SYLLABLE STRUCTURE AND PHONOTACTICS OF SIWU

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ABSTRACT

This study investigates the syllable structure of Siwu and its language-specific rules on syllabification in an attempt to contribute to efforts to document minority languages. In a multilingual setting dominated by a few major languages like Ghana, it is expected that languages spoken by minority groups will face endangerment if their data is not preserved through research. Siwu and other Ghana-Togo Mountain languages are such a group of languages in a subregion dominated by a major lingua franca, Ewe. This study begins with a review of existing works on the Siwu syllable as well as a study of available literature on four other GTM languages in order to determine the scope of the study and to enable a comparative study of these languages. The main focus of the study involves using data from the FCBH Global Bible (2008) to identify all possible syllable types that constitute Siwu's inventory, examine the sub-constituents of the Siwu syllable, and analyse permissible and non-permissible sequences in Siwu complex onsets. One of my findings is that although some closed syllables are in the language, the majority of Siwu's syllables are without the coda. Syllables with codas are mostly restricted to ideophones or loan/coined words. Regarding clusters, I find that there is an unequal preference for one of the two segments that occupy the C2 position of Siwu clusters. [r] is more freely distributed than [l]. I provide an analysis of restrictions on onset clusters that makes reference to both sonority and place features within the framework of feature geometry. The comparative study of syllable structure in Siwu and four other GTM languages also reveals that GTM languages have more similarities than differences in their syllable constitution. This study is significant because it is the first to provide a detailed description and analysis of the Siwu syllable.

ACKNOWLEDGEMENT

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CHAPTER ONE – INTRODUCTION

1.1 Introduction

This thesis will provide a description and analysis of the Siwu syllable with a focus on the rules of segment sequencing. All permissible and non-permissible cluster sequences will be analysed and accounted for with reference to relevant theoretical frameworks and language-specific phonotactic rules. This study is guided by three major research goals. These are; a) to provide a description of the basic inventory of Siwu syllable structures and their distribution; b) to provide a description of the composition of the sub-constituents of the Siwu syllable including permissible segment sequences in onsets and rhymes; and finally, c) to provide an analysis of Siwu onsets using the notion of sonority, as formalised in feature geometric representations. The study will also examine auxiliary questions such as what role syllable structure plays in loanword adaptation in Siwu and how orthographic forms provide evidence relevant to phonological processes such as deletion and metathesis, which are motivated by syllable structure constraints.

The remainder of this chapter gives a brief background of the language under study and its speakers, the scope and objectives of the study, and its significance. Chapter Two provides a review of the phonology of Siwu, including phonemic inventories proposed in various Siwu studies and the one adopted in this work. I further review existing literature on relevant syllable structures especially those of languages that are in the same language group as Siwu. I do a comparative analysis of these syllable structures to point out the similarities that these languages share in terms of syllabification and to contribute to the ongoing debate about their genetic grouping. Some preliminary literature on the Siwu syllable was also reviewed to help determine the scope of the thesis. In Chapter Three, I examine a number of theoretical approaches to syllabification that are crucial to the attainment of the goals of this study. Notably, I discuss universal constraints on syllabicity as a guide to language-specific phonotactic rules, the concept of sonority, and

syllabification in complex onsets through the lens of 'structure' as proposed by Rice (1992). I also outline the methodology that I employ in my study. The Chapter Four focuses on the presentation and analysis of data, while Chapter Five draws conclusions and proposes directions for future research.

1.2 Siwu Language Background

Siwu is the language spoken by Mawu, the people of Lolobi and Akpafu. Lolobi is made up of three separate townships while Akpafu has five townships altogether. Mawu are located in the Volta Region of Ghana. Together with Santrofi (Sɛlɛɛ) and Likpe (Sɛkpɛlé), they are on the border of the Volta Region and the newly created Oti Region, which was also formerly part of the Volta Region. Mawu share boundaries with Hohoe (Eʋe), a major ethnic group/language in the sub-region, to the South. They border Likpe (Sɛkpɛlé) to the East, Buem (Lɛlɛmi) to the North, and Santrofi (Sɛlɛɛ) to the West of Lolobi and North of Akpafu in-between them and Hohoe.

Volta Region is inhabited by several ethnic groups but most of these ethnicities are minor ethnic groups of Eʋe, hence Eʋe is the lingua franca in the region. It is the language of power and this power is exhibited in trade activities, public institutions, and even early childhood education. Per Ghana Education Service's language policy, the learners' L1 must be used as the medium of instruction from Kindergarten to the third grade and English must be taught as a subject (United States Agency for International Development (USAID) 2020). The reverse is the case after Grade 4. Eʋe serves as the L1 in this capacity because instructors in schools are non-speakers of Siwu and like many other minority languages in Ghana, Siwu is not incorporated in the school curriculum. This situation, as well as interaction with speakers of other major languages like Twi, has led to the introduction of a number of loanwords in Siwu, some of which have replaced native words which further led to their extinction (Atsu 2003). Apart from Eʋe's influence on Siwu, the

official language of Ghana, English, also influences speakers of Siwu. This has led to the incorporation of English loanwords into the language.

By default of their location and the fact that almost every Ɔwu (singular of Mawu) is bilingual in Siwu and Eʋe because of the social and economic influence that Eʋe wields, Mawu are often considered Eʋes by other ethnicities in Ghana. The actual number of Siwu speakers is unknown but an estimate of 27000 speakers is provided by Lewis (2009). It is one of the fifteen Ghana-Togo Mountain languages whose linguistic lineage is disputed by several researchers (e.g. Ameka & Essegbey 2017). The language is divided along two dialectal lines; Siwu (Lolobi speakers) and Siwui (Akpafu speakers).

The Siwu language was understudied until the early 2000s when sudden interest was drawn to the language with the emergence of several works on different aspects of Siwu grammar (e.g. Ring, Addae & Atsu 2002; Dingemanse 2009b; Atsu 2006; Ford 2009). In 2002, the Ghana Institute of Linguistics, Literacy and Bible Translation (GILLBT) started an active literacy program in Siwu (Atsu 2003 pg. 11) which targeted adults and young adults. A major initiative also took place where the New Testament of the Bible was translated into Siwu (e.g. FCBH Global Bible App APK Store 2008). Until then, only the Eʋe bible was used in the church. The project was led by the Siwu Language Committee, a committee comprising speakers from both dialectal lines. The Siwu Bible became the most recent documentation of Siwu that captured the 'standard' of both dialects. Literature in the Siwu language expanded soon after, notably Dingemanse's works on the Siwu ideophones (e.g. Dingemanse 2009; 2011; 2013; 2014; 2017). Before this period, the first major work in Siwu had been Ford and Iddah (1973) – which attempts to provide a complete description of the grammar of Siwu and remains unpublished.

The syllable structure of Siwu, however, has received little attention. The first detailed work of the language, Ford and Iddah (1973), interestingly does not touch on the syllable at all. Ring et al. (2002) only provide a partial account of the Siwu syllable where only the syllable inventory is given. Dingemanse (2011) gives a cursory discussion on syllable phonotactics and how some of the syllable types are distributed in Siwu ideophones. I have not found any literature that investigates phonotactic constraints of the Siwu syllable, probing its complete inventory and internal structure and further conducting a comparative analysis with other Ghana Togo Mountain (GTM) languages. My work is the first that is focused on studying and analysing the complete structure of the Siwu syllable and aims to provide theoretical and practical insight into the Siwu syllable-internal structure and especially into why some segment sequences or syllable structures will be considered ill-formed in Siwu within certain theoretical frameworks.

One version of the history of Mawu has it that the Lolobi and Akpafu groups migrated and settled together in their journey until they were separated by a feud, forcing the Lolobi group to move further away to their current settlement (Ogbete 1998; Atsu 2003). Another also suggests that the Lolobi group took a different diversion in the course of their migration. Both accounts are coherent with the fact that these groups share a language and that, although this language has evolved into two different dialects, there is a high level of mutual intelligibility between the two dialects (Kpodo 2013).

Noticeable differences exist in various aspects of the language ranging from the lexicon to "allophonic variation and several morphophonological assimilation processes which are regressive in Akpafu and progressive in Lolobi" (Dingemanse 2011 p.94). Kpodo also established very minor differences in the acoustic properties of vowels from both dialects. For example, he observes that [ɛ], [ɔ], and [a] are slightly higher in the Lolobi dialect. Kpodo, however, concludes that the

differences are not significant enough "to make us consider the vowels of the two dialects as different from each other", hence, they are virtually the same (2013 pg. 193).

Although the Siwu Language Committee attempted to develop a standard language that blends the two dialects, for purposes of inclusivity, the result is that the standard language does not always reflect the ordinary use of either of the dialects. Speakers, especially of the Lolobi dialect, have often expressed how different the language in the Siwu bible is from what is spoken. Some have said it is the Siwui. I am of this opinion because this study is based on the Lolobi Siwu. Also, due to my background as a native speaker of the Lolobi dialect, my personal experience and interactions have mostly been with Siwu speakers from Lolobi. I cannot speak to those of the Akpafu origin but this sentiment is further backed by Atsu's claim that "to some extent, the Akpafu may speak to conform but the Lolobi speak something else" (pg. 14). Atsu's statement appears "nonlinguistic" but it implies that the Lolobi variant has evolved vastly from its counterpart.

1.3 Scope and Objectives

While the syllable is a well-known concept, its definition is evasive in the phonological theory. This study does not aim to solve this problem but rather attempts to describe what is considered a syllable in Siwu according to two broad perspectives from which the syllable is looked at; the speakers' viewpoint (Haugen 1956) and the phonological viewpoint (Feinstein 1979), both of which establish that the syllable is the ideal phonological unit where phonotactic rules of a language can best be described. The main objective of the study is to provide a comprehensive description of the Siwu syllable, detailing phonotactic rules that determine a well-formed Siwu syllable. To reach this goal, I will employ three major theoretical approaches for various aspects of the analysis.

The first is Pulgram's (1970) general principles on syllabification. This approach is ideal because of its basic tenet which acknowledges that universal principles on syllabicity influence language-specific phonotactic rules. I will show in my analysis that the proposition is primarily true. However, language-specific rules could take precedence over this universality. The second framework I will use in my analysis is Rice's (1992) structural view of sonority and place properties, which will be used to address issues of sonority, and permissible and non-permissible segment sequences in Siwu. I will provide evidence in the Siwu data to back Rice's assertion that "the relationships that… hold between two consonants (e.g. sonority ranking and place of articulation) are important in determining their syllabification" (pg. 65).

Lastly, Bosch (2011), which provides a review of various models of syllable internal structure, will be used to examine the sub-syllabic constituents of the Siwu syllable, in particular, the internal structure of the syllable from the point of view of Blevins (1995) and Davis (1990). I adopt Pike and Pike's (1947) binary structure for Siwu because of the language's optional coda typology, as discussed in Zec (2007).

1.4 Methodology

My research relies largely on data from the Siwu bible, compiled and published by Wycliffe Bible Translators, Inc with the aid of the Siwu Language Committee. This resource consists of both orthographic and audio files that can be downloaded from the Google Play store. The advantage of this data is that it provides a significant quantity of audio material. The audio gives an idea of the accurate pronunciation or articulation of words in situations where the orthographic forms appear misleading. It also triggers my intuition as a native speaker which further aids my analysis. For this reason, transcribed audio data was mostly used.

The disadvantage of this data source is that it does not always accurately reflect the native speakers' use of the language in ordinary speech. I ascribe this shortcoming to the merging of the two dialects in order to derive a 'standard'. Because of this, I applied for and got approval from the *Interdisciplinary Committee on Ethics in Human Research* (*ICEHR*) to employ the native speaker intuition by other speakers including myself. I established contact with one of the consultants of the Siwu Language Committee who speaks Siwu (Lolobi dialect) and one other native speaker of Siwui (Akpafu dialect). I decided to settle on these consultants due to the scope of this study, which focuses mostly on the Lolobi dialect of Siwu, with very minor reference to the Akpafu dialect. The option to involve native speakers in my study is particularly important in cases where the pronunciation in the audio files available from the Siwu bible differs from my own intuitions. This is to ensure that all biases are minimised. My research consultants have also been very instrumental in cases of marginal syllable types that are infrequent or absent from the data source, such as those found in loanwords and ideophones. My elicitation was mostly conducted through WhatsApp calls. On a few occasions, we exchanged voice notes or written correspondence. I engaged them in different exercises during such interactions. For example, in order to test the hypothesis of vowel deletion in some CVCV forms, discussed in Chapter 4, I asked them to pronounce orthographic CVCV that occurred with (CCV) and without (CVCV) clusters in the Siwu Bible audio files. I also asked consultants to produce some of the words in the bible in order to compare the accuracy of the audio files from the same source. Exercises about loan words involved consultants confirming whether particular words were loanwords or not and what their native counterparts would be if indeed they were borrowed. They also provided me with some additional loanwords, their spelling, and their meaning. Based on the data available in the Siwu bible, in conjunction with consultation with native speakers and previous literature on Siwu

and related languages, this study documents the range of syllable types found in Siwu, the distribution of more marginal syllable shapes, such as closed syllables, CVVV sequences, and consonant clusters.

1.5 Preliminary Findings

I will outline a few preliminary results of my work in this section. In addition to CV, V, N, CCVV, CCV, CVV, which have been established in the literature, I have identified two more potential syllable patterns; CVVV and VV. However, further analysis has suggested that CVVV is, in fact, a sequence that can be broken into two syllables in two kinds of patterns. I draw this conclusion based on tone patterning which I observe contributes to syllable parsing, especially syllable types that have diphthongs or long vowels in their nucleus. The study has also found that all syllable types are not freely and evenly distributed in the language. Some syllable types like the CVC are restricted to marginalised vocabulary like ideophones and loanwords. No native Siwu word that is not an ideophone or loanword has been found with this particular syllable type. Also, further assessment of data reveals that what appears like vowel deletion in syllable types such as CCV is an inherent phonological form masked by orthographic representations, meaning CCV is also a basic component of the Siwu syllable inventory.

Another finding in my comparative analysis of Siwu and other GTM languages regards the status of their onset clusters. The syllable structure of Siwu does not vary significantly from those of other GTM languages. They share several similarities such as the N syllable type, preference for open syllables, possibility of complex onsets, etc. However, the composition of their onset clusters differs in minor ways. Most of these languages allow a consonant-glide sequence in their clusters. Siwu is one of the languages in this group that does not allow this kind of sequence in its clusters. Instead, one of the glides, [w], actually occurs in C1 position of complex onsets despite

sonority arguments proposing that the more sonorous a segment is, the less its ability to occupy the C1 position (Rice 1992). The other glide in Siwu inventory [y], on the other hand, does not occur in clusters in any way. This has resulted in difficulty in viewing glides in Siwu as a natural class and necessitating that each of these segments be ranked independently on the sonority scale I propose for Siwu. I discuss these results in detail in my data analysis in Chapter Four.

1.6 Significance of the Study

Despite several studies on various aspects of Siwu, there has been no study whose focus is syllable structure. Works that provide insight into Siwu syllable structure do so peripherally while focusing on other aspects of language structure. Apart from identifying some syllable patterns, Ring et al., for example, do not provide details on any phonological processes or phonotactics and a closer look at the proposed inventory suggests that there are more patterns than proposed. Dingemanse (2011), on the other hand, provides limited description of the phonotactics of the Siwu syllable but focuses on how syllable types manifest in ideophones.

The scope of this study includes a thorough analysis of the inventory of the Siwu syllable and how it compares to other GTM languages. The depth of the study will provide researchers with ample linguistic data and evidence which will aid current and future discussions on key issues in phonological theory such as what determines natural classes in terms of sonority, unexpected but permissible complex onsets, and whether the concept of a sonority scale is enough to account for syllable structure restrictions. In addition, the comparative analysis of the Siwu syllable and that of other GTM languages has the potential to either reinforce or challenge the ongoing debate about the linguistic lineage of GTM languages. Also, given that Siwu is a minority language bordering a major language of influence, this study will contribute to ongoing efforts to document and preserve aspects of the phonology.

CHAPTER TWO – LITERATURE REVIEW

2.1 Introduction

This chapter will provide a review of previous literature on the phonology of Siwu. This includes a brief background on the classification of the language and a description of the phonemic inventory and suprasegmental features. Additionally, I will discuss existing literature on the syllabification of related languages and how they contribute to the study of the Siwu syllable.

2.2 Ghana-Togo Mountain Languages

The Ghana-Togo Mountain languages are a group of fifteen languages spoken along the borders of Ghana and Togo. This group is a sub-grouping of Kwa, coined by Gottlob Krause and, like most West African languages, it belongs to the Niger-Congo language tree. Siwu falls specifically within the Na-Togo classification of the Kwa languages (Heine 1968). Heine classifies Siwu, Sɛkpɛlé, Lɛlɛmi, and Sɛlɛɛ under one group because they are more closely related than others.

