

DOCTORAL DISSERTATION

An Analytical Study of Hiatus Resolution Strategies in Esahie (Sehwi) and Nzema- Phonological and Morphological Perspectives

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2026

Eotvos Lorand University
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DOI: 10.15476/ELTE.2026.311

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Acknowledgements

My sincere gratitude extends to my supervisor, Dr. Peter Szigetvari, for his unwavering guidance, patience, time, and unwavering support throughout this academic endeavor. His discussions fostered a conducive environment, his innovative ideas were highly inspiring, and his insightful comments consistently challenged me to excel and deliver exceptional results. I am deeply indebted to him for his invaluable contributions.

Furthermore, I extend my gratitude to my opponents, Professors Kwasi Adomako and Peter Siptar, for their meticulous review of the previous version of this dissertation. Their thoughtful questions and invaluable comments and suggestions have been instrumental in refining my work.

I am also grateful to the members of my pre-defense and public defense committee for their invaluable contributions and the productive discussions they facilitated.

Additionally, I express my gratitude to the faculty members of the English American Studies Department at ELTE, particularly Dr. Attila Starcevic and my colleague Vencel Wutka.

Numerous individuals have made significant contributions to my academic journey, and I extend my sincere appreciation to each of them.

Finally, I extend my heartfelt gratitude to my family for their unwavering support, motivation, encouragement, and constant reminders of my deadlines. Notably, I would like to express my gratitude to Samuel Amoh, George Amoh (my father), Akua Konadu (my belated mother), Joyce Karikari Mensah, the F. O. Adu's family, James Owusu Ansah, Emmanuel Afrifa Antwi, Isaac Nyarko, Frederick Adjei Quansah, Nathaniel Adu, Agyemfra Jonas, Asare Emmanuel, Lawrence Sandow, Beatrice Archer, Rahiratu Ahmed, Regina Cobbinah, and everyone I couldn't mention your names.

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Introduction

The sequence of two vowels (termed vowel hiatus) is typically disfavored by languages across the globe. In most cases, this occurrence is resolved by employing various phonological processes. Across languages, vowel hiatus is commonly resolved through processes such as epenthesis, elision, and coalescence. In the literature, researchers have examined how hiatus is resolved in many languages and in different contexts. In adjacent identical vowels for instance, it becomes difficult to determine the vowel that deletes. The dissertation attempts to illustrate that the tonal structure of the vowels in question could aid in determining whether it is the first or the second vowel that deletes. I will therefore illustrate how downstepping happens when a tone floats. Getting to know the diverse ways that languages approach hiatus can offer valuable insight into analyzing phonological and morphological systems.

This research presents an analytical study of hiatus resolution strategies in Esahie and Nzema. Despite their geographical proximity, the languages do exhibit notable differences in handling hiatus. This study seeks to uncover the specific strategies these languages employ, and how they interact with the grammatical structures. The research has a dual focus, in that while the phonological analyses are bringing about the strategies, the morphological factors will bring to light processes like affixation and compounding influencing the selection of a strategy.

This study employs Optimality Theory and Autosegmental Phonology for theoretical analysis. While Optimality Theory focuses on constraint-based analyses, Autosegmental Phonology provides a feature-based representation of speech sound segments.

The dissertation is structured as follows: Chapter One provides an overview of hiatus resolution strategies applied by Esahie and Nzema, the research objective, the research questions, the significance of this study, and the theoretical framework. Chapter Two briefly discusses the different views regarding the resolution of hiatus in various languages. Chapter Three outlines the methodology applied in this research, including the research design, research methods, research site, data collection strategy, and sample size. Chapters Four and Five will provide answers to the research questions. The final chapter will present the findings and conclusion.

CHAPTER ONE

An overview of Esahie and Nzema

1.0 Introduction

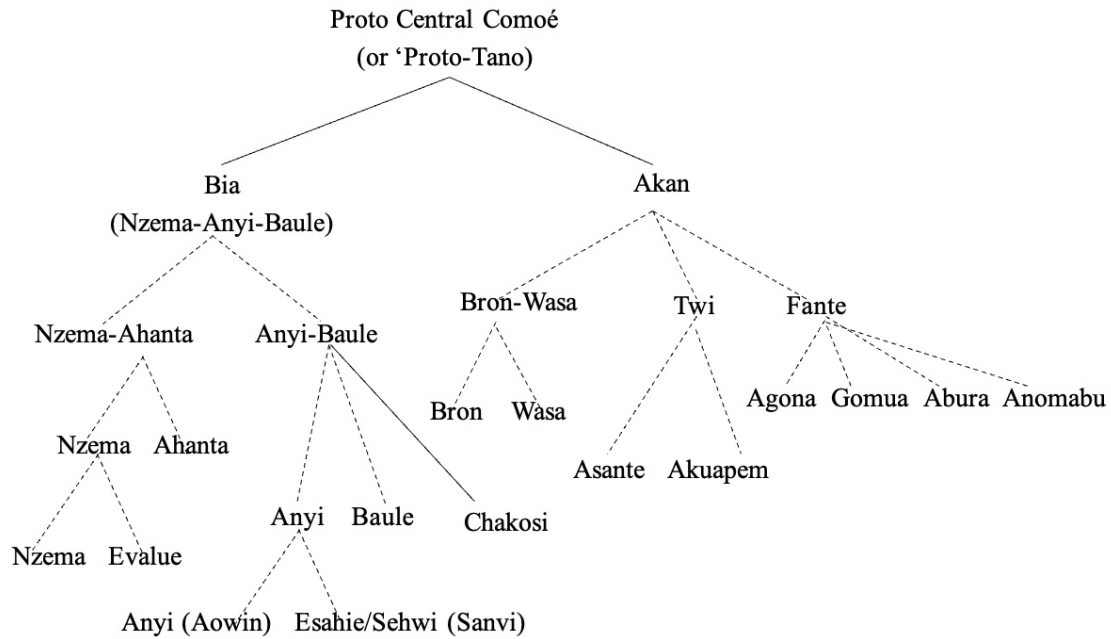
This chapter lays the groundwork for the research by giving an overview of the essential components of the study. It begins with the background of the study, giving insight into the languages under study. It then outlines the various linguistic components of the two languages.

1.1 The Phonological structure of Esahie and Nzema (The Bia languages)

The languages we are concerned with are Esahie (the speakers are Sehwi people) and Nzema (the speakers are called Nzemas). This section discusses the Nzema and Sehwi communities in terms of their geographical location, linguistic structures, and demographics.

The Central Comoé languages can be grouped into the Bia group - which consists of Anyi (Aowin), Sehwi (Esahie/ Sanvi), Baule, Chakosi, Nzema, and Ahanta - and the Akan group (Twi and Fante) according to Stewart (1966, cited in Kropp Dakubu, 2015, p. 52). The Bia group is further sub-categorized into Northern Bia (Anyi-Baule, Sehwi (Esahie/ Sanvi), and Chakosi) and Southern Bia (Nzema, Ahanta, and Evalue). Ahanta, Esahie, Nzema, and Anyi are spoken in Ghana and some parts of Ivory Coast, while Chakosi is spoken in both Togo and Ghana.

Figure 1: The language tree of Comoé languages adapted from (Kropp Dakubu, 2015)



As proposed by Kropp Dakubu (2015) and Dolphyne (2006), Figure (1) illustrates the historical development and relationships among the various languages within this family tree, highlighting points of divergence. Nzema and Evalue are sub-grouped to indicate their level of mutual intelligibility. They also exhibit some degree of comprehension with Anyi. Esahie branches out from the Anyi subgroup, which is part of the Anyi-Baule group. This classification makes it possible to group the dialects of these languages based on the stages at which they diverged from one another.

Esahie (Sehwi) and Nzema are spoken primarily in the newly created Western North Region and Western Region respectively. Western North was established in 2019 as part of a national administrative reorganization that increased the number of regions from 10 to 16 (Ghana Broadcast Corporation, 2019). Ntumy & Boafo (2002) report that Sehwi shares its northern boundary with the Brong and Ahafo regions and its southern boundary with the Ashanti Region. Nzema communities are mainly found in Ghana's Western Region, particularly in the Jomoro, Ellembelle, and Nzema East districts. In Côte d'Ivoire, they reside around Grand-Béréby and Tabou. Their proximity to the coast has historically led them to engage in fishing, trade, and interactions with European merchants. Sehwi is also known to have three paramount areas, Bekwai, Asawinso, and

Wiawso. The figure below, showing the Ghana language map [61] and [58], illustrates where the two languages are situated in the Western North and Western Region of Ghana.



Figure 2: Language map of Ghana (SIL, 2012)

Regarding the use of the language, Nzema is a written language with an officially recognized orthography, which enables its use in various media, education, and other contexts. In contrast, Esahie and Ahanta¹ lack an official orthography. However, some basic religious materials have been specifically designed for preschoolers and individuals seeking to learn how to read and write Esahie. Additionally, there are a few scholarly works dedicated to the grammar and phonology of Esahie. According to the National Population Census conducted from 1960 to 2021, there has been a gradual increase in the number of speakers of these languages. Notably, both languages have experienced a rise in their speaker populations, as evidenced by the following statistics:

Table 1

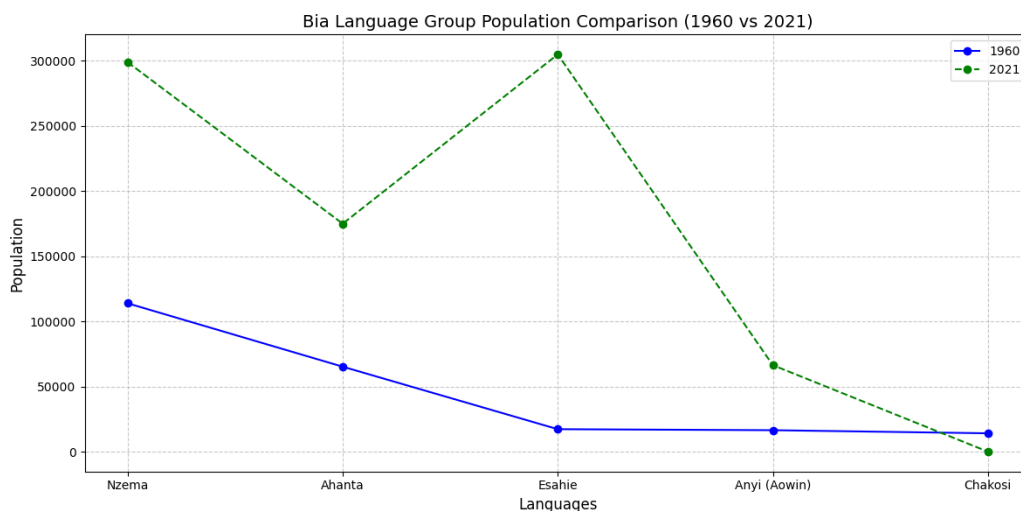
Bia language group (1960)		Bia language group (2021)	
Nzema (including Evalue)	113,890	Nzema (including Evalue)	299,000
Ahanta	65,230	Ahanta	175,000
Esahie	17,240	Esahie	305,000
Anyi (Aowin)	16,470	Anyi (Aowin)	66,400
Chakosi	14,090	Chakosi	no data found

(Ghana Statistical Service, 2021)

As Figure 3 shows, Nzema held the highest population among the other languages in 1960. There was a massive growth of over 2.6 times. Ahanta had nearly 2.7 times the growth. Anyi had 4 times the growth in 1960. However, Esahie experienced significant growth with almost 18 times the growth and surpassed Nzema in addition to the other languages in 2021. Despite being one of the smallest language groups, Esahie surpassed both Ahanta and Nzema to become the largest in 2021. Despite the remarkable growth of the number of Esahie speakers between 1960 and 2021, there is still the need to document the language because it is long overdue to have official recognition. This will pave the way for it to be used in schools.

¹ Through the effort of Hon. Mavis Kukuaa Bissie, the Member of Parliament for Ahanta West, the Ahanta language is included in the Ghana National Educational Curriculum. The orthography has been endorsed by the Bureau of Ghana Languages and yet to be used in schools. (<https://www.parliament.gh/floor?dis=116>)

Figure 3: Graphical comparison between 1960 and 2021



Despite the rise in the number of speakers, Akan remains the dominant language, as the majority of people are shifting towards its use, particularly Twi. Unconfirmed sources suggest that Nzema speakers are shifting towards French due to their shared border with Ivory Coast. This could be a contributing factor to Esahie's ability to overtake Nzema in terms of numbers of speakers. This significant language shift is occurring while Nzema and Esahie are still spoken, but their use is not as widespread as that of Akan. This study seeks to contribute to the preservation of these languages, aligning with UNESCO's advocacy for linguistic diversity and sustainability.

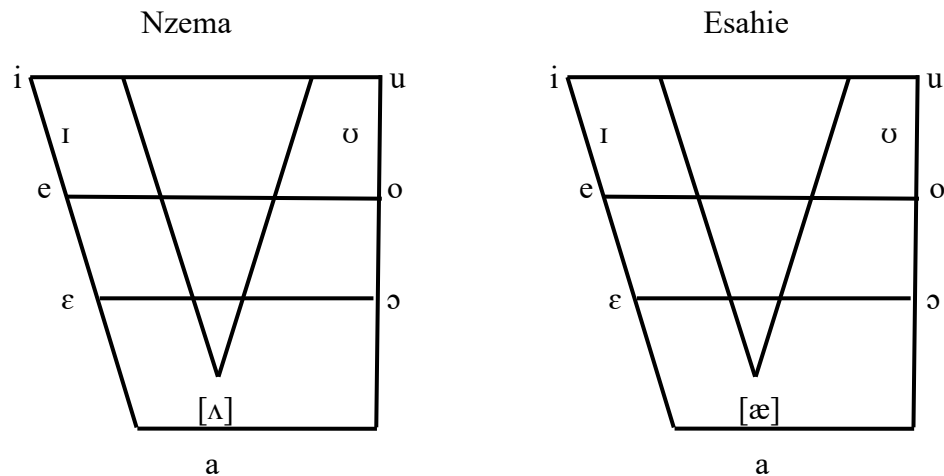
1.1.1. The Phonology of Esahie and Nzema

All the Central Comoé languages share the same vowel phonemes (Kropp Dakubu, 2015). The language has seven phonemes, three of which exhibit distinct allophonic variation in different phonological environments. They are /i, e, u, o, ε, ɔ, a/. In Esahie and Nzema, the allophonic distinctions are typically not reflected in spelling. /e/ can be pronounced as [e] or [ɪ], /a/ as [a] or [æ] in Esahie or [ʌ]² in Nzema, and /o/ as [o] or [ʊ]. This is confirmed by Essuah (1965), Annan (1980), Tomekyin (2007), and Kropp Dakubu (2015). Universally, the distinctiveness of these

² The distinction in /a/ realization between Nzema and Esahie remains inconclusive at this juncture. Comprehensive research and meticulous phonetic analyses are imperative to ascertain whether the realization of /a/ exhibits distinct characteristics in each language. Based on the available data, it can be observed that the environment in which the /a/ sound becomes an [ʌ] sound occurs when it precedes either the /u/ or /i/ sound, similar to the case of Esahie.

vowels is determined by various factors such as height, backness, nature of the tongue root, and roundness. Because Esahie and Nzema differ only in the realization of /a/ as [æ] vs [ʌ] while sharing all other vowels, this thesis presents two vowel charts (Figure 4), highlighting where they diverge. The vowel chart presented below illustrates the articulatory dimensions of the vocal tract and the corresponding vowels.

Figure 4: The vowel chart of Esahie and Nzema (Kropp Dakubu, 2015; Annan, 1980)



The vowel [æ] in Esahie and [ʌ] in Nzema, which are the allophones of /a/, are realized depending on the phonetic environment. The conditions that lead to this realization can be compared to the Akan language (Twi to be precise). When /a/ occurs before either /i/ or /u/ in a word, it is realized as [æ]. A sub-dialect of Fante behaves differently, where the progressive influence of /i/ affects the following vowel /a/. In the absence of /i/ and /u/, it remains as /a/.

(1)

a. Twi

awisea [æwiseja] ‘orphan’

akatua [akætuja] ‘pay’

adeɛ [adijɛ] ‘something’

b. A Fante sub-dialect only

sika [sikæ] ‘money’

asowa [asowa] ‘ear’

c. **Nzema**³

kaku ekyi [kʌku tɛi] ‘little kaku’

azie [ʌziɛ] ‘sepulcher’

amgbeɛ [amgbijɛ] ‘a shellfish’

d. **Esahie**

adwufua [ædzuf^hija] ‘word’

bayifoɛ [bəyifowɛ] ‘witch, sorcerer’

ewiase [ewijasi] ‘world’

The allophone [ɪ] surfaces from the phoneme /e/, when /e/, /u/, and /i/ are absent in the same morpheme. The phoneme /e/ remains unchanged when the aforementioned phonemes are present in the same morpheme. There are instances in the subsequent chapters where /e/, /u/, and /i/ are present in the word, and the allophone of /e/ is observed. In such cases, such as *ndeamue* [n-dija-mu-wɛ] ‘to cry out’, *gyedie* [dʒɪ-dije] ‘belief’, and others, the words are composed of two or more morphemes. The allophone of /e/ occurs because the phonemes that can restrict it from producing a variant are present in the morpheme. Let us examine some instances of allophonic variation in both languages.

(2) /e/ as [ɪ] or [e]

a. **Esahie**

bokyea [bʊtɛja] ‘cooking stone’

eyein [ejejin] ‘firewood’

b. **Nzema**

aleɛ [alijɛ] ‘food’

debie [debijɛ] ‘something’

³ Data in this thesis come from two sources: (i) primary data collected by the candidate through fieldwork with native speakers of Esahie and Nzema (see Section 3.2 for consultant profiles), and (ii) secondary data from published works, cited accordingly. Primary data are presented without a citation; secondary data are followed by the author, year, and page number in parentheses.

The phoneme /o/ is realized as [ʊ], presenting a more intricate alternation compared to /e/ and /a/. Examination of the data presented in Chapter Four and the audio recordings from the respondents reveal that most of this variation manifests when /a/ is the last vowel within the morpheme. Additionally, it is noteworthy that this variation occurs when all the vowels within the morpheme are /o/. We will stick to these two observations mentioned above. Future research should look into this alternation just as it is clear in /a/ and /e/ vowel change. Below are examples of these variations from both languages:

(3) /o/ becoming [ʊ] or remaining as /o/

a. Esahie

hoa [hʊwa] ‘story’
 dwodwo ahone [dʒʊdʒʊwə hʊnɪ] ‘to calm down’
 nzu ehoin [ɲzʊ jɛhɔjin] ‘be thirsty’
 bobɔ enu [bʊbɔ nʊ] ‘to crunch’
 buluo [buluwo] ‘yam’
 bodua [bodʷija] ‘amulet, charm’

b. Nzema

agyale ezukoa [adʒalɛ zukowa] ‘bride price’
 bɔlo ɛde [bɔlʊ dɪ] ‘a ball has burst’
 etu ɛdo [tu dʊ] ‘there is a gunshot’
 tuoƙe [tuwoke] ‘hernia’

The vowels discussed so far are oral vowels. In addition to these, there are six nasalized vowels: [ã, ã̃, õ, ã̃̃, ĩ, ã̃̃̃]. These vowels are not indicated in the spelling in either Esahie or Nzema, even though they are phonemic — that is, they can distinguish word meanings. The vowels [e, ɛ, o, æ/ʌ] cannot be nasalized in either Nzema or Esahie⁴. In Akan (Twi to be precise), aside from these lexical nasalized vowels, there is also a productive process of nasalization. Specifically, an oral

⁴ The observation that [e, ɛ, o, æ/ʌ] cannot occur nasalized in Nzema is based on the descriptive grammars of Annan (1980) and Essuah (1965); neither work reports nasalized counterparts for these vowels. For Esahie, this claim is based on my field data.

vowel becomes nasalized when it occurs immediately after a nasal consonant within the same syllable. For example, *ma* ‘to give’ becomes [mã]. This is distinct from the lexical contrasts shown below:

(4)

a.	fĩ	‘dirt’	fĩ	‘to go out’
b.	kã	‘say’	ka	‘to be left behind’
c.	tõ	‘to bake’	to	‘to throw’
d.	hũ	‘to see’	hu	‘to blow air’
e.	sĩ	‘teeth’	si	‘to sharpen’

(Dolphyne, 2006, p. 4)

Regarding nasalization in Akan CV stems, when the initial consonant is voiceless, the vowel in the CV stem can be oral or nasalized as in (4). Conversely, when the initial consonant is nasal, the vowel is always nasalized as in (5).

(5)

a.	mã	‘to give’	ba	‘to come’
b.	nũ	‘to stir’	du	‘to arrive’
c.	nyã	‘to obtain’	gya	‘to leave behind’

The distribution of oral vowels and nasalized vowels in consonant-vowel (CV) stems allows to bring about meaning change. For instance, *fa* ‘take’ and *fã* ‘half’ have the same spelling, but the nasality of /a/ will bring the difference in the meaning. The nasal quality of the vowel helps distinguish between the two words. Consequently, the surface representation will be *fã* ‘take’ and *fã* ‘half’.

Besides nasalization, vowel harmony is a phonological phenomenon that is observed in both Esahie and Nzema, which are like many Kwa languages. These languages have a rich inventory of vowels, including both advanced tongue root (+ATR) and unadvanced tongue root (-ATR). This characteristic leads to the categorization of vowels into two sets based on the position of the tongue root during articulation.

- [+ATR]: [i, e, u, o, æ/ʌ]
 [-ATR]: [ɪ, ɛ, ʊ, ɔ, a]

In general, in any Akan word of two or more syllables, the vowels are expected to come from one of the sets. This means that there is a restriction on how they are distributed. The restriction is not limited to ATR in words but to verbal prefixes in terms of rounding harmony. In the example provided in (6), Fante demonstrates an additional realization of vowel harmony. In this instance, the prefixes within a verbal domain are derived from the individual vowels present in the root word. If the vowels in the root word come from either [+/-ATR] set and possess the [+round] feature, the prefixes will adopt that specific form, as observed in (6a). Also, if the vowels in the root comes from either [+ATR] or [-ATR] set, the vowels in the prefixes will be chosen from the same set, as exemplified in (6b).

(6)

- a. /murukotu/ ‘I’m going to dig it up’ /mʊrʊkɔtɔw/ ‘I’m going to throw it’
 b. /mirikedzi/ ‘I’m going to eat it’ /mɪrɪkɛtsɪw/ ‘I’m going to pluck it’
 (Dolphyne, 2006, p. 18)

In Esahie and Nzema, vowels are classified into [+ATR] and [-ATR] sets, and this distinction determines the combination of vowels that can occur in words. This restriction on the distribution of their vowels prevents the occurrence of vowels from the set I in the same word as those from the set II. The following examples illustrate this point.

(7)

	Set I	Set II
Nzema:	[mɪkɛdɪ] ‘I shall eat (it)’	[mɪkɛtɪ] ‘I shall pluck (it)’
	[bɔɲɪ] ‘nose’	[kɔmɪ] ‘neck’
	[ʌkubɛ] ‘Akube’ (a girl’s name)	[aɖzɔɸɔbɔ] ‘Adwoba’ (a girl’s name)

(Kropp Dakubu, 2015, p. 59)

Esahie:	[esurejin] ‘fear, frighten’	[kɔmvɔjɛ] ‘fetish priest’
	[pætɔjɛ] ‘owl’	[nɔsɔwɔ] ‘twilight, sunset’

Within a word, vowels harmonize based on tongue root position. As shown in the example provided, the vowels share the same tongue root position, either [+ATR] or [-ATR]. The vowels in both the affixes and the stems consistently harmonize with each other. Specifically, the stem determines the affix’s tongue root value, and affixes have two distinct pronunciations depending on whether they occur with a [+ATR] or [-ATR] stem. ATR harmony is a feature of the vowel systems of Esahie and Nzema (as described above), but a detailed analysis of ATR harmony is beyond the scope of this dissertation, which focuses on hiatus resolution.

Similar to Fante, the two languages demonstrate that verbal affixes are pronounced differently depending on whether they occur with a stem containing [+ATR] or [-ATR] set of vowels. (8a) and (8b) illustrate the interaction between the first-person singular pronoun *me* and the verb stem. The pronunciation of the pronoun is contingent upon the set of vowels in the verb. (8c) and (8d) exhibit the alternations of the ingressive prefixes. When the vowel in the verb stem is [+ATR], it assumes that form, same to a verb stem with [-ATR] vowel.

(8)

	Set I	Set II	
a.	[me-si] ‘I will wash’	[mɛ-wɔ] ‘I will pound’	Esahie
b.	[kofi be-si] ‘Kofi comes to wash’	[kofi bɛ-wɔ] ‘Kofi comes to pound’	Esahie
c.	[me-tu] ‘I will uproot’	[mɛ-yɛ] ‘I will do it’	Nzema
d.	[kofi be-tu] ‘Kofi comes to uproot it’	[kofi bɛ-yɛ] ‘Kofi comes to do it’	Nzema

Unlike the vowels that are uniform across all the Central Comoé language group, the data presented below reveals a complex relationship that leads to differences. For instance, in Nzema, Esahie, and Akan, /kp/ and /p/ are contrastive phonemes, distinguishing words in minimal pairs. Nzema consistently maintains the labial-velar stop /kp/ in its phonemic inventory. However, Esahie reduces it to a bilabial stop in most cases, as exemplified in (9). There are a few instances where /kp/ is maintained in Esahie. Akan, on the other hand, reduces it to a simple bilabial stop /p/. This

complex relationship distinguishes the Nzema-Anyi-Baule dialectal clusters from the Akan language and characterizes Esahie as a separate language.

