secondary articulation and subsequently triggers vowel elision.

4.3.2 Blocking secondary articulation in siSwati

As highlighted above, languages of the world select, firstly, which vowels may trigger secondary articulation, and secondly, which consonants may participate in secondary articulation. SiSwati and the other Nguni languages are no different. Firstly, Khumalo (1987) notes that isiZulu, and by extension siSwati, blocks secondary articulation in contexts where input V_1 is coronal /i/ or /e/ to eliminate possible *Cj surface representations. I define the markedness constraint that blocks palatalised prevocalic consonants below:

280. *Cj

Palatalised consonants are prohibited.

(Sibanda, 2009, p. 48)

In addition to the above restrictions, Nguni languages block secondary articulation in cases where the co-articulated segment is followed by a v-initial morpheme whose input vowel is labial /u/ or /o/ (Sibanda, 2009). To mitigate against dispreferred [LABIAL][LABIAL] output configurations in such instances, I draw from the Obligatory Contour Principle (OCP), a morpheme structure constraint that prohibits adjacent segments that share similar features (Goldsmith, 1976; Yip, 1988; Clements & Humes, 1995). This constraint is defined as:

281. The Obligatory Contour Principle (OCP)

Adjacent identical elements are prohibited.

(Yip, 1988, p. 66; Clements & Hume, 1995, p. 262)

OCP is a markedness constraint that disallows the co-occurrence of identical segments and prosodic features (Yip, 1988). Yip notes that OCP blocks the application of certain phonological rules depending on whether the surface representation will consist of a sequence of identical segments or suprasegmental features. For instance, OCP ranks high in siSwati since it does not allow the [labial] feature to be followed by another labial. In the current dispensation, I use OCP to account for the reasons why siSwati grammar blocks secondary articulation in labial onsets, a configuration that would yield a dispreferred labialized labial onset. To satisfy OCP, siSwati grammar triggers vowel deletion as an optimal diagnostic tool.

Casali (2011) argues that languages delete V_1 rather than V_2 to eliminate dispreferred VV sequences. He illustrates this in the Yoruba examples below (Casali, 2011, p. 21):

282.	/bu ata/	→	[ba.ta]	'pour ground pepper'
283.	/gé olú/	→	[gó.lú]	'cut mushrooms'
284.	/ta epo/	→	[te.po]	'sell palm oil'

Note that in the above data, Yoruba deletes V_1. In addition, the data indicates that Yoruba bans secondary articulation in similar phonological contexts as siSwati. For instance, [ba.ta.] in (282) is not parsed as *[b^wata] in the surface representation, [gó.lú] in (283) is not parsed as *[g^jo.lu]. This indicates that the same constraint ranking I assume for siSwati would suffice for Yoruba. I now turn to the discussion on vowel elision, which highlights the various morphosyntactic and phonological contexts that trigger this phenomenon. I then provide a formal OT analysis of vowel elision as an optimal repair strategy in contexts where glide formation and secondary articulation are not optimal.

4.4 Vowel deletion in siSwati

Vowel deletion is triggered when glide formation and secondary articulation are blocked (See Sibanda, 2009; Mudzingwa, 2010; Khan, 2016; Vratsanos & Kadenge, 2017; Vratsanos, 2018), amongst others. In the above discussion, I noted that coronal vowels are blocked from participating in secondary articulation for their violation of *C^j. Blocking the occurrence of palatalised consonants is a common phenomenon in some Bantu languages (Sibanda, 2004, 2009; Mudzingwa, 2010, 2013; Kadenge & Simango, 2014). In the following sections, I present the different morphosyntactic contexts where V_1 deletes instead of triggering secondary articulation to satisfy *C^j and OCP. The first environment is the concatenation of the infinitive prefix /ku-/ with onsetless verb root beginning with labial vowel /o/. I exemplify this phenomenon below:

285.	/k**ú-ó**sà/ Cl15-roast	→	[k**ó**.sà]	*$k^{\mathbf{w}}$**o**sa

'to roast'

286. /k**ú-ó**na/ → [k**ó**.nà] *k^w**o**na
CL15-sin
'to sin'

287. /k**ú-ó**^{ŋ}gà/ → [k**ó**.^{ŋ}gà] *k^w**o**^{ŋ}ga
CL15-save
'to save'

288. /k**ú-ó**mà/ → [k**ó**.mà] *k^w**o**ma
CL15-dry
'to dry'

To avoid a surface form that would yield prohibited structures with two adjacent labial features, an OCP violation, siSwati blocks secondary articulation and triggers vowel elision. Each candidate optimally deletes V_1. These examples demonstrate that [+round] vowels do not automatically glide or labialise, but that labialisation depends on the syllable restrictions enforced by the language. I illustrate this constraint interaction below:

Tableau 4: Vowel deletion in siSwati OCP contexts

/kú-ónà/	ONSET	COMPLEX^{ONS}	OCP	MAX-IO(R_T)	MAX-µ	SECARTIC
a) kú.ó.nà	*!					
b) kwó.nà		*!				
c) k^{w}ó.nà			*!		*	*
☞d) kó.nà				*		

For siSwati grammar to faithfully parse a monophthong in the output, the grammar eliminates candidate (a) for parsing an onsetless vowel word-medially. OT dictates that syllabic well-formedness in siSwati must conspire to yield monophthongal vowels in all surface forms. Furthermore, the satisfaction of structural constraints involving consonants requires that candidate (b) be eliminated for parsing a consonant cluster in the output since consonant clusters are not attested in siSwati. Even though Candidate (c) eliminates the consonant cluster through secondary articulation, it violates OCP, another high ranking constraint in the grammar. As illustrated, both /w/ and /o/ are labial, a phonological context that blocks secondary articulation. Candidate (d) aligns with the grammar by eliminating one of the offending vowels in the VV sequence, in line with the siSwati CV syllable template. Even though deletion is not optimal in the siSwati grammar, the overall candidate chooses to delete one of the input vowels to satisfy OCP, a higher ranking constraints than MAX-IO(RT). [kó.nà] is the winner.

Another morphosyntactic context that is conducive for vowel deletion is the formation of the absolute pronoun in siSwati. In this phenomenon, the onset-initial SM of the various noun classes in siSwati is juxtaposed with the formative marker /-ona/. I illustrate this formation in the table below:

Table 9: Vowel deletion in the siSwati absolute pronoun

	Underlying representation	**Permissible Surface form**	**Blocked output form**	**Constraint violation**
289.	/l**í-ó**nà/ CL5-it 'it'	[l**ó**.nà]	*l^{j}ona	*C^{j}
290.	/s**í-ó**nà/ CL7-it 'it'	[s**ó**.nà]	*s^{j}ona	*C^{j}
291.	/t′**í-ó**nà/ CL8-it 'they'	[t′**ó**nà]	*t^{j}ona	*C^{j}
292.	/l**ú-ó**nà/ CL11-it 'it'	[l**ó**.nà]	*l^{w}ona	OCP
293.	/ɓ**ú-ó**nà/ CL14-it 'it'	[ɓ**ó**.nà]	*ɓ^{w}ona	OCP
294.	/k**ú-ó**nà/ CL15-ona 'it'	[k**ó**.nà]	*k^{w}ona	OCP

In Table 9 above, each example blocks secondary articulation, even though the morphosyntactic context is conducive. In (289), (290), and (291) block secondary articulation since the output would parse a palatalised segments therefore violating *C^{j}. Similarly, the examples in (292), (293), and (294) block secondary articulation since the output would yield a labialised labial onset, a configuration that siSwati disprefers for its OCP violation.

In verbs, deletion occurs in the formation of the past tense, where there is the concatenation of various morphemes including the SM, Past Tense Marker, OM followed by the verb stem[7]. I illustrate this below:

295. /ú-á-**lí-ó**ŋgà/ → [wá.**ló**.^{ŋ}gà] *[wa.**l^{j}o**.^{ŋ}ga]
CL1.SM-PST-CL3.O-save
'she saved it'

296. /ú-á-**ɓú-é**ntà/ → [wá.**ɓé**.^{n}tà] *[wa.**ɓ^{w}e**.^{n}ta]
CL1.SM-PST-CL14.OM-made
'she made them'

297. /í-á-**sí-é**ntà/ → [já.**sé**.^{n}tà] *[ja.**s^{j}e**.^{n}ta]
CL3.SM-PST-CL7.OM-made
'it made them'

In each example, V_1 is deleted instead of triggering secondary articulation. For instance, (296) blocks this labialisation to block a potential *[$ɓ^{w}$] surface form where an already labial segment is labialised. Similarly, the grammar blocks secondary articulation in (295) and (297) to avoid *[l^{j}] and *[s^{j}] surface forms, respectively.

The diminutive formation process provides further evidence that prohibits secondary articulation of prevocalic consonants. In this phenomenon, the noun is juxtaposed with the diminutive suffix morpheme /-ana/ denoting 'a smaller version of'. In nouns ending in prevocalic coronal vowels /i/ and /e/, siSwati grammar does not trigger secondary articulation but deletes V_1 to satisfy the structural constraints of the language. I provide examples for diminutive formation below:

298. /úmù-**t'í-à**nà/ → [ú.mu.**t'a**.na] *****[umu**t^{j}**ana]
CL3-homestead-Dim
'small homestead'

[7] The phonological context selects vowel elision even though the morphological domain dictates that the grammar should select spreading. I revisit this domain in hiatus resolution involving spreading under Section 4.5 below.

299. /íN-jò**sí-à**nà/ → [í.ɲó.**sà**.nà] *[iɲo**sʲ**ana]
CL9-bee-Dim
‘small bee’

300. /émà-**sí-à**nà/ → [é.mà.**sà**.nà] *[ema**sʲ**ana]
CL6-sour porridge-Dim
‘small bowl of sour porridge’

301. /émà$^{\mathbf{n}}$**tí-à**nà/ → [é.mà.$^{\mathbf{n}}$**tà**.nà] *[eman**tʲ**ana]
CL6-water-Dim
‘small body of water’

302. /lí-ɓù$^{\mathbf{n}}$**tí**-ànà/ → [lí.ɓù.$^{\mathbf{n}}$**tà**.nà] *[liɓu^{n}**tʲ**ana]
Cl5-forehead-Dim
‘small forehead’

303. /úmù-lé$^{\mathbf{n}}$**tè-a**na/ → [ú.m̩.lé.$^{\mathbf{n}}$**tà**.nà] *[umlen**tʲ**ana]
CL3-leg-Dim
‘small leg’

304. /li-t′e**t′è**-ànà/ → [lí.t′é.**t′à**.nà] *[lite**t′ʲ**ana]
CL6-swamp-Dim
‘small swamp’

305. /sí-ɮé**kè-à**nà/ → [sí.ɮé.**kà**.nà] *[siɮe**kʲ**ana]
CL7-nest-Dim
‘small nest’

306. /ɓú-**ɬè-à**nà/ → [ɓú.**ɬà**.nà] *[ɓu**ɬʲ**ana]
CL14-beauty-Dim
‘small beauty’

307. /lí-vè-ànà/ → [lí.**và**.nà] *[li**vʲ**ana]
CL5-country-Dim
‘small country’

In vowel hiatus configurations involving coronal vowels, there is the possibility to delete V_1. Notably, the above examples end with the front vowels /i/ and /e/ and are, therefore, prohibited from palatalising since siSwati coronal vowels in V_1 position do not trigger secondary articulation.

Instead of palatalising, the illicit vowel gets deleted in line with $*C^j$ restrictions. I demonstrate this constraint interaction in Tableau 5 below:

Tableau 5: Vowel deletion in siSwati *Cj contexts

/lívì-ànà/	ONSET	$COMPLEX^{ONS}$	$*C^j$	MAX-μ	SECARTIC
a) lívì.à.nà	*!				
b)lí.vjà.nà		*!		*	
c) lí.v^jà.nà			*!		*
☞d)lí.và.nà				*	

In siSwati grammar, glide formation and secondary articulation are blocked by $COMPLEX^{ONSET}$ and $*C^j$ candidates, both indomitable constraints. The grammar therefore eliminates Candidates (b) and (c) for parsing consonant clusters and palatalised consonants. As expected, the grammar also eliminates candidate (a), for parsing an onsetless syllable; a surface configuration that are never optimal in siSwati. In this analysis, deleting V_1 blocks a possible marked *Cj representation. [lí.và.nà] is the optimal candidate.

Even though the Bantu syllable template permits CV syllables, what is permissible in each language varies. This is evident in languages such as Luganda (Rosenthall, 1997: Hyman, 2003), and Shimakonde (Liphola, 2001), where the restrictions enforced on the siSwati syllable do not apply. For instance, Luganda permits the occurrence of labialised segments as well as palatalised consonants. Consider the following examples (Rosenthall, 1997, p. 150):

308.	/li-ato/	→	[$\mathbf{l^j}$a:to]	'boat'
309.	/ki-oto/	→	[$\mathbf{k^j}$o:to]	'metal object'
310.	/mu-iko/	→	[$\mathbf{m^w}$i:ko]	'trowel'
311.	/mu-ojo/	→	[$\mathbf{m^w}$o:jo]	'soul'

The above examples illustrate the variation in secondary articulation and vowel deletion in Bantu. They indicate instances where coronal V_2 palatalises and labial consonants labialise. For example, (308) and (309) highlight consonant palatalisation, (310) and (311) highlight the labialisation of a labialised [m]. [m^wo:jo] in (311) exemplifies an instance where labialisation precedes a labial-initial morpheme. As evident, where siSwati blocks [LABIAL][LABIAL], *C^j, and OCP contexts, Luganda does not, indicating the typological variation in vowel hiatus patterns in Bantu.

Furthermore, labial and palatal offglides can occupy the C-Slot in Shimakonde, where the /C/ can be any consonant including labials and coronals. In this language, these co-articulated segments are phonemic and derivative, the latter evident in surface forms resulting from phonological processes such as vowel hiatus. I illustrate the parsing of phonemic [C^w] and [C^j] segments in Shimakonde below (Liphola, 2001, p. 75-77):

312.	/kú-pwálé:la/	→	[kú.**p**^{w}á.lé:.la]	'to buy'
313.	/kú-bwááda/	→	[kú.**b**^{w}á:.da]	'to boil'
314.	/kú-twáála/	→	[kú.**t**^{w}á:.la]	'to take'
315.	/mw-ááka/	→	[**m**^{w}á:ka]	'year'
316.	/kúú-pja/	→	[kú:**p**^{j}a]	'to burn'
317.	/kú-bjáána/	→	[kú.**b**^{j}á:.na/	'to kill'
318.	/kú-djúúka/	→	[kú.**d**^{j}ú:.ka]	'to resuscitate'

Shimakonde clearly indicates that its grammar allows secondary articulation in contexts where siSwati bans it. For instance, the examples in (312) to (315) permit labialised consonants even in cases where the preceding consonant is labial. (316) to (318) demonstrate contexts where palatal off-glides are permitted in the language.

In hiatus contexts, Shimakonde enforces similar restrictions on derivative surface forms. Where V_1 is labial, the grammar enforces labialisation while contexts with coronal vowels in the input permit surface [C^j] forms. Consider the following examples (Liphola, 2001, p. 89):

319.	/li-a-njaala/	→	[**l**^{j}a.n^{j}a:.la]	'rag'
320.	/li-e-mbé:ñu/	→	[**l**^{j}e.mbé:.ñu]	'fool'
321.	/kú-é-pú:ka/	→	[**k**^{w}é.pú:ka]	'to sprout'
322.	/kú-á-dú:la/	→	[**k**^{w}a.dú:.la]	'to destroy'

The above surface realisations are possible because the grammar underlyingly allows [C^w] and [C^j] forms in its consonant inventory. In Luganda and Shimakonde, both OCP and *C^j are low-ranking constraints. I formally present this constraint ranking in Tableau 6 below:

Tableau 6: Secondary articulation in Luganda and Shimakonde

/ki-oto/	ONSET	NoDiph	COMPLEX^{ONS}	MAX-IO (RT)	*C^j	OCP	SecArtic	NLV
a) ki.o.to	*!							
b) kio.to		*!						
c) kjo.to			*!					
☞d) k^jo:to					*!		*	*
e). ko.to				*!				

The grammar in Tableau 6 has eliminated candidates (a), (b), and (c) for violating markedness constraints that militate against onsetless syllables, consonant clusters, and diphthongs. The Shimakonde and Luganda grammar has also eliminated candidate (e) for deleting V_1, a surface form that would be optimal in siSwati and other Bantu languages that enforce a ban on palatalised consonants. Hiatus resolution in *C^j contexts in Shimakonde and Luganda does not involve deleting V_1 in contexts where siSwati does. As evident, the optimal candidate (d) has parsed a palatal offglide in the output instead of deleting the coronal input vowel. Where siSwati would delete the offending vowel to satisfy high-ranking structural constraints, OCP and *C^j, Luganda and Shimakonde trigger secondary articulation, displaying varied hiatus patterns and constraint ranking. Luganda and Shimakonde grammar equally ranks SecArtic and NLV to satisfy structural constraints in the two grammars, since they allow labialised labials and palatalised consonants in the output.

Another language that exhibits disparity in OCP ranking is chiShona (Mudzingwa, 2010; Kadenge & Simango, 2014). While this language allows labialised prevocalic consonants, palatalised consonants are blocked in all contexts. Consider the following examples (Kadenge & Simango, 2014, p. 115):

323. /mù-ánà/ → [**m^w**à.nà]
CL1-child
'child'

324. /mù-énì/ → [**m**^{w}é.nì]
CL1-visitor
'visitor'

325. /mu-a-wela/ → [**m**^{w}a.we.la]
SM-PST-come
'you came'

In Shona, OCP is a low-ranking constraint, while *C^j is indomitable to allow a grammar that parses labialised labials but block palatalised consonants. Another language that displays this variation is iKalanga (Kadenge & Chebanne, 2017). The blocking of secondary articulation within different Bantu languages indicates the intimate relationship between morphology and phonology in phonological analysis. It highlights the importance of taking into consideration the morphosyntactic and phonological context of a configuration, to avoid rule overgeneralisation.

The discussion has so far highlighted the varied hiatus resolution patterns where some languages trigger secondary articulation, while others trigger vowel deletion in the same phonological and morphological contexts. I have noted that siSwati and the other Nguni languages trigger secondary articulation in contexts where prevocalic V_1 is labial. However, the same grammar blocks labialised labials and palatalised consonants across all contexts, hence the indomitable ranking of OCP and *C^j. Shona and iKalanga, on the other hand, present a slight variation in that they allow labialised labials but block [C^j] surface forms. Lastly, Luganda, Cilubà, Kisa, and Shimakonde grammar permit the seemingly marked structures evident in siSwati, Shona, and iKalanga. These languages allow labialised consonants as well as palatalised segments in all surface forms. This variation in VV resolution patterns is motivated by the different rankings of structural constraints across the various Bantu languages. As has been indicated in the discussion thus far, despite the ban on VV sequences and the motivation to fill the Bantu CV syllable template, segments that can occupy the consonant and vowel slots are language-specific. I present a representative summary of secondary articulation and vowel deletion patterns interaction below:

Table 10: A summative representation of secondary articulation patterns in Bantu

	NLV	OCP	$*C^j$
SiSwati	X	X	X
Other Nguni Langs.	X	X	X
Shona	X	✓	X
IKalanga	X	✓	X
Luganda	✓	✓	✓
Shimakonde	X	✓	✓

Where siSwati and the other languages block surface forms that potentially violate OCP and $*C^j$, Luganda, and Shimakonde parse labialised and palatalised consonants. Luganda also triggers compensatory vowel lengthening to account for the lost mora due to secondary articulation, while the other languages under discussion have no such restriction. The surface forms evident in different languages point to the typological differences in Bantu languages and vowel hiatus resolution patterns crosslinguistically.

The current study has so far highlighted how the siSwati grammar selects glide formation, secondary articulation, and vowel deletion when the hiatus configuration occurs within the INFL Stem in verbs, and if the VV sequence occurs within the Prefix and Noun Stem. Previous studies have noted that the Bantu INFL Stem consists of any derivational prefixes preceding the object marker (OM), while the MStem consists of the OM and other derivational markers up to and including the inflected verb stem (Kula, 2002; Kadenge & Chebanne, 2017; Downing & Mtenje, 2017), amongst others. Further, the interaction between the phonological and morphosyntactic contexts has to be conducive for the selection of each repair strategy. For instance, glide formation is triggered when V_1 in the dispreferred VV sequence is not preceded by a consonant, while secondary articulation necessitates that V_1 be preceded by a consonant. If the two repair strategies are not optimal, the grammar selects vowel deletion.

In the following sections, I consider spreading as an optimal hiatus repair strategy that siSwati grammar selects within the Macro Stem (MStem) which consists of the Object Marker (OM) and subsequent derivational affixes including the inflected verb stem. In my analysis, I first introduce the phenomenon, and then present the morphosyntactic domains that exemplify hiatus configurations that trigger spreading in siSwati. Lastly, I provide an OT analysis of glide epenthesis in siSwati.

4.5 Spreading in siSwati

Spreading is defined as the spreading of features between adjacent segments, where one segment shares its place features with another (Clements & Hume, 1995; Lombardi, 2002; Mudzingwa, 2010). In hiatus resolution patterns that trigger spreading: labial, coronal, and pharyngeal vowels spread their features onto the epenthetic site, resulting in the formation of corresponding glides contingent upon the environment in which they occur (Sibanda, 2009; Mudzingwa, 2010; Kadenge & Mudzingwa, 2014; Kadenge & Chebanne, 2014). The current study notes that VV sequences are marked structures in siSwati grammar, and that all word-medial vowels must have onsets. Any output form emanating from spreading must therefore conform to the siSwati CV syllable by eliminating all vowel sequences. The motivation for the output corresponding glides is for them to function as V_2 onsets. In this regard, the motivation for and output of spreading align with one of the goals of the dissertation: all syllables must have onsets except word-medially.

Previous Bantu and crosslinguistic literature highlights the importance of mapping the close relationship between the featural makeup of vowels and their corresponding glides. For instance, Mudzingwa (2010), and Kadenge and Mudzingwa (2014) use the interconnectedness between coronal, labial, and pharyngeal vowels to account for phonological analysis on issues related to the dispreferred parsing of VV sequences in Shona. They argue that chiShona pairs front vowels [e, i] with coronal [j], round vowels with the labial glide [w], and the pharyngeal vowel [a] with the laryngeal segment [ʔ]. Lombardi (2002) supports glottal stop insertion, noting that laryngeal consonants are least marked epenthetic segments compared to coronal [j]. In cases where the epenthetic site has to be filled by a non-moraic segment, each vowel selects a corresponding segment from its natural class, as per the precepts of the FG theory (Cements & Hume, 1995). Nevins and Chirotan (2008) note that glides and vowels form a natural class, with glides syllabified as 'non-nuclear versions of vowels' (p.1979). In siSwati, only the labial and coronal constituents participate in spreading since the pharyngeal vowel [a] does not trigger spreading in the language

(Sibanda, 2009). I illustrate the similarity in labial and coronal feature organisation in Figure 8 and Figure 9 below:

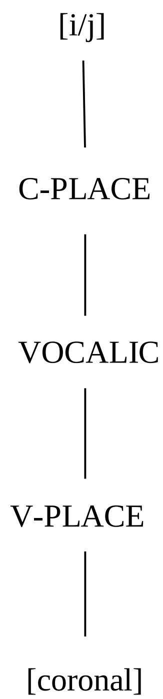


Figure 8: Coronal vowel and corresponding glide feature structure (Kadenge & Mudzingwa, 2014, p.147)

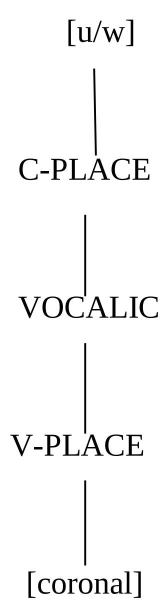


Figure 9: Labial vowel and corresponding glide feature structure (Kadenge & Mudzingwa, 2014, p. 147)

Figure 8 and Figure 9 above demonstrate the relationship between the high vowels and the corresponding glides [j] and [w]. The other coronal and labial vowels [e] and [o] have a similar structure, except the [open] feature absent in high vowels. These vowels usually behave similar to their [+high] counterparts in phonological analysis, except in processes that involve height sensitivity such as glide formation.

As noted in Section 4.1, vowel hiatus patterns in verbs select spreading if the dispreferred VV sequence occurs within the Macro Stem (MStem). One morphosyntactic context that triggers spreading in siSwati occurs in the formation of the past tense, where the SM is juxtaposed with the Past Tense Marker (PST), OM followed by the inflected verb. Consider the following examples that illustrate spreading in siSwati:

326. /ú-**á-í**-tséŋà/ → [wá.**jí**.tsé.ŋà]
CL1.SM-PST-CL4.OM-buy
's/he bought it'

327. /ú-**á-ú**-tséŋà/ → [wá.**wú**.tsé.ŋà]
CL1.SM-PST-CL3.OM-buy
's/he bought it'

328. /ú-**á-í**-ó^{ŋ}gà/ → [wá.**j**ó.^{ŋ}gà]
CL1.SM-PST-CL3.OM-save
'she saved it'

329. /ú-**á-ú**-ó^{ŋ}gà/ → [wá.**w**ó.^{ŋ}gà]
CL3.SM-PST-CL4.OM-save
'she saved it'

330. /ú-**á-ú**-e^{n}ta/ → [wa.**w**e.^{n}ta]
CL1.SM-PST-CL1.OM-made
'she made them'

331. /í-**á-í**-e^{n}ta/ → [ja.**j**e.^{n}ta]
CL3.SM-PST-CL1.OM-made

'it made it'

The above data in (326) to (331) represent hiatus resolution within the MStem in verbs. In each case, V_2 has spread its place features onto the epenthetic site, resulting in a corresponding glide. Note that the first sequence of vowels /u/ and /a/ are repaired through glide formation since the configuration occurs within the INFL Stem and not the MStem.

SiSwati grammar selects spreading in the formation of negation where the OM is juxtaposed with the inflected verb and negation markers. I illustrate this configuration in the examples below:

332. /à-ŋí-k**à-í-**tsats-i/ → [à.ŋí.kà.**jí.**tsà.tsí]
NEG-1st Pers-TAM-CL4.OM-take-FV
'I did not take it'

333. /à-ŋí-k**à-ú-**p^hèk-í/ → [à.ŋí.kà.**wú.**p^hè.kí]
NEG-1stPers-TAM-CL1.OM-cook-FV
'I did not cook it'

In the above data, the dispreferred VV sequences are eliminated through spreading, each vowel having spread its features to the epenthetic site, resulting in a corresponding glide. For instance, the coronal vowel /i/ in (332) has spread its features onto the left edge, resulting in the formation of the corresponding glide [j]. This output glide is subsequently parsed as the onset of the onsetless vowel in the sequence, therefore eliminating the dispreferred hiatus configuration.

In OT, UNIQUE militates against the spreading of features between segments. Previous research on loanword nativisation and hiatus resolution consider UNIQUE as one of the constraints that play a pivotal role in determining phonotactic well-formedness related to dispreferred VV sequences. This constraint prohibits the spreading of V-PLACE features from neighbouring labial and coronal vowels to the input segment. For instance, Mudzingwa (2010) and Kadenge (2012) use UNIQUE to necessitate the spreading of said features across segments, making it a low-ranking constraint in their grammar as optimal candidates invariably spread their features onto epenthetic segments to satisfy structural requirements. In this thesis, UNIQUE ranks low to allow the surface representation of corresponding glides absent in the underlying representation. I define this constraint in (334) below:

334. UNIQUE

∀x, where x is a feature or class node, x must have a unique segmental anchor y.

(Mudzingwa, 201, p. 134; Kadenge & Chebanne, 2017, p.151)

In siSwati grammar, this faithfulness constraint guards against the parsing of output glides that are not present in the underlying representation. I demonstrate this constraint interaction in Tableau 7 below:

Tableau 7: Spreading in siSwati

/ ú-**á**-**ù**-tséŋà/	ONSET	ANCHOR-L	MAX-IO(RT)	UNIQUE
a. w**á.ù**.tsé.ŋà	*!			
b. wú.**wù**.tsé.ŋà		*!		*
c. /w**á.**tsé.ŋà/			*!	
☞d. /w**á.wù.**tsé.ŋà/				*

In Tableau 7, candidate (a) has parsed a VV sequence, diphthong, and long vowel, in fatal violation of ONSET, a high-ranking constraints in the grammar. ANCHOR-L protects V_1 from deletion and eliminates candidate (b) as a potential winner. Deleting V_1 in contexts that do not violate OCP and $*C^j$ is less optimal in siSwati grammar. Deleting one of the root vowels in the MStem is prohibited, hence the elimination of candidate (c) as a possible winner, for its fatal violation of MAX-IO(RT). Even though candidate (d) violates UNIQUE, a low-ranking constraint, it surfaces as the winner since spreading is optimal within the MStem. At the PStem boundary, spreading trumps deletion and coalescence[8].

Ndebele resolves a sequence involving three vowels by applying at least two of the hiatus repair strategies discussed in the previous sections (Sibanda, 2009). Sibanda argues that in each VVV

[8] Phonologically, [a+u] → [o] but this representation is contingent upon the morphological domain in which the dispreferred sequence occurs. For instance, [a+u] sequence within the PStem triggers spreading, while the same configuration triggers coalescence if it occurs post-lexically. I discuss vowel coalescence in detail under Section 4.6 of this dissertation.

configuration, the isiNdebele grammar selects glide formation (analysed as either glide formation or secondary articulation in this thesis), vowel deletion, or coalescence to eliminate the dispreferred sequence of vowels. In each instance, the goal is to parse a monophthong in the surface representation despite the three input vowels. Worth noting is that Sibanda does not consider the morphological context in his analysis, but focuses on hiatus resolution from a purely phonological perspective. I illustrate the analysis that Sibanda (2009, p. 46) adopts in (335) and (336) below:

335. /lu-a-enza/ → [$\mathbf{l^w}$**a**-enza] → [l^w**e.**^{n}za
CL11.SM-REMPAST-do-FV
'it did it'

336. /si-a-ona/ → [**sa**-ona] → [s**o**.na]
CL7.SM- REMPAST-do-FV
'it did it'

Between the underlying representation and the surface forms in (335), there are two repair strategies triggered. First, to eliminate the /u/ and /a/ sequence, the grammar selects glide formation, resulting in a secondary articulated [l^w]. Secondly, the grammar eliminates the second sequence consisting of /a/ and /e/ through deleting V_1, in this case vowel /a/. The grammar has opted to preserve the stem vowel in the deletion process. In (336) the grammar first selects deletion to avoid a prohibited *C^j segment, and further deletes [a] to preserve the stem vowel. In each of the above examples, isiNdebele grammar triggers different repair strategies to eliminate the VVV sequence.

In this study, I adopt a different analysis from the one Sibanda proposes. I demonstrate that in cases where there are three or more vowels within the dispreferred sequence, the siSwati grammar selects a repair strategy based on the morphological context in which the dispreferred sequence occurs. As already highlighted, the morphological structure of the verb conditions strategy selection, with glide formation, secondary articulation, and vowel deletion selected within the INFL Stem while spreading is selected within the MStem. Consider the following examples:

337. /lú-á-í-ákhà/ → [$\mathbf{l^w}$á.**jà**.k^hà]
CL11.SM-REMPAST-CL9.OM-build
'it built it'

338. /lú-á-ú-ákhà/ → [**l**ʷá.**w**à.kʰà]
CL11.SM-REMPAST-CL1.OM-build
'it built it'

In examples (337) and (338), the grammar selects secondary articulation in the first VV sequence since it occurs within the INFL Stem, but triggers spreading to eliminate the second sequence, since it appears within the MStem. In OT terms, siSwati grammar ranks UNIQUE low across all configurations to allow the surface representation of corresponding glides.

This siSwati constraint ranking patterns with chiShona another Bantu language that triggers spreading within the MStem domain. According to Kadenge and Mudzingwa (2011), if the VV sequence occurs across the PStem, chiShona grammar selects spreading. Consider the following chiShona examples (Kadenge & Simango, 2014, p. 112, 115):

339. /í-á-èndà/ → [já.**j**è.ⁿdà]
CL9SM-PAST-go-TV
'it went'

340. /tu-a-iᵐb-a/ → [tʷa.ji.ᵐb-a]
CL13SM-PAST-it-sing-FV
'they sang'

Similar to siSwati grammar, the first VV sequence is resyllabified through glide formation, due to its occurrence within the INFL Stem domain. The second VV sequence in the configuration is resyllabified though spreading as it appears within the MStem, respectively. In these instances, a similar ranking obtains where UNIQUE ranks low to allow the surface representation of an output corresponding glide. Spreading in Shona therefore assumes ONSET, NLV, NODIPH, ANCHOR-L >> MAX-IO(RT) >> UNIQUE to allow surface forms with glides [j] and [w]. I formalise this ranking below:

Tableau 8: Spreading in Shona

/í-á-èndà/	ONSET	NLV	N_OD_{IPH}	ANCHOR-L	UNIQUE
a. já.è.ndà	*!				
b. jáè.ndà			*!		
c. jáè:.ndà		*!			*
d. jè.ndà				*!	*
☞e. já.**j**è.ⁿdà					*

Vowel hiatus resolution in Shona patterns with siSwati in that it prohibits word-medial onsetless vowels, diphthongs, and long vowels in the output. ONSET, NLV and N_OD_{IPH}, therefore eliminate candidates (a), (b) and (c) as possible output forms. In this analysis, V_1 deletion is less optimal, hence the elimination of candidate (d). Candidate (e) incurs a non-fatal UNIQUE violation, and surfaces as the optimal output form. Ranking UNIQUE low enables chiShona grammar to apply spreading by rightfully parsing the coronal [j] in the output.

Unlike siSwati, chiShona, and the other Nguni languages, ciNsenga grammar presents variation in Bantu hiatus resolution patterns. Kadenge and Simango (2014) note that ciNsenga grammar tolerates hiatus resolution in a context where the other Bantu languages select spreading. Even though the language patterns with siSwati, isiNdebele, and chiShona in hiatus resolution through glide formation, secondary articulation, and vowel epenthesis within the INFL Stem, ciNsenga blocks spreading within the MStem. Kadenge and Simango adopt ALIGN ($ROOT_{VERB}$, L, σ, L), an alignment constraint whose responsibility within ciNsenga grammar is twofold:

i. It ensures that the left edge of the verb root is aligned with the left edge of the syllable.
ii. It blocks the grammar from selecting any hiatus resolution strategy that would create a potential mismatch on the syllable restrictions of the grammar.

I illustrate this variation below (Kadenge & Simango, 2014, p. 121):

341. /si-u-ka-ni-on-a/ → [su.ka.n**i.o**.na] ***su.ka.ni.*****wo*****.na***
NEG-SM-FUT-OM-see-FV
'you (sg) will not see me'

342. /si-u-ka-ni-uʒ-a/ → [su.ka.n**i.u**.ʒa] **su.ka.ni.****wu****.ʒa*
NEG-SM-FUT-OM-tell-FV
'you (sg) will not tell me'

343. /u-a-ni-it-a/ → [wa.n**i.i.**ta] **wa.ni.****ji****.ta*
CL1.SM-PAST-OM-tell-FV
'you called me'

As the above examples indicate, spreading in ciNsenga is not optimal. To align with the current discussion, I assume an indomitable ranking of UNIQUE and ALIGN-PStem in ciNsenga to block spreading in surface representations. This means that for output forms to appear with heterosyllabic word-medial, onsetless vowels within the MStem, as seen in (343) to (345) above, ciNsenga would have to adopt ALIGN(ROOT$_{VERB}$, L, σ, L), UNIQUE >> ALIGN-PStem to block spreading, and to further ban the other repair strategies that the grammar adopts in other morphosyntactic contexts. Note that (341) has triggered vowel deletion and (343) has triggered glide formation in the first VV sequences since they appear within the INFL Stem, a domain that permits their selection. This variation in the selection of diagnostic tools, attest to the variation that exists across Bantu languages. It also points to the importance of avoiding generalisations when applying OT constraints within a set group of related languages such as Bantu, particularly because some languages trigger hiatus resolution across all contexts, while others enforce a partial ban.

Spreading has indicated that for siSwati grammar to select spreading, UNIQUE must rank low, necessitating the surface realisation of glides [j] and [w], respectively. For each of the output forms, labial and coronal vowels predictably select corresponding glides [j] and [w], aligning the analysis on spreading with the expected grammar I assume for siSwati. The next section of the dissertation discusses vowel coalescence as one of the repair strategies that siSwati selects to eliminate VV sequences. In environments that require the fusion of the two vowels, the phonological and morphological contexts make it impossible for the other hiatus resolution strategies to occur. While glide formation, secondary formation, and spreading occur within the PWord, coalescence is a post-lexical phenomenon. In the following sections, I discuss the various morphosyntactic contexts in which vowel coalescence occurs in siSwati. I then provide a formal OT analysis of the factorial representations on constraint ranking in coalescence as an optimal resolution strategy. I end the section with a summary of the overall discussion on vowel hiatus patterns in siSwati.