The GTM languages' linguistic lineage is uncertain. Some researchers argue that they are a genetic group while others hold the view that they are only a "geographical and socio-cultural grouping or a typological grouping masquerading as a genetic unit" (Ameka & Essegbey 2017 p. 245). In their study of the divergence and convergence among the GTM languages, Ameka and Essegbey demonstrate some similarities that these languages share which include the noun class systems, the manifestation of Advanced Tongue Root vowel harmony, and similar segmental inventories. With respect to vowel inventories, for example, they note that a 10-vowel system has been proposed for the GTM proto-language (Kwa) but language internal changes have led to some of these languages reducing their inventory (Siwu, Sɛlɛɛ, Tutrugbu, Sɛkpɛlé) while others have even added on (Anii, Bassila). Ameka and Essegbey conclude that these languages do not have

typologically uniform features, which also means that the diversity among them is extensive and they cannot constitute a typological grouping.
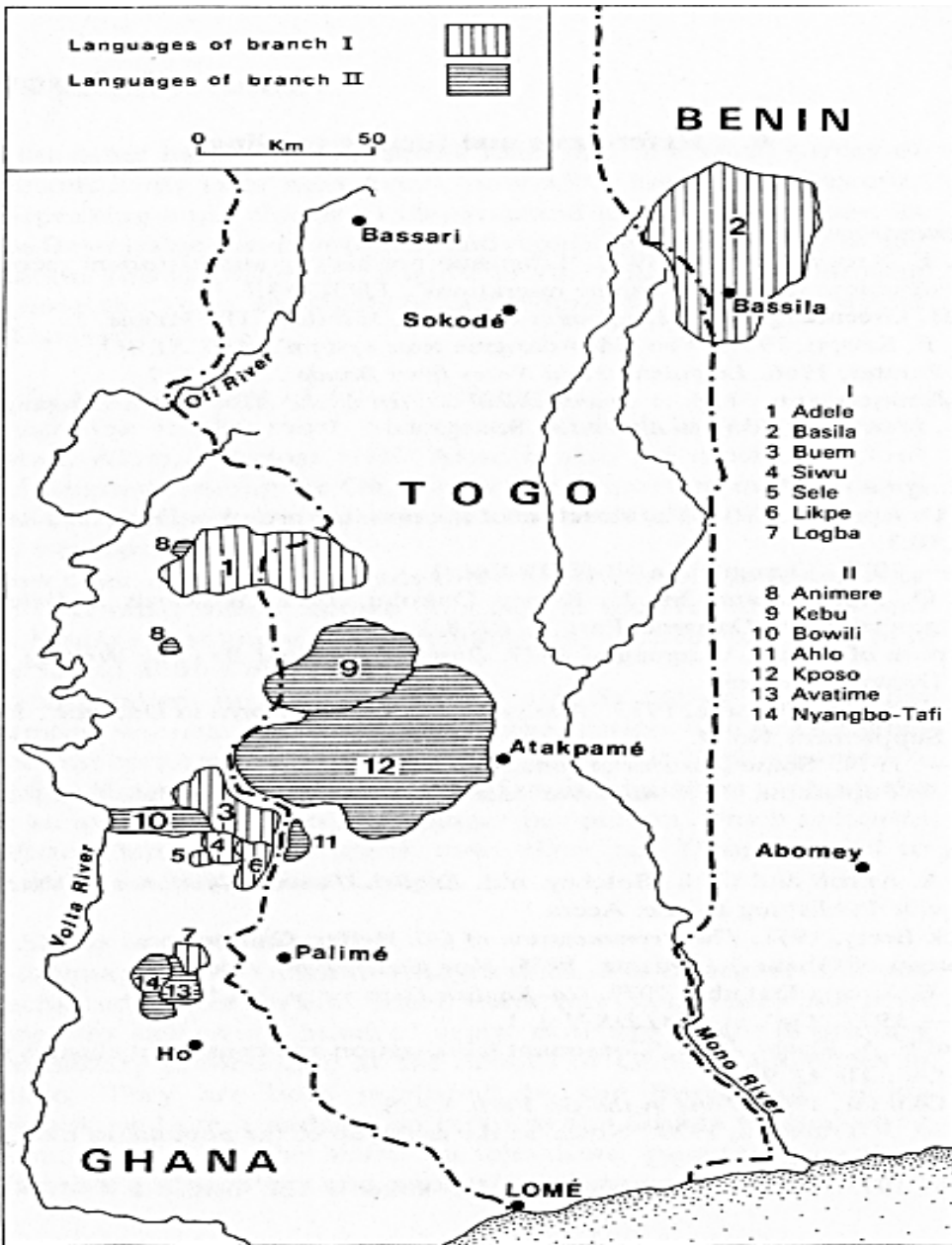
Fig. 1 Distribution of the GTM languages. Branch I and II correspond to Heine's Na- and Ka-Togo (Kropp Dakubu and Ford 1988; based on Heine 1968a) (Dingemanse 2011 p. 84)

2.3 Phonemic Inventory of Siwu

The following segmental inventory of Siwu is presented by Dingemanse (2011) in the most recent comprehensive study of the phonology of Siwu.

	Bilabial	labio-dental	apico-dental	Alveolar	Palatal	Velar	labio-velar	Glottal
Plosives	p b		t	ɖ	ts [c] dz [ɟ]	k g	kp gb	
Fricatives		f (v)		S				(h)
Nasals	m			n	ny [ɲ]			
Trills				r				
approximant				l	y [j]		w	ɣ [ʕ]

Fig. 2 Consonant inventory and orthography of Siwu as adapted from Dingemanse (2011 p. 96).

Dingemanse posits that symbols in round brackets occur only in ideophones and loanwords.[1] Symbols in square brackets represent the phonetic transcriptions of their orthographic counterparts. Voiceless consonants assimilate to their voiced counterparts after /n/. Dingemanse also states that /ɖ/ has the allophones [ɖ] (apico-dental) after /n/, [d] (apico-alveolar) elsewhere, and no retroflex realisation. The symbol was borrowed from Ewe orthography. Kropp (1967), however, argues that /ɖ/ and /d/ are two distinct elements in contrastive distribution but evidence from her work shows the same distribution as predicted by Dingemanse. For example, /d/ occurs in environments after /n/ like [pàndè] 'cricket', [màɣe-du] 'honey' < màɣe 'bees' + n-du 'water', or is limited to loan words like [dɔktà] 'doctor'. Given the distribution in both works, the argument

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[1] In my work, I came across the word [avrà̃] or [avruà̃] 'rice chaff from winnowing', which is a native word according to my sources.

holds that it is unlikely that /ɖ/ and d/ are contrastive. Dingemanse therefore concludes that the "contrast does not appear to be phonemic" (p. 96).

/n/ has the allophones [ŋm] before labio-velars (n-gba [ŋ͡m-gba] 'life'), [ŋ] before velars (ǹ-gu [ŋ̀-gu] 'sheabutter'), and [n] elsewhere. There is a lack of consensus on the classification of /ɣ/ in Siwu. "Phonetically, [ʕ] is pronounced with the tongue lying low and the jaw more open than in [j]. In some careful pronunciations, it almost sounds like a vowel [ɛ] without initial glottal closure" (Dingemanse 2011 p. 97). The sound has been classified as a pharyngeal approximant by Ford and Iddah (1973) and as a dorso-velar frictionless continuant by Kropp (1967). Although its phonemic status remains unclear, available studies suggest that /ɣ/ and /y/[2] are in some kind of allophonic relationship. Kropp views /ɣ/ as an unusual variant of /y/. Ford and Iddah's assertion that /ɣ/ becomes /y/ after [i] and before a front vowel is in line with Dingemanse's claim that these two phonemes may be in complementary distribution. In Dingemanse's lexical data, /y/ is common before close vowels /i, u/, whereas /ɣ/ is mostly found before open-mid vowels /ɛ, ɔ/. On the other hand, he shows evidence that an assimilation process occurs with these two segments in some nouns that have /i, a/ noun classes, as seen in (1a) below, and in gerunds of verbs formed by prefixing the norminaliser /i/, seen in (1b). An illustration of the /ɣ, y/ assimilation is shown in (1) below.[3]

1. (a)   i-yatà [ijatà] 'leaf',   a-yatà [aʕatà] 'leaves'
    (b)   ɣa   [ʕa]   'lick' →   ìɣa   [ìja]   'licking'
            ɣɛ   [ʕɛ]   'say' →   ìɣɛ   [ìjɛ]   'saying' (pg. 97)

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[2] Due to the phonetic ambiguity that exists with [j] and [ʕ], I have decided to represent them using their orthographic symbols /y, ɣ/.

[3] Although these examples are from Dingemanse (2011), the majority of examples provided are from the Siwu bible. Unless otherwise noted, examples are from the Siwu bible. Examples from previous literature and from consultants are identified as such when presented.

Dingemanse also notes that /ɣ/ and /w/ are not always clearly distinguishable in Siwu. For example, /wu/, the root morpheme for Siwu (the language), Mawu (the people), and Kawu (the community), when combined with the singular noun class morpheme /ɔ/ [ɔwu], is indistinguishable from [ɔɣu] 'oven'. The unclear phonemic status of /w, y, ɣ/ in Siwu is further manifested in the formation of complex onsets, which is discussed in subsequent chapters.

	FRONT	CENTRAL	BACK	nasal counterparts	
CLOSE	i		u	ĩ	ũ
CLOSE-MID	e		o		
OPEN-MID	ɛ		ɔ	ɛ̃	ɔ̃
OPEN		a		ã	

Fig. 3 Vowel inventory (Dingemanse 2011 p. 98).

Figure 3 illustrates the basic shape of the Siwu vowel inventory. Mid and Close vowels occur with both front and back articulation and there is a single low vowel with a central place of articulation. The mid vowels have [+ATR] and [-ATR] counterparts but there is no [ATR] contrast among the Close or Open vowels. There is some disparity in the description of the nasal vowels. Dingemanse states that, although /ɛ̃/ and /ɔ̃/ are listed as nasal counterparts of the oral vowels in his work, they do not occur in his data. In addition, the first comprehensive study of Siwu, Ford and Iddah (1973), shows /ɔ̃/ instead of /ɔ̃/. This is consistent with preliminary observations of the Siwu vowels undertaken in this study. For these reasons, this study will employ the vowel inventory in Fig. 4 as presented by Ford and Iddah, because it gives a more accurate reflection of the vowel system of the language.

	Oral				Nasal			
	Front		Back		Front		Back	
	Root-Advanced	Root-Retracted	Root-Advanced	Root-Retracted				
High	i		u		ĩ		ũ	
Mid	e	ɛ	o	ɔ		ɛ̃		ɔ̃
Low		a				ã		

Fig. 4 Siwu vowel inventory Ford & Iddah (1973 p. 6)

Although vowel sequences or diphthongs are observed in the data, diphthongs have not been included as part of the vowel inventory in previous literature. Some phonotactic constraints affecting vowels in Siwu have been observed in existing studies but these works have not discussed diphthongs directly. Ford and Iddah (1973) indicate that Siwu does exhibit some restrictions on vowel co-occurrence. "Two vowels may occur together across morpheme boundaries given that the basic syllable structures are either a consonant and a vowel or a simple vowel… and the vowel following a morpheme boundary can only be either /ɔ/, /i/ or /a/" (pg. 164). Data observed in this study suggest that diphthongs are common in the Siwu syllable inventory and I will be discussing them and their syllabification in Chapter 4, Section 4.1.3.

2.4 Tone

The pioneering work on Siwu, Ford & Iddah (1973), which provides a comprehensive description of the grammar of the language, is generally based on the Lolobi dialect of the Siwu language with intermittent references to the Akpafu dialect whenever necessary. Among the aspects of the language discussed is the grammar of tone. Like all other GTM languages, they find that Siwu is a lexical tone language and that there are three level tones – High [´], Low [`], and Mid. The mid-level tone is unmarked on vowels and marked [-] on syllabic nasals. They also assert that most tones are subject to change; either raising or lowering, depending on context. For

example, the merging of individual base forms to form compound words changes tones as seen in the following illustration.

2. (a)   [kùdziri]   +   [ɔ̀bi]   [ɔ̀dziribí]   'fruit'
          'tree'   'child'
    (b)   [ika]   +   [ìɖe]   [ikaɖé]   'speech'
          'speech'   'talking'
    (c)   [kùdziri]   +   [i]   [kùdzirí]   'cane'
          'tree'   DIM

                                    (Ford & Iddah 1973 p. 10)

In examples (2a) and (2b) above, the second base forms [ɔ̀bi] and [ìɖe] have been reduced and the tones changed and carried over to the remaining forms [bi] and [ɖe]. The implied mid tones on the second syllables are changed to high tones in the compound forms. In (2c), the mid-tone on the diminutive form becomes a high tone on the compound word.

Ford and Iddah (1973), however, do not discuss tone patterning on vowel sequences. I have also not found any discussions in available literature about tones and their manifestation on vowel sequences in Siwu. The main source of data for this study, FCBH Global Bible (2008), also does not indicate the lexical tone feature of the language in its orthographic representations, in order to avoid dissension among speakers and to accommodate dialectal differences which may lead to the misrepresentation of tones for some speakers. A discussion on the role that tone plays in syllabification and how tone patterning in vowel sequences provides evidence regarding different syllable types will be provided in Chapter Four, sub-section 4.2. I also attempt to represent tones in the data presented throughout this work. The majority of the tones indicated are a reflection of my native speaker's intuition, either from listening to the audio files from the main data source or through elicitations. Other tone markings are based on references from Ford and Iddah's work.

2.5 The Syllable

The syllable is a widely researched area in the phonological literature. Early works on the syllable focus mainly on segment sequencing and parsing, providing a guide to syllabification of segment sequences. One such early work is Pulgram (1970), which suggests that if the syllable is the basic unit of all languages, then it is a universal constituent that needs a universal definition, despite the existence of language-specific phonotactics. In other words, these works raise the question of how the syllable can be approached such that there is a universal way to implement syllabicity while leaving room for language-specific variation. This leads to Pulgram's basic principles of syllabicity, which will be discussed in Chapter Three.

Kahn (1980) also establishes that the syllable is a very significant phonological unit that is intermediate between the segment and the word and that plays an important role in "conditioning distributional statements, sound change, synchronic phonological rules". The syllable structure of many languages has since been explored (e. g. Bagemihl 1991).

While syllable theories may suggest universality in segment sequencing, thereby laying the foundation for the general well-formedness of a syllable, specifics of syllable structure vary across languages. Crosslinguistically, syllable structures may, however, overlap and generally share similarities in their patterns. These similarities are usually associated with the language family or grouping. For example, the Ghana-Togo Mountain languages exhibit onset consonant clusters with CL/CG sequences and generally have a preference for open syllables.

There are, however, some languages whose syllable structures seemingly differ and do not share similarities with most languages and may not even fit the description of a syllable, as theoretically defined. The phonotactic rules of syllabification of such languages, therefore, do not align with the proposed principles of syllabification. Such is the case of Nuxalk (Nater 1994), also

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known as Bella Coola, a Salish language spoken on the central coast of British Columbia. Nuxalt has been analysed with two extreme proposals. Newman (1947) argues that this language lacks syllables but Hockett (1955) and Hoard (1978) are of the view that every segment is a syllable. The basis for these claims follows from the fact that Nuxalk has many vowelless words. The following examples illustrate where the syllable boundaries are, whether or not there is a syllabic peak, and how many syllables occur in the obstruent-only word in Nuxalk, according to various studies.

Source	Syllabification	Number of syllables
3. Newman (1947)	c'kt̩skʷc'	0
Hockett (1955)	c'.k.t.s.kʷ.c'	6
Greenberg (1962)	c'kt̩skʷc'	2?
Fudge (1976)	c'*.k*t.skʷ*c'	3
Hoard (1978)	c̦'.k̦.tș.k̦ʷ.c̦'	5

. = syllable boundary; C̩ = syllabic element; * = null/zero peak
(Bagemihl 1991 p. 593)

Bagemihl's position on Nuxalk's syllable structure is intermediate between these two extreme claims. He demonstrates this position through four hypotheses each of which is used to syllabify each of the following words; [caɬ] 'lake', [tksn̩] 'shoot with a bow', [tχt] 'stone'. See (4) below.

4. No Syllable Hypothesis (NSH)
   c a ɬ   t k s n̩   t χ t

Obstruent Syllabicity Hypothesis (OSH)
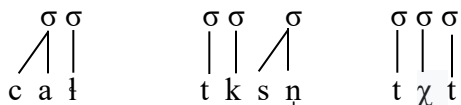
Simple Syllable Hypothesis (SSH)

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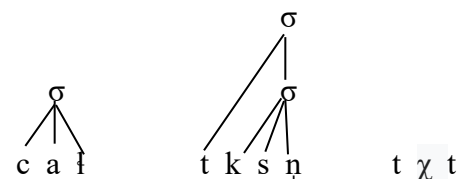
Complex Syllable Hypothesis (CSH)

σ   σ

c a ɬ   t k s ṇ   t χ t   (Bagemihl 1991 p. 596)

Bagemihl's first two hypotheses reflect the two extreme ends of arguments concerning Nuxalk's syllabification while the other two show an intermediary between these two extremes. While Nuxalk's case is very unique and different from Siwu's, both share the trait of allowing sonorants as syllabic elements. Siwu allows only nasals while Nuxalk allows both liquids and nasals. Apart from this similarity, Nuxalk's vowelless syllables contrast with Siwu's VVV sequences analysed in Chapter Four, where I demonstrate that tone is a key factor in determining whether such sequences are monosyllabic or polysyllabic. The syllabification of unusual segment sequences such as those found in Nuxalk and Siwu using the principle of sonority and tone, respectively, emphasises that language-specific phonotactic rules of syllabification may be just as important as the universal rules of syllabification.

Relatively little work has been published on the syllable structure of Siwu. However, more detailed descriptions are available for related languages. A review of this literature is provided in following sections.

2.6 The Syllable Inventories of GTM Languages – Sɛkpɛlé, Sɛlɛɛ, Lɛlɛmi, and Tafi

Sɛkpɛlé is a neighboring language spoken by the people of Likpe. This language shares immediate boundaries with Siwu to the East. Delalorm (2016) documents six syllable patterns in Sɛkpɛlé as follows; V, N, CV, CVV, CCV, and NCV, where CCV patterns are strictly consonant-lateral-vowel (CLV) or consonant-glide-vowel (CGV) sequences. Examples of the identified patterns are below.

5. V   -   ò.k͡pâ   -   'dog'`
                  wù.ú.sù   -   'He will go
   N   -   ḿ.bà   -   'salt'
                  ń.tù   -   'water'
   CV   -   lè.má   -   'war'
                  sì.tɔ́   -   'clay'
   CVV   -   kù.kúə́   -   'book'
                  lè.sìà.bí   -   'knife'
   CLV   -   fló.mà   -   'change'
                  ká.k͡pó.kló   -   'tortoise'
   CGV   -   ɔ-kwɛ   -   'farm'
                  ka.kwɛ   -   'spider'

   NCV   -   kù.k͡pə̀ .nsɛ́   -   'famine'
                  ké.ŋké   -   'all'   Delalorm (2016 pgs 68-69)

The CLV sequence is limited to consonant-lateral-vowel sequence. This may be a result of the fact that, although /r/ is present in some native words, it is more prevalent in loanwords. Delalorm notes that all syllable types occur in all positions of a word (word-initial, word-medial and word-final). The only exception to this rule is the prenasalised onset syllable, NCV, which occurs only in word-medial and word-final positions.