(9)

	Nzema	Akan	Esahie	
a.	kɔ̃ŋɡɔ	pɔ̃nko	pɔ̃ŋɡɔ	‘horse’
b.	kpaneɛ	paneɛ	paneɛ	‘needle’
c.	kpenyi	pɛnyin/panin	pɛnyi	‘elder’

(Kropp Dakubu, 2015, p. 62)

Data from Akan and the Bia languages indicates that intervocalic [l] and [r] alternate freely. This alternation does not conform to a regular phonological pattern, unlike the allophonic variation of /a/. The lack of conditioning environment suggest that [l] and [r] are in free variation, that is, they can be used interchangeably, rather than reflecting distinct phonemes or a phonologically governed process.

(10)

	Nzema	Akan	Esahie	Gloss
a.	kɔ̃kɔ̃lɛ	kɔ̃kɔ̃	kɔ̃kɔ̃rɛ/ kɔ̃kɔ̃lɛ	‘the color red’
b.	etile	etire/ etile	etire/ etile	‘the head’
c.	fɛlɛ	frɛ/ flɛ	frɛ/ flɛ	‘to call’

(Kropp Dakubu, 2015, p. 63)

Based on the tree diagram for the language family (Figure 1), it can be inferred that the language family is divided into two branches: Ahanta and Nzema on one hand, and Anyi, Baule, and Esahie on the other.

The consonant inventories of Esahie and Nzema include a range of stops, nasals, fricatives, affricates, liquids, and glides. However, for the purposes of hiatus resolution, only two consonantal segments are directly relevant: the palatal glide /j/ and the labial-velar glide /w/. These are the consonants that are epenthesized between vowels to resolve hiatus, as discussed in detail in

Chapter Four (§4.1). The choice of glide is determined by the feature specification of the first or second vowel in the hiatus: a front unrounded vowel triggers /j/; a back rounded vowel triggers /w/.

The glottal stop /ʔ/ appears in the cross-linguistic literature as a common epenthetic consonant (e.g., in Malay, Farsi, and several other languages; see Chapter Two), but it is not used as an epenthetic segment in Esahie or Nzema because there is no evidence to support it. A brief mention is included here only for comparative purposes.

Other consonantal classes – stops, affricates, nasals, fricatives, and liquids – do not play a role in the phonological processes of epenthesis, elision, or coalescence as they apply to vowel hiatus. They are therefore not discussed in detail in this section. In summary, the only consonants that are directly relevant to the hiatus resolution strategies analyzed in this dissertation are the glides /j/ and /w/. The following chapters will demonstrate their systematic insertion in both Esahie and Nzema.

1.1.1.1. The syllable structures of Esahie and Nzema

This section describes the basic syllable types found in Esahie and Nzema. The syllable is a standard unit in phonological analysis, useful for describing phonotactics, stress, and tone. While some theoretical debates exist about whether the syllable is a necessary primitive (e.g., Szigetvári, 2000; Chomsky & Halle, 1968), for the purposes of this study I adopt the syllable as a convenient and widely used descriptive unit. The following description of syllable structure in Esahie and Nzema will provide the foundation for tone assignment analysis in Chapter Four.

1.1.1.1.1 Syllable types in Nzema

Based on Annan (1980) and my data for this research, Nzema has three syllable types: V (vowel alone), CV (consonant + vowel), and syllabic C (nasal consonants). These are illustrated in (11).

(11) Nzema syllable

- | | | |
|---------------|----------------|---------|
| a. Vowel (V): | V as in [ɛ.tu] | ‘gun’ |
| | V as in [ɛ.da] | ‘arrow’ |

b. Consonant and a vowel (CV):	CV as in [jɛ]	‘our’
	CV as in [wɔ]	‘your’
c. Consonant (C):	C as in [ɲ.da.lɛ]	‘twin’
	C as in [m.gbo.lɛ]	‘insults’
	C as in [ɲ.ga.ku.sɛ.m]	‘childish’

The CV syllable is the most frequent. Syllabic consonants are restricted to nasals [n, ŋ, m], which can form independent syllables, as shown.

Tone bearing units (TBUs) in Nzema

Each of these syllable types can carry tone. In Nzema, tone is associated with the syllabic nucleus – either a vowel or a syllabic nasal. Example (12) shows high (ˈ) and low (ˉ) tones on these TBUs.

(12) Nzema tone structure

a. [ɛ̌.tú]	‘gun’
b. [ɛ̌.dà]	‘arrow’
c. [dì.ɛ̌]	‘to take’
d. [ɲ̌.dà.lɛ̌]	‘twin’
e. [m̌.gbò.lɛ̌]	‘insults’
f. [ɲ̌.gà.kú.sè.m̌]	‘childish’

In (12d–f), the syllabic nasals [n, m, ŋ] bear distinct tones (high or low) just like vowels. This confirms that in Nzema, the tone-bearing unit is the syllabic nucleus, regardless of whether it is a vowel or a nasal consonant.

1.1.1.1.2 Syllable types in Esahie

Esahie patterns very similarly. It also permits V, CV, and syllabic C (nasal) syllables, as shown in the example below.

(13) Esahie syllable

a. Vowel (V):	V as in [a.sa.wu]	‘hunting net’
	V as in [e.wu.je]	‘death’

b. Consonant and a vowel (CV):	CV as in [tu.ji]	‘gun’
	CV as in [hi.ja]	‘need (v)’
c. Consonant (C):	C as in [n.dɪ.ja.sɪ.jɛ]	‘to agree’
	C as in [m.ba.ji.n.jɛ.lɛ]	‘senile person’
	C as in [ŋ.ka.ta.sʊ.jɛ]	‘roof’

As in Nzema, the CV syllable is the most frequent. Syllabic nasals [n, m, ŋ] occur and function as independent tone-bearing units.

(14) Esahie tone structure

- | | | |
|----|---------------|-------------|
| a. | [bʰí.á] | ‘pot’ |
| b. | [bʰí.à] | ‘to answer’ |
| c. | [ŋ.gò.à] | ‘life’ |
| d. | [m.bó.à.nó.à] | ‘beach’ |
| e. | [n.zú.é] | ‘water’ |

In (14c–e), the syllabic nasals carry tone (e.g., high on [ŋ] in ‘life’, low on [n] in ‘water’), exactly like vowels.

1.1.1.1.3 Summary and relevance of syllable for tone

Tone is assigned to the syllabic nucleus in both languages – whether that nucleus is a vowel or a syllabic nasal. This means that identifying syllable boundaries and syllable nuclei is a necessary first step for any analysis of tone distribution and tonal processes (spreading, downstepping, or assimilation). In Chapter Four, I will build on this description to show how tone melodies are assigned to these syllabic units to help in identifying an elided vowel in a situation of identical vowels.

The present section thus establishes the empirical foundation: the syllable types of Esahie and Nzema, and the fact that each syllable’s nucleus is a tone-bearing unit. This is not a theoretical claim about the necessity of the syllable as a universal primitive, but a practical descriptive fact about these two languages.

1.1.2. The Morphology of Esahie and Nzema

The morphological structure of Esahie and Nzema is related, and their grammatical relations and categories are often marked with affixation and compounding. Both language systems are predominantly prefixing; occasionally, suffixation signals grammatical distinctions. Compounding is also applied to create new lexical items. These processes interact with phonological domains such as tone and syllable structure. While the syllable structure is modified, the tonal units are also affected sometimes. In what follows, I examine the affixation system and compounding strategies of each language.

Nzema is a prefixing and suffixing language, where prefixes and suffixes are attached to verbs and noun stems to mark grammatical categories such as tense, aspect, negation, number, and others. The most prominent one is prefixing. Affixation processes include subject agreement prefixes on verbs. For instance, {ɔ-su} ‘he/she cries’, {me-pe} ‘I like’, {wɔ-die} ‘you (3P.sg) like’. Nominal prefixes are commonly the nasals {m-, n-}, and the vowel {a-}.

(15)

Singular	Plural
a. {aleɛ} ‘food’	{n-leɛ} ‘foods’
b. {ebia} ‘chair’	{m-mia} ‘chairs’
c. {dua} ‘plant (n)’	{n-nua} ‘plants (n)’
d. {etu} ‘gun’	{a-tu} ‘guns’

Esahie morphological structure and its affixes are similar to Nzema. Esahie also possesses subject agreement prefixes; *me* as in {me-hia} ‘I need’, *wo* as in {wo-hia} ‘you need’, *wɔ* as in {wɔ-hia} ‘they need’. Esahie’s verbal affixes encompass negation and tenses. {m-, n-} are used to express negation. {n-} as in {n-hia} ‘do not need it’, {m-} as in {m-pia} ‘do not push it’, {m-} as in {m-moa} ‘do not pack’. {bɛ-, a-, -iɛ, -eɛ, re-} are the common tense markers in the language. This can be seen in example (16).

(16)

	Future tense	Past tense	Present Cont.	Past (Perfect)
a.	{bε-bue} ‘will open’	{bue-(e)ε} ‘opened’	{re-bue} ‘is opening’	{a-bue} ‘has opened’
b.	{bε-tu} ‘will uproot’	{tu-iε} ‘uprooted’	{re-tu} ‘is uprooting’	{a-tu} ‘has uprooted’

To mark singular and plural in nouns, {m-, n-, a-} are prefixed and sometimes cooccur with suffixes like {-nom} and {-foε}.

(17)

Singular	Plural
a. {ayisea} ‘orphan’	{n-yisea} ‘orphans’
b. {bayie} ‘witchcraft’	{m-mayifoε} ‘witchcrafts’
c. {bokyea} ‘cooking stove’	{m-mokyea} ‘cooking stoves’
d. {kunanie} ‘widow’	{a-kuna-foε} ‘widows’
e. {papa} ‘father’	{papa-nom} ‘fathers’

The languages exhibit certain similarities in the way affixes function during the compounding process. In this case, Nzema is typically right-headed, meaning that the final element determines the grammatical category and core meaning of the compound. A common type of compounds in Nzema involves a noun-noun construction. In (18) below, the first elements specify the information given in the heads.

(18) **Right headed**

Input	Output
a. bana ‘plantain’ + edwinli ‘farm’	{bana dwinli} ‘plantain farm’
b. butule ‘quarrel’ + εya ‘plant’	{butule ya} ‘quarrel plant’ (fern)
c. εzene ‘funeral’ + εdanle ‘cloth’	{εzene danle} ‘funeral cloth’

The word *edwinli* serves as the head, defining the overall meaning as ‘a type of farm.’ The modifier *bana* specifies the particular type of farm being referred to. After compounding, the resulting output retains the grammatical category of a noun. In example (18b), *eya* denotes ‘plant’, and its modifier *butule* modifies it, establishing a symbolic association between the plant and conflict. In (18c), the head word *edanle* signifies ‘cloth’ in general. To specify the specific type of cloth, a modifier is necessary. The modifier *ezene* then modifies the cloth, indicating its use for funerals.

Esahie compounds exhibit equal productivity in the formation of nouns, verbs, and ideophones, similar to Nzema. Notably, the first element in these compounds typically functions as a modifier, classifier, or specifier.

(19) Right headed

Input	Output
a. ngaen ‘machine’ + anwa ‘oil’	{ngaen-anwa} ‘petrol’
b. bakaa ‘tree’ + baa ‘child’	{bakaa-baa} ‘seed’
c. a-manyɔ ‘PL- politics’ + fekue ‘group’	{amanyɔ fekue} ‘political party’

(Broohm, 2019, p. 206)

The compound in (19a) refers to petroleum. In its composition, it has the headword *anwa*, which denotes all types of oil. To ascertain the purpose associated with the oil, *ngaen* is applied as a modifier. In (19b), the resulting meaning of *baa* is ‘seed’, which serves as the head of the compound, and it is metaphorically extended as the offspring or product of a tree by employing the modifier *bakaa*. In (19c), *fekue* signifies the fundamental category of the compound, a ‘group.’ To specify the domain of the group, *amanyɔ* is used as a modifier. There are instances where the compound is left headed. In this case, the second element serves as a specifier that adds detail to the head word. (20a) to (20c) have their head words *ngaen*, *maen*, and *atemuafoɛ*. These heads have their modifiers as *kɔmea*, *daen* and *panin*. This gives a bidirectional headedness in Esahie compounding.

(20) Left headed

Input	Output
a. ngaen ‘machine’ + kɔmea ‘magician’	{ngaen-kɔmea} ‘computer’
b. maen ‘nation’ + daen ‘parent’	{maen-daen} ‘country’
c. atemuafoɛ ‘judge’ + panin ‘leader’	{atemuafoɛ-panin} ‘chief justice’

(Broohm, 2019, p. 217)

1.2 Statement of the Problem

Linguistic research in Ghana has predominantly focused on major languages such as Twi, Ewe, Fante, and others, while lesser-studied languages have received limited attention. Investigating these languages contributes to their documentation, preservation, and resistance against shift toward dominant languages. Hiatus resolution—a phonological process that repairs adjacent vowels—is one area that requires further exploration across Ghanaian languages. This research therefore aims to compare the hiatus repair strategies employed in Esahie (Sehwi) and Nzema.

Although hiatus resolution has been examined in many languages (cf. Casali, 1996, 1997, 2011; Motte, 2013; Mba, 2011; Ekanjume, 2010; Sabao, 2015; Siptár, 2006), no existing study systematically compares Esahie and Nzema. Nzema has a largely phonemic orthography and official recognition (Annan, 1980; Essuah, 1965), which supports its documentation. Esahie, by contrast, remains unofficially used and less documented, despite initial work by Broohm (2019) and Owusu-Ansah (2020). Comparing the two sister languages offers valuable insights into their respective phonological systems.

The paucity of research on hiatus resolution in these languages raises unresolved questions: Which linguistic strategies do Nzema and Esahie speakers use to resolve hiatus? Which specific vowel and consonant segments are involved? Without systematic answers, our understanding of the phonological and morphological structure of both languages remains incomplete.

Despite the scholarly works on Esahie (Broohm, 2019; Owusu-Ansah, 2020) and Nzema (Essuah, 1965; Annan, 1980; Tomekyim, 2007), a systematic comparative analysis of hiatus resolution strategies in these two languages remains absent. Specifically, no study has: (i) compared the full range of strategies (epenthesis, elision, and coalescence) across both languages; (ii) accounted for

the observed patterns within Optimality Theory and Autosegmental Phonology; or (iii) examined the role of morphological structures in resolving hiatus. This thesis fills these gaps by providing a comparative, OT and Autosegmental Phonology-based analysis of primary data from both speech communities.

1.3 Research Objective

Assigning equal emphasis to phonological and morphological aspects, the principal aim of this research is to undertake an exhaustive and methodical examination of hiatus resolution techniques in the Esahie and Nzema languages. Concerning the phonological mechanisms that regulate the interaction of adjacent-position vowels, the research specifically seeks:

- a. To identify and describe the phonological processes and strategies (epenthesis, elision, and coalescence) that Esahie and Nzema employ to resolve hiatus.
- b. To analyze how morphological structure conditions hiatus resolution in Esahie and Nzema.
- c. To model the hiatus resolution patterns of Esahie and Nzema within the frameworks of Optimality Theory and Autosegmental Phonology.

The study attempts to contribute to the scholarly discourse on language structure and variation by analyzing the intricate dynamics of hiatus resolution in Esahie and Nzema, as outlined in the research objectives.

1.4 Research Questions

Based on the objectives highlighted above, the following research questions will be answered during this research. The questions raised are:

- a. What phonological processes and strategies do Esahie and Nzema use to address hiatus?
- b. What is the impact of morphological structure on hiatus resolution in both Esahie and Nzema?
- c. How can Optimality Theory and Autosegmental Phonology be applied in the description of these phonological processes?

1.5 Significance of the study

Language is productive, so speakers will continually create new expressions and novel utterances by manipulating their linguistic resources to describe new objects and situations (Yule, 2010). It is possible for languages to accommodate new words, and as these new words come to be part of the lexicon, speakers will have to utilize their tacit intuition of phonology in pronouncing them in respect of the phonotactics of that language. Consequently, the phonology of the receptor language may change. This invariably leads to some phonological issues such as which vowels follow each other and which do not, and which consonant can best be inserted to repair borrowed words, etc. In cases such as these, speakers do employ several mechanisms to enable them to speak as fast as possible and speak in a relaxed manner, particularly when making emphasis. The present study aims at having a broader knowledge about the repair strategies Esahie and Nzema adopt to resolve hiatus. It will also support existing knowledge and improve upon the previous work done on the same subject. Thus, it could serve as a reference point for both teachers and students of both languages in teaching and learning their phonology. The findings from the research could help fellow researchers who would want to research into other areas that are yet to be examined. The study will also serve as a guide to linguists who are non-speakers but would want to research Esahie and Nzema phonology.

1.6 Theoretical background

When exploring phonological phenomena like hiatus resolution, it is important to adopt a framework that accounts for variations observed cross-linguistically. A theory proposed by Prince & Smolensky (1993), which is Optimality Theory, best helps account for some of the patterns. Autosegmental Phonology (Goldsmith, 1976) will also be used in accounting for the deletion of one of the adjacent identical vowels to curb hiatus. I chose these theories because each theory offers a unique advantage in understanding how both languages deal with hiatus. OT is a constraint-based theory. It captures variation in, and flexibility of hiatus resolution, showing how constraints (universal constraints) interact across different languages. Since Autosegmental Phonology focuses on non-linear representations, it helps us account for feature-level changes that occur during hiatus resolution. It allows for vowels to be represented on separate tiers and for the processes that occur to be described in terms of feature manipulation. Adopting both theories will aid in accounting for the variability in strategies used in both languages.

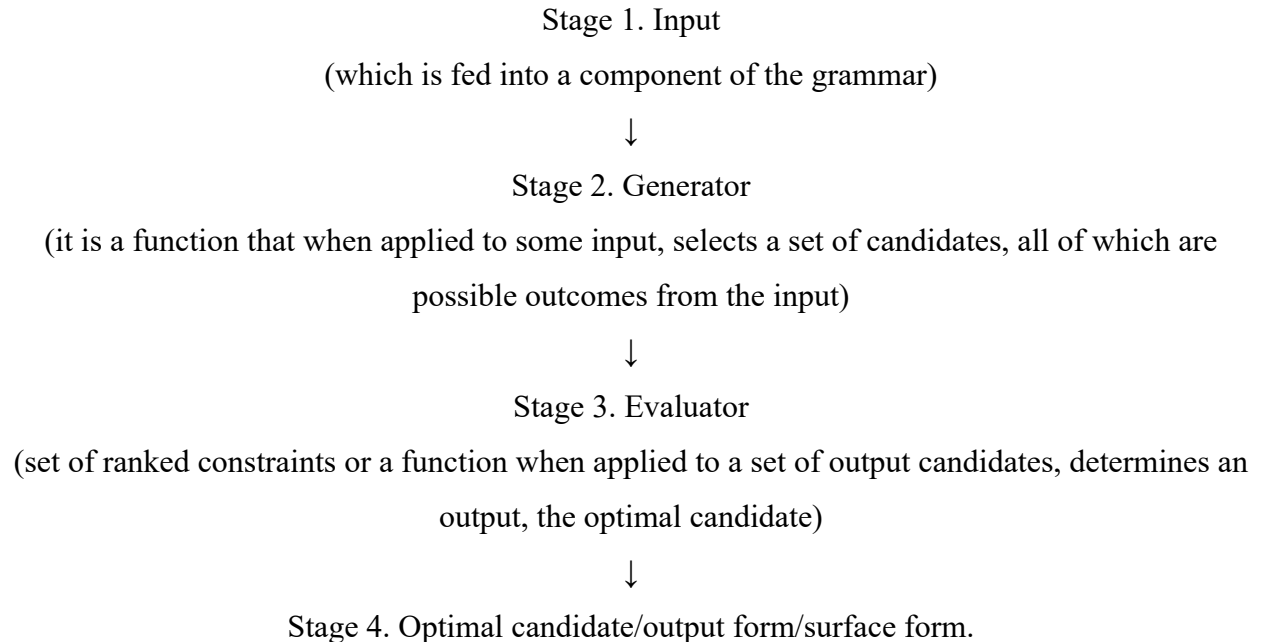
1.6.1 Principles of OT

Optimality Theory (OT) is governed by principles that encompass universality, violability, parallelism, and rankability. Universality refers to the idea that constraints are applicable across all languages. As Kager (1999) explains, all constraints are rooted in the grammar of natural languages. However, not all constraints hold the same weight in every language, as their ranking varies. For instance, a constraint *Y* may be crucial in language *A* due to its higher ranking, but it may not play any role in language *B*. This approach rules out the possibility of language-specific constraints or variations in relating phonological markedness constraints to universality.

Violability is one of the essential principles of OT. Constraints are violable, but violations should be minimal (Kager, 1999). This implies that constraint violations are not random. The aim is to avoid the violation of a higher-ranked constraint.

The evaluator compares all the candidates generated by GEN against the ranked constraints. It chooses the optimal candidate, the one that best satisfies the hierarchy of constraints. In terms of rankability, every potential output is evaluated based on its compliance with a specific set of constraints. The output is assigned a score, ranging from zero to infinity, for each constraint violation identified. Naturally, an output with an infinite score is not practically feasible for determining the ideal result. The significance of constraint violations is that each violation serves an essential function in preventing a higher-ranked constraint violation.

OT is different from earlier generative models, like Declarative Phonology, which posits that constraints are ‘hard’ and inviolable. On the other hand, OT assumes constraints to be violable and is a theory of constraint interaction independent of what the constraints are. OT is an input-output mechanism that pairs an output form to an input form, with every input having precisely one output as Kager (1999) suggests. The surface form/output form can only be one when the full process (components of the OT grammar) has been duly followed, as illustrated below:



The best candidate is not necessarily perfect, as it may still violate a lower-ranked constraint. According to Kager (1999, p. 3), breaking a language rule does not always result in ungrammatical sentences, nor is it necessary to completely disregard all rules to produce a valid grammar. Instead, the most optimal grammar output is achieved by breaking the least important rule. Although rules are universal, the order in which they are ranked may vary from language to language. By prioritizing language-specific constraints and rankings, one can create the most effective grammar output. Linguistic structures have two values: marked and unmarked. Marked values are typically avoided in most languages but may be used for contrast. Unmarked values, on the other hand, are preferred in all languages (Kager, 1999, p. 3). This is what OT operates upon. Grammars must balance universal rules to select the most harmonious and optimal output.

1.6.1.1 The constraints

In OT, there are two main categories of constraints: Faithfulness and Markedness. Each constraint evaluates a specific aspect of output markedness or faithfulness. Markedness constraints focus on the structural well-formedness of output forms and may prohibit certain phonological structures, such as segment types (i), prosodic structures (ii), or specific segment types in certain positions (iii), as illustrated by Kager's examples.

- a. Vowels must not be nasal.
- b. Syllables must not have codas.

- c. Obstruents must not be voiced in the coda position.
- d. Syllables must have onsets.

These constraints (a-d) conflict with the grammar of languages in general. This presupposes that while some languages may exhibit these constraints, others may not. Nevertheless, these constraints apply to all languages and are ranked according to the specific grammar rules of each language. Faithfulness constraints expect the output forms to maintain the characteristics of their original (lexical) forms, which requires some degree of similarity between the input and output. In Prince & Smolensky's (1993) original Containment Theory, no element could be added or removed from the input. Instead, the deletion of a segment or feature was achieved indirectly. As a result, every candidate output must contain the input, even if it is not pronounced in some of the candidate outputs. The faithfulness constraints strictly prohibit epenthesis or elision of input segments. Kager (1999, pp. 8-11) provides examples of faithfulness constraints below.

- a. The output must preserve all segments present in the input.
- b. The output must preserve the linear order of segments in the input.
- c. Output segments must have counterparts in the input.
- d. Output segments and input segments must share values for [voice]

Regarding the strict output-input correlation required by faithfulness constraints, Kager (1999) argues that faithfulness constraints are not pure output constraints, since they consider elements at two levels: input and output. Whereas markedness constraints never consider elements in the input, faithfulness constraints require output-input correspondence.

1.6.2 Autosegmental Phonology

The key principle of Autosegmental Phonology (AP) is that segmental and suprasegmental properties are represented on independent and separate tiers (Goldsmith, 1976). One important aspect of this theory is that it consists of strings of timing units that mediate between the segmental tier and other tiers (e.g., syllable tier, tonal tier). A feature may dissociate from a segment, leading to feature loss.

Autosegmental Phonology rests on some core tenets. First, tones are represented on their own tonal tier and linked to tone-bearing units (vowels and nasal consonants) by association lines. Second, the Well-Formedness Condition (Goldsmith, 1976) requires that every tone be associated with at least one tone-bearing unit, and that association lines do not cross.

Third, underspecification allows predictable feature values to be omitted from underlying representations, a property that remains important in constraint-based models. Fourth, phonological rules may involve delinking and reassociation of features (e.g. tones, which accounts for tone spreading, tone sandhi, and floating tone phenomena).

These tenets will be applied further in Chapter Five. The theory will show how tone can be delinked from a syllable tier, leading to downstep. This happens when a floating tone links to the nearest available segment or triggers a phonological change. This framework is valuable for this research because it captures the complex interaction of features in a tonal system, separating them onto their own tiers with the aid of association lines. This analysis is particularly suited for examining tonal structures, as will be exemplified in this study on adjacent twin vowel elision.