4.6 Vowel coalescence in siSwati

Vowel coalescence, sometimes referred to as fusion, is the merging of two distinct vowels to form one monophthongal vowel with features of both input vowels. Casali (2011) proposes that coalescence is when a [-high] vowel merges with a [+high] to form a third vowel that is [-high] and has qualities of the second vowel in the sequence. On the same distribution, other scholars note that coalescence takes place when V_1 is consistently low vowel [a], and the V_2 position is occupied by high vowels /i/ and /u/ (Mudzingwa 2010; Kadenge & Chebanne, 2017).

Vowel coalescence patterns are typologically similar in most Bantu languages. Sabao (2015) notes that coalescence effects in Ndebele are twofold: a) the two input vowels merge to form a new vowel that retains some qualities of both input vowels, and b) two simple and identical vowels merge into a single, but similar monophthongal vowel. On the vowel quality of the output vowel, Mudzingwa & Kadenge (2014) add that V_1 contributes its height feature and V_2 its place features, resulting in an output vowel that is a [-low] labial if V_2 is labial, but [-low] coronal, if the input vowel is coronal. I summarise these patterns as follows (Harford, 1997, p. 70; Casali, 2011, p. 6; Sibanda, 2009, Mudzingwa, 2010, p. 185; p. 39; Sabao, 2015, p. 127):

344.	/a + a/	→	[a]
345.	/a + i/	→	[e]
346.	/a + u/	→	[o]

Even though configurations in which the order of the vowels is reversed are not subject to coalescence, there are languages such as Foodo (spoken in Ghana), where the reverse distribution is resolved through coalescence (Casali, 2011). However, this reverse coalescence is not attested in siSwati, and will not form part of the current discussion.

Previous literature on Nguni languages proposes a morphological context in which various grammars opt for coalescence to resolve dispreferred hiatus configurations (Harford, 1997; Mudzingwa, 2010, 2013; Sabao, 2012, 2015). For instance, Sabao proposes that isiNdebele resolves dispreferred VV sequences through coalescence at lexical word boundaries in nominals, especially when the function word combining with the noun is a preposition. Harford (1997) adds that cliticisation triggers coalescence in chiShona. She notes that when an independent morpheme attaches to a PWords as a clitic, the grammar creates a rich morphological context for coalescence to take place. Mudzingwa (2010) observes that coalescence is the preferred diagnostic tool in eliminating post-lexical VV sequences. He concludes that the morphological domain is vital in determining the optimal repair strategy across various lexical and post-lexical levels.

Given the above phonological and morphological contexts, I turn to coalescence in siSwati. I begin my analysis with how siSwati grammar eliminates dispreferred VV sequences in the formation of the associative pronoun.

4.6.1 Vowel coalescence in associative pronouns

The first morphosyntactic context that provides evidence for coalescence as a diagnostic tool is in the juxtaposition of formative /là-/ with the NOUN in the formation of the associative pronoun. In each instance, clitic /là-/ combines with augment-initial nouns. Consider the following examples:

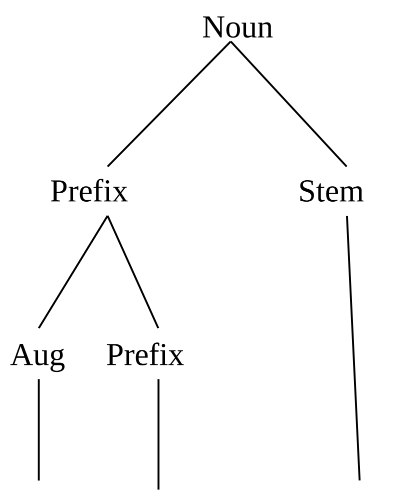
Table 11: The formation of associative: Noun classes with overt augments

	CLASS	INPUT	OUTPUT	COALESCENCE
347.	1	/là-**ú**-mù-ntfù/ ASSOC-AUG.CL1-person ‘the person’	[lò.mù.^{n}tfù]	**/a + u/ → [o]**
348.	3	/ là-**ú**-mù-t´i/ ASSOC-AUG.CL3-homestead ‘the homestead’	[lò.mù.t´í]	**/a + u/ → [o]**
349.	4	/ là-**í**-mì-t´í/ ASSOC-AUG.CL1- ‘homesteads’	[lè.mìt´í]	**/a + i/ → [e]**
350.	6	/là-**é**-mà-^{n}tí/ ASSOC-AUG.CL6-water	[là.mà^{n}tí]	**/a + e/ → [a]**

		‘the water’		
351.	9	/là-**í**-N-dʒà/ ASSOC-AUG.CL1-dog ‘the dog’	[lè.ⁿdʒà]	**/a + i/ → [e]**

The above data indicates that noun classes with an overt preprefix trigger coalescence by merging the formative vowel /a/ with the augment, giving rise to a fused third vowel with features of both.

On the issue of the clitic and PWord juxtaposition, Bantuists have noted that languages without an overt augment still trigger coalescence. This ‘anomaly’ is attributed to the existence of a ‘ghost augment’ (Harford, 1997; Mudzingwa, 2010; Mudzingwa & Kadenge, 2013; Kadenge, 2015) which accounts for the occurrence of unpredictable output vowels in classes without an overt augment. Note that in classes where the pre-prefix is visible, the formative /la/ merges with the pre-prefix to form the surface vowel as per the dictates of the coalescence process. In examples without an overt augment preceding the noun class prefix, scholars agree that various Bantu grammars lean on vowels that are no longer in existence, but may have been part of the noun class system diachronically. They agree that the noun class system consists of an overt pre-prefix, an onsetless vowel occurring before the noun class prefix, a common phenomenon in Bantu and Nguni morphology (Harford, 1997; Liphola, 2001; Sibanda, 2009; Mudzingwa, 2010; Harford & Malambe, 2011; Mudzingwa & Kadenge, 2013; Kadenge, 2015; Sabao, 2015). The isiZulu, isiNdebele, and isiXhosa grammars have maintained the pre-prefix across all noun classes; even in those in which siSwati has lost the initial vowel. Sibanda and Mabuza (1996), Harford and Malambe (2011), Mudzingwa and Kadenge (2013) as well as Kadenge (2015) note that siSwati grammar has a mixed system of noun classes, where only classes 1, 3, 4, 6, and 9 appear with the pre-prefix. I present a revised nominal structure of all the augment classes in Figure 10 below:



Class 1 /u	mu	ntfu/	[ú.mù.^{n}tfù]	'person'
Class 3 /u	mu	ti/	[ú.mù.tí]	'homestead'
Class 6 /e	ma	nti/	[é.mà.^{n}tí]	'water'
Class 9 /i	N	komo/	[í.$^{\text{ŋ}}$kó.mò]	'cow'

Figure 10: The augment in the siSwati noun class system

In chiShona (Harford, 1997; Mudzingwa & Kadenge, 2013; Kadenge, 2015), the augment has since been lost in all noun classes but has been argued to resurface in vowel coalescence. Harford (1997) notes that the ghost augment is a copy of the existing vowels in each noun class prefix that functions as a coalescence trigger. In the other Nguni languages, coalescence occurs without triggering any extinct vowels, as augments still exist across all noun class prefixes. As evidence for the relevance of the augment in siSwati, I assume that the now extinct augment in consonant-initial noun class prefixes, merges with low vowel [a] to form a third vowel, which is monophthongal, in line with the siSwati vocalic system. I illustrate this disparity in Table 11 below (I have enclosed the augment within brackets ()).

Table 12: The formation of associative pronouns: Noun classes without overt augments

	CLASS	INPUT	OUTPUT	COALESCENCE
352.	2	/là-**(a)**-ɓá-ntfù/ ASSOC-(AUG)-CL2-people 'the people'	[là.ɓá.^{n}tfù]	**/a + a/ → [a]**
		/là-**(i)**-lí-ɓálà/		

353.	5	ASSOC-AUG-CL5-yard 'the yard'	[lè.lí.ɓá.là]	**/a + i/ → [e]**
354.	7	/là-**(i)**-sí-fò/ ASSOC-(AUG)-CL1-disease 'the disease'	[lè.sí.fò]	**/a + i/ → [e]**
355.	8	/là-**(i)**-tí-fò/ ASSOC-(AUG)-CL8-diseases 'the diseases'	[lè.tí.fò]	**/a + i/ → [e]**
356.	10	/là-**(i**)tí-N-dʒà/ ASSOC-(AUG)-CL10-dog 'the dog'	[lè.tí.ⁿdʒà]	**/a + i/ → [e]**
357.	11	/là-**(u)**lù-fá/ ASSOC-(AUG)-CL11-things 'the crack'	[lò.lù.fá]	**/a + i/ → [e]**
358.	14	/là-**(u)**-ɓú-ɬè/ ASSOC-(AUG)-CL14-beauty 'the beauty'	[lò.ɓú.ɬé]	**/a + u/ → [o]**
359.	15	/là-**(u)**-kú-ɮà/ ASSOC-(AUG)-CL15-food 'the food'	[lò.kú.ɮà]	**/a + u/ → [o]**

The data illustrates that vowel /a/ in V_1 position coalesce with the different ghost augments in V_2 position to form a distinct third vowel. Note, however, that /a/ + /a/ results in an identical vowel. Also worth noting is that each ghost augment is a copy of the existing noun prefix vowel (Harford, 1997).

4.6.2 Vowel coalescence in adjective concords

A similar representation as the one discussed in associate pronouns above persists for coalescence in adjective concords. In the formation of adjectives, the grammar combines the adjective formative [la] with the noun class prefix and the adjectival stem. In each case, the final vowel of the formative morpheme merges with the pre-prefix of the noun class prefix, creating a hiatus configuration. Noun classes in which the preprefix is not overt, coalescence triggers the resurfacing of the now extinct augment. I illustrate this realisation of output forms in noun classes without augments below:

Table 13: The formation of the adjective concord: Noun classes without overt augments

	CLASS	INPUT	OUTPUT	COALESCENCE
360.	2	/lá-(**a**)-ɓá-ɬè/ ADJ-(AUG)-CL2-beautiful 'the beautiful ones'	[l**á**.ɓá.ɬè]	**/a + a/ → [a]**
361.	5	/lá-**(i)**-lí-kʰùlù/ ADJ-(AUG)-CL5-big 'the big one'	[l**é**.lí.kʰù.lù]	**/a + i/ → [e]**
362.	7	/lá-**(i)**-ɓí/ ADJ-(AUG)-CL1-ugly 'the ugly one'	[l**é**.lì.ɓí]	**/a + i/ → [e]**
363.	8	/lá-**(i)**-tí-ɬè/ ADJ-(AUG)-CL8-beautiful 'the beautiful ones'	[l**é**.tí.ɬè]	**/a + i/ → [e]**
364.	10	/lá-**(i)**t**í**-N-dʒè/ ADJ-(AUG)-CL10-tall 'the tall ones'	[lé.tí.ⁿdʒè]	**/a + i/ → [e]**
365.	11	/lá-**(u)**-lú-dʒè/ ADJ-(AUG)-CL11-tall 'the tall one'	[ló.lú.dʒè]	**/a + u/ → [o]**
366.	14	/lá-**(u)**-ɓú-ɬè/ ADJ-(AUG)-CL14-beautiful 'beautiful'	[ló.ɓú.ɬè]	**/a + u/ → [o]**
367.	15	/lá-**(u)**-kú-ⁿǀánè/ ADJ-(AUG)-CL15-small	[ló.kú.ⁿǀá.nè]	**/a + u/ → [o]**

		'the small one'		

The above data illustrates coalescence in the formation of the subject concord. Note that the clitic vowel /a/ combines with the ghost augment to form V_3, as expected. In each case, the grammar eliminates dispreferred VV sequences through coalescence.

In siSwati, any output form that merges two input vowels violates UNIFORMITY-IO, a faithfulness constraint that bans coalescence (Kager, 1999). I define the constraint below:

368. UNIFORMITY-IO (UNIF-IO)
No element in the output has multiple correspondents in the input.
(Kager, 1999; p. 77)

Even though the phonological context could trigger spreading, the morphological domain dictates that UNIQUE must outrank UNIFORMITY-IO to block any feature spreading. While the vowel distribution triggers either spreading or coalescence, the morphological context determines the optimal diagnostic tool in each context. For instance, when the low vowel [a] juxtaposes with the [+high] vowels within the MStem, siSwati grammar triggers spreading. Post-lexically, the grammar selects coalescence, therefore, ranking UNIQUE >> UNIFORMITY-IO. I formalise this constraint interaction in Tableau 9 below:

Tableau 9: Coalescence in siSwati

/lá-**ú**-mù-ntfù/	ONSET	NODIPH	MAX-IO(RT)	UNIQUE	UNIF-IO
a. láú.mù.ntfù		*!			
b. lá.ú.mù.ntfù	*!				
☞ c. ló.mù.^{n}tfù					*
d. l**á**.mù.^{n}tfù			*!		
e. lá.wú.mù.^{n}tfù				*!	

The structural constraints ONSET and NODIPH rule out candidates (a) and (b) for parsing a diphthong and an onsetless word-medial vowel in the output. MAX-IO(RT), a faithfulness constraint that blocks V_2 deletion, eliminates candidate (d). The morphological context in which the dispreferred VV sequence occurs selects the optimal candidate between (c) and (e). As highlighted earlier, the juxtaposition of [a] and [u] yields varied results depending on the morphological context in which they occur. If they appear within the MStem, the grammar selects spreading. If post-lexical, the grammar triggers vowel coalescence. UNIQUE bans candidate (e) from becoming the optimal candidate since it appears within the MStem. Despite violating UNIF-IO, candidate (c) surfaces as the winner. [ló.mù.ntfù], which appears post-lexically and has parsed a merged vowel [o] in the output form, is optimal.

Mudzingwa's (2010, 2013) analysis of VV sequences indicates that Zezuru and Karanga exhibit similar coalescence patterns to siSwati. Where the dispreferred sequence is a combination of a clitic and a PWord, and the vowel distribution is a low V_1 followed a [+high] V_2, the Shona dialects trigger coalescence. Consider the following examples (Mudzingwa, 2010, p. 182):

369. /sà-ìní/ → [s**é**ní]
ASSOC.-1SG PRON
'like the me'

370. /sà-ù-jú/ → [s**ó**jú]
ASSOC-STAB-CL1.SG-PRON.AFFIX
'like the him/her'

In each of the above examples, the dispreferred, post-lexical VV sequence is resolved through merging. As expected, the low vowel /a/ in V_1 position is fused with high vowels /i/ and /u/ in V_2 position, resulting in vowels [e] and [o] in the output. Similar to siSwati, the same vowel distribution within the PStem triggers spreading, not coalescence. This means that the two dialects adopt the same ranking where UNIQUE outranks UNIF-IO to block spreading across the PWord, but allow the merging of the input vowels. Mudzingwa's analysis confirms the importance of the morphological domain in vowel hiatus resolution patterns in Bantu.

4.7 Summary of the chapter

In this chapter, I have demonstrated that hiatus resolution patterns underpin the phonology and morphology interface. I have highlighted how siSwati grammar phonologically bans word-medial onsetless syllables across all hiatus resolution strategies. The selection of optimal repair strategies is, however, context-dependent: VV sequences within the INFL Stem trigger glide formation, secondary articulation, and vowel deletion, while spreading operates within the MStem. The grammar selects coalescence if the dispreferred VV sequence occurs post-lexically. The analysis also demonstrated how siSwati and other Bantu languages rank ONSET, NLV, and NoDiph as indomitable constraints that block the surface representation of word-medial onsetless syllables, long vowels, and diphthongs. Dissimilar Bantu languages such as Luganda, Kisa, and Cilubà with contrastive vowel length, parse long vowels in the output. I also demonstrated how siSwati grammar enforces conformity to the CV syllable template by ensuring that all surface forms parse onsetful syllables, except word-initially. Ranking constraints such as $\text{COMPLEX}^{\text{ONSET}}$ >> SecArtic eliminates complex clusters through secondary articulation, ensuring that output consonants occupy a single C-Slot. The discussion and analysis herein ensure that all surface vowels are monophthongs.

I further demonstrated how languages such as ciNsenga display variation in the elimination of VV sequences. Where other languages permit spreading at the MStem level, ciNsenga adopts resyllabification through heterosyllabification to allow the surface representation of word-medial onsetless syllables. Note that ciNsenga grammar bans such output forms within the INFL Stem. This variation points to the importance of the morphology and phonology interface in phonological analysis. In Chapter 5, I discuss /mu/ reduction as a phonological phenomenon that tackles NC syllabification effects across various morphosyntactic contexts in siSwati.

CHAPTER 5

/mu/ REDUCTION AND ITS EFFECTS

5.1 Introduction

/mu/ reduction is a phonological phenomenon attested in various Bantu languages (See Poulos & Msimang, 1998; Liphola, 2001; Harford & Malambe, 2015; Kadenge, 2015; Odden, 2015; Kadenge & Chebanne, 2017; Downing & Mtenje, 2017), amongst others. In these languages, the Class 1 and 3 prefix is obligatorily reduced in polysyllabic nominal and verbal stems, but is sometimes retained before monosyllabic ones. For instance, Cope (1984, p, 84) notes that isiZulu uses 'the full of the prefix' with monosyllabic stems, while the shortened version is used with polysyllabic stems. The application of this phonological phenomenon is conditioned by minimality restrictions imposed on the PWord. The variation in /mu/ reduction is demonstrated in the surface realisation of the resultant Nasal and Consonant (NC) sequence, whereby languages demonstrate varied syllabic effects.

Typological research on /mu/ truncation and the subsequent syllabification of output NCs in Bantu has demonstrated the representation of the resultant nasal as a) a complex segment that shares the same place features with the following consonant, b) a syllabic and moraic segment c) a syllabic but non-moraic segment, and d) a sequence that undergoes post-nasal hardening (see Khumalo, 1985; Kadenge, 2015; Odden, 2015; Kadenge, 2015; Kadenge & Chebanne, 2017; Persohn, 2019). These degrees of variation across Bantu languages may either mirror or be dissimilar to how each language syllabifies non-derived sequences in the grammar.

This chapter provides a detailed descriptive and theoretical analysis of /mu/ reduction and its syllabification effects in siSwati. I argue that the syllabification of the output NC sequence is driven by the interaction of various markedness constraints in the grammar of the language. In avoidance of output codas and the surface realisation of NCs as branching onsets, which are both marked syllable structures in siSwati, I demonstrate that the resultant nasal appears as a non-moraic syllabic nasal instead of the generic ^{N}C segment attested in non-derived contexts. As already discussed, syllables in siSwati must conform to the preferred CV syllable template in which the C-Slot may be occupied by any simple consonant as well as labialised (C^{w}) and prenasalised (^{N}C)

consonants regarded as complex, but unitary segments. In this section, I demonstrate that, in addition to the V-Slot being occupied by a simple vowel in the language, it can also be filled by the syllabic labial nasal [m̩] derived from /mu/ reduction. The chapter therefore presents evidence in support of the different representations of segments that form part of the CV template in siSwati, in alignment with the goals of the dissertation. I end the discussion by summarising the /mu/ reduction syllabification effects in siSwati and other Bantu languages.

The chapter begins by discussing aspects of siSwati morphosyntax that exhibit the disparate realisations of Nasal Consonant sequences (NCs) and their syllabification effects across various morphosyntactic domains in the language. Secondly, I consider the different non-derived and derived environments with a discussion of the siSwati NC distribution and syllabication thereof. I further provide evidence for the different syllabification effects triggered by /mu/ reduction in other Bantu languages. Lastly, the chapter presents a formal OT analysis of NC syllabification in siSwati and attempts a typological analysis of /mu/ reduction in other Bantu languages under discussion.

5.2 Previous accounts of /mu/ reduction in siSwati

In this discussion, I examine /mu/ contraction in the Classes 1 and 3 prefix, as well as their corresponding Object Markers (OM) across various morphosyntactic contexts in siSwati grammar. The morpheme can appear with Classes 1 and 3 nominal stems, verbs, adjectives, as well as other morphemes across the grammar. In each instance, /mu/ is contracted if the nominal or verb stem is two syllables or more.

Previous research on high vowel elision and /mu/ reduction in siSwati presupposes the existence of coda nasals in the syllabification of the resultant NC (Harford & Malambe, 2011; Kadenge, 2015). Harford and Malambe (2011) provide evidence of how nasal noun classes (1, 3, 4 and 9) typically appear with a pre-prefix, while other classes have since omitted it. As a result of the obligatory high vowel /u/ deletion in Classes 1 and 3, the nasal occurs immediately adjacent to the consonant it precedes. They propose that the nasal emanating from /mu/ truncation is not syllabified with the following consonant, but belongs to a separate syllable where it appears as a coda of the pre-prefix as illustrated in (371) to (375) below (Harford & Malambe, 2011, p. 9):

371. u***m***.fati "woman"

372. u***m***.fula "river"

373. i***m***.fula "rivers"

374. i***n***.tfombi "girl"

As evident in the above examples, the nasal [m] appears as a coda of the pre-prefixes /u/ and /i/, as per Harford and Malambe's analysis. Their argument builds on the contentious syllabification of NCs in Bantu (See Bell, 1970; Kula, 2002; Downing, 2005; Mudzingwa, 2010; Kadenge, 2015), among others, with one school of thought viewing them as a unitary segment while others regard them as heterosyllabic. Their argument is based on the inability of the vowel before the NC to undergo vowel lengthening to compensate for the lost nasal mora in cases of prenasalisation. Kadenge (2015) follows on the above discussion by assuming a non-assimilatory, non-syllabic specification of the nasal in siSwati compared to the isiZulu non-assimilatory but syllabic nasal in isiZulu. He, following Malambe and Harford, opts for coda specification where the siSwati resultant nasal is syllabified as a coda of the previous vowel [VN.C] as opposed to the isiZulu [V^{N}C].

In contrast to these previous studies, I propose that the resultant NC must conform to the siSwati CV syllable structure. As already discussed, the siSwati preferred prosodic structure is CV and as such militates against complex constructions such as branching onsets and codas. In this dissertation, I argue against cluster realisation and coda specification of the NC in siSwati. Further, I present that the application of this morpho-phonological process depends on the size of the PStem it attaches to. If monosyllabic, the stem is considered sub-minimal; therefore /mu/ reduction is blocked. However, if the stem is two or more syllables, it is considered well-formed hence creating a conducive environment for /mu/ contraction to occur. This application and blocking of /mu/ reduction in Bantu is conditioned by the disyllabic minimality requirement on the PWord, a condition that applies in siSwati. I revisit the discussion on word minimality in Chapter 7.

I further demonstrate the disparity between derived and non-derived NC sequences attested in siSwati. I contend that there are two phonological representations of NCs, depending on the morphology and phonology involved. If the NC occurs in monomorphemic, non-derived contexts, it is realised as a prenasalised segment. I demonstrate that in this instance, the NCs are homorganic in that they share the same place of articulation with the following consonant, and function as non-branching onsets. On the other hand, the nasal in NC contexts derived from a phonological process referred to as /mu/ reduction, is realised as syllabic and non-homorganic. The chapter, therefore, explores the two arguments I advance for siSwati, where I demonstrate how /mu/ reduction applies in monomorphemic contexts and across morpheme boundaries. I further provide an OT account of the realisation of the two NCs across various morphosyntactic contexts.

Before I discuss the syllabification of NCs in siSwati, it is important to note that there are exceptions to this analysis. So far, I have highlighted the two ways in which siSwati NCs manifest themselves in phonological and morphological contexts. There is, however, an exception to this predictability: Class 9/10 nouns. Even though these are derived, since they appear across the prefix and nominal stem boundary, they do not conform to the syllabification criteria I present for NCs in derived contexts. Just like Classes 1 and 3, Classes 9/10 are considered nasal classes because of the nasal in their class prefix. Consider the examples in Table 14 below:

Table 14: The syllabification of Class 9/10 derived NCs

	CLASS 9	**CLASS 10**
375.	/íN-fene/ → [í.^{m}fé.nè] CL9-baboon ‘baboon’	/tíN-fénè/ → [tí.^{m}fé.nè] CL10-baboon ‘baboons’
376.	/íN-bùt´í/ → [í.^{m}bù.t´í] CL9-goat ‘goats’	/tíN-bùtí/ → [tí. ^{m}bù.tí] CL10-goat ‘goats’
377.	/íN-ʤà/ → [í.^{n}ʤà] CL9-dog ‘dog’	/tíN-ʤa/ → [tí.^{n}ʤà] CL10-dog ‘dogs’
378.	/íN-déŋàné/ → [í.^{n}dé.ŋà.né] CL9-soft porridge ‘bowl of soft porridge’	/tíN-déŋàné/ → [tí. ^{n}dé.ŋà.né] CL10-soft porridge ‘bowls of soft porridge’
379.	/íN-k^{h}áɓà/ → [í.^{ŋ}k^{h}á.ɓà] CL9-belly button ‘belly button’	/tíN-kháɓà/ → [tí.^{ŋ}k^{h}á.ɓà] CL10-belly button ‘belly buttons’
380.	/íN-gùɓò/ → [í.^{ŋ}gù.ɓò] CL9-blanket/dress	/tíN-gùɓò/ → [tí.^{ŋ}gùɓò] CL10-blanket/dress

	'blanket/dress'	'blankets/dresses'

Table 14 demonstrates that the archiphoneme /N/ in the nominal class 9/10 input does not have its place of articulation but shares the same place of articulation with the following consonant. As evident, the archiphoneme is parsed as [m] before labials, [n] before coronals and [ŋ] before dorsals. This argument places NCs in Classes 9 and 10 outside of the predictable pattern for derived NCs discussed in this study. Even though Class 9/10 NCs appear across morphemes, their derivative nature is morphological rather than phonological, hence are parsed as homorganic and prenasalised unitary segments rather than syllabic and non-assimilatory, as expected of derived NCs. However, /mu/ truncated NCs come about as a phonological phenomenon. This exception is another reason why it is important to consider morphology in phonological analysis. The following section examines /mu-/ reduction as a source of NCs.

5.3 /mu/ reduction in siSwati and other Bantu languages

This section highlights some of the morphosyntactic categories in which the Class 1 and 3 /mu/ prefix is reduced. I begin with nouns from the said classes.

5.3.1 Nominal Classes 1 and 3

The first morphological process that demonstrates /mu/ contraction in Class 1 and 3 nouns with more than one syllable as seen in (381) to (390) below:

381. /úmù-ʃánà/ → [ú.**m̩**.ʃá.nà]
CL1-niece/nephew
'niece/nephew'

382. /úmù-fát´ì/ → [ú.**m̩**.fá.t´ì]
CL1-wife
'wife'

383. /úmù-fánà/ → [ú.**m̩**.fá.nà]
CL1-boy
'boy'

384. /úmù- fú^{n}dzì/ → [ú.**m̩**.fú.^{n}dzì]
CL1-learner

‘learner’

385. /úmù-fú^{n}dìsì/ → [ú.**ṃ**.fú.^{n}dì.sì]
CL1-pastor
‘pastor’

386. /úmù-ɲáŋò/ → [ú.**ṃ**.ɲá.ŋò]
CL3-door
‘door’

387. /úmù-séɓé^{n}t´ì/ → [ú.**ṃ**.sé.ɓé.^{n}t´ì]
CL3-work
‘work’

388. /úmù-sèlè/ → [ú.**ṃ**.sè.lè]
CL3-ditch
‘ditch’

389. /úmù-gódzì/ → [ú.**ṃ**.gó.dzì]
CL3-pit
‘pit’

390. /úmù-tsàɲélò/ → [ú.**ṃ**.tsà.ɲé.lò]
CL3-broom
‘broom’

The data in (381) to (390) present the effects of /mu/ truncation in Classes 1 and 3 nouns, where /mu/ prefixes occuring before polysyllabic nominal stems surface without vowel /u/ in the output. For instance, the Class 1 noun /úmù-ʃánà/ *‘niece/nephew’* in (381) is realised as [ú.**ṃ**.ʃa.na], where the resultant nasal syllabifies as a syllabic, non-assimilatory segment. As expected, the grammar does not enforce homorganicity on these NCs, displaying an ungrammatical construction *[u.***^{n}ʃ***a.na] that would be a result of enforced homorganicity in a phonologically derived context. The same nasal syllabification process is blocked in [ú.ṃ.fú.***^{n}dzì***], [u.ṃ.fu.***^{n}d***i**.**si] and [ú.ṃ.sé.ɓé.***^{n}t***´ì]. As expected, these do not appear as syllabic **n.dzi*, **n.di* and **n.ti* since they appear within the stem, which in this case is a non-derived environment. This indicates that parsing of the nasal as a syllabic segment in NC sequences is not automatic but is restricted to /mu/ contracted contexts; otherwise siSwati maintains homorganicity between the nasal and the following consonant. This disparity in syllabification is observed across other morphosyntactic contexts in the language.

5.3.2 /mu/ reduction in Classes 1 and 3 loanwords

Loanwords usually undergo phonetic and phonological adaptation into the adoptive language (Batibo, 1996). Even though I formally analyse the phonological adaptation of loanwords in siSwati in Chapter 6, it is important to mention how ‘personal’ and ‘impersonal’ nouns assigned into Classes 1 and 3 conform to the obligatory truncation of the class prefix /mu/ in polysyllabic stems. The examples in (391) to (395) below are an illustration of this truncation in polysyllabic loanwords.

391. /úmù-bàbàt´ísí/ → [ú.**m̩**. bà.bà.t´í.sí]
CL1-baptist
‘baptist’

392. /úmù-díkʰónì/ → [ú.**m̩**.díkʰó.nì]
CL1-deacon
‘deacon’

393. /úmù-bínì/ → [ú.**m̩**.bí.nì]
CL3-bin
‘bin’

394. /úmù- dòlí/ → [ú.**m̩**.dò.lí]
CL3-doll
‘doll’

395. /úmù-ʃínì/ → [u.**m̩**.ʃí.nì]
CL3-machine
‘machine’

The above examples demonstrate that loanwords behave similarly to Classes 1 and 3 indigenous nouns, whereby the application of the /mu/ reduction process gives rise to a non-assimilatory, syllabic nasal [m̩]. For example, ‘doll’ in (394) is realised as [u.m̩.do.li], with the resultant nasal becoming a syllabic, but non-homorganic [m̩] rather than a homorganic NC *[u.***ⁿdo***.li]. This is further evidence for the phonological integration of loanwords in conformity to the grammar of the language.

In isiZulu, a Nguni language alongside siSwati, isiNdebele and isiXhosa, Kadenge (2015) presents the phonological representation of the derived NC. He notes that in this language, the derived nasal surfaces as a syllabic but non-moraic segment as seen in the following isiZulu examples (Kadenge, 2015, p. 95). (396) and (397) are a representation of the realisation of isiZulu NCs as unitary, prenasalised segments in non-derived environments, while the sequence is parsed as the syllabic but non-moraic nasal in examples (398) and (399).

396. /umu-t^{h}akat^{h}i/ → [u.**m̩**.t^{h}a.ka.t^{h}i]
AUG-CL1-witch
'witch'

397. /umu-gidi/ → [u.**m̩**.gi.di]
AUG-CL1-party
'party'

398. /umu-ntu/ → [u.mu-**^{n}t**u]
AUG-CL1-person
'person'

399. /u-phondo/ → [u.p^{h}o-**^{n}d**o]
AUG-CL11-horn
'horn'

Based on the above examples, isiZulu clearly displays similarities with siSwati in its syllabification of both derived and non-derived NCs.

5.3.3 Truncation of Classes 1 and 3 OM in adjectives

I further present evidence of how high vowel /u/ in Class 1 and 3 object marker (OM), is elided. In the formation of qualifiers such as adjectives and relative pronouns, siSwati uses formative marker /la/ followed by the OM, plus the morpheme that signifies the qualifier (I discussed the merging of the vowels in Chapter 4 of this dissertation). Below, I look at how /mu/ is reduced in these grammatical categories; I use adjectives to illustrate /mu/ truncation in qualifiers:

400. /ló-mù-dvúnà/ → [lo.**m̩**.dvú.nà]
QUAL-CL1.OM-male
'the male one'

401. /lò-mù-síɠàt´í/ → [lò.**m̩**.sí.ɠà.t´í]
QUAL-CL1.OM-female
'the female one'

402. /lò-mù-kʰùlù/ → [lò.**m̩**.kʰù.lù]
QUAL-CL1/3.OM-big
'the big one'

403. /lò-mù-ᵑ|ánè/ → [lò.**m̩**.ᵑ|á.nè]
QUAL-CL1/3.OM-small
'the small one'

404. /lò-mù-dzálà/ → [lò.**m̩**.dzá.là]
QUAL-CL1/3.OM-old
'the old one'

The examples presented above demonstrate the truncation of OMs in the formation of adjectives. As indicated, these NCs display the same behaviour as the Classes 1 and 3 nominal prefixes where the resultant nasal is syllabified as syllabic and non-assimilatory, in line with the syllabification effects in /mu/ derived contexts.

In OT terms, the markedness constraint that enforces obligatory /mu/ elision is H^igh^V^owel^E^lision^(Harford & Malambe, 2015; Kadenge, 2015). This is the first indomitable constraint that necessitates the obligatory deletion of high vowel /u/ in Class 1 and 3 /mu/ prefix before polysyllabic stems. This markedness constraint militates against the parsing of high rounded vowels. Harford and Malambe (2011) provide contexts in which the deletion of high vowel /u/ is permitted. They propose that [u] only deletes if preceded by the labial nasal /m/, and appears within a non-prominent environment such as an unstressed syllable or in an affix. In such cases /mu/ contracts if it appears within the Class 1 and 3 prefix. H^igh^V^owel^E^lision^ further permits the truncation of high vowel /u/ if it appears in a morpheme (affix), appears in an unstressed syllable and is preceded by the nasal /m/. Any candidate that remains faithful to the input by parsing the high vowel /u/ violates this high ranking markedness constraint. Since the optimal candidate must delete the high vowel /u/, MAX-IO is violated. MAX-IO is a faithfulness constraint that militates against the elision of any segment in the input/output correspondence (Kager, 1999). It requires that all output forms be present in the input, which is not the case in /mu/ deletion. Furthermore, the resultant nasal is syllabified as a syllabic, non-assimilatory segment thus in violation of PEAK (Archangeli, 1997). According to Archangeli, this constraint requires that all syllables must have a vowel, a requirement that /mu/ truncation also violates.

In addition, changing the input form of the nasal in siSwati dictates the violation of IDENT-IO that enforces faithfulness to the specifications of input segments, in this case nasality (Kager, 1999; Brakovic, 2007). In this analysis, the IDENT constraint requires the underlying form of the nasal to assimilate its place of articulation and further surface as a prenasalised segment. This faithfulness constraint will be formalised as IDENT(^{PLACE}) to account for nasal assimilation in the syllabification of non-derived NCs. This constraint is low-ranking to account for the grammar on the syllabification of siSwati NCs in /mu/ derived contexts, since the resultant NC construction parses the output as a syllabic nasal rather than a unitary, prenasalised construction.

Further, the analysis accounts for cluster intolerance in siSwati. I include two syllable structure constrains - COMPLEX^{ONSET} and NoCoda - to account for syllabic well-formedness of the output candidates. COMPLEX^{ONSET} is a markedness constraint that restricts the existence of consonant sequences parsed as branching onsets (Kager, 1999; Kadenge, 2015). This would mean that even though /mu/ deletion is expected to yield a nasal and consonant sequence, these two segments can neither be parsed as a cluster [NC] nor a prenasalised segment [^{N}C]. Instead, the grammar should allow the resultant nasal to surface as syllabic and non-assimilatory. NoCoda comes into play to enforce open syllables (Archangeli, 1997). This means that parsing of the resultant nasal as the coda of the pre-prefix is also prohibited in siSwati.

The last markedness constraint in the grammar requires adjacent output segments to agree for a specific feature. In this analysis, I use AGREE(nasal) as proposed by Brakovic (2009), to ensure that the nasal and following consonant share the same place features. The ranking of this constraint will determine optimal output candidates between derived and non-derived NCs. /mu/ reduction in siSwati reveals how ranking AGREE(nasal) higher than IDENT$^{(PLACE)}$ forces the input nasal to surface as a homorganic and prenasalised segment, while re-ranking the constraints as IDENT(Place) >>> AGREE$^{(PLACE)}$ will suffice for phonologically derived environments where the output nasal remains faithful to the input since it does not assimilate. The two constraints assume a unidirectional progressive assimilation that changes the nasal place feature rather than the consonant it precedes. It also targets the nasal segment such that it surfaces as either homorganic or syllabic, with the assumption that the assimilation only occurs in non-derived contexts.