Sɛlɛɛ is spoken by the people of Santrokofi and is closely related to Siwu, Sɛkpɛlé and Lɛlɛmi as its cognate languages in the Na-Togo classification of the GTM languages (Agbetsoamedo 2014). The syllable structure of Sɛlɛɛ presents an interesting case that is slightly different from that of other GTM languages. For example, there is the CV: pattern indicating a consonant and a long vowel (two moras) and a rather unusual cluster pattern of CCV where the consonant clusters can be composed of a nasal and an obstruent, rather than allowing the syllabic nasal (N) pattern as is evidenced in other GTM languages. Examples below;

6.

V	CV	CV:	CCV	*CVC
a. ɛ.ɛ 'yes'	ka 'read'	sɛ: 'witch'	mba 'salt'	*ɔ.lan.le
b. a.lɛ 'that'	sa 'sing'	nɛ: 'hand'	mpa 'bed'	* ɔl.an.le
c. a.ku 'rubbish'	du 'reach'	pa: 'labour'	kle 'wear'	ɔ.la.nle 'slave'
d. ɔ.ka 'chief'	fu 'receive'	fa: 'shout'	ŋkpa 'life'	*kpan.te
e. e.ku 'rope'	lo 'kill'	bu: 'rot'	nta 'drink'	*kpant.e
f. o.si 'yam'	wo 'due'	fu: 'boil'	ntɔ 'blood'	kpa.nte 'hunter'

(Inusah 2024 p. 35)

As can be seen from the examples above, Sɛlɛɛ does not permit codas under any circumstance. It is a system that fits perfectly with 'onset maximization', a principle of cross-linguistic syllabification of VCV, where V.CV is preferred to VC.V. (Zec 2007). Based on the linear organisation of the syllable, as established in works on the typology of syllable inventories in Jakobson (1981); Prince & Smolensky (2004); Clements & Keyser (1983), Inusah (2024) classifies Sɛlɛɛ under 'systems without codas' where either; a) onsets are required: CV or b) onsets are optional: CV, V and c) codas are banned: CV, CV: CCV.

Like Siwu, Lɛlɛmi is divided along dialectal lines. It is a sub-dialect of a bigger language group (Buem) and it is mutually intelligible with all of the other forms of Buem (Allan 1973). Although in extremely limited distribution, closed syllables can also be found in the Lɛlɛmi syllable inventory. In all cases, the sequence is Consonant-Vowel-/n/ (CVn) or Vowel-/n/ (Vn). Allan (1973) states that syllabic nasals exist in Lɛlɛmi. However, they can only occur in word-initial position. This means that when nasals occur elsewhere, they must be syllabified as codas.

Lɛlɛmi also exhibits onset clusters that are similar to other GTM languages. However, sometimes they have underlying forms that may differ from CC sequences which he refers to as 'false CW-clusters'. Onset clusters in Lɛlɛmi are either Consonant-Liquid sequences or Consonant-/w/ sequences. Allan states that there are two types of Consonant-Glide sequences; true and false CGV sequences. The false CG onset cluster is "merely the phonetic result of suffixing a vowel to a verb stem which happens to end in /u/" (Allan 1973 p. 52). In other words, if a verb stem ends

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in /u/ and another vowel is added as a suffix, the result is not a diphthong or a sequence of adjacent vowels, but rather, a false Consonant-Glide sequence. For example;

7. (a)
	UR/Base form			
	bɔ̀cùì	'to be burnt'	bɔ̀cùlà	'to burn'
	bɔ̀kùì	'to be dried'	bɔ̀kùlà	'to dry' (Allan 1973 p. 52)

(b)[4]
False CW-cluster
[bɔ̀tʃwì]	'to be burnt'
[bɔ̀kwì]	'to be dried'

(c)
True CW-cluster
[bɔbwɛ]	'to apologize, feel sorry'
[budwo]	'to welcome'
[bɔfwini]	'to yell in anger'

(Allan 1973 p. 52)

In addition to false onset clusters, there exist some CL clusters that result from diachronic metatheses or borrowings. For example, the form for 'canoe' in Sɛkpɛlé is [ɔkɔlɔ] but in Lɛlɛmi, it is [ɔklɔɔ]. The form for 'dog' in Lɛlɛmi is borrowed from the Twi form [ɔkrama] to become [ɔklama]. The phoneme /r/ appears in restricted vocabulary in one of the dialects, hence the [l]-[r] alternation. The following is documented as the syllable inventory of Lɛlɛmi in the descending order of frequency.

8.
CV	-	dɛ	'how?'
		bo	'come'
V	-	ɔtɔ	'house'
		úbò	'he came'
CwV	-	ŋwa	'his, her, its'
		fwi	'spit'
Clv	-	bla	'do!'
		vla	'bang!!'
N	-	ntu	'water'
		nsù	'but'
Vn	-	ànta	'born'
		ɔnjɛ	'yonder'
CVn	-	lɛnta	'corn'
		bánvɔ	'those' (Allan 1973 pgs. 39-41)

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[4] These examples are intentionally transcribed with Consonant-Glide sequence to reflect Allan's false clusters.

Tafi belongs to the second group of Heine's (1968) classification of the GTM languages, the Ka-Togo category. It shares some mutual intelligibility with Nyangbo hence the joint classification Tafi-Nyangbo. Tafi has a unique characteristic as far as closed syllables are concerned. Bobuafor (2013) asserts that there is a strong preference for open syllables in Tafi except under two grammatical contexts, both due to historical vowel loss in a (C)VCV sequence. The first context is numerals, usually multiples of ten except for the forms for 'thirty' [áfaatá] and 'fifty' [áfeití] which retain their second vowels in the (C)VCV sequence. The other context is the 3rd person plural pronoun [balí], when it occurs in the object position in a clause. When the 3rd person plural indicator /í/ is the final word in a clause, it is elided and the initial consonant is deleted as well, leaving the VC sequence [al]. Bobuafor also notes that the only phonemes allowed in these codas are /f/ and /l/. This is illustrated below;

9. áf.ta.lĩ   'forty'
    áf.te.gé.né   'seventy'
    áf.ta.sōī   'eighty'
    áf.te.zhi.tá   'ninety'

    Ésí átɔ́ ˀɛdō kɔ́ ˀál
    Ésí   á-tɔ́   kí-dɔ́   kɔ́   **_balí_**.
    Esi   SM-cook   CM-thing   DAT   3PL
    Esi cooked for them.
                            (Bobuafor 2013 p. 17)

Like most GTM languages, Tafi also permits a nasal syllabic consonant and a CCV sequence which is either a consonant-liquid-vowel or a consonant-glide-vowel. The syllable inventory is outlined in the following.

10. V   í.tú   -   'I pound'   (N.CV)
          ó.bú   -   'you remove'   (N.CV)
    N   ka.m.pé   -   'a pair of scissors'   (CV.N.CV)
          kó.ŋ   -   'very much'   (CV.N)
    CV   bú.tu.tu   -   'saliva'   (CV.CV.CV)
          bé.gu.gu.dɔ   -   'mad people'   (CV.CV.CV.CV)
    VC   (referenced in (9) above)

CVV	pé.téé	-	'all'	(CV.CVV)
	nyáá	-	'each, every, any'	(CVV)
CCV	kla	-	'count, read'	(CLV)
	bʊia	/bwɪa/ -	'pay'	(CGV.V)
	kámpiesí	/ká.m.pye.sí/-	'armpit'	(CV.N.CGV.CV)

<div align="right">(Bobuafor 2013 p. 16-18)</div>

Tafi syllable structure may appear similar to that of Sɛkpɛlé, Lɛlɛmi, and Sɛlɛɛ on the surface level but a further analysis reveals that it is distinct in several regards. Bobuafor (2013) notes, for example, that the CVV sequence is only present in loanwords and ideophones. The CGV sequence, however, is consistent with Allan's (1973) claim concerning Lɛlɛmi's false CGV sequence. Bobuafor reveals that in a vowel sequence, when a consonant precedes a [+high] vowel, the result is [y], and when a consonant precedes a [+back] vowel, it becomes [w]. These glides proceed to form clusters with the consonants. Simply put, there is a phonological process involved in vowel sequences in both Tafi and Lɛlɛmi which results in a CC sequence.

2.7 Preliminary Studies of the Siwu Syllable Inventory

Although the syllable patterns of Siwu have not previously been thoroughly investigated, a partial account of various identified syllable patterns is provided in Ring, Addae & Atsu (2002). They identify the patterns, N, V, CV, CVV, CCV, and CCVV. Examples of these syllable types are illustrated in (11) below.

11.	N	-	[n.du]	'water'
	V	-	[ɔ]	'it/he/she'
	CV	-	[ba]	'come'
	CVV	-	[sia]	'farm'

<div align="center">(FCBH Global Bible 2008)</div>

CCV/CCVV	[gliglii]	*giligili* (orthography) -	'round'
		Ring et al. (2002 p. 24)

Ring et al. claim that CCV syllables are part of the syllable inventory of the language. However, in their description, a "transition vocalization" (2002, p. 24) is present in the orthography where written forms are presented as CVCV.

It is important to note that there is indeed very limited documentation of underlying CCV forms in Siwu. Iddah and Ford (1973 pgs. 2, 34, 40), for example, document forms such as;

12. [braá]   'make/do'
    [àbrekutu]   'palm-nut soup'
    [kàfrɛi]   'fish'

Additionally, Dingemanse (2011) asserts that consonant clusters and complex onsets do not generally occur in Siwu except for the sequence consonant-liquid (CL) as in the forms '*bra*' for 'do'. He goes further to describe such sequences as ambiguous since the pronunciation of such forms varies among speakers in either slow or rapid speech resulting in the CVCV forms, '*bara*' or '*bəra*'. Additional evidence regarding the status of CC onset clusters as obtained from the present study of the FCBH Global Bible (2008) and consultation with native speakers will be discussed in Chapter 4.

2.8 Comparison of Siwu Syllable Structure to Other GTM Languages

GTM languages may differ vastly in other aspects of language structure, as claimed by Ameka and Essegbey (2017), but they share extensive similarities in their syllable structure. I will discuss the similarities and differences that are present in the syllable structure of five GTM languages – Siwu, Sɛkpɛlé, Sɛlɛɛ, Lɛlɛmi, and Tafi.

A recurring characteristic that is found in the syllable structure of these languages is their preference for open syllables. GTM languages have shown that onset maximisation is a key principle in the well-formedness of their syllables. Nevertheless, some of them permit restricted segments to be in the codas of a very limited vocabulary (Siwu, Lɛlɛmi, Tafi) (Allan 1973; Bobuafor 2013) while others do not allow for codas in any context (Sɛkpɛlé, Sɛlɛɛ) (Delalorm

2016; Inusah 2024). In Siwu, codas exist only in ideophones and loanwords. The case of Tafi is circumstantial – the tolerance for codas is due to historical vowel loss and grammatical deletion of vowels and this manifests only in numerals and pronouns. Lɛlɛmi allows only the phoneme /n/ to attach to prefixes. The other context in which we see a CVn or Vn sequence is in determiners of a subdialect of Lɛlɛmi. I should also state that segments in the codas are very restricted to either a natural class, such as Siwu allowing only nasals, or specific phonemes such as Tafi's /f/ and /l/ (Bobuafor 2013 p. 10) , and Lɛlɛmi which allows only /n/ (Allan 1973 p. 42).

One other similarity that can be observed in the syllable inventory of GTM languages is the syllabic nasal – the N syllable type. This syllable type is found in all the GTM languages under discussion except for Sɛlɛɛ. The N syllable type is always a part of a polysyllabic form and cannot stand on its own. For Siwu, it can sometimes perform a grammatical function of marking plural but is usually part of a polysyllabic root word. Its position in a word is one notable difference that exists among these languages. For Siwu and Lɛlɛmi, this syllable type occurs only in word-initial position. It is found in word-medial and word-final positions only in Tafi. Not all nasals are the N syllable type. There is the prenasalised onset syllable, NCV, in some GTM languages like Sɛkpɛlé and Sɛlɛɛ where we observe nasal + obstruent sequence syllabified as onsets, according to descriptions in the literature (Delalorm 2016; Inusah 2024). In Sɛkpɛlé, this prenasalised onset syllable occurs only in word-medial and word-final positions but data available shows that there is no limit to its distribution in Sɛlɛɛ. In prenasalised onset syllables, N is accounted for as the first component of a cluster. This leads us to another notable characteristic that GTM languages share in terms of their syllable structure – complex onsets.

Onset consonant clusters are a prominent trait among GTM languages but their composition varies among them. The most common cluster types consist of Consonant-Liquid or

Consonant-Glide sequences. My observation is that within the Liquids category, Rhotics are usually restricted in the vocabularies of most of these languages, hence CL clusters mostly consist of Consonant-Lateral sequences. In Sɛkpɛlé, /r/ is only prevalent in loan words. It is completely absent in the Sɛlɛɛ segment inventory. Like in Sɛkpɛlé, it is also restricted to a few words in a sub-dialect of Lɛlɛmi. This is why a loan word from Twi like [ɔkrama] 'dog' becomes [ɔklama] in Lɛlɛmi. Conversely, /r/ is well accounted for in a vast vocabulary in Siwu and Tafi so CL clusters in these languages have an almost equal l-r distribution. Data in Siwu even shows that /r/ has a freer distribution than /l/ in complex onsets. The other cluster sequence, CGV, is absent in Siwu. Although highly sonorous, glides in Siwu are either not able to form clusters at all, or they occur in the first position in clusters. A comprehensive discussion of Siwu onset clusters is provided in Chapter 4, Section 4.1.4.

An unusual cluster of Nasal-Consonant (stop) can also be observed in a few GTM languages. The question of when to parse an NCV sequence as an onset cluster or simply as a syllabic nasal followed by a CV syllable arises especially when, within the same language, like Sɛkpɛlé, an N syllable type is also included in the syllable inventory. Like most GTM languages, syllables are tone-bearing units and a critical analysis of the NCV situation reveals that N in any NCV sequence must bear tone to be considered a syllabic nasal. The following examples in Sɛkpɛlé are illustrative.

13. N	-	ḿ.bà	-	'salt'	
		ń.tù͡	-	'water'	
NCV	-	kù.k͡pə̀ .nsɛ́	-	'famine'	
		ké.ŋké	-	'all'	(Delalorm 2016 pgs. 68-69)

Other traits that the Siwu syllable shares with some of the GTM languages are the long vowel CVV (long vowel), shared with Sɛlɛɛ and Tafi, CVV (diphthong), shared with Sɛkpɛlé, and a metathesis process, shared with Lɛlɛmi.

2.9 Conclusion

This chapter has discussed the existing literature on Siwu phonology and related languages. The focus has been on syllable structure in GTM languages because of the characteristics that other languages within this language group share with Siwu. In addition, phonological preliminaries such as the phonemic inventory of Siwu and tone, key features at the centre of this study, have been introduced and discussed. The chapter has also shown that there exist no studies that give a comprehensive description of the Siwu syllable, which is the main goal of this study. Chapter Four will give a detailed description of syllable structure in Siwu, based on data available in the FCBH Global Bible (2008). This includes a discussion of the various observed syllable types, their distribution, and proposed constraints that guide the well-formedness of the Siwu syllable.

CHAPTER THREE – THEORETICAL FRAMEWORK

3.1 Introduction

The syllable itself is a theoretically defined constituent and a theoretical approach is necessary to provide an adequate account of the Siwu syllable. Several scholars have found the definition of the syllable to be elusive (Haugen 1956; Baertsch 2010). The syllable has been looked at from two broad perspectives; first, the speakers' viewpoint, according to which speakers of a language utter syllables whose sequences can be grouped and divided naturally (Haugen 1956). This is expressed by Whitney and Saussure as cited in Goldsmith (2011 p. 167) as the view that "a syllable is that part of a word which is uttered by a single effort or impulse of the voice". The second perspective is that of the phonological viewpoint, expressed by Feinstein (1979 p. 255) as guided by "linguistically significant generalization." Bosch (2011 p.1) further elucidates the elusiveness of the syllable, stating that, although relevant concepts and terminologies are well-known and used often, there is no known "invariant acoustic or articulatory evidence for these constituents". Irrespective of key universal concepts associated with the syllable, these varying views have led to the development of different theoretical frameworks about the syllable and its constituents. Nevertheless, these views project a common theme about what the syllable is – the domain for phonotactics. In simple terms, the syllable is the right phonological unit to derive the rules of segment sequencing of a language.

Goldsmith (2011) discusses several theoretical approaches to the syllable that are relevant to this study. In line with the goals of this study, some of these views, especially those that centre around general syllabification (Pulgram 1970), sonority (segment sequencing), and constituents of the syllable, will be explored in this chapter, and the Siwu syllable will be analysed using these

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concepts in the subsequent chapters. A brief discussion of phonological processes affected by syllable structure will also be provided.

3.2 Principles of Syllabification

The issue of dividing words into syllables is guided by some basic principles. These principles include both universal and language-specific aspects. Goldsmith (2011) highlights five of these principles through the lens of Pulgram (1970) who recognises that the general phonotactic restrictions on syllabification also play a role in language-specific rules of syllabification.

The first rule he proposes is determining the ***domain*** within which phonotactics can be applied. In this case, what should be considered a syllable? As cited in Bell (1976 p. 242), Pulgram focuses on identifying the peak first and then segmenting "each section by dividing the consonants between nuclei into a permissible section-final cluster and a permissible section-initial cluster". For example, in segmenting the sequence [mɛntælɪti], the nuclei /ɛ, æ, ɪ, i/ need to be identified first before pairing the consonants according to what English allows in the onset or coda.