1.7 Why Optimality Theory? A comparison with Autosegmental Phonology

Generative phonology since the mid-1990s has been dominated by Optimality Theory (OT), a constraint-based model proposed by Prince and Smolensky (1993). OT differs fundamentally from earlier rule-based frameworks such as linear phonology (SPE) and, as originally conceived, Autosegmental Phonology. In rule-based theories, a grammar consists of an ordered sequence of language-specific rules that transforms an underlying representation into a surface form. OT replaces this with a set of universal, violable constraints that are ranked in a language-specific hierarchy (Kager, 1999). The optimal output is the candidate that best satisfies the highest-ranked constraints.

Three principal advantages motivate the choice of OT over rule-based frameworks for this present study. First, OT eliminates the problem of arbitrary rule ordering, which has long been recognized as a weakness of derivational models (Prince & Smolensky, 1993, p. 5). Second, OT provides a principled account of phonological conspiracies – situations where multiple distinct processes

converge on a single surface effect – without requiring stipulation. Third, the mechanism of constraint re-ranking makes OT inherently typologically oriented, generating a factorial typology of possible grammars and thereby accounting for cross-linguistic variation (Kager, 1999, p. 18; McCarthy, 2002, p. 72).

Despite these strengths, OT has faced recognized difficulties with certain phenomena. Notably, some researchers have argued that standard OT struggles with tonal phonology, especially patterns that require reference to multiple derivational steps (Odden, 1996, pp. 444–445). This is precisely the area where Autosegmental Phonology (AP) excels. AP, introduced by Goldsmith (1976) and elaborated in subsequent work, is a theory of non-linear phonological representation. Its core tenets include the representation of tones on independent tiers, the Well-Formedness Condition governing association lines, and the principle of underspecification. These representational tools are essential for capturing tonal stability, tone spreading, and vowel feature mapping in the present dataset.

In the current thesis, therefore, OT and AP play distinct and complementary roles: OT is employed as the constraint-based computational engine for selecting optimal hiatus resolution strategies, while AP provides the representational apparatus for handling tone and for modelling the mapping of vowel features across tiers. This dual-framework approach allows the study to benefit from the typological and conspiracy-handling strengths of OT while exploiting the well-established representational power of AP for non-linear phenomena. As Yip (2002, p. 65) observes, tone and its analysis in OT depend crucially on an autosegmental representation; the two frameworks are not competing alternatives but mutually supporting components of a comprehensive phonological analysis.

1.8 Summary of the chapter

This chapter provided a comprehensive background on the two languages being studied. The primary objective and research questions that will be investigated are explicitly outlined. Furthermore, the rationale for selecting the two theoretical frameworks is elucidated, and their application will be systematically explored.

CHAPTER TWO

Literature Review

2.0 Introduction

This chapter of the dissertation delves into the existing body of literature on resolving hiatus, with much focus on coalescence, elision, and epenthesis. It systematically explores these strategies, examines them as they apply in various languages and with different theoretical frameworks. Through the analysis, the chapter will lay the foundation for a deeper understanding of the phonological structures that facilitate the investigation of hiatus resolution.

2.1 Defining hiatus resolution strategies

Before reviewing the existing literature, it is necessary to define the core concepts used throughout this thesis. Following the typological framework of Casali (1996, 1998, 2011), hiatus resolution refers to any phonological process that eliminates or repairs a sequence of adjacent vowels belonging to separate syllables. The three primary strategies are epenthesis, elision, and coalescence.

Epenthesis is the insertion of a segment – typically a consonant – between two adjacent vowels to break the hiatus. In phonological textbooks, epenthesis is defined as “the addition of one or more sounds to a word, especially to the interior of a word” (Kenstowicz, 1994, p. 45). Gussenhoven & Jacobs (2017, p. 78) characterize epenthesis as a phonological repair strategy that improves syllable structure by providing an onset where none exists. Crowley (1997, p. 92) notes that epenthetic segments are often “the least marked” consonants in each language’s inventory. In this thesis, epenthesis refers specifically to the insertion of glides [j] and [w].

Elision is the deletion of one of the two adjacent vowels in a hiatus sequence. Kenstowicz (1994, p. 112) describes elision as “the loss of a vowel in certain phonological environments”. As Casali (1997, p. 4) observes, elision is “among the common strategies for eliminating vocalic hiatus” and typically targets the less sonorous or less prominent vowel in the sequence. Elision may be progressive (the first vowel is deleted), regressive (the second vowel is deleted). This typology follows Casali (1996, pp. 45–50).

Coalescence is the merger of two adjacent vowels into a single vowel that simultaneously carries features from both inputs. In phonological theory, coalescence has been rigorously defined as “a type of synchronic alternation in which two phonological elements seem to fuse into one” (Zaleska, 2021, p. 2). Casali (2011, p. 10) offers a more specific formulation: “vowel coalescence involves a non-high V₁ coalescing with a high V₂ to become another non-high vowel”. A simpler definition from the phonological literature is that coalescence is “the phonological process in which two segments merge” (Harley, 2006, p. 89).

These definitions establish the analytical perspective of the present study. Their application to Esahie and Nzema data is demonstrated in Chapter Four.

2.2 Epenthesis

Consonantal sounds are epenthesized between two vowels that do not conform to the underlying structure of a language. This phenomenon serves as a means of avoiding hiatus. Consequently, epenthesis has become an integral part of processes proposed by scholars. Various scholars have approached epenthesis from diverse perspectives, providing theoretical explanations and empirical evidence. For instance, McCarthy & Prince (1995) assert that comprehending epenthesis necessitates considering the prosodic hierarchy and faithfulness constraints.

Kager (1999) supports McCarthy & Prince’s view that epenthesis can be triggered to satisfy the well-formedness condition (onset must be maximized). This is in relation to languages that have CV syllable structure. Steriade (2001) shares a similar view on the role of perceptual salience in hiatus resolution. This was not the first time epenthesis has been discussed theoretically. Within SPE, Chomsky & Halle (1968) emphasize the interaction between underlying and surface representations. This can be seen as a pioneering work providing phonological transformation for later theories like what Prince & Smolensky (1993) brought to light. Goldsmith (1976) gives an analysis in a framework that does not involve what is seen in SPE and OT in recent times. In the analysis using the Autosegmental Phonology framework, phonological phenomena are presented in distinct tiers. Each segment is connected to a feature represented on a skeletal slot. Each segment possesses a unique property, such as the presence of [-/+] features. In Autosegmental Phonology, epenthetic hiatus resolution is represented by inserting an empty skeletal slot (x) between the two

vowels. The underlying representation (UR) has no such slot because the consonant is absent; the surface representation (SR) adds one. This skeletal slot serves as a timing unit. The epenthetic consonant's features are then associated to this slot, typically by spreading from adjacent vowels or by default feature insertion.

Figure 5: Hiatus resolved by consonant epenthesis in AP (present study, based on AP conventions; see Goldsmith, 1976; Clements & Keyser, 1983; Kenstowicz, 1994)

Underlying representation (Before epenthesis)

V	C	V
x		x

Surface representation (After epenthesis)

V	C	V
--> x	x	x

Although various theoretical frameworks have been proposed by scholars, they all converge on the necessity of maintaining or creating CV syllable structure. Languages employ consonants as epenthetic segments to resolve hiatus. However, the specific choice of the epenthetic segment exhibits cross-linguistic variability. Casali (2011, p. 3) mentions three primary possible sound segments that are widely applied. Firstly, a semivowel is often utilized, typically one that shares similar articulatory properties with either the preceding or following vowel. Secondly, languages may employ a glottal stop [ʔ] or fricative [h] to break the hiatus. Lastly, coronal consonants such as [t] or rhotic sounds may be inserted to resolve the hiatus. Svantesson et al. (2005) hypothesized a dorsal epenthesis. These diversities raise questions regarding the factors that govern each epenthetic segment.

2.2.1 Vowels and the epenthetic segment

It is assumed that vowels are featurally identical to the epenthetic segment (Casali, 2011). Building upon Bronstein's (1960) framework, it is noted that languages commonly utilize the three

frictionless glides: [j], [w], and [r]⁵. They are realized depending on whether they are in consonantal or vocalic positions. So, [j] is the consonantal term of the alternation, while [ɪ] or [i] is its vocalic counterpart. Likewise, [w] and [ʊ] or [u] occur in the consonantal and vocalic positions, respectively. These two, [w] and [j], are the relevant ones for the purpose of this study. This observation is echoed by Vaux (2001), who suggests that the choice of a consonant for epenthesis varies across languages. Vaux’s position aligns with the notion that while languages draw upon a shared foundation of Universal Grammar (as proposed by Kager, 1999), the specific type of consonant selected for epenthesis may differ significantly from one language to another.

In Faroese⁶ (Lockwood, 1955; Anderson, 1972; Young & Clewer, 1985; Thráinsson et al., 2004; Árnason, 2011), the possibility of epenthesis is contingent upon the presence of a high and non-high vowel in concatenation. Example (21) illustrates the underlying sequence where the first vowel is high; in this case, [j] or [w] are epenthesized. Conversely, when the first vowel is non-high, epenthesis does not occur.

(21) Faroese glide epenthesis (Staroverov, 2014, p. 20)

	VV	Example	Stem alternations	
a.	/i:a/	/mi:-aɪ/	[mi:jaɪ] ‘middle-PL.FEM’	
b.	/i:ɪ/	/si:-ɪ/	[si:jiɪ] ‘lower-PST.PART’	
c.	/i:ʊ/	/si:-ʊɪ/	[si:jʊɪ] ‘custom-NOM’	[si:lɛsʊɪ] ‘immoral’
d.	/u:a/	/tʰu:-a/	[tʰu:wa] ‘to say tú (thou)’	
e.	/u:ɪ/	/pu:-ɪ/	[pu:wɪ] ‘live-1SG.PST’	[pɔi:ɪt] ‘live.2SG’
f.	/u:ʊ/	/su:-ʊɪ/	[su:wʊɪ] ‘south-NOM’	[su:ɪ] ‘southerly’

⁵ Bronstein (1960) observes that in American English, the rhotic consonant [r] appears in onset or coda positions, while the rhotic vowels [ɔ̃] or [ɜ̃] appear in the nucleus. This alternation parallels the well-known relationships between the glide [j] and the vowel [i], and between the glide [w] and the vowel [u]. In all three cases, the consonantal and vocalic variants share the same featural content but differ in syllabic position.

⁶ Examples (21-23) were copied from Árnason (2011: 82) as they are. The data in (21e-f) may contain some inaccuracies. A cross-check suggests that the forms [pu:wɪ] ‘live-1SG.PST’, [pɔi:ɪt] ‘live.2SG’, [su:wʊɪ] ‘south-NOM’, and [su:ɪ] ‘southerly’ may have been mistranslated or misrepresented. For the purposes of this review, we draw attention to the remaining examples, which appear to be consistent and accurate.

Examining the sequences (21a-c) and (21d-f), it becomes evident that a palatal glide is epenthesized in the former, while a labial glide is epenthesized in the latter. This observation supports the claims of Bronstein (1960) and Casali (2011). Based on the sequences in (21), it can be inferred that the trigger for epenthesis in resolving hiatus in Faroese lies in the first vowel, regardless of whether it is front high or back high. Equally, when there is no high vowel, the glide is not derivable from the surrounding vowels.

(22) Glides contrasting in Faroese (Staroverov, 2014, p. 21)

- | | | |
|----|------------|--|
| a. | /rø:-a/ | [rø:va] ‘speech-NOM’ |
| b. | /elska-aɪ/ | [elskavaɪ] ‘beloved-NOM/ACC.FEM.PL’ |
| c. | /le:-a / | [le:va] ‘place-where-something-lies-NOM’ |

(22) demonstrates that the vowel in the sequence should harmonize with the glide inserted as it appeared in (21). In the absence of a high vowel, a different segment is applied. Therefore, [v] is epenthesized in the absence of a high vowel to trigger either a palatal glide or a labial glide.

Example (21) from Faroese shows glide epenthesis triggered by a high vowel. Example (23) from Dutch illustrates a similar process, though Dutch also allows epenthesis after mid vowels. As Staroverov (2014) points out, if the first vowel in the sequence is a high vowel, it triggers either the insertion of a palatal or a labial glide. Referring to (23a-d), all the second vowels in the hiatus configuration are front-high. Thus, the palatal glide is triggered to resolve hiatus. (23e) indicates the insertion of [v], where one would anticipate a labial glide insertion. However, there is insufficient evidence to definitively conclude this. It is plausible that this segment is closely related to [w], potentially replacing the expected labial glide, but further evidence is needed to confirm this analysis.

(23) Epenthesis before a front high vowel (Staroverov, 2014, p. 21)

	VV	Example	No epenthesis
a.	/o:ɪ/	/so:-ɪn/	[so:jɪn] ‘boiled’
			[so:a] ‘scum on boiling liquid’
b.	/e:ɪ/	/kle:-i/	[kle:ji] ‘pleasure’
			[kle:a] ‘please’

- c. /ø:ɪ/ /lø:-ɪn/ [lø:jin] ‘odd’
- d. /aɪ/ /kʰatla-ɪ/ [kʰatlaɪ] ‘call-1SG.PST’ /kʰatla-ɪ/ [kʰatlaɪ] ‘call-2SG.PRES’
- e. /e:ʊ/ /le:-ʊɪ/ [le:vʊɪ] ‘leather-NOM’

The hiatus is resolved in Dutch through glide epenthesis. Unlike in Faroese, both high and mid vowels trigger glide epenthesis and determine which glides are inserted. First vowels in the sequence play a role in determining the epenthetic segment in all cases, as demonstrated in (24). (24a) has a palatal glide epenthesized due to the front-high vowel, whereas (24b) and (24c) show that [v] is inserted as the repairing segment after a back high rounded vowel.

(24) Dutch glide epenthesis (Booij, 1995, cited in Staroverov, 2014, p. 52)

(Epenthesis after a high vowel)

- a. /iə/ /kni-ə/ [knijə] ‘knees’
- b. /ui/ /hɪndu-ismə/ [hɪndu'vismə] ‘hinduism’
- c. /uə/ /barbəkju-ə/ [barbəkjuvə] ‘to barbecue’

When the initial vowel is a mid-front vowel, like (25a-b), it triggers the epenthetic segment [j], as observed in the case of the front-high vowel in (24). Likewise, (25c) and (25d) demonstrate the cooccurrence of mid-back vowels and [v].

(25) Epenthesis after a mid-vowel (Booij, 1995, cited in Staroverov, 2014, p. 52)

- a. /ei/ /fa:rize:-is/ [fa:rize:jis] ‘pharisaic’
- b. /eə/ /ze:-ə/ [ze:jə] ‘seas’
- c. /oi/ /e:ʏo:-ismə/ [e:ʏo:vismə] ‘egoism’
- d. /oə/ /jydo:-ə/ [jydo:və] ‘to judo’

Hiatus caused by suffixation in Tamil (Ramasamy, 2011, p. 178) is resolved by the epenthesis of [j] or [v]. Unlike Faroese and Dutch, low vowels in Tamil have [v] as the preferred epenthetic segment, as exemplified below. The rationale behind the insertion of [v] remains unclear. It could be the default segment used by the language, but this is not definitively established. The explanation for the insertion of [j] is more straightforward in (26a) due to the relationship between

(26) Tamil glide epenthesis (Christdas, 1988, cited in Staroverov, 2014, p. 55)

a.	/poli-ε/	[polijε] ‘tiger-ACC’
b.	/ta:tta:-ε/	[tattavε] ‘grandfather-ACC’
c.	/pura:-a:/	[pura:va:] ‘pigeon-INTERROGATIVE’

- (27) ChiManyika⁷**

- In contrast to ChiManyika, the realizations in ChiHwesa exhibit distinct differences, despite sharing the same vowel sequence /a + e/. In ChiManyika, this sequence is resolved through epenthesis, whereas in ChiHwesa, (28a-c) demonstrates elision. Analyzing all the examples in (28), the targeted vowel that undergoes elision is the initial one except in the event of having /a + i/.

34

(28) ChiHwesa

- | | | | |
|----|------------|------------------------|-----------------------------|
| a. | /za+entse/ | [zentse] ‘all of them’ | |
| b. | /va+entse/ | [ventse] ‘all of them’ | |
| c. | /ra+entse/ | [rentse] ‘all day’ | |
| d. | /ma +ino/ | [mano] ‘teeth’ | (cf. Mvundura, 2015, p. 62) |

With respect to the vowels making up the sequence, these dialects approach resolution differently. As Mvundura (2015) posits, vowels elide in ChiHwesa as against epenthesis (or gliding) in ChiManyika. Looking at (29), both dialects have the /a + i/ sequence, but the approach to hiatus resolution differs. ChiHwesa elides one of the vowels in this sequence, while ChiManyika chooses to coalesce them.

(29)

ChiManyika Coalescence

- | | | |
|----|----------|----------------|
| a. | /ma+ino/ | [meno] ‘teeth’ |
| b. | /ma+iso/ | [meso] ‘eyes’ |

ChiHwesa Deletion

- | | |
|----------|----------------|
| /ma+ino/ | [mano] ‘teeth’ |
| /ma+iso/ | [maso] ‘eyes’ |

(cf. Mvundura, 2015, p. 63)

Even though these two are dialects of the same language, they tend to analyze and resolve hiatus differently.

The identifiable segments utilized in Malay hiatus resolution are the glide and the glottal stop. This is an additional example of segments used to resolve hiatus. In contrast to ChiManyika and ChiHwesa, where the condition leading to the differing realization of the sequence is not explicitly stated, it is evident that morphological positions influence the strategy that must be employed in Malay. A stem-suffix boundary favors gliding (see example (30)), while a prefix-stem boundary leads to glottal stop epenthesis (see examples (33) and (34)). Both Malay and ChiManyika employ glides that align with the feature of one of the adjacent vowels.

(30)

- | | | | |
|----|---------|----------|-------------------------|
| a. | /leuat/ | [le.wat] | ‘late’ |
| b. | /seua/ | [se.wə] | ‘rent’ |
| c. | /goiaŋ/ | [go.yaŋ] | ‘to shake’ |
| d. | /loia/ | [lo.yə] | ‘to feel like vomiting’ |

In Malay, high vowels /i/ and /u/ are often realised as glides [j] and [w] when they occur before another vowel. Ahmad (2005) analyses this in terms of syllabification, not as a separate process of glide formation. According to Ahmad, Malay has no underlying glides; the distinction between a high vowel and a glide arises from its position in the syllable. When a high vowel appears before another vowel, it is parsed into the onset of the following syllable, surfacing as a glide. For example, in (30a) /leuat/ → [le.wat] ‘late’, the high vowel /u/ is syllabified as the onset of the second syllable, yielding [w]. Similarly, in (30c) /goiaŋ/ → [go.jaŋ] ‘to shake’, the high vowel /i/ becomes the onset [j]. This analysis accounts for all the Malay examples in (30) without requiring a separate rule of glide insertion or vowel deletion. A detailed discussion of syllabification and glide emergence in Malay can be found in Ahmad (2005, pp. 22–40)

Furthermore, word-initial high vowels in Malay never surface as independent vowels when another vowel follows. As shown in (31), underlying /u/ and /i/ at the beginning of a word are syllabified as the onset of the first syllable, surfacing as [w] and [j] respectively. For example, /uaŋi/ is realized as [waŋi] ‘fragrance’, not as *[u.wa.ŋi]; /iuran/ becomes [ju.ran] ‘fee’, not *[i.ju.ran]. This follows from the general phonotactic principle that Malay syllables must have an onset where possible, and high vowels are the only vowels that can occupy the onset position (Ahmad, 2005, pp. 22–30). Thus, the occurrence of word-initial glides is not a separate process of glide formation or insertion, but a direct consequence of Malay syllabification.

(31)

- | | | | |
|----|---------|-----------------------|---------------|
| a. | /uaŋi/ | [waŋi], *[u.wa.ŋi] | ‘fragrance’ |
| b. | /iuran/ | [ju.ran], *[i.yu.ran] | ‘fee’ |
| c. | /iaken/ | [ja.ken], *[i.ya.ken] | ‘to convince’ |
| d. | /uaŋ/ | [waŋ], *[u.waŋ] | ‘money’ |

Across the languages discussed above, one striking similarity is that hiatus resolution often involves high vowels (which may surface as glides) or mid vowels. However, when a mid or low vowel is followed by another vowel, some languages employ a glottal stop rather than a glide.

Apart from glides, Naderi & van Oostendorp (2011) and Casali (2011) provide instances of a laryngeal segment occurring between vowels. In the case of Farsi, the dialect epenthesizes a glottal stop after mid and low vowels. This process aligns with Staroverov’s (2014) Splitting Theory, which posits that an epenthetic segment must correspond to an input segment rather than being inserted arbitrarily. The theory predicts that glides occur adjacent to mid vowels. As Tableau (1) illustrates and the preceding examples suggest, only a homorganic glide can be inserted. Consequently, it is impossible to epenthesize a glide in sequence of a mid and low vowel in Farsi. Similarly to Dutch and other languages, the second vowel is of secondary importance, while the first vowel remains paramount.

(32) Hiatus resolution in Farsi (Staroverov, 2014, p. 70)

- a. /sep̤hi-ɒn/ [sep̤hiʝɒn] ‘soldiers’
 /ʔahu-i/ [ʔahuwi] ‘a deer’
 /bɒzɒri-i/ [bɒzɒriji] ‘a businessman’
- b. /xɒne-at/ [xɒneʔat] ‘colloquial’
 /rɒdijo-i/ [rɒdijoʔi] ‘relating to radio’
 /bɒlɒ-i/ [bɒlɒʔi] ‘the one above’
 /mohɒvere-i/ [mohɒvereʔi] ‘colloquial’

The constraints used in this tableau (ONSET, IDENT-[place], INTEGRITY) are defined in section 5.1 (Constraint Inventory).

Tableau 1

/sep̤hi-ɒn/	ONSET	IDENT-[place]	INTEGRITY
☞ a. sep̤hiʝɒn			*
b. sep̤hiɒn	*!		
c. sep̤hiʔɒn		*!	

In Tableau (1), the UR exhibits a hiatus due to the contact of two vowels across a morpheme boundary. The first candidate only violates the lower-ranked constraint INTEGRITY. The palatal

glide is epenthesized at the morpheme boundary to yield the corresponding output [sepɒhijɒn]. The IDENT-[place] constraint is satisfied because the epenthetic segment shares the same place as /i/, resulting in no violation. The insertion satisfies ONSET, as the subsequent syllable contains [j], which qualifies as an onset. Consequently, candidate (a) emerges as optimal.

Upon comparing candidate (a) with (b) and (c), it becomes evident that either (b) or (c) violates either the ONSET or IDENT-[place] constraints, which are highly ranked constraints. (b) lacks an onset, and the hiatus persists. (c) satisfies the onset constraint but violates IDENT-[place] due to the presence of a glottal place in the epenthetic segment.

To insert a glottal stop to resolve hiatus, as in Tableau (2), additional constraints should be added and ranked. These constraints include:

- i. ID-[high]: Do not change the [+/- high] feature of a segment from input to output.
- ii. *[sg]: Penalize segments with the [spread glottis] feature.
- iii. *[cg]: Penalize segments with the [constricted glottis] feature (e.g., glottal stops [ʔ]).
- iv. *LAR: Penalize segments with any [laryngeal] features.

The highly ranked constraints are ONSET, ID-[high], and *[sg]. While candidates (b), (c), and (d) violate one of the highly ranked constraints, candidate (a) satisfies all of them. Therefore, candidate (a) is optimal among the remaining candidates. (a) inserted a segment with a constricted glottis feature. The other constraints were violated, but they are lower-ranked and do not significantly impact the outcome.

Tableau 2⁸

/xɒneat/	ONSET	ID-[high]	*[sg]
☞ a. xɒneʔat			
b. xɒneat	*!		
c. xɒnejat		*!	
d. xɒnehat			*!

Glottal stop epenthesis, as exemplified in the illustration provided, is also a morpho-phonological phenomenon observed in Malay, CV prefixes in Malay induce hiatus, and the default segment to bridge this hiatus is a glottal stop. The Farsi language may have chosen a glottal stop to resolve the sequence due to its known minimal invasiveness and preservation of vowel quality (Uffmann, 2007). Beyond hiatus resolution, the inserted glottal stop generates a maximized sonority drop to mark a prosodic boundary between the two vowels (Casali, 2011). In addition, it becomes the onset of the ensuing syllable. From (33), it can be inferred that the glottal stop serves as a neutral hiatus-resolving segment before /u/, /i/, /e/, and /o/.

(33) UR	SR ⁹	Gloss	
a. /di-ubah/	[diʔubah]	‘to change (pass)’	
b. /sə-indah/	[səʔindah]	‘to be as beautiful as’	
c. /sə-elok/	[səʔelo]	‘to be as pretty as’	
d. /di-olah/	[diʔolah]	‘to beguile (pass)’	(cf. Casali, 2011, p. 4)

⁸ Constraints such as [cg], ID-[place], LAR, and INT have been excluded from the current tableau because they do not play an active role in the analysis at hand—they are violated by all candidates and therefore do not contribute to the selection of the optimal form. While these constraints may be relevant in other parts of the author’s broader analysis or invoked to account for different data sets, they are not essential for the specific pattern discussed here. For the sake of clarity and analytical focus, only constraints that crucially determine candidate evaluation have been retained.

⁹ In these forms, the glottal stop appears as a superscript in the original data. The Malay language employs the glottal stop as a strategy to resolve vowel hiatus. Although it is represented as a superscript, it nonetheless functions to break the hiatus. This could be a formatting choice or may reflect a phonological interpretation in which the glottal stop is treated as a secondary articulatory feature. Given that its primary role is to interrupt vowel sequences and resolve hiatus, I interpret it as normal glottal stop. However, to remain faithful to Casali’s original notation and analytical choices, I retain the superscript form in the data as presented.