Below I present a summary of all the relevant constraints I consider in the analysis of NC syllabification in siSwati.

5.3.4 A summary of relevant constraints

405. HIGHVOWELELISION
Parsing of high rounded vowel is prohibited.
(Kadenge, 2015, p. 96)

406. COMPLEX^{ONSET}
Complex onsets are prohibited.
(Kager, 1997, p. 97; Kadenge, 2015, p. 97)

407. NoCoda
All syllables must end in a vowel.
(Archangeli, 1997, p. 8)

408. MAX-IO
Elision of segments is prohibited.
(Kager, 1999, p. 67)

409. IDENT$^{(PLACE)}$
Corresponding input and output segments have the same value of the feature *x*.
(Braković, 2007, p. 336)

410. AGREE (nasal)
Adjacent output segments have the same value of the feature x.
(Braković, 2007, p. 336)

411. PEAK
All syllables must have at least one vowel
(Archangeli, 1997, p. 8)

This constraint interaction can be schematically represented in Tableau 10 as follows:

Tableau 10: /mu/ reduction in siSwati nominals and verbs

/úmù-ʃánà/	$H^{igh}V^{owel}E^{lision}$	$COMPLEX^{ONS}$	NoCoda	$IDENT^{PLACE}$	$AGREE^{NASAL}$	MAX-IO	PEAK
a) ú.mú.ʃá.nà	*!						
☞b) u.m̩.ʃa.na					*	*	*
c) u.^{n}ʃa.na				*!		*	*
d) u.mʃa.na		*!				*	
e) um.ʃa.na			*!			*	

In the Tableau 10, candidate (a) is eliminated because it parses high vowel [u] that has to be obligatorily deleted in Classes 1 and 3. This candidate fatally violates $H^{igh}V^{owel}E^{lision}$, a high-ranking constraint. Candidate (c) does not surface as our ultimate winner since it assimilates and prenasalises the resultant nasal in a derived context, a representation that the grammar prohibits. Candidate (d) incurs a fatal violation of $COMPLEX^{ONSET}$, another high ranking constraint since siSwati prohibits cluster specification of the resultant NC sequence. The last candidate is ruled out because the resultant nasal surfaces as the coda of the pre-prefix, thus incurring a violation of the NoCoda constraint. Candidate (b) surfaces as the optimal winner since it satisfies $H^{igh}V^{owe}lE^{lision}$, $COMPLEX^{ONSET}$, and NoCoda, the indomitable constraints in the grammar on derived NC syllabification. This analysis indicates that in siSwati, $H^{igh}V^{owel}E^{lision}$, $COMPLEX^{ONSET}$, NoCoda, $IDENT^{(PLACE)}$ >>>> AGREE(nasal), MAX-IO, PEAK allows NCs in /mu/ reduction contexts to surface as syllabic, non-assimilatory [m̩] in the grammar. As evident in the above tableaux, another crucial ranking is that of PEAK which allows the resultant nasal to surface as a syllabic segment. In this grammar for derived contexts, PEAK is ranked low to allow the surface realisation of the non-homorganic syllabic nasal [m̩] in the optimal candidate in (b).

On the above constraint hierarchy, Kadenge (2015) argues for a NoCoda, $IDENT^{(PLACE)}$ >> AGREE(nasal), PEAK ranking in isiZulu to allow the parsing of the syllabic but non-moraic nasal [m̩]. Following Harford and Malambe's (2011) proposition on the surface NC in siSwati, he proposes that PEAK and $IDENT^{(PLACE)}$ outrank NoCoda and AGREE(nasal), allowing the surface representation of a coda. Crucially, the surface NCs are [V^{N}C] in isiZulu but [VN.C] in siSwati, a representation I dispute. This thesis highlights that siSwati and isiZulu adopt the same grammar to parse a non-assimilatory, syllabic nasal in the output.

Given the above formal discussion and analysis on /mu/ truncation patterns in derived contexts, the grammar for the non-assimilation of the derived nasal does not hold for input nasals in non-derived underlying forms since these are realised as unitary, prenasalised segments rather than the syllabic nasals in siSwati and isiZulu. This means that Nguni languages block the parsing of the output nasal as a syllabic segment if it occurs across morpheme boundaries – except Class 9/10 – thus enforcing homorganicity in line with how these languages syllabify NCs that occur without any derivative material. For instance, given /ɓú-ngàní/ '*friendship'* a Class 14 candidate, the high vowel /u/ of the prefix does not delete, therefore not violating $H^{igh}V^{owel}E^{lison}$, a markedness constraint only restricted to the Class 1 and 3 nominal prefix. The NC sequence /ɓú-**ng**àní/ is, on the contrary, represented as [bú.ᵑ**g**àní], in line with the syllabification of non-derived NC sequences in siSwati.

So far, the discussion has demonstrated how nasal sequences derived from /mu/ truncation are syllabified in siSwati. I have pointed out how siSwati parses the output of a /mu/ derived NC sequence as a non-assimilatory, non-moraic nasal [m̩], while NCs in non-derived contexts assimilate their place of articulation to that of the consonant they precede. I have noted that isiZulu typologically behaves similar to siSwati since they are both Nguni languages, highlighting the importance of typological classification and analysis of related languages in phonological analysis. The above discussion clearly displays that in siSwati and isiZulu grammar, $IDENT^{(PLACE)}$ outranks AGREE(nasal) and PEAK to allow the surface realisation of a syllabic nasal in /mu/ contracted contexts. This ranking also blocks the prenasalisation and homorganicity of the surface form in derived contexts. For the output candidate to surface as a syllabic and non-assimilatory segment, $IDENT^{(PLACE)}$ must outrank AGREE(nasal) and PEAK as illustrated in (412).

412. Derived contexts [m̩]: $IDENT^{(PLACE)}$ >>> AGREE(nasal), PEAK

For these reasons, NCs derived from /mu/ truncation would be schematically represented as (b) while those that occur in non-derived ones would appear as (a).

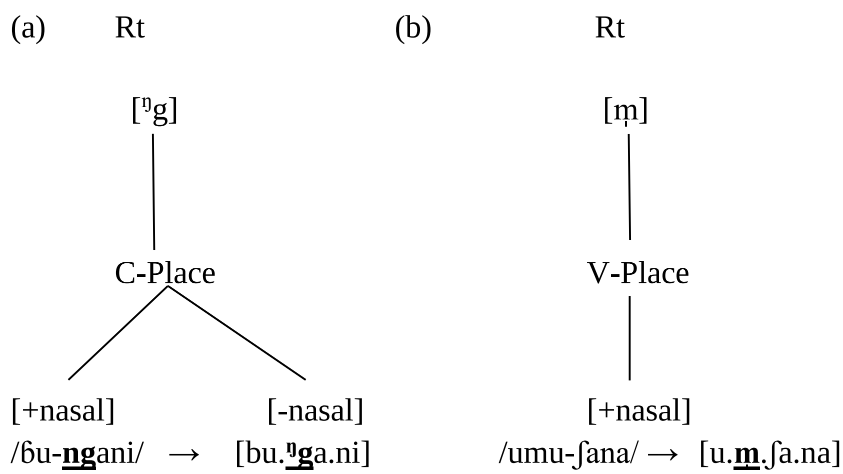


Figure 11: The representation of prenasalised NCs and syllabified nasals in siSwati

ChiNambya (Kadenge, 2015) presents slightly different effects on the syllabification of the NC sequence derived from /mu/ truncation. Unlike the disparity observed in the syllabification of derived and non-derived, chiNambya grammar makes no such distinction. The resultant nasal in chiNambya is not syllabic or moraic but homorganic with the consonant it precedes across all contexts. This means that chiNambya grammar only permits the occurrence of surface ^{N}Cs in contexts derived from the obligatory deletion of /mu/ as well as those that occur in the grammar without any derivative input. According to Kadenge (2015, p. 100), chiNambya realises its NC sequences as prenasalised segments in both derived and non-derived environments.

413. /ka-**^{m}b**o/
CL12-song
'song'

414. /tu-**^{m}b**o/
CL13-song
'short songs'

415. /u-mu-bali/ → [u.**^{m}b**a.li]
AUG-CL1-secretary'
'secretary'

416. /u-mu-sitʃana/ → [u.**^{n}s**i.tʃa.na]
AUG-CL1-girl
'girl'

417. /u-mu-kwe^{n}da/ → [u.^{ŋ}**k**^{w}e.^{n}da]
AUG-CL1-traveller
'traveller'

The above examples demonstrate that all chiNambya NCs are prenasalised, unitary segments whether they are non-derived as illustrated in (413) and (414) or an output of /mu/ truncation as indicated in (415) to (417). Tableau 11 below schematically represents the ranking of constraints for chiNambya homorganic and prenasalised NCs. In OT terms, chiNambya has a different ranking to that of siSwati and isiZulu, to account for the output prenasalised segments in /mu/ derived contexts.

Tableau 11: /mu/ reduction in chiNambya

/umu-bali/	H^{igh}V^{owel}E$^{l.}$	COMP^{ONS}	NoCoda	AGREE^{NASAL}	PEAK	IDENT PLACE	MAX-IO
a) u.mu.ba.li	*!					*	
b) u.mba.li		*!					*
c) um.ba.li			*!			*	*
☞ d) u.^{m}ba.li						*	*
e) u.m̩.ba.li					*!		*

Similar to isiZulu and siSwati, chiNambya prohibits syllable codas and the cluster realisation of the resultant NC, hence candidates (b) and (c) are non-optimal as they violate the two high ranking, constraints, COMPLE^{ONSET} and NoCoda. Similarly, parsing the high vowel [u] incurs a fatal violation of H^{igh}V^{owel}E^{lision}, another indomitable constraint. The grammar therefore eliminates candidate (a). However, unlike the two languages where the resultant nasal can surface as a syllabic, non-assimilatory [m̩], chiNambya prohibits syllabic nasals therefore necessitating the elimination of candidate (e) as a possible winner. The possible chiNambya grammar for both derived and non-derived contexts is AGREE(nasal), PEAK >>>> IDENT$^{(PLACE)}$. This language indicates that even though languages may typically undergo the same phonological processes, the syllabification effects, thereof are certainly different. For chiNambya, homorganicity outranks input faithfulness in derived NCs, allowing the surface realisation of derived NCs as ^{N}C rather than [m̩] attested in the two Nguni languages discussed herein.

Other Bantu languages such as Nyakyusa (Persohn, 2019) present a rich representation of the distribution and effects of /mu/ truncation. In his descriptive analysis of Nyakyusa /mu/ reduction, Persohn notes that the application of this process is phonologically and morphologically conditioned, with the resultant nasal syllabic and assimilatory in Classes 1 and 3. This is in contrast with the non-assimilatory nasal in siSwati and isiZulu. Consider the following examples (Persohn, 2019, p. 196):

418. /ʊ-mu-pa:pi/ → [ʊ.**m̩**.pa:.pi]
AUG-CL1-parent
'parent'

419. /ʊ-mu-ta:ni/ → [ʊ.**n̩**.ta:.ni]
AUG-CL1-cross-cousin
'cross cousin'

420. /ʊ-mu-ɟololo/ → [ʊ.**ɲ̩**.ɟo.lo.lo]
AUG-CL3-chain/prison
'chain/prison'

421. /ʊ-mu-kino/ → [ʊ.**ŋ̩**.ki.no]
AUG-CL3-game
'game'

The examples above illustrating the parsing of the output nasal as a syllabic and homorganic segment whose place of articulation is conditioned by the following consonant. After the obligatory elision of /u/, the input nasal /m/ is realised as [m̩] before labials, [n̩] before alveolars, [ɲ̩] before palatals, and [ŋ̩] before dorsals, respectively. Tableau 12 is an illustration of the different ranking of the constraint hierarchy applied in siSwati, isiZulu and chiNambya.

Tableau 12: /mu/ reduction in Nyakyusa

/ʊmu-kino/	HighVowelEl	COMPLEX ONS	NoCoda	AGREE NASAL	MAX-IO	IDENT PLACE	PEAK
a) ʊ.mu.ki.no	*!						
☞b) ʊ.ŋ̩.ki.no					*	*	*
c) ʊ.mki.no		*!		*	*		
d) ʊm.ki.no			*!	*	*		
e) ʊ.m.ki.no				*!	*		*

Similar to the other Bantu languages discussed in this chapter, the resultant NC in Nyakyusa cannot surface as either a cluster or coda. This means that candidates (c) and (d) are eliminated for their violation of COMPLEX^{ONSET} and NoCoda. Candidate (a) is eliminated for parsing the high vowel [u] in violation of H^{igh}V^{owe}lE^{lision}. Candidate (e) fatally violates AGREE$^{(NASAL)}$, a high-ranking constraint militating against non-assimilatory surface nasals. Simialr to siSwati and isiZulu, the construction where the NC derived from /mu/ truncation surfaces as a non-assimilatory but syllabic segment, is not a possible winner in Nyakyusa. Candidate [ʊ.ŋ̩.ki.no] in (b) surfaces as the optimal winner since it realises the resultant nasal as a syllabic segment. The only difference is that the nasal assimilates its place features, only violating the low-ranking constraint PEAK. Evidently, this new ranking indicates that· Nyakyusa is typologically different from siSwati, isiZulu and chiNambya. Based on the optimal candidate, we assume that its constraint ranking would therefore be AGREE(nasal), >>>> IDENT$^{(PLACE)}$, PEAK since Nyakyusa grammar allows the resultant nasal to assimilate but not change its input form.

IKalanga displays similar /mu/ reduction syllabification effects as Nyakyusa (Kadenge & Chebanne, 2017). In iKalanga, homorganicity outranks faithfulness to the input nasal to allow the surface realisation of a syllabic segment that shares the same place of articulation as the following consonant. The variation comes through the moraic nature of the surface form. Kadenge and Chebanne (2017) note that since the input Class 1 and 3 high vowel bears tone, the output syllabic nasal in iKalanga is parsed as a tone bearing unit. This becomes possible through the retention of the tone of the input vowel which then attaches to the syllabic segment, one that is non-moraic in the input. Kadenge and Chebanne (2017, p. 183) illustrate these syllabification effects in the examples below:

422. /mù - búsì/ → [m̩̀.bú.sì]
CL1-ruler
'ruler'

423. /mù - lúmè/ → [ǹ̩.lú.mè]
CL1-man
'man'

424. /mù - tshìbhà/ → [ɲ̩̀.tshì.bhà]
CL3-neck
'neck'

425. /mù - kádzì/ → [ŋ̩̀.ká.dzì]
CL3-woman
'woman'

The examples above indicate that the resultant nasal in iKalanga is syllabic, homorganic and tone bearing, a syllabic effect that is different from Nyakyusa where the nasal is syllabic, homorganic but non-moraic.

The different realisations of the resultant NCs in the Bantu languages discussed herein provide evidence that even though languages have access to the same constraints; the interaction of these constraints gives rise to different grammars motivated by what is considered syllabic well-formedness in each language. As already mentioned, OT is built on the premise that languages have access to the same set of universal constraints but that these constraints are ranked differently depending on the permissible syllable structures in individual grammars. In /mu/ reduction, the different rankings of IDENT$^{(PLACE),}$ AGREE(nasal) and PEAK indicate the typological similarities and differences in the languages discussed in this dissertation. A summary of these rankings is presented in Table 14 below:

Table 14: The ranking of NC syllabification constraints in Bantu /mu/ reduction

SISWATI:	IDENT$^{(PLACE)}$	must outrank	AGREE(nasal), PEAK
ISIZULU:	IDENT$^{(PLACE)}$	must outrank	AGREE(nasal), PEAK
CHINAMBYA:	AGREE(nasal), PEAK	must outrank	IDENT$^{(PLACE)}$
NYAKYUSA:	AGREE(nasal)	must outrank	IDENT$^{(PLACE)}$, PEAK
IKALANGA:	AGREE(nasal)	must outrank	IDENT$^{(PLACE)}$, PEAK

Another effect of NC syllabification as a result of /mu/ truncation exhibited by some Bantu languages is post-nasal hardening. In this case, there is the co-occurrence of regressive and progressive assimilation effects on nasal and adjacent consonants. The resultant nasal first assimilates to the place of articulation of the next consonant, and then if the stem is l-initial (as seen in chiNambya and Nyakyusa) the approximant is hardened to a 'stronger' counterpart which is usually a [d] (Kadenge, 2015; Persohn, 2019). The labial fricative [v] has been argued to demonstrate similar hardening effects, whereby it becomes the 'stronger' labial counterpart [b] as a consequence of /mu/ truncation in Shimakonde. This phenomenon is exemplified in chiNambya (426) to (427) as illustrated in Kadenge (2015, p. 102), Nyakyusa (428) to (429) as illustrated in Persohn (2019, p. 197), as well as Shimakonde (Liphola, 2001) in (430) to (431) below:

Chinambya

426. /umu-lapa/ → [u.**ⁿd**a.pi] **u^{n}lapi*
AUG-CL1-heal
'healer'

427. /umu-limi/ → [u.**ⁿd**i.mi] **u^{n}limi*
AUG-CL1-farm
'farmer'

Nyakyusa

428. /mu-li-ino/ → [**n̩**.di:.no] **n̩.li:mo*
CL18-CL5-tooth
'in tooth'

429. /mu-lʊ-isi/ → [**ṇ**.dwɪ:si] * *ṇ.lwisi*
CL18-CL7-pit
'pit'

Shimakonde

430. /va-nku-ngú-vini:la/ → [va.nkú.ṃ.bi.ni:.la] 'they are dancing for me'

431. /va-nku-ngú-vale:ka/ → [va.nku.ṃ.ba.le:ka] 'they are holding on to me as a baby'

As evident in the above examples, the chiNambya and Nyakyusa trigger post-nasal approximant strengthening of stem initial /l/ to the perceived stronger counterpart [d], while Shimakonde further triggers v-hardening to labial [b] as illustrated in (430) and (431).

Even though post-nasal approximant hardening seems to be prevalent in other languages, it is not attested in siSwati and other Bantu languages such as isiZulu and iKalanga. For instance, Nguni languages do not exhibit consonant hardening as a /mu/ reduction. Note that where chiNambya and Nyakyusa realise their post-nasal approximants as [d], siSwati (432) to (437) and isiZulu (438) to (439) block this hardening effect as illustrated below.

432. /úmù-língànì/ → [ú.**ṃ**.lí.ŋà.nì] **u.ṃ.di.ŋa.ni*
CL1-agemate
'agemate/colleague'

433. /úmù-líɓátísì/ → [ú.**ṃ**.lí.ɓá.tí.sì] **[u.ṃ.di.ɓa.ti.si]*
CL1-companion
'companion'

434. /úmù -lámùlí/ → [ú.**ṃ**.lá.mù.lí] **[u.ṃ.da.mu.li]*
CL1-mediator
'mediator'

435. /úmù-lómò/ → [ú.**ṃ**.ló.mò] **u.ṃ.do.mo*
CL3-mouth
'mouth'

436. /úmù-lílò/ → [ú.**ṃ**.lí.lò] **u.ṃ.di.lo*
CL3-fire
'fire'

437.	/úmù -lótsà/ CL3-ash ‘ash’	→	[ú.**ṃ**.ló.tsà]	**u.ṃ.do.tsa*
438.	/úmù-límí/ CL1-farm ‘farmer’	→	[ú.**ṃ**.lí.mí]	**u.ṃ.dimi*
439.	/ úmù-lùngù/ CL1-white person ‘white person’	→	[ú.**ṃ**.lù.ŋù]	**u.ṃ.duŋu*

As evident in the examples from siSwati and isiZulu, post-nasal hardening is not attested, hence the banning of forms that appear with hardening effects on the output NC in both languages. As previously noted, the target for /mu/ reduction in Bantu languages is to satisfy the high-ranking constraint on the Class 1 and 3 prefix in Bantu. In essence the target is the same, but the syllabification effects are different across various Bantu languages. This analysis proves how dissimilar siSwati and isiZulu grammars are from the other Bantu languages discussed so far. The consonant hardening exhibited in chiNambya, Nyakyusa, and Shimakonde, as well as the assimilation of the output nasal in iKalanga and Nyakyusa point to the restrictions imposed on the syllable templates of individual grammars, thereby contributing to linguistic typology.

5.4 /mu/ truncation in siSwati reduplicated forms

The final evidence I present for /mu/ contraction I discuss in this study shows the realisation of NCs in siSwati reduplicated verbs. As discussed in Downing (1997) and Malambe (2006), well-formed PWords in siSwati reduplication copy the first two syllables of the verb stem (440) to (444) while the monosyllabic verb stems in (445) to (447) rely on augmentation through epenthesis to enforce restrictions on the binarity of a reduplicant.

Disyllabic stems

440.	/tsátsà/	→	[tsatsa – tsatsa]	‘take a little bit!’
441.	/ɓútà/	→	[ɓuta – ɓuta]	‘ask a little bit!’
442.	/gézà/	→	[geza – geza]	‘bath a little bit!’
443.	/phéɠâ/	→	[pheɠa – pheɠa]	‘cook a little bit’

Monosyllabic stems

444.	/fá/	→	[fá – ji – fà]	'die a little a bit'
445.	/ʒá/	→	[ʒá – ji – ʒà]	'eat a little bit'
446.	/p^há/	→	[p^há – ji – p^hà]	'give a little bit'
447.	/l^wá/	→	[l^wá – ji – l^wà]	'fight a little bit'

The examples in (440) to (443) are disyllabic and thus copy both syllables of the verb in line with the requirements of the reduplication process. The monosyllabic input verbs in (444) to (447) require augmentation through [ji] epenthesis to satisfy binarity restrictions on the siSwati reduplicant.

In the morphosyntactic structure of the Bantu verb (Kula, 2002; Mudzingwa, 2010; Mudzingwa & Kadenge, 2014; Downing & Mtenje, 2017), the Macro Stem (MStem) consists of the OM and other derivational markers including the inflected verb stem. Even though both the OM and the verb stem form part of the MStem in the hierarchical structure of the verb, the target for the reduplication process is only the verb stem, and not the OM and other affixes contained therein. For this reason, the OM is placed outside of the target for reduplication as illustrated the examples below. The examples consist of the OM and the verb stem.

448. /mù-^{m}bóɲà/ → [m̩.^{m}boɲa-^{m}boɲe]
CL1.OM-cover
'cover him/her a little bit!'

449. /mù-^{m}pí^{m}bà/ → [m̩.^{m}pi^{m}ba-^{m}pi^{m}be]
CL1.OM-snitch
'snitch on him/her a little bit!'

450. /mù-mémà/ → [m̩.mema-meme]
CL1-invite
'invite him/her a little bit

451. /mù-tsátsà/ → [m̩.tsatsa-tsatse]
CL1.OM-carry
'carry him/her a little bit!'

452. /mù-gézé/ → [m̩.geza-geze]

CL1.OM-bathe
'bathe him/her a little bit!'

453. /mù-níkà/ → [m̩.nika-nike]
CL1.OM.give
'give him/her a little bit'

The above examples illustrate the target for verb reduplication in siSwati. They demonstrate that the syllabic nasal is parsed outside the bare stem and is subsequently not reduplicated as the first syllable of the verb. For instance, /mù-tsátsà/ in (451) is realised as [**m̩.**tsatsa-tsatse] and not prenasalised *[^{n}**tsa**tsa-tsatse]* or even the syllabic version *[**m̩.tsa**-**m̩**tsatse]* where the first two syllables of the construction are reduplicated. This is evidence that the nasal does not constitute the same syllable with the following consonant, but belongs to a separate syllable that does not participate in the reduplication process. In addition, this provides evidence that the target for reduplication is the bare stem and not the whole [OM-verb stem] construction.

5.5 Summary of the chapter

In Chapter 5, I have discussed the effects of /mu/ reduction in siSwati and other Bantu languages. The chapter has specifically demonstrated the contrast in NC syllabification in siSwati, explaining how this is conditioned by the interaction between phonology and morphology, whereupon if the sequence occurs in phonologically derived contexts, the nasal is realised as the syllabic but non-moraic segment [m̩]. However, if it occurs in a non-derived context, it is homorganic with the consonant that follows, and is parsed as a prenasalised, unitary segment [^{N}C]. This representation also holds for isiZulu, a sister language to siSwati. Furthermore, other languages represent their resultant NCs differently, with chiNambya triggering homorganicity in all contexts while Nyakyusa has the assimilatory, syllabic nasal in /mu/ truncated forms but prenasalised segments in non-derived environments. Ikalanga also displayed disparate syllabic effects where the output homorganic nasal appears as syllabic and tone-bearing. This cross-linguistic dispensation of the syllabification of the NC indicates that, even though languages are susceptible to the same phonological processes, the phonological effects are typologically different. The discussion in Chapter 6 harmonises with the goals of the dissertation in that it provides evidence for the interaction between phonology and morphology in phonological analysis. It further highlights the segments that can occupy the C-Slot and the V-Slot in various languages, to account for conformity to the Bantu CV syllable template. The table below provides a summary of the /mu/ reduction effects in the languages discussed in this Chapter.

Table 15: A summary of /mu/ truncation effects in some Bantu languages

	Syllabicity	Prenasalisation	Assimilation	Post-nasal hardening	Moraicity
SiSwati	✓	x	x	x	X
IsiZulu	✓	x	x	x	X
ChiNambya	X	✓	✓	✓	X
Nyakyusa	✓	x	✓	✓	X
IKalanga	✓	x	✓	x	✓

CHAPTER 6

SISWATI LOANWORD PHONOLOGY

6.1 Introduction

One common phenomenon amongst languages is interlanguage borrowing through which recipient languages increase their lexical inventories (Khumalo, 1984; Koopman, 1992; Batibo, 1996; Chang, 2003; Uffmann, 2006; Lin, 2009; Kang, 2011; Ban & Matovac, 2012; Mahlangu, 2014). Different languages, however, have individual grammars enforced by the phonotactic requirements of each language. Because of these various phonotactic constraints, crosslinguistically, loanwords introduce dispreferred syllable structures such as consonant clusters, syllable codas, and diphthongs, elements that are usually prohibited in recipient Bantu languages.

In loanword phonology, the introduction of dispreferred constructions inherited from donor languages requires adaptation to the syllable restrictions of the recipient languages to harmonise the input syllable structures with the phonological systems of the recipient languages. Like many Bantu languages, siSwati has borrowed extensively from foreign languages such as English and Afrikaans. This study is focused on loanwords borrowed from the English language.

Cross-language borrowing, particularly across completely dissimilar phonological systems, maps the importance of investigating loanword adaptation patterns and subsequent effects on the syllable structure of recipient languages with restrictive syllable structures. One such effect is that of recipient languages incorporating foreign segments into their vowel and consonant inventory as a result of borrowing. For example, [r] is not native to any of the Nguni languages, but it has since been adopted into the Nguni consonant system (Khumalo, 1984; Koopman, 1992; Sibanda & Mthembu, 1996; Malambe, 2006).

The current study highlights the typological similarities and differences exhibited by siSwati in loanword adaptation. The chapter explores the various harmonisation patterns that the language adopts to ensure that all output forms align with the siSwati syllable template. As already discussed and demonstrated in previous chapters, the siSwati grammar allows the following syllable types:

a) [CV]
b) [^{N}CV]
c) [C^{w}V]
d) [^{N}C^{w}V]
e) [m̩]

Each of the above syllable forms occupies a single C-Slot; there are no vowel or consonant clusters. In siSwati, all syllables must align with the CV syllable template, with C-Slots that permit simple and complex consonants such as C^{w}s and ^{N}Cs. The goal in loanword adaptation in this dissertation is to ensure that the siSwati grammar parses onsetful PWords devoid of consonant clusters, syllable codas, and VV sequences. In my discussion, I therefore demonstrate how siSwati grammar eliminates dispreferred syllable structures from English, the source language, to harmonise with OT constraints on syllabic well-formedness, as per the goals of the dissertation.

This study situates siSwati within linguistic typology and loanword adaptation research by providing evidence for the rephonologisation of adoptives in harmony with the prosodic structure of the language. To this end, I draw insights from the discussions on Swahili (Mwita, 2009) and Tswana (Batibo, 1996) to establish the degree of relative similarities and differences on how Bantu languages harmonise loanwords to fit individual syllable templates. In my discussion, I first present the resolution strategies that siSwati employs to adapt the complex English syllable structure to its preferred CV syllable template. I consider feature change, vowel epenthesis, segment deletion, and spreading. I further provide an OT account of loanword nativisation in siSwati, highlighting the interaction between markedness and faithfulness constraints to attain optimal syllabic well-formedness. The chapter closes with an overall summary of the discussion.

6.2 Nativisation strategies in siSwati

In this section of the chapter, I present a detailed analysis of the various nativisation strategies that siSwati employs. I further present an OT analysis of the repair strategies that siSwati adopts in the nativisation of English adoptives.

6.2.1 Feature change

Feature change in loanword adaptation involves changing the feature of an underlying segment, provided the recipient language does not have that segment in its vowel and consonant inventory (Hyman, 1970; Picard, 2002; Rose & Demuth, 2006; Kadenge & Mudzingwa, 2011; Vratsanos, 2018). While siSwati has a simple, five vowel system, English, has a relatively complex and detailed vowel system with diphthongs and vowels that do not exist in the inventory of the receptor language. This disparity in the vowel inventory during the borrowing process and nativisation thereof requires adaptation of the English loans to fit the vowel and consonant inventory of siSwati, the receptor language. In this section of the dissertation, I first present the varied vowel systems of both siSwati and English. I further demonstrate the corresponding segments that input English vowels adapt into to harmonise with the siSwati vowel system. Lastly, I provide a constraint-based analysis of feature change in siSwati.

Table 17: The SiSwati vowel system (as presented in Chapter 3)

	Labial	**Coronal**	**Pharyngeal**
Mid	**[o]**	**[e]**	
High	**[u]**	**[i]**	
Low			**[a]**

Table 18: The English vowel system (Roach, 2009, p. 18)

VOWEL	**TRANSCRIPTION**	**GLOSS**
/i/	/ʃit/	‘sheet’
/ɪ//	/fɪlm/	‘film’
/æ/	/mæn/	‘man’
/ə/	/ætləs/	‘atlas’
/e/	/desk/	‘desk’
/ɜ:/	/nɜ:s/	‘nurse’
/ʊ/	/bʊk/	‘book’

/u/	/skul/	‘school’
/ɔ/	/fɔk/	‘fork’
/ɒ/	/bɒks/	‘box’
/ʌ/	/bʌs/	‘bus’
/ɑ/	/klɑs/	‘class’
/aɪ/	/paɪnt/	‘pint’
/eɪ/	/peɪnt/	‘paint’
/aʊ/	/haʊs/	‘house’
/əʊ/	/stəʊv/	‘stove’
/ɔɪ/	/pɔɪnt/	‘point’
/ɪə/	/θɪətə/	‘theatre’
/eə/	/feə(r)/	‘fair/
/ʊə/	/tʊə(r)	‘tour’

Compared to the simple five vowel system in siSwati, English evidently has a more complex system. In the feature change process, the grammar selects a receptor language vowel that is closely related to it in terms of articulation and perception (Khumalo, 1984; Lin, 2009; Kadenge, 2011; Kang, 2011). Table 18 below demonstrates the siSwati–English vowel correspondence in the adaptation process.

Table 19: SiSwati-English simple vowel correspondence

CHANGE	ENGLISH	SISWATI	GLOSS
[ʊ] → [u]	/b**ʊ**k/	[lí.b**ù.**ɠú]	‘book’
[ɔ] → [o]	**/ɔ**də/	[lí.ʔ**ò.**dá]	‘order’
[ɒ] → [o]	/d**ɒ**l/	[ú.m.d**ò.**lí]	‘doll’
[ə] → [a]	/bənɑn**ə/**	[bà.ná.nà]	‘banana’
[æ] → [a]	/b**æ**ŋk/	[lí.b**à.**ŋé]	‘bank’
[ʌ] → [a]	/b**ʌ**s/	[í.b**à.**sí]	‘bus’
[ɜ:] → [e]	/n**ɜ:**s/	[lí.n**è.**sí]	‘nurse’

[ɪ] → [i]	/p**ɪ**l/	[lí.p^{h}**í.**lì.sì]	‘pill’

Similar to the vowels, siSwati and English exhibit the same variation in their consonantal inventory. English has consonants that do not exist in the siSwati consonant inventory; these, therefore, are substituted with ones that siSwati has in its grammar. However, unlike vowels, consonant substitution is not that prevalent and consistent in the siSwati-English correspondence. Below are the few changes that I have observed in the data:

454.	/**tʃ**eɪndʒ/	→	[í.**ʃ**í.^{n}tj´ì]	‘change’	/tʃ/ → [ʃ]
455.	/wɒ**tʃ**/	→	[lí.wà.**ʃ**í]	‘watch’	/tʃ/ → [ʃ]
456.	/**θ**ɪətə/	→	[**t**´í.jè.t´ì]	‘theatre’	/θ/ → [t´]
457.	/**r**aɪs/	→	[lí.**l**á.jí.sí]	‘rice’	/r/ → [l]
458.	/lɒ**r**i/	→	[í.ló.**lì**]	‘lorry’	/r/ → [l]
459.	/gærɑ**ʒ**/	→	[lí.gà.lá.**dʒì**]	‘garage’	/r/ → [l]
460.	/ʌmb**r**elə/	→	[sá.^{m}bù.**lé**.lò]	‘umbrella’	/r/ → [l]
461.	/b**r**ʌʃ/	→	[lí.bù.**l**á.ʃí]	‘brush’	/r/ → [l]

The above examples show the consonantal changes that siSwati makes on English consonants. Note that /tʃ/ changes to [ʃ] in (454 and (455), /θ/ becomes [t´] in (456), and /r/ consistently becomes [l] in (453) through to (461). The examples in (462) to (464) below, on the other hand, present English words that have input /r/ that does not change to [l] as expected.

462.	/**r**ulə/	→	[í.**r**ú.là]	‘ruler’
463.	/**r**ʌbə/	→	[í.**r**à.bà]	‘rubber’
464.	/**r**ɪŋ/	→	[í.**r**í.ŋì]	‘ring’

The exception in /r/ change is consistent with loanword adaptation effects in other Nguni and other Bantu languages. Firstly, Khumalo (1984) observes that /r/ does not change into the corresponding liquid [l] which exists in the isiZulu sound inventory, but notes that the usage of the foreign sound is limited to nativised loanwords. Secondly, isiNdebele and isiXhosa exhibit similar /r/ effects, where lexical items containing the /r/ sound are incorporated into the lexicon as evidenced in dictionary entries and the increased usage of the sound in everyday speech (Drame, 2000; Ncube, 2005; Mahlangu, 2014).

In other Bantu languages, the inconsistency observed with various lexical items is due to their popularity (Batibo, 1996; Ncube, 2005; Mwita, 2009). Ncube (2005) highlights the increasing rate at which isiNdebele speakers use loanwords, noting that 'the probability usage of loan-words represents 85% of the isiNdebele lexicon (p. 302). Subsequently, loanwords, and in turn, their phonological structures, used consistently, are most likely to be accepted into the lexicon over native words used infrequently. Other scholars such as Chang (2003) attribute these adaptation issues to sociolinguistic factors such as the borrower's proficiency level in the input language. In all these languages, it is worth noting that incorporating the /r/ sound into the consonant inventory does not exempt it from its limited use – that of being a foreign segment. In all the Nguni languages, the sound still exclusively appears in borrowed words. These loanword adaptation effects point to the importance of incorporating crosslinguistic research in phonological analysis.

As already discussed, the English segmental inventory consists of vowels and consonants that are not attested in siSwati. To harmonise the input forms, the grammar uses OK(SEG. Initially designed as OK(σ) to prohibit dispreferred syllable structures in the output (Rose & Demuth, 2006) and simplified to OK(SEG) to block the parsing of dispreferred vowels and consonants in the output (Vratsanos, 2018), this markedness constraint militates against segment substitution. I define this constraint below:

465. OK(SEG)

Dispreferred segments from the source language must not be parsed in the nativised output forms.

(Rose & Demuth, 2006, p, 1123)

In order to eliminate dispreferred input segments, siSwati grammar employs IDENT-IO(F) (Kager, 1999). This faithfulness constraint militates against changing the identity of any of the input segments. I define this constraint below:

466. IDENT-IO(F)

Output segments must correspond with input segments.

(Kager, 1999, p. 205)

In siSwati adaptation grammar, markedness trumps faithfulness by ranking OK(SEG) over IDENT-IO(F). Tableau 13 below is a representation of how siSwati grammar substitutes /θ/ with /t/ to eliminate dispreferred segments.