Pulgram's second rule, ***maximal open syllabicity***, works ideally for languages that do not allow codas. This rule demands a syllable boundary after each vowel. The second rule calls for the third rule, ***minimal coda***, in situations where particular vowels may not be permitted at syllable boundaries in which case, the syllable boundary shifts to the right "but only the smallest number of shifts necessary to achieve a sequence that is possible word-finally" (Goldsmith 2011 p. 173). The coda must be as simple or minimal as possible. The case of English lax vowels [ɪ, ɛ, æ, ʌ, ʊ, ɔ], usually not permitted to close a syllable, requires the application of Rule 3. In a word like [nɛklɪs], *necklace,* (Bell 1976 p. 243) with a $C_1V_1C_2C_3V_2C_4$ structure, because V_1 is not permitted to be at the boundary, C_2 must be shifted to the left. The second part of the rule which states that only minimal shifts may be made ensures that C_3 is not shifted, giving us a CVC.CVC pattern.

The fourth rule, ***the maximal onset principle***, states that if a particular sequence of consonants is not permitted syllable-initially, the syllable boundary should keep shifting to the right. This rule will therefore syllabify [ɪmplɔɪ] as [ɪm.plɔɪ] rather than [ɪ.mplɔɪ] because the sequence /mpl/ is not permitted syllable initially in English. Pulgram's final rule of syllabification calls for an imperfect onset over an imperfect coda in cases where a sequence results in both an unacceptable onset and coda. The ***principle of the irregular coda*** suggests that it is preferable for the coda to bear the imperfection instead of the onset. Pulgram uses the Spanish example [trans.cri.bir] to illustrate that a /ns/ coda is better than a /sk/ onset, although both are unacceptable at word edges.

In Chapter 4, I show that Pulgram's principles are an ideal model that helps to account for Siwu syllabification. However, I contend that language-specific rules can supersede general rules of syllabicity given that some languages like Siwu tend to rely on other cues, including prosodic features, in determining the domain of syllabification.

3.3 Sonority and Segment Sequencing

3.3.1 The Sonority Scale

In addition to the principles governing syllabification discussed above, another factor which plays an important role in syllable structure is sonority. Sonority is the relative loudness of a sound. The concept of sonority has been developed into a hierarchy whereby all phonemes or natural classes have been assigned a sonority value which helps to explain syllabification in languages. Universally, the most sonorous elements, typically vowels, occupy the peak of a syllable. The sequencing of segments within a syllable based on their sonority is reflected in Goldsmith's definition of sonority as the "method of organizing the segments from a language along a one-dimensional scale, with the ultimate purpose of describing permissible syllables"

(2011 p.178). The Sonority Sequencing Principle is one influential formalisation that further breaks down how sonority works in syllables. The SSP, also SSG (Sonority Sequencing Generalisation) states that "in any syllable, there is a segment constituting a sonority peak that is preceded and/or followed by a sequence of segments with progressively decreasing sonority values" (Selkirk 1984 p. 116). Most syllable structures of the world's languages align with the SSP constraint which ensures that sonority is at its peak in the nucleus and falls at its margins, giving an arch shape to phoneme intensity within the syllable (Santolin et al. 2023). In accordance with the SSP constraint, a typical sequencing in a CVC syllable is likely to look like Obstruent < Vowel > Obstruent. Some languages may allow other segments that are less sonorous than vowels, such as liquids, to occupy the nucleus and others may disregard the SSP constraint altogether and allow segments low in sonority, like obstruents, to function as the syllable peak, as seen in Nuxalk. A general sonority scale always has vowels at one end (most sonorous) and obstruents at the other end (least sonorous). However, what segments appear in between these two extremes may vary among studies, most probably because of cross-linguistic differences. (14), below, provides two sonority scales from the literature, with most sonorous elements on the left and least sonorous elements on the right. These illustrate the limited range of variation found in proposed sonority rankings between natural classes. Although both scales have vowels as the most sonorous and obstruents as the least sonorous, they differ in terms of the details of how other segment classes are divided according to sonority. For example, the sonority scale from Zec (2007), provides sonority distinctions between vowels whereas vowels are treated as a group in the scale from Clements (1990).

14. a) Vowels (low, mid, high) > Liquids (rhotics, laterals) > Nasals > Obstruents

(Zec 2007 p. 178)

b) Vowel > glide > liquid > nasal > obstruent (Clements 1990) as cited in (Rice 1992 p. 65).

Based on segments' ability to be syllabified into complex onset sequences, I propose a sonority scale in for Siwu in Chapter Four, Section 4.2.3, where every natural class of segments in the Siwu phonemic inventory is ranked. This section will show that Siwu provides an example of a case where segments often understood to constitute a natural class, such as glides, may behave differently from one another in terms of syllable structure and can be argued to occupy different positions on a sonority scale.

3.3.2 Different Views of Sonority

3.3.2.1 The Structural View of Sonority and Place of Articulation

Although the general notion of sonority as relative loudness is well-established, different frameworks vary in terms of how sonority is formalised in phonological representations and, more specifically, what phonological features contribute to a segment's sonority. Rice (1992) argues that "possible syllabification relationships of consonants are structurally determined" (pg. 61) and that both sonority and place of articulation features are key to determining consonant syllabification in clusters. This is in opposition to Clements (1990), who proposes that the sonority scale, the key idea that guides cluster syllabification, is independent of place features. Clements' argument is due, in part, to the "dual patterning" of coronals (they can be both higher and lower in sonority than other places of articulation) (Rice 1992 p. 75). This inconsistent patterning of coronals is also seen in studies like Harris (2006), which claims that coronal obstruents possess a degree of sonority that is higher than other obstruents.

According to Rice's proposed structure, Sonorant Voice, just like Laryngeal, Supralaryngeal, Place, and Air Flow nodes, is an organising node and is associated with the feature [sonorant] in other frameworks. As in other models of feature geometry (e.g. Clements 1985), constituent nodes function together phonologically in processes such as assimilation and neutralisation. See Fig. 5 below.

```
                          ROOT
         Laryngeal         /                Air Flow
                  Supralaryngeal    Continuant    (Stop)
                      /      Sonorant Voice
                     /       /         \
               Place    Lateral     (Nasal)
           Peripheral  (Coronal)
         Dorsal   (Labial)
```
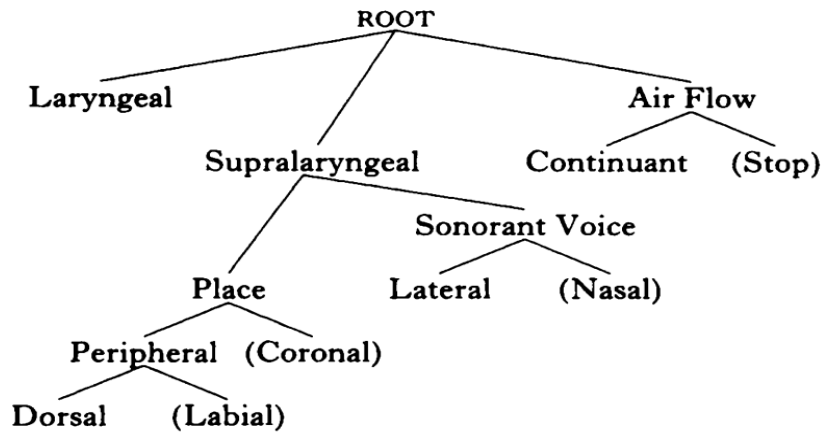
Fig 5 Feature Geometry (Rice 1992 p. 66)

The organising nodes have their dependents which are the defining characteristics of their mother nodes. For example, [lateral] and [nasal] are the distinct features that are dependents of Sonorant Voice. Rice further postulates that each constituency node has a universally unmarked feature that is typically unspecified in the underlying representation and considered a default realisation of the bare organising node. The unspecified features for Place, SV, and AF nodes are Coronal, Nasal, and Stop respectively.

Structurally, she argues that the less complex a segment is in terms of Sonorant Voice, the less sonority it has. She demonstrates this using the three major consonantal classes, liquids, nasals, and obsturents as shown in (15) below. Of the representations below, the liquid /l/ is most sonorous, since it contains both the SV node and the SV-dependent feature Lateral. The nasal is less sonorant

since it contains only a bare SV node and the obstruent has no SV node at all, making it the least complex in terms of SV structure and, according to Rice (1992), the least sonorous.

15.　　liquid (/l/)　　nasal　　　　obstruent

　　　　ROOT　　　　ROOT　　　ROOT
　　　　　|　　　　　　　|
　　　　　SV　　　　　SV
　　　　　|
　　　　Lateral
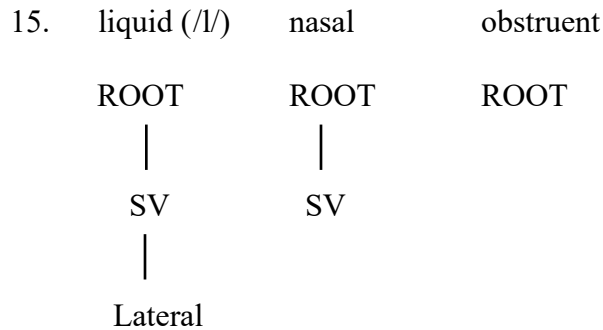
(Rice 1992 p. 65)

Rice further uses the relationship between onset clusters in English to illustrate that structurally, the first segment in any onset cluster ought to have a less complex SV structure than the second segment. In simple terms, the less sonorous a segment is, the better it functions as the first element of an onset cluster and vice versa. Thus, any permissible onset clusters should have a structure similar to the structure in (16) below.

　　16.　stop　　　　lateral
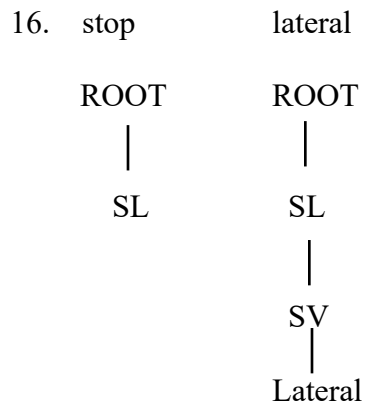
　　　　　ROOT　　　　ROOT
　　　　　　|　　　　　　|
　　　　　SL　　　　　SL
　　　　　　　　　　　　|
　　　　　　　　　　　SV
　　　　　　　　　　　　|
　　　　　　　　　　Lateral　　　　　　　(Rice 1992 p. 66)

The generalisations above should mean that clusters like */pw, bw, tl, dl/ are permitted since they meet the sonority criteria. However, these clusters are not permitted in English and this raises the question of the role of Place in syllabification. If the sonority profile alone is invoked, where the first segments, /p, b, t, d/, have less SV structure than the second segments, /w, l/, these

clusters would be permissible. This leaves Rice to suggest that the identical place of articulation that these clusters share is responsible for the constraint against their syllabification. Structurally, /p/ and /b/ have as much Place structure as /w/, the same as /t/ and /d/ have with /l/. See (17) below.

17. labial   labial   coronal   coronal

     ROOT   ROOT   ROOT   ROOT
       | | | |
     Place   Place   Place   Place
       | |
     Labial   Labial   /t, d/   /l/

     /p, b/   /w/
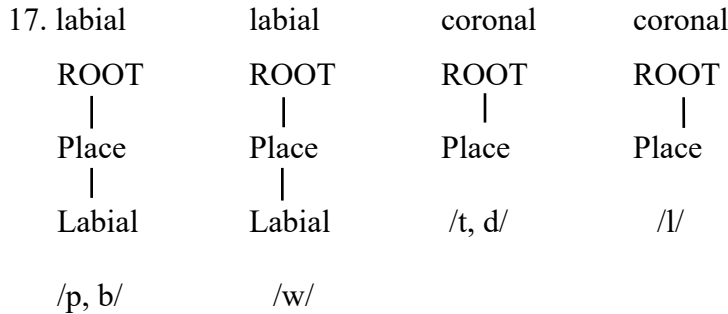
According to Rice, unlike the SV structure, either of the segments that are being syllabified has to have more place structure than the other. For example, the first segment can have more place structure than the second as in [pl], or the reverse like [tw], giving us the following in (18).

18. labial   coronal   coronal   labial

     ROOT   ROOT   ROOT   ROOT
       | | | |
     Place   Place   Place   Place
       | |
     Labial   Labial

     /p/   /l/   /t/   /w/
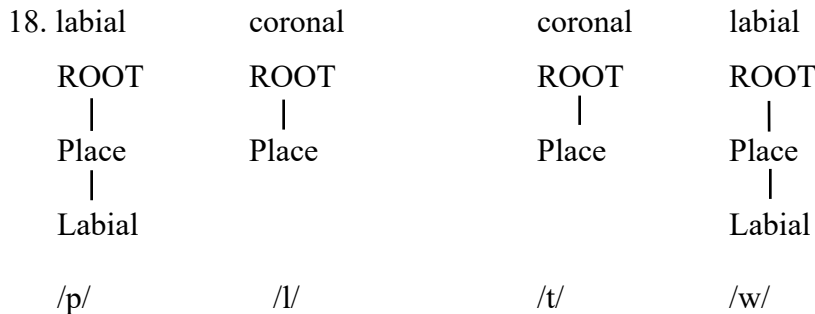
The structural argument presented by Rice above shows the sonority scale to be insufficient in determining cluster syllabification. Place of articulation is equally important in segment sequencing in complex onsets. My analysis of Siwu onset clusters in Chapter Four adopts Rice's structural argument. I propose feature geometric representations for Siwu segments that account for permissible onset sequences using both the place dimension and Sonorant Voice features.

In addition to the structural arguments, Rice argues that the minimum sonority distance (MSD), (Clements 1990 pgs. 317-318) is key in syllabifying clusters. This distance is the minimum required distance between segments on the sonority scale that languages allow in onset clusters. It

differs among languages but evidence shows that the greater the distance the better. For example, English clusters project this distance to be two or more hence explaining why obstruent-nasal clusters are not permitted in English, but sequences such as obstruent-liquid and obstruent-glide are allowed. In an attempt to explain the nasal-liquid sequences in Siwu in Chapter 4, I employ the MSD.

3.3.2.2 Arguments Against Sonority

Although sonority is argued to play an important role in syllabification in a variety of frameworks, some works have argued against the use of sonority in phonological analyses. Harris (2006 p. 1483) criticises the concept of sonority based on the idea that it lacks "consistent phonetic correlates" compared with distinctive features whose phonetic properties can distinctly be measured and which also possess the peculiar linguistic characteristic of signaling meaningful contrast. According to Harris (2006), sonority is not a framework that is phonetically objective enough to guide the principle of segment sequencing. The fact that there are cross-linguistic variations within the sonority scale itself affirms this. In addition, Harris argues that sonority is only a cover for a combination of acoustic properties such as "clear formant structure, periodicity, steady-state and transient formant patterns" (2006 p.4). Available literature suggests that Sonority is as evasive a term as the syllable itself. Price (1980 p. 328), for example, states that the term 'sonority' has been viewed as an overall feature of voice quality, a feature of stress carried by syllables, or a feature of segments that form the internal structure of syllables.

Apart from the consensus that some sounds are inherently more sonorous than others, some researchers argue that the sonority of segments can be determined by the contexts in which they are found. This means that other segments in the phonological environment can contribute to whether a particular segment is syllabic or non-syllabic. This claim comes about after Dell and

Elmedlaoui (1985) establish that in Imdlawn Tashlhiyt Berber, an Afro-Asiatic language spoken in North Africa, any segment at all can be the nucleus of a syllable, regardless of its position on the sonority hierarchy scale. The only determinant of such is the phonological context. In (19) below, we see how certain segments alternate between being syllabic or not within the same morpheme due to the presence or absence of particular morphemes or segments.

19. (a)	**3m.sg.**	**3f.sg.**	**Gloss**
	IldI	tLdI	'pull'
	IrbA	tRbA	'carry on one's back'
	IxsI	tXsI	'go out (fire)'

	2sg.perfective	**3f.sg.perfective with dat. 3m.sg.object**	**Gloss**
(b)	tRgLt	tRglAs	'lock'
	tSkRt	tSkrAs	'do'
	tMsXt	tMsxAs	'transform

Goldsmith (2011 p.176)

Segments that have been capitalised are syllabic. In (19a), [l, r, x] become syllabic after the 3rd person singular (feminine) morpheme [t]. In (19b) again, the same segments are syllabified before the 2nd person singular (perfective) morpheme, [t]. Other segments [r, s, m] equally become syllabic in any environment adjacent to the segment [t]. The general rule that can be derived from the data is that [t] in any phonological environment appears to trigger syllabification of other segments.

The arguments against sonority above hold true as we would see the limitations of sonority in accounting for certain unpermissible sequences in Chapter Four, Section 4.2.3. The analysis will show that while sonority is important in syllabification, other mechanisms are needed in addition to the concept of sonority to account for syllabicity.

3.4 Linear Organisation of the Syllable

3.4.1 Sub-Syllabic Constituents

Although the syllable is thought of as a phonological unit without clear phonetic correlates, Zec (2007) holds that its core role in phonological theory as a constituent responsible for segment grouping is well established. Syllabification, however, transcends just the grouping of segments within the syllable and this has motivated various theories regarding other possible constituents within the syllable unit. This section will discuss the structural organisation of the syllable as examined in Bosch (2011) and Goldsmith (2011).

Bosch (2011) contends that arguments for constituents within the syllable are rooted in evidence for the syllable itself. Two out of the four arguments outlined for evidence of the syllable by Blevins (1995) are also found to be valid arguments for the constituents within the syllable; the fact that, a) the syllable is the domain for phonological processes such as nasalisation and also that, b) the syllable is the target structure for processes such as tone assignment or language games. In the first case, Bosch references the choice of Italian articles [il] or [lo], as analysed in Davis (1990), as evidence for the sub-syllabic constituent, onset. The argument holds that the structural composition of the following onset is a determining factor in which of the two articles is most appropriate. The fact that in Italian, the choice of article is dependent on the structural composition of an onset is evidence that there is a sub-constituent within the syllable. Arguments for the rhyme take into consideration linguistic behaviours such as stress assignment in quantity-sensitive languages and the identification of syllable constituents in language games. In quantity-sensitive languages, the type of rhyme; a nucleus with only a short or long vowel, or a nucleus and a coda (vowel and consonant) is key in assigning stress to a syllable. In some language games, such as

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the American language game "ubby dubby", the onset and rhyme are the target for inserting the sequence [əb] hence "hello" becomes /*həbɛləboʊ*/.