The selection of a glottal stop as the optimal segment to resolve hiatus in Malay extends to identical adjacent vowels as well. This is not only realized in monomorphemic words but across morpheme boundaries, too. Unlike the unidentical vowel sequence where the epenthetic segment could be determined by the neighboring vowels, this becomes difficult because the vowels are the same. Just as [ʔ] was used as the default segment in (33) to resolve hiatus across a prefix-stem boundary with non-identical vowels, (34) exhibits a similar resolution pattern, though in different environments. In (33), the glottal stop separates non-identical vowels (e.g., /di+ubah/ → [di.ʔu.bah]). In (34), however, the glottal stop is inserted between identical vowels (e.g., /saat/ → [sa.ʔat]), and this occurs both morpheme-internally and across word boundaries. Thus, while the function of the glottal stop is similar – to break hiatus and provide an onset – the specific contexts and vowel sequences differ. This could lead to a sonority break, as Uffmann (2007) points out. A syllable boundary is created, and the onset preference is satisfied.

(34)

a. Morpheme-internal sequences of identical vowels

a. /saat/	[sa.ʔat]	‘seconds, moment’
b. /peel/	[pe.ʔel]	‘behavior’
c. /suum/	[su.ʔum]	‘rice noodle’
d. /maap/	[ma.ʔap]	‘forgive, pardon’
e. /tabii/	[tabi.ʔi]	‘natural instinct or form’

b. Identical vowels in affixed forms

a. /tʃuba+an/	[tʃu.ba.ʔan]	‘test’
b. /kə-əmpat/	[kə.ʔəm.pat]	‘fourth’
c. /di-ikat/	[di.ʔi.kat]	‘to tie (passive)’
d. /kə-ənam/	[kə.ʔə.nam]	‘sixth’
e. /di-intip/	[di.ʔin.tep]	‘to spy (passive)’

(cf. Sun & Chung, 2023, p. 435)

Moving on to Madurese, glides remain the optimal segment type used to resolve both identical and non-identical vowel sequences, as discussed by Cohn & Lockwood (1994) and Cohn (1993). This approach aligns with Faroese, Malay, and Farsi, as glides appear immediately following

homorganic high or mid vowels. The resolution pattern is illustrated in (35) and (36). In the first example, a sequence of non-identical vowels is present, with the first vowel being non-central. [w] and [j] emerge in these cases. This focus is on the first vowels since they appear to match with the glides. (35a-f) exhibit the palatal glide while (35g-k) exemplify the labial glide.

(35) Madurese glide epenthesis (Cohn & Lockwood, 1994)

a.	/ia/	/libali-an/	[libɾlijan]	‘several times’
		/barian/	[bɾrijɾŋ]	‘feel unwell’
b.	/iu/	/t̪hiuk/	[t̪hijuk]	‘commotion’
c.	/iə/	/diəm/	[dijəm]	‘calm’
d.	/ɛa/	/ɔlle-a/	[ɔlleja]	‘will get’
e.	/ɛə/	/sɛər/	[sɛjər]	‘fall asleep’
f.	/ɛɔ/	/pɛər/	[pɛjər]	‘coconut’
g.	/ɔa/	/ka-ratɔ-an/	[karatɔwan]	‘palace/kingdom’
h.	/ɔə/	/sɔər/	[sɔwər]	‘notch’
i.	/ɔɛ/	/ɛka-taɔ-ɛ/	[ɛkataɔwɛ]	‘is known’
j.	/ui/	/bui/	[buwi]	‘fetter’
k.	/ua/	/duaʔ/	[duwɾʔ]	‘two’

By examining the linguistic similarities between Malay and Madurese and other languages (which will be further explored in the subsequent section), such as Fante (Abakah, 2004), Belep (McCracken, 2012), Meithei (Chelliah, 1997), and Blackfoot (Elfner, 2005), we can discern distinct phonological processes employed in their handling of identical adjacent vowels. These processes encompass coalescence and epenthesis.

(36) Glottal stop is inserted between identical vowels (Staroverov, 2014, p. 94)

	VV	Example		Gloss
a.	/aa/	/maca-a/	[macaʔa]	‘will read’
b.	/ɾɾ/	/bɾɾ/	[bɾʔɾ]	‘flood’
c.	/εε/	/mate-ε/	[mateʔε]	‘kill’
d.	/ɔɔ/	/tɔɔt/	[tɔʔɔt]	‘knee’

- e. /uu/ /t^huum/ [t^huʔum] ‘distribute’

Although Casali (1996, 1997, 2011) suggests that languages generally employ the aforementioned and illustrated segments (a glide or a glottal stop) as their preferred segments, there are certain instances where a language may utilize a segment that is not widely used or never utilized by other languages to resolve hiatus. (isi) Ndebele has a different segment that is been used to resolve hiatus. The rationale behind this deviation may be morphologically conditioned. If a noun in (isi) Ndebele commences with /-o/, which serves as a plural marker, the epenthetic segment at the preposition-noun boundary assumes the form /b/ (Sabao, 2015).

(37) Epenthesis in Ndebele (Sabao, 2015, p. 7)

	UR	SR	Gloss
a.	/la-o-mama/	[labomama]	‘with mothers’
b.	/la-o-mangoye/	[labomangoye]	‘with cats’

Sabao (2015) assumes that the back mid vowel /o/ triggers the insertion of /b/. The author does not provide a detailed explanation for the rationale behind /b/ epenthesis, unlike the other epenthetic segments. As previously mentioned, the segment and the vowel must share a common feature with the preceding or preceded vowel (Casali, 1996). In (37), the vowel that shares a feature with /b/ is /o/, which is the second vowel, not the first vowel, /a/. Despite the difference in roundness between /o/ and /b/, both are [+Labial]. This shared [+Labial] feature enables /b/ to be inserted between /a/ and /o/ to resolve the hiatus created. This is an assumption on what is happening. Further research will be needed to substantiate what I have suggested.

Ghorbanpour et al. (2019) support what other scholars have put forth by postulating that the resolution of hiatus is historically driven by morpho-phonemic considerations, citing the case of Persian hiatus. The choice of the inserted segment is influenced by the specific morpho-phonemic environment in which the hiatus occurs. Specifically, the authors bring forth that in adjective formation, a glottal stop [ʔ] is epenthesized, while in noun formation, plural formation, and adverbial derivations, a latent segment [ɹ] is epenthesized. However, the authors are not in agreement with this interpretation of using a latent segment as the epenthetic segment. The study

suggests that these epenthetic segments are in complementary distribution, depending on the grammatical category of the surfacing word. The authors' argument is supported by evidence from Persian.

Additionally, the study provides justification for the role of the [j] segment. It demonstrates that when a suffix is added to a base that ends with /e/, the modality of hiatus resolution differs depending on the derivation. For instance, in adjective formation, hiatus resolution involves the insertion of a glottal stop.

(38) Adjectiviser /-i/ added to bases ending in /e/ (Ghorbanpour et al., 2019, p. 70)

- | | | | |
|----|----------------------------------|------------|----------------------------|
| a. | /ceraje/ 'rent' (n.) + /-i/ | [cerajeʔi] | 'rental' (adj.) |
| b. | /setare/ 'star' (n.) + /-i/ | [setareʔi] | 'starlike' (adj.) |
| c. | /firuze/ 'turquoise' (n.) + /-i/ | [firuzeʔi] | 'turquoise (color)' (adj.) |

With the same /e-i/ sequence in a noun formation, a latent segment is epenthesized to resolve the hiatus created.

(39) Nominaliser /-i/ added to bases ending in /e/ (Ghorbanpour et al., 2019, p. 70)

- | | | | |
|----|--|--------------|-------------------|
| a. | /ɟorosne/ ¹⁰ 'hungry' (adj.) + /-i/ | [ɟorosneji] | 'hunger' (n.) |
| b. | /divane/ 'insane' (adj.) + /-i/ | [divaneji] | 'insanity' (n.) |
| c. | /afsorde/ 'depressed' (adj.) + /-i/ | [ʔafsordeji] | 'depression' (n.) |

In the case of plural formation with a different suffix, it continues to be resolved by the latent segment, but it appears as [g] before a back vowel, as can be seen below too.

(40) Pluraliser /-an/ added to a base ending in /e/ (Ghorbanpour et al., 2019, p. 73)

- | | | |
|------------------------------|-------------|--------------|
| /setare/ 'star' (n.) + /-an/ | [setaregan] | 'stars' (n.) |
|------------------------------|-------------|--------------|

¹⁰ The transcription [ɟorosneji] in (39a) contains the latent symbol [j] in the underlying form. This segment is not part of the underlying Persian consonant system, and its appearance here is likely a typo in Ghorbanpour et al. (2019). The intended form is likely /ɟorosne/ and the surface form then becomes [ɟorosneji] with a latent segment insertion. I retain the data for fidelity to the source. The former is likely a transcription error.

Finally, adverbial derivation leads to latent segment insertion.

(41) Adverbialiser /-ane/ added to a base ending in /e/ (Ghorbanpour et al., 2019, p. 73)

/batʃtʃe/ ‘child’ (n.) + /-ane/ [batʃtʃegane] ‘childishly’ (adv.)

The authors contend that the [j] sound was present in Middle Persian but was absent in modern Persian contexts. They acknowledge the existence of words such as *banda* ‘servant’, which was *bandaj* in Middle Persian. This sound is retained in modern Persian when the same word is pluralized as *bandagan* ‘servants’. Naderi and van Oostendorp (2011) acknowledge that the segment exhibits characteristics more like a latent segment rather than being solely epenthetic. If this is indeed the case, it should be observed to be consistent with all hiatus contexts but not only in morphological environments. The insertion of [j] is considered highly marked, rendering it unlikely to function as a default segment for hiatus resolution. Historical evidence supports the existence of this insertion. Therefore, it is more plausible to suggest that the insertion of [j] is predictable based on the suffix or that it surfaces in hiatus contexts as a historically motivated latent segment rather than a purely epenthetic insertion.

2.2.2 Summary

This review synthesizes the key arguments from various scholars and theoretical frameworks, providing a comprehensive analysis of the phonological motivations, OT model, and typological variations associated with consonant epenthesis. It underscores the widespread occurrence of this phonological process across languages. The literature emphasizes the significant cross-linguistic variation in the selection of epenthetic segments, which are often influenced by phonological, morphological, or historical factors. A prevalent epenthetic strategy involves the insertion of glides, particularly in languages where hiatus resolution or syllable structure constraints necessitate vowel bridging. Similarly, the insertion of the bilabial stop [b] is documented in (isi) Ndebele, where it frequently shares a feature with the rounded vowel /o/. The glottal stop also frequently appears as an epenthetic segment, and Persian exhibits the insertion of a latent segment.

2.3 Coalescence

Languages employ the technique of merging vowel sequences to resolve epenthesis. This approach is adopted as an alternative strategy in addition to epenthesis in the resolution to hiatus. In this section, coalescence will be discussed to show how viable it is to be considered as a strategy for resolving hiatus. A significant number of languages, including Japanese, Washo, Ciyao, and others, use coalescence to address hiatus. For instance, in Japanese (as observed by Youngberg, 2013), Owari and Tokyo Japanese have different realizations of hiatus resolution. While Owari coalesces the vowels, Tokyo Japanese maintains them. The modification in Owari results in a prolonged vowel. The vowel quality changes due to the merger.

(42) Realization of coalescence in Owari and Tokyo Japanese

	Owari Japanese	Tokyo Japanese	Gloss
a.	ræ:nen	rainen	‘next year’
b.	osö:	oso-i	‘slow-PRES’
c.	fury:	furu-i	‘old-PRES’

(Youngberg, 2013, p. 5)

The sequences of /ai/, /oi/, and /ui/ undergo a merging process, in which the resulting vowel is lengthened. Owari permits this merging to occur. Over generations, there has been a shift in the realization of coalescence (Youngberg, 2013). We can observe variation in example (43), where older generations consistently produce coalesced vowels, while younger generations partially exhibit coalescence. The influence of the Tokyo dialect could be a contributing factor to this phenomenon as Youngberg (2013) says.

(43)

	<u>Older speakers</u>	<u>Younger speakers</u>	<u>TJ</u>	<u>Gloss</u>
a.	ræ:nen	rʲænen	rainen	‘next year’
b.	ɕiharʲe:	ɕihæ:rʲæ ~ ɕiharʲa:	ɕiharai	‘payment’
c.	hæ:	hʲæe ~ hae	hae	‘fly’
d.	hæ:	hæ: ~ hʲæ:	hai	‘ashes’
e.	pø:	pø: ~ pe:	-ppoi	‘like’

f. o:	oi	oi	‘nephew’
g. kø:	kø: ~ kœ	kœ	‘fish’

(Youngberg, 2013, p. 5)

While older speakers of Owari Japanese produce coalesced vowels, some younger speakers retain the hiatus, possibly influenced by Tokyo Japanese. This results in generational differences in hiatus resolution. Does this imply that coalescence is not a reliable mechanism for resolving hiatus? This may not be the case, as there are attested examples demonstrating the efficient use of this phonological process. The influence of Tokyo Japanese (specifically, on the Owari dialect) suggests that coalescence may be losing its functionality or relevance over time.

Washo (Jacobsen, 1980 cited in Staroverov, 2014) presents a merger of vowels in bimorphemic stem constructions (i.e., between a lexical prefix and a dependent stem).

(44)

- a. /ua/ /ge-du-aŋaʔ-ha/ IMP-burn-on-CAUS [gadoŋaha] ‘burn it!’
- b. /ɛi/ /ge-sebe-ilbɛ-aʔj-i/ [gesebelbaʔji]
- 3OB-blow-push-away-IPF ‘he’s blowing it away’

(Jacobsen, 1980 cited in Staroverov, 2014, p. 127)

In these cases, the vowel /u/ and /a/ undergo lowering and raising to [o], while /ɛi/ merges to become [e]. These changes are not solely phonological but are influenced by morphological factors. Specifically, the alternation patterns are morphologized, indicating that they are associated with particular morphological constructions rather than being the result of automatic phonetic processes.

One plausible explanation for these mergers is that coalescence occurs when the insertion of a homorganic glide is not feasible. In other words, when glides that share the place of articulation with the adjacent vowels cannot be epenthesized to resolve the hiatus, the two vowels merge into a single segment. Staroverov (2014) suggests that vowel coalescence in Washo serves to satisfy markedness constraints when epenthesis is unavailable. However, this risks circularity: coalescence is said to occur precisely where epenthesis cannot apply. A more principled account

within Optimality Theory would derive coalescence from constraint ranking: when V.V dominates UNIFORMITY, and feature faithfulness constraints (e.g., IDENT[front], IDENT[-high]) favor fusion over deletion, coalescence emerges as optimal regardless of whether epenthesis is 'feasible.' The choice is not a last resort but a consequence of constraint interaction.

Tebay (2018: 7) examines how coalescence in Mee is affected by linear order (i.e., the order of the two vowels in the sequence) and how it yields surface forms like those found in Washo. Notably, this language allows coalescence to operate at word boundaries, irrespective of the morphosyntactic context. For instance.

(45)

- | | | | |
|----|----------|---------|---------------|
| a. | didi-owa | dide:wa | ‘hospital’ |
| b. | peku-epa | peko:pa | ‘near a lake’ |

(Takimai, 2015, p. 229 cited in Tebay, 2018, p. 4)

There is a lowering of a high vowel to a mid-vowel, which is directed toward the preference of non-high vowels. This supports the claim made by Casali (1996) that non-high vowels must be preserved.

Comparing Washo and Mee, although their focus is on coalescence, they diverge in the sequence of vowels involved. While the sequence in Washo is /ɛi/, /ua/, Mee has sequences like /io/ and /ue/. In Washo, the coalesced vowel is not lengthened as it is observed in Mee. This highlights the differences. These two analyses provide insight into how languages can differ in the realization of coalescence. In Youngberg’s (2013) analysis, unary features that are driven by phonological constraints on licensing and headship aided in understanding the merging process. Spread-R and Spread-L demonstrate the directionality of feature spreading, where first vowel features consistently dominate.

Casali (1996) discusses two logical types of coalescence based on the height of the vowels involved: *e*-coalescence and *ɛ*-coalescence. In *e*-coalescence, /a + i/ is realised as [e] and /a + u/ as [o]. This type of coalescence preserves the non-high specification of V₁. The rules must be ordered in a specific manner to first lower the high vowel following the non-high vowel, followed by the

deletion of the first vowel (Casali, 1996). Both sequences are realised in Ciyao and Nguni, as illustrated below. In contrast, ε -coalescence involves the merger of /a + i/ to [ɛ] and /a + u/ to [ɔ]; this pattern is typically found in three-height (seven-vowel) systems where the feature [-ATR] is phonologically active (Casali, 1996: pp. 87–90). Since the present study focuses on Esahie and Nzema, only e -coalescence is relevant to the following discussion.

(46) Coalescence as a resolution mechanism for hiatus in Ciyao (Ngunga, 2000, p. 24)

UR	SR	Gloss
a. /a + i/ → [e:]		
/ma-ísó/	[mé:só]	‘eyes’
b. /a + u/ → [o:]		
/ma-úngu/	[mó:ngu]	‘pumpkins’
/ma-úvá/	[mó:vá]	‘days’
c. /a + e/ → [e:]		
/ga-éswé:lá/	[gé:swé:lá]	‘white’
d. /a + o/ → [o:]		
/ma-óla/	[mó:la]	‘frogs’

In example (46), we observe that both [+low] and [+high], [+low] and [-high] merge, resulting in a [-high] vowel. Although the resulting (third) vowel is a mid-vowel, it shares characteristics with the first and second vowels, as Casali (1996) suggests. In examples (46a) and (46c), the resulting third vowel shares the [-high] feature with the first vowel. Additionally, it shares the [-round] feature with the first and second vowels. On the other hand, in examples (46b) and (46d), the resulting third vowel shares the [-high] feature with the first vowel and shares the [+round] feature with the second vowel. This aligns with Casali’s (1996) description of height coalescence, where /a + i/ coalesce to [e], and /a + u/ coalesce to [o]. In Ciyao, as evident from the examples in (46), not only /a + i/ and /a + u/ coalescence that leads to [e] and [o], but also /a + e/ and /a + o/. This is because /i/ and /e/ share the same frontness, while /o/ and /u/ share the same backness and roundness. Furthermore, let us consider examples from Nguni (Sibanda, 2009) to illustrate this phenomenon.

(47) Coalescence in Nguni (Sibanda, 2009, p. 12)

UR	SR	
a. /a+isi/	[esi]	‘the big chair’
b. / a+ulu/	[olu]	‘the long stick’
c. / la+inja/	[lenja]	‘and/with the dog’
d. /la+umuntu/	[lomuntu]	‘and/with the person’

As observed in (47), coalescence is applied in Nguni when the vowel /a/ is followed by either /i/ or /u/, resulting in [e] or [o]. Notably, the first vowel (which is [+low]) and the second vowel (which is [+high]) share a common feature with the resultant vowel [e], namely, [-round]. However, this is not the case in (47b) and (47d). It is necessary to note that the resultant vowels, both [-high], are nevertheless [+ATR]. This aligns with Casali’s (1996) description of a canonical height coalescence, specifically belonging to e-coalescence.

Harford (1997) examines vowel coalescence in Shona, focusing on two main triggers: epenthetic /i/ and a historical initial vowel. One of her key examples involves the verb form *u-no-bv-a pi* ‘where does it come from?’. The monosyllabic clitic *pi* cannot stand alone as a word. To remedy this, Shona may either cliticize *pi* to the preceding verb or insert an epenthetic /i/ (giving *ipi*). When epenthesis applies, the sequence of /a/ (verb final vowel) + /i/ (epenthetic) coalesces to [e], resulting in *u-no-bv-e-pi*. This demonstrates how epenthetic /i/ can trigger coalescence, fully resolving the hiatus without any remaining vowel sequence. Harford’s analysis thus shows that coalescence is a complete repair strategy, not one that leaves hiatus unresolved.

(48) Epenthetic *i*-insertion

u-no-bv-a pi

Epenthetic *i*-insertion

u-no-bv-a ipi

Cliticisation

u-no-bv-**a-i**-pi (vowels to undergo coalescence in bold)

Vowel coalescence and vowel shortening

u-no-bv-e-pi

(Harford, 1997, pp. 74–75)

By synthesizing the data from these languages, we can deduce that coalescence in Shona primarily targets syntactic boundaries inside a phonological word, not all vowel junctures. In Shona, coalescence is triggered by an epenthetic /i/ (inserted to avoid monosyllabic words) and by a historical initial vowel that is no longer present but left behind coalescence effects (Harford, 1997). In contrast, Owari Japanese uses coalescence in both monomorphemic and compound forms, producing long vowels as surface outputs; the process is triggered whenever sequences such as /ai/, /oi/, or /ui/ occur across morpheme or word boundaries. Mee and Washo coalesce vowels at morpheme boundaries, and this process is characterized by linear order: the first vowel in the sequence determines the features of the resulting vowel. In Mee, the trigger for coalescence is simply the presence of two adjacent vowels, with the directionality fixed to left-to-right (Tebay, 2018). Unlike Shona and Owari Japanese, coalescence in Mee adheres to strict directionality, ensuring that the underlying vowel sequence influences the surface form.

2.3.1 Summary

Coalescence is another way that languages fix vowel hiatus by merging two adjacent vowels into one new vowel. The new vowel often shares features from both original vowels. Different languages use coalescence in different ways, but the goal is always to avoid having two vowels next to each other.

In Shona, coalescence happens mostly at certain grammatical boundaries, such as between a preposition and a noun, or between a verb and a following particle. Two main things trigger coalescence in Shona: an extra vowel /i/ that is added to fix very short words, and a historical vowel that no longer exists but leaves behind effects on how vowels combine. Shona only allows coalescence inside a single phonological word, not across word boundaries.

In Owari Japanese, coalescence is more widespread. It occurs inside single words (monomorphemes) and in compound words. When two vowels merge in Owari Japanese, the result is a long vowel. This long vowel keeps some features of the original vowels.

In Mee, coalescence follows a strict left-to-right direction. That means the first vowel in the sequence decides what the final merged vowel will sound like. This is different from Shona and

Owari Japanese, where the direction is not always the same. In Washo, coalescence also happens at morpheme boundaries, and the first vowel again determines the quality of the merged vowel.

Even though each language does coalescence in its own way, they all use it for the same purpose: to remove vowel hiatus and make speech smoother. The differences come from each language's own sound rules and grammar.

2.4 Vowel elision

Elision can be applied in various linguistic structures, including lexical words, the boundaries between lexical and functional words, CV prefixes and roots, and root-suffix combinations. Pulleyblank (1988) and Casali (1997) have both illustrated how elision operates, highlighting that these junctures, as observed in the previous analysis, are susceptible to hiatus, potentially disrupting the seamless flow of speech. To maintain a natural and fluent speech pattern, elision plays a crucial role in ensuring this. This is significant and it will be discussed further in this section.

The specific vowels that elide and the precise points at which they do so are language-specific. Casali (1997) has observed that the initial vowel of the cluster tends to be elided in cases of vowel elision. Additionally, there are specific environments where elision is likely to occur. Casali (1997) has identified instances of elision within words (e.g., Yoruba, Pulleyblank, 1988) and across word boundaries (e.g., Ewe, Shona). Furthermore, the triggers for elision may be unique to particular languages.

ChiChewa provides an example of a vowel one and a vowel two at word boundaries that are prone to elision. Additionally, the data indicates the triggers for these elisions. As Sabao (2013) asserts, this phenomenon is prevalent in Bantu languages. However, it is essential to examine ChiChewa language to determine the validity of this claim. Based on Sabao (2013)'s findings, both the first and second vowels are likely to be elided, contingent upon the structural position of the functional word. Below are instances of first vowel elision, where the functional word occupies the prefix position:

(49)

- | | | | | |
|----|--------------|----------|---|--------------------|
| a. | si-u-pita | /supita/ | /i ₁ #u ₂ /→[u ₂] | ‘you will not go’ |
| | neg-you-go | | | |
| b. | si-u-funa | /sufuna/ | /i ₁ #u ₂ /→[u ₂] | ‘you don’t want’ |
| | neg-you-want | | | |
| c. | si-u-dya | /sudya/ | /i ₁ #u ₂ /→[u ₂] | ‘you will not eat’ |
| | neg-you-eat | | | |

- | | | | | |
|----|---------------|-----------|---|----------------------|
| d. | si-u-lira | /sulira/ | /i ₁ #u ₂ /→[u ₂] | ‘you will not cry’ |
| | neg-you-cry | | | |
| e. | si-u-lemba | /sulemba/ | /i ₁ #u ₂ /→[u ₂] | ‘you will not write’ |
| | neg-you-write | | | |

(Sabao, 2013, p. 34)

From the data provided, it is evident that the CV prefix is affected by elision. However, the free morpheme (root word) remains protected. It is possible that the language prefers eliminating material from prefixes rather than from roots. Height and backness could be contributing factors, as suggested by Mtenje (1980) cited in Sabao (2013). However, this impact on elision may be minimal. Phonological processes are triggered when a segment conflicts with the language’s phonotactics. Sabao (2013) shows in (49) that the vowel of a CV prefix can undergo elision when it creates a hiatus. However, the presence of a prefixed vowel does not automatically trigger deletion. As shown in (50), when the lexical word does not begin with a vowel, there is no hiatus and consequently no elision. Thus, elision is conditioned by the phonological environment, not simply by the presence of a prefix.