Tableau 13: Feature change of /θ/ to /t/ in siSwati

/**θ**ɪətə/	OK(SEG)	IDENT-IO(F)
a. **θ**í.jè.t´ì	*!	
b. **t**´í.jè.t´ì		*

In Tableau 13, OK(SEG) eliminates candidate (a) for parsing [θ] in the output, a segment that is not attested in the siSwati grammar. Candidate (a) eliminates the dispreferred consonant through changing its IDENTITY, and subsequently surfaces as the winner. This aligns the output form with the siSwati consonantal inventory. In this regard, the elimination of marked structures trumps faithfulness to the input.

The next section of the study focuses on the different diagnostic tools that siSwati employs to harmonise English syllable structures with the siSwati syllable template. I begin my discussion and analysis with vowel epenthesis.

6.2.2 Vowel epenthesis

Uffmann (2006) defines vowel epenthesis as a phonological tool used by source languages with 'restrictive constraints on syllable structure' (p. 1080) to adapt input complex structures from donor languages with a less restrictive syllable template. He proposes that crosslinguistic epenthesis patterns involve three distinct phonological processes: vowel height harmony (VHH), onset feature assimilation, and default insertion. The quality of the epenthetic vowel is sometimes context-dependent, where adjacent segments influence the output (Uffmann; 2006; Rose & Demuth, 2006; Kyumin, 2009; Mwita, 2009; Mudzingwa, 2010; Mudzingwa & Kadenge, 2011; Kadenge, 2012; Repetti, 2012; Chebanne, Kadenge, & Phili, 2016). In such cases, the propensity of the epenthetic vowel is to either attain its place features from the consonant preceding it (onset feature assimilation) or assume the vowel height of other vowels within the same PWord (VHH).

While this phenomenon is not attested in siSwati, VHH is common in other Bantu languages such as chiShona (Uffmann, 2006; Kadenge, 2012), Sesotho (Rose & Demuth, 2006), and Setswana (Batibo, 1996). The two common vowel epenthesis strategies in siSwati are default insertion and onset feature assimilation.

Default insertion refers to epenthetic segments that are independent of the phonological context in which they occur. The default epenthetic vowel in siSwati is coronal vowel [i] because of its relatively salient features (Malambe, 2006; Sibanda & Mthembu, 1996). Kager (1999: 96) calls [i] an "obligatory epenthetic vowel" and this is evident crosslinguistically in languages such as Chichewa (Downing & Mtenje, 2017), chiShona (Uffman, 2006; Kadenge, 2012), Yoruba, Kikuyu, Samoan, and Fijian (Uffmann, 2006), and Sesotho (Rose & Demuth, 2006), amongst others. Most scholars argue that default insertion is the most common epenthesis pattern, with some languages selecting [i] as their default vowel while others such as Japanese select [u] (see Batibo, 1996; Rose & Demuth, 2006; Uffmann, 2006; Kyumin, 2009; Mwita, 2009; Kadenge, 2012; Repetti, 2012; Broselow, 2015).

Onset feature assimilation, on the other hand, is different. Crosslinguistic investigation of epenthesis patterns reveal that segment insertion is predictable, noting that vowel epenthesis is determined by the environment in which the insertion occurs, with coronals typically selecting front vowels /i/ and /e/, while labials select round vowels /u/ and /o/ (Uffmann; 2006; Kyumin, 2009; Mwita, 2009; Kadenge, 2012; Repetti, 2012). This is in line with Clements and Hume (1995) FG theory where place features of the preceding consonant spread onto the neighbouring segment, forcing it to assimilate its place features.

Dissimilarities in vowel epenthesis reveal that velar consonants do not trigger the same epenthesis effects. Downing and Mtenje (2017) assume a marked representation for dorsals in Chichewa; they note that velars do not form a natural class with any vowel in the Unified Feature Theory (Clements & Hume, 1995) the way labial consonants pattern with round vowels, and coronal consonants with front vowels, respectively. In dispreferred syllable structures involving dorsal consonants, Chichewa copies the preceding vowel, except when the preceding vowel is the pharyngeal /a/, which blocks VHH (Odden, 2015; Downing & Mtenje, 2017). The same analysis suffices for Sesotho where the velar consonants do not undergo onset feature assimilation; instead, dorsals employ VHH to eliminate VC and CCV syllable structures (Rose & Demuth, 2006; Kyumin, 2009). Kyumin (2009) argues for a similar specification for Korean, noting that velars select /ɯ/ rather than the default coronal segment /ɨ/ as their epenthetic vowel. All these epenthesis patterns involving velars reveal the disparity in vowel epenthesis patterns in Bantu and other languages.

Despite the varied effects in vowel epenthesis, the role of vowel epenthesis in loanword adaptation is twofold. First, it provides syllable nuclei for all coda consonants, and, secondly, it eliminates consonant clusters, ensuring that all output forms have open syllables. For cluster simplification and coda elimination, the siSwati grammar selects either default vowel epenthesis or onset feature assimilation. According to Malambe (2006, 2015) VHH is not attested in the language. Instead of harmony, Malambe argues that siSwati vowel copying is a result of co-articulation, not VHH. In this section, I investigate how the theory of epenthesis interacts with the siSwati syllable to ensure that all surface representations are structurally well-formed. I further demonstrate the disparate environments in which default insertion and onset feature assimilation occur. I begin my analysis with coda resyllabification.

6.2.2.1 Coda resyllabification in siSwati

Vowel epenthesis provides syllable nuclei to resyllabify syllable coda consonants as onsets. As already highlighted, the English syllable permits coda specification, whereas siSwati consists of open syllables. Consider the following siSwati examples that illustrate how the siSwati grammar uses both default insertion and onset feature assimilation to create output CV syllables:

467.	/ʃɜ**t/**	→	[lí.ʃè.tʰ**í**]	‘shirt’
468.	/wɒ**tʃ/**	→	[lí.wà.ʃ**í**]	‘watch’
469.	/kʰɑ**d**/	→	[li.kʰa.d**i**]	‘card’
470.	/geɪ**t**/	→	[lí.gé.d**è**]	‘gate’
471.	/dʒeɪ**l**/	→	[lí.ʤé.l**è**]	‘jail’
472.	/bæ**g**/	→	[bà.ɠ**í**]	‘bag’
473.	/sɪ**ŋk**/	→	[í.sí.**ᵑkí**]	‘sink’
474.	/dʒæ**m**/	→	[ʤá.m**ù**]	‘jam’
475.	/mæ**p**/	→	[í.mè.pʰ**ú**]	‘map’
476.	/slæ**b**/	→	[sí.lé.b**ú**]	‘slab’
477.	/kəʊ**m**/	→	[lí.k΄à.m**ò**]	‘comb’

In the examples above, English words have closed syllables that are prohibited in siSwati grammar. As discussed in previous chapters, siSwati grammar bars coda specification, and therefore employs default insertion as well as coronal and labial attraction to eliminate all codas.

As expected, the C_1VC_2 sequences are resyllabified through vowel epenthesis. Note that when C_2 is coronal, the grammar selects [i] or [e] as seen in the examples ending in /t/ /tʃ/, /d/, and /l/ in (467) to (471), respectively. But, in forms ending in labial consonants, the epenthetic segment is either [u] or [o] as seen in the forms ending in /m/, /p/, and /b/ in (474) to (477). However, the dorsal consonants /k/ and /g/ have selected the default [i] since velars do not share a natural class with any vowel in siSwati, a similar representation exhibited by other Bantu languages (Mudzingwa, 2010; Downing & Mtenje, 2017). For instance, *'bag'* in (472) is realised as [bàɠí] where the dorsal consonant /g/ has epenthesised the default epenthetic segment [i]. The same analysis applies for *'sink'* in (473) which is realised as [í.sí.^{ŋ}k**ì**], the word-final epenthetic [i] provides the nucleus to the coda. I summarise the effects of the interaction between coda resyllabification and vowel epenthesis in siSwati as follows:

Coda specification	**Vowel selection**	**Strategy**
Labial	[u] or [o]	labial attraction
Coronal	[i] or [e]	coronal selection
Dorsal	[i]	default insertion

As expected, labials pattern with round vowels, coronals with front vowels, while dorsals select default epenthesis since they do not form a natural class with any vowel in siSwati as per my analysis.

Note that the adapted forms in (467) to (477) appear with more epenthetic material than accounted for phonologically. In each instance, the siSwati output forms appear with a V or CV syllable that signals morphological adaptation of the English loans into respective classes within the siSwati noun class system. Numerous descriptive studies have presented the morphological and semantic adaptation of English loans into the siSwati grammar (See Ziervogel & Mabuza, 1976; Dlamini, 1979; Sibanda & Mthembu, 1996). For example, the [lí-] in [**lí**.ʃè.t^{h}í] in (467) is the Class 5 prefix.

Similarly, the [i] in [**í**.sí.ᵑkí] in (473) is the Class 9 prefix, respectively. Unless otherwise necessary, I do not discuss and analyse the morphological adaptation of English loanwords in this thesis.

The target for epenthesis in loanword phonology is to ensure that all output forms parse open syllables. To formalise vowel epenthesis in siSwati, I revisit constraints discussed in previous chapters. The first OT constraints I assume for loanword harmonisation with the siSwati CV syllable template is NoCoda. NoCoda is a markedness constraint that prohibits coda specification in output forms as it enforces open syllables (Archangeli, 1997). For this reason, an optimal output candidate should insert a vowel to open all closed syllables suggesting that any optimal candidate invariably violates DEP-IO (Kager, 1999), a faithfulness constraint that militates against segment epenthesis. This constraint stipulates that all segments that are present in the output must be present in the input. In siSwati loanword harmonisation optimal candidates that epenthesise vowels and glides incur a non-fatal DEP-IO violation.

In siSwati grammar, NoCoda trumps DEP-IO since codas are never optimal in this language. In previous chapters, I demonstrated how CVC output forms are never optimal in siSwati. In my analysis, I also include MAX-IO, a faithfulness constraint that militates against segment deletion (Kager, 1999). This is to indicate that the resyllabification grammar I propose for siSwati favours epenthesis over deletion. I illustrate this constraint interaction in Tableau 14 below:

Tableau 14: Coda resyllabification through vowel epenthesis in siSwati /ʃɜt/

/ʃɜt/	NoCoda	MAX-IO	DEP-IO
a) li.ʃet	*!		
☞b) li.ʃe.t<u>**i**</u>			*
c) li.ʃe		*!	

Tableau 14 demonstrates that codas are not tolerated in siSwati, hence candidate (a) is eliminated for its fatal violation of a high-ranking constraint, NoCoda. The grammar further eliminates candidate (c) for fatally deleting an input segment. This indicates that input faithfulness in this case is paramount, hence ranking MAX-IO higher than DEP-IO in the coda elimination process. Candidate (b) surfaces as our optimal output in that it satisfies siSwati structural requirements –

that of parsing CV syllables in the output. However, this is achieved through [i] epenthesis in violation of DEP-IO, which is a non-fatal violation.

Loanword adaptation patterns in Setswana reveal variation in the vowel epenthesis effects I observed in siSwati. Similar to other Bantu languages, this language is typically a CV type language where all syllables must conform to the canonical Bantu CV syllable template (Batibo, 1996). The only difference is that Setswana underlyingly permits syllabic consonants which are usually the sonorous nasals and liquids, making Setswana somewhat dissimilar to siSwati that only permits a derivative syllabic [m̩]. Consider the following examples (Batibo, 1996, p. 36):

478.	/rra/	→	[**r̩**.ra]	'father'
479.	/lla/	→	[**l̩**.la]	'cry'
480.	/mma/	→	[**m̩**.ma]	'mother'
481.	/nna/	→	[**n̩**.na]	'I/me'

The above examples illustrate how nasals and liquids can occupy the V-Slot in Tswana. For instance, [l̩.la] 'cry' in (479), the liquid [l] is parsed as a syllabic segment instead of being separated by a vowel to conform to the CV syllable template. This indicates that the language tolerates more sonorous segments compared to siSwati.

In loanword adaptation, Setswana adopts the same nativisation patterns; however, in addition to the two vowel insertion strategies that siSwati selects, Setswana also employs VHH, where the epenthetic vowel(s) copies qualities of one of the input vowels. Furthermore, Setswana statistically prefers VHH over onset feature assimilation and default insertion, with recorded cases of the former at 68% making VHH the primary repair strategy in Setswana (Batibo, 1996). Consider the following examples illustrating coda elimination in Setswana (Batibo 1996, p. 36):

482.	/fɔ**m**/	→	[fo.m**o**]	'form'
483.	/pɛ**n**/	→	[pe.n**e**]	'pen'
484.	/bʌ**s**/	→	[be.s**e**]	'bus'
485.	/hɔ**l**/	→	[ho.l**o**]	'hall'
486.	/fɔ**m**/	→	[fo.m**o**]	'form'
487.	/dʒæ**m**/	→	[dʒe.m**e**]	'jam'
488.	/wi**k**/	→	[be.k**e**]	'week'

The above examples demonstrate the vowel epenthesis pattern that Setswana adopts in its coda resyllabification process. The examples indicate that VHH is the default epenthetic strategy in Setswana since labial, coronal and dorsal consonants optimally select copying over onset feature assimilation. This is perfectly exemplified in how the coronal /s/ in (484), labial /m/ in (487), dorsal /k/ in (488) all copy vowel [e] regardless of the place features of the input consonant.

Just like siSwati, Setswana bans output codas. This means that NoCoda also ranks high in the Setswana grammar, while DEP-IO invariably ranks low since repair involves vowel insertion across all patterns. Tableau 15 below schematically presents Tswana constraint ranking in coda resyllabification:

Tableau 15: Coda resyllabification through vowel epenthesis in Setswana

/pɛn/	**NoCoda**	**MAX-IO**	**DEP-IO**
a) pen	*!		
☞b) pe.ne			*
c) pe		*!	

Similar to siSwati, Setswana prohibits coda specification thus eliminating candidates (a) violating NoCoda, an indomitable constraint. Candidate (c) is eliminated for its violation of MAX-IO, a faithfulness constraint that enforces faithfulness to the input. Optimally, the grammar inserts an epenthetic vowel to eliminate the input coda, thus allowing candidate (b) to surface as our optimal output form. DEP-IO therefore ranks low in the Setswana grammar on coda elimination. The elimination of consonant clusters is presented below.

6.2.2.2 Cluster simplification in siSwati

In addition to coda resyllabification, vowel epenthesis also creates open syllables by eliminating consonant clusters as illustrated in the examples below:

489.	/**sk**ɜt/	→	[s**í**.k´è.t´í]	'skirt'
490.	/**st**əʊv/	→	[s**í**.tò.fú]	'stove'
491.	/bɑ**sk**ɪt/	→	[í.bà.s**ì**.k´í.dí]	'basket'
492.	/**sp**ænə/	→	[s**í**.pá.nè.là]	'spanner'
493.	/**pl**eɪ**t**/	→	[lí.p´**ú.**lé.dè]	'plate'
494.	/**br**ʌ**ʃ**/	→	[lí.b**ù.**lá.ʃì]	'brush'

The same observation I presented for coda resyllabification applies to the consonant clusters /sk/, /st/ and /sp/ which are simplified through vowel [i] insertion. For instance, the complex cluster /sk/ in 'skirt' [s**i**k´et´i] is separated using coronal [i] to provide a syllable nucleus for branching onset /s/, a coronal consonant, while the labial consonants /p/ and /b/ in (493) and (494) have selected [u], a labial vowel. This argument indicates that coronals and labials use onset feature assimilation to eliminate illicit codas and complex clusters borrowed from English.

In the incorporation of English loans into the phonological systems of recipient languages, the interface between phonology and morphology sometimes determines the shape of output forms. Khumalo (1984) and Koopman (1992) note that when s-initial clusters are incorporated into the isiZulu noun class system, where the noun prefix is /si-/, occurring after the augment /i/, English loans adapted into Class 7 behave differently from nouns in other classes. In line with loanword adaptation and vowel epenthesis patterns in Nguni languages, /s/ inserts coronal vowel [i] to function as the nucleus of the coronal consonant. However, the output is not morphologically represented as the other loanwords in the grammar. When nouns are adapted into the grammar, they are assigned into a noun class which provides a noun class prefix as an additional morpheme, while the English loan becomes the noun stem. I first illustrate the general rule in loanword adaptation in (495) to (499) below:

Table 20: The morphology of non-s-initial clusters

	NOUN PREFIX	LOANWORDS	SURFACE FORM
495.	/li-/	/ʃɜt/	[lí.ʃè.t^hí] CL5.shirt 'shirt'
496.	/li-/	/wɒtʃ/	[lí.wà.ʃì] CL5.watch 'watch'
497.	/li-/	/k^hɑd/	[lí.k^hà.dí] CL5.card 'card'

498.	/umu-/	/dɔl/	[ú.m̩.dò.lí] CL3.doll 'doll'
499.	/umu-/	/bæptɪst/	[ú.m̩.bà.bà.tí.sí] CL1.baptist 'baptist'

In the above data, all the input loanwords are parsed as [Noun Prefix + PStem] where the loanword is parsed as the PStem attached to a Noun Prefix. For instance, 'card' in (497) surfaces as [lí.k^hà.dí] where [lí-] is the Class 5 prefix and [-k^hà.dí] the PStem. S-initial clusters do not follow the same pattern. Where the other adoptives become PStems, the s-initial loans are separated into noun class prefixes and PStems. Consider the following examples:

Table 21: The morphology of s-initial clusters

	NOUN PREFIX	LOANWORDS	SURFACE FORM
500.	/si-/	/skɜt/	[sí-kè.tí] CL7.skirt 'skirt'
501.	/si-/	/stəʊv/	[sí-tò.fú] CL7.stove 'stove'
502.	/si-/	/spænə/	[sí-pà.né.là] CL7.spanner 'spanner'
503.	/si-/	/spun/	[sí-pù.nú] CL7.spoon 'spoon'

Note how in all the s-initial clusters /si-/becomes the prefix and the remaining part of the loanword becomes the PStem. For instance, *'spoon'* in (503) surfaces as [si-pu.nu], not **[si.si.pu.nu]* where the Class 7 prefix takes the whole loanword as its PStem. This disparity between s-initial clusters and non-s-initial clusters highlights the importance of mapping the close link between phonology and morphology in phonological analysis.

As mentioned earlier, siSwati enforces a ban on all consonant clusters. To eliminate dispreferred consonant clusters, I revisit another structural constraint discussed in previous chapters: COMPLEX^{ONSET}. COMPLEX^{ONSET} is a markedness constraint that restricts consonant sequences parsed as branching onsets. I include this high-ranking constraint to account for the syllabic well-formedness of output candidates. Tableau 16 formalises cluster simplification.

Tableau 16: Cluster simplification through vowel epenthesis in siSwati

/stəʊv/	COMPLEX^{ONSET}	NoCoda	MAX-IO	DEP-IO
a) stò.f	*!	*		
b) sí.tòf		*!		*
c) sò.fú			*!	
☞d) sí.tò.fú				**

In Tableau 16 above, Candidate (a) is eliminated because it has an /st/ cluster, which is dispreferred in siSwati grammar. Secondly, the grammar militates against the deletion of input segments, which is why candidate (c) is eliminated for its violation of MAX-IO, a high raking constraint in the grammar proposed for cluster elimination. The same goes for candidate (b) that has a coda, in violation of NoCoda. Lastly, candidate (d) demonstrates that in cluster elimination the siSwati grammar eliminates complex onsets through [i] insertion thus in violation of DEP-IO, as seen in our optimal candidate. This means that the grammar intentionally violates the no-insertion constraint to satisfy the phonotactic constraints of the language. Worth noting is that the coronal consonant in the /st/ cluster has rightfully selected coronal vowel [i], while the labial coda consonant /f/ has rightfully attracted the labial vowel [u]. This is in line with the expectations of the grammar as well as the tenets of the FG theory, where coronal consonants select coronal vowels as their nucleus while labials attract round vowels, respectively. In FG terms, coda elimination and cluster simplification are represented thus:

Default insertion **Spreading of features**

Figure 12: A Feature Geometric representation of cluster simplification (Uffman 2006, p. 1095)

The siSwati default epenthetic segment [i] is inserted to resyllabify the coda, a dispreferred syllable structures in the siSwati grammar. Note that this insertion is independent of the influence of the adjacent segment. However, the grammar predicts that the labial [m] will spread its consonantal features onto the output vowel, thus rightfully attracting a labial vowel to break the offending construction. This is an indication that the environment in which a construction occurs matters in loanword rephonologisation.

Other Bantu languages such as Setswana adopt similar rephonologisation strategies in cluster simplification. As earlier indicated, Setswana grammar employs onset feature assimilation and VHH to resyllabify input codas. Input clusters are simplified the same way. I illustrate this below (Batibo, 1996, p.37)

504.	/**sk**ul/	→	[se.ko.le]	'school'
505.	/bɒ**ks**/	→	[bo.k**o**.s**e**]	'box'
506.	/de**sk**/	→	[te.s**e**.ke]	'desk'

As illustrated, all input clusters are simplified through vowel epenthesis. The first dispreferred sequence in example eliminates the /sk/ cluster in (504) through onset feature assimilation – coronal to coronal – while the dorsal consonant in (501) employs VHH, in line with the precepts of the Setswana grammar. In (506), the dispreferred syllable structure is eliminated through copying. Tableau 17 below schematically represents Setswana constraint ranking in cluster elimination:

Tableau 17: Cluster simplification through vowel epenthesis in Setswana

/**sk**ul/	COMPLEX^{ONSET}	NoCoda	MAX-IO	DEP-IO
a) sko.le	*!			*
☞b)se.ko.le				**
c) se.kol		*!		*
d) se.ko			*!	*

Similar to siSwati, Setswana prohibits cluster and coda specification, thus eliminating candidates (a) and (c) for their violation of COMPLEX^{ONSET} and NoCoda, both indomitable constraints. Candidate (d) is eliminated for its violation of MAX-IO, a faithfulness constraint that enforces faithfulness to the input. Optimally, the grammar inserts an epenthetic vowel to eliminate codas and cluster specification, thus allowing candidate (b) to surface as our optimal output form. DEP-IO, therefore ranks low in the proposed Setswana grammar on cluster and coda elimination.

My discussion has highlighted how siSwati grammar employs vowel epenthesis to simplify consonant clusters and eliminate coda specification. The next discussion demonstrates that siSwati grammar does not adapt all input English clusters through vowel epenthesis. These are NC and CG sequences. I discuss their nativisation below.

6.2.2.3 Resyllabification of NC and CG English consonant clusters

This study has so far demonstrated how siSwati repairs English complex onsets and resyllabifies codas to harmonise both constructions with the siSwati CV syllable template. Worth noting is that input NCs and CGs, which are parsed as consonant clusters in English, do not undergo similar simplification processes, if at all. In Section 3.5.3, I discussed NCs and CGs as the only permissible consonant sequences in siSwati. Even so, the language does not regard them as complex sequences but represents them as complex segments that occupy a single C-Slot functioning as unitary segments, not branching onsets. All things regarding input complex onset simplification being equal, we would expect that these segments either insert a vowel to simplify the cluster or delete one of the offending consonants as observed in the other input English complex clusters. For instance, *'sweet'* /lí.swì.dí/ would be syllabified as **lis**<u>**i**</u>*widi* where coronal vowel [i] is inserted after coronal /s/. However, this is not the case. I present this as further evidence to support the representation of siSwati NCs and Cws as unitary segments that do not need any simplification, like other complex segments from the English Language. Consider the following examples:

NC sequences

507.	/stæ**nd**/	→	[sí.t΄à.**^{n}dí**]	‘stand’
508.	/bæ**nd**ɪdʒ/	→	[lí.bà.**^{n}dì**.ʃí]	‘bandage’
509.	/kæ**mp**/	→	[í.^{ŋ}kà.**^{m}bú**]	‘camp’
510.	/stæ**m**p/	→	[sí.t΄è.**^{m}b**ú]	‘stamp’

CG sequences

511.	/**skw**eə/	→	[sí.**k΄^{w}**è.lé]	‘square’
512.	/**sw**it/	→	[lí.**s^{w}**ì.dí]	‘sweet’
513.	/**gw**avə/	→	[lí.**g^{w}**à.và]	‘guava’

In the input NCs and CGs illustrated above, I note that the clusters /nd/ and /mp/ in (507) through to (510) are not simplified using either default insertion or onset feature assimilation. Instead, the grammar parses them as prenasalised segments [^{n}d] and [^{m}p]. The same applies with the consonant plus glide sequences in (511) to (513), where input /kw/, /sw/, and /gw/ are represented as secondary articulated segments [k^{w}], [s^{w}], and [g^{w}] that occupy a single C-slot. In Chapter 3, I provided evidence that the C-Slot can be occupied by simple and complex consonants, the latter of which are parsed as unitary segments, not consonant clusters. I conclude that even though NCs and CGs are complex onsets in English, siSwati prenasalises or labialises them, for phonotactic well-formedness. This analysis aligns the current discussion with the syllabification of complex segments indigenous to siSwati, where output forms must be optimally CV.

The grammar I assume for siSwati exempts ^{N}Cs and C^{w}s from cluster elimination since these are not considered branching onsets in the grammar. To this end, I use ^{N}Cs to illustrate the blocking of vowel epenthesis in the nativisation of source words with consonant clusters that are parsed as unitary segments in siSwati. Tableau 18 schematically represents the non-simplification of ^{N}Cs and C^{w}s in siSwati:

Tableau 18: The non-simplification of NCs in siSwati loanword rephonologisation

/stænd/	COMPLEX^{ONSET}	NoCoda	MAX-IO	DEP-IO	IDENT$^{(Place)}$
a) sta.nd	**!				
b) si.ta^{n}d		*!			*
c) si.tan.di		*!		*	
☞d) si.ta.^{n}di				**	*
e) si.ta.ni.di				***!	
f) si.ta.di			*!	**	

For the non-simplification of some complex onsets in the siSwati grammar, I revisit the discussion on NCs and their syllabification in Chapters 3 and 5. I argue that these are the only complex segments that are permissible in the grammar. However, siSwati grammar does not parse them as branching onsets as indicated in (a), but unitary segments that occupy a single C-Slot as seen in (d). Deleting the nasal or parsing it as a coda of the preceding syllable is not optimal hence (c) and (f) are eliminated for their violation of NoCoda and MAX-IO. A candidate such as [si.ta.ṇ.di] would also not be optimal since it would violate PEAK that allows only the syllabic nasal [ṃ] to surface as a syllabic segment. As discussed in Chapter 5 of this dissertation, IDENT^{PLACE} permits ^{N}C, a homorganic and prenasalised segment, in the surface form. This representation aligns the output with the siSwati CV syllable template. Candidate (d) surfaces as our optimal winner even though it violates DEP-IO and IDENT^{PLACE}. Note that the seemingly optimal candidate (b) that constitutes all CV syllables has multiple violations of DEP-IO, and it is eliminated. ^{N}Cs and C^{w}s are not consonant clusters hence the ban on their simplification through vowel epenthesis. The same grammar I assume for ^{N}Cs suffices for C^{G}s in siSwati, respectively.

In Section 6.2, I have investigated the nativisation of English loanwords to fit the siSwati preferred syllable structure. I have highlighted how siSwati grammar eliminates codas and simplifies consonant clusters through vowel epenthesis, depending on the featural makeup of the consonants in the input. For instance, I have demonstrated that coronal consonants pattern with front vowels [i] and [e], while labial segments select the round vowels [u] and [o]. Dorsal consonants are not specified for any feature in siSwati grammar so they select default insertion. Also, I indicated that siSwati grammar would suffice for the other Nguni and some Bantu languages such as Setswana. To eliminate all codas and consonant clusters, isiZulu, isiNdebele, and isiXhosa adopt the same $\text{COMPLEX}^{\text{ONSET}}$, NoCoda >> MAX-IO >> DEP-IO constraint ranking as siSwati.

Languages such as Swahili bear a systematic variation to siSwati and the other Bantu languages discussed so far. Structurally, Swahili is a language that favours open syllables but differs slightly from siSwati in terms of the syllable structure it permits outside of the canonical CV template (Batibo, 1996; Mwita, 2009). First, I note that Setswana permits syllabic nasals /ṃ/ and [ṇ] in derived non-derived contexts, unlike siSwati that only permits the syllabic nasal [ṃ] in derived contexts. Secondly, Swahili allows the occurrence of onsetless vowels even word medially hence hiatus is not always resolved; however, the vowels have to be heterosyllabic (510) and (513). Consider the following examples (Mwita, 2009, p 50):

514.	/**m**tu/	→	[**ṃ**.tu]	‘person’
515.	/**n**ne/	→	[**ṇ**.ne]	‘four’
516.	/**oa**/	→	[**o.a**]	‘marry’
517.	/p**ia**/	→	[p**i.a**]	‘also’

As illustrated above, Swahili permits syllabic [ṃ] in (514) as well as the alveolar nasal [ṇ] in (515). Further, the examples in (516) and (517) indicate the occurrence of adjacent vowels that are, however, assigned to separate syllables.

In loanword nativisation, there is a systematic linguistic variation that is evident in siSwati and Swahili. In the nativisation of input Arabic syllables structures, Swahili employs the same repair strategies as siSwati except in how Swahili handles word-medial complex clusters. Although Swahili breaks illicit CC sequences using vowel insertion, there are exceptions to this rule. If the dispreferred sequence appears word medially, then the extrasyllabic consonant is resyllabified as a coda of the previous syllable (Mwita, 2009). He notes that this follows the Sonority Hierarchy that requires complex onsets to rise in sonority while codas fall in sonority. If the input CC sequence does not rise in sonority, instead of inserting a vowel to break the cluster, the Swahili grammar allows the surface form to reassign C_1 as a coda of the preceding syllable, and C_2 as an onset of the following syllable as seein in (520) and (521). Other scholars such as Odden (1995) and Batibo (1996) confirm the tendency for Swahili to retain word-medial clusters. If, however, the CC sequence rises in sonority, then vowel insertion applies, to harmonise the input form with the Swahili open syllable template as seen in (518) and (519). The same applies to input single-consonant codas that appear word finally; these are simplified through onset assimilation to eliminate the dispreferred input codas from Arabic. Consider the following examples (Mwita, 2009, p. 54/56):

518.	/i**bl**is/	→	[i.b**i.**li.si]	'devil'
519.	/i**br**is/	→	[i.b**i.**ri.ka]	'kettle'
520.	/su**lt**an/	→	[su**l.ta**.ni]	'king/ruler/chief'
521.	/u**sq**uf/	→	[a**s.ko**.fu]	'bishop'

As illustrated in the above examples, consonant clusters that rise in sonority are simplified through vowel epenthesis while those that do not, are resyllabified, where the first consonant becomes a coda of the previous syllable. To attain optimal syllabic well-formedness of clusters that rise in sonority, COMPLEX^{ONSET} is an indomitable constraint in Swahili as the language prohibits branching onsets. Furthermore, final codas are prohibited hence NoCoda is another high-ranking constraint. Optimal candidates are prohibited from deleting extrasyllabic consonants making the violation of MAX-IO fatal. Tableau 19 below is a representation of the interaction for cluster simplification in Swahili:

Tableau 19: Cluster simplification through vowel epenthesis in Swahili

/iblis/	COMPLEX^{ONSET}	NoCoda	MAX-IO	DEP-IO
a) i.bli.si	*!			*
☞b)i.bi.li.si				***
c) i.bi.li.s		*!		
d) i.bi.si			*!	

In Tableau 19, candidates (a) and (c) are eliminated for the fatal violation of COMPLEX^{ONSET} and NoCoda. The grammar further maximises faithfulness by prohibiting the deletion of one of the input consonants to satisfy syllabic well-formedness thus, eliminating (d) for its fatal violation of MAX-IO. The optimal candidate (b) satisfies all high-ranking constraints; however, to satisfy the Swahili CV template, it inserts epenthetic segments in violation of DEP-IO, a low-ranking constraint in the grammar, a similar adaptation pattern as siSwati. However, Swahii grammar is different in contexts where the cluster appears word-medially. Mwita (2009) observes that in non-sonorous contexts, the input consonants are resyllabified to separate syllables, where C_1 becomes a coda of the previous syllable while C_2 becomes an onset of the following syllable. This variation necessitates the re-ranking of the coda elimination constraints to allow word-medial codas in the surface form. I schematically represent word-medial coda resyllabification in Tableau 20 below:

Tableau 20: Cluster simplification through resyllabification in Swahili

/sultan/	COMPLEX^{ONSET}	MAX-IO	DEP-IO	NoCoda
a) su.li.ta.ni			**!	
☞b)sul.ta.ni			*	*
c) su.lta.ni	*!		*	
d) su.ta.ni		*!	*	

Tableau 20 demonstrates the variation in Swahili cluster simplification. First, the grammar eliminates candidate (c) for fatally violating COMPLEX^{ONSET}. The grammar also bans candidate (d) for violating MAX-IO, a constraint that enforces faithfulness to input segments. In this candidate, deleting the coda consonant is not optimal. In addition, the grammar rejects the seemingly optimal candidate (a) that eliminates all clusters and codas through vowel epenthesis since the grammar permits word-medial codas, as long as the consonants clusters are reassigned to separate syllables. The re-ranking of NoCoda as a low ranking constraint in the grammar permits candidate (b) to surface as our optimal output form even though it appears with coda specification.

The discussion has so far highlighted that the goal of vowel epenthesis in loanword nativisation is to parse open syllables in all surface forms. I have illustrated how different grammars use default insertion, onset feature assimilation, and VHH, with varying degrees of application, to achieve this end goal. However, languages such as Swahili have seen the emergence of marked structures such as word-medial coda specification (Batibo, 2002; Mwita, 2009). As already pointed out, Swahili grammar bans all word-final codas but tolerates them word-medially, a surface representation that hinges on the sonority of the input cluster. In such representations, vowel epenthesis is not optimal to allow syllable codas in Swahili surface forms.

SiSwati and the other Nguni languages do not tolerate codas in any context. I have also presented evidence to support C-Slot specification in siSwati, that is, what consonantal sounds can optimally function as ONSETs. The discussion has indicated how the contentious syllabification of NCs and CGs is resolved in loanwords where all input clusters are simplified through vowel epenthesis, NCs and CGs are exempt, confirming that siSwati does not parse these structures as clusters but complex, unitary segments, as per my earlier assertion on the siSwati syllable template in Chapter 3. Loanword adaptation provides evidence that CV syllables are the most preferred surface representations in siSwati. I now turn the discussion to the third loanword adaptation pattern: segment deletion.

6.2.3 Segment deletion

In the process of resyllabifying dispreferred syllable structures, siSwati grammar may additionally opt to delete the offending segments. This process can be divided into vowel truncation and consonant deletion.

6.2.3.1 Eliminating extrasyllabic vowels

As discussed in Chapter 4, siSwati grammar prohibits tautosyllabic vowels. In the case of a language such as English that has diphthongs, these are sometimes truncated to resyllabify the dispreferred diphthongs as single vocalic segments. In the siSwati loanword adaptation process, the language selects one of the two phonological processes: dipthong simplification though monophthongisation and resyllabification through spreading. I first discuss monophthongisation as a resyllabification strategy that siSwati adopts. The vowels that get deleted are usually those that would optimally be syllabified out of the canonical CV syllable structure.

According to Batibo (1996), the marginal or satellite vowel, in this case $V_{1,}$ gets eliminated. The selection of the second vowel in the sequence also aligns with Casali’s (1997) *‘Which vowel goes’* investigation of vowel hiatus resolution patterns, where he argues that where two adjacent vowels exist within the same syllable, most languages have the tendency to select V_1 as a target for deletion. Even though languages like English tolerate vowel sequences, siSwati does not, as demonstrated in vowel hiatus resolution in Chapter 4. I illustrate how siSwati grammar resyllabifies diphthongs as simple vowels in the following examples:

522.	/steɪʃn/	→	[sí.t´**è.**ʃĩ]	'station'
523.	/geɪt/	→	[lí.g**é.**dè]	'gate'
524.	/pleɪt/	→	[lí.p´u.l**è.**dè]	'plate'
525.	/peɪpə/	→	[lí.pʰ**è.**pʰà]	'paper'
526.	/vəʊt/	→	[lí.vò.t´ì]	'vote'
527.	/stəʊv/	→	[sí.t´**ò.**fú]	'stove'
528.	/gəʊl/	→	[lí.gò.lí.dè]	'gold'
529.	/pəʊl/	→	[lí.p´**à.**lí]	'poll'

The above examples are an illustration that siSwati eliminates incoming English diphthongs to harmonise them with the siSwati monophthongal vowel system. In the data, most of the examples have parsed a diphthong that requires simplification. For example, in (252), the diphtnong /eɪ/ is resolved through simplifying it to the simple vowel [e]. The same applies in contexts where [əʊ] is simplified to [a]. The monopthongs in the output align with the assertion that the siSwati vocalic system must consist of only simple vowels, as demonstrated in Chapter 4.