Theories of syllable-internal structure range from flat structure, which is the mere marking of syllable boundaries (Kahn 1980), to more structurally organised constituents of the syllable (Pike & Pike 1947; Kurylowicz 1948; Hockett 1955). The discussion has given us significant evidence of two main syllable-internal structures – the onset and the rhyme. Two binary structures of these constituents have been proposed but one is more conventional. See (20) below.

20. (a)   Syllable   (b)   Syllable
      Onset   Rhyme   Body   Coda
              Nucleus   Coda   Onset   Nucleus
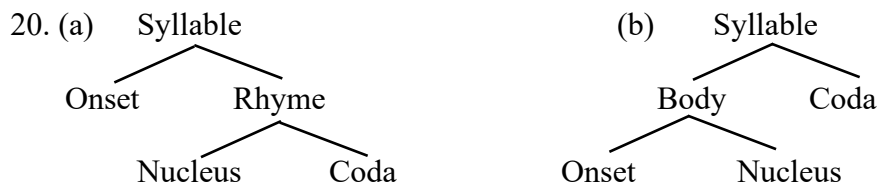
Both structures are taken from Bosch (2011 p.5), as cited from (Pike & Pike 1947) and (Yoon & Derwing 2001), respectively. The first structure in (20a) is the most common while (20b) is proposed for a few languages such as Korean and Mandarin Chinese. A variation of (20a) which mirrors the phrase structure rule is proposed by Levin (1985) where the nucleus (N) is the head of the syllable, because "the obligatory subconstituents are the rime, and one of its dependents, the nucleus" (Zec 2007 p. 177). The onset is the specifier and the coda, the complement. See the illustration in (21) below.

21.   N´´
        Specifier   N´
                         N   Complement
                     Nucleus
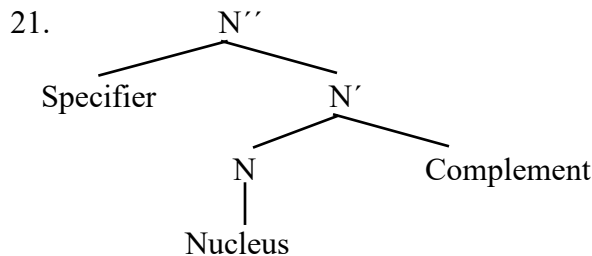
(Bosch 2011 p.5)

The argument for structure (20b) is further highlighted in Goldsmith (2011) for languages like Japanese whose phonological structures revolve around the mora, suggesting that syllable structures that were analysed as CVC should be CV followed by a "defective" syllable. Such a structure is represented as in (22) below where the Onset and Nucleus together form a constituent which therefore makes the "constituent" the obligatory part of the syllable instead of the traditional rhyme.

22.   Syllable

        (constituent)   Coda

Onset   Nucleus
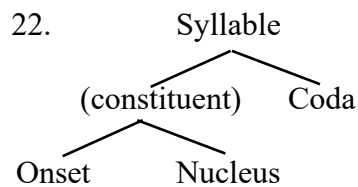
(Goldsmith 2011 p.170)

Goldsmith concedes that establishing a conclusive constituency structure has proven to be difficult because existing structures do not provide decisive answers to the question of what the "generally accepted principles for determining constituency in phonology" are (Goldsmith 2011 p.170). I adopt structure (20a) from Bosch in analysing sub-syllabic constituents in Siwu because of the language's preference for open syllables, thereby making the onset and nucleus the two most salient constituents of syllable structure.

3.4.2 Syllable Shapes and Implicational Relationships

A number of studies, as outlined in Zec (2007), investigate crosslinguistic variation in syllable inventories and use these patterns to propose syllable typologies. Four syllable types are identified as the universal basic inventory from which several syllable typologies are derived. These are CVC, CV, VC, and V. Based on this inventory, studies draw out different systems of syllable shapes, depending on whether codas are permissible or non-permissible and whether onsets are optional or obligatory.

For systems without codas, two types of syllable shapes are found; one where onsets are required and the other where they are optional exemplified in (I) below.

I.   (a) Required Onsets – CV

(b) Optional Onsets – CV, V

The next type to look at is that which allows codas. Just like systems that do not allow codas, systems that allow codas are equally subdivided into whether onsets are required or not as in (II) below.

II.   (a) Required Onsets – CV, CVC

(b) Optional Onsets – CV, V, CVC, VC

The syllable structure of languages like English, whose syllable margins could have either complex onsets or codas, (C)(C)V(C)(C), prompts another syllable shape typology, systems that allow complex onsets. The two categories under this system focus on whether codas are optional or banned.

III.   (a) codas are banned – CV, CCV

(b) codas are optional – CV, CCV, CVC, CCVC

Zec highlights an existing implicational relationship between syllable types under this system. In this category generally, the presence of syllable types with complex margins implies the presence of types with simple margins. This relationship is best exemplified in CCV and CV or CVCC and CVC. In English, the possibility of [splæʃ] or [kæts] denotes that there is [pleɪ], [leɪt] or [kæt].

Unlike the implicational relationship examined above, the linear organisation of the syllable suggests an independent relationship between the onset and the coda, in that the presence of one does not demand the presence or absence of the other. However, an asymmetrical

relationship exists between the onset and the coda. Zec (2007) asserts that cross-linguistically, onsets are highly preferred over codas. This is evidenced in the analysis of the cross-linguistic syllable inventories which shows some languages requiring the presence of onsets as compared to no language requiring codas. In other words, codas are either banned or optional while onsets can be obligatory. Another way in which this asymmetrical relationship can be looked at is the cross-linguistic syllabification of VCV. Generally, languages will have a V.CV rather than a VC.V. This asymmetrical relationship is also consistent with Pulgram's Rules 4 and 5 which suggest a perfect onset over a coda that deviates from the phonotactics of a language. In simple terms, an onset is preferred over a coda.

Zec's work brings into focus what constituents within the syllable are deemed crucial or most preferable in the syllable template in each of the examined languages. She demonstrates that the nucleus is by far the basic property of all syllable types, a fact that corresponds to the structural organisation of the syllable examined above. Zec also shows that based on Prince and Smolensky's (2004) markedness constraints referring to the basic syllable form, namely; NUC – syllables must have nuclei, ONS – syllables must have onsets, and ⌐COD – syllables may not have a coda, the CV is the least marked syllable type cross-linguistically.

3.5 Phonological Processes and Syllable Structure

Phonological processes which crucially reference syllable structures usually perform the function of repairing structures that deviate from the rules of the language in question. Epenthesis, elision, and metathesis are among the most common processes found to be conditioned by syllabification. Epenthesis has been identified as one of the repair strategies that can be used to "resolve syllable-structure markedness by allowing a bad coda to be re-syllabified as an onset" (Moore-Cantwell, McCarthy & Pater 2016). Zec (2007) also analyses epenthesis and elision within

the framework of Optimality Theory where they can be applied to input strings that contain more or less segments than a language may allow. For example, elision or an epenthetic vowel can be applied to the input VCCV to become VCV or VCVCV respectively, if the language does not permit codas. Ultimately, a nucleus is introduced to eliminate an offensive coda or the offensive coda itself is eliminated directly. Instances of epenthesis are observed in loanwords in Siwu where selected vowels are syllabified to eliminate a bad coda. This is discussed in Chapter Four, Section 4.3.

With respect to metathesis, several studies have attributed arbitrariness to metathesis because most cases are diachronic or historical (Finley 2017). A typical example of metathesis with no clear phonological or phonetic explanation is mirror image metathesis in Hungarian and Pawnee where opposite directions of metathesis are observed ((Hume 2004) as cited in Finley (2017)). On the one hand in Hungarian, /hr/ becomes /rh/ as in /tehernek/ 'load-DAT'→[terhek], *[tehrek]'load-PL') while the opposite is seen in Pawnee with /ti-ir-hisak-hus/→[tihrisasku] 'he is called' (Finley 2017 p. 2). Despite the unpredictability of most cases of metathesis, some have been identified to be rooted in language-specific constraints. A constraint such as stress assignment, for example, has resulted in /sk/ becoming /ks/ in Old English. The word [aske] becomes [akse] 'ash' after the initial syllable is stressed. In Colloquial French, this mirror image metathesis is as a result of the stress on the final syllable seen /fiks/→[fisk] 'fish'.

Although metathesis has been associated with "performance error, child language or sound change" mostly due to its "sporadic and irregular" nature (Hume 2001 p. 1), evidence in the above languages and instances suggests language-specific phonotactics may play a role in metathesis, as will be discussed in the case of Siwu epenthesis found in the data considered here.

3.6 Conclusion

This chapter has discussed theoretical concepts that are key to data analysis in Chapter Four. Various views of sonority examined in this chapter will be used to account for Siwu's complex onsets. Rice's structural view of sonority and the place dimension particularly is used in analysing permissible and non-permissible clusters in the inventory of Siwu syllable structures.

The organisation of syllable-internal structure in Bosch (2011) and Goldsmith (2011) has been discussed with the goal of determining how the Siwu syllable can be viewed in terms of its constituents and not only in terms of where syllable boundaries are marked. These concepts will be useful in parsing CVVV sequences in Siwu and ascertaining whether such sequences are monosyllabic or multisyllabic. Syllable-internal constituents will be referred to to account for constraints on segment sequencing in the Siwu syllable in several instances in my analysis.

My analysis also shows that the phonological processes that I discuss in this chapter manifest in marginal vocabulary such as loanwords, as well as in native words to eliminate bad codas or simply, to produce structures that conform to Siwu language-specific rules on syllabification. I explore metathesis in Siwu, for example, and conclude that the process is not only a result of error in performance but can be predicted and sometimes serves as a repair strategy.

CHAPTER FOUR – DATA ANALYSIS

4.1 Syllable Inventory, Distribution, and Complex Onsets

4.1.1 Introduction

This chapter will provide a detailed description of the distribution and phonotactics of the Siwu syllable based on data available in the FCBH Global Bible (2008) and consultation with native speakers. In previous literature, a partial account of the syllable structure of Siwu has been provided by Ring, Addae, and Atsu (2002). This chapter will provide a description of syllable types not considered in this previous work. Phonological processes that function to alter syllable structure will be considered, both in loanwords and in native vocabulary. The syllable template of Siwu will be discussed as will the syllabification of segment strings, including the role of tone in determining the syllabification of VV sequences. In addition, this chapter will provide an analysis of phonotactic restrictions within the syllable using the Sonority Sequencing Principle, implemented within the framework of feature geometry.

4.1.2 The Syllable Inventory of Siwu

Seven syllable types have been identified in Siwu as follows; N, V, CV, CVV, CVVV, CCV, and CVC. (23) provides examples illustrating the four most common syllable patterns.

23. N   [ń.dã]   'beverage'
            [ń.dú]   'water'
            [ŋ̀.gbã]   'life'
            [m̀.ma]   'salt'

     V   [ɔ́.bá]   's/he came'
            [í.tì]   'head'
            [à.wã.mí]   'stars'
            [ɔ̀.kà.là]   'mat'

   CV   [bɔ́.dzó]   'bend down'
           [kù.be]   'hill' 'mountain'
           [ɔ́.bí.bì.ni] 'black person'   (Example from consultant)
           [kpɔ́.kpɔ́] 'duck'   (Example from consultant)

CVV	[fiɛ́]	'sweep'
	[bié]	'look for'
	[siá]	'farm' 'cultivate (yam)'
	[ɖuí]	'poke' 'inject'

These four patterns form the basic syllable inventory of Siwu in the sense that they are the most common in the language's vocabulary. Other attested patterns, illustrated in (24), below, are more restricted. While the CVVV pattern is present in native words, its occurrence is very limited. CVC, on the other hand, can only be observed in loanwords and ideophones. CCV is among the syllable types noted by Ring et al. (2002). However, the absence of these forms in orthographic representations raises questions about the underlying status of these sequences. Details of these patterns will be discussed in section 4.3.

24. CVVV [m̀.mùaí] 'answer'
             [síaí] 'follow'
             [búaí] 'help'

CVC	[gbíim̀]	'explosion'	
	[pum.bu.luu]	'round and fat'	
	[tò.lon.tò.lon.tò.lon]	'water drops'	
	[peèn.ti]	'paint'	(Dingemanse 2011 pgs. 134, 137, 165, 203)
	[abonsam]	'satan'	(Example from consultants)

CCV	[sì.grá]	'kingship'
	[sì.wrɛ̃]	'hair'
	[kré.kré]	'only'
	[pléplé]	'completely'

4.1.3 Distribution of Syllable Types

This section will describe the distribution of syllables without consonant clusters. The status and distribution of syllables with branching onsets (CCV syllables) will be considered in section 4.3. Syllabic nasals (N) occur in very limited phonological environments within Siwu forms and they do not form words on their own. They are always a part of a multisyllabic word,

either as a part of the stem, as in examples in (25a), or as the realisation of the plural marker, as can be seen in example (25b) below. Syllabic nasals occur only in word-initial position.

25. (a) [m̀.mó]   'thanks   (example from consultant)
         [ḿ.mɔ́]   'there'
         [ń.nɔí]   'oil'

         SG   PL
    (b) [kɔ̀.rɔ̃⁵]   [ǹ.rɔɔ̀]   'hand'
         [ká.rɔ̃]   [ń.rɔ̃]   'land'
         [ka.trɔɛ̃́]   [ǹ.drɔɛ̃́]   'firewood'

Unlike the syllabic nasal, the V syllable can form a word on its own, as in the adverb of place and time or the third-person possessive personal pronoun. Examples of the adverb of place, /i/, and the third-person possessive, /ɔ̃/, are illustrated in (26) below.

26. ɔ̀-si   **i**   kubé   ísó.
     s/he-sit   PLACE ADV   mountain   on
     S/he is sitting on the mountain.   (Example from consultant)

     íta   **i**   nɔ́mé
     starting   TIME ADV   today
     Starting from today   (Example from consultant)

     ɔ̀biárá   klɛ̀   ɔ̃   áɖé.
     everyone   go   3sg POSS PRO   hometown
     Everyone went to his/her hometown.

The V syllable can also constitute a bound morpheme when attached to roots in polysyllabic forms. Examples of this kind include the third-person subject pronoun, singular and plural markers, and the negation marker. These are all illustrated in (27) below.

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5 The /a/ and /ɔ/ alternations in the singular forms in (25b) are allomorphs of the morph class [ka].

27. [ɔ́.sɛ̀]   ɔ́-sɛ̀   's/he went'
            3sg SUBJ PRO-went
     [ì.ɖe]   i-ɖe   'it is'
            3sg SUBJ PRO-is

     SG   PL
     [í.nɔ́.mi]   í-nɔ́.mi   [á.nɔ́.mi]   á-nɔ́.mi   'eye'
            SG MARKER-eye   PL MARKER-eye
     [ì.yo]   i-yo   [à.yo]   à-yo   'house'
            SG MARKER-house   PL MARKER-house
     Negation
     [ì.í.ɖe]   ì-í-ɖe   'it is not'
            it-NEG MARKER-is

When attached to a polysyllabic form, the V syllable type occurs either in word-initial position as seen in (27) above, or in word-final position, where it functions as a second-person object marker like seen in (28) below.

28. [mà.ɖɔ́ɛ-ɔ̀]   mà-ɖɔ́ɛ-ɔ̀   'they love you'
            they-love-2SG OBJ
     [ló.pɛ́-ɔ́]   ló-pɛ́-ɔ́   'I beat you'   (Example from consultants)
            I-beat-2SG OBJ

Apart from performing grammatical functions, V can also occur as part of a polysyllabic word as one of its syllables. (29) provides examples of V occurring as one of the syllables of a polysyllabic word.

29. [ɔ́.wí]   'time'
     [ɔ̀.wrí]   'air/wind'
     [à.wù]   'dress'
     [à.dzrɔ́ɛ]   'brain/mind'

Typical of the Siwu language group (Kwa), the most common syllable type in Siwu is CV with V being the nucleus of the syllable and bearing tone (Dingemanse 2011). CV is the most prominent syllable type in Siwu and it manifests in both affixes and stems. It also occurs in all positions of the word (word-initial, word-medial, and word-final). Many such examples have already been seen in forms provided to illustrate other syllable types.

The CVV syllable type includes diphthongs and long vowels. This syllable type is the most common after the CV type. As indicated earlier, the previous literature does not mention diphthongs when discussing constraints involving vowel sequences, instead focusing on vowel cooccurrence constraints across morpheme boundaries. The CVV syllable consists of a consonant and two different vowels or a long vowel. Examples of this syllable type show that one of the vowels necessarily bears a mid-tone. The sequence of vowel pairing is observed among vowels of different heights and places. These are some of the possible vowel pairings in diphthongs; high-low, low-high, front-back, back-front, high-high, and low-low. Vowel pairing in Siwu can therefore be classified under three categories – closing, opening, and height-harmonic. Opening and closing diphthongs are the most common. High vowel pairing in the height-harmonic category is also in a vast vocabulary. The least frequent are the mid-vowels which are in a very marginalised vocabulary. Table 1 below demonstrates diphthong categories in Siwu with examples illustrating tonal patterns realised on these diphthongs. Based on the data considered in this study, the initial vowel in height-harmonic diphthongs always bears a mid-tone. Tone patterning in the non-height harmonic diphthongs does not seem to follow a precise pattern although all examples have a mid-tone on either the initial or final vowel of the diphthong.[6]

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[6] Although some types of structures for all examples can be exhaustively searched for in the bible, tone is not searchable because it is not marked in the orthography. Tone markings included here are based on my intuitions as well as those of language consultants.