Additionally, there should be a condition that triggers elision. A vowel falling within a CV prefix does not automatically delete, as seen in (50). Similarly, when the lexical word does not begin with a vowel, there is no possibility of inserting a vowel that could lead to hiatus. Synthesizing (49) and (50) indicates that, elision affects a functional word only when it is the source of the hiatus, not indiscriminately.

(50)

- | | | | |
|----|------------|------------|---------------------|
| a. | si-upano | /sipano/ | ‘it’s not here’ |
| | neg-here | | |
| b. | si-umunthu | /simunthu/ | ‘it’s not a person’ |
| | neg-person | | |
| c. | si-uwanga | /siwanga/ | ‘it’s not mine’ |
| | neg-mine | | |
| d. | si-ukonko | /sikonko/ | ‘it’s not there’ |
| | neg-there | | |

This rationale is substantiated by Mtenje’s example (cited in Sabao, 2013, p. 35) regarding the deletion of the second vowel. As indicated in the text provided, when the position of the word is shifted, the vowel in the lexical word is deleted.

(51)

- a. mwana + uyu /mwənəyu/ /a₁#u₂/ → [a₁] ‘that/this child’
child-this/that
- b. nyumba + iyi /nyumbayi/ /a₁#i₂/ → [a₁] ‘this house’
house-this
- c. denga + ili /dengali/ /a₁#i₂/ → [a₁] ‘this roof’
roof-this
- d. anthu + awa /anthuwa/ /u₁#a₂/ → [u₁] ‘these people’
people-these

(Sabao, 2013, p. 35)

Cindali, Akóóse, and Nambya (Kadenge, 2010) exhibit similar characteristics to ChiChewa in their targeting of functional words. In Cindali, the second vowel is not left unchanged; rather, the surviving vowel undergoes compensatory lengthening. This strategy ensures that the syllable timing or phonological weight remains intact. The pattern depicted below illustrates the position of the functional word, parallel to example (52) in Cindali.

(52) Cindali

	UR	PR	UF	EG
a.	/i-tʃĩ-éni/ AUG-7-forehead	[itʃê:ni]	*itʃje:ni	‘forehead’
b.	/i-tʃĩ-ávu/ AUG-7-jaw, palate	[itʃâ:vu]	*itʃjâ:vu	‘jaw, palate’
c.	/i-tʃĩ-akulja/ AUG-7-food	[itʃa:kulja]	*itʃja:kulja	‘food’
d.	/i-tʃĩ-úku/ AUG-7-mould	[itʃû:ku]	*itʃjû:ku	‘mold’

e. /i-tʃĩ-ola/

AUG-7-bag	[itʃô:la]	*itʃjô:la	‘bag’
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f. /i-tʃĩ-aβupi/

AUG-7-gift	[itʃa:βupi]	*itʃj a:βupi	‘gift’
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(Mtenje-Mkochi, 2018, p. 331)

Elision does not solely impact the vowel /i/ in functional words, as observed in (52) in Cindali, unlike in ChiChewa. This occurs when a vowel within a functional word forms part of the sequence of vowels that would otherwise result in hiatus. In the examples (53) and (54), /a/ and /u/ appear to be functional affixes or markers. This pattern aligns with the phonological tendency to be subject to elision. Consequently, they elide. What distinguishes Cindali is its unique approach to this elision process. Just as it prevails in the elision of /i/, the vowel that persists in the root morpheme is lengthened to compensate for the loss. This phenomenon manifests in both nouns and verbs. This compensation differs from what occurs in ChiChewa, where vowel lengthening does not transpire after the deletion process. Essentially, in Cindali, the language maintains a balanced rhythm by lengthening the surviving vowel.

(53) Deletion of /a/ before another vowel

	UR	PR	EG
a.	/N-a-ímb-a/		
	1sSM-PFV-sing-FV	[nî:mba]	‘I have sung’
b.	N-a-énd-a/		
	1sSM-PFV-walk-FV	[nê:nda]	‘I have walked’
c.	N-ka-énd-a/		
	1sSM-Rpast-walk-FV	[ŋgê:nda]	‘I walked’
d.	/tu-ka-énd-a/		
	1pSM-Rpast-walk-FV	[tukê:nda]	‘we walked’
e.	/a-ka-is-a/		
	3sSM-Rpast-come-FV	[akî:sa]	‘s/he came’

f. /mu-ka-isa-ya/

2pSM-Rpast-come-ASP [mukî:saya] ‘you (pl) used to come’

g. /N-a-imb-ite/

1sSM-PST-sing-PFV [nî:mbite] ‘I sang’

(Mtenje-Mkochi, 2018, p. 332)

(54) Deletion of rounded vowel in hiatus situations

	UR	PR	UF	EG
a. /u-ku-óp-a/				
	AUG-INFV-fear-FV	[ukô:pa]	*ukwopa	‘to be afraid’
b. /u-ku-onḡány-a/				
	AUG-INF-mix-FV	[uko:ḡána]	*ukwoḡana	‘to mix’
c. /u-ku-ótel-a/				
	AUG-INF-bask-FV	[ukô:tela]	*ukwotela	‘to bask’
d. /u-ku-onḡ-a/				
	AUG-INF-suck-FV	[ukô:ḡa]	*ukwoḡa	‘to suck’
e. /u-ku-ókel-a/				
	AUG-INF-transplant-FV	[ukô:kela]	*ukwokela	‘to transplant’
f. /u-ku-ótʃ-a/				
	AUG-INF-roast-FV	[ukô:tʃa]	*ukwotʃa	‘to roast’

(Mtenje-Mkochi, 2018, p. 333)

The distinctive observation from these examples sets it apart from ChiChewa and Akóóse. Prosodic structures are preserved through lengthening. It is also evident that the deletion of /a/, /i/, and /u/ is influenced by position. Since root morphemes carry semantic weight in contrast to prefixes, functional words become more disposable and can be elided.

Casali (1996) demonstrates the directionality of elision, indicating that vowel elision can target either the leftmost or rightmost vowel in a sequence. This phenomenon is not confined to a single language family but is observed across various languages, including Etsako, and Akóóse (a Bantu language spoken in Cameroon). The examples provided support the foregoing discussion on the

directionality of elision. These examples illustrate the distinction between a Bantu language and another language like Etsako in terms of whether the target is the functional or lexical word.

(55)

- a. **Akóóse** (Ekanjume, 2010, p. 163)

/b <u>e</u> / + /awinde/	→	[bawinde]
plural pencil		‘pencils’

- b. **Etsako** (Casali 1997, p. 493)

d <u>e</u> / + /akpa/	→	[dakpa]
buy cup		‘buy a cup’

(56)

- a. **Akóóse** (Ekanjume, 2010, p. 160)

/ekù/. + / <u>e</u> mvèd/	→	[ekùmwèd]
leg left		‘left foot’

- b. **Etsako** (Casali 1997, p. 493)

/akpa/ + / <u>ɔ</u> nikeθe/	→	[akpanikeθe]
cup small		‘a small cup’

These languages demonstrate that both rightmost and leftmost vowels are susceptible to elision. However, the examples suggest that the target of elision cannot be determined solely based on the individual vowels. Instead, the interplay between the lexical and functional words in the compounded words provides a clearer framework to understand the dynamics. While (55) reveals the leftmost deletion, (56) shows the rightmost deletion.

Akóóse differs from other Bantu languages such as ChiChewa and Etsako in how it handles elision at morpheme boundaries. While Akóóse follows the pattern of other Bantu languages (eliding the vowel of the functional word), Etsako does not always behave the same way. For example, in (55) where both words are lexical, deletion affects the vowel of the first word (e.g., /de/ + /akpa/ → [dakpa] ‘buy a cup’). In (56), however, deletion affects the vowel of the second word (e.g., /akpa/ + /ɔnikeθe/ → [akpanikeθe] ‘a small cup’). Thus, the direction of elision in Etsako is not

consistently predictable from the position of functional words, unlike in many other Bantu languages where functional words are more likely to be elided.

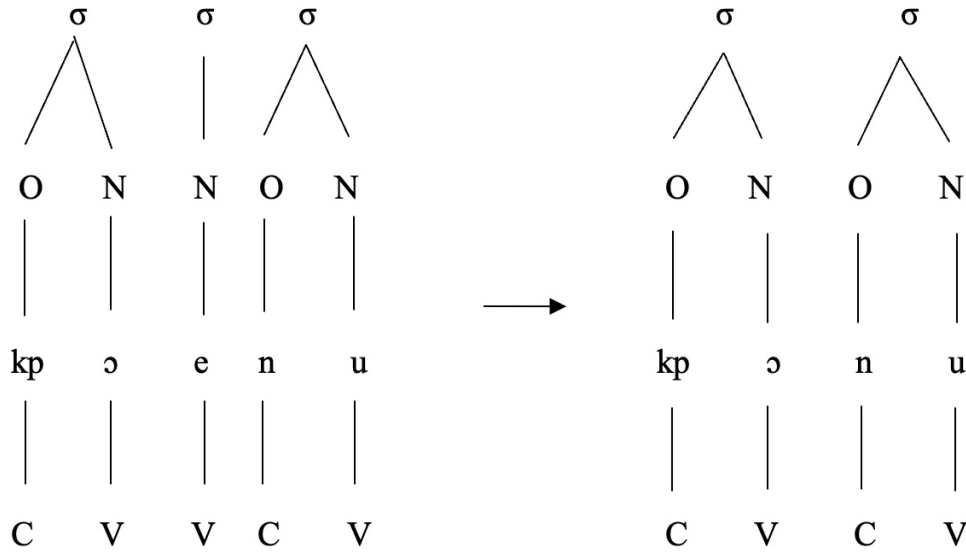
The alternation in Ewe is similar to Etsako because their realization is not straightforward. The data in (57 a-b) have a compound made of lexical words. Despite the absence of a functional word, there is still a deletion. A step further to (57c-d) gives a different realization, where there is a functional and lexical compound. Predicting the target based on the position of either the functional or the lexical word is impossible.

(57) Ewe (Motte, 2013, p. 12)

	Word	Gloss	Word	Gloss	SR
a.	koko	‘cocoa’ +	agble	‘farm’ →	*kokoagble → kokogble (cocoa farm)
b.	aha	‘liquor’ +	kpa	‘to tap’ + ehe	‘knife’ → *ahakpache → ahakpahe (a knife used in tapping liquor)
c.	kpɔ	‘to see’ +	enu	‘something’ →	*kpɔenu → kpɔnu (to see something, an image)
d.	ble	‘deceive’ (v) +	ame	‘someone’ (n) →	*bleame → blame (to deceive someone)

Diagram (58) illustrates the process of vowel elision in Ewe. The left-hand structure shows a vowel hiatus where two vowels occur in separate syllables. The right-hand structure shows the outcome after vowel elision: the second vowel has been deleted. This visual representation supports the discussion of Ewe vowel elision by showing how the language removes one vowel to achieve a well-formed syllable structure (Motte, 2013)

(58) Environment for vowel elision in Ewe



(cf. Motte, 2013)

The Fante examples (59) show some resemblance to the aforementioned languages, and its realization of elision could be considered more straightforward compared to Ewe. Both the initial and final vowels in hiatus are susceptible to deletion (Abakah, 2004), resulting in a smoother transition between morphemes. Furthermore, it maintains phonological economy. Predicting whether a vowel survives or is deleted can be based on the functionality and lexicality of the morpheme.

Generally, in the examples provided (59), elision targets the rightmost vowel in a sequence, originating from the second morpheme. For instance, in *okura* + *ɔbiri* → *okurabir* ‘female mouse’, the initial and final vowels of the second morpheme are elided, preserving the initial vowel of the preceding morpheme. Similarly, in *kɔtɔ* + *itu* → *kɔtɔtu* ‘crab hole’, the first vowel of the second morpheme is deleted. These examples illustrate one of the directional patterns of vowel deletion, specifically targeting the second vowel to prevent hiatus. In these examples, the second word may be a modifier (e.g., *ɔbiri* ‘female’) or the head of the compound (e.g., *itu* ‘hole’), but in either case the elision target is the rightmost vowel. This pattern is comparable to findings in Akan (Dolphyne, 2006) and Ewe (Clements, 1986; Motte, 2013), where vowel elision resolves hiatus but occasionally alternates with glide formation or vowel coalescence.

(59) Fante vowel elision (Abakah, 2004, p. 183)

A	B	C (A+B)	Gloss
a. okura	ɔbiri	okurabir	‘female mouse’ (mouse + female)
b. kɔtɔ	itu	kɔtɔtu	‘crab hole’ (crab + hole)
c. wɔ	ɪɖɛɪn	wɔɖɛɪn	‘your grey hair’ (your + grey hair)
d. mi	osew	misew	‘my in-law’ (my + in-law)
e. tu	imuna	tumuna	‘to dig a hole’ (dig + hole)

Abakah’s data also reflects the tendencies in languages such as Cindali, Akóóse, Etsako, Yoruba, and Igbo, where similar hiatus resolution strategies are applied at morpheme boundaries. However, unlike Ciyao (in 46), which often employs coalescence as an alternative strategy (Ngunga, 2000), the data here indicates a rigid preference for elision. This uniformity highlights language-specific phonological priorities.

Interestingly, the absence of vowel coalescence in the data distinguishes this language from others where coalescence is a frequent hiatus resolution strategy. For instance, in Bantu languages like Swahili, coalescence often merges the qualities of the adjacent vowels into a single vowel (Odden, 1996). Abakah’s data, however, reveals a more straightforward mechanism, where the second vowel is entirely elided, suggesting an underlying principle of phonological simplification rather than complex integration.

This second set of data (60) from Abakah (2004, p. 184) reveals a different pattern of elision compared to (52). Here, elision targets the first vowel in a sequence rather than the second. The surviving vowel undergoes lengthening, a compensatory process similar to Cindali and ChiChewa. This reverse order provides insight into the flexibility of morphophonemic processes in the language and highlights dialectal variations that influence output realizations.

(60)¹¹

Input	Output	Gloss
a. <i>mɪ # asɪw</i>	[maasɪw] (Ig. / An/)	‘my in-law’
b. <i>wɔ # abufuw</i>	[weeb ^w uf ^w uw] (Ig. / An)	‘your anger’
	[wææb ^w uf ^w uu] (Bk)	‘your anger’
c. <i>nɪ # akumã</i>	[neek ^w umã] (Ig. / An)	‘his or her axe’
	[nææk ^w umæ̃] (Bk.)	‘his or her axe’
d. <i>kofɪ # anan</i>	[kofɪaanan]	‘Kofi Anan’ (a proper name)
e. <i>dzi # adziban</i>	[dzeedziban] (Ig. / An.)	‘eat food’
	[dzæædzibẽĩ] (Bk.)	‘eat food’
f. <i>ɔ + jɛ # adzɪ</i>	[ɔjaadzɪ]	‘he or she does well’

(Abakah, 2004, p. 184)

In the example *mɪ # asɪw* → [maasɪw] ‘my in-law’, the initial vowel of the first morpheme is elided, and the second vowel is lengthened. This is a clear instance of vowel elision.

Abakah (2004) also describes dialectal variation in Fante hiatus resolution. For the phrase ‘your anger’, Iguae and Anee resolve the hiatus through coalescence (giving [weeb^wuf^wuw]), while Boka uses elision (giving [wææb^wuf^wuu]). Since this section focuses on vowel elision, the coalescence patterns of Iguae and Anee are mentioned only for comparison; the Boka form illustrates the elision strategy. A detailed analysis of the dialectal differences is beyond the scope of this study.

In contrast to the earlier data (which favored elision of the second vowel), the examples below show deletion of the first vowel. For instance, in *dzi # adziban*, the first vowel is elided, simplifying the sequence while preserving the prominence of the second vowel through lengthening. This shift in elision preference shows that Fante employs multiple strategies for resolving vowel hiatus, with the choice influenced by the morphophonemic context.

A distinctive characteristic of this data is the compensatory vowel lengthening that accompanies elision. This process ensures that the deletion of a vowel does not result in a diminution of

¹¹ Note (Ig. = Iguae, An. = Anee, Bk. Boka). They are all sub-dialects of Fante.

phonological weight, thereby preserving the prosodic structure of the word. This phenomenon is consistent with findings in other languages, such as Cindali and ChiChewa, where compensatory lengthening compensates for the phonological impact of segment deletion.

The presence of dialectal variation adds another layer of complexity. In the Iguae and Anee dialects, the word *akumã* (his or her axe) undergoes vowel lengthening with minimal quality change, resulting in pronunciations such as [neekumã] or [nææk^wumã]. Conversely, the Boka dialect exhibits nasalization and centralization of the surviving vowel. This demonstrates that while the core phonological process remains consistent, dialect-specific phonetic preferences influence the final output. When compared to the (52) dataset, this second dataset highlights the language's dynamic approach to resolving vowel hiatus. While the first dataset favored the elision of the second vowel, this dataset consistently deletes the first vowel, compensating with the subsequent lengthening of the surviving vowel.

As noted by Abakah (2004), Clements (1986), and Lunden (2018), it is noteworthy that when two vowels of the same quality appear to be in sequence, it becomes challenging to determine which vowel in the sequence is deleted. Various scholars have proposed strategies to account for this phenomenon. Clements (1986) observed that the first vowel is the one that is deleted. Subsequently, the second vowel spreads to compensate for the deleted vowel. This behavior appears to be similar to that observed by Elfner (2005, cited in Lunden, 2018). In Blackfoot, identical adjacent vowels across morpheme boundaries tend to be long vowels. Based on the data provided, accounting for an adjacent identical vowel can be interpreted as indicating that the syllable consists of two moras, as exemplified in (61).

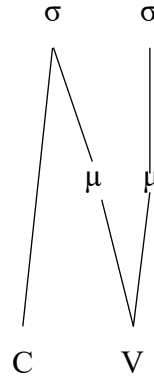
(61)

Blackfoot /ápokomi-iksi/ → [á.pɔ.ko.mi:k.si] ‘horses with white neck markings’

a. as a long vowel



b. in hiatus



(Lunden, 2018, p. 3)

Elfner’s argument can be interpreted as a reflection of bimoraic structure. From our current understanding, each vowel contributes a mora. They significantly influence tone, stress, and rhythmic patterns. This interpretation aligns with Prince’s (1983) Weight-Stress Principle, which states that bimoraic (heavy) syllables attract more stress than monomoraic ones.

Hayes (2009) perceives adjacent identical vowels differently. He argues that this occurrence can result in compensatory lengthening. This form of lengthening is what Mba (2011) characterizes as “assimilation”. However, a closer examination of the data reveals that the process is best analysed as vowel elision with compensatory lengthening: the first vowel is deleted, and the second vowel is lengthened just as in Boka (a dialect of Fante) according to Abakah (2004).

(62) Assimilation as hiatus resolution in Igbo (Mba, 2011)

UR	SR	Gloss
a. ulo + elu	uleelu	‘storey building’
b. ùdé + ísí	údíísí	‘hair pomade’
c. ódù + águ	ódáágu	‘tiger’s tail’
d. àkpà + égó	àkpéégó	‘bag of money’

In Blackfoot, a sequence of identical vowels across a morpheme boundary is realized as a single long vowel (e.g., /apokomi-iksi/ → [apokomi:k.si] ‘horses with white neck markings’),

which is tautosyllabic and therefore eliminates hiatus entirely (Elfner 2005). In Igbo, Mba (2011) describes a process of vowel deletion and compensatory lengthening: when a vowel is elided, the remaining vowel is lengthened. This is comparable to the Fante patterns observed by Abakah (2004), where a surviving vowel is lengthened after deletion (e.g., in the Boka dialect of Fante). In Belep, on the other hand, the sequence /ju-u/ (from the ditransitive verb ‘dig’) surfaces as [ju.u], i.e., two short vowels in separate syllables; here, hiatus is not eliminated (McCracken, 2012). These languages thus illustrate different strategies for treating adjacent identical vowels.

(63)

Belep /ju-u/ → [ju.u] ‘dig (ditransitive)’

(Lunden, 2018, p. 3)

2.5 Adjacent Identical Vowels in other languages

In addition to the strategies discussed so far, languages employ various techniques to resolve hiatus created by sequences of adjacent identical vowels. One such technique, observed in Malay, is the insertion of a glottal stop. This occurs not only at word boundaries, as seen in the preceding examples, but also in word-medial positions. Other languages, such as Barwe, use glide insertion to separate identical vowels. In Fante, the second vowel deletes in the hiatus resolution process. This section briefly examines how several languages treat identical vowel sequences, providing a cross-linguistic context before the analysis of Esahie and Nzema in Chapter Four.

(64) Identical vowels in word-medial position

- a. /saat/ [sa.ʔat] ‘seconds, moment’
- b. /peel/ [pe.ʔel] ‘behavior’
- c. /suum/ [su.ʔum] ‘rice noodle’
- d. /maap/ [ma.ʔap] ‘forgive, pardon’
- e. /tabii/ [ta.bi.ʔi] ‘instinct or form’

(65) Identical vowels in Affixed forms

- a. /tʃuba+an/ [tʃu.ba.ʔan] ‘test’
- b. /kə-əmpat/ [kə.ʔəm.pat] ‘fourth’

- c. /di-ikat/ [di.ʔi.kat] ‘to tie (passive)’
- d. /kə-ənam/ [kə.ʔə.nam] ‘sixth’
- e. /di-intip/ [di.ʔin.tep] ‘to spy (passive)’ (Sun & Chung, 2023, p. 435)

This segment could serve as a least marked segment for resolving this issue. These are Arabic loanwords adapted into Malay (Sun & Chung, 2023). Since this language does not tolerate hiatus, a glottal stop is inserted at morpheme boundaries between identical vowels to break the sequence. This adaptation may have occurred because it has the propensity to break vowels, ensuring their distinct recognition. This is because there could be a momentary pause in both (64) and (65). It may be perceived that these identical vowels are separate and should be in different syllables. (64) demonstrates the ability of the glottal stop to mark the syllable boundary. Without it, the sequence could be interpreted as a long vowel. In the affixed forms in (65), it separates the root word from the affix for clarity. Glides are occasionally used to separate adjacent identical vowels, as exemplified in Barwe. From the data, it appears that the selected glide shares the same place of articulation with the vowels in the sequence.

(66) Barwe hiatus resolution

- a. /mu-uyi/ → [muuyi] / [muwuyi] ‘he/she who comes’
- b. /mu-umisi/ → [muumisi] / [muwumisi] ‘he/she who dries things’

(Mangoya, 2012, p. 77)

Fante stands out among the languages discussed above. Instead of inserting a segment, one of the vowels is eliminated through elision. Abakah (2004) proposes a tone-based approach to address this issue, as exemplified in example (67), showing how tonal processes can disambiguate adjacent identical vowels. Abakah’s approach appears to be the most suitable solution to this problem. He argues that because the two identical vowels carry different tones (e.g., a high tone on V₁ and a low tone on V₂), they cannot be interpreted as a single long vowel (which would bear only one tone) nor as a single underlying phonological unit; instead, they are two separate vowels, each with its own tone. Abakah’s analysis highlights the potential of tone as a primary strategy for resolving identical vowels, rather than the other approaches discussed previously. To further illustrate this, consider the examples provided below.

(67)

Input	Output
a. [ɲkòtòwá # àséǹ]	[ɲkòtòwàséǹ] ‘light issue’
[ɲkwàntá # ànáǹ]	[ɲkwàntànáǹ] ‘crossroad’
[kwàsiá # àdzɔ́ɲ]	[ɲkwàsìàdzɔ́ɲ] ¹² ‘foolish thought’
b. [àdzìɔ́iá # àdzí]	[àdzìɔ́iádzí] (the act of carrying # thing) ‘load’
[èteíwá # àdzí]	[èteíwádzí] (a thing despised # thing) ‘an abomination’
c. [èsù má # àdzí]	[èsù má'dzí] (hiding # thing) ‘a secret thing’
[àsò má # àséǹ]	[àsò má'séǹ] (sending # matter) ‘a message’

(cf. Abakah, 2004, p. 186)

This data elucidates the interaction between tone-bearing units in resolving identical vowel hiatus. Clements (1986) proposed a Twin Vowel Deletion rule for Luganda, whereby the first of two identical vowels deletes and the second spreads to occupy its position. Abakah (2004) examines whether this rule applies to Fante, where two identical vowels at a word boundary carry different underlying tones: the first vowel (V_1) bears a high tone, and the second vowel (V_2) bears a low tone.

Abakah identifies three patterns. In (67a), the high-toned V_1 deletes while the low-toned V_2 survives, resulting in no downstep. This aligns with Clements’ suggestion that V_1 deletes, and Abakah’s data partially supports this pattern, as the low-toned vowel persists. However, (67b) presents a deviation: the high-toned V_1 also deletes, but its high tone spreads to V_2 , dislodging its underlying low tone. Again, no downstep occurs. These cases show that deletion of the high-toned vowel does not produce downstep.

The crucial counterexample appears in (67c). Here, at a morpheme boundary, the configuration is HLH. In this instance, it is the low-toned V_2 that deletes. Its low tone does not delete but rather

¹² In Abakah's (2004) data, the syllabic velar nasal [ɲ] that appears in some output forms is a nominalizer prefix in Akan (Fante). It is morphologically conditioned and not part of the hiatus resolution process itself. The same nasal segment can also function as a negation marker or a plural marker in other contexts.

floats, and this floating low tone causes the following high tone to be downstepped, yielding HL'H or H'H. This downstep effect occurs only when V₂ (the low-toned vowel) is elided.

Thus, Abakah demonstrates that either V₁ or V₂ can delete in Fante, but downstep is diagnostic of V₂ deletion: the floating low tone affects the following high tone, not the preceding one. This phenomenon is characteristic of Akan tonology and provides a tonal solution to the otherwise ambiguous question of which identical vowel deletes.