To ensure that the loanword adaptation grammar preserves V_1, I consider ANCHOR-L as one of the constraints in operation. Kager (1999) defines ANCHOR-IO as an input-output correspondent constraint that militates against the deletion or epenthesis of a segment at Prosodic word (PrWd) or PStem edge, among other units of phonological representation. In this thesis, the unit for analysis is the syllable, hence it will be considered as an edge. I consider the target for deletion in hiatus resolution (Chapter 4), where I argue that siSwati targets V_1, as per Casali's assertion on vowel deletion in loanword adaptation. In the hiatus resolution grammar below, ANCHOR-L should preserve the first vowel in the diphthong.

I also revisit ONSET and N_OD_{IPH}, markedness constraints that militate against parsing onsetless syllables and diphthongs in the output. In Chapter 4, I noted that siSwati does not tolerate onsetless syllables except word. Syllables that appear with tautosyllabic vowels violate ONSET. For the current analysis, ONSET accounts for the elimination of English diphthongs where optimal candidates do not parse compelx syllable nuclei. N_OD_{IPH} eliminates the possibility of parsing a diphthong in the output since the siSwati vocalic system is monophthongal. A factorial representation of these constraints would be ONSET, $N_O D_{IPH}$, ANCHOR-L >>> MAX-IO to allow segment deletion for optimal syllable structure well-formedness. I schematically represent this constraint interaction in Tableau 21 below:

Tableau 21: Eliminating VV sequences through monophthongisation in siSwati

/pəʊl/	ONSET	NoCoda	$N_O D_{IPH}$	ANCHOR-L	MAX-IO	DEP-IO
a) li.p´**aʊ**.li			*!			*
☞b) li.p´**a**.li					*	*
c) li.p´**a.u**.li	*!					*
d) li.p´**u**li				*!	*	*
e) li.pa.l		*!			*	

In Tableau 21, candidate (a) has incured a fatal violation of $N_O D_{IPH}$ for parsing a bimoraic vowel in the surface form, while candidate (c) violates ONSET for parsing an onsetless [u] in the output. Candidate (d) is eliminated for its fatal violation of ANCHOR-L, an alignment constraint that preserves the first vowel in the diphthong. As indicated in Section 6.3, the grammar preserves V_1. Candidate (e) has violated structural constraints on coda specification, and it is eliminated for fatally violating NoCoda. Even though candidate (b) has simplified the input diphthong, it has incurred a non-fatal violation of MAX-IO, a low-ranking constraint. It therefore surfaces as the optimal candidate. In monophthongisation, the grammar allows the output to parse a monomoraic nucleus, in line with the siSwati vocalic system.

Earlier on in my discussion, I pointed out the crosslinguistic variation evident between siSwati and Swahili constraint interaction in coda elimination. I noted how Swahili grammar sometimes parses output codas, a marked representation in siSwati. Swahili displays a similar tolerance for dispreferred sequences in the nativisation of Arabic VV sequences. Similar to the examples presented in (516) and (517) above where indigenous Swahili words resolve hiatus through resyllabification, loanwords also follow the same pattern. Consider the following examples (Mwita, 2009, p. 57):

530. /aib/ → [a.i.bu] ‘shame’
531. /za:id/ → [za.i.di] ‘more/besides’
532. /kaid/ → [ka.i.di] ‘obstinate/disobedient’

The above examples demonstrate that the Swahili grammar sometimes does not simplify VV sequences through deletion. Instead, the input vowels become heterosyllabic. I represent this disparity in constraint ranking below:

Tableau 22: Resyllabification of VV sequences in Swahili

/zaid/	NoCoda	NODIPH	ANCHOR-L	MAX-IO	DEP-IO	ONSET
a) za.di				*!		
b) zaid		*!				
☞c)za.i.di					*	*
d) za.i.d	*!					

In Tableau 22, the Swahili grammar prohibits the deletion of the offending vowel as seen in the elimination of candidate (a) for violating MAX-IO. Candidate (d) is eliminated for parsing a word-final coda. Candidate (c), which is the optimal surface form in Swahili, permits the re-ranking of ONSET as a low ranking constraint to allow the realisation of a surface form with a heterosyllabic V.V sequence. This is an indication of the varied nature of languages and their adaptation patterns.

Similar to siSwati and Swahili, Setswana eliminates input VV sequences. However, Setswana adopts both adaptation strategies in the elimination of illicit vowel sequences: monophthongisation through deletion and heterosyllabification. Consider the examples below (Batibo, 1996, p. 36) below:

533. /bl**aʊ**z / → [bo.la.o.se] ‘blouse’
534. /t**aɪ**/ → [ta.i] ‘tie’
535. /b**eɪ**sn̩/ → [be.i.sa.ne] ‘basin
536. /f**əʊ**n/ → [fo.u.ne] ‘phone’

537. /tʃ**eɪ**ndʒ/ → [tʃe.^{n}tʃi] ‘change’
538. /br**eɪ**k/ → [bo.ri.ki] ‘brake’

539. /st**əʊ**v/ → [se.to.fo] ‘stove’
540. /tr**eɪ**n/ → [te.re.na] ‘train’

The examples above illustrate the two repair strategies that Setswana adopts in the adaptation of input VV sequences. In (533) to (536), the input English diphthongs are parsed as heterosyllabic vowels, while those in (537) to (540) are truncated. Note that this is similar to siSwati where the application and choice of one simplification strategy over another is not predictable. For instance, the input vowel [eɪ] is simplified through heterosyllabification in /b**eɪ**sn̩/ → [be.i.sa.ne] but V_2 truncation in (538) /br**eɪ**k/ → [bor**i**ki]. As observed in siSwati, there seems to be no predictability or phonological explanation in the selection of either deletion or resyllabification through vowel reassignment. This could be attributed to native speaker intuition in deciding which VV simplification process to select since the same VV sequences trigger different nativisation patterns. I next consider consonant deletion as a possible resolution strategy in loanword rephonologisation.

6.2.3.2 Deletion of extrasyllabic consonants

Batibo (1996, 2002) notes that this is the least productive nativisation method, with only about 3% chance of selection compared to other nativisation processes. Similar to the assertion on vowels, Batibo argues that consonant deletion affects extra-syllabic segments, that is, those that would optimally be syllabified out of the canonical CV syllable structure. In loanword phonology, the aim is to preserve as much of the original word as possible, hence the deletion of consonants is the least preferred repair strategy. Sometimes, consonants are deleted for ease of articulation and like vowels; consonants susceptible to deletion are usually extrasyllabic.

As will be discussed in Chapter 7, SiSwati has a disyllabic requirement on the PWord. This is evident in the truncation of extrasyllabic consonants. We note that if deleting the consonant will result in a subminimal construction, one where the stem would be less than one syllable, then deletion is blocked. Consider the following examples:

541. [plæŋ**k**] → [lí.p´u.là.ŋò] ‘plank’
542. [tæŋ**k**] → [lí.t^hà.ŋé] ‘tank’
543. [bæŋ**k**] → [lí.bà.ŋé] ‘bank’

544.	[kəntræk**t**]	→	[í.gò.^{n}t^{h}ì.rá.kí]	‘contract’
545.	[lə̠ʊkeɪʃ**n̩**]	→	[lí.lò.ɠí.ʃì]	‘location’
546.	[steɪ̠ʃ**n̩**]	→	[sí.t´è.ʃí]	‘station’
547.	[kɪ.tʃɪ**n**]	→	[lí.k^{h}ì.ʃí]	‘kitchen’
548.	[gɑd**n̩**]	→	[í.^{ŋ}gà.dzé]	‘garden’
549.	[ʌv**n̩**]	→	[í.ʔà.ví.nì]	‘oven’
550.	[kɜt**n̩**]	→	[lí.k^{h}é.t^{h}í.nì]	‘curtain’

In as much as consonant deletion is not a productive repair strategy in the nativisation of loanwords, there are a few instances in which the grammar allows such to occur. Note that the above data have deleted final consonants. However, deleting the final consonant in in (549) and (550) would yield a subminimal construction; hence the siSwati grammar protects the final consonant. However, it is worth noting that this is not a conclusive analysis of this repair strategy, hence the need for further research that would provide insights on the reason and target for consonant deletion over the much more prevalent consonant retention that has been discussed in previous sections.

So far, the chapter has discussed various repair strategies that siSwati adopts in the loanword adaptation process. I have illustrated how siSwati grammar sometimes eliminates dispreferred VV and consonant sequences through deletion. In each instance, deleting the extrasyllabic vowel or consonant is optimal, with the surface representations aligned with the syllable template I assume for siSwati. I noted, however, that if the deletion of any of the input consonants violates minimality, segment deletion is blocked. The next section presents spreading as an optimal repair strategy in diphthong simplification in siSwati.

6.2.4 Spreading

In line with the FG theory, Clements and Hume (1995) and Uffmann (2006) define spreading as a phonological process where features of one of the input vowels are said to spread onto the inserted segment forcing it to share the same place features. In his investigation of vowel hiatus in Karanga and Zezuru, Mudzingwa (2010) states that spreading involves labial, coronal and pharyngeal spreading where front vowels inset [j] and labials insert [w], while the pharyngeal vowel attracts either the glottal stop [ʔ] or [ɦ], respectively. In addition, Kadenge (2012) explores glide epenthesis in Shona loanword adaptation as the spreading of V-Place features from input labial and coronal vowels onto the epenthetic segment, noting that dorsals do not participate in spreading in this language. He notes that the goal of spreading loanword adaptation is to eliminate English diphthongs, which are banned in Shona and other Bantu languages. As already highlighted in the above discussion, siSwati prohibits diphthongs. In the current dispensation, I explore how siSwati repairs English VV sequences through spreading.

6.2.4.1 Resyllabification through spreading in siSwati

Similar to the discussion on vowel insertion where the epenthetic vowels share the same features as the preceding consonant in Section 6.2.2 above, the epenthetic glide is determined by the V-Place features of the input vowel. If the input vowel is coronal, then the grammar inserts [j] while labials attract glide [w]. Consider the following examples that illustrate spreading in siSwati:

551.	/b**aɪ**sɪkḷ/	→	[lí.bà**.jí.**sí.ɠí.lì]	'bicycle'
552.	/b**aɪ**bəl/	→	[lí.bà**.jí.**bè.lì]	'bible'
553.	/t**aɪ**/	→	[tʰ**á.jì**]	'tie'
554.	/ʃ**aʊ**ə/	→	[í.ʃ**á.wà**]	'shower'
555.	/t**aʊ**əl/	→	[lí.tʰ**à.wú.**là]	'towel'
556.	/bl**aʊ**s/	→	[lí.bù.là**.wú.**sì]	'blouse'

The examples in (551) to (553) have rightfully selected [j] as their epenthetic segment since V_2 is coronal. For example, /taɪ/ 'tie' has inserted [j] yielding a permissible construction [tʰá.jì] that has the coronal vowel spreading its features onto the epenthetic segment. I further observe that the examples in (554) to (556) have selected the labial glide [w] since input V_2 is labial.

In the elimination of tautosyllabic vowels through either elision or spreading, it appears as if there is no determining factor on the vowels susceptible to either repair strategy. In both instances, the vowels that get deleted or separated through spreading are the same in terms of quality. For instance, the illicit VV sequence in 'plate', /pleɪ̲t/ → [líp´ùl**é**dè] is resolved through monophthongisation, while the same vowel appears in /baɪ̲bəl/ but the same structural violation is resolved through spreading. In the current study, I can neither attribute this disparity in the choice of nativisation strategy to phonology nor morphology, but native speakers' intuition. This is the reason why it is important to holistically explore such phonological constructions as borrowing from a native speaker's perspective to avoid rule overgeneralisation.

6.2.4.2 A feature geometric representation of spreading

In his crosslinguistic investigation of spreading in loanword phonology, Kyumin (2009) notes that Korean not only uses labial and coronal spreading but velar consonants also tend to spread their features onto the epenthetic segment. I assume the same FG representation of spreading in siSwati, with the exception of velar spreading that does not exist in the language. Below I present a featural representation of coronal and labial spreading in siSwati.

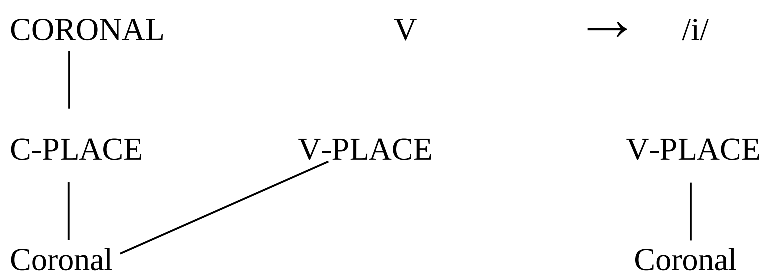


Figure 13: A Feature Geometrdic representation of coronal spreading (Kyumin, 2009, p. 65)

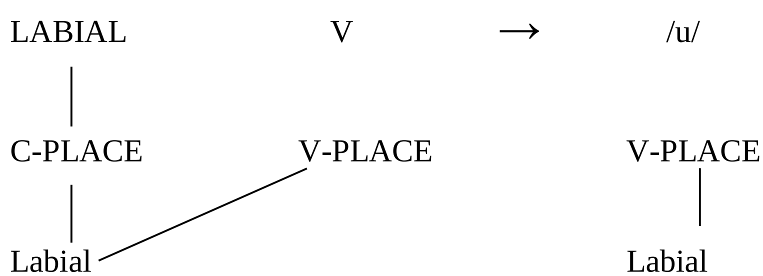


Figure 14: A Feature Geometric representation of labial attraction (Kyumin, 2009, p. 65)

The figures illustrate the spreading of the coronal and labial features onto the epenthetic vowel, a phenomenon that is attested in loanword phonology crosslinguistically.

To ensure that surface forms do not parse dispreferred VV sequences, siSwati grammar invokes UNIQUE. Previous research on loanword nativisation utilise UNIQUE as one of the constraints that eliminate VV sequences through spreading. This constraint is argued to prohibit spreading of features between adjacent segments, since it militates against the spreading of place features from neighbouring labial and coronal vowels to the input segment. For instance, Mudzingwa (2010) and Kadenge (2012) observe that UNIQUE prohibits the spreading of V-PLACE features to epenthetic segments in vowel epenthesis and spreading. In this dissertation, I use UNIQUE to illustrate how siSwati simplifies English diphthongs to align with the monophthongal vowel system in siSwati. For this reason, the grammar I assume for the elimination of VV sequences through spreading is ONSET, $\text{N}_\text{O}\text{D}_\text{IPH}$, ANCHOR-L >>> MAX-IO >>> UNIQUE. In the next analysis, the grammar should allow the English diphthong [aʊ] in /blaʊs/ to surface as a monophthong in order to fit the siSwati vowel inventory that only consists of monophthongs. Tableau 23 below illustrates how siSwati repairs input diphthongs through spreading.

Tableau 23: Eliminating VV sequences through spreading in siSwati loanword phonology

/blaʊs/	$\text{COMPLEX}^{\text{ONSET}}$	NoCoda	ONSET $\text{N}_\text{O}\text{D}_\text{IPH}$	MAX-IO	DEP-IO	UNIQUE
a) li.bu.lau.si			*!		**	
b) li.bu.la.u.si			*!		**	
☞c)li.bu.la.wu.si					***	*
d) li.bu.la.si				*!	**	
e) li.bla.wu.si	*!				**	*
f) libulawus		*!			**	*

In Tableau 23 above, candidates (a) and (b) are faithful to the input but they fatally violate ONSET and $\text{N}_\text{O}\text{D}_\text{IPH}$, both high ranking constraints in the grammar that prohibits any form of VV sequences. As mentioned earlier, diphthongisation and heterosyllabification are outlawed in siSwati. For this reason, it is eliminated. Candidates (e) and (f) violate $\text{COMPLEX}^{\text{ONSET}}$ and NoCoda, both indomitable constraints in the grammar. They are thus eliminated. Our optimal candidate (b) satisfies all high ranking constraints but spreads labial features onto the epenthetic site, resulting in an epenthetic glide [w]. However, since spreading is low-ranking in the grammar, its violation is not fatal. Candidate (d) eliminates the sequence through deleting V_2, violating

MAX-IO in the process. I therefore conclude that in spreading, vowel truncation is not optimal, while the spreading of place features is permitted.

6.2.5 Cluster tolerance

Often times, sociolinguistic factors such as a speaker's level of bilingualism as well as frequency of use of the lexical item override structural well-formedness (Batibo, 1996; Adler, 2006; Mwita, 2009). In Section 6.2.2 of this chapter, I highlighted the tendency for siSwati to eliminate consonant clusters through vowel epenthesis. However, like other languages such as chiShona (Batibo, 1996) and Swahili (Mwita, 2009), siSwati may opt to retain the input complex clusters that violate structural requirements enforced by the language. In this case, there seems to be the preference to remain faithful to the input over markedness constraints. Koopman (1992) notes that isiZulu, a Nguni language, also simplifies vowel and consonant clusters through vowel epenthesis, where each dispreferred configuration is 'spread over two syllables" (p. 111). He notes, however, that urbanisation and education play a role in r-retention and cluster tolerance in isiZulu surface forms. Since isiZulu and siSwati are sister languages, they are typologically similar in how they sometimes tolerate output clusters. Consider the following examples illustrating cluster tolerance in siSwati:

557.	/kl/	[**kl**ɑs]	→	[lí.**kl**à.sí]	'class'
558.	/dr/	[**dr**ʌm	→	[lí.**drà**.mú]	'drum'
559.	/tr/	[bæ**tr**i]	→	[í.bè.**trí**]	'battery'
560.	/tl/	[æ**tl**əs]	→	[í.ʔá.**tl**àsí]	'atlas'

As evident in the above examples, siSwati native speakers may sometimes opt against simplifying clusters from the donor language because of their level of bilingualism. This strategy has nothing to do with phonological adaptation, but the ease of articulation and comfort of the native speaker determines whether they want to simplify the input illicit construction or not. In this regard, they may opt to retain the seemingly prohibited construction. The current study does not delve into sociolinguistic factors that contribute to language change and/or influence. I therefore reserve this siSwati/English interaction for future research. For my analysis, clusters are still phonologically prohibited in the grammar I assume for siSwati.

6.3 Summary of the chapter

The discussion on siSwati loanword phonology underscores the predictability of repair strategies in loanword adaptation, thus underpinning the goals of this dissertation. As evident in the languages under investigation, the selection of repair strategies is dictated by the phonotactic requirements of the receptor language. We noted that constraint interaction hinges on what is permissible in each language, with some allowing structures such as [V.V] sequences while others such as siSwati simplify dispreferred VV sequences through either deletion or spreading. For instance, the chapter has demonstrated how parsing ONSET as a low ranking constraint in seTswana and Swahili permits the occurrence of heterosyllabic vowels, while the same constraint ranks high in siSwati to block the occurrence of illicit VV sequences, even if they are syllabified separately. This speaks to the predictability of repair strategies across all languages, with the exception in the choice between vowel simplification strategies – spreading and truncation for siSwati, and heterosyllabification and truncation in Swahili and Setswana. Furthermore, there is no determining factor in the selection of the vowel simplification strategies across all languages. This, I believe, is conditioned by native speaker intuition, and the speaker's ease of articulation.

Lastly, I also observed the variation in cluster simplification exhibited by Swahili, does not exist in siSwati or Setswana. This is an indication that despite these languages subscribing to the CV syllable template posited for Bantu languages, they each enforce varied constraint interaction and ranking, thus giving rise to variation in individual grammars. Table 22 below presents a summary of all repair strategies selected across the three Bantu languages investigated in Chapter 6.

Table 22: A summary of repair strategies in some Bantu languages

	Vowel epenthesis	**Consonant deletion**	**Mid-coda tolerance**	**Vowel deletion**	**Spreading**	**Heterosyll.**
SiSwati	✓	✓	X	✓	✓	X
Swahili	✓	✓	✓	✓	X	✓
Setswana	✓	✓	X	✓	X	✓

CHAPTER 7

WORD MINIMALITY

7.1 Introduction

Languages of the world impose different minimality restrictions on the size of the PWord. Previous literature has highlighted this variation in word minimality requirements across languages of the world (Bryant, 1849; Park, 1995, 1997; Downing, 1999; Downing, 2005; Demuth, et al., 2006; Odden, 2006; Mudzingwa, 2008, 2010; Mkochi, 2009; Zerbian, 2012; Kadenge & Mathangwane, 2017; Mutonga et al, 2018), noting that some languages enforce a disyllabic requirement on the size of the PWord while others permit the parsing of monosyllabic PWords in surface representations. It has also been reported that there may be intralinguistic variation in how various grammatical categories repair subminimality (Kadenge & Mathangwane, 2017). In such cases, the repair for subminimality can either utilise phonological or morphological augmentation depending on the category of the word under investigation.

Furthermore, crosslinguistic research on word minimality reveals that variation in Bantu languages is threefold: some advocate for the syllable versus the mora as a unit for analysis (Malambe, 2006; Mudzingwa, 2008); what is considered subminimal varies across languages; and subminimality repair is arguably language specific (Mudzingwa, 2010; Downing and Kadenge, 2015; Kadenge & Mathangwane, 2017). In languages such as isiZulu and chiShona, for example, the syllable is the unit for analysis in the investigation of phonological processes such as minimality. However, other languages such as Swahili and Chitonga use the mora as a determining factor in the size of the PWord. On moraic minimality conditions, Park, (1995) and Mkochi (2009) state that the mora and not the syllable is a determining factor on whether a PWord is considered well-formed or not. Park (1995, p. 307) states that ‘a short vowel is monomoraic, a long vowel bimoraic’, noting that bimoraicity involves monophthongal vowel lengthening to satisfy binarity requirements. Park also notes that crosslinguistically, languages impose minimality conditions by either lengthening their monosyllabic vowels (Luganda), while others such as Chichewa epenthesise [i] to satisfy binarity. For example, in Swahili the mora is sometimes used as a measure for minimality as illustrated below (Park, 1995, p. 307):

561.	/va/	→	[va:]	wear	***i.va**
562.	/ko/	→	[ko:]	‘throat’	***i.ko**
563.	/ka/	→	[ka:]	‘crab/stay’	***i.ka**

In the above Swahili data, the surface forms have phonologically lengthened the input vowel rather than phonologically epenthesising [i] or a morpheme to augment the subminimal configurations. The data shows that the mora, and not the syllable, counts for minimality in some Swahili PWords.

Establishing a distinction between the PStem and PWord is important in determining whether various grammars enforce minimality restrictions or not. Downing (1999, 2001) notes that PStems and PWords are distinct phonological domains, each subject to different constraint application and blocking. Downing distinguishes minimality constraints enforced on the PWord from those used on the PStem, noting the predictability of constraint application if the PWord and PStem are defined as distinct phonological domains, with the PWord immediately dominating the PStem in the Prosodic Hierarchy (PH). In addition, Downing and Kadenge (2015) propose that the stem level, which is phonologically represented as the PStem, is distinguishable from the word level, phonologically represented as the PWord. They present evidence for the asymmetrical relationship between the two phonological domains, noting that vowel harmony, tonal processes, reduplication, vowel hiatus, and word minimality provide evidence for the distinct roles that the two domains play in phonological analysis. Building on their argument on the role of the PH in Bantu, Downing and Kadenge (2020) use word minimality to establish the distinction between the PWord and PStem in phonological analysis, pointing out that the two domains do not trigger the same constraint application. First, they argue that subminimal PWords are augmented through epenthesising ‘morphologically empty material’ (p.13). Secondly, they argue that minimality restrictions are enforced on the PWord and not the PStem. They use Zezuru, a chiShona dialect, to support their argument on the asymmetry between the PWord and PStem in phonological analysis. I illustrate this in (564) to (567) below (Downing & Kadenge, 2015, p. 296; 2020, p. 14):

	Verb Stem	Imperative Form	Infinitive Form	Gloss
564	/pá/	[i.pá]	[ku.pá]	'give'
565	/djá/	[i.djá]	[ku.djá]	'eat'
566	/bvá/	[i.bva]	[ku.bvá]	'leave'
567	/nwá/	[i.nwá]	[ku.nwá]	'drink'

Note that the imperative forms, which are independent PWords in the grammar, require phonological augmentation through [i] epenthesis to satisfy minimality restrictions on the Zezuru verb. However, in the infinitive forms formed by prefixing the infinitive marker [ku-], the verb stem is not augmented. In the infinitive, the verb stem, which is also the PStem, appears attached to another morpheme and forms a disyllabic and therefore well-formed construction. This indicates that other morphemes account for minimality hence the grammar blocks augmentation. For instance, [ku.pá] in [564] can never be parsed as *[ku-***i***pa], where the PStem is augmented as [ku-] satisfies the minimality restriction on the PWord. Similarly, verb stems that with two or more stems are never augmented, indicating that [***i***] epenthesis is not an imperative marker; rather, it is inserted to phonologically augment monosyllabic verb stems. For example, [túmírá] *'send'* (Downing & Kadenge, 2015 p. 14) can never be parsed as *[***i***túmírá] since it is minimally well-formed and does not require augmentation. This concludes that Zezuru grammar requires that PWords, exemplified through the imperative form, must be disyllabic to be considered well-formed, while PStems, illustrated in the infinitive form, remain monosyllabic. This disparity in the augmentation process in Zezuru confirms that the target for augmentation is the PWord not the PStem.

To align the current study with previous research, I note that all PWords in siSwati must be minimally disyllabic, while PStems need not be. As highlighted in previous research (Downing, 1999; Mudzingwa, 2010; Zerbian, 2012; Downing & Kadenge, 2015; 2020; Downing & Mtenje, 2017), the main issue is that PWords, particularly in imperatives, are independent grammatical words while PStems are sometimes dependent on relevant affixes to form meaningful grammatical words. In this regard, siSwati PWords are minimally disyllabic and are subject to phonological or morphological augmentation to satisfy minimality conditions. PStems, on the other hand, are not subjected to the same restrictions. Following the works of previous researchers on Bantu minimality, I present that minimality in siSwati is conditioned by prosodic requirements on the permissible word size. The theoretical goal is to demonstrate that the PH and its domains determine whether the siSwati grammar triggers or blocks augmentation to satisfy minimality constraints.

In this chapter, I demonstrate that siSwati is typologically similar to languages where all monosyllabic PWords are subminimal constructions prohibited in the grammar. In my discussion, I indicate that subminimal constructions in siSwati are morphologically and sometimes phonologically augmented through the insertion of morphologically empty segments (Downing & Kadenge, 2015; 2020). The focus of the study is threefold: I first provide evidence for word minimality in various morphosyntactic contexts in siSwati grammar. Secondly, I illustrate that siSwati grammar triggers different augmentation strategies across various morphosyntactic domains. Lastly, I provide a formal OT analysis of the minimality restrictions on the PWord, highlighting how minimality effects in siSwati pattern with other Bantu and Nguni languages.

7.2 Evidence for Word Minimality requirements in siSwati verbs

In this section, I explore the various contexts that provide evidence for disyllabic word minimality requirements in siSwati grammar. I discuss each of these in detail below, beginning with evidence for restriction on the size of the PWord in verbs. Within the verb, the imperative, infinitive, passive, and the reduplication process create a rich context to illustrate word minimality effects in siSwati.

7.2.1 Word minimality in the siSwati imperative form

The imperative provides sufficient data for the minimal size of the PWord. As already noted, imperatives are the bare form of the verb that consists of the verb root (VR) and the final vowel (FV), with no prefixal or suffixal morphemes attached to it (Downing, 1999; 2001; Kula, 2002; Mudzingwa, 2008; Downing & Kadenge, 2015, 2020; Kadenge & Mathangwane, 2017). They are a perfect example to illustrate the permissible prosodic length of verbs in siSwati and other Bantu languages with a disyllabic word minimality requirement. I demonstrate that siSwati verbs that are two or more syllables are well-formed, hence no augmentation is required. However, if the verb is monosyllabic, the grammar triggers morphological augmentation to satisfy the minimum requirement on the size of the PWord as evidenced below.

Disyllabic verbs:

568.	[vá.là]	‘close!’
569.	[p^hé.kà]	‘cook!’
570.	[^{m}bó.ɲà]	‘cover!’
571.	[ɬé.kà]	‘laugh!’
572.	[ɓé.kà]	‘place’
573.	[tsá.tsà]	‘take!’

Polysyllabic verbs:

574.	[gá.mù.lá]	‘break!’
575.	[t^há.^{n}dá.zà]	‘pray!’
576.	[p^há.kè.là]	‘serve!’
577.	[ǀá.mè.lá]	‘lean on!’
578.	[tsá.mè.lá]	‘bask (in the sun)!’
579.	[ɓú.kè.lá]	‘watch!’

Monosyllabic verbs:

580.	/p^há/	→	[p^há-**nì**]	‘give!’
581.	/vá/	→	[vá-**nì**]	‘hear’
582.	/ɮá/	→	[ɮá-**nì**]	‘eat!’
583.	/fá/	→	[fá-**nì**]	‘die!’
584.	/l^wá/	→	[l^wá-**nì**]	‘fight!’
585.	/má/	→	[má-**nì**]	‘wait!’

The disyllabic and the polysyllabic verbs in (568) through to (579) do not trigger augmentation since they are well-formed, minimaly disyllabic. However, the monosyllabic verbs in (580) to (585) require augmentation through epenthesising /-ni/, a morphologically empty morpheme, serving as a morphological augmentation strategy to satisfy siSwati’s disyllabic requirement. Epenthesising morpheme [-ni] to any of the well-formed examples denotes plurality not augmentation. For instance, [gá.mù.lá-ni] 'break!' in (574) would be the plural form of the imperative while *gamula-ni-ni* is ill-formed. The monosyllabic imperatives, on the other hand, take both morphemes: the augmentative [-ni] and the imperative plural marker [-ni] to indicate plurality. The plural form of 'eat' in (582) for example, would be [ɮá-ní-nì] where both morphemes are epenthesised without a threat to grammaticality.

The PStem and PWord asymmetry is also evident in the formation of the infinitive form where the infinitive marker /kú-/ is prefixed to verb stems. Consider the following examples:

586.	/kú-ɮà/ INF-eat 'to eat'	→	[kú.ɮà]	***kuɮa-*ni***
587.	/kú-fà/ INF-die 'to die'	→	[kú.fà]	***kufa-*ni***
588.	/kú-p^{h}à/ INF-give 'to give'	→	[kú.p^{h}à]	***kup^{h}a-*ni***
589.	/kú-wà/ INF-fall 'to fall'	→	[kú.wà]	***kuwa-*ni***
590.	/kú-mà/ INF-stand 'to stand'	→	[kú.mà]	***kuma-*ni***
591.	/kú-l^{w}à/ INF-fight 'to fight'	→	[kú.l^{w}à]	***kul^{w}a-*ni***

The above data show that the grammar does not augment monosyllabic PStems. In each instance, siSwati grammar blocks /-ni/ epenthesis to augment the verb stems since only PWords and not the PStem, trigger augmentation rules. The infinitive marker accounts for minimality hence the blocking of any form of augmentation.

Constraints on the permissible word size militate against the augmentation of minimally well-formed imperatives while triggering epenthesis in monosyllabic forms. The grammar achieves this through the interaction of several constraints, the pivotal of which is M_{IN}-W_D (Park, 1997). I define this constraint as:

592. M_{IN}-W_D:
Prosodic words must be minimally disyllabic.
(Park, 1997, p. 251)

This constraint enforces minimality restrictions on the PWord in siSwati, stipulating that all surface realisations must be binary. The grammar I assume demonstrates that M_{IN}-W_D necessitates the augmentation of subminimal constructions through phonological or morphological epenthesis, while blocking the same process in constructions that the grammar considers well-formed. I further employ DEP-IO; a constraint that militates against segment epenthesis.

593. DEP-IO
An output segment must have input correspondent. (No epenthesis)
(Kager, 1999, p. 101)

For augmentation processes such as /i/ epenthesis in the passive (to be discussed below) and /-ni/ epenthesis in the imperative, M_{IN}-W_D has to dominate DEP-IO to allow the optimal candidate to epenthesise segments without incurring a fatal violation of indomitable constraints. The proposed ranking of the two constraints is, therefore, M_{IN}-W_D >> DEP-IO, where minimality restrictions on the PWord outrank segment epenthesis. I formalise this ranking in Tableau 24 below:

Tableau 24: Resolving minimality through augmentation in monosyllabic imperatives

/ʓá/	M_{IN}-W_D	DEP-IO
a. [ʓá]	*!	
☞b. [ʓá-nì]		*

Tableau 24 illustrates that imperatives conform to the disyllabic template for the minimal word in siSwati. The monosyllabic verb in (b) triggers augmentation through morpheme /-ni/ epenthesis to satisfy M_{IN}-W_D, a high-ranking constraint. However, the non-augmented candidate (a) is in fatal violation of minimality restrictions in the grammar, hence its elimination. It also parses the subminimal PStem as an independent grammatical word, which is another phonological violation on minimality. As discussed earlier, PStems can be monosyllabic as long as they appear with affixes to form minimally disyllabic, well-formed PWords. Tableau 25 below illustrates that epenthesising /-ni/ to an already well-formed verb incurs a fatal violation of M_{IN}-W_D.

Tableau 25: Blocking augmentation in well-formed imperatives

/pʰékà/	M_{IN}-W_D	DEP-IO
☞a. [pʰé.kà]		
b. [phé.kà.nì]	*!	*

Even though the disyllabic verb [pʰé.kà] does not appear with any epenthetic morpheme, it still surfaces as the optimal candidate. M_{IN}-W_D eliminates candidate (b) for adding /-ni/ to a well-formed PWord, thus incurring a fatal violation. The grammar indicates that it is not optimal to insert a syllable to a well-formed PWord.

The augmentation of monosyllabic verbs is a common phenomenon in Nguni languages. According to Downing (2001), isiNdebele imposes minimality restrictions on the imperative, passive, reduplication as well as the future and participial tenses. On the imperative, she notes that monosyllabic verb stems are augmented through prefixing /ji-/ to satisfy minimality (Downing, 2001, p. 36).

594.	/lwa/	→	[ji-lwa]	'fight!'
595.	/pha/	→	[ji-pha]	'give!'
596.	/zwa/	→	[ji-zwa]	'hear!'
597.	/fa/	→	[ji-fa]	'die!'

In each of the examples in the above data, the monosyllabic verb stems appear with augmented material to form a minimally well-formed PWord. If the same monosyllabic verb stems appear with the infinitive marker [úkú-], the grammar does not trigger augmentation. Consider the following examples (Downing, 2001, p. 36):

598.	/úkú-lwa/	→	[ú.kú.lwa]	‘to fight’
599.	/úkú-pha/	→	[ú.kú.pha]	‘to give’
600.	/úkú-zwa/	→	[ú.kú.zwa]	‘to hear’
601.	/úkú-fa/	→	[ú.kú.fa]	‘to die’

The data above shows that Ndebele assumes the same minimality restrictions and constraint ranking as siSwati. Note that augmentation is only triggered in monosyllabic PWords as seen in the imperative, and not the PStems, as seen in the infinitive. For instance, the grammar does not parse [ú.kú.pha] in (599) as *[ú.kú.***ji***.pha] ‘to give’, where the PStem is augmented even though it appears with the infinitive marker [ú.kú]. As highlighted earlier in siSwati grammar, the infinitive morpheme accounts for minimality, hence the grammar blocks augmentation in this case. I next discuss word minimality in the siSwati passive, noting how minimality contributes to the variation in the form of the passive morpheme.

7.2.2 Word minimality in the siSwati passive

In the siSwati passive form, the size of the PStem determines the shape of the passive morpheme. Monosyllabic verbs take the phonologically augmented form /-iw-/, while longer verb stems take the non-augmented /-w-/ form. This follows on Malambe (2006)’s investigation of the siSwati passive, and how the shape of the passive morpheme hinges on the size of the PStem. Consider the following examples:

Polysyllabic verb stems:

602. /gámùl-w-á/ → [gá.mù.**l**^{w}à] ***gamul-iw-a**
Break-PASS-FV
‘be broken’

603. /dzélél-w-à/ → [dzé.le.**l**^{w}à] ***dzelel-iw-a**
Undermine-PASS-FV
‘be undermined’

604. /p^{h}àkél-w-à/ → [p^{h}à.ké.l^{w}à] ***p^{h}akel-iw-a**
serve-PASS-FV
‘be served’

605. /ɓùkél-w-à/ → [ɓù.ké.**l**^{w}à] ***ɓukel-iw-a***
Watch-PASS-FV
‘be watched’

606. /dzìlít´-w-a/ → [dzì.lí.**t**$^{\prime w}$à] ***dzilit´-iw-a***
Destroy-PASS-FV
‘be destroyed’

Monosyllabic verb stems:

607. /p^{h}-w-a/ → [p^{h}**í**.wà] ***p^{h}wa***
Give.Pass.FV
‘be given’

608. /v-w-a/ → [v**í**.wà] ***vwa***
Hear.Pass.FV
‘be heard’

609. /ɮ-w-a/ → [ɮ**í**.wà] ***ɮwa***
Eat.Pass.FV
‘be eaten’

610. /m-w-a/ → [m**í**.wà] ***mwa***
Deny-PASS-FV
‘be denied’

611. /f-w-a/ → [f**í**.wà] ***fwa***
Die-PASS-FV
‘die’

The form of the passive morpheme illustrates that phonologically epenthesising [i] augments subminimal constructions as evident in the monosyllabic verb stems, while the same augmentation strategy is blocked in the polysyllabic stems since they are minimally well-formed. The above examples also indicate that using a mismatched shape of the passive yields an ungrammatical construction. The polysyllabic verbs in (602) to (606) take the passive morpheme /-w-/ without any phonological augmentation since they are minimally well-formed in the grammar. However, the siSwati grammar requires the monosyllabic verbs **p^{h}wa, *vwa, *ɮwa, *lwa, and *fwa* to take the augmented /-iw-/ form. The motivation for the augmented form of the passive is the disyllabic restriction that the siSwati grammar imposes on its PWords.