Close Diphthong	Word	Meaning
/ia/	[sì.tiá]	'insult'
/ua/	[mà.ra.suá.dzé	'students'
Open Diphthong	**Word**	**Meaning**
/ɔi/	[bɔí]	'animal'
/ai/	[kú.ro.dzái]	'birds'
	[áĩ]	'yes'
Height-harmonic	**Word**	**Meaning**
/ui/	[kuí.rá]	'nothing'
/eo/	[weó.và]	'tenth'
/oe/	[ɖoè]	'kill'
/ɔɛ/	[kù.ɖɔɛ́]	'love'
	[mɔɛ̃́]	'catch' 'hold'

Table 1 Diphthong Categories in Siwu

In addition to diphthongs, CVV syllables can contain long vowels as shown in (30). The tone sequence in long vowels does not differ from that of diphthongs. In both cases, there is a two-tone-bearing scenario, the first vowel typically bears a mid-level tone while the second bears a high or low-level tone.

30. [ma.nyií.bí]   'siblings'
    [ɣaà]   'God'
    [gbaã̀]   'extreme'
    [gbɔ̀.gbɔɔ́.gbɔ́]   'until'
    [nrɔɔ̀̃]   'hands'

CVV has no restrictions regarding which position of the word it occurs in. Based on the data gathered in this study, it can be found in all positions of the words. However, it is restricted to stems. No affixes exist in Siwu with the CVV composition.

The last syllable type considered in this section is CVC. Siwu has a strong preference for open syllables except in very few instances such as ideophones or loanwords. In the following examples of ideophones and a loanword, nasals appear to be the only phonemes allowed in the coda position.

31. [gbíìm̀] 'explosion'
    [pum.bu.luu] 'round and fat'
    [tò.lon.tò.lon.tò.lon] 'water drops'
    [peèn.ti] 'paint' (Dingemanse 2011 pgs. 134, 137, 165, 203)

There are a few instances where very little adaptation occurs within a borrowed word, leading other segments to be found in the coda position, but these forms are very marginal. Two examples found are in (32) below.

32. (a) [ɔ́.krís.tò.ni] 'christian' (example from consultant)
    (b) [da.mas.ko.se] 'someone from Damascus'

The word in (32a) above is composed of a stem [kristo] 'christ', a singular marker prefix [ɔ́], and a noun forming suffix [ni], borrowed from Twi. Although this is the only example that my sources provided, I find that it is possible to derive other such forms that maintain an /s/ in the coda, like (32b). Forms like the above are likely to be found in nominal stems.

4.1.4 Underlying and Derived Onset Clusters

The only permitted onset clusters in Siwu syllables consist of a Consonant-Liquid (CL) sequence. Liquids, /r/ and /l/ occupy the second position of onset clusters. All other consonants can occur in C1 position, with the exceptions of the nasal /n/ and the segments [y, ɣ, h]. Table 2 is an outline of all possible onset clusters in Siwu and (33) provides examples illustrating the full range of onset clusters[7]. Note that, while /r/ can occur following all possible C_1 consonants, /l/ is subject to additional restrictions. /l/ does not occur in clusters following /d, dz, t, ts, ny/.

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[7] These data are compiled from multiple sources; the Siwu bible (SB), consultants (Cs), and others from existing works. The forms at the extreme left are the orthographic representations and those in square brackets are the phonetic representations. There is a noticeable difference between written and audio forms in terms of clusters. Based on the fact that the main source of this study, the bible, does not indicate clusters in orthographic representations, I have decided not to show clusters in the orthography of the examples provided to me during elicitation. Examples from my respondents were transcribed with a collaborative effort between them and me based on our native speaker intuitions and written forms from the bible.

C1 \\ C2	l	r
b	+	+
d	-	+
dz	-	+
f	+	+
g	+	+
gb	+	+
h	-	-
k	+	+
kp	+	+
m	+	+
n	-	-
ny	-	+
p	+	+
s	+	+
t	-	+
ts	-	+
v	+	+
w	+	+
y	-	-
ɣ	-	-

Table 2 Possible Onset Clusters in Siwu

		Orthography	*PT*	*Meaning*	*Source*
33.	[b]	bɔrɛ	[brɔɛ́]	'get out'	SB
		bala	[blà]	'smear on something'	Cs
	[d]	ndɔrɛ̃	[ǹ.drɔɛ̃́]	'firewood'	Cs
	[dz]	kudziri	[kù.dzri]	'tree'	Cs
	[f]	afalaga	[á.flá.gá]	'flag'	Cs
		firiki	[fri.kí]	'turn' 'change'	SB
	[g]	gliglia	[glì.glìa]	'round'	Dingemanse (2011 p. 81)
		garagaragara	[gràgràgrà]	'irregular' 'rough'	Cs
	[gb]	igbarã	[í.gbrã́]	'sugarcane'	Cs
		igbolobi	[ì.gblò.bi]	'small gutter'	Cs
	[k]	kɛlɛ	[klè]	'go'	SB
		kɔrɔ̃kɔrɔ̃	[krɔ̃́.krɔ̃́]	'smell pleasantly'	Dingemanse (2011 p. 407)
	[kp]	kpere	[kprè]	'call'	SB
		ikpalamo	[ì.kplà.mò]	'lizard'	Cs
	[m]	mala	[mlá]	'gather' 'pick up'	Cs
		mɛ̃rɛ̃mɛ̃rɛ̃	[mrɛ̃́.mrɛ̃́]	'sweet'	Dingemanse (2011 p. 154)
	[ny]	nyɛrɛ̃	[ɲrɛ̃́]	'chop' 'sneeze'	Cs

[p]	pɔlɔpɔlɔ	[plɔ́.plɔ́]	'smooth'	Dingemanse (2011 p. 135)
	ɔpɔrɔ̃	[ɔ̀.prɔ̃́]	'table' 'door'	SB
[s]	sore	[sroè]	'carry on your head'	Cs
	sɔla	[slɔá]	'smear on your body'	SB
[t]	tɔrɛ	[trɔɛ́]	'pluck'	Cs
[ts]	tsiri	[tsrì]	'hate'	Cs
[v]	vɛlɛvɛlɛ	[vɛ̀lɛ̀vɛ̀lɛ̀] [vlɛ̀.vlɛ̀]	'dizzy'	Dingemanse (2011 p. 135)
	avurã	[avrã̀] [avruã̀]	'rice chaff'	Cs
[w]	siwã̀rã	[sì.wrã̃́]	'breath' 'spirit'	SB
	iwolewole	[ì.wloé.wloé]	'self-conceit'	Cs

/v/ and /h/ are relatively rare in Siwu generally and Dingemanse (2011) proposes that these phonemes are present only in loan words and ideophones. The former occurs in a CCV sequence in the ideophone [vlɛ̀.vlɛ̀], 'dizzy', while the latter has not been found to possess the ability to pair with liquids to form complex onsets.

An examination of the examples from the Siwu Bible provided above shows a difference between the orthographic forms and the phonetic realisation of these forms. One possible explanation for this discrepancy is that the complex onsets found in the phonetic forms result from processes of vowel elision. In orthographic CVCV sequences where the two Vs are the same vowel, there appears to be deletion of the first vowel. From observing the orthography, this looks like a vowel deletion process within the CVCV sequence that renders this syllable type CCV on the surface. This could be accounted for under the hypothesis that segmental features play a role in what consonants are allowed to co-occur in CC clusters and what vowels can be deleted in these environments.

In order to test this hypothesis, I examined the Siwu bible and performed an exhaustive search for orthographic CVCV forms with segment sequences like those above. This search was intended to determine if forms like this occur with both vowels pronounced and, therefore, without a CC onset cluster. As exemplified in (34) below, similar forms pronounced without any CC cluster are indeed attested. This rules out the possibility of a systematic deletion rule. The same

orthographic consonant and vowel sequences can be pronounced as either a CVCV or a CCV in different lexical items. There are minimal pairs and near minimal pairs showing that the difference between a CCV sequence and a CVCV sequence is underlying and lexically distinctive. The data below illustrate this assertion.

	Orthography	PT	Meaning
34.	ɔkala	[ɔ́.klá]	'soul'
	ɔkala	[ɔ̀.kà.là]	'mat'
	ikulu	[ì.klu]	'traditional day of the week' (example from consultant)
	kulu	[kú.lú]	'conflict'
	ɔkolo	[ɔ̀.klɔ́]	'boat'
	ɔporo	[ɔ́.pó.ró]	'squirrel' (example from consultant)
	ɔpɔrɔ	[ɔ̀.prɔ́]	'table'
	kɔrɔ̃	[kɔ̀.rɔ́]	'hand'
	kudziri	[kù.dzrí]	'tree'
	siri	[sì.ri]	'paths'
	kerekere	[kré.kré]	'only'
	imele	[ì.mé.lé]	'which one'
	kɛlɛ	[klɛ̀]	'go'
	sɛrɛ	[sɛ́.rɛ̀]	'goat/sheep'

Based on these data, the discrepancies between orthographic and pronounced consonant clusters appear to be related to the rules of orthography, rather than to a phonological process of vowel deletion. Documentation of Siwu has progressed rapidly in recent years. Existing literature shows a lack of consistency in various aspects of documentation, especially writing. Both Ford and Iddah (1973) and Dingemanse (2011), for example, document underlying clusters in orthographic representations of ideophones.

	Orthography	PT	Meaning
35.	kprakpra	[kprà.kprà]	'heavy speed (running)'
	tɛbrɛɛ	[tɛ.brɛɛ]	'near'
	tɛglɛɛ	[tɛ.glɛɛ]	'shallow'
	seklee	[se.klee]	'clean' Ford and Iddah (1973 pgs 74 and 79)
	tsratsratsra	[tsra.tsra.tsra]	'fast and light walk'
	dzradzradzra	[dzrà.dzrà.dzrà]	'fast and heavy walk' Dingemanse (2011 p. 172)

FCBH Global Bible (2008), however, does not include any orthographic clusters in its written files, although audio files clearly contain pronounced clusters. A cursory comparison of these written and audio files suggests a possible deletion of vowels to create clusters but further analysis shows that rules of orthography require that the liquids /l/ and /r/ must always be surrounded by vowels.

Although it has been established that clusters can be found in underlying representations in Siwu, other cases of discrepancies between orthographic forms without clusters and pronounced realisations with clusters do appear to be the result of a phonological process. A metathesis process that results in complex onsets can be observed as shown in example (36) below.

	Orthography	*PT*	*Meaning*
36.	maturi	[mà.truí]	'people'
	sore	[sroé]	'carry on your head'
	bɔrɛ	[brɔɛ́]	'get out'
	ibɔra	[ì.brɔá]	'metal'

The examples of metathesis provided above occur only with specific vowel combinations suggesting that metathesis in Siwu is far from being sporadic and irregular since it can be phonologically predicted. This is contrary to the popular assumption that metathesis results from performance error or is limited to patterns in child language. An analysis of metathesis patterning shows that in any given CVCV environment where we have the following sequence; C = any consonant eligible to occur in C1 position of a cluster (that is any consonant except /n, l, r, y, ɣ, h/), V = back vowel, C = /l, r/ and V = front vowel, the back vowel (V1) undergoes metathesis with the l/r (C2). Example (37) illustrates this.

	Orthography	PT	Meaning	
37. u-i –	maturi	[mà.truí]	'people'	
	ikuri	[í.kruì]	'group'	
	iturikuri	[í.truí.kruí]	'a group of people'	
o-e –	fore	[froé]	'wash'	
	sore	[sroé]	'carry on the head'	(example from consultant)
	kole	[kloé]	'carry on the back'	(example from consultant)
ɔ-ɛ –	tɔrɛ	[trɔɛ́]	'pluck'	
	kɔrɛ	[krɔɛ́]	'cough'	
	kukɔlɛ	[kù.klɔɛ́]	'height'	

The data further indicates that these vowel combinations are subject to a restriction that they must agree in both height and [ATR]. CVCV sequences with the same consonant sequences do not become CCVV in cases where the vowels disagree in these properties. Examples in (38) below illustrate such sequences.

	Orthography	PT	Meaning	
38. u-ɛ –	kulɛ	[kù.lɛ]	'beauty'	
	kurɛ	[kù.rɛ]	'dream'	
ɔ-e –	asɔre	[à.sɔ́.re]	'church'	(example from consultant)

Perceptual and articulatory ease have been argued to influence metathesis. Based on earlier claims that word recognition and salience are usually associated with the initial part of the word and evidence of metathesis mostly occurring at the left edge of the word, Hume (2001) also proposes that perception can be a reason for metathesis. In the case of Siwu, articulatory ease could be a major contributing factor to metathesis in line with Hume's (2001 pg. 10) assertion that "articulatory considerations may also influence patterns of metathesis". Speakers may tend to form diphthongs with sequences of vowels that share the same height.

The data in (38) also suggest that there is a restriction on the [ATR] value of vowels which become adjacent as a result of metathesis. The Siwu language seems to be the only exception in its language group (GTM languages) that does not exhibit [ATR] harmony. However, agreement in [ATR] and height is central to metathesis. When vowels in a CVCV sequence agree in [ATR]

and height, there is metathesis which produces the outcome of an onset cluster and a height-harmonic diphthong sequence (CCVV). This process is allowed in any part of the word (word-initial, medial, or final), contrary to Hume's claim that metathesis is peculiar to the left edge of the word, a key reason why perception is argued to have a role in motivating metathesis. I argue that articulatory ease influences metathesis in Siwu for two reasons. First, metathesis is predictable with vowels that have the same articulatory features (height and ATR). Secondly, metathesis can be observed in any part of the word, hence word recognition and salience do not appear to be a key factor in metathesis in Siwu.

The final point I will make on metathesis is that if it is part of the phonology of Siwu to ensure that certain sequences such as CV[+back, αATR, ßhigh]l/rV[-back,αATR, ßhigh] are not permissible, then a process like metathesis is required for such sequences to be repaired. Unlike the case of the CCV clusters, a search of the Siwu bible did not result in any forms that contain any such sequence in the orthography without metathesis occurring in the pronounced form. This suggests that metathesis in Siwu is a regular phonological process responsible for resolving ill-formed segment sequences.

4.2 Phonotactic Restrictions on Syllable Constituents

4.2.1 The Rhyme

The two-part syllable theory is appropriate in describing the Siwu syllable, in part, because Siwu has a preference for open syllables. The main constituents of the Siwu syllable are the onset and rhyme. Because Siwu syllables are usually open, the rhyme is typically not branching. In other words, there is no co-occurrence of the nucleus with any segment within the rhyme. A typical Siwu syllable will, therefore, have two components limited to either a simple or complex onset and a

rhyme that has only the nucleus with no branching node to form a constituent with a coda. This can be represented using the structure in diagram (39a) adapted from Goldsmith (2011) below.

39. (a)

```
              Syllable
             /        \
        Onset          Rhyme
                      /     \
                 Nucleus    Coda
```

(b)[8]

```
              Syllable
             /        \
        Onset          Rhyme
                      /     \
                 Nucleus   (Coda)
```
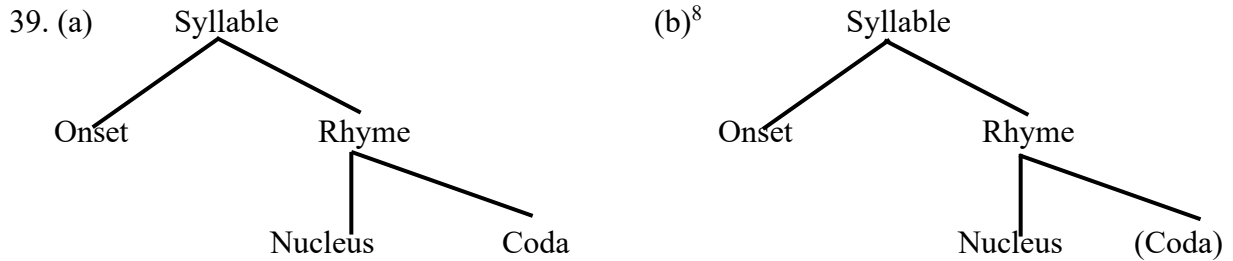
Goldsmith (2011 p. 170)

In more restricted vocabulary, such as ideophones and loanwords, where codas can be observed, the rhyme is a branching constituent formed from the nucleus and the coda. The following diagram provides syllable structures for the word [*ɔ́.krís.tò.ni*], showing V, CCVC, and CV patterns, using the two-part model of the syllable.

40.
```
      Syllable                 Syllable                  Syllable                 Syllable
     /       \                /        \                /        \               /        \
  Onset     Rhyme         Onset       Rhyme         Onset       Rhyme        Onset       Rhyme
           /     \        / |         /    \              |    /    \             |      /    \
      Nucleus  Coda      /  Nucleus  Coda        Nucleus  Coda       Nucleus  Coda
        |      |        |  |  |       |              |    |    |          |     |    |
   C    V     C        C  C  V       C          C    V    C          C    V    C
        ɔ́               k  r  í       s          t    ò               n    i
```
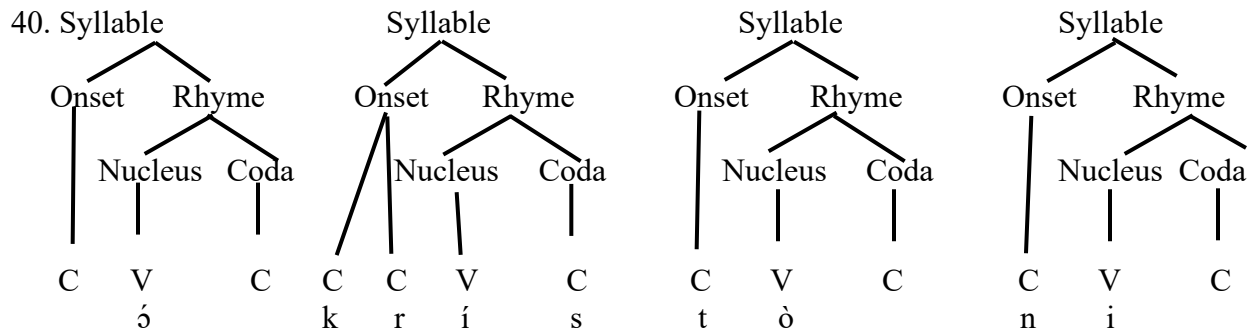
According to the syllable typology outlined in Zec (2007), and in view of both native words and marginalised vocabulary (loanwords and ideophones), the Siwu syllable template can be viewed as a system that allows complex onsets with optional codas. This means that a non-branching rhyme (nucleus) is the key constituent in the Siwu syllable. The existing implicational relationship between complex and simple onsets that is referenced in cross-linguistic syllable typologies can be observed in the data I have presented so far.