Linguistic analyses across various contexts reveal that elision primarily targets functional words within compound sequences. The debate centers on the directionality of elision, whether it occurs from the rightmost or leftmost functional word. Contrary to some scholars' claims that the directionality is linked to individual vowels, the data suggests that elision operates dynamically, depending on the position of the functional word. Abakah's approach in resolving adjacent identical vowels stands out as the most comprehensive and robust in my opinion. It provides a clearer resolution compared to Clements, Elfner, McCracken, and Chelliah. These analyses leave traces of hiatus or fail to fully account for the interaction of vowels. Belep, Blackfoot, Meithei, and Luganda appear incomplete after applying the approaches proposed. However, in Fante, as suggested by Abakah, the process ensures well-formedness and eliminates ambiguity. Abakah's approach serves as a compelling model that could inform its application in subsequent chapters of this study.

2.6 Summary

This chapter explained the diverse linguistic strategies employed to account for hiatus, including elision, epenthesis, and coalescence. The review examined various positions and existing analyses of hiatus, drawing upon language-specific examples. These examples show that different languages may favor different strategies depending on their phonological inventory and syllable structure constraints. While sequences of identical vowels may exist across languages, the phonological processes applied to resolve the hiatus created differ. The review further explored how different frameworks have been utilized to analyze these hiatus resolution strategies in various languages.

CHAPTER THREE

Methodology

3.0 Introduction

This chapter presents the methodology and procedures used in the study to address the research questions guiding this study on hiatus resolution in Esahie and Nzema. It provides an account of the research design, area of study, population and sampling techniques, data collection instruments and procedures, as well as methods of data analysis. In addition, the chapter clarifies the structure and interpretation of the dataset presented in the appendices. Because the goal of this research is to observe and describe the patterns as they naturally occur in both languages, I adopt a qualitative, descriptive research design rooted in fieldwork. The aim is to ensure transparency, reliability, validity and methodological rigor.

3.1 Research design

The study uses a descriptive research design, which falls under the qualitative design. A descriptive design is appropriate when the researcher's goal is to give a detailed picture of a linguistic situation as it exist, without manipulating the environment or testing an experimental hypothesis (Owu-Ewie, 2017). In this study, I recorded natural speech and how the speakers pronounced the task that I provided. I then described the phonological patterns that emerged.

Descriptive research design offers flexibility because, in the interview and recording sessions, I could ask follow-up questions when something unexpected happened. For instance, when a respondent goes off track or pronounces a word in a different manner. I could also probe further to understand the conditions under which a speaker preferred one surface form over another. That flexibility is crucial in descriptive phonological work, because many repair strategies are subtle and can only be clarified through in-depth questioning with the same speaker.

3.2 Area of study

Fieldwork was conducted in the Western and Western North Region of Ghana, where Esahie and Nzema are spoken by a sizeable proportion of the population. The specific districts and settlements chosen were:

Nzema: Jomoro Municipality, Ellembelle District, and Nzema East Municipality

Esahie: Sehwi Wiawso Municipal district (Asawinso, Sehwi Bekwai, and Wiawso).

The motive behind the selection of these areas is that they lie inside the traditional speech communities of the two languages, yet at a sufficient distance from large Akan-dominant cities to reduce the daily influence of Akan on the local phonology. In addition, some elicitation and verification sessions were held on the campus of the University of Education, Winneba, Ajumako (Central Region). This location gave me access to educated adult native speakers who were students and staff in the Department of Akan-Nzema Education on Ajumako campus. Working with these consultants from the Akan-Nzema Department made it possible to discuss written forms, check transcriptions, and obtain self-monitored pronunciations while still drawing on their intuitions as first language speakers. It is important to note that Nzema has a standardized, government-sponsored orthography (Annan, 1980; Essuah, 1965, etc.). Esahie, by contrast, has a developing orthography (Broohm, 2019; Owusu-Ansah, 2020, etc.) but is not yet fully standardized nor taught as a formal subject at any Ghanaian university. This study contributes to the documentation of Esahie precisely because of its less-established written form.

3.3 Population of the study

The target population for this study consists of all native speakers of Esahie and Nzema living in the traditional speech communities of the Western North and Western Regions of Ghana. This population is estimated at approximately 305,000 Esahie speakers and 330,000 Nzema speakers (Ghana Statistical Service, 2021). From this population, a sample of twenty (20) native speakers was selected for detailed consultation – ten for Esahie and ten for Nzema. The sample is not statistically representative of the entire population but was chosen purposively to capture variation across age, gender, and education.

3.3.1 Participant demographics

The twenty consultants comprised two subgroups: community members vs. students/staff.

- Community members (non-student): 14 speakers (7 Esahie, 7 Nzema), aged 35–80 years.
- Student consultants: 5 speakers (3 Esahie, 2 Nzema), all undergraduate or graduate students at the University of Education, Winneba (Ajumako Campus), aged 20–30 years.
- Staff: 1 speaker (Nzema), Department of Akan-Nzema Education, aged 36 years.

The student consultants had studied Nzema (or, in the case of Esahie speakers, had taken courses at the University of Education, Ajumako campus, but as native Esahie speakers) up to the tertiary level. No Esahie-specific course is offered at any Ghanaian university; however, the student consultants were included because they had metalinguistic training that facilitated transcription verification and judgement tasks. Age ranges were recorded to detect potential generational differences in hiatus resolution.

3.3.2 Sampling technique

The sampling strategy was purposive, not random. In descriptive phonological work of this nature, I needed speakers who can produce clear, natural speech. I also need a group of speakers who are metalinguistically aware enough to make judgements about what sounds “correct” or “more natural” in their language. Therefore, consultants were chosen because they met the following criteria:

- a. They were known to be first-language speakers.
- b. They could produce both careful citation forms and relaxed, connected speech.
- c. They were willing to spend time in one-on-one recording sessions and answer follow-up questions.
- d. They were willing to contribute to this research.

3.4 Data

All data used in the analysis were obtained from primary sources (the recordings of the consultants) and supplemented with secondary sources. Primary data consist of audio recordings of elicited words, phrases, carrier sentences, and short narratives, together with the field notes taken during sessions. Secondary data were drawn from online audios, videos, and published research articles on Esahie, Nzema, and related Kwa languages. These secondary sources were used to contextualize the findings, to check whether the patterns observed in the recordings support the theoretical analysis.

To protect participants’ privacy, all recordings were stored in password-protected digital files, and each speaker was assigned a code (e.g., ESH-M-35 for an Esahie male speaker aged 35). No personal names appeared in the thesis or the appendices.

3.5 Data collection instruments

Four data collection instruments were designed to elicit vowel sequences in a systematic yet natural way. The choice of instruments was guided by the need to obtain both controlled, comparable tokens and stretches of spontaneous speech.

1. Word list and phrase list. A list of nouns, verbs, and short phrases was prepared in which hiatus could occur across a morpheme or word boundary. Examples included contexts such as a vowel-final subject prefix followed by a vowel-initial verb stem, or a possessive pronoun before a vowel-initial noun. This instrument was used to record clear, careful pronunciations that could later be compared across speakers.
2. Carrier sentences. Simple frame sentences were designed so that a target word with an initial vowel was placed immediately after a function word (e.g., a conjunction, a preposition, or an auxiliary) that ended in a vowel. By keeping the surrounding structure constant, the carrier sentences allowed me to isolate the effect of the vowel sequence on the repair strategy.
3. Short semi-spontaneous narratives. Speakers were asked to describe their morning routine, retell a well-known folktale, or describe pictures on a sheet. These narratives provided stretches of connected speech in which many vowel sequences occurred naturally, without the speaker focusing on the form.
4. Repetition and judgement task. In selected cases, I pronounced two possible surface realizations of the same underlying vowel sequence. The consultant was then asked to repeat the form that sounded more natural in his or her language and to say whether the other form was possible at all. This task was used often, mainly to resolve ambiguous tokens.

In addition to these structured instruments, observation played a supporting role. During breaks and informal chats, I would note how speakers produced vowel sequences in entirely unguarded speech. These observations were recorded as field notes and used to cross-check the recorded data. All interview and recording sessions were conducted one-on-one in a quiet room, either indoors or in a shaded outdoor area. A digital audio recorder was used to capture the speech, and all tokens were later transcribed using the International Phonetic Alphabet (IPA).

3.6 Administration of instruments

Because the sample included both literate and non-literate speakers, the administration of the instruments was adjusted to suit each consultant.

- For educated speakers, I presented a written English prompt, and the speaker provided the equivalent Esahie or Nzema form. Alternatively, a written Esahie or Nzema word containing a hiatus context was given, and the speaker was asked to pronounce it in isolation and then inside a carrier sentence.
- For non-literate speakers, I used oral prompts. I described a scenario (with the help of a field assistant who speaks the language), an object, or an action, and the speaker produced the appropriate word or phrase. In some cases, I produced an Akan or English equivalent and asked how one would say it in the local language.

All sessions began with a brief warm-up conversation to help the speaker feel comfortable. Before any recording, I obtained verbal informed consent from each participant: I explained the purpose of the study in Esahie or Nzema (with the help of a local assistant), told them that participation was voluntary, that they could withdraw at any time without penalty, and that their name would not appear in any publication. Each consultant gave explicit verbal agreement. I then moved to the word and phrase lists, followed by carrier sentences, and finally the narrative and judgement tasks. Each session lasted between 45 and 90 minutes, and speakers were offered breaks whenever they wished.

3.7 Method of data analysis

The analysis followed a series of clearly defined steps. First, all recorded material was carefully listened to, and every instance of a vowel sequence was identified and segmented. Each token was transcribed in IPA, and I entered them in spreadsheet that recorded the language, speaker code, morphological/syntactic context, underlying vowel sequence, surface pronunciation, and any repair process observed.

Second, the tokens were grouped according to the type of repair strategy used: elision (deletion of one vowel), epenthesis (insertion of a glide [j] or [w]), or coalescence (merging of the two vowels into a single vowel that shares features of both). Within elision, a further distinction was made

between first-vowel deletion and second-vowel deletion, and the conditioning environment was noted (for example, which vowel quality, which morphological boundary, and whether the sequence fell inside a prosodic word or across a phonological phrase).

Third, the patterning of glide insertion was examined in detail. The data show that a palatal glide [j] tends to appear after a front high vowel, while a labial glide [w] tends to appear after a back round vowel. These tendencies were checked against all tokens and stated as regular phonological processes.

Fourth, the data were analysed within two theoretical frameworks. Optimality Theory (OT) was used to capture the competition between different candidate surface forms and to express the ranking of constraints that yields the observed repair strategy. However, because OT alone could not straightforwardly represent certain tonal and autosegmental phenomena, Autosegmental Phonology was employed as a supplementary framework. This second framework made it possible to account for tone and vowel features as separate tiers, accounting for patterns in which, for example, a tone belonging to a deleted vowel survives on an adjacent segment.

Finally, the patterns found in Esahie and Nzema were systematically compared, and any differences in the frequency or the environment of a given repair strategy were highlighted.

3.8 Structure and interpretation of the dataset in the appendices

The primary data that support the analysis are presented in four appendices (Appendices A–D, pages 166–176). Each appendix corresponds to a major repair type or environment:

- Appendix A: Epenthesis data
- Appendix B: Elision data
- Appendix C: Data on the coalescence to /e/ (*e*-coalescence)
- Appendix D: Data on what happens when two identical vowels become adjacent

Within each appendix, the tokens are listed alphabetically by the orthographic (Spelling) form of the word or phrase. Every entry is given in three columns:

- Spelling: the standard Esahie or Nzema orthographic representation.

- SR (Surface Representation): a broad phonetic transcription of the form as actually produced.
- Gloss: a plain English translation of the meaning.

It is important to explain how to read entries that show two layers of surface representation. Occasionally, a form appears as, for example: *akatus: akætuja* [akæt^ɹija] ‘pay’. In such a case, the first transcription *akætuja* represents a broad surface form in which a glide [j] is assumed to be the best glide to resolve hiatus. The second transcription, enclosed in square brackets [akæt^ɹija], provides a more detailed, narrow transcription. Here, the symbol [ɹ] shows that the glide is produced with simultaneous rounding and raising of the tongue body, resulting from the combined influence of the preceding vowel and the following front vowel. In other words, the form in square brackets is a finer-grained representation of the same utterance, not a different repair strategy. This two-level notation is used only when a closer phonetic detail is necessary to understand the quality of the glide or the degree of coarticulation. It allows the reader to see both the phonological category of the inserted segment (a glide) and its precise articulatory realization. No such double representation appears in cases where a single broad transcription sufficiently captures the repair. The gloss remains the same for both layers.

3.9 Summary of chapter

This chapter has described the methodological steps taken to investigate vowel hiatus resolution in Esahie and Nzema. I adopted a qualitative, descriptive design based on fieldwork in Nzema land and Sehwi land, with supplementary verification sessions at the University of Education, Winneba. Twenty native speakers (ten per language) were chosen through purposive sampling to represent a range of ages, genders, and educational backgrounds. Data were collected using word lists, carrier sentences, short narratives, and occasional judgement tasks, all audio-recorded and transcribed in IPA. The analytical procedure involved segmenting, classifying, and patterning the repair strategies, before framing the regularities in Optimality Theory and Autosegmental Phonology. Finally, the chapter explained the organization of the four appendices and clarified how to interpret the two-layer surface representations, thus ensuring that the dataset is fully transparent and useable by other researchers. Every methodological choice was made to align with the research objectives

and to guarantee the reliability, validity, and rigour of the findings that will be presented in the following chapters.

CHAPTER FOUR

Data analysis

4.0 Introduction

In this chapter, we examine the strategies used for resolving hiatus in Esahie and Nzema, two closely related Central Comoé languages. Extending the descriptive characterizations presented above, this chapter analyses three phonological processes – epenthesis, elision, and coalescence – that occur in hiatus resolution across different phonological domains. These domains include: (i) hiatus within a monomorphemic word (e.g., root-internal vowel sequences), (ii) hiatus across morpheme boundaries inside a word (e.g., between a prefix and a stem or a stem and a suffix), and (iii) hiatus across word boundaries (e.g., between two separate words in a phrase). The discussion is organized into sections, each dedicated to a specific strategy and its application in the data. The chapter is divided into four main sections: the first discusses epenthesis, the second focuses on elision, the third explores coalescence, and the fourth addresses sequences of identical adjacent vowels. Subsequently, a summary and conclusion are provided.

4.1 Epenthesis

Hiatus in Esahie and Nzema is resolved through the insertion of palatal glides [j] or labial glides [w]. Unlike Malay, Persian, and Faroese (discussed in Chapter Two), where various epenthetic segments (e.g., glottal stops or fricatives) are used, Esahie and Nzema consistently insert a glide. The choice of glide is determined by the first vowel in the sequence: if the first vowel is back and rounded, the epenthetic glide is [w]; if it is front and unrounded, the glide is [j]. Thus, the glide shares one articulatory feature (roundness or frontness) with the first vowel, making it a natural repair segment. In a few cases, a vowel alternation occurs before glide insertion, as in the labial-palatalization process also seen in Akan. This process is particularly relevant for sequences of the type C-u-a (CUa)¹³, where the underlying forms in Esahie undergo specific changes before surfacing. The sequence CUa behaves differently in Nzema.

¹³ CUa = C (any consonant), U ([+high, +back, +ATR] vowel), /a/ ([+low, central] vowel)

4.1.1 Hiatus in monomorphemic words

In Akan, when a consonant comes before a rounded vowel, the consonant is labialized: i.e. the rounded lip position (of the following vowel) is anticipated by the consonant. Palatalization of Akan consonants happens when a front-high vowel follows a consonant. There are instances where both labialization and palatalization processes will occur in the same monomorphemic word. This can be seen in sequences like the CVV (where V₁ is /u/ and V₂ is /a/) stem with a rounded vowel, followed by an /a/ (Dolphyne, 2006, p. 106). When that happens, it is called a labial-palatalization phenomenon. During production, as the tongue is raised towards the palate to produce the second vowel, lip-rounding occurs under influence from the first rounded vowel. This articulatory effect modifies the quality of the initial vowel, and results in its movement closer to its [+high, +front] correspondent, /i/. Because the shift in vowel quality is not phonologically realized (i.e., it does not reflect a change in underlying vowel phonemes but rather surface coarticulation), it is better analyzed as a phonetic representation rather than a phonological representation. In the present instance, the surface shapes of vowels occurring in such sequences provide the primary criterion for selecting a glide to resolve the hiatus.

Extending this occurrence in Akan to example (68), one might predict insertion of a labial glide because the orthographic representation contains a rounded vowel in the V₁ sequence position. The same trend occurs in the Faroese and ChiManyika languages, where back rounded vowels are associated with a labial glide. As mentioned before, any analysis of this pattern must be based on the phonetic representation rather than orthographic representation. As a Kwa language, Esahie behaves like Akan with respect to CUa sequences. The results suggest an alternation in which /u/ becomes [i] phonetically due to coarticulation rather than a segment miscomprehension. The following cases show this trend.

(68) CUa sequence in Esahie nouns

Spelling	SR	Gloss
a. brasua	/bræsuja/ [bræsu ^u ija]	‘woman’
b. akatua	/akætuja/ [akætu ^u ija]	‘pay’
c. dua	/duja/ [du ^u ija]	‘plant, tail’

d. amrokua	/amookuja/ [amo:k ^ɰ ija] ¹⁴	‘mouse, squirrel’
e. kyeremvua	/teeremvuwa/ [teeremv ^ɰ ija]	‘egg’
f. adwufua	/ædzufuja/ [ædzuf ^ɰ ija]	‘word’
g. bua	/bujə/ [b ^ɰ ija]	‘a pot’
h. abemua	/abemuja/ [abem ^ɰ ija]	‘a boy’

In the example provided in (68), a three-step phonological derivation occurs before the application of the hiatus resolution strategy, each step contributing to the conditioning environment that licenses the subsequent application of glide epenthesis.

Step 1: Consonant labialization due to vowel roundness

i. Labialization

Spelling	Intermediate level
brasua	[bras ^w ua] ¹⁵ [the environment for /j/-insertion is not present yet at this stage]

This process involves the labialization of the coronal fricative /s/ due to a following rounded vowel /u/. This gives the intermediate [bræs^wua]. This labialization occurs through coarticulatory assimilation of place of articulation; the [+round] feature on /u/ spreads to the preceding consonant and creates [s^w]. This is in line with what happens in Akan (see Dolfhyne, 2006) where the CVV sequences (CUa) receive a similar coarticulatory application.

In the CUa sequence, the high back vowel /u/ and the low vowel /a/ are adjacent. To resolve the hiatus, a palatal glide [j] (rather than a labial glide [w]) is inserted between the two vowels because /u/ becomes [i] during articulation. Following Abakah (2013), this vowel change is not merely

¹⁴ The underlying representation of the form is /amrokua/, which surfaces as [amo:k^ɰia]. The deletion of /r/ appears to be attributable to rapid speech, although this has not been investigated in the literature. The compensatory lengthening of the following vowel /o/ accounts for the segmental loss. For the purposes of the present study, the surface form [amo:k^ɰia] is maintained. A more comprehensive account may be the subject of future research.

¹⁵ The symbols [w] (labial glide) and [j] (palatal glide) represent full consonantal segments; they are not diacritics nor products of secondary articulation. When raised to superscript position – i.e., [w^ɰ] and [j^ɰ] – they become diacritics that indicate secondary labialization or palatalization on another segment (e.g., [k^w] or [t^j]). In this thesis, [w] and [j] are used only as independent epenthetic consonants, never as raised diacritics unless explicitly stated.

phonetic coarticulation but a horizontal vowel shift: the labial vowel /u/ and the coronal vowel /i/ are horizontal counterparts. Since the following vowel /a/ is [-Round], the phonology replaces the [+Round] vowel /u/ with its [-Round] counterpart /i/ to achieve featural agreement. This horizontal shift was consistently attested in the pronunciations of the Esahie speakers I consulted for this study: in words such as *brasua* ‘woman’, *akatua* ‘pay’, and *dua* ‘plant’, the underlying /u/ was consistently realized as [i] before palatalization and glide insertion, yielding surface forms like [bræs^ɥija], [akæt^ɥija], and [d^ɥija]. No speaker produced a labial glide [w] in these contexts, confirming that the horizontal vowel shift is a productive phonological rule in Esahie, not a sporadic phonetic effect. This replacement then feeds palatalization of the preceding labialized consonant. The surface form [bræs^{wj}ija] (from *brasua* ‘woman’) is derived through the subsequent steps of labialization and palatalization, as shown below. There is a co-articulation of labiality and palatality on [i], resulting in [bræs^{wj}ija]. Let us move on to the second step.

Step 2

ii. Palatalization

Spelling	Intermediate level
brasua	[bras ^{wia}] turns to [bræs ^{wj} ia] (vowel raising and palatalization)

However, the output in step 2 is ill-formed, as it assigns two secondary articulators to the same segment. Instead, the two secondary articulators—[w] from the original labialized consonant and [j] from the front high vowel—merge, yielding the secondary articulator [ɥ], as illustrated in step 3. (Dolphyne, 2006, p. 28) The surface form then becomes [bræs^ɥia]. The change of /a/ to [æ] is a vowel raising effect, induced by the front high vowel¹⁶.

Step 3

iii. Labial-palatalization

Spelling	SR
brasua	[bræs ^ɥ ija] [Labial-palatalization and <i>j</i> -epenthesis]

¹⁶ In Akan, too, the vowel /a/ raises to [æ] when it occurs before /i/, /u/, or /o/ in the same morpheme (Agyekum, 2010, p. 3; Dolphyne, 2006, p. 2; Agyemfra & Amoh, 2025, p.11. This is a raising effect, not directly an ATR-harmony effect, though ATR harmony is also present in Akan (and in Esahie/Nzema).

It is important to emphasize that, although the hiatus is initially triggered by the sequence /u+a/, the intervening vowel alternation (/u/ → [i]) reconfigures the sequence as /i + a/. Consequently, the glide required for hiatus resolution is not [w], which would be appropriate for /u/, but rather [j], reflecting the phonological properties of [i]. The same account applies to (68c) *dua* → [d^hija] ‘plant, tail’, as well as to the remaining examples in (68). In each case, the derivation proceeds identically: consonant labialization, vowel change from /u/ to [i], labial-palatal articulation, and *j*-epenthesis.

It is unusual for a single segment to involve multiple coarticulation in Kwa languages. Where such configurations arise, the coarticulators tend to merge, often historically into a single, complex segment (Dolphyne, 2006). Ladefoged and Maddieson (1996, pp. 333–334) note that while languages like Yoruba (Kwa) contrast labial-velar stops /k^hp/ and /g^hb/, these are treated as unitary double-articulated segments, not sequences. In broader cross-linguistic perspective, however, segments with multiple coarticulators are well attested: e.g., labial-velars (Niger-Congo), labial-coronals (e.g., /t^hp/ in Yeletiyé), and secondary articulations like palatalization (Russian /pʲ/) or labialization (Arabic /k^w/). (Ladefoged & Maddieson, 1996, pp. 329–358; Sagey, 1986). As is seen here in Esahie and some Akan languages, there is a simultaneous pronunciation of the two secondary articulators, leading to a labio-palatalization (represented as [ɥ]) before the front vowel. This alternation further explains the rationale behind the epenthesis of a palatal glide observed in (80a–h). Crucially, the epenthetic segment is oriented toward the initial vowel (V₁).

The pattern of labial-palatalization is not restricted to Esahie nominal domains. Data from verbal forms, as shown below (69), demonstrate that the CUa configuration triggers glide insertion via labial-palatalization. This indicates that the process is not limited to only one domain but constitutes an integral aspect of Esahie’s broader phonological system. The examples in (69) provide further illustration of this pattern. The three steps used in (68) work perfectly to explain what happens in these examples. The derivation begins with the application of labialization, which is triggered by the presence of a following rounded vowel. This initial process creates the phonetic conditions for a subsequent vowel change, which in turn paves way for the application of palatalization. Following the sequential application of these two processes, labial-palatalization

emerges as the final step in the derivation. The resulting surface forms include [s^uija], [h^uija], [t^uija], [suwes^uija], and [buweb^uija].

(69) CUa sequence in Esahie verbs

Spelling	SR	Gloss
a. sua	suja [s ^u ija]	‘to learn’
b. hua	huja [h ^u ija]	‘to smell’
c. tua	tuja [t ^u ija]	‘to close, to shut’
d. suesua	suwesuja [suwes ^u ija]	‘to imitate’
e. buebua	buwebuja [buweb ^u ija]	‘to cover’

We now turn to Nzema, where CUa sequences are resolved differently than in Esahie. The complex labial-palatalization process found in Esahie is absent in Nzema. Instead, Nzema employs a simple [w]-insertion strategy, with no vowel quality change. The following examples illustrate this straightforward pattern.

All four forms in (70) contain the sequence /u + a/. In the surface realization, this surfaces as [uwa]. A labial glide [w] is inserted between /u/ and /a/. Phonologically, /u/ is [+high, +back, +round]; /a/ is [–high, –back, –round]. The transition between them requires the tongue body to move from velar to low central position and the lips to spread from rounding to unround. Because the transition begins from a rounded vowel, the intervening segment inherits [+round], surfacing as [w].