In his investigation of minimality in Zezuru, Mudzingwa (2008) contends that the passive morpheme is /-w-/ which then has to be phonologically augmented through [i] epenthesis to satisfy word minimality requirements. For instance, he notes that when a monosyllabic noun root appears with other morphemes in Zezuru, the epenthetic [i] is not parsed. However, when the monosyllabic noun root appears in isolation, it surfaces with an epenthetic segment that does not appear in other forms. For example, the noun stem /-^{m}bá/ *'house'* surfaces as [ku-^{m}bá] *'at the house'* when it appears with a prefix /ku-/ but as [i-^{m}bá] '*at the house'* in isolation. This points to the surface realisation of an epenthetic [i] that functions to augment monosyllabic nouns thus blocking subminimal output forms. In my discussion, I adopt the same analysis for siSwati as indicated in the examples presented above. I therefore conclude that subminimality of the monosyllabic verbs motivates their phonological augmentation to satisfy the siSwati disyllabic requirement and that the overall application and blocking of phonological augmentation of the passive form is conditioned by the size of the input PStem.

In passives, M_{IN}-W_D ensures that the grammar selects the correct form, with /-w-/ in disyllabic and polysyllabic stems, and the augmented /-iw-/ in subminimal ones. I formalise this disparity below:

Tableau 26: Resolving word minimality through augmentation in siSwati passives

/ɮ-w-a/	M_{IN}-W_D	DEP-IO
a. [ɮʷa]	*!	
☞b. [ɮí.wà]		*

Since the grammar considers the monosyllabic verb [ɮí] subminimal, siSwati opts for the extended shape of the passive that has epenthetic [i]. This therefore eliminates candidate (a) for its fatal violation of M_{IN}-W_D, an indomitable constraint in the grammar. Candidate (b) rightfully appears with an inserted segment to satisfy minimality requirements in the grammar. The DEP-IO violation is not fatal since minimality outranks epenthesis in this grammar.

Well-formed constructions adopt the same ranking. The grammar blocks the augmentation of verbs that are already two syllables or more, as seen in Tableau 27 below where the disyllabic verb optimally selects /-w-/ rather than the extended form /-iw-/.

Tableau 27: Blocking augmentation in well-formed passives

/phek-w-a/	M_{IN}-W_D	DEP-IO
☞a. [phe.k^{w}a]		
b. [phe.ki.w-a]		*!

In Tableau 27, candidate (b) fatally violates DEP-IO by using epenthesis as a repair strategy for a construction that does not require augmentation. Candidate (a) is the optimal winner since it has used the correct form of the passive morpheme, as it is minimally well-formed in the siSwati grammar.

The shape of isiZulu passives is no different from siSwati and Ndebele (Doke, 1954; Poulos & Msimang, 1998; Givón, 1971; Keet & Khumalo, 2017). They identify the two forms of the passive in isiZulu as /-w-/ and /-iw-/, noting that these two shapes are allomorphs of the same phoneme, with /-w-/ patterning with disyllabic and polysyllabic verb stems, while /-iw-/ patterns with monosyllabic ones. I therefore conclude that Ndebele and isiZulu adopt the same ranking as siSwati where M_{IN}-W_D outranks DEP-IO to allow the parsing of surface forms that are minimally disyllabic. The same grammar where M_{IN}-W_D >> DEP-IO would optimally prohibit the augmentation of minimally well-formed configurations as demonstrated in the infinitive and polysyllabic verb stems.

Similar to siSwati, isiNdebele, and isiZulu, Chichewa enforces binarity across all categories in its grammar. According to Downing and Mtenje (2017), the target is to enforce disyllabicity across all grammatical representations in the grammar. They contend that Chichewa grammar enforces [i] augmentation of subminimal constructions while blocking the same resolution strategy in disyllabic, well-formed input forms. To first illustrate minimality in Chichewa, Downing & Mtenje present variation in the Class 9/10 prefix. They indicate that consonant-initial but disyllabic noun stems take on a homorganic nasal as their class prefix. They note that monosyllabic stems, on the other hand, have an epenthetic [i] preceding the nasal prefix. They argue that the epenthetic segment is motivated by the minimality constraints in the language. Consider the following example (Downing & Mtenje, 2017, p. 210):

Disyllabic stems:

612.	/N-bí:dzi/	→	[mbí:dzi]	'zebra'
613.	/N-vú:la/	→	[mvú:la]	'rain'
614.	/N-do:do/	→	[ndo:do]	'stick'
615.	/N-go:zi/	→	[ŋgo:zi]	'accident'

Monosyllabic stems:

616.	/N-fa/	→	[í:-mfa]	'death'
617.	/N-psó/	→	[í:-mpsó]	'kidney'
618.	/N-vi/	→	[í:-mvi]	'grey hair'
619.	/N-sá/	→	[í:-nsa]	'deer'

As evident in the above examples, the minimality effects in Chichewa dictate the surface realisation of the form of the prefix in Class 9/10 nouns. Note that stems with disyllabic and polysyllabic stems as illustrataed in (612) to (615) take the archiphoneme /N/, which is the noun class prefix, yet the monosyllabic stems in (616) to (619) take the same prefix preceded by an epenthetic segment. In this discussion, I can therefore conclude that subminimal forms take /iN-/ as their prefix while other stems take the bare archiphoneme as their prefix.

Verbs and the formation of imperatives present further evidence for minimality constraints in Chichewa. Like other Bantu languages, the imperative form of the verb consists of the bare stem. Consider the following examples (Downing & Mtenje, 2017, p. 211):

620.	/vi:na/	→	[vi:na]	'dance'	***i-vi:na***
621.	/gó:na/	→	[gó:na]	'sleep'	***i-gó:na***
622.	/lemé:la/	→	[lemé:la]	'get heavy'	***i-lemé:la***
623.	/jasamu:la/	→	[jasamu:la]	'yawn'	***i-jasamu:la***

The polysyllabic stems above do not require any augmentation as they are minimally well-formed. The data in (620) to (623) below, however, consists of monosyllabic PWords. Note that these appear with epenthesised [i] to fulfil the minimality restriction on the Chichewa grammar.

624.	/ba/	→	[i:ba]	‘steal’
625.	/gja/	→	[i:gja]	‘eat’
626.	/gwa/	→	[i:gwa]	‘fall’
627.	/mwa/	→	[i:mwa]	‘drink’

As illustrated above, the verbs are subminimal hence their augmentation through [i] epenthesis to ensure that they conform to the binarity requirement of PWords in Chichewa. While this discussion has presented evidence from noun class 9/10 and imperatives, the minimality restriction in Chichewa extends to other morphophonological processes such as reduplication, infinitive formation, and /mu/ reduction, each of which is conditioned by the size of the PWord, respectively. In Chichewa, the minimality constraint M_{IN}-W_D outranks dependency since optimal subminimal constructions have to augment their surface forms through epenthesis. Chichewa, therefore, assumes the same ranking as siSwati and the other Nguni languages. I illustrate this similarity in ranking below:

Tableau 28: Resolving word minimality through the augmentation of subminimal constructions in Chichewa

/mwa/	M_{IN}-W_D	DEP-IO
a. [mwa]	*!	
☞b. [i.mwa]		*

In Tableau 28, candidate (a) has been eliminated for its fatal violation of minimality restrictions in the grammar. Our optimal candidate has inserted [i] in violation of DEP-IO, but still surfaces as the overall winner since [i] epenthesis is optimal in Chichewa augmentation.

While siSwati, isiNdebele, isiZulu, chiShona, and Chichewa enforce a disyllabic minimality requirement on their PWords in all morphosyntactic contexts, iKalanga is typologically different (Kadenge & Mathangwane, 2017). An analysis of minimality effects in iKalanga reveals disparity in what its grammar considers subminimal, with monosyllabic configurations in nouns and verbs perfectly well-formed while verbs and pronouns require augmentation to satisfy minimality restrictions on the PWord. Kadenge and Mathangwane (2017) attribute this variation to the existence of co-phonologies that permit different minimality conditions on its morphosyntactic categories. For example, the augmentation of monosyllabic and monomoraic forms is permitted in (628) to (631), while it is blocked in (632) to (637). Consider the examples below (Kadenge & Mathangwane, 2017, p. 144):

Verbs

628.	/já/	→	[i.já]	'eat'	
629.	/dwá/	→	[i.dwá]	'go out'	
630.	/dá/	→	[i.dá]	'love'	
631.	/fá/	→	[i.fá]	'die'	

Nouns

632.	/go/	→	[go]	'wasp'	***i.go**
633.	/dzu/	→	[dzu]	'eagle'	***i.dzu**
634.	/ngwe/	→	[ngwe]	'tiger'	***i.ngwe**

Adjectives

635.	/psá/	→	[psá]	'new'	***i.psá**
636.	/bí/	→	[bí]	'ugly/bad'	***i.bí**
637.	/tshu/	→	[tshu]	'black male cattle'	***i.tshu**

In addition to blocking the augmentation of disyllabic forms for their well-formedness, iKalanga grammar also blocks augmentation of monosyllabic nouns and adjectives. This is in line with Kadenge and Mathangwane (2017)'s argument that form extension through epenthesis is restricted to verbs and pronouns. Phonological augmentation of the forms in (632) to (637) above would be ungrammatical since subminimality is optimal in nouns and adjectives. For instance, iKalanga grammar would rule out **i.psá*, **i.bí* and **i.tshu* since iKalanga adjectives do not trigger augmentation.

IKalanga places M_{IN}-W_D higher than DEP-IO to allow the surface realisation of [i] epenthesis in verbs and pronouns, while the ranking is reversed to DEP-IO >> M_{IN}-W_D in nouns and adjectives to block epenthesis. I formalise this disparity in Tableaux 29 and 30 below:

Tableau 29: The augmentation of subminimal verbs and pronouns in iKalanga

/já/	M_{IN}-W_D	DEP-IO
a. [já]	*!	
☞b. [i.já]		*

The above tableau illustrates the augmentation of monosyllabic verbs in iKalanga. Note that the grammar eliminates candidate (a) for its violation of M_{IN}-$W_{D,}$ which is an indomitable constraint in verbs and pronouns. The augmented form in (b) is the optimal canidate, since it has epenthesised [i], in line with the minimality conditions expected in iKalanga verbs and pronouns. The same grammar does not suffice for nouns and adjectives, as illustrated in Tableau 30 below:

Tableau 30: Blocking the augmentation of monosyllabic nouns and adjectives in iKalanga

/go/	DEP-IO	M_{IN}-W_D
☞a. [go]		*
b. [i.go]	*!	

As evident in Tableau 30, [i] epenthesis is blocked hence the grammar eliminates candidate (b) for its violation of the now indomitable DEP-IO that prohibits augmentation in nouns and adjectives. IKalanga adopts the same grammar for disyllabic forms such as *lima* 'farm' and *baka* 'build' that do not trigger [i] epenthesis (Kadenge & Mathangwane, 2017, p. 133). For this language, subminimality is well-formedness in nouns and adjectives, hence the surface realization and subsequent optimal representation of [go] in candidate (a), presenting cross-linguistic variation to the ongoing debate on minimality effects in Bantu.

Languages such as Chitonga introduce a different minimality restriction on the PWord. Similar to Swahili, Mkochi (2009) notes that Chitonga considers bimoraicity as its unit of analysis to satisfy minimality requirements in the language. Even though the imperative form in monosyllabic PStems appears with an epenthetic [i], Mkochi argues that Chitonga permits both augmentation and vowel lengthening 'to satisfy a general structure of Foot Binarity' (p. 279), where both bimoraicity and disyllabicity account for word minimality in the grammar. Consider the following Chitonga examples (Mkochi, 2009, p. 279):

638.	/to/	→	[to:]	'take'
639.	/pe/	→	[pe:]	'get subdued'
640.	/ko/	→	[ko:]	'catch'
641.	/po/	→	[po:]	'get cold'
642.	/me/	→	[me:]	'grow'

In each of the Chitonga examples, the output parses a lengthened vowel to account for minimality, ranking M_{IN}-W_D above dependency. This indicates that the word minimality constraint must account for both moraic and syllabic representation across Bantu languages.

The discussion has so far highlighted the importance of mapping the asymmetry between PWords and PStems, pointing out how this variation determines minimality effects in each grammar. Firstly, I have indicated that monosyllabic PStems do not trigger augmentation while PWords do. I have also demonstrated the disparity in what languages consider subminimal: the syllable in siSwati and the other Nguni languages accounts for minimality, while Chitonga and Swahili use moraic representation. In each of the languages under investigation, M_{IN}-W_D outranks DEP-IO to allow the parsing of epenthetic material in surface forms that are underlyingly subminimal. Even with Swahili and Chitonga, the surface form must be bimoraic, and therefore susceptible to the minimal word constraint, ranking M_{IN}-W_D above dependency. I now turn to the next piece of evidence for word minimality within the siSwati verb: the reduplication process.

7.2.3 Word minimality in siSwati verb reduplication

Another context in which siSwati demonstrates its ban on subminimal constructions is within the reduplication process. As discussed in Section 6.3.4, siSwati reduplicated forms of the verb copy the first two syllables of the verb as seen in the examples below. I first illustrate the reduplication of disyllabic verb stems:

643.	/hámbà/	→	[**hamba**-hamba]	'walk a little bit'
644.	/válà/	→	[**vala**-vala]	'close a little bit'
645.	/ɬálà/	→	[**ɬala**-ɬala]	'sit a little bit'
646.	/ɓúkà/	→	[**ɓuka**-ɓuka]	'sit a little bit'
647.	/tsèlà/	→	[**tsela**-tsela]	'pour a little bit'

The disyllabic verb forms in (643) to (647) above have copied the verb stems as they are, allowing both the reduplicant and the base to surface as disyllabic forms. SiSwati grammar stipulates that the reduplicant must be binary (Downing, 1999; Malambe, 2006). The OT grammar I assume for siSwati reduplication uses RED[σσ], which I define below, to enforce binarity of the reduplicant.

648. RED[σσ]
The reduplicant must be minimally disyllabic.
(Hyman, Inkelas & Sibanda, 1999, p. 280)

RED[σσ] ensures that the siSwati reduplicant is two syllables. In my OT analysis, RED[σσ] and M_{IN}-W_D have similar restrictions as they both enforce binarity, one on the PWord and the other on the reduplicant. However, these two constraints are not equally ranked to account for the output forms in polysyllabic and vowel-initial verb forms (I discuss these in subsequent subsections). I illustrate this ranking in Tableau 31 below:

Tableau 31: Reduplication and minimality in disyllabic verb forms

/p^hékà/	RED[σσ]	M_{IN}-W_D	DEP-IO
☞a. [**p^heka**-p^heka]			
b. [**p^heka-ji**-p^heka]	*!		*

The reduplicant has to be binary as illustrated in Candidate (a) where both syllables of the input are copied. Candidate (a) satisfies all constraints since it is well-formed, while Candidate (b) is eliminated for inserting the augmentative morpheme /-ji-/ to a minimally well-formed reduplicant. As evident, the augmentation of verb roots that are two or more syllables is prohibited. The grammar therefore eliminates Candidate (b) for its violation of RED[σσ].

Unlike disyllabic verb forms, polysyllabic stems are not copied as they are. Downing (1999, 20001, 2005) notes that partial reduplication demands that PWords are not copied as they are, but that only the first two syllables of each verb stem are copied, supporting her argument that reduplicants are not PWords. She notes that reduplicants in and of themselves, are not PWords but require to be attached to the verb stem as INFL=RED + base (Downing, 2001, p. 46) to parse an optimal PWord. Consider the following examples:

649.	/gámùlá/	→	[**gamu**-gamula]	'break a little'
650.	/p^{h}ákèlá/	→	[**p^{h}ake**-p^{h}akela]	'serve a little'
651.	/t^{h}á^{n}dàzá/	→	[**t^{h}a^{n}da**-t^{h}a^{n}daza]	'pray a little'
652.	/lámùlà/	→	[**lamu**-lamula]	'stop (a fight) a little bit'
653.	/phúɲùlà/	→	[**phuɲu**-phuɲula]	'let go (of sth) a little bit'

The examples in (649) to (653) illustrate that RED[σσ] ensures that siSwati grammar copies part of the verb form in polysyllabic stems. I formalise this discussion in Tableau 32 below:

Tableau 32: Partial reduplication and minimality in polysyllabic verb stems

/lámùlá/	RED[σσ]	MinWord	MAX-IO
a. [lamula-lamula]	*!		
☞b. [**lamu**-lamula]			*

The grammar blocks the polysyllabic stem in (a) from copying as is hence its fatal violation of RED[σσ]. The optimal candidate (b) has parsed a disyllabic reduplicant, in line with the reduplication grammar in siSwati. As evident in the tableau, both canidates do not violate minimality or dependency. Even though (b) deletes a syllable in violation of MAX-IO to parse a binary RED, the violation is non-fatal.

In monosyllabic verb stems, the grammar enforces morphological augmentation to satisfy the disyllabic word size on the PWord. Since the grammar bans subminimality, the reduplicant surfaces with an epenthetic syllable /-ji-/ to augment the monosyllabic, subminimal verb forms. For instance, forms such as /fá/'die' would optimally surface as [**faji**-fa] 'die a little'. Similarly, [**ɮaji**-ɮa] would suffice for /ɮá/ 'eat,' indicating that siSwati reduplicants morphologically augment subminimal forms using morpheme /-ji-/ to repair subminimality, in line with the prosodic word size requirements. Downing (1999, 2001) notes that isiNdebele and other Bantu languages pattern with siSwati in this regard. She argues that all monosyllabic verb forms augment through /-ji-/ epenthesis to satisfy RED[σσ]. She further proposes that the target for reduplication is the PStem, not the PWord. This accounts for the surface realisation of the output forms in partial reduplicants where the reduplicants are disyllabic forms rather than a copy of the whole PStem. Aligning the epenthetic syllable with the reduplicant indicates that /-ji-/ augments the reduplicant, not the PWord which constitutes the reduplicant and the input verb stem. For instance, the grammar would not parse *lwa-lwa as an optimal reduplication candidate even though it is a minimally well-formed PWord. This points to RED[σσ] ranking higher than M_{IN}-W_D to block the occurrence of monosyllabic, therefore subminimal reduplicants. I illustrate this interaction in Tableau 33 below:

Tableau 33: Resolving word minimality through augmentation in monosyllabic reduplicated verb forms

/ɮa/	RED[σσ]	MINWORD	DEP-IO
a. [ɮa-**ɮa**]	*!	*	
☞b. [**ɮa-ji**-ɮa]		*	*

Candidate (a) fatally violates RED[σσ], a high ranking constraint in the grammar since the reduplicant is monosyllabic when siSwati grammar stipulates that it has to be two syllables. Even though (b) violates DEP-IO by epenthesising the diagnostic morphologically empty morpheme [ji], the grammar does not consider this fatal, hence its realisation as our optimal candidate.

The discussion has so far highlighted how the siSwati grammar enforces binarity on the reduplicant regardless of the size of the input verb stem. I have pointed out how disyllabic verb stems are copied as they are since the reduplicant and the base are both disyllabic. Polysyllabic stems undergo partial reduplication where only the first two syllables are copied. With monosyllabic verb forms, the grammar augments the subminimal stems trough [ji] epenthesis. All these processes ensure that the reduplicant is minimally well-formed.

The last piece of reduplication evidence I consider is in relation to vowel-initial verb stems. Downing (1999) argues that the initial vowel in onsetless verb stems does not reduplicate in line with the reduplication template in siSwati and other Nguni languages. She notes that the reduplicant excludes the stem-initial vowel from reduplicating if the output form will be minimally disyllabic. Similar to the analysis on /mu/ reduction and the position of the augment in phonological analysis (which I discuss in Section 7.3.2 below), I show that the initial vowel in vowel-initial stems lies outside of the PStem, hence its inability to reduplicate in line with the specified reduplication precepts in the grammar. Consider the following examples:

654.	/élùsà/	→	[j-e-**lusa**-lusa]	'herd livestock a little bit'
655.	/élàp^{h}á/	→	[j-e-**lap^{h}a**-lap^{h}a]	'heal a little bit'
656.	/émùká/	→	[j-e-**muka**-muka]	'drown a little bit'
657.	/é^{ŋ}gètá/	→	[j-e-**^{ŋ}geta**-^{ŋ}geta]	'add a little bit'

The above data demonstrates that the initial vowels in vowel-initial verb forms are not copied in the reduplicant. Note that the reduplication template stipulates that only the first two syllables form part of the reduplicant. However, the above examples have excluded the vowel, following Downing (1999)'s argument on their status as extra-prosodic segments. The grammar therefore does not recognise the stem-initial vowels as part of the PStem. Tableau 34 illustrates this interaction:

Tableau 34: Reduplication and minimality in well-formed vowel-initial verb forms

/élùsá/	RED[σσ]	M_{IN}-W_D	DEP-IO
a. [**elu**-lusa]	*!		
☞b. [e-**lusa**-lusa]			
c. [**elusa**-elusa]	*!		

The grammar eliminates candidates (a) for being subminimal and (c) for parsing an extra-prosodic segment within the reduplicant. RED[σσ], therefore eliminates both candidates for violating minimality restrictions imposed on the reduplicant. Candidate (b) is optimal, even though the reduplicant has not parsed the extra-prosodic [e].

Downing (1999) further notes that the extra-prosodic segment in vowel initial stems is maintained if its exclusion threatens the subminimality of the reduplicant. This means that phonological restrictions trump faithfulness to morphological conditions in this case. Consider the following examples:

658.	/éɓà/	→	[j-**eɓa**-j-eɓa]	'steal a little bit'
659.	/é^{n}dzà/	→	[j-**e^{n}dza**-j-e^{n}dza]	'marry a little bit'
660.	/é|à/	→	[j-**e|a**-j-e|a]	'skip a little a bit'
661.	/élà/	→	[j-**ela**-j-ela]	'sieve a little bit'

Note that in each case, all stem-initial vowels are parsed in the surface forms. The grammar maintains these extra-prosodic segments to satisfy minimality requirements enforced on the reduplicant. I formalise this disparity in Tableau 35 below:

Tableau 35: Reduplication and minimality in monosyllabic vowel-initial forms

/ela/	RED[σσ]	M$_{IN}$-W$_{D}$	DEP-IO
a. [e-**la**-**j**-ela]	*!		*
☞b. [**ela**-**j**-ela]			*

In Tableau 35, RED[σσ] eliminates candidate (a) for subminimality, even though it has excluded the extra-prosodic vowel from the reduplicant. Candidate (b), on the other hand, has parsed a minimally well-formed reduplicant, hence its being optimal. I now turn the discussion to minimality restrictions in nominals.

7.3 Evidence for word minimality requirements in siSwati nominal processes

Similar to verbs, nouns enforce binarity requirements on the PWord. This means that subminimal constructions are not permitted across nominals in siSwati. To illustrate this, I provide evidence for the blocking and application of augmentation repair strategies in nouns, pronouns, and hypocoristic names. I begin the analysis with nouns.

7.3.1 Word minimality in /mu/ reduction

The size of the PStem determines the application and blocking of /mu/ reduction in Classes 1 and 3 nouns in siSwati. First discussed in Chapter 5, obligatory /mu/ truncation is conditioned by the size of the noun stem whereupon the class prefix is realised with the vowel in monosyllabic PStems, but appears truncated when it appears with nouns that are two or more syllables. Consider the examples below:

662.	/úmù-^{n}tfù/ CL1-person 'person'	→	[ú.mù.^{n}tfù]	*u.ṃ.tfu
663.	/úmù-fí/ CL1-deceased 'the deceased'	→	[ú.mù.fí]	*u.ṃ.fi
664.	/úmù-tí/ CL3-homestead 'homestead'	→	[ú.mù.tí]	*u.ṃ.ti
665.	/úmù-tsí/ CL3-herb/medicine 'herb/medicine'	→	[ú.mù.tsí]	*u.ṃ.tsi

In the monosyllabic nouns in (662) to (665), /mu/ reduction is blocked since it would lead to subminimality. As already highlighted, the prefix is reduced when it appears before disyllabic and polysyllabic PStems as illustrated below:

666.	/úmù-ʃánà/ CL1-niece/nephew 'niece/nephew'	→	[ú.**ṃ**.ʃá.nà]
667.	/úmù-fánà/ CL1-boy 'boy'	→	[ú.**ṃ**.fá.nà]

668. /úmù-tsákàtsí/ → [u.**m̩**.tsá.kà.tsí]
CL3-witch
'witch'

669. /úmù-fúlà/ → [ú.**m̩**.fú.là]
CL3-river
'river'

670. /úmù-ɬáɓà/ → [ú.**m̩**.ɬá.ɓà]
CL3-earth
'earth'

The above disyllabic and polysyllabic examples typically reduce /mu/ and the resultant nasal is syllabic, non-moraic [m̩] since the input PStems are minimally well-formed. As discussed in Chapter 5, the /mu/ reduction process provides an ideal context on how siSwati grammar blocks or permits the occurrence of various phonological processes due to minimality conditions.

/mu/ reduction as a phenomenon occurring in Classes 1 and 3 points to the importance of the phonology and morphology interface in phonological analysis. As discussed in Chapter 4, siSwati has a mixed noun class system, with noun classes that have an overt augment, while others do not. Of importance in this discussion is whether the augment should account for minimality in siSwati grammar. I assume two explanations for the exclusion of the pre-prefix from counting towards minimality. First, the discussion on the prosodic domain and its relevance in determining minimality rule application obtains that the size of the PStem, not the PWord, is the motivation for the application and blocking of the /mu/ reduction process. To form minimally well-formed PWords in siSwati, the prefix before monosyllabic PStems is not susceptible to truncation, while disyllabic and polysyllabic get reduced. This means that disyllabic PStems should be considered minimally well-formed in the grammar, hence their susceptibility to /mu/ truncation, a phonological process contingent upon the size of the PStem. Secondly, the augment is argued to fall outside of the PWord (Kadenge, 2015). On the retention of the augment in /mu/ truncation classes, Kadenge notes that the pre-prefix in isiZulu and isiNdebele does not form part of the PWord, but that it is prefixed to an already well-formed PWord. I adopt the same analysis for siSwati, noting that the language retains the labial vowel in monosyllabic stems to avoid parsing a subminimal PWord consisting of the syllabic nasal and the subminimal noun stem in the surface representation. Even though the output nasal in /mu/ truncation is syllabic and should therefore count towards minimality, deleting the labial vowel in subminimal PStems is not optimal since it violates minimality requirements in the grammar.

In OT terms, the /mu/ truncation grammar employs HighVowelElision and MAX-IO, two constraints that necessitate /mu/ truncation in Classes 1 and 3 noun stems with two or more syllables, as discussed in Chapter 5 of this dissertation. I have pointed out that /mu/ reduction is blocked in subminimal forms thus violating a high ranking constraint, HighVowelElision. However, since Min-Wd is an indomitable constraint in the grammar I assume for word minimality, HighVowelElision will be ranked lower, to permit the surface realisation of the class prefix /mu/ in subminimal forms. The factorial representation of the two constraints is Min-Wd >> HighVowelElision >> MAX-IO to block deletion in monosyllabic PStems. As defined in Chapter 5, I formalise the two constraints below:

671. HighVowelElision

Parsing of high rounded vowel is prohibited.

(Harford & Malambe, 2011, p. 7; Kadenge, 2015, p. 96)

672. MAX-IO

Elision of segments is prohibited.

(Kager, 1999, p. 67)

In /mu/ reduction Min-Wd outranks HighVowelElision and MAX-IO as seen in Tableau 36 below.

Tableau 36: Blocking /mu/ reduction in subminimal PStems

/ú-mù-^{n}tfù/	Min-Wd	HighVowelElision	MAX-IO
a. [ú.ṃ.^{n}tfù	*!		*
☞b. ú.mù.ntfù		*	

The grammar has eliminated candidate (a) for deleting thus violating Min-Wd, an indomitable constraint. Candidate (b) parses the [u] but this is not considered a fatal violation since HighVowelElision is low ranking. Note that the augment does not count towards minimality otherwise (a) would have been optimal in the grammar.

The same grammar blocks parsing [u] in the surface representation of minimally well-formed PStems, where the optimal candidate elides [u] and parses an output syllabic [m̩], ranking MIN-WD and HIGHVOWELELISION over MAX-IO to allow /mu/ deletion in the optimal candidate.

Tableau 37: /mu/ reduction and minimality in well-formed PStems

/ú-mù-ʃá-nà/	MIN-WD	HIGHVOWELELISION	MAX-IO
a. [ú.mu.ʃá.nà]	*!	*	
☞b. [ú.m̩.ʃá.nà]			*

Even though minimally well-formed, candidate (a) is eliminated for parsing vowel [u] in the prefix, thus incurring a fatal violation of MIN-WD, which requires disyllabic PStems to truncate the prefix vowel. This deletion violates HIGHVOWELELISION. The optimal candidate (b) has truncated the prefix and the PStem is binary, and satisfies MIN-WD and HIGHVOWELELISION, both high-ranking constraints in the grammar. MAX-IO violation is not fatal since it is a low ranking constraint in the grammar.

7.3.2 Word minimality in pronouns

In the formation of absolute pronouns in siSwati, the language juxtaposes the SM, formative [o] and stabiliser [-nà] (Ziervogel & Mabuza, 1976; Sibanda & Mthembu, 1996) to satisfy the disyllabic word minimality restriction to on the PWord. Consider the following examples:

673. /ú-o-nà / → [wó.nà]
CL3.it
'it'

674. /lí-o-nà / → [ló.nà]
CL5.it
'it'

675. /sí-o-nà/ → [só.nà]
CL7.it
'it'

676. /tí-o-nà/ → [kó.nà]
CL8.it
'it'

677. /í-o-nà/ → [jó.nà]
CL9.SM-it
'it'

678. /ɓú-o- nà/ → [ɓó.nà]
CL14.SM-it
'it'

679. /kú-o-nà/ → [kó.nà]
CL15.SM-it
'it'

The above data illustrate the formation of the absolute pronoun in siSwati, highlighting how the addition of the stabiliser satisfies the minimality requirement in the grammar. Note that V_1 in each configuration eliminates the dispreferred VV sequences. As discussed in Section 4.2, siSwati grammar does not tolerate hiatus configurations and as such employs various repair strategies such as glide formation and vowel elision to eliminate output VV sequences.

Ziervogel and Mabuza (1976) as well as Sibanda and Mthembu (1996) note that the stabiliser does not appear when the SM and formative /o/ occur with other affixes. This is evident in cases where the absolute pronoun denotes location. This analysis points to the augmentative role that /-nà/ plays in the formation of the pronoun in siSwati. I illustrate this below:

680. /kú-li-o/ → [kú.lò] ****ku.lo-na***
LOC-CL5.SM-it
'to it'

681. /kú-si-o/ → [kú.sò] ****ku.so-na***
LOC-CL7.SM-it
'to it'

682. /kú-ti-o/ → [kú.tò] ****ku.to-na***
LOC-CL8.SM-it
'to them'

683. /kú-ɓu-o/ → [kú.ɓò] ***ku.ɓo-na**
LOC-CL14.SM-it
'to it'

684. /kú-ku-o/ → [kú.kò] ***ku.ko-na**
LOC-CL15.SM-it
'to it'

In these pronouns, M_{IN}-W_{D} blocks /-nà/ insertion when the absolute pronoun marker appears with other affixes such as the ones in (680) to (684), indicating that [kú-] counts for minimality. This patterns with the assumed grammar on the siSwati imperative where augmentation through /-nà] insertion is only allowed with the bare PStem in underlying monosyllabic forms such as [p^há**-nì**] and not in [kú.p^hà], respectively. The grammar I assume for minimality conditions in siSwati pronouns therefore remains M_{IN}-W_{D} >>> DEP-IO to allow the augmentation of subminimal constructions while blocking epenthetic material material in well-formed PWords.

7.3.3 Word minimality in hypocoristic nouns

Additional evidence for word minimality is presented in the shortening of given names. Malambe (2006) states that the common practice in forming nicknames or pet names in siSwati is to shorten the name to two syllables rather than one or three. This is in line with minimality conditions in the language in that monosyllabic names are subminimal, while two or more syllables would defeat the purpose for shortening the hypochoristic names. Consider the following examples:

685. /fezile/ → [fe.zi]
686. /ɓusis^{w}a/ → [ɓu.si]
687. /ɬoɓisile/ → [ɬo.ɓi]
688. /lomagugu/ → [gu.gu]

In the above examples, the polysyllabichypocoristic names are reduced to minimally well-formed shortened PWords. Shortening these forms any further would yield minimally ungrammatical representations, violating minimality restrictions in the grammar. In the next section, I summarise minimality effects in the Bantu languages discussed in this chapter.

7.4 Summary of the chapter

Chapter 7 demonstrated that languages employ different phonological resolution strategies that conspire to enforce binarity on their PWords. The discussion also indicated that siSwati ranks M_{IN}-W_D high to enforce restrictions on subminimality across all grammatical categories. Of key importance is that the analysis placed the syllable at the centre of the discussion, aligning minimality restrictions on the PWord with the goals of the dissertation. The chapter further indicated that Bantu languages are typologically different, as the unit for minimality measure can either be the syllable or the mora, as seen in some Swahili and Chitonga representations (Park, 1995; Mkochi, 2009). I also noted how other morphological processes such as reduplication enforce binarity on the PStem, and not the PWord.

Furthermore, Chapter 7 revealed that resolution strategies for word minimality in siSwati can either utilise phonological or morphological augmentation independent of the category of the word under investigation. In this discussion, I presented that in verbs, epenthetic coronal vowel [i] is inserted in the passive form, while the same category inserts morphemes [-ni] in imperatives and [-ji-] in reduplicated forms. SiSwati minimality effects pattern with the grammar of other languages such as isiNdebele, isiZulu, isiXhosa, and chiShona, amongst others, highlighting the typological similarities and differences in minimality effects across various Bantu languages.

Lastly, Chichewa (Downing & Mtenje, 2017) demonstrated that even though the target for minimality effects is the same as in siSwati, the repair strategies are dissimilar. I noted how Chichewa grammar enforces phonological augmentation through [i] epenthesis across all grammatical categories. IKalanga, on the other hand, exhibited the existence of co-phonologies where the grammar selected depended on the word category. For instance, monosyllabic verbs and pronouns are subminimal and therefore repaired through augmentation, while monosyllabicity is optimal in nouns and adjectives. All the languages discussed herein demonstrate the importance of crosslinguistic analysis of phonological processes to map the level of similarities and differences in phonological analysis.

CHAPTER 8

CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

This dissertation set out to investigate siSwati segmental phonology. The focus was on examining various phonological processes that create contexts that give rise to dispreferred syllable structures in siSwati gramamr. The ultimate goal was to argue for a CV syllable template and a disyllabic minimal word size across all PWords in siSwati. This chapter, therefore, provides an overview of the general conclusions I made on the syllable structure and minimal word restriction in siSwati grammar. I explore how each phonological process and the effects thereof align with the objectives of the study. I also situate the current argument within the larger Bantu language context for typological reasons. I begin this section with general conclusions on each phonological process under investigation, then present recommendations for future research.

8.2 General Conclusions

In Chapter 3, I presented evidence in support of the different syllable types permitted in siSwati grammar. I demonstrated how each of these fit into the canonical siSwati and Bantu CV syllable. Firstly, I noted how ONSET ensures that the grammar blocks word-medial onsetless syllables. Furthermore, I demonstrated how contentious consonant sequences such as affricates, prenasalised consonants, and labialised glides are parsed as unitary segments that fit into a single C-Slot. For instance, the longest permissible syllable in siSwati is phonologically represented as the prenasalised and labialised affricate [^{n}tf^{w}] in [u.ṃ.^{n}**tf**^{w}a.na] *'child'*. The different representations of the siSwati syllable are conditioned by the Unified Feature Geometry model, a phonological framework that demonstrates how the different syllable types can fit within singular V-Slots and C-Slots. The discussion also highlighted how the V-Slot in siSwati can be optimally occupied by a moraic nasal [ṃ] through ranking PEAK as a low-ranking constraint to allow the surface representation of a syllabic nasal.