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[8] This is a typical Siwu syllable. The coda is in brackets because it is an optional component.

The discussion of the Siwu syllable inventory and constituency is consistent with Pulgram's principles of syllabification which also serve as a guide to phonotactics. The tenets are key to determining the domain within which other rules can be applied. Pulgram's principles provide a model which accounts for Siwu language-specific rules, the syllable inventory of the language, and restrictions affecting Siwu syllable structure. For example, Siwu's restriction on s+stop clusters refers to two of Pulgram's principles, the maximal onset principle and the principle of maximal open syllabicity. In a form like [*ɔ́krístòni*], because [st] is not a permissible syllable onset, the boundary consistent with maximal onsets shifts to the right to make [s] the coda. The preference for maximal open syllabicity prevents the syllable boundary from shifting further to include [t] and therefore makes [t] an onset, giving us the proposed V.CCVC.CV.CV syllabification.

It is important to note that identifying the syllable nucleus establishes the starting point for syllable boundaries, which eventually results in identifying other constituents within a bigger constituent – the syllable. While vowels are generally assumed to occupy the nucleus, languages like Siwu rely on other cues such as tone to determine what segments are in the peak of the syllable since other segments like nasals are also permitted in the nucleus. The role of tone in syllable parsing is discussed in the following section.

4.2.2 Syllable Parsing, Tone, and the Status of VVV Sequences

In the data presented so far, every Siwu syllable bears one of the three-level tones. The tone patterning in vowel sequences can provide evidence with respect to whether a CVV sequence is a simple onset and a diphthong or a CV syllable followed by a V syllable. Based on my observations, both from data in the Siwu bible as well as responses during elicitation, although diphthongs and

long vowels can bear two tones, one element of the CVV syllable necessarily bears a mid-level tone, and the other element, a high or low tone, as shown in (41) below.

41. [ńsɛ́gbaí]   'character'
    [kíniɔ̀]   'right now'
    [nyuá]   'let go'
    [kàloì]   'a wake' (example from consultant)

The presence of a mid-tone gives the syllable peak a rising or falling tonality. Apart from very few exceptions, the first vowel typically carries the mid-tone in diphthongs. This differs from heterosyllabic V.V sequences where both vowels can bear high, low, or mid-tone, as in example (42) below.

42. (a)   [ló.pɛ́-ɔ́]   'I beat you'
    (b)   [ì.í.ɖe]   'it is not'

The use of tone within a sequence can provide evidence regarding whether that sequence is monosyllabic or multisyllabic. A very marginal inventory of CVVV sequences which mainly consist of /uai/ or /iai/ has been identified in Siwu. The tone sequence on these vowels consists of a high or low tone followed by a mid-tone, which is in turn, followed by a high or low tone. In other words, the second vowel in the sequence is always realised with a mid-tone whereas the initial and final vowels are never realised with a mid-tone. A question that arises is whether these sequences are, (a) a combination of onset and a rhyme consisting of three vowels in its nucleus (CVVV), (b) two different syllables consisting of onset and a rhyme with two vowels in its nucleus followed by a V syllable (CVV.V), or (c) two syllables with the first consisting of onset and a vowel and the second containing only a diphthong (CV.VV).

As discussed earlier, for any two vowel slots in a diphthong, one must bear a mid-tone. This requirement, therefore, presents us with two possible structures for the CVVV sequence – CVV.V or CV.VV. I will argue that CVV.V is the more plausible pattern because, although CVV

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syllables are found, no monomorphemic VV syllables have been identified in Siwu. In cases where such sequences are observed, analysis suggests that each vowel is performing a grammatical function, making the word polymorphemic. (43) below are examples of VV patterns that show that each vowel is performing a grammatical function and that the vowel sequence can be parsed as a V.V.

43. (a) [ì.í.ɖe]   ì-í-ɖe   'it is not'
                      it-NEG MARKER-is
    (b) [ɔ̀.à.ɖí.ɔ̀] ɔ̀-à-ɖí-ɔ̀   's/he will save/remove you'
                      3sg SUBJ PRO-FUT MARKER-save/remove-2SG OBJ
    (c) [à.í.ba.sú] à-í-ba-sú   'you will not take/use'
                      2sg SUBJ PRO-NEG MARKER-come-take/use

In (43a) above, the first V is the pronoun and the second V is the negation morpheme. The [i-ɔ] sequence in (43b) is not a diphthong but rather a CV.V sequence where the second V functions as a second-person object pronoun. The first V in (43b) is a third-person subject pronoun while the second V is marking future tense. The first V in the last example (43c) functions as a second-person subject pronoun and the following V is marking negation.

Another reason why CVV.V is the preferred structure is that all data examined so far show that syllables with diphthongs have onset consonants. Therefore a syllable type VV without an onset consonant will be a deviation from the syllable inventory of Siwu. Below is a diagram of the word [m̀.mùaí] showing the N pattern and a CVV.V sequence, using the two-part syllable theory.
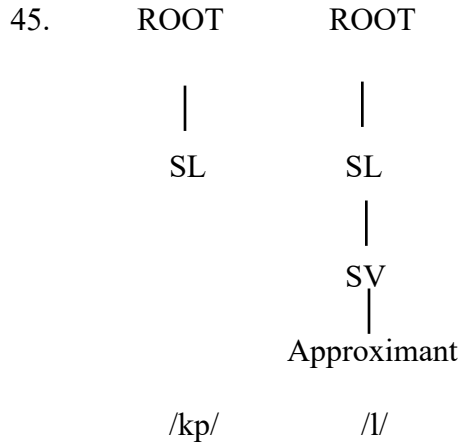
44.

Despite the evidence in support of a CVV.V parsing, there is also an argument for parsing these sequences as CV.VV based on observed tone patterning in diphthongs. We have seen that in diphthongs, one of the vowels has to bear a mid-level tone, typically the first V. In examples (24) ([m̀.mùaí] 'answer' and [síaí] 'follow', [buaí] 'help'), we see that the CVVV forms have V_2 bearing a mid-tone. This leaves a possibility of CV.VV. Nonetheless, there are diphthongs where the second V bears the mid tone, as in the form [áĩ], 'yes'. If all factors are considered, grammatical function, syllable type, and tone, the evidence remains ambiguous with respect to the possibility that CVVV sequences can either be parsed as CVV.V or CV.VV

4.2.3 Sonority Constraints

This section will consider the composition of Siwu onset clusters in light of the Sonority Sequencing Principle (SSP) (Clements 1990), which proposes that syllables must have rising sonority in the onset of a syllable and falling sonority in the coda. A model of sonority which incorporates the structural representation of sonority proposed in Rice (1992) will be used to account for the set of permissible onset clusters in Siwu.
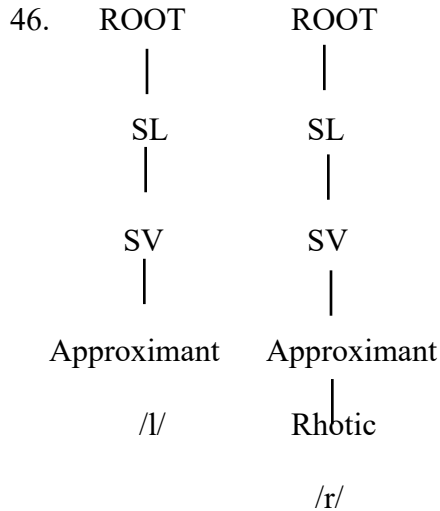
The Siwu syllable does not deviate from SSP. Data shows that a well-formed CCVC sequence in native words, or even loanwords, in Siwu, has a perfect rising sonority profile, with obstruents followed by liquids in the onset, a sonority peak in the vowel, and falling sonority to nasals, in those rare cases where a coda consonant is present. The ability of obstruent consonants in Siwu to form clusters with liquids /l, r/ is consistent with Rice's (1992) structural view of sonority. All obstruent C1s in Siwu clusters have less SV structure, according to Rice's representations, than the liquids permitted in C2 position. A feature geometric representation of a Siwu cluster for the sequences [kpl] will therefore look like (45) below.

45.   ROOT   ROOT

         | |

         SL   SL

                       |

                       SV

                       |

                  Approximant

     /kp/   /l/

Although liquids are generally permitted in the second position in cases of complex onsets, the trill /r/ has a higher ability to form clusters with every eligible obstruent than the lateral approximant /l/. This also implies that any segment that is unable to pair with /r/ in complex onsets also cannot pair with /l/ as can be seen in the Table 2. For example, /r/ can pair with /ts, dz, ny/ to form syllables like [tsrɛ́] 'write', [kù.dzri] 'tree', [nyrɛ̃́] 'chop'. There are, however, no known onsets such as [*tsl, *dzl, *nyl].

As employed so far, the structural view does not account for the difference between segments in the same natural class, /l/ and /r/. Some additional mechanisms are needed to explain what is responsible for the further restrictions on /l/'s ability to occur as the C2 in clusters, relative to /r/. One possibility is that these two segments differ in sonority and the segment that is highest on the sonority scale within any category is preferred in C2 position of onset clusters. Following Rice's structural approach, it implies that one has more SV structure than the other. The conclusion can therefore be drawn that /l/ is more restricted in Siwu clusters than /r/ because it is lower on the sonority scale within the liquids category, making /r/ more preferred. A feature geometry/structural view of /l/ and /r/ in Siwu could be represented as in (46) below using Rice's structural framework where /r/ has more SV structure than /l/.

64

46.   ROOT   ROOT
        | |
        SL   SL
        | |
        SV   SV
        | |
   Approximant   Approximant
                       |
       /l/   Rhotic
                       |
   /r/

While Rice's structural view of sonority is congruent with Siwu complex onsets, the patterning of Siwu syllables suggests that the place dimension, in addition to sonority, plays a role in constraining consonant sequences. Sonority differences between /l/ and /r/ were proposed above to account for differences in their ability to combine with obstruents in C1 position. Given crosslinguistic restrictions on sequences of segments with identical place features, however, restrictions on coronal-coronal sequences may account for the absence of /*dl, *dzl, *tl, *tsl/. The well-formedness of other coronal-coronal onset sequences, such as /dr, dzr, tr, tsr/, however, raises questions about restrictions on homorganic sequences.

Either of two hypotheses can be drawn; a) the place dimension theory (Rice 1992), requiring that two onset segments must not have an identical place structure, does not apply to some languages and Siwu is one of them. Hence clusters involving segments with the same place of articulation are permitted. Or b), /r/, within the liquids category, may be lacking the coronal feature, accounting for its ability to pair with other coronal segments. If (a) is true, clusters with identical place features such as /*tl/ and /tr/ should be expected. If the absence of /*tl/ followed from /l/ being less sonorous than /r/, we would also expect an asymmetry between /l/ and /r/ clustering with other consonants. However, /sl/ and /sr/ are both good onset clusters, as are /ml/
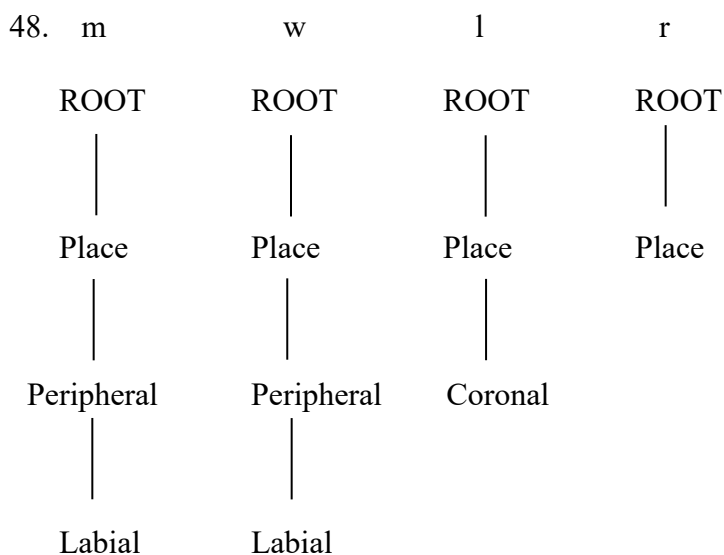
and /mr/. The ill-formedness of /*tl/, in conjunction with the well-formedness of /sl/ and /ml/ provides evidence against the first proposal.

The second supposition, on the other hand, seems more logical but it also does not account for the permissibility of /sl/ if (a) is false. I can, however, look at /sl/ and /*tl/ within the place dimension analysis and argue that /s/ has less place structure than /t/. Specifically, /s/ lacks a [coronal] feature, consistent with the proposal that coronal is the unmarked place of articulation and can be absent from underlying representations (e.g. Paradis & Prunet 1991; Rice & Avery 1989). This accounts for the contrast between /sl/ and /*tl/ only if coronal is not universally unspecified but only absent in the strident, /s/. This is a justifiable proposal, given that Siwu contains stops with multiple places of articulation but only a single strident fricative. In a perspective that requires contrasts to be underlyingly specified but allows for default interpretation of unspecified features in the absence of contrast (e.g. Dresher, Piggott & Rice 1994; Rice & Avery 1989), the coronal place of articulation can be understood as a default realisation of a [+strident] segment whereas the stops must contain a [coronal] feature to differentiate them from their labial and dorsal counterparts. Proposed representations are provided in (47) below.

47.

s	t	l
ROOT	ROOT	ROOT

[strident]   Place   Place   Place

Coronal   Coronal
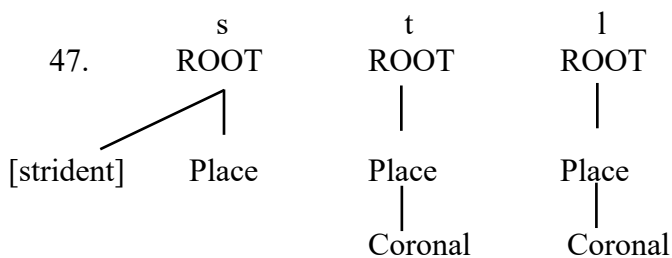
Additional clusters in Siwu include /mr, ml, wr, wl/. The unmarked minimum sonority distance (MSD) (e.g. Steriade 1982; Harris 1983; Selkirk 1984; Clements 1990) is the most plausible theory to account for the absence of Nasal-Liquid clusters such as [*nl, *nr]. However, [mr, ml] are allowed in the language. [wr, wl] are also unexpected due to C1's phonetic status of

being a semi-vowel which translates to its supposed high sonority status. One would therefore predict that even if /w/ occurs in a cluster, its position would be C2 since the cluster would "fit the sonority profile of an onset… (and) the second consonant of the sequence has more sonorant structure than the first" (Rice 1992 pg. 76). [wr, wl] deviate from the structural sonority argument and [mr, ml] further from the MSD. One commonality that these permissible clusters share is that their C1s have a Labial feature. The presence of this Place feature is a cue that the place dimension argument could account for these clusters. (48) below is a feature geometry showing that /m, w/ are further specified with [Labial] and have more place structure than /l, r/ which explains why these clusters are permissible over other segments in the same natural class like /n/ or /y/. Consistent with Rice's model of feature geometry (presented in Fig. 5 in Chapter 3), I show representations for [m, w] in (48). These segments have both a Peripheral node under the Place node and a Labial feature under Peripheral (Rice 1992 pg. 62). The unmarked coronal feature, on the other hand, is absent from the underlying representation of /r/, and /l/ has Coronal directly below Place, as shown in representations for provided for [l, r].

48.   m   w   l   r

ROOT   ROOT   ROOT   ROOT
| | | |
Place   Place   Place   Place
| | |
Peripheral   Peripheral   Coronal
| |
Labial   Labial

A few other segments in Siwu do not occur in complex onset sequences with either of the liquids. The segments [h, y, ɣ] do not occur in any clusters in Siwu. Of these segments, [h] is highly marginal, occurring only in loanwords. With regards to the inability of, /ɣ/, sometimes described as a glottal approximant, to form clusters with the liquids, I propose this relates to its status as a laryngeal segment. Laryngeal is one of the organising nodes in Rice's feature geometry. However, unlike the other organising nodes that are in a "dependency relationship… defined based on assimilation facts…, the Laryngeal node does not appear to enter into this system" (pg. 62). By extension, laryngeal segments have no dependent features under the Supralaryngeal or Sonorant Voice nodes. This may also account for their inability to cluster with other segments that contain dependant features of the Supralaryngeal, Place, or Sonorant Voice nodes. In effect, I conclude that /ɣ/ has no SL or SV nodes and this prevents it from being in a syllabification relationship with /l, r/.

Another point of view concerns the proposal that [ɣ] and [y] are in complementary distribution. An allophone is defined as "a speech segment with a distinct acoustic realization that can be context dependent and position specific, but not necessarily so" (Mitterer, Reinisch & McQueen 2018 pg. 78). By this definition and Dingemanse's analysis, discussed in Section 2.2, [ɣ] and [y] are allophones having a common phoneme, "a context-independent and position-nonspecific representation of a speech segment" (pg. 78). This also suggests that they share similar underlying features hence, one's inability to occur in clusters is an indication that the other would not form clusters as well. A glide, such as /y/, is typically highly sonorous and is not expected to pattern as C1 in an onset cluster. The potential allophonic relation between [y] and [ɣ] may therefore account for the absence of [ɣ] in clusters.

Based on the inventory of attested onset clusters, the Siwu sonority scale can best be described as V(owels) > (/y, ɣ/) > /r/ > /l/ > N(asals) > /w/ > O(obstruents). Though the actual phonetic status of /ɣ/ is unknown, I deem it fit to rank its sonority status with /y/ due to the suggested complementary relationship that they share. /w/ in Siwu fails to exhibit features similar to semi-vowels because of its ability to be syllabified in C1 position of onset clusters. I therefore somewhat unexpectedly rank the sonority of /w/ closer to that of obstruents. Due to the different manifestations exhibited by /y/ and /w/ in Siwu syllabification, I do not treat them as a natural class in this study and this is reflected in their ranking on the proposed Siwu sonority scale. I position /y/ close to vowels while I put /w/ close to obstruents.