(70) CUa sequence in Nzema nouns

Spelling	SR	Gloss
a. abua	Λbuwa	‘smoke pipe’
b. efua	efuwa	‘name- Friday born (fem)’
c. sua	suwa	‘house’
d. abusua	Λbusuwa	‘family’

Nzema diverges despite sharing the C+u+a (CUa) template with Esahie. Unlike Esahie, Nzema treats this sequence with no palatal glide insertion or vowel replacement, even though both

languages belong to the Central Comoé group and operate the same syllable structure. A precise minimal pair illustrates the divergence:

(71)

Language	Spelling	Surface form	Gloss	Process
Esahie	sua	[s ^h ija]	‘to learn’	Vowel replacement and palatal glide insertion
Nzema	sua	[suwa]	‘house’	Labial glide insertion

The Esahie verb *sua* ‘to learn’ surfaces as [s^hija]. This exemplifies a broader cross-linguistic pattern in Esahie verbs: CUa sequences trigger labialization, palatalization, and palatal glide insertion. The rounded vowel /u/ labializes the preceding consonant, and the following /a/ induces a vowel replacement. This leads to the surface form [s^hija].

Nzema *sua* ‘house’, by contrast, surfaces faithfully as [suwa] with no vowel mutation. The language tolerates the vowels to remain what they are with no replacement. The permitted change is the insertion of the labial glide.

Nzema and Faroese parallel each other in the string CUa, as shown by example (21) in Chapter Two above. In the two languages, if the first vowel in this sequence is rounded, hiatus resolution is resolved by the insertion of a segment that contains the [+round] articulatory feature. Across all Faroese examples in (21), a labial glide—invariably [w]—constitutes the optimal hiatus repair strategy. The data in (21) establish a systematic correlation between the rounding specification of the initial vowel and the labial quality of the epenthetic glide. Nzema exhibits precisely this configuration: given the underlying sequence /u + a/, the language epenthesizes [w], a segment which simultaneously preserves the [+round] feature of the preceding vowel.

Having shown that Esahie resolves CUa sequences in a separate phonological process compounding intermediate vowel reanalysis (i.e. /u/ → [i])/ and the merger of the labial and palatal coarticulation to [ɥ]. We may then ask what the recommended resolutions of hiatus are when the data does not exhibit the CUa configuration. The data provided in (72) and (73) from both

languages below suggest that, in these contexts, hiatus is obligatorily resolved as glide insertion, where the selection of the glide inserted to resolve hiatus is computed directly from the phonetic properties of first vowel in the sequence.

In Esahie, when the first vowel of a nominal sequence is back rounded, hiatus resolution takes place by the insertion of [w], a labial glide. Crucially, no vowel change, reanalysis or labial-palatal interaction is present in such cases, unlike in CUa sequences. The repair mechanism is transparent and based only on the articulatory properties of the trigger vowel. The difference between these cases and CUa sequences is that CUa sequences involve the high back rounded vowel /u/ as the first vowel and /a/ as the second vowel, which triggers labial-palatalization (including the change of the vowel's quality to /i/). In examples like (72), such a sequence is not seen.

(72) Labial glide insertion -Esahie

Spelling	SR	Gloss
a. <i>hoa</i>	<i>howa</i>	‘story’
b. <i>nyɔkoa</i>	<i>ɲɔkuwa</i>	‘grinding stone’
c. <i>nzue</i>	<i>ɲzuwe</i>	‘water, dam’
d. <i>bue</i>	<i>buwe</i>	‘nest’
e. <i>huɛ</i>	<i>huwɛ</i>	‘husband’
f. <i>ɛwɔfoɛ</i>	<i>ɛwɔfowɛ</i>	‘guest, visitor’
g. <i>buluo</i>	<i>buluwo</i>	‘yam’

The first vowel [ɔ] in (72a) is specified as [+back, +round], a feature profile correlated with the insertion of a labial glide [w], as seen by the other examples. This trending operation is illustrated in (72b), where the sequence /ɔ + a/ undergoes repair by *w*-epenthesis, producing the surface form [ɲɔkuwa]. The feature-based repair mechanism occurs likewise in the rest of (72). In all these cases the glide [w] is entirely predictable and therefore serves as a transparent hiatus resolution trigger because it does not lead to any change in vowel quality.

This contrastive pattern is at variance with the CUa string in *sua* → [s^hija], where vowel hiatus is repaired with coarticulation reanalysis (u → [i]) and the activity of an additional secondary

articulator [ʷ], as highlighted before. This comparison emphasizes the difference between simple, feature-based glide epenthesis and the derivationally more complex labial–palatalization route found only in CUa sequences.

Moving on to (73) shows that a similar repair strategy is in play for non-CUa hiatus patterns in Nzema, and this confirms glide epenthesis as a stable rule with the Central Comoé group. In all cases in which the first vowel is rounded, hiatus resolution involves no vowel re-analysis nor secondary articulatory coalescence, but merely insertion of a labial glide [w]. The Nzema examples in (73) below demonstrate this pattern clearly.

(73) Labial glide insertion- Nzema

Spelling	SR	Gloss
a. aboa	abowa	‘animal’
b. tiboā	tibowa	‘conscience’
c. boani	bowani	‘sheep’
d. tuokɛ	tuwoke	‘hernia’
e. elue	eluwe	‘yam’

As seen in (73a), *aboa* → [abowa] ‘animal’, /o + a/ sequence is repaired by inserting a labial glide [w] to result in a CV-type well-formed syllable. And the data in (73b) and (73c) show that [w] is consistently inserted after a rounded vowel. Nzema resolves even CUa sequences (e.g. *abua* ‘smoke pipe’, see (70)) in the same way that other V₁V₂ sequences are changed into simple CV, without reanalyzing /u/ as [i] preceded by the complex secondary articulator [ɥ]. This pattern is consistent with the absence of the labial-palatalization process in Nzema, which instead employs a simpler, uniform strategy for glide epenthesis (still feature-directed, but without the change of the vowel’s quality and secondary articulation found in Esahie).

Both languages show an unambiguous preference for feature-sensitive glide insertion, specifically in the context of the first vowel (V₁) of hiatus sequences. This supports the observation of a well-documented phonological generalization as laid out in Casali (1997) and St-Amand (2012), according to which whether hiatus resolution proceeds by epenthesis or by elision depends

primarily on the feature specification of V₁. The glide insertion patterns in Esahie and Nzema add further support to the claim that vowel hiatus environments are not uniformly treated, either within a single language or across languages. Although the two languages have labial glide [w] insertion, they differ in how to derive cases involving a rounded V₁: Esahie alone, based on this discussion, regards CUa strings as a form that requires a multi-step derivation that involves vowel replacement and articulatory merging. On the other hand, Nzema uses an entirely uniform type of epenthesis irrespective of a particular pair of vowels.

4.1.1.1 Glide insertion in verbs

In the previous section the focus was on hiatus resolution in noun forms in Esahie and Nzema. Similar patterns, however, also exist in the verbal form. This section thus investigates glide epenthesis in verbs, and whether the phonological repair mechanisms identified for nouns also operate in verbal morphology and inflection. A question to be investigated is whether the choice of the epenthetic glide remains phonologically conditioned by the same features of the first vowel (V₁) in hiatus, and whether there are any category-specific restrictions or exceptions for verb forms.

The examples in (74) and (75) constitute an additional indication for the fact that Esahie as well as Nzema exhibit uniform glide epenthesis to resolve vowel hiatus in verbs, aligned with facts from nominal constructions discussed earlier. Importantly, the surface shapes show that glide insertion is not tied to lexical categories like nominal stems but is a phonologically- conditioned process taking place across morphological domains. Resolution of hiatus occurs exclusively through the insertion of glides beside another vowel in both languages. The following sections provide a close look at one example for each type of verbal form under discussion, to illustrate how this mechanism is put into practice.

Regarding the verbal data in (74a), the form *boa* involves a sequence of vowels /*ʊ* + *a*/ which requires hiatus resolution. The vowel [ʊ] is characterized as [+high, +back, +round], a set of features that obviously allows the labial glide [w] to be inserted as a linking item in a natural manner. The epenthetic [w] supplies a syllabic onset and thus resolves vowel hiatus

straightforwardly. This development is very much like the nominal data that we saw before (e.g., *hoa* → [hɔwa] ‘story’ in (72a)).

For a similar pattern see (74b) where the /*ʊ* + *a*/ sequence is also present. Again, the resolution of hiatus is *w*-epenthesis generating surface representation such as [mɔwa]. In (74c), the form has the vowel sequence as /*u* + *ɛ*/. The initial vowel /*u*/, which is both [+high] and [+round], triggers the insertion of a labial glide [w] before the following mid front vowel /*ɛ*/. Unlike CUa, this vowel cluster with a low vowel does not cause either the reanalysis of vowels or glide coalescence. Hence the surface form [ɛsuwɛ] co-occurs with nominal forms like *bue* → [buwɛ] ‘nest’ and *hue* → [huwɛ] ‘husband’ in (73).

Finally, in cases where the vowel sequence contains two rounded vowels such as /*u* + *o*/, hiatus resolution also occurs via [w] insertion, resulting in forms like [obuwo]. This result is like what can be observed in the nominal data *buluo* → [buluwo] ‘yam’ in (72g), lending further support to the generalization that [w] operates as the default epenthetic glide if the initial vowel is [+round], regardless of the morphological category involved.

(74) Labial glide insertion in Esahie verbs

Spelling	SR	Gloss
a. <i>boa</i>	buwa	‘to assemble, to pack’
b. <i>moa</i>	mowa	‘to fold, to squeeze’
c. <i>ɛsue</i>	ɛsuwɛ	‘to cry’
d. <i>obuo</i>	obuwo	‘to obey’

The verbal data in (75) directly parallel the patterns observed in Esahie for non-CUa contexts. In (75a), *boa* → [buwa] ‘to assemble, to pack’, the hiatus created by the vowel sequence /*ʊ* + *a*/ is resolved through the insertion of the labial glide [w]. One may ask, why is the glide consistently labial in this context? The answer lies in the feature specification of the initial vowel: being [+high, +back, +round], [ʊ] naturally licenses a labial transitional segment. This demonstrates that the phonological system is feature-driven (i.e., conditioned by specific phonetic features such as frontness or roundness) rather than category-driven (i.e., conditioned by abstract categories like

morpheme boundaries), because specific phonetic features determine the choice of the epenthetic glide.

Similarly, the /u + a/ sequences in (75b–d) are uniformly repaired by inserting [w], with no phonological modification to either vowel. This leads us to consider: what accounts for the absence of complex processes such as vowel reanalysis or glide coalescence in Nzema? Comparing these patterns with Esahie CUa forms like *tua* → [tʰija] ‘to close, to shut’, we see that Nzema treats CUa sequences analogously to other V₁V₂ sequences, avoiding derivational complexity. This suggests that Nzema’s phonology favors predictable repairs.

Additional evidence comes from (75e), where *ebue* → [ebuwe] ‘to shed’ reflects the noun *elue* → [eluwe] ‘yam’ in (73e). One might wonder here: is this pattern the result of a completely general phonological rule, or are there possible category-specific counterexamples that have not been noted? The fact that glide insertion in Nzema seems to apply homogeneously across lexical categories makes a good case for the claim that hiatus resolution in this language is primarily determined by vowel features, and not morpheme type or lexical class.

(75) Labial glide insertion in Nzema verbs

Spelling	SR	Gloss
a. soa	sowa	‘to carry’
b. bua	buwa	‘to cover something’
c. kua	kuwa	‘to gather’
d. dua	duwa	‘to plant’
e. ebue	ebuwe	‘to shed’

4.1.1.2 Palatal glide insertion in nouns

The insertion of a labial glide is a basic solution for vowel hiatus beginning with a back rounded vowel (Casali, 1997, 2011). Extending this analysis, the next section considers hiatus environments in which the first vowel is front and unrounded, i.e., /i/, /e/ (sometimes realized as [ɪ]) or /ɛ/. Esahie and Nzema seem to be no exception in such hiatus contexts, where both languages have a systematic insertion of palatal glide [j]. The robustness of the preference for [j]

in these contexts suggests that hiatus resolution in those languages is responsive to the phonetic value of the triggering vowel. Just as [w] is a natural choice after back rounded vowels, it is not surprising that any epenthesis after front vowels appears as [j]. This regularity is suggestive of a feature-driven phonological process, as glide choice appears to be predictable from articulatory features rather than being conditioned by lexical class (Casali, 1996, 1997, 2011; St-Amand, 2012).

The generalization from (76) is that vowel hiatus within Esahie nouns ends up being uniformly repaired by the operation of *j*-insertion, if the first vowel of the cluster is front and unrounded. This relationship is systematically determined by properties of the first vowel in the sequence, specifically its [+front] feature specification and in many cases, [+high] quality. E.g., in *sia* ‘in-law’, the front high /i/ comes before the low back /a/, so the palatal glide is inserted, and we get [sija]. A similar pattern is found in *ayisia* ‘orphan’, pronounced [ajisija].

A similar process occurs in *bokyea* ‘cooking stone’ → [botɛija], *gyedie* ‘belief’ → [ɖɛɪdije] and *akyideɛ* ‘forbid’, where front vowels (/i/ or /e/ (which is realized as [ɪ])) permit insertion of [j]. It is interesting that mid-front vowels (/e/, /ɛ/) also induce the insertion of the palatal glide: e.g. *awisea* ‘nephew’ → [æwiseja] and *aween* ‘horn’ → [aweɛjɪn]. This reflects a pattern in which vowel frontness, rather than height, is the dominant factor conditioning glide epenthesis.

It is very similar to the labial glide insertion reported with back rounded vowels, except for the feature content of the inserted glide. If the first vowel is front, Esahie favors [j], a co-occurrence pattern that lends itself to analyzing hiatus resolution in terms of features rather than as restricted to lexical conditioning or influenced by orthography.

(76) Palatal glide insertion in Esahie nouns

Spelling	SR	Gloss
a. <i>sia</i>	<i>sija</i>	‘in-law’
b. <i>ayisia</i>	<i>ajisija</i>	‘orphan’
c. <i>awisea</i>	<i>æwiseja</i>	‘nephew’
d. <i>eyein</i>	<i>ejejin</i>	‘firewood’

e. bokyea	bɔtɛɾja	‘cooking stone’
f. gyedie	dʒɪdɪje	‘belief’
g. bayie	bæjɪje	‘witchcraft’
h. awɛen	awɛjɪn	‘horn’
i. kunaniɛ	kunanijɛ	‘widow’
j. akyideɛ	ætɛɪdɪjɛ	‘forbid’

Pointing next to dataset (77), we see a similar strong preference for palatal glide insertion in Nzema as is found in Esahie in (76), [j] consistently comes to be used when a front unrounded vowel is the first member of the hiatus. Glide choice is shown to be transparently correlated with the phonetic specification of this cluster-initial vowel. This is why *amgbɛɛ* is pronounced [amgbɪjɛ] denoting ‘shellfish’ and *aleɛ* surfaces as [alɪjɛ] ‘a meal’, in which [ɪ] triggers insertion of glides only with /ɛ/. A similar result holds for forms starting with /i/, e.g. *ebia* → [ɛbɪja] ‘chair’, and *debie* → [debɪje] ‘something’, thus validating the predictability of palatal glide insertion in these contexts.

This is preserved in layout such as *abialeɛ* → [ʌbɪjalɪjɛ] ‘bathroom’ and *nealeɛ* → [nɪjalɪjɛ] ‘mirror’, where glide insertion generalizes over multiple hiatus contexts. The palatal glide is even inserted word medially, as in *ɛmianlee* → [ɛmɪjanlɛ] ‘hardship’, so the process is not limited to word boundaries or simple vowel sequences.

Crucially, Nzema contrasts with Esahie in that the emergence of [j] does not require prior reanalysis of CUa sequences. Instead, labial glide insertion in Nzema is a surface-transparent process, directly sensitive to the featural specification of the triggering vowel. The uniformity apparently suggests a general phonological explanation for palatal glide epenthesis, a rule that is determined by the vowel features which indicate what glide to produce.

(77) Palatal glide insertion in Nzema nouns

Spelling	SR	Gloss
a. amgbɛɛ	amgbijɛ	‘a shellfish’
b. aleɛ	alijɛ	‘food’
c. ebia	ebija	‘chair’
d. abialeɛ	ʌbijalijɛ	‘bathroom’
e. ɛmianleɛ	ɛmijanlijɛ	‘hardship’
f. nealeɛ	nijalijɛ	‘mirror’
g. debie	debije	‘something’
h. azie	ʌzije	‘sepulcher’

4.1.1.3 Palatal glide insertion in verbs

Having established that nouns in Esahie and Nzema use *j*-insertion to resolve hiatus when the first vowel is front and unrounded, we now ask whether verbs behave the same way. Specifically, do front vowel sequences within verbs also trigger the insertion of [j]? Answering this question is necessary to determine how similar the hiatus repair strategies of Esahie and Nzema are across different word classes. The following data from verbs provide the basis for this comparison.

If the phonetic properties of the initial vowel—most notably frontness—systematically condition [j] insertion in verbs, this would support an analysis in which glide epenthesis is a generalized phonological process, insensitive to lexical category. Conversely, the variation of verbs in either the contexts licensing vs. those disallowing glide insertion and the surface reflection of hiatus would point at category-specific or morphosyntactic constraints. The cases illustrated below in each language are presented here with the aim of specifying these possibilities, and to determine how far cross-category generalizations can be extended when it comes to deciding on hiatus resolution.

The data in (78) and (79) demonstrate that palatal glide insertion in Esahie is not restricted to the nominal domain but also operates in verbal forms. Just as in the noun data discussed above, hiatus environments in the verb are consistently resolved through adding a [j] wherever the first vowel is front and unrounded, typically /i/ or /e/ (which is realized as [ɪ]). Hence, *pia* ‘push’ appears as

[pija], where /i/ is the front high vowel in a prevocalic environment that triggers palatal glide epenthesis. Similar resolution is found in *bosea* ‘to lend, to borrow’ ([busija]), where /ɪ + a/ is resolved by the same glide. It holds across different verbal forms. Words like *ahurusie* → [æhurusije] ‘to rejoice’ and *mviasee* → [mvijasije] ‘to start, to begin’ also show identical hiatus resolution in both edgy and non-edgy environments: glide insertion is not confined to verbal complexity or internal morphological composition. Even *ensurein* → [ensurejin] ‘to fear’ follows this pattern, showing that vowel height is not a determining factor in palatal glide epenthesis in the verbal system.

Altogether, these findings suggest that Esahie verbs and nouns make use of a common hiatus resolution mechanism, which is uniformly conditioned by the featural characteristics of the preceding (initial) vowel. The verbal data and the parallel behavior of nominal forms like *sia* → [sija] ‘in-law’ and *gyedie* → [dʒɪdije] ‘belief’, among others, indicate that glide insertion applies across categories: not only is it predictable and feature-sensitive, but also runs independently of lexical class. This uniformity is indicative of a phonological system in which hiatus resolution is regulated by economy and articulatory smoothness, rather than by asymmetrical category related constraints.

(78) Palatal glide insertion in Esahie verbs

Spelling	SR	Gloss
a. pia	pija	‘to push’
b. bosea	busija	‘to lend, to borrow’
c. ahurusie	æhurusije	‘to rejoice’
d. esurein	ensurejin	‘to fear’
e. mviasee	mvijasije	‘to start, to begin’

Examining Nzema verbal forms in (79) once more serves to support the role of palatal glide insertion as the preferred procedure for resolving vowel hiatus. Just as in the nominal domain, hiatus is caused when a higher vowel—either /i/ or /e/ (which is realized as [ɪ])—is followed by another vowel, and like that configuration it is also invariably restored via the epenthesis of [j]. In the verb *die* ‘to take’, for instance, the underlying /i + e/ sequence gives us [dije], the glide

stepping up to avoid a string of vowels. The pattern of insertion is the same in *kyea* ‘to bend’ and *nea* ‘to look’, realized as [tɛɾja] and [nɪja], respectively.

Additionally, in forms like *pia* ‘to push’ → [pija] and *tia* ‘to walk’ → [tija], the vowel /i/ induces a palatal glide epenthesis. The pattern has been replicated with other verbs indicating predictability of the process and a focus on vowel features rather than the lexical or morphological factors. Overall, given the approximate parallelisms between the verbal and nominal data, Nzema data also reveals much about what triggers glide insertion across lexical categories – the featural specifications of the initial vowel.

(79) Palatal glide insertion in Nzema verbs

Spelling	SR	Gloss
a. die	dije	‘to take’
b. kyea	tɛɾja	‘to bend’
c. nea	nɪja	‘to look’
d. pia	pija	‘to push’
e. tia	tija	‘to walk’

4.1.2 Hiatus across morpheme and word boundaries

This section explores the resolution of vowel hiatus in polymorphemic words in Esahie and Nzema. These constructions include various combinations, such as root + suffix, compound nouns, and compound verbs, where two distinct morphemes occur side-by-side, often resulting in adjacent vowels across morpheme boundaries. In both languages, these environments offer a valuable glimpse into the interplay between phonological rules and morphological structure. While previous sections focused on hiatus within single words, this section examines how the same repair strategies, particularly glide insertion is applied at word boundaries. The data reveals that hiatus resolution remains largely feature-sensitive, with a vowel in the sequence determining the type of glide inserted [w] for back vowels, [j] for front vowels. However, morpheme structure introduces some observations: in certain instances, hiatus occurs within only one of the morphemes (e.g., within the root), while in others it spans the morpheme boundary. This section presents examples of diverse vowel combinations and analyzes how epenthesis operates in these contexts, closely

examining whether the same rules apply across both languages and whether morphological boundaries influence the choice or application of the repair strategy.

4.1.2.1 Hiatus across a morpheme boundary inside a word

In Esahie, the behavior of words at the boundary provides important clues about vowel hiatus that go beyond simple word shapes. A great many of these forms, both nominal and verbal, have medial vowels which may be in either one or the other of their constituent parts; or neither, if we understand by this that they are to be found at the point where the stems meet. These internal hiatus contexts are already present in the morphemes themselves, and they require phonological repair whether isolated or occurring at the word boundary. It is characteristic of the language that in these phonemic groups, a palatal glide [j] may be used consistently, particularly when the first element of this kind is front and unrounded. This phenomenon seems to be a function of the phonological properties of the triggering vowel, rather than the stem shape per se, and may therefore suggest that glide insertion in Esahie targets those low-level domains which are distinct in terms of their phonetic specification. By studying compounds with verb-noun combinations with hiatus environments, one could investigate whether glide insertion follows the same pattern as we found it in monomorphemic words. The data reveal that Esahie is phonotactically well-formed within a complex word and further provide evidence of whether morphologically complex environments affect the realization of phonological rules.

(80) Glide insertion in Esahie

Spelling	SR	Gloss
a. kuanie	k ^u ijanije	‘farmer’
b. abusuanie	æbus ^u ijanije	‘relative’
c. bia nzue	bija ŋzuwe	‘to swim’
d. pɛ yia	pɛ jija	‘to surround’
e. nimdeɛ	nimdɪje	‘knowledge’

Examples (80a–e) demonstrate that palatal glide insertion applies in Esahie across morpheme boundaries inside a word (i.e., between a root and a suffix, or between elements of a compound). Concerning *kuanie* → [k^uijanije] ‘farmer’, there are two hiatus sites. First, within the root *kua*

itself, the sequence /u/ + /a/ undergoes labial-palatalization (discussed in §4.1.1), which results in a front vowel /i/ and triggers insertion of the palatal glide [j]; the labial-palatal approximant [ɰ] appears as part of the articulation. Second, at the boundary between the suffix *-ni-* and the following suffix *-ε*, the sequence /i/ + /ε/ triggers [j] insertion. There is no hiatus between the root *kua* and the suffix *-ni-* because the suffix begins with the consonant /n/. Similarly, *abusuanie* → [æbus^hijanije] ‘relative’ follows the same pattern. The free morpheme *abusua* ‘family’ combines with the bound morphemes *-ni-* and *-ε*, and the CUa sequence in the first component again yields labial-palatalization. In *bia nzue* → [bija ŋzuwe] ‘to swim’, the sequence /i/ + /a/ within the first morpheme *bia* is resolved by inserting [j].

The verb *akɔniaba* → [akɔnijaba] ‘to swing’ contains a hiatus between /i/ and /a/ in the sequence *ni-a*, which is resolved by inserting [j]; again, no vowel change occurs, showing that the process operates across morpheme boundaries. In *pe yia* → [pɛ jija] ‘to surround’, the second word *yia* begins with the underlying glide /j/, so there is no hiatus across the word boundary. The epenthetic [j] that appears in the output occurs in a sequence within *yia* (i.e., the sequence /i/ + /a/). Similarly, in *sɔ nea* → [sɔ nja] ‘to try’, the trigger is the sequence /ɪ + a/ in *nea*; as in previous examples, front vowels such as [ɪ] always induce [j] insertion. Finally, *nimdeε* → [nimdije] ‘knowledge’ is a compound of the verb root *nim-* ‘to know’ and the suffix *-deε* ‘something’. Here, the sequence /ɪ + ε/ is bridged by [j], preserving both vowels and maintaining a smooth syllable structure.

4.1.2.2 Hiatus across a word boundary (between two separate words)

When two separate words are combined in a phrase, and the first word ends in a vowel while the second begins with a vowel, the resulting hiatus is resolved through glide insertion. In both Esahie and Nzema, the choice of glide is predictable from the quality of the first vowel. If the first vowel is back and rounded, the labial glide [w] is inserted. If the first vowel is front and unrounded, the palatal glide [j] is inserted. The following examples (81) from Esahie and (82) from Nzema illustrate this pattern across true word boundaries. Glide insertion is one strategy for resolving hiatus across word boundaries; other strategies, such as vowel elision, are discussed in section 4.2.