Seeing that siSwati is an agglutinative language, like most Bantu languages, the study demonstrated how morpheme sequences give rise to a series of dispreferred configurations that potentially violate the siSwati syllable template. In Chapter 4, I explored how morpheme concatenation creates vowel hiatus contexts which siSwati grammar eliminates through predictable repair strategies. Firstly, I noted that the grammar selects glide formation, secondary articulation, and vowel elision within the INFL Stem to block dispreferred VV sequences. Glide formation converts prevocalic labial and coronal vowels /u/ and /i/ in V_1 position into corresponding glides [w] and [j]. In contexts where V_1 is preceded by a consonant, the grammar selects secondary articulation to ensure that output forms are devoid of consonant clusters. Where glide formation and secondary articulation are banned for possible OCP and $*C^j$ violations, the grammar selects vowel deletion. The discussion demonstrated how the grammar selects spreading when dispreferred sequences occur within the MStem, highlighting the importance of leaning on morphology in phonological analysis. The study also highlighted how morphology plays a pivotal role in the selection of optimal repair strategies. For instance, /a/ + /u/ and /a/ + [i] configurations trigger either spreading or coalescence, surface representations contingent upon the morphological context in which the dispreferred sequences occur. As highlighted, spreading is triggered within the MStem while the grammar selects coalescence across word boundaries. For example, if /a/ precedes /u/ within the MStem, the grammar selects spreading, while the same sequence triggers coalescence across lexical boundaries. This disparity in output forms necessitates leaning on morphology in phonological analysis, aligning hiatus resolution patterns with the goals of the dissertation.

In Chapter 5, the study examined/mu/ reduction effects on NC syllabification in siSwati. The discussion first revealed that /mu/ truncation is restricted to contexts where the PStem is longer than two syllables. Monosyllabic stems block /mu/ truncation to avoid parsing subminimal forms in the output. Secondly, the study revealed the different representations of NCs in siSwati. /mu/ truncated output forms parse a non-assimilatory, syllabic nasal [m̩] while all other representations of the NC in siSwati surface as the complex, unitary segment [^{N}C]. The argument also highlighted the typological variation /mu/ truncation has on Bantu NC syllabification. The same constraint hierarchy in siSwati and isiZulu where PEAK and AGREE$^{(nasal)}$ rank low to realise a surface syllabic but non-assimilatory segment, does not suffice for iKalanga, chiNambya, and Nyakyusa. Where siSwati and isiZulu parse the syllabic nasal in all truncated forms, chiNambya, iKalanga, and Nyakyusa prove to be typologically different. IKalanga and Nyakyusa parse a syllabic and assimilatory nasal, assuming an AGREE$^{(nasal)}$ >> PEAK ranking. ChiNambya bans syllabic nasals, adopting an indomitable PEAK ranking which ensures that all NC surface representations – derived and non-derived – are parsed as the complex, unitary segment [^{N}C]. Despite the different NC representations in the Bantu languages discussed in this thesis, all output forms fit within the canonical Bantu CV syllable template.

I further expounded upon the siSwati syllable structure restrictions in Chapter 6 which, focused on how English loanwords, a Type IV language with a permissive syllable template, are adopted and adapted into the siSwati grammar, a Type II language with a restrictive syllable template. The analysis indicated how English complex syllable structures such as consonant clusters and syllable codas are eliminated through vowel epenthesis. In phonology, vowel epenthesis provides syllable nuclei for branching onsets and resyllabifies codas as onsets. Dispreferred vowel sequences are repaired through vowel deletion and spreading to ensure that all output vowels are monophthongal in keeping with the syllable restrictions imposed by siSwati grammar. COMPLEX^{ONSET}, NoCoda, and ONSET, which are all indomitable markedness constraints, ensure that siSwati surface forms conform to the canonical CV syllable structure, with surface monophthongs and consonantal segments that fit into the proposed V-Slot and C-Slot, respectively.

The analysis demonstrated how siSwati grammar suffices for Nguni and other Bantu languages such as chiShona, while others such as Setswana and Swahili are typologically dissimilar. The OT constraint hierarchy in Setswana and Swahili VV sequences is in keeping with the native phonology of the two languages, which permits heterosyllabification as an optimal hiatus resolution effect. Setswana and Swahili loanwords follow this template by allowing output sequences of vowels, as long as the input vowels are assigned to separate syllables in the output, thereby contributing to variation in the restrictions enforced on the Bantu syllable. The overall discussion on loanword phonology highlighted how siSwati grammar invokes various repair strategies to harmonise disparate English and siSwati syllable structures, with the ultimate goal of preserving the grammar of the recipient language, thereby aligning the argument on loanword nativisation with the goals of the dissertation. The foregrounded discussion on loanword phonology and its effects also point to the different syllable restrictions crosslinguistically, noting how surface representations are contingent upon syllable restrictions imposed by individual grammars.

In Chapter 7, the thesis demonstrated how siSwati enforces minimality restrictions on the PWord through epenthesising phonological and morphological material to augment subminimal constructions. SiSwati grammar blocks augmentation in minimally well-formed constructions. The grammar ranks MINIMALITY above DEPENDENCY to achieve minimally well-formed surface representations. This ranking suffices for all Nguni languages and other Bantu languages that enforce binarity on all surface forms, with the Nguni languages leaning on both phonological and morphological epenthesis to augment subminimal configurations. Swahili and Luganda, on the other hand, consider bimoraicity and disyllabicity in word size restrictions. In these languages, there are morphosyntactic contexts that permit monomoraic PWords, while others are typologically similar to siSwati in that they augment subminimal forms through phonological or morphological epenthesis. To compensate for minimality requirements, Swahili and Luganda trigger vowel lengthening as an optimal augmentation strategy to ensure that surface forms are bimoraic. In Chitonga, monomoraicity is optimal, making it typologically different from siSwati. Chichewa and iKalanga have also proven to be typologically dissimilar in dealing with prosodic minimality. Chichewa, for instance, triggers [i] epenthesis across all contexts, while iKalanga minimality is context-dependent. Monosyllabic nouns and adjectives in iKalanga are well-formed, while verbs and pronouns require [i] epenthesis to satisfy minimality restrictions. While all languages discussed place MINIMALITY above DEPENDENCY in their grammar, iKalanga permits dual grammars in which M_{IN}-W_{D} outranks DEP-IO in contexts that trigger augmentation, but DEP-IO outranks M_{IN}-W_{D} in contexts where monosyllabicity is not a minimality violation in the iKalanga grammar.

The discussion on the various minimality restrictions imposed on different grammars demonstrated that siSwati grammar is typologically similar to most Bantu languages that place a disyllabic requirement on their PWords, situating the study within the broader theoretical discussion on Bantu linguistics and minimality effects. Ranking MINIMALITY above DEPENDENCY also highlights the interaction between markedness and faithfulness in OT, indicating that siSwati grammar sometimes penalises subminimality by violating faithfulness to the input. In this case, markedness constraints trump faithfulness constraints to ensure conformity to the binarity restrictions on the PWord, in line with the goals the dissertation set out to attain.

In this thesis, I provided evidence for the distinct roles that the PWord and the PStem play in phonological analysis. The discussion noted how siSwati grammar places certain restrictions on the PWord that are not necessarily applicable within the PStem. /mu/ truncation, word minimality, and the reduplication process displayed this disparity in detail. Firstly, the argument highlighted how /mu/ truncation is contingent upon the size of the PStem and not the PWord. SiSwati grammar indicated that monosyllabic PStems do not undergo /mu/ reduction while stems longer than two syllables optimally truncate the prefix, parsing a syllabic nasal in the output. Secondly, the study indicated that minimality restrictions are enforced on the PWord and not the PStem, pointing out that siSwati minimality restrictions are applicable to the PWord and not the PStem. For instance, siSwati grammar places a disyllabic requirement on all surface representations of the PWord, while PStems can be optimally monosyllabic. However, subminimal PStems do not appear as independent morphemes but require augmentative material to form minimally well-formed PWords. Lastly, the reduplication process revealed how monosyllabic PStems require morphological augmentation to satisfy RED[σσ], while disyllabic and polysyllabic stems do not trigger epenthesis. The different PH domains play a pivotal role in highlighting the importance of studying the intricate phonological and morphological domains in phonological analysis. The distinct roles that the PStem and PWord play in phonological analysis also support Downing and Kadenge's (2015, 2020) argument that the PStem ≠ the PWord. The next section summarises possible areas of interest for future research.

8.3 Recommendations for future research

The study centred on the contribution of the syllable to phonological analysis in siSwati, and how most morphophonemic processes occur to enforce conformity to the preferred CV syllable. However, some areas may not have been addressed within the scope of the research but would be beneficial to the typological study of siSwati and Bantu linguistics. In this section, I briefly outline how the nativisation of English loanwords into the siSwati grammar highlighted several areas that require further research.

Firstly, the literature pertinent to the study revealed that the siSwati grammar sometimes triggers hiatus breakers such as glottal stop insertion to repair dispreferred VV sequences, particularly in loanword nativisation. I noted how cases of [ʔ] and [ɦ] selection are optimal in Zezuru native phonology (Mudzingwa, 2010) but not in siSwati and other Nguni languages. In these Southern Bantu languages, the FG theory only makes possible the spreading of labial and coronal features; pharyngeal [a] does not form a natural class with any epenthetic segments the way the coronal and labial vowels do. For instance, [li.**ʔ**o.fi.si] or [li.**ɦ**o.vi.si] '*office*', [li.**ʔ**o.da] '*order*', and [li.**ʔ**o.ri.ⁿtʃʼi] '*orange*' would optimally trigger labial attraction whereby the round vowel [o] spreads its features to the epenthetic site resulting in *[li.***w***o.fi.si], *[li.***w***o.da], and *[li.***w***o.ri.ⁿtʃʼi], respectively. Forms such as [ɓo.**ʔ**a.ɲa.ni.si] '*onions*' and [i.**ʔ**a.ji.si] '*ice*' would optimally delete V_2, in line with the precepts of the grammar I assume for siSwati. However, this is not the case since the above examples select pharyngealisation, not labialisation or deletion. Despite this contrastive evidence, the data in this thesis does not provide enough evidence to support the selection of pharyngealisation as a hiatus resolution pattern in siSwati, particularly because it is not a hiatus resolution strategy attested in siSwati native phonology. Further research could focus on morphological or phonological contexts that select [ʔ] and [ɦ] as epenthetic segments in siSwati loanword phonology, exploring how this patterns with other Nguni and Bantu languages. I therefore leave this area for future research.

Also, this study demonstrated how the siSwati grammar harmonises English loans through various diagnostic tools, the output of which aligns with the siSwati syllable template. One aspect that the current research did not delve into is the unpredictability of segment deletion as an optimal repair strategy in loanword phonology. In other repair strategies such as consonant cluster elimination, coda resyllabification, and spreading, the grammar is clear on the phonological contexts in which they occur, while I attribute vowel and consonant deletion to speaker intuition and ease of articulation as motivators for selection. For instance, the same sequence of vowels is sometimes susceptible to spreading, yet in other instances the same configuration deletes one of the input vowels. An in-depth analysis of the data would hopefully shed light on the phonological and morphological contexts in which spreading and vowel epenthesis are preferred over vowel and consonant deletion. The current study noted that consonant deletion, for instance, is blocked in sequences that would yield subminimal configurations; however, there are well-formed constructions that block deletion. I, therefore, leave this area for further investigation in future research.

Lastly, the loanword nativisation research provided empirical and theoretical evidence for the adaptation of English loanwords sourced from native speaker intuition. I am well-versed in phonology and phonological analysis, and may have a preconceived idea of the CV syllable template enforced by siSwati grammar. An in-depth analysis into loanword phonology from an intralinguistic perspective that delves into loanword adaptation from different speakers with varied levels of bilingualism and education could possibly provide empirical evidence on whether these sociolinguistic factors would ultimately confirm or reshape siSwati, and by extension, the Bantu syllable structure. Such a study would provide a unified account of loanword adaptation and syllable structure in siSwati. I also leave this area for future research.

8.4 Summary of the chapter

In summary, the chapter established the importance and relevance of the syllable as a unit for analysis in phonology. It further highlighted the importance of mapping the close link between the phonological and morphological domains in grammar. The discussion demonstrated the pivotal role that each context plays in phonological analysis. Lastly, the argument outlined the distinct roles that prosodic domains, particularly the PStem and the PWord, within the PH play in phonological analyses. The study has contributed to Bantu linguistics and phonological typology by arguing for the canonical CV syllable, examining the various representations of the preferred syllable types in siSwati and Bantu languages, respectively.

References

Adler, A. N. (2006). Faithfulness and perception in loanword adaptation: A case of Hawaiian. *Lingua*, *116*(2006), 1024-1045.

Archangeli, D. (1997). Optimality Theory: An introduction to linguistics in the 90s. In D. Archangeli and D.T. Langendoen (Eds.), *Optimality Theory: An Overview*, pp.1-32. Blackwell Publishers.

Ban, L. & Matovac, D. (2012). On Turkish loanwords in Croatian language. *Trakya University Literature Faculty*, *2*(4), 155-166.

Batibo, H. M. (1996). Loanword clusters nativisation rules in Setswana and Swahili: A comparative study. *South African Journal of African Languages*, *16*(2), 33-41.

Batibo, H. M. (2002). The evolution of the KiSwahili syllable structure. *South African Journal of African Languages*, *22*(1), 1-10.

Beddor, P. S. & Onsuwan, C. (2003). Perception of prenasalised stops. *Paper presented at the 15th ICPhS*, Barcelona.

Bell, A. (1970). Development of syllabic nasals: The case of the Bantu noun class prefixes mu-, mi-, ma-. *Working Papers on Language Universals*, *2*(1), 1-21.

Bojcic, I. & Braovic, M. (2012). Language borrowing. *Proceedings of the Međimurje Polytechnic in Čakovec*, *3*(2), 714-727.

Braver, A., & Bennett, Wm, G. (2016). Phonotactic c(l)ues to Bantu class disambiguation. *Linguistics Vanguard*. Advanced Online Publication.

Braković, E. (2007). Local assimilation and constraint interaction. In P. de Lacy (Ed), *The Cambridge handbook of phonology*, pp. 335-352. Cambridge University Press.

Broselow, E. (2015). The typology of position-quality interactions in loanword vowel insertion. In Y. Hsiao and L. H. Wee (Eds). *Capturing Phonological Shades*, pp. 292-319. Cambridge Scholars Publishing.

Bryant, J. (1849). The Zulu language. *Journal of the American Oriental Society*, *1*(4), 383-396.

Cahill, M. (1998). Nasal assimilation and labia-velar geometry. I. Maddieson & T. J. Hinnebusch (Eds), *Language history and linguistic description in Africa (2nd ed.), Trends in African Linguistics*, pp. 127-136. Africa World Press.

Cahill, M. (1999). Aspects of the phonology of labial-velar stops. *Studies in African Linguistics*, *28*(2), 155-184.

Casali, R. F. (1995). Patterns of glide formation in Niger-Congo: An Optimality Account. *Paper presented at the 69th Annual Meeting of the Linguistic Society of America, New Orleans.*

Casali, R. F. (1996). *Resolving hiatus*. [PhD thesis]. University of California, Los Angeles.

Casali, R. F. (1997). Vowel elision in hiatus contexts: Which vowel goes? *Language*, *73*(3), 493-533.

Casali, R. F. (2011). Hiatus resolution. In M. van Oostendorp, C. J. Ewen, E. Hume, and K. Rice (Eds.), *The Blackwell companion to phonology*, pp. 1-27. John Wiley & Sons, Ltd.

Chang, C. B. (2003). *"High-interest loans": The phonology of English loanword adaptation in Burmese*. [Unpublished MA thesis]. Harvard University.

Chebanne, A., Kadenge, M., & Phili, C. (2016). Making the form fit: Repair strategies in iKalanga loanword phonology. *South African Journal of Languages*, *36*(2), 231-241.

Chen, S., & Malambe, G. B. (1998). Palatalisation in siSwati: An Optimality Theoretic Approach. In I. Maddieson, and T. J. Hinnebusch (Eds.), *Language history and linguistic description in Africa*, pp. 137-146. Africa World Press.

Clements, G. N. (1999). Affricates as non-contoured stops. In O. Fujurima, B. D. Joseph, and B. Palek (Eds.), *Proceedings of LP '98: Item order in language and speech*, pp. 271-299. The Karolinum Press.

Clements, G. N. & Hume, E. (1995). The internal organisation of speech sounds. In J. Goldsmith (Ed.), *Handbook of phonological theory*, pp. 245-306. Blackwell Publishing.

Clements, G. N. & Keyser, S. J. (1983). *CV Phonology: A generative theory of the syllable*. The MIT Press.

Coetzee, A. & Pater, J. (2011) The Place of variation in Phonological theory. In J. Goldsmith, J. Riggle and A. C. L. Yu (Eds.), *Handbook of phonological theory* (2nd ed.), pp. 401-434. Blackwell Publishing.

Cope, A. T. (1971). A consolidated classification of the Bantu languages. *African Studies*, *30*(3-4), 213-236.

Cope, A. T. (1984). An outline of Zulu grammar. *African Studies*, *43*(2), 83-102.

Creissels, D. (1999). Bimoraic syllables in a language without length contrast and without consonants in coda position: The case of siSwati (S43). In J. A. Blanchon and D. Creissels (Eds.) *Issues in Bantu tonology*, pp.153-196. Rüdiger Köppe Verlage.

Demuth, K., Culbertson, J., & Alter, J. (2006). Word-minimality, epenthesis and coda licensing in the early acquisition of English. *Language and Speech*, *49*(2), 37-74.

Dlamini, J. V. (1979). *Luhlelo lwesiSwati (SiSwati Grammar).* Shutter and Shooter.

Doke, C. M. (1950). Bantu languages, inflexional with a tendency towards agglutination. *African Studies*, *9*(1), 1-19.

Doke, C. M. (1954). *The southern Bantu languages: Handbooks in African Languages (*1st ed.). Routledge.

Downing, L. J. (1997). Correspondence effects in siSwati reduplication. *Studies in the Linguistic Sciences*, *25*(1), 17-35.

Downing, L. J. (1998). On the prosodic misalignment of onsetless syllables. *Natural Language and Linguistic Theory*, *16*(1), 1-52.

Downing, L. J. (1999). Prosodic stem ≠ prosodic word in Bantu. In T. Alan Hall and U. Kleinhenz (Eds.), *Studies on the phonological word,* pp. 73-98. Benjamin Publishing.

Downing, L. J. (2000). Satisfying minimality in Ndebele. In T. A. Hall (Ed.), *Investigations in prosodic phonology: The role of the foot and the phonological word*, pp. 23-39. ZAS.

Downing, L. J. (2001). Ungeneralizable minimality in Ndebele. *Studies in African Linguistics*, *30*(1), 33-58.

Downing, L. J. (2003). Morphological constraints on Bantu reduplication. *Linguistic Analysis*, *29*(1-2), 6-46.

Downing, L. J. (2005). Morphological complexity and prosodic minimality. *Catalan Journal of Linguistics*, *4*(1), 85-106.

Downing, L. J. (2005). On the ambiguous segmental status of nasal in homorganic NC sequences. In M. van Oosterndorp and J. van der Weijer (Eds.), *The internal organisation of phonological segments,* pp. 183-216. Mouton de Gruyter.

Downing, L. J., & Kadenge, M. (2015). Prosodic stems in Zezuru Shona. *Southern African Linguistics and Applied Language Studies*, *33*(3), 291–305.

Downing, L. J. & Mtenje, A. (2017). *The Phonology of Chichewa*. Oxford University Press.

Downing, L. J., & Kadenge, M. (2020). Re-placing the PStem in the prosodic hierarchy. *The Linguistic Review*. Advanced Online Publication.

Drame, A. (2000). Foreign words as a problem in standardisation/lexicography: English and Afrikaans loan-words in isiXhosa. *Lexikos, 10*(2000), 231-241.

Givón, T. (1971b). On the verbal origin of the verbal suffixes of Bantu verb suffixes. *Studies in African Linguistics*, *2*(2), 145-163.

Goldsmith, J. A. (1976). *Autosegmental Phonology*. [PhD thesis]. Massachusetts Institute of Technology.

Goldsmith, J. (2011). The syllable. In J. Goldsmith, J. Riggle and A. C. L. Yu (Eds.), *Handbook of phonological theory* (2nd ed.), pp. 164-196. Blackwell Publishing.

Goldstein, L. (1994). Possible articulatory bases for the class of guttural consonants. In P. A. Keating (Ed.), *Phonological structure and phonetic form: Papers in laboratory phonology III*, pp. 234-241. Cambridge University Press.

Goldston, C. (1996). Direct Optimality Theory: Representation as pure markedness. *Language*, *72*(4), p.713-748

Greenberg, J. H. (1963). *The languages of Africa*. Mouton & Co: Indiana University, Bloomington.

Gunnink, H. (2018). *A grammar of Fwe: A Bantu language of Zambia and Namibia*. [Unpublished PhD thesis]. Ghent University.

Guthrie, M. (1948). *The classification of the Bantu languages*. International African Institute, Oxford University Press.

Guthrie, M. (1967). *Comparative Bantu: The comparative linguistics of the Bantu languages*. Gregg International.

Guy, G. R. & Boberg, C. (1997). Inherent invariability and the Obligatory Contour Principle. *Language Variation and Change*, *9*(1997), 149-164.

Harford, C. (1997). When two vowels go walking: Vowel coalescence in Shona. *Zambezia*, *24*(1), 69-85

Harford, C. (1999). Shona syllabification and the prosody-syntax interface in Optimality Theory. *Malilime: Malawian Journal of Linguistics*, *1*(1), 22-40.

Harford, C. & Malambe, G. B. (2011). A nominal preprefix in siSwati: A mixed System. *A paper presented at the XI Conference of the Linguistic Association of SADC Universities, Zambia.*

Harford, C. & Malambe, G. B. (2015) Optimal register variation: High vowel elision in siSwati. *Southern African Linguistics and Applied Studies*, *33*(3), 343 -357.

Harford, C. & Malambe, G. B. (2012). An Optimality Theoretic perspective on perfect imbrication in siSwati. *Nordic Journal of African Studies*, *26*(4), 277-291.

Herman, R. (1996). Prosodic structure in siSwati. *Working Papers in Linguistics*, *48*(1), 31-55.

Hoberman, R. D. (1985). The phonology of pharyngeals and pharyngealisation in pre-modern Aramaic. *Journal of the American Oriental Society*, *105*(2), 221-231.

Hubbard, K. (1995). 'Prenasalised consonants' and syllable timing: Evidence from Runyambo and Luganda. *Phonology*, *12*(2), 235-256.

Hyman, L. M. (1970). The role of the borrowing in the justification of phonological grammars. *Studies in African Linguistics*, *1*(1), 1-48.

Hyman L.M., Inkelas S., Sibanda G. (2009) Morphosyntactic correspondence in Bantu reduplication. In K, Hanson K. and S. Inkelas (Eds), *The nature of the word: Essays in Honor of Paul Kiparsky*, pp. 273–310. MIT Press,

Hyman, L. M. (2003). Segmental phonology. In D. Nurse and G. Philippson (Eds), *The Bantu languages*, pp. 42-58. Routledge.

Inkelas, S. (2011). The interaction between morphology and phonology. In J. Goldsmith, J. Riggle and A.C.L, Yu (Eds), *The handbook of phonological theory* (2nd ed.), pp. 68-102. Wiley-Blackwell.

Jin-young, T. (2011). Universals of prenasalised consonants: Phonemic or derived, single or complex? *Journal of Universal Language*, *12*(2), 127-158.

Jokweni, M. (1992). English and Afrikaans Loanwords in Xhosa. *General Linguistics*, *32*(45), 199-216 .

Kadenge, M. (2010). Complexity in phonology: The complex consonants of simple CV-syllables in Zezuru. *Southern African Linguistics and Applied Language Studies*, *28*(4), 393-408.

Kadenge, M. (2012). The rephonologisation of Shona loanwords from Engish: An Optimality Theory analysis. *Acta Academia*, *44*(1), 56-84.

Kadenge, M. (2014). Comparing nasal-obstruent clusters derived from [mu-] reduction in Shangwe and Zezuru: An Optimality Theory analysis. *Language Matters: Studies in the*

Languages of Africa, 45(1), 40-62.

Kadenge, M. (2015). The augment and /mu-/ reduction in Bantu: An Optimality Theory analysis. *South African Journal of African Linguistics*, *35*(1), 93-104.

Kadenge, M. & Chebanne, A. M. (2017). Hiatus resolution and /mu/ prefix reduction in iKalanga. South African Journal of African Languages, *37*(2), 173-186.

Kadenge, M. & Mathangwane, J. (2017). Minimality in iKalanga. *Language Matters, 48*(1), 126-146.

Kadenge, M., & Mudzingwa, C. (2011). Diphthong simplification through spreading: An Optimality Theoretic account. *Language Matters*, *41*(1), 142-161.

Kadenge, M., & Simango, S. R. (2014). Comparing vowel hiatus resolution in ciNsenga and chiShona: An Optimality Theory analysis. *Stellenbosch Papers in Linguistics Plus*, *44*(2014), 105-127.

Kager, R. (1999). *Optimality Theory*. Cambridge University Press.

Kang, E. (2002). Edge-integrity and epenthesis. *Working Papers of the Cornell Phonetics Laboratory*, *14*(1), 46-81.

Kang, H. (2010). Position and height asymmetries in hiatus resolution: a case study of korean VV sequences. *Bekerly Linguistics Society*, *36*(1), 174-187.

Kang, J. (2011). Loanword phonology. In M. van Oostendorp, C. J. Ewen, E. Hume, and K. Rice (Eds.), *The Blackwell Companion to Phonology*, pp. 1-25. John Wiley & Sons, Ltd.

Katamba, F. (1978). How agglutinating is Bantu morphonology? *Linguistics, 16*(210), 77-84.

Katamba, F. (1989). *An Introduction to phonology*. Longman.

Keet, C. M., & Khumalo, L. (2017). Grammar rules for the isiZulu complex verb. *Southern African Linguistics and Applied Language Studies*, *35*(2), 183-200.

Khan, T. (2016). *IsiZulu adoptives from English and Afrikaans: An Optimality Theory Analysis*. [Unpublished MA thesis]. University of the Witwatersrand.

Khumalo, J.S.M. (1984). A preliminary survey of Zulu adoptives. *African Studies*, *43*(2), 205-216.

Khumalo, J. S. M. (1987). *An autosegmental account of Zulu phonology*. [Unpublished PhD thesis]. University of the Witwatersrand.

Kiparsky P. (1976). Abstractness, opacity and global rules. In A. Koutsoudas (Ed.), *The application and ordering of grammatical rules*, pp. 160–186. De Gruyter Mouton.

Kiparsky, P. (2000). Opacity and cyclicity. *The Linguistic Review*, *17*(2-4), 351-365.

Kisserbeth, C.W. (1970). On the functional unity of phonological rules. *Linguistic Inquiry*, *1*(1), 291-306.

Kockaert, H. J. (1997). Vowel harmony in siSwati: An experimental study of raised and non-raised vowels. *JALL*, *18*(2), 139-156.

Koopman, A. (1992). Zulu and English adoptives: Morphological and Phonological interference. *South African Journal of African Languages*, *12*(1), 105-115.

Kula, N. (2002). *The phonology of verbal derivation in Bemba*. [PhD thesis]. University of Leiden.

Kyumin, K. (2009). Coronals in epenthesis in loanwords with comparison to velars. *Toronto Working Papers in Linguistics*, *30*(1), 53-67.

Leben, W. (1973). *Suprasegmental phonology*. [PhD thesis]. MIT, Cambridge.

Lee, J. (1999). Morphologically-driven vowel hiatus and its phonological realisations. *Studies in Phonetics, Phonology and Morphology*, *5*(1), 171-191.

Lin, Y. (2009). Loanword adaptation and phonological theory. *Proceedings of the 21st North American Conference on Chinese Linguistics*, 1-12.

Liphola, M. M. (2001). *Aspects of phonology and morphology in Shimakonde*. [Unpublished PhD thesis]. Ohio State University.

Lombardi, L. (1990). The nonlinear organization of the affricate. *Natural Language & Linguistic Theory*, *8*(3), 375-425.

Lombardi, L. (2002). Coronal epenthesis and markedness. *Phonology*, *19*(2), 219-251.

Lukusa, S. T. M. (1997). An account of vowel lengthening in Cilubà. *South African Journal of African Languages*, *17*(1), 9-12.

Mabaso, P. (2013). *The segmental phonology of Shangani*. [Unpublished PhD thesis]. University of South Africa.

Mahlangu, S. (2014). The lemmatization of loan words in the isiNdebele English isiHlathululi-magama/dictionary and their successful incorporation into the language. *Lexikos, 24*(2014), 186-197.

Malambe, G. B. (2006). *Palatalization and other non-local effects in Southern Bantu languages*. [PhD thesis]. University College London.

Malambe, G. B. (2015). Mid vowel assimilation in siSwati. *Southern African Linguistics and Applied Language Studies, 33*(3), 261-272.

Mathangwane, J. T. (1999). *Phonetics and phonology of iKalanga: A diachronic and synchronic study*. Cambridge University Press.

Mberia, K. (2002). Nasal consonant processes in Kitharaka. *Nordic Journal of African Studies*, *11*(2), 156-166.

McCarthy, J. (1994). The phonetics and phonology of pharyngeals. In P. A. Keating (Ed.), *Phonological structure and phonetic form: Papers in laboratory phonology III*, pp. 191-233. Cambridge University Press.

Mchombo, S. A. (2001). Chichewa (Bantu). In A. Spencer and A. M. Zwicky (Eds.), *The handbook of morphology* (1st ed.), pp. 500-520. John Wiley & sons, Inc.

Meinhof, C. (1932). *Principles of the comparative grammar of the Bantu language*s. Reimer.

Mkochi, W. (2009). Bimoraic word minimality in Chitonga: OT analysis. *SKY Journal of Linguistics*, *22*(2009), 277-285

Mkochi, W. (2017). Minimal prosodic stems/words in Malawian Tonga: A Morpheme-Based Template Theory analysis. *Journal of Humanities (Zomba)*, *25*(1), 128-150

Morrison, M. (2009). Homorganic NC sequences in Kibena: Pre-nasalised consonants, consonant clusters or something else? *Rice Working Papers in Linguistics*, *1*(1), 223-241.

Mtenje, A. (2016). *A comparative analysis of the phonology and morphosyntax of Cisukwa, Cindali and Cilambya*. [PhD Thesis]. University of Cape Town.

Mudzingwa, C. (2008) Minimality in Zezuru. *NAWA Journal of Language and Communication. 2*(1), 33-57.

Mudzingwa, C. (2010). *Shona morphophonemics: Repair strategies in Karanga and Zezuru*. [Unpublished PhD thesis]. The University of British Columbia.

Mudzingwa, C. (2013). Hiatus resolution strategies in Karanga (Shona). *Southern African Linguistics and Applied Language Studies*, *31*(1), 1-24.

Mudzingwa, C. & Kadenge, M. (2011). Comparing Hiatus Resolution in Karanga and Nambya: An Optimality Theory Account. *Nordic Journal of African Studies 20*(3), 203-240.

Mudzingwa, C., & Kadenge, M. (2013). An analysis of the ghost augment in chiShona. *South African Journal of African Languages*, *33*(1), 87-93.

Mudzingwa, C. & Kadenge, M. (2014). Class 1 deverbal and non-deverbal nouns in Shona: A comparative analysis. *Stellenbosch Papers in Linguistics Plus*, *44*(1), 129-148.

Mutonga, L. (2017). Hiatus resolution in Ndau. *Marang: Journal of Language and Literature*, *28*(2017), 1-20.

Mutonga, L., Mabugu, P.R., Mukaro, L., & Mugari, V. (2018) Ndau minimality effects. *Marang: Journal of Language and Literature*, *30*(2018), 1-16.

Mwaliwa, H. C. (2014). *An analysis of the syllable structure of Standard KiSwahili loanwords from Modern Standard Arabic*. [Unpublished PhD thesis]. University of Nairobi.

Mwihaki, A. N. (1998). *Loanword nativization: A generative view of the adaptation of Gikuyu loanwords.* [PhD Thesis]. Kenyatta University.

Mwihita, A. N. (1998). *Loanword nativisation: A generative view of the phonological adaptation of Gikuyu loanwords*. [Unpublished PhD thesis]. Kenyatta University.

Mwita, L. C. (2009). The adaptation of Swahili loanwords: A constraint-based analysis. *Journal of Pan African Studies*, *2*(8), 46-61.

Nash, J. (1992). *Aspects of Ruwund grammar*. [Unplished PhD Thesis]. University of Illinois, Urbana.

Ncube, C. (2005). Language development or language corruption? The case of loan-words in Isichazamazwi sesiNdebele. *Lexikos*, *15*(2005), 294-305.

Negash, T. (2015). Homorganic nasal assimilation in Arsi-Bale Afan oromo: A non-linear phonology. *Humanities and Socials Sciences Journal*, *3*(4), 240-248.

Nevins, A. & Chitoran I. (2008). Phonological variations and the variable patterning of glides. *Studies on the Phonetics and Phonology of Glide*s, *118*(12), 1979-1997.

Nurul, A. (2018). Anglicism in Indonesian. *Ethical Lingua: Journal of Language Teaching and Literature*, *5*(1), 61-71.

O'Connor, J. D. & Trim, J. L. M. (1953) *Vowel, Consonant, and Syllable: A Phonological Definition.* Taylor and Francis Group.

Odden, D. (1996). *The phonology and morphology of Kimatuumbi*. Clarendon Press.

Odden, D. (1996). Patterns of reduplication in Kikerewe. *OSU Working papers in Linguistics*, *48*(1), 111-149.

Odden, D. (2006). Minimality and onsetless syllables in Zinza. *Phonology*, *23*(3), 431-441.

Odden, D. (2015). *Bantu Phonology*. Oxford Handbooks Online.

Ondondo, E. A. (2020). Vowel hiatus resolution processes as delimiters of prosodic domains in Kisa. *International Journal of Language and Linguistics, 8*(4), 164-173.

Orie, O.O. & Pulleyblank, D (2002) Yoruba vowel elision. *Natural Language and Linguistic Theory, 20*(1), 101-156

Paradis, C. (1992/2014). *Lexical phonology and morphology: The nominal classes in Fula*. Routledge.

Paradis, C. & LaCharité, D. (2011). Loanword adaptation: From lessons learned to findings. In J. Goldsmith, J. Riggle and A. C. L. Yu (Eds.), *Handbook of Phonological Theory* (2nd ed.), pp. 741-758. Blackwell Publishing.

Park, J. (1995). Minimality effects in Swahili. In A. Akinlabi (Ed.), *Trends in African Linguistics: Theoretical Approaches to African linguistics Volume 1*, pp. 295-312. Africa World Press.

Park, J. (1997). Disyllabic Morphology in Swahili morphology. *University of Pennsylvania Working Papers in Linguistics*, *4*(2), 244-259.

Persohn, B. (2019). /mu/ and mu-reduction in Nyakyusa. *South African Journal of African Languages*, *39*(2), 191-203.

Picard, M. (2002). The differential substitution of English /θ ð/ in French: The case against underspecification in L2 phonology. *International Journal of Linguistics*, *25*(1), 87-96.

Poulos, G., & Msimang, C. T. (1998). *A linguistic analysis of the Zulu language*. Via Afrika.

Prince, A., & Smolensky, P. (1993/2004). *Optimality: Constraint interaction in generative grammar*. Blackwell Publishers.

Repetti, L. (2012). Consonant-final loanwords and epenthetic vowels in Italian. *Catalan Journal of Linguistics*, *11*(2012), 167-188.

Roach, P. (2009). *English phonetics and phonology: A practical course*. Cambridge University

Press.

Rose, Y. & Demuth, K. (2006). Vowel epenthesis in loanword adaptation: Representational and phonetic considerations. *Lingua*, *116*(1), 1112-1139.

Rosenthall, S. (1997). The distribution of prevocalic vowels. *Natural Language and Linguistic Theory*, *15*(1), 139-180.

Sabao, C. (2012). Feature sensitive and context [in-]-sensitive glide formation and coalescence in hiatus resolution in isiNdebele. *The Dyke*, *6*(1), 134-154.

Sabao, C. (2015). Resolving hiatus in (isi)Ndebele: An optimality theoretic account. *Ampersand: An International Journal of General and Applied Linguistics*, *2*(2015), 122-135.

Selkirk, E. & Lee, S. (2015). Constituency in sentence phonology: An introduction. *Phonology*, *32*(1), 1-18.