4.3 The Syllable in Marginal Vocabulary

4.3.1 Loanwords

Several factors have led to the incorporation of loanwords into Siwu. Such factors include contact with neighbouring languages through various engagements like trading, education, social media, etc. Though minimal, the official language of Ghana (English) also has an influence on Siwu. All these factors, in addition to coined vocabulary in an attempt to describe emerging phenomena, have contributed to exceptional vocabulary in Siwu. Most of these borrowed words are made to conform to the language's phonotactics. The most notable features of these loanwords are their syllable structures and tone patterning. The data in examples (49) and (50) below shows multiple cases of epenthesis and elision, together with tone patterns, as English words undergo the borrowing process into Siwu.

49. Epenthesis

		English transcription	
(a) [tsɔ́.tsì]	[tʃɜːtʃ]	'church'
(b) [tí.kè.tì]	[ˈtɪk.ɪt]	'ticket'
(c) [kɔ́.tò]	[kɔːt]	'court'
(d) [bó.kì.tì] [bó.gì.dì]	[ˈbʌk.ɪt]	'bucket'
(e) [pò.lí.sì] [pó.lí.sì]	[pəˈliːs]	'police'
(f) [bɔ́.lù]	[bɔːl]	'ball'

50. Elision

(a) [sù.kú]	[skuːl]	'school'
(b) [pé.trò]	[ˈpet.rᵊl]	'petrol'
(c) [krò.pɔ́.tì] [kró.pɔ̀.tì]	[kəʊl pɒt]	'coal pot'	(data from consultants)

Most of the borrowed words in the examples above are single syllables so they do not give strong evidence for tone adaptation but even such loanwords give prominence to the first syllable by assigning it the high tone and relegating the low-level tone to the epenthetic syllable. The forms for 'ticket', 'bucket', and 'police', however, demonstrate the ideal case of tone adaptation since high-level tone appears to be on syllables that bear primary stress in the donor language while the low tone is seen on syllables with relatively low prominence in English. The tone contrast on the forms for 'police' reflects differences in speakers but the second syllable which bears the stress in English, is still adapted with a high tone irrespective of the speaker.

It has been established that Siwu has a strong preference for open syllables, with the occurrence of codas limited to exceptional vocabulary such as loanwords and ideophones. We have seen from the examples that the most preferred segments in these codas are nasals. Example (32) has also been used to claim that other segments can be allowed in the coda. Data in examples (49) and (50) above, however, demonstrates several cases where codas present in the donor language are either completely dropped or resyllabified through vowel epenthesis in the course of the borrowing process.

An analysis of the data suggests that vowel epenthesis occurs after every coda that is not nasal as in (49) and (50) above. Codas with nasals are unaffected regardless of their position in the word like in (51) below.

51. [peèn.tì]   'paint'
    [fîm]   'film'
    [bam]   'balm'
    [vó.liòm]   'volume'

The data also suggests that /s/ can be allowed in the coda position only if the CVC syllable is not in the word-final position as seen in example (32) in the words [ɔ́.krís.tò.ni] and [da.mas.ko.se]. Otherwise, it is either elided completely like in [sí.dì] 'cedis' (the official currency of Ghana) or a vowel is added as in [pò.lí.sì] 'police'. Epenthesis is also seen in [sùkú] 'school' due to the onset cluster sequence /s+stop/, which does not exist in Siwu.

While it can be predicted that any non-nasal segment in the coda position of a word-internal syllable will be elided, the data does not provide a clear phonological prediction as to what specific vowel will be inserted in cases of epenthesis. Of the vowels in the Siwu inventory, only three vowels /i/, /o/, /u/ are observed in cases of epenthesis in loanwords.

These data also show that in situations where an epenthetic vowel cannot come after /l/ as a segment in the coda position, it is completely elided. This is seen in [kro.pɔ.ti], [su.ku], [pɛ.tro] in example (50) above. The metathesis and substitution we observe where /l/ becomes /r/ could also be an indication that the language holds an uncompromising position on what segments it allows in its coda and fricatives may possess this advantage over liquids. In other words, apart from fricatives that are allowed in the coda if the syllable is not word final, the only segments that can occupy the coda position in any word-final syllable must be nasal.

English is not the only language from which Siwu borrows. Loanwords from Twi and Eʋe are common in Siwu. A noticeable characteristic of Eʋe and Twi is that there is an equal preference

for CV syllables which has resulted in very little or no adaptation to the loanwords from these languages. Unlike loanwords from English, which must often go through epenthesis or elision due to the presence of codas, these words are kept intact because they already conform to the syllable structure of Siwu. In the following data, we see examples of borrowed words from Eʋe and Twi that do not change their original forms.

Loan word	Eʋe	Twi	Meaning
[kɔ́.dzí]	[kɔ́.dzí]		'hospital'
[bà.ɣɛ́.rɛ́]		[bà.ɣɛ́.rɛ́]	'yam'
[gà.tsí]	[gà.tsí]		'spoon'
[tá.pó.lí] (Siwui)	[tá.pó.lí]		'wooden masher'
[à.sɔ́.re]		[à.sɔ́.re]	'church'
[gà.ké]	[gà.ké]		'but'
[á.me.ɖi.ƒé]⁹	[á.me.ɖi.ƒé]		'cemetery'
[sé.ƒo.ƒo] (Siwui)	[sé.ƒo.ƒo]		'flower'
[sì.kã̀]		[sì.ká]	'money'

Table 3 Loanwords in Siwu (Data from consultants)

Based on evidence up to this point, two major conclusions can be drawn regarding loan words in Siwu. The first regards tonal adaptation. Glewwe (2021 p. 204) views the concept of tone adaptation as a stress-to-tone principle that "occurs when acoustic correlates of stress in the source language are perceptually similar enough to the lexical tones of the borrowing language for stress to be adapted as tone." As a lexical tone language whose syllables manifest tone, Siwu loan words mostly adapt tone patterning from their superstrates. Syllable tone patterns of loanwords in Siwu from a stressed language like English are realised similarly to the stress pattern of the English words with a high-level tone corresponding to the primary stress or highest prominence and a low-level tone of relatively low prominence. For example, the word 'ticket' has the following stress pattern; [ˈtɪ.kɪt]. The high tone on the first syllable in [tí.kè.tì], indicates the highest prominence

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⁹ [ƒ] is the voiceless bilabial fricative /ɸ/. It is in the phonemic inventory of Ewe.

and the other two syllables bear low tones, corresponding to relatively low prominence or secondary stress. Similarly as cited in Glewwe, Chen (2000) and Hao (2009) find that among loan words in Cantonese, syllables that are originally stressed in English are assigned high tones while pretonic unstressed ones bear mid-tones and posttonic unstressed syllables carry low tones.

The second conclusion is that loanwords are compelled to conform to the syllable structure of Siwu. Cross-linguistically, it has been observed among loan words that the structure and phonotactics of recipient languages are prioritised over those of donor languages (Kenstowicz 2006; Mwaliwa 2014; Ghorbanpour et al. 2019). In Yuroba for example, loan words must conform to the CV structure and be assigned tone. In Persian, an epenthetic vowel is necessary in loan words that have onset clusters because complex onsets are not allowed in the syllable structure of Persian. Similarly, in the case of Siwu, the borrowing process is subject to the syllable structure of Siwu hence the manifestation of phonological processes such as epenthesis and elision to shape loan words into the desired syllable structure of the language.

CHAPTER FIVE - CONCLUSION

5.1 Introduction

The objective of this study has been to describe the phonology of the Siwu syllable as a whole, beyond what has been provided in the existing literature. This objective was guided by research goals that included providing a description of the syllable inventory, the composition of syllable-internal structure, and an analysis of the phonotactic rules that guide the well-formedness of complex onsets. This chapter is a summary and presentation of key findings and their theoretical implications. I will also highlight some limitations of the study and directions for future research.

5.2 Summary of Key Findings

My comparative study of the GTM languages demonstrated that languages in this group have more similarities than differences in their syllable structure. Features such as preference for open syllables, presence of the syllabic nasal (N syllable type) in their syllable inventories, complex onsets that are composed of only two consonants, are key similarities identified among GTM languages. The similarities that these languages share in their syllable structure, together with other similarities in other aspects of language attested to in other studies, however, do not denote that GTM languages are a genetic grouping and this study does not aim to prove that. Other studies have indicated that despite their similarities, they are vastly different in other language structures and this could be one of the reasons they are not mutually intelligible in spite of the proximity they bear to each other.

Findings based on this study's investigation of data in the FCBH Global Bible (2008) include identification of two potential syllable types not discussed in previous literature (e.g. Ring et al.); CVVV and CVC. In my data analysis in Chapter Four, however, tone patterning in Siwu vowel sequences has shown that CVVV is a composition of two possible syllable types

masquerading as a monosyllabic pattern. I argued that this sequence can be parsed as either CVV.V or CV.VV because the middle vowel always bears a mid-level tone in the few examples available in the language. This is in line with the tone pattern on CVV type (one of the vowels in diphthongs always bears a mid-tone), or the only identified monomorphemic VV sequence I found in the language. Although the evidence examined is in support of both structures, the argument for CVV.V far outweighs that for CV.VV, hence the former is more plausible. This finding has highlighted the key role that tone plays in syllabification in the language.

This study also found that the Siwu syllable structure is partially tolerant to the coda contrary to the account of Ring et al. (2002) which suggests that the language does not allow closed syllables. However, available evidence indicates that such closed syllables are restricted to loanwords and ideophones. It is worth noting that although segments in the coda are limited to nasals, other segments can be allowed provided the syllable in question is not in the word-final position.

The next finding regards phonotactic rules concerning complex onsets. The study found that there is an imbalance preference of the two segments that occupy the C2 position of Siwu clusters. While both /l/ and /r/ are allowed as C2 in complex onsets, /r/ can pair with several more eligible C1s more than /l/ can. As a result, any C1 that cannot pair with /r/ to form a permissible onset cluster cannot do so with /l/. I deduced in conjunction with Rice's Structural view of sonority that /r/ ranks higher on the sonority scale than /l/ within the liquid class and that Siwu language-specific rules may demand that the segment that ranks higher in sonority within a natural class is more preferable in C2 positions than those that are less sonorous. In addition, I suggest that place structure may play a role in the restrictions on clusters with /l/ occurring after coronals such as *dl, *tl, *dzl, etc.

Tone adaptation, elision, epenthesis, and metathesis are the phonological processes that were found to be influenced by the syllable structure of Siwu. Elision and epenthesis were found in loanwords for the borrowed forms to conform to the syllable structure of the language. As mentioned earlier, closed syllables are found in a marginal vocabulary with limited coda segments. Since only selected segments are allowed in the coda, there is an elision process to eliminate bad codas, or an epenthetic vowel is added in order to introduce a new CV syllable. No elision is observed in syllable types in Siwu native words. My earlier hypothesis that CCV is a possible outcome of a deletion process within CVCV was nullified after it was shown through minimal pairs and near minimal pairs test both CVCV and CCV sequences are present and underlying in the language. Metathesis is, however, found in native Siwu words and can be predicted phonologically, contrary to established claims that metathesis is mostly erratic.

5.3 Theoretical Implications

There are some implications that my findings have on the theoretical approaches that I employed in my study. The first is the concept of sonority. The Siwu complex onset has challenged Goldsmith's idea of sonority having the ultimate purpose of describing permissible sequences for one reason - the inadequacy of the sonority scale to describe same. In my data analysis, it emerged that not all natural classes can even be precisely grouped on the scale based on how differently each segment within its class may behave in the same or similar syllabification environments. Most notably, the glides [y, w] are ranked independently on the proposed Siwu sonority scale because one can occur in clusters, while the other cannot. Moreover, the segment that can form clusters, [w], assumes a C1 position instead of a predicted C2 position, indicating that both segments possess different degrees of sonority. This analysis has further provided insight into why sonority alone is insufficient to determine or explain consonant sequences in line with Rice's argument that

"both sonority and place of articulation relationships are important in determining the syllabification of consonants in clusters" (pg.1). Siwu also does not deviate from the SSP given that only sonorous elements are allowed in its syllable nucleus.

Another implication of the study is that the structural organisation of the Siwu syllable is in accordance with Pike and Pike's (1947) proposed syllable-internal structure and also agrees with Levin's (1985) which imitates the phrase structure rule and suggests that the nucleus is the most important constituent of the syllable. The presence of the V and N syllable types in the inventory and the language's general predisposition for no codas is an attestation that the nucleus is the obligatory component and head of the syllable. Additionally, the preference for onsets over codas, seen in the Siwu inventory lends credence to the asymmetrical implicational relationship between these two constituents highlighted in the crosslinguistic study of syllable typologies.

The syllable as examined in this study supports the claim from several scholars that, although the concept lacks definitive phonetic correlates, its role as the ideal phonological unit where a language's phonotactic rules are derived is undisputed. The Siwu syllable affirms the two arguments put forth as evidence for the syllable that I presented in Chapter Three; the syllable being the domain for phonological processes and also the target for processes such as tone assignment. I demonstrated through processes like metathesis, tone assignment, and tone adaptation in my analysis how both of these pieces of evidence manifest in the Siwu syllable as an attestation to the arguments for evidence for the syllable.

5.4 Contribution

As a minority language bordered by a major language of influence, Siwu, and other GTM languages, face possible endangerment. There is therefore the need to draw attention to it in linguistic research which will lead to documentation. In the years past, interest has been cultivated

in studying different aspects of the language but little has been done in researching its syllable structure and phonotactics. Not only does this study contribute to efforts to document Siwu, but it is also the first to focus on its syllable structure and derive Siwu language-specific rules. Apart from the contribution towards the language's preservation, it has provided ample linguistic data that will aid further future inquiry.

The inconclusive debate about the genetic grouping of GTM languages is yet another area to which this study contributes. My comparative analysis provides evidence to support claims about their convergence and closes the gap in that regard but most importantly, this study adds to other studies of the syllable structure of GTM languages.

5.5 Limitations and Recommendations for Further Studies

While I did my best to remove all biases, some limitations of the study have the potential to influence the findings. One of them is the sample size and age of my research respondents. My consultants represented both dialect backgrounds, however, they did not represent all speaker groups. Different age groups of a language may tend to use language differently and it is possible that this variable among Siwu speakers could provide another insight into some of the syllable patterns identified, hence influencing the findings.

The mode of data collection is another limitation. As I described in my methodology, my main source of data was the Siwu bible, and three consultants representing both dialectal lines. Apart from some grammatical inadequacies of the text, as is to be expected of a novel edition, the bible is still unable to reflect the use of language in ordinary speech by the native speaker. Worse still, some speakers feel that the bible was written in the 'other' dialect. I attribute this to efforts to merge the two dialects into a standard. Moreover, the elicitation technique involving questions and

answers restricts speech compared to natural interaction with a larger number of speakers which would throw more light on more marginalised forms and expand analysis on such vocabulary.

In view of these limitations, I suggest a modified methodology in future research. A larger number of consultants representing all age groups should be included, in order to reflect different language use, and elicitation through natural interaction or discussion of topics of interest would be best compared to the methods employed by this study.

Areas for future research include the relationship between tone and syllabification in Siwu. I indicated in my work that tone is important in Siwu because the language itself is tonal and also, tone plays a key role in syllabification (every syllable bears tone). While this is true, my main source of data, also the most recent and detailed work in Siwu, the bible, does not mark tone in its orthography. Also, while other works such as (Ford & Iddah 1973; 2017) discuss tone in Siwu extensively, the focus has been on tone in other aspects of grammar, such as word-final and phrase-final tone patterns and the role of tone in marking mood, word classes etc. Most of the forms with tone marked here are based on my native speaker intuition with the help of my consultants. There is a need for a detailed study into how tone manifests in different syllable types, tone adaptation in loanwords, and tone patterning in vowel sequences. Further study on tone and syllabification could be a step toward the inclusion of tone marking in future editions of the Siwu bible or other works of translation.

Another gap to be explored in future work is the status of the segments [h, y, ɣ]. An investigation into the acoustic properties of these segments may shed light on their relation to one another as well as how acoustic properties may impact their inability to occur in complex onsets. An acoustic study may also offer further explanation as to why some typical natural classes, like

[y, w] and [m, n] act distinctly in complex onsets in Siwu. The phonetic properties of [w] in particular, may be important in accounting for its ability to function as C1 in onset clusters.

A final recommendation for future research is a comparative analysis of a larger sample of GTM languages. Existing literature has accounted for fifteen GTM languages but this study looked at only five. Additional aspects to consider in future work include the influence of Ewe or other major languages on syllable structures of GTM languages.

5.6 Conclusion

The main goal of this study has been to describe the syllable structure of Siwu and the phonotactic rules that determine the well-formedness of the Siwu syllable. A number of theoretical frameworks were considered in order to reach this goal. First, I adopted Pike and Pike's (1947) syllable-internal structure as the most ideal for the Siwu syllable because of the language's predisposition for open syllables which in turn, makes the nucleus the head and the most important subconstituent of the syllable. I further based my analysis of the Siwu complex onset on Rice's (1992) structural view of sonority which proposes that sonority and place of articulation are key determinants of syllabification in clusters. Using this approach, I account for all consonant clusters in the Siwu syllable inventory showing that within the context of sonority, indeed the consonant occupying the first position of the consonant clusters needs to be less sonorant. In cases where the cluster is ill-formed although it meets the sonority criteria, analysis has shown that one of the segments must have more place structure than the other. Siwu syllable clusters conform with the basic tenet of Rice's structural proposal that consonants in a cluster cannot be of the same level of sonority or possess the same place of articulation.

This study has given an account of the Siwu syllable beyond what previous studies have documented. As part of a minority language group whose influence is minimal in a multilingual

landscape like Ghana, Siwu needs documentation in order to preserve linguistic data. A study of its syllable structure is especially significant because of the notion that the syllable is the most suitable phonological unit from where language-specific rules can be derived.

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