(81) Glide insertion in Esahie

Spelling	SR	Gloss
a. <i>bu animtia</i>	<i>buwanimtija</i>	‘to disdain, to despise’
b. <i>dwodwo ahone</i>	<i>ɖɔɔɖɔɔwəhɔni</i>	‘to calm (oneself)’
c. <i>nwu amanee</i>	<i>nwuwamanije</i>	‘to suffer’
d. <i>nzu ehoin</i>	<i>ɲzuwehɔjin</i>	‘to be thirsty’
e. <i>tu atee</i>	<i>tuwatɪ:</i>	‘to travel’

In (81a) *bu animtia* → [buwanimtija] ‘to disdain, to despise’, the verb *bu* ends in the high back rounded vowel /u/. Because /u/ is [+round] and [+back], the hiatus is repaired by inserting the labial glide [w]. The resulting sequence /u/ + [w] + /a/ produces a smooth transition without any deletion of the original vowels. The same pattern is observed in (81c) *nwu amanee* → [nwuwamanije] ‘to suffer’, where the verb *nwu* also ends in /u/. The inserted [w] provides an onset for the following word *amanee*, which begins with /a/. No deletion or vowel quality change occurs in the first vowel.

Example (81b) *dwodwo ahone* → [ɖɔɔɖɔɔwəhɔni] ‘to calm (oneself)’ shows a slightly different vowel quality. The verb *dwodwo* ends in /o/ (mid back rounded). In the surface form, this /o/ is realised as [ɔ] – a higher and more centralized vowel – but it retains its [+round] feature. The inserted glide remains [w], confirming that back rounded vowels, whether high or mid, trigger the labial glide. The following word *ahone* begins with /a/, and the glide creates a clear syllable boundary.

In (81d) *nzu ehoin* → [ɲzuwehɔjin] ‘to be thirsty’, the first word *nzu* ends in /u/, again triggering [w] insertion before the initial vowel /ɛ/ of *ehoin*. This example also illustrates that the inserted [w] is not affected by the frontness of the following vowel; the glide remains labial regardless of whether the second vowel is back or front. Example (81e) *tu atee* → [tuwatɪ:] ‘to travel’ follows the same pattern: /u/ + [w] + /a/.

As we saw in (69), CUa sequences within a monomorphemic word (e.g., *sua* → [s^hija]) trigger labial-palatalization, involving the change of the vowel’s quality and secondary articulation.

However, when the same vowel sequence occurs across a word boundary – as in *bu animtia* (81a), *tu atee* (81e) – only simple [w] insertion occurs, without the vowel quality change (/u/ to [i]), that accompanies labial-palatalization application in monomorphemic contexts. This confirms that labial-palatalization process is restricted to monomorphemic or morpheme-internal environments, while across word boundaries the simpler [w] insertion suffices.

(82) Glide insertion in Nzema

Spelling	SR	Gloss
a. <i>bo aka</i>	<i>bowaka</i>	‘to beat Aka’
b. <i>di aleɛ</i>	<i>dijalɪjɛ</i>	‘to eat a food’
c. <i>te aluna</i>	<i>tɪjɒluna</i>	‘to harvest groundnut’

The Nzema data in (82) show an identical feature-driven pattern, though the specific vowels differ slightly. In (82a) *bo aka* → [bɔwaka] ‘to beat Aka’, the verb *bo* ends in the mid back rounded /o/, which surfaces as [ɔ] – like the Esahie example (81b). The labial glide [w] is inserted before the initial /a/ of *aka*. This confirms that Nzema also uses the first vowel’s rounding as the decisive feature for selecting [w].

In (82b) *di aleɛ* → [dijalɪjɛ] ‘to eat a food’, the verb *di* ends in the high front unrounded vowel /i/. Because /i/ is [-round] and [+front], hiatus is resolved by inserting the palatal glide [j]. The surface form [dijalɪjɛ] shows both the insertion of [j] and the preservation of the vowels.

Example (82c) *te aluna* → [tɪjɒluna] ‘to harvest groundnut’ further supports this generalization. The verb *te* ends in the mid front unrounded vowel /e/, which is pronounced as [ɪ]. Despite this raising, the vowel remains front and unrounded, and the inserted glide is the palatal [j]. The following word *aluna* begins with /a/, and the glide [j] becomes the onset, preventing hiatus.

The analysis of epenthesis in Esahie and Nzema has revealed a systematic, feature-driven process for resolving vowel hiatus. Both languages consistently insert a glide between adjacent vowels: the labial glide [w] follows a back rounded vowel, and the palatal glide [j] follows a front unrounded vowel. This pattern holds across monomorphemic words and word boundaries,

confirming that the choice of glide is determined solely by the articulatory properties of the first vowel in the sequence.

A major difference between the two languages concerns the resolution of CUa sequences (C + /u/ + /a/). In Esahie, such sequences trigger a labial-palatalization process involving three ordered steps: consonant labialization, the change of vowel quality (/u/ → [i]), and merging of [w] and [j] into the labial-palatal approximant [ɥ], followed by epenthesis of [j]. This derivation yields surface forms like [s^ɥija] ‘to learn’ and [b^ɥija] ‘pot’. In Nzema, by contrast, CUa sequences undergo only simple [w] insertion (e.g., [suwa] ‘house’), without the change of vowel quality or secondary articulation. The labial-palatalization process is therefore restricted to Esahie. The data also show that glide insertion is not limited to nouns but applies equally to verbs, with the same feature sensitivity. The subsection (verbs) demonstrated that labial glide insertion in verbs mirrors the nominal pattern. Also, the data confirmed that palatal glide insertion in verbs is equally regular. Likewise, hiatus across morpheme boundaries inside a word and across word boundaries both adhere to the same feature-driven generalization.

4.2 Elision

For both Esahie and Nzema, vowel hiatus across a word boundary typically results in the deletion of one of the two vowels. This section analyses the similarities and differences in how the two languages treat hiatus through elision, focusing on cases where either V₁ or V₂ is deleted. The data are organized according to vowel type (high vs. low, front vs. back) to examine how vowel quality influences elision patterns. In contrast to glide insertion (where the choice of glide is predictable from the first vowel’s features), elision patterns are more variable, as they are conditioned by the interaction of segmental features with morphosyntactic domains. Of particular interest is the direction of deletion – whether the first or second vowel is more likely to be elided – and how any such tendency compares across the two languages. By comparing Esahie and Nzema, we ask whether they employ the same or different elision strategies and what this reveals about their phonological systems.

4.2.1 First vowel elision

We turn now to the section of first vowel elision, a phenomenon that involves deletion of an initial (V_1) in a hiatus to prevent the occurrence of illicit V-V combinations. This process most commonly applies in both Esahie and Nzema, especially after a vowel-final word before a vowel-initial word. While both languages occasionally violate the No Hiatus constraint in the way described in Chapter Five to deal with hiatus, there are cases where vowel elision serves as the repairing strategy.

Starting with Esahie, we can observe that the first vowel is elided in at least some instances of vowel hiatus, specifically in sequences of mid vowel followed by a low vowel (e.g. $\epsilon + a$ and $e + a$). In this environment, the first mid vowel (V_1) undergoes deletion at word boundaries. This is demonstrated in the data in (85), which show that, preceding a low vowel, elision targets the mid vowel.

Although it may be somewhat surprising, the fact that $/\epsilon/$ is the only vowel in a grammatical morpheme does not prevent it from being deleted in Esahie. In (85a-c), examples (85a) $y\epsilon asoe \rightarrow [jasoje]$ ‘to obey’, (85b) $y\epsilon apina \rightarrow [japina]$ ‘our bat’, and (85c) $y\epsilon asetena \rightarrow [jasitna]$ ‘our life’, there is a possessive pronoun $y\epsilon$ with a mid-front vowel $/\epsilon/$ ending it. The vowel $/\epsilon/$ is dropped when it is followed by $/a/$. In (85d-e), (85d) $nzue ase\epsilon \rightarrow [\eta zuwasije]$ ‘to marsh’ and (85e) $nzue atole \rightarrow [nzuwatole]$ ‘to draw water’, the noun *nzue* which ends in the (mid front) vowel $/\epsilon/$ drops the final vowel when adjoining $/a/$ of *ase\epsilon* and $/a/$ of *atole*, such that $/\epsilon/$ is entirely deleted. Even the fact that $/\epsilon/$ is the last vowel in a nominal root does not prevent deletion. Finally, in (85f) $me agyapade\epsilon \rightarrow [madzapadije]$ ‘my property’, the mid front vowel $/\epsilon/$ of possessive *me* is elided when adjacent to *agyapade\epsilon*. Due to the loss, the $/\epsilon/$ of the possessive is no longer present in the output $[madzapadije]$, suggesting that even personal pronouns show a proclivity toward first vowel deletion in $/e + a/$ subsequences.

These illustrations show that Esahie deletes the mid front $/\epsilon/$ and $/e/$ before low vowels, $/a/$ specifically. It is word-internal and applies to grammatical morphemes (e.g., possessive) and full noun stems. Esahie has a segmental generalization with strong descriptive coverage for V_1 -deletion in mid + low sequences.

(85) Mid + Low: ϵ + a, e + a sequence in Esahie

Spelling	SR	Gloss
a. <i>yε asoε</i>	<i>jasoʝε</i>	‘to obey’
b. <i>yε apina</i>	<i>japina</i>	‘our bat’
c. <i>yε asetena</i>	<i>jasitina</i>	‘our life’
d. <i>nzue asee</i>	<i>ŋzuwasijε</i>	‘to marsh’
e. <i>nzue atole</i>	<i>nzuwatole</i>	‘to draw water’
f. <i>me agyapadee</i>	<i>maɖzapadijε</i>	‘my property’

Furthermore, Nzema has non-lexical words with prefixes (these occurring between a pronoun or subject marker and the following verb or noun). The deletion we are concerned with here is of the initial vowel in a sequence, when it spans more than one word. The pattern in (86) occurs with mid and low vowel sequences, especially when / ϵ / or / $\mathfrak{c}$ / precedes another vowel such as /a/ or [ʌ]. Such contexts serve as morphosyntactic boundaries, most often found between function words and lexical stems. This supports the idea that vowel hiatus between morphemes or words is most saliently tackled through deletion of one of the adjacent vowels. In these examples, the first mid vowel is regularly elided before a following low vowel.

In (86a) *ye ale* → [jaɭɪ] ‘(that) we may eat’, the mid front vowel / ϵ / of the subject prefix *ye* is deleted before the low vowel /a/ of *ale*. The deletion yields a surface form where the initial consonant /j/ of the prefix (the glide counterpart of /i/) becomes the onset of the following syllable, resulting in [jaɭɪ]. The remaining vowel /a/ is preserved without change. This pattern is consistent across similar examples, as shown in (86b–f).

In some cases, however, elision co-occurs with other phonological processes. For example, in *bε azu* → [bʌzu] ‘(that) they may cry’, the mid front vowel / ϵ / of the prefix *bε* is deleted because it comes before the low vowel /a/ of *azu*. The resulting /a/ then undergoes a quality change to [ʌ] due to ATR harmony triggered by the following /u/ in the second syllable of *azu*. Thus, the vowel change is independent of elision; elision simply removes the prefix vowel, and the harmony rule adjusts the remaining vowel’s quality.

Examples *wɔ ava* → [wava] ‘(that) they may take’ and *wɔ abeɛ* → [wabeɛ] ‘your corn’ also support the pattern of first vowel elision with different subject prefixes. Here, the mid back vowel /ɔ/ is deleted before a following /a/, with no subsequent change of quality from one word to the next. In contrast to the above items, there is no back high vowel following /a/ in either word, and this lends stability to the /a/ vowel.

This data demonstrates that Nzema applies a feature-sensitive patterning for elision at word boundaries, especially in mid and low-vowel sequences. The elision of the first vowel is also very consistent and predictable among subject prefixes. These results are taken as a proof of the effect of vowel hiatus resolution in Nzema on adjacent vowels.

(86) Mid + Low: ε + a, ε + Λ , $\mathfrak{ɔ}$ + a sequence in Nzema

Spelling	SR	Gloss
a. yɛ ale	jalɪ	‘(that) we may eat’
b. yɛ akuma	jaɫkuma	‘our axe’
c. bɛ asɔne	basɔnɪ	‘their church’
d. bɛ azu	b Λ zu	‘(that) they may cry’
e. wɔ ava	wava	‘(that) they may take’
f. wɔ abeɛ	wabeɛ	‘your corn’

Following the discussion of mid + low vowel interactions, this subsection turns to hiatus configurations involving high + low vowel sequences, which introduce another pattern of phonological alternation in both Esahie and Nzema. In these environments, a high vowel, either front or back, occurs before a low vowel, typically /a/ or [Λ]. Such vowel combinations are well known in the literature to produce hiatus cross-linguistically (Casali, 1997), thereby motivating the application of repair strategies such as elision. What is particularly revealing in these languages is not simply the presence of elision, but the direction in which it applies, and the specific vowel qualities involved.

In Esahie, high–low vowel sequences—especially those involving the back high rounded vowel [ʊ] and the low vowel /a/—tend to undergo deletion of the first vowel. In Nzema, however, the

picture is different: elision is found when there is a sequence of a front high vowel [ɪ], and either /a/ or [ʌ]. The divergent behavior of these sequences constitutes a significant piece of evidence for the interaction of vowel height and backness in determining elision patterns, as well as the possibility that different languages may have different vowels being deleted. The relevant data representing these patterns are shown in (87) for Esahie and (88) for Nzema.

In the Esahie examples of (87a–b), *wo asiwa* → [wæsiwa] ‘your betrothed’ and *wo alee* → [walɪɛ] ‘your food,’ the second person singular possessive prefix *wo* ends in back high round vowel [ʊ]. In both forms, this vowel is deleted when followed by a low vowel, resulting in surface forms that begin with the consonantal onset /w/ directly preceding the vowel-initial stem. Crucially, in (87a) the low vowel /a/ of *asiwa* surfaces as [æ]. The change of vowel quality is influenced by the following front high vowel /i/, which exerts articulatory pressure on the vowel quality. This kind of raising effects are in line with phonetic interaction patterns described for a range of Kwa languages, where neighboring front vowels can lead to rather subtle alterations in vowel quality (cf. Casali, 1997).

In contrast, the low vowel /a/ in (87b) remains unchanged. One plausible explanation is that the following syllable contains [ɪ] rather than /i/, which appears insufficient to trigger the same degree of vowel raising observed in (87a). This difference points to a gradient sensitivity to vowel height and tenseness in shaping surface realizations, even within otherwise parallel hiatus contexts.

A similar pattern is also observed in (87c), *no ahore* → [nahoreɛ] ‘his/her truth’. Here again, the subject prefix *no* ends in [ʊ], which is deleted before the following low vowel /a/. This example shows first-vowel elision in this context. However, Esahie does not use first-vowel elision systematically for all high + low vowel sequences; as seen in (83c) *bu animtia* → [buwanimtija] ‘to disdain, to despise’, a labial glide [w] may be inserted instead. Thus, the choice between elision and glide insertion depends on other factors, such as morphological or lexical conditions.

(87) High + Low: ʊ + a sequence in Esahie

Spelling	SR	Gloss
a. wo asiwa	wæsiwa	‘your betrothed’
b. wo aleε	waliʝe	‘your food’
c. no ahore	nahore	‘his/her truth’

The data in (88) also adds support to the trend of Nzema to resolve high + low vowel hiatus by deleting the high V₁. In all the illustrations, the subject-markers *me* and *ye* with front high vowel [ɪ] are followed by verbs or nouns that begin in vowels. The second vowel is retained, while the first is dropped before it in surface forms.

In (88a) *me ava* → [mava] ‘(that) I may take’ and (88b) *me anlɔŋa* → [manlɔŋa] ‘my grandchild’, the vowel [ɪ] of *me* is deleted when before /a/. One mild complication is with (88c) *me ali* ‘(that) I may eat’, where elision of [ɪ] is combined with centralization of /a/ to [ʌ]. This can be seen to echo a parallel process in Esahie (cf., e.g. 87a), where a back high vowel in the noun stem seems to induce centralization of a preceding or following vowel. Such a vowel shift is phonetic, due to vowel raising.

Consider also (88d) *ye adɔ* → [jadɔ] ‘(that) he may buy’, and (88e) *ye ahɔ* → [jahɔ] ‘(that) he may go,’ where the front high vowel [ɪ] of *ye* is deleted before low vowels /a/. The derived forms maintain the vowel of the root and suppress the vowel in the first syllable.

(88) High + Low: ɪ + a/ʌ sequence in Nzema

Spelling	SR	Gloss
a. me ava	mava	‘(that) I may take’
b. me anlɔŋa	manlɔŋa	‘my grandchild’
c. me ali	mʌli	‘(that) I may eat’
d. ye adɔ	jadɔ	‘(that) he may buy’
e. ye ahɔ	jahɔ	‘(that) I may go’

The elision pattern in (85)–(88) – where the vowel of a personal pronoun deletes before a vowel-initial morpheme – is not restricted to Esahie and Nzema. In the analysis of Abakah (2004, p. 184), he points out a strikingly similar process in Fante. Abakah shows that when a personal pronoun such as *mi* ‘I’, *wo* ‘you’ (singular), or *ɔno* ‘he/she’ is followed by a vowel-initial verb or noun, the pronoun’s vowel is elided, yielding a single vowel at the surface. For instance, /mi + a/ surfaces as [ma], exactly parallel to the examples where *me*, *ye*, *ɔno* or *wo* loses its vowel before a vowel initial stem. This correspondence indicates that elision of the pronoun vowel is a common hiatus-resolution strategy across Kwa languages.

In (89a) *bakaa afia* → [bakæ:fija] ‘trunk (tree)’, the low /a/ at the end of *bakaa* deletes while the central vowel [æ] at the beginning of *afia* remains. The /a/ at the beginning of *afia* is realized as a raised vowel. Analogously, in (89b) *agyaa asi* → [aɖæ:si] ‘heel’ the vowel /a/ from *agyaa* surfaces as [æ], being yet another raised vowel.

(89) Low + Low: a + æ sequence in Esahie

	Spelling	SR	Gloss
a.	<i>bakaa afia</i>	bakæ:fija	‘trunk (tree)’
b.	<i>agyaa asi</i>	aɖæ:si	‘heel’

Turning now to mid + mid vowel sequences, Esahie also resolves hiatus through elision of the first vowel. The following examples in (90) illustrate this pattern. In each case, the first word ends in /ɛ/ and the second word begins with /e/, creating a mid-vowel hiatus that Esahie repairs by deleting the first vowel.

In (90a) *sie ebue* → [sijebuwe] ‘small of back’, the final vowel /ɛ/ in *sie* is dropped. The following word *ebue* begins with /e/. The hiatus created by the sequence /i/ (from *sie*, after deletion of /ɛ/) and /e/ is resolved by epenthesizing the palatal glide [j], which is triggered by the high front vowel /i/ that precedes the elided vowel.

And, in (90b) *kye ebie* → [tɛbiɛ] ‘to prevent’ the /ɛ/ is deleted from *kye* while /e/ in *ebie* is retained. The glide [j] aids in resolving hiatus at this point. What happens here is something we

have seen before in Esahie sequences with mid vowels. The first one usually must go, particularly if the subsequent vowel is also front and mid.

Nzema also shows the phenomenon of mid-vowel sequences (with mid vowels being /e/ and /ɛ/) as well. Deletion persists when the order of vowels is reversed, providing evidence that phonotactic shape and morpheme edge position have higher priority than specific vowel quality. In (91a) *agyale ezukoa* → [adzalezukowa] ‘bride price’, the first vowel is deleted. This is further evidence that Nzema would rather delete V₁, even from a noun such as *agyale*. In (91b) *yɛ etu* → [jetu] ‘our gun’, the initial vowel /ɛ/ in the subject-marker *yɛ* is deleted, leaving /e/ in the verb. We see the same thing again: Nzema deletes the leftmost vowel.

Esahie and Nzema both delete the initial vowel in mid + mid vowel sequences, generalizing from /ɛ + e/ to /e + ɛ/. This is consistent with the finding that, hiatus resolution in these two languages is not only segment-based but can be also dependent of position – targeting V₁ across morphosyntactic boundaries.

(90) Mid + Mid: ɛ + e sequence in Esahie

Spelling	SR	Gloss
a. siɛ ebue	sijebuwe	‘small of back’
b. kyɛ ebie	tɛɛbije	‘to prevent’
c. kyɛ enu	tɛenu	‘to divide, to separate’

(91) Mid + Mid: ɛ + e sequence in Nzema

Spelling	SR	Gloss
a. agyale ezukoa	adzalezukowa	‘bride price’
b. yɛ etu	jetu	‘our gun’

4.2.2 Second vowel elision

In the previous section, we showed that in most cases the first vowel in a sequence serves as the target for elision. Here, we present instances in which the second vowel is affected and subsequently deleted. It will be shown in this section that there are also attested cases where the

second vowel of the sequence is subject to elision. This pattern contributes to the reconstruction of the hiatus resolution strategies of the languages: it echoes Casali's (1997) typological observation that 'in some cases, it is the first vowel that elides, whereas in other cases, it is only the second vowel'. This section tends to provide some insight concerning vowel elision and contribute toward the understanding of how elision is part of the larger system involving hiatus resolution in Esahie and Nzema by analyzing cases where V_2 deletion is possible. The examples in (92) also show us some of the conditions for second vowel elision in Esahie, particularly when morphologically complex words/phrases are concerned. These types are particularly telling because they show that the elision may not necessarily have to affect the first vowel but can also affect the second one according to the structure and grammatical role of the elements involved.

In (92a), the form *bowie ekunu* → [bowijekunu] 'bone marrow' is made up of two nouns *bowie* 'bone' and *ekunu* 'marrow'. The ultimate vowel of the modifier *bowie* and the initial vowel of the head *ekunu* combine naturally in hiatus. To resolve this, a palatal glide [j] is inserted between /i + e/ in *bowie*, which matches the frontness of the vowel /i/. But for the residual VV sequence, one of the adjacent vowels must be removed. The elision acts on the second of these vowels, that is, on the initial /ε/ of *ekunu* rather than the final /e/ of the modifier. The result is a genitive nominal compound [bowijekunu].

The same scenario occurs in (92b) where *bayie eyele* → [bæjjije jele] 'to cast a spell, to bewitch' is made up of two words, namely the noun *bayie* 'witch' and the verb *eyele* 'to act like, to cast'. Final /e/ of *bayie* and initial /ε/ in *eyele* will also constitute an unresolved hiatus. The language then repairs this hiatus by deleting the second vowel /ε/, resulting in a single-vowel remaining. Although the grammatical subject and the pivot are different (noun + verb), again elision prefers deletion of the second vowel.

When compared with the previous data (see, for instance, (90)), where we have the sequence of /ε + e/, there is the deletion of /ε/. The opposite of the /e + ε/ sequence in example (92) in Esahie results in the deletion of /ε/. From these two examples (90) and (92), it can be concluded here that, whether /ε/ is the first or the second vowel in the form, it is deleted all the time.

(92) Mid + Mid: e + ε sequence in Esahie

Spelling	SR	Gloss
a. bowie ekunu	bowijekunu	‘bone marrow’
b. bayie eyele	bæjije jële	‘to cast spell, to bewitch’

On the other hand, the examples in (93) provide a contextual illustration of how Nzema deals with mid vowel sequences across word boundaries especially where both vowels are mid (/ε/, /e/, /o/, /ɔ/). Hiatus in Nzema is resolved by deletion of the second vowel in the second word, which is the head noun. For instance, the head of the phrase is *ekpa* ‘mat’ and *wɔ* ‘your’ is the possessive determiner in (93a). The target for elision is the head word but not the possessive pronoun seen in first vowel elision. This case is exceptional at this point. Moving on to (93b), *ndɔ* ‘Indian’ (a noun used adjectivally), the head noun loses its initial /ε/ in the process of the hiatus resolution.

(93c) *butule eya* → [butuleja] ‘quarrel plant’ and (93d) *ahule eluale* → [ʌhuleluwale] ‘groundnut sowing’ follow in this sequence. In both cases, the noun modifier *butule* and *ahule* preserve their final vowel /e/ while the head nouns *eya* and *eluale* lose their initial /ε/. After the application of elision at the word boundary, the vowel sequence in the head word is resolved through the insertion of a labial glide [w]. It then becomes *luwale*. The output is now [ʌhuleluwale].

Example (93d) *ahule eluale* → [ʌhuleluwale] ‘groundnut sowing’ and (93e) *kodwo ekye* → [kodzɔtɛɪ] ‘little Kodwo’ both show the same pattern: the second vowel in the sequence (the initial vowel of the second word) is deleted. In (93d), this occurs in a noun-noun compound; in (93e), in a noun-adjective phrase. The process is consistent across different syntactic structures.

(93) Mid + Mid: ɔ + ε, e + ε, o + e sequence in Nzema

Spelling	SR	Gloss
a. wɔ ekpa	wɔkpa	‘your mat’
b. ndɔ ekpa	ndɔkpa	‘Indian mat’
c. butule eya	butuleja	‘quarrel plant (fern)’
d. ahule eluale	ʌhuleluwale	‘groundnut sowing’
e. kodwo ekye	kodzɔtɛɪ	‘little Kodwo’

Taken together, the Esahie and Nzema data exhibit a uniform preference for the elision of the second vowel in mid + mid sequences, especially when it is associated with the head noun or verb in a modifier-head relation. However, the Nzema contrast in (93e) shows that there are some exceptions. This variation is consistent with Casali's (1997) typological observation and adds insights about how these two Central Comoé languages handle vowel hiatus. Patterns of elision are determined not only by vowel quality but