Sibanda, E. & Mthembu, N. (1996). *Sihlatiya siSwati.* Macmillan.

Sibanda, G. (2004). *Verbal phonology and morphology in Ndebele*. [Unpublished PhD thesis]. University of California, Berkeley.

Sibanda, G. (2009). Vowel processes in Nguni: Resolving the problem of unacceptable VV sequences. *Annual conference on African Linguistics*, *73*(3), 493-533.

Simango, S. R. & Kadenge, M. (2014). Vowel hiatus resolution in ciNsenga: An OT analysis. *Southern African Linguistics and Applied Language Studies*, *32*(1), 79-96.

Siptár, P. (2005). Hiatus resolution in Hungarian: An Optimality Theoretic account. *Abstract submitted for ICSH*, *7*(2005), 29-31.

Ström, E. (2013). *The Ndengeleko language of Tanzania.* [PhD thesis]. University of Gothenburg.

Taljaard, P. C., Khumalo, J. N. & Bosch, S. E. (1991). *Handbook of siSwati*. J. L. Van Schaik Ltd.

Tsvetkov, Y., Ammar, W. & Dyer, C. (2015). Constraint-based models of lexical borrowing. *Paper presented at the Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*.

Tucker Childs, G. (2003). *An introduction to African languages*. John Benjamins Publishing Company.

Uffmann, C. (2004). *Vowel epenthesis in Loanword phonology*. [PhD thesis]. Philipps University.

Uffman, C. (2006). Epenthetic vowel quality in loanwords: Empirical and formal issues. *Lingua*, *116*(7), 1079-1111.

Van de Velde, M. (2019). Nominal morphology and syntax. In M. van de Velde, K. Bostoen, D. Nurse, and G. Philipson (Eds.), *The Bantu Languages* (2nd Ed.), pp 237 - 269. Routledge.

Van de Weijer, J. (2011). Secondary and double articulation. In M. van Oostendorp, C. J. Ewen, E. Hume, and K. Rice (Eds.), *The Blackwell companion to phonology*, pp 1-17. John Wiley & Sons, Ltd.

Vratsanos, A. (2018). *Some repair strategies in Xitsonga.* [Unpublished MA thesis]. University of the Witwatersrand.

Vratsanos, A., & Kadenge, M. (2017). Hiatus resolution in Xitsonga. *Stellenbosch Papers in Linguistics Plus*, *52*(1), 175-196.

Yip, M. (1988). The Obligatory Contour Principle and phonological rules: A loss of identity. *Linguistic Inquiry*, *19*(1), 65-100.

Zerbian, S. (2002). Morpho-phonological and morphological minimality in Tswana monosyllabic stems. In T. Stolz, N. Nau, and C. Stroh (Eds.), *Monosyllables: From phonology to typology*, pp. 131-148. Akademie.

Ziervogel, D. & Mabuza, E. J. (1976). *A grammar of the Swati language*. J. L. Van Schaik Ltd.

APPENDIX 1

SISWATI NOUNS AND NOUN CLASSES

(Only singular nouns and noun classes included in the list)

Classes	**Nouns**	**Transcription**	**Gloss**
Class 1	1. Umuntfu	[umu^{n}tfu]	‘person’
	2. Umntfwana	[um^{n}tf^{w}ana]	‘child’
	3. Umtukulu	[umtˊukulu]	‘grandchild’
	4. Umshana	[umʃana]	‘niece/nephew’
	5. Umfati	[umfatˊi]	‘wife’
	6. Umfana	[umfana]	‘boy’
	7. Umfundzi	[umfu^{n}dzi]	‘learner’
	8. Umfundisi	[umfu^{n}disi]	‘pastor’
	9. Umufi	[umufi]	‘deceased’
	10. Umgijimi	[umgidʒimi]	‘runner’
	11. Umongi	[umo^{ŋ}gi]	‘nurse’
	12. Umutfwa	[umutf^{w}a]	‘dwarf’
	13. Umnaketfu	[umnaketfu]	‘brother’
	14. Umngani	[um^{ŋ}gani]	‘friend’
Class 1a	15. Malume	[malume]	‘uncle’
	16. Gogo	[gogo]	‘grandmother’
	17. Mkhulu	[mk^{h}ulu]	‘grandfather’
	18. Make	[maɠe]	‘mother’
	19. Babe	[ɓaɓe]	‘father’
	20. Babekati	[ɓaɓeɠatˊi]	‘aunt’
	21. Malumekati	[malumeɠatˊi]	‘uncle’s wife’
	22. Thishela	[t^{h}iʃela]	‘teacher’
	23. Dzadzewetfu	[dzadzewetfu]	‘sister’
	24. Mzala	[mzala]	‘cousin’
	25. Lohheya	[loɦeja]	‘crow’
	26. Chamu	[|^{h}amu]	‘mountain lizard’
	27. Logwaja	[log^{w}adʒa]	‘hare’
	28. Ncedze	[ŋ|edze]	‘small bird’
Class 3	29. Umuti	[umutˊi]	‘homestead’
	30. Umutsi	[umutsi]	‘herb’
	31. Umkhatsi	[umk^{h}atsi]	‘division’
	32. Umfula	[umfula]	‘river’
	33. Umtfwalo	[umtf^{w}alo]	‘load’
	34. Umukhwa	[umuk^{w}a]	‘knife’

	35. Umbhidvo	[umbidvo]	'green vegetable'
	36. Umbane	[umɓane]	'lightning'
	37. Umshibo	[umʃiɓo]	'relish'
	38. Umgewu	[umgewu]	'vagabond'
	39. Umushi	[umuʃi]	'stripe'
	40. Umoya	[umoja]	'wind'
	41. Ummemo	[ummemo]	'official invite'
	42. Umendvo	[ume^{n}dvo]	'marriage'
	43. Umhlaba	[umɬaɓa]	'earth'
	44. Umtsetfo	[umtsetfo]	'law'
	45. Umlente	[umle^{n}te]	'leg'
	46. Umkhaba	[umk^{h}aɓa]	'potbelly'
	47. Umjovo	[umʤovo]	'vaccine'
	48. Umgogodla	[umgogoɮa]	'spine'
	49. Umtsanyelo	[umtsaɲelo]	'broom'
	50. Umnyango	[umɲaŋo]	'door'
	51. Umuno	[umuno]	'finger'
	52. Umsebenti	[umseɓe^{n}t´i]	'work'
	53. Umsele	[umsele]	'trench'
	54. Umgodzi	[umgodzi]	'pit'
	55. Ummbila	[um^{m}bila]	'maize'
	56. Umlomo	[umlomo]	'mouth'
	57. Umncele	[um^{n}ǀele]	'border'
	58. Umtsambo	[umtsa^{m}bo]	'vein'
	59. Umgedze	[umgedze]	'cave'
	60. Umbono	[umɓono]	'idea'
	61. libala	[liɓala]	'yard'
	62. licandza	[liǀandza]	'egg'
Class 5	63. liso	[liso]	'eye'
	64. litinyo	[lit´iɲo]	'tooth'
	65. lihlombe	[liɬo^{m}be]	'shoulder'
	66. likhala	[lik^{h}ala]	'nose'
	67. lidvolo	[lidvolo]	'knee'
	68. ligundvwane	[ligu^{n}dv^{w}ane]	'rat'
	69. ligagasi	[ligagasi]	'wave'
	70. licala	[liǀala]	'court case'
	71. libunti	[liɓu^{n}t´i]	'forehead'
	72. libhande	[liba^{n}de]	'belt'
	73. libhuloho	[libuloho]	'bridge'
	74. lihhashi	[liɦaʃi]	'horse'

	75. licaca	[liǀaǀa]	‘skunk’
	76. likhaya	[lik^{h}aja]	‘home’
	77. likhasi	[lik^{h}asi]	‘page’
	78. libhala	[libala]	‘wheelbarrow’
	79. lidaladi	[lidaladi]	‘barbed wire’
	80. likamelo	[lik´amelo]	‘bedroom’
	81. libhayi	[libaji]	‘baby blanket’
	82. libele	[liɓele]	‘breast’
	83. libele	[liɓele]	‘sorghum’
	84. linyeva	[liɲeva]	‘thorn’
	85. lisondvo	[liso^{n}dvo]	‘wheel’
	86. Lisontfo	[liso^{n}tfo]	‘church’
	87. Litsanga	[litsaŋa]	‘thigh/pumpkin’
	88. Libutfo	[liɓutfo]	‘regiment’
	89. Libulo	[liɓulo]	‘swarm’
	90. Lilima	[lilima]	‘people who weed’
	91. Lizinyane	[liziɲane]	‘kid’
	92. Libhubesi	[libuɓesi]	‘lion’
	93. Litfole	[litfole]	‘calf’
	94. Lituba	[lit´uɓa]	‘dove’
	95. Litfuba	[litfuɓa]	‘chance’
	96. Liphela	[lip^{h}ela]	‘cockroach’
	97. Liphupho	[lip^{h}up^{h}o]	‘dream’
	98. Lidvuba	[lidvuɓa]	‘zebra’
	99. Litubulo	[lit´uɓulo]	‘first born’
	100. Litfumbu	[litfu^{m}bu]	‘intestine’
	101. Liloko	[liloɠo]	‘dress’
	102. Licembe	[liǀe^{m}be]	‘leaf’
	103. Licembu	[liǀe^{m}bu]	‘team’
	104. Lintjwele	[li^{n}tʃ^{w}ele]	‘chick’
	105. Litulu	[lit´ulu]	‘rain’
	106. Libhontjisi	[libo^{n}tʃisi]	‘bean’
	107. Lintongomane	[li^{n}toŋomane]	‘peanut’
	108. Litsemba	[litse^{m}ba]	‘trust/hope’
	109. Libhodo	[libodo]	‘pot’
	110. Litje	[litʃ´e]	‘stone’
	111. Ligala	[ligala]	‘branch’
	112. Lihlatsi	[liɬatsi]	‘forest’’
	113. LiSwati	[lis^{w}ati]	‘Swati’
	114. Lishiya	[liʃija]	‘eyebrow’
	115. Sisu	[sisu]	‘stomach’
	116. Sihlahla	[siɬaɬa]	‘tree’
	117. Sibaya	[siɓaja]	‘kraal’
Class 7	118. Sitsendze	[sitse^{n}dze]	‘heel’
	119. Sitsembu	[sitse^{m}bu]	‘polygamy’

	120.	Silwane	[sil^{w}ane]	‘animal’
	121.	Sinkhwa	[si^{ŋ}kwa]	‘bread’
	122.	Sibunu	[siɓunu]	‘buttock’
	123.	Silevu	[silevu]	‘beard/chin’
	124.	Sihlatsi	[siɬatsi]	‘cheek’
	125.	Sibuko	[siɓuko]	‘mirror’
	126.	Sigulane	[sigulane]	‘sick person’
	127.	Sihlakaniphi	[siɬaɠanip^{h}i]	‘smart person’
	128.	Sintfu	[si^{n}tfu]	‘vernacular’
	129.	Sandla	[sa^{n}ɮa]	‘hand’
	130.	Sahhukulu	[saɦuɠulu]	‘owl’
	131.	Sangcotfo	[sa^{ŋ}|gotfo]	‘hailstorm’
	132.	Sicatfulo	[si|atfulo]	‘shoe’
	133.	Sati	[sat´i]	‘wise person’
	134.	Sono	[sono]	‘sin’
	135.	Sondlo	[sonɮo]	‘child maintenance’
	136.	Sento	[se^{n}t´o]	‘deed’
	137.	Sihlakala	[siɬaɠala]	‘ankle’
	138.	Sidalwa	[sidal^{w}a]	‘crippled person’
	139.	Silomo	[silomo]	‘beautiful person’
	140.	Sichwe	[si|h^{w}e]	‘dwarf’
	141.	Sigwegwe	[sig^{w}eg^{w}e]	‘bow leg’
	142.	Sigwadzi	[sig^{w}adzi]	‘single man’
	143.	Sidzakwa	[sidzakwa]	‘drunkard’
	144.	Sivalo	[sivalo]	‘door’
	145.	Sipheko	[sip^{h}eɠo]	‘food contribution’
	146.	Siphambano	[sip^{h}a^{m}bano]	‘cross’
	147.	Sililo	[sililo]	‘dirge’
	148.	Sigulumba	[sigulu^{m}ba]	‘tractor’
	149.	Sihlantsi	[siɬa^{n}tsi]	‘traditional mat’
	150.	Sifo	[sifo]	‘disease’
	151.	Sifuba	[sifuɓa]	‘chest’
	152.	Simo	[simo]	‘condition’
	153.	Sigwebo	[sig^{w}eɓo]	‘sentence’
	154.	siphepho	[sip^{h}ep^{h}o]	‘hailwind’
	155.	Sive	[sive]	‘nation’
	156.	Sihlutfu	[siɬutfu]	‘unkempt afro’
	157.	Sikhehle	[sik^{h}eɬe]	‘nest of wasps’
	158.	Siwekle	[siwekle]	‘ward of cash’
	159.	Sidleke	[siɮeɠe]	‘bird nest’
	160.	Sikipa	[sik´ip´a]	‘T-shirt’
	161.	Sicuku	[si|uɠu]	‘crowd’
	162.	Inja	[i^{n}ʤa]	‘dog’
	163.	Intfo	[i^{n}tfo]	‘thing’
Class 9	164.	Intfulo	[i^{n}tfulo]	‘blue-head’

	165. Indvodza	[i^{n}dvodza]	‘man/husband’
	166. Indengane	[i^{n}deŋane]	‘soft porridge’
	167. Indlebe	[i^{n}ɮeɓe]	‘ear’
	168. Indlu	[i^{n}ɮu]	‘house’
	169. Ingcosa	[i^{ŋ}|gosa	‘elbow’
	170. Indlovu	[i^{n}ɮovu]	‘elephant’
	171. Intsamo	[i^{n}tsamo]	‘neck’
	172. Intsambo	[i^{n}tsa^{m}bo]	‘rope’
	173. Inhlanyelo	[i^{n}ɬaɲelo]	‘seed’
	174. Indlulamitsi	[i^{n}ɮulamitsi]	‘giraffe’
	175. Indlala	[inɮala]	‘hunger’
	176. Incwancwa	iŋ|^{w}aŋ|^{w}a]	sour porridge’
	177. Incenye	[i^{ŋ}|eɲe]	‘part of’
	178. Incence	[i^{ŋ}|e^{n}|e]	‘breast milk’
	179. Inkhomo	[i^{ŋ}k^{h}omo]	‘cow’
	180. Inkhobe	[iŋk^{h}oɓe]	‘boiled mealies’
	181. Inkhophe	[iŋk^{h}ope]	‘eyelash’
	182. Inkhundla	[i^{ŋ}k^{h}unɮa]	‘Traditional admin.’
	183. Inkhukhu	[i^{ŋ}k^{h}uk^{h}u]	‘chicken’
	184. Inkhosi	[i^{ŋ}k^{h}osi]	‘king’
	185. Inkhosikati	[i^{ŋ}k^{h}osiɠat´i]	‘queen’
	186. Inkhosatana	[i^{ŋ}k^{h}osat´ana]	‘eldest daughter’
	187. Inkhaba	[i^{ŋ}k^{h}aɓa]	‘belly button’
	188. Ingulube	[i^{ŋ}guluɓe]	‘pig’
	189. Ingubo	[i^{ŋ}guɓo]	‘blanket/dress’
	190. Inganekwane	[i^{ŋ}ganeɠ^{w}ane]	‘folktale’
	191. Ingoma	[i^{ŋ}goma]	‘song’
	192. Ingobiyane	[i^{ŋ}gobijane]	‘monkey’
	193. Inkomishi	[i^{ŋ}k´omiʃi]	‘cup’
	194. Ingwembe	[i^{ŋ}g^{w}e^{m}be]	‘pin’
	195. Imbuti	[i^{m}buti]	‘goat’
	196. Imvu	[i^{m}vu]	‘sheep’
	197. Imfene	[i^{m}fene]	‘baboon’
	198. Imbolwane	[i^{m}bolwane]	‘mongoose’
	199. Impompi	[i^{m}p´o^{m}p´i]	‘tap’
	200. Imphepho	[i^{m}p^{h}ep^{h}o]	‘incense’
	201. Imphumulo	[i^{m}p^{h}umulo]	‘nose’
	202. Inyoka	[iɲoɠa]	‘snake’
	203. Inyama	[iɲama]	‘meat’
	204. Inyalitsi	[iɲalitsi]	‘needle’
	205. Inyoni	[iɲoni]	‘bird’
	206. Inyosi	[iɲosi]	‘bee’
	207. Inyekevu	[iɲeɠevu]	‘cricket’
	208. Inyembeti	[iɲe^{m}bet´i]	‘teardrop’
	209. Inyanga	[iɲaŋa]	‘traditional healer’

	210. Inyeti	[iɲet´i]	‘moon’
Class 11	211. Lunyawo	[luɲawo]	‘foot’
	212. Lunwele	[lun^{w}ele]	‘hair’
	213. lulwimi	[lul^{w}imi]	‘tongue’
	214. luhlanya	[luɬaɲa]	‘lunatic’
	215. ludziwo	[ludziwo]	‘calabash’
	216. lugalo	[lugalo]	‘finger’
	217. lubondza	[luɓondza]	‘wall’
	218. luswane	[lus^{w}ane]	‘infant’
	219. luswayi	[lus^{w}ayi]	‘salt’
	220. lubisi	[luɓisi]	‘milk’
	221. luswati	[lus^{w}at´i]	‘stick for beating’
	222. lukhuni	[luk^{h}uni]	‘firewood’
	223. lukhula	[luk^{h}ula]	‘weed’
	224. lukhalo	[luk^{h}alo]	‘waist’
	225. lutsi	[lutsi]	‘stick’
	226. lutsango	[lutsaŋo]	‘traditional fence’
	227. lutwane	[lut´^{w}ane]	‘toe’
	228. lucetu	[lu|et´u]	‘piece’
	229. ludziwo	[ludziwo]	‘calabash’
	230. luphuya	[lup^{h}uja]	‘pauper’
Class 14	231. buhlalu	[ɓuɬalu]	‘beads’
	232. bubi	[ɓuɓi]	‘ugliness’
	233. buvila	[ɓuvila]	‘laziness’
	234. bulili	[ɓulili]	‘gender’
	235. bucili	[ɓu|ili]	‘slyness’
	236. buhle	[ɓuɬe]	‘beauty’
	237. bukhulu	[ɓuk^{h}ulu]	‘size (big)’
	238. buncane	[ɓu^{ŋ}|ane]	‘size (small)’
	239. budze	[ɓudze]	‘height’
	240. buncane	[ɓu^{ŋ}|ane]	‘age/number(small)’
	241. bubanti	[ɓuɓa^{n}t´i]	‘width’
	242. butfongo	[ɓutfoŋo]	‘sleep’
	243. bukhosi	[ɓuk^{h}osi]	‘royalty’
	244. buso	[ɓuso]	‘face’
	245. buntfu	[ɓu^{n}tfu]	‘humanity’
	246. budli	[ɓuɮi]	‘gluttony’
	247. bulwane	[ɓul^{w}ane]	‘‘bestiality’
	248. buve	[ɓuve]	‘nationality’
	249. boya	[ɓoja]	‘fur’
Class 15	250. kudla	[ɠuɮa]	‘food’
	251. kufa	[ɠufa]	‘death’
	252. kulwa	[ɠul^{w}a]	‘fight’
	253. kuhamba	[ɠuha^{m}ba]	‘departure’

	254. kubuka	[ɠuɓuɠa]	‘looking’
	255. kungena	[ɠu^{ŋ}gena]	‘entrance’
	256. kuphuma	[ɠup^{h}uma]	‘exiting’
	257. kwati	[ɠ^{w}at´i]	‘knowing’
	258. kosa	[ɠosa]	‘roasting’
	259. kona	[ɠona]	‘sinning’
	260. kopha	[ɠop^{h}a]	‘bleeding’
	261. koma	[ɠoma]	‘thirst’

APPENDIX 2

SISWATI VERBS

Monosyllabic

1. fa	[fa]	‘die’
2. pha	[pa]	‘give’
3. va	[va]	‘hear’
4. dla	[ɮa]	‘eat’
5. wa	[wa]	‘fall’
6. ya	[ja]	‘go’
7. ta	[t΄a]	‘come’
8. lwa	[l^{w}a]	‘fight’
9. na	[na]	‘rain’
10. sha	[ʃa]	‘burn’
11. sho	[ʃo]	‘say’

Vowel initial

12. akha	[ak^{h}a]	‘build’
13. osa	[osa]	‘roast’
14. onga	[oŋga]	‘save’
15. opha	[op^{h}a]	‘bleed’
16. oma	[oma]	‘be dry/thirsty’
17. ona	[ona]	‘sin’
18. ati	[at΄i]	‘know’
19. atsi	[atsi]	‘say’
20. eba	[eɓa]	‘steal’
21. endza	[e^{n}dza]	‘marry’
22. elusa	[elusa]	‘herd’
23. ewela	[ewela]	‘cross’
24. enta	[ent΄a]	‘do’

Disyllabic

25. Pheka	[p^{h}eɠa]	‘cook’
26. Hleka	[ɬeɠa]	‘laugh’
27. Pompa	[p΄omp΄a]	‘pump’
28. Vuma	[vuma]	‘agree’
29. Tsela	[tsela]	‘pour’
30. Tjela	[tʃ˝ela]	‘tell’
31. Geza	[geza]	‘bath’
32. Hlanta	[ɬant΄a]	‘throw up’
33. Lala	[lala]	‘sleep’
34. Hlala	[ɬala]	‘sit’

35. Bona	[ɓona]	‘see’
36. Buka	[ɓuɠa]	‘look’
37. Buya	[ɓuja]	‘return’
38. Natsa	[natsa]	‘drink’
39. Shaya	[ʃaja]	‘beat’
40. Cela	[|ela]	‘ask’
41. Cala	[|ala]	‘start’
42. Cina	[|ina]	‘be strong’
43. China	[|hina]	‘braid’
44. Chuma	[|huma]	‘burst’
45. Cuma	[|uma]	‘grunt’
46. Cumba	[|umba]	‘swell in size’
47. Ncwila	[ŋ|^{w}ila]	‘drown’
48. Bhala	[bala]	‘write’
49. Bala	[ɓala]	‘count’
50. Gana	[gana]	‘fall in love’
51. Tsandza	[tsa^{n}dza]	‘like/love’
52. Nika	[niɠa]	‘give’
53. Nuka	[nuɠa]	‘smell’
54. Dvuma	[dvuma]	‘sound of engine/thunder’
55. Dvuba	[dvuɓa]	‘pout’
56. Bhodla	[boɮa]	‘burp/roar’
57. Bamba	[ɓa^{m}ba]	‘hold’
58. Ngena	[ŋgena]	‘enter’
59. Phuma	[p^{h}uma]	‘exit’
60. Hamba	[hamba]	‘go’
61. Bita	[ɓit´a]	‘call’
62. Bila	[ɓila]	‘boil’
63. Mbimba	[^{m}bi^{m}ba]	‘run very fast’
64. Mpimba	[mpimba]	‘snitch’
65. Mbatsa	[^{m}batsa]	‘cover oneself’
66. Mbetsa	[^{m}betsa]	‘cover someone else’
67. Mbonya	[^{m}boɲa]	‘cover’
68. Mfimfa	[^{m}fi^{m}fa]	‘leak’
69. Nyanya	[ɲaɲa]	‘dislike’
70. Basa	[ɓasa]	‘light a fire’
71. Landza	[la^{n}dza]	‘fetch’
72. Hlaza	[łaza]	‘embarrass’
73. Sala	[sala]	‘remain’
74. Senga	[seŋa]	‘milk’
75. Luma	[luma]	‘bite’
76. Lima	[lima]	‘cultivate’
77. Khala	[k^{h}ala]	‘cry’
78. Kala	[k´ala]	‘measure’
79. Gala	[gala]	‘prepare to sow’

80. Khula	[k^{h}ula]	‘grow’
81. Khetsa	[k^{h}etsa]	‘choose’
82. Gcina	[|gina]	‘stop/keep’
83. Gcoka	[|goɠa]	‘get dressed’
84. Phela	[p^{h}ela]	‘finish’
85. Phila	[p^{h}ila]	‘live’
86. Sika	[siɠa]	‘cut’
87. Goba	[goɓa]	‘bend’
88. Juba	[ʤuɓa]	‘cut’
89. Gubha	[guba]	‘dig’
90. Gula	[gula]	‘fall sick’
91. Khipha	[k^{h}ip^{h}a]	‘remove’
92. Hleba	[ɬeɓa]	‘gossip’
93. Hleka	[ɬeɠa]	‘laugh’
94. Bopha	[ɓop^{h}a]	‘tie/arrest’
95. Vuta	[vut´a]	‘leak’
96. Vela	[vela]	‘appear’
97. Veta	[vet´a]	‘reveal’
98. Tsetsa	[tsetsa]	‘scold’
99. Faka	[faɠa]	‘put’
100. Vutsa	[vutsa]	‘burn’

Three syllables

101.	Thandaza	[tha^{n}daza]	‘pray’
102.	Fakaza	[faɠaza]	‘testify’
103.	Hlakula	[ɬaɠula]	‘weed’
104.	Hlonipha	[ɬonip^{h}a]	‘respect’
105.	Gibela	[giɓela]	‘climb’
106.	Hushula	[huʃula]	‘pour everything out’
107.	Bukela	[ɓuɠela]	‘watch’
108.	Buketa	[ɓuɠet´a]	‘review/revise’
109.	Memeta	[memet´a]	‘scream’
110.	Lalela	[lalela]	‘listen’
111.	Gamula	[gamula]	‘break’
112.	Tamula	[t´amula]	‘yawn’
113.	Tayela	[t´ajela]	‘get used to’
114.	Shayela	[ʃajela]	‘drive’
115.	Nyatsela	[ɲatsela]	‘step on’
116.	Khamisa	[k^{h}amisa]	‘open your mouth’
117.	Nambitsa	[na^{m}bitsa]	‘savour’
118.	Tsanyela	[tsaɲela]	‘sweep’
119.	Nyatsela	[ɲatsela]	‘step on’
120.	Hlanyela	[ɬaɲela]	‘sow’
121.	Phakela	[p^{h}aɠela]	‘serve’

122.	Fohlota	[fołot´a]	‘crush’
123.	Khanyisa	[k^haɲisa]	‘switch on’
124.	Chafata	[ǀhafat´a]	‘press’
125.	Gicika	[giǀiɠa]	‘roll’
126.	Gicita	[giǀit´a]	‘roll sth’
127.	Sebenta	[seɓe^{n}ta]	‘work’
128.	Lingisa	[liŋisa]	‘imitate’
129.	Lungisa	[luŋisa]	‘fix’
130.	Sinata	[sinat´a]	‘grin’
131.	Khumula	[k^humula]	‘undress’
132.	Khuluma	[k^huluma]	‘talk’
133.	Khombisa	[k^ho^{m}bisa]	‘show’

Four syllables

134.	Hlanganyela	[łaŋaɲela]	‘meet with’
135.	Hlangabeta	[łaŋaɓet´a]	‘meet halfway’
136.	Shumayela	[ʃumajela]	‘preach’
137.	Hlukumeta	[łuɠumet´a]	‘illtreat’
138.	Gugubula	[guguɓula]	‘unearth’
139.	Phakamisa	[paɠamisa]	‘lift’

Five syllables

140.	Cacametela	[ǀaǀamet´ela]	‘struggle’
141.	Pheleketela	[p^heleɠet´ela]	‘accompany’

APPENDIX 3

ENGLISH-SISWATI LOANWORDS

Gloss	English	SiSwati
1. Garden	/gɑdn/	[i^{ŋ}gadze]
2. Location	/ləʊkeɪʃn/	[liloɠiʃi]
3. Kitchen	/kɪ.tʃɪn/	[lik^{h}iʃi]
4. Station	/steɪʃn/	[sit´eʃi]
5. Oven	/ʌvn/	[iʔavini]
6. Box	/bɒks/	[liboɠisi]
7. School	/skul/	[sik´ol^{w}a]
8. Class	/klɑs/	[lik´ilasi / liklasi]
9. Book	/bʊk/	[libuɠu]
10. Film	/fɪlm/	[lifilimu]
11. Orange	/ɒrɪndʒ/	[liʔoli^{n}tj´i]
12. Apple	/æpl/	[liɦabula]
13. Atlas	/ætləs/	[iʔatlas]
14. Office	/ɒfɪs/	[liɦovisi
15. Order	/ɔdə/	[liʔoda]
16. Movie	/muvi/	[imuvi]
17. Plate	/pleɪt/	[lip´ulede]
18. Banana	/bənɑnə/	[banana]
19. Sheet	/ʃit/	[liʃidi]
20. Stool	/stul/	[sit´ulo]
21. Stove	/stəʊv/	[sit´ofu]
22. Fork	/fɔk/	[i^{m}foloɠo]
23. Sugar	/ʃʊgə/	[ʃuɠela]
24. Spoon	/spun/	[sip´unu]
25. Sink	/sɪŋk/	[isi^{ŋ}ki]
26. Tank	/tæŋk/	[lit^{h}aŋe]
27. Bank	/bæŋk/	[libaŋe]
28. Plank	/plæŋk/	[lip´ulaŋo]
29. Desk	/desk/	[lidesiɠi]
30. Market	/mɑkɪt/	[imaket^{h}e]
31. Packet	/pækɪt/	[lip^{h}akete]
32. Docket	/dɒkɪt/	[lidoɠet´i]
33. Basket	/bɑskɪt/	[libasikidi]
34. Jacket	/dʒækɪt	[idʒak^{h}et^{h}i]

35. Paint	/peɪnt/	[p´e^{n}de]
36. Point	/pɔɪnt/	[lip^{h}oji^{n}t´i]
37. Pint	/paɪnt/	[lip^{h}aji^{n}t´i]
38. Vote	/vəʊt/	[livot´i]
39. Towel	/taʊəl/	[lit^{h}awula]
40. Bottle	/bɒtl/	[liboɮela]
41. Kettle	/ketl/	[ligeɮela]
42. Candle	/kændl/	[lik^{h}a^{n}ɮela]
43. Pill	/pɪl/	[lip^{h}ilisi]
44. Tool	/tul/	[lit^{h}ulusi]
45. Ball	/bɔl/	[ibola]
46. Hall	/hɔl/	[liɦola]
47. Doll	/dɒl/	[umdola]
48. Stamp	/stæmp/	[sit´e^{m}bu]
49. Lamp	/læmp/	[lila^{m}bu
50. Camp	/kæmp/	[iŋka^{m}bu]
51. Pump	/pʌmp/	[ip´a^{m}pu]
52. Card	/kɑd/	[lik^{h}adi]
53. Cake	/keɪk/	[lik^{h}eke]
54. Bin	/bɪn/	[umbini]
55. Spanner	/spænə/	[sip´anela]
56. Shower	/ʃaʊə/	[iʃawa]
57. Drawer	/drɔ/	[lidrowa]
58. Bench	/bentʃ/	[libe^{n}tj´i]
59. Change	/tʃeɪndʒ/	[iʃi^{n}tji]
60. Theatre	/θɪətə/	[t´iyet´i]
61. Rice	/raɪs/	[lilajisi]
62. Lorry	/lɒri/	[iloli]
63. Ruler	/rulə/	[irula]
64. Rubber	/rʌbə/	[iraba]
65. Ring	/rɪŋ/	[iriŋi]
66. Glass	[ɡlɑs]	[i^{ŋ}gilazi]
67. Tent	/tent/	[lit^{h}e^{n}de]
68. Cent	/sent/	[lise^{n}t´i]
69. Cotton	/kɒtn/	[k´ot´ini]
70. Doctor	/dɒktə/	[doɠot´ela]
71. Nurse	/nɜːs/	[linesi]
72. Tomato	/təmɑtəʊ/	[t´amat´isi]
73. Lettuce	/letɪs/	[ilet^{h}isi]

74. Cabbage	/kæbɪdʒ/	[lik^{h}aɓiʃi]
75. Onion	/ʌnjən/	[aɲanisi]
76. Bible	/baɪbl/	[libajibeli]
77. Baptist	/bæptɪst/	[umbabat´isi]
78. Petrol	/petrəl/	[p^{h}etroli]
79. Truck	/trʌk/	[itrak^{h}i]
80. Tray	/treɪ/	[litreji]
81. Contract	/kəntrækt/	[igo^{n}traɠi]
82. Shirt	/ʃɜt/	[liʃet^{h}i]
83. Skirt	/skɜt/	[sik´et´i]
84. Gate	/geɪt/	[ligede]
85. Dam	dæm/	[lidamu]
86. Jam	/dʒæm/	[ʤamu]
87. Van	/væn/	[iveni
88. Map	/mæp/	[imep^{h}u]
89. Guava	/gwɑvə/	[lig^{w}ava]
90. Style	/staɪl/	[sit´ajela]
91. Socks	/sɒks/	[lisoɠisi]
92. Fence	/fens/	[fenisi]
93. Peg	/peg/	[lip^{h}eɠisi]
94. Brush	/brʌʃ/	[libulaʃi]
95. Golf	/gɒlf/	[igaluva]
96. Porridge	/pɒrɪdʒ/	[lip^{h}aliʃi]
97. Cream	/krim/	[ik^{h}ilimu]
98. Club	/klʌb/	[ik´ilabu]
99. Condom	/kɑndəm/	[ik^{h}o^{n}domu]
100. Machine	/məʃin/	[umʃini]
101. Watch	/wɒtʃ/	[liwaʃi]
102. Key	/ki/	[sik^{h}ija]
103. Store	/stɔ/	[sit´olo]
104. Corner	/kɔnə/	[lik´ona]
105. Sweet	/swit/	[lis^{w}idi]
106. Furniture	/fɜnɪtʃə/	[ifeniʃa]
107. Tyre	/taɪə/	[lit^{h}aji]
108. Taxi	/tæksi/	[it^{h}eɠisi]
109. Novel	/nɒvəl/	[inoveli]
110. Chemist	/kemɪst/	[lik^{h}emisi]
111. Curtain	/kɜtn/	[lik^{h}et^{h}ini]
112. Cat	/kæt/	[lik´at´i]

113.	Bus	/bʌs/	[ibasi]
114.	Wool	/wʊl/	[iwuli]
115.	Ward	/wɔːd/	[liwodi]
116.	Garage	/gærɑʒ/	[ligalaʤi]
117.	Bandage	/bændɪdʒ/	[liba^{n}diʃi]
118.	Sausage	/sɒsɪdʒ/	[isoseʤi]
119.	Sponge	/spʌndʒ/	[sip´o^{n}tʃ˝i]
120.	Juice	/dʒus/	[iʤusi]
121.	Jean	/dʒin/	[iʤini]
122.	Park	/pɑk/	[ip^{h}ak^{h}i]
123.	Dinner	/dɪnə/	[lidina]
124.	Gold	/gəʊld/	[ligolide]
125.	Silver	/sɪlvə/	[isiliva]
126.	Hotel	/həʊtel/	[liɦot´ela]
127.	Shelf	/ʃelf/	[liʃelufa]
128.	Soldier	/səʊldʒə/	[lisotʃ˝a]
129.	Stand	/stænd/	[sit´a^{n}di]
130.	Farm	/fɑm/	[ifamu]
131.	Pole	/pəʊl/	[lip´ali]
132.	Pass	/pɑs/	[lip´asi]
133.	Bicycle	/baɪsɪkl̩/	[libajisiɠili]
134.	Square	/skweə/	[sik´^{w}ele]
135.	Battery	/bætri/	[ibetri]
136.	Umbrella	/ʌmbrelə/	[sa^{m}bulelo]
137.	Yard	/jɑd/	[lijadi]
138.	Zion	/zaɪən/	[lizajoni]
139.	Bomb	/bɒm/	[ibomu]
140.	Comb	/kəʊm/	[lik´amo]
141.	File	/faɪl/	[lifajela]
142.	Jail	/dʒeɪl/	[liʤele]
143.	Mile	/maɪl/	[limayela
144.	Tile	/taɪl/	[lit^{h}ajela]
145.	Tie	/taɪ/	[t^{h}aji]
146.	Line	/laɪn/	[lilajini]
147.	Wine	/waɪn/	[liwajini]
148.	Mine	/maɪn/	[imajini]
149.	Fine	/faɪn/	[ifajini]
150.	Pipe	/paɪp/	[lip^{h}ajip^{h}i]
151.	Sign	/saɪn/	[isajini]

152.	Paper	/peɪpə/	[lip^{h}ep^{h}a]
153.	Saul	/sɒl/	[sawula]
154.	Paul	/pɔl/	[p´awula]
155.	Sofa	/səʊfə/	[sofa]

[English phonetic transcription - http://www.photransedit.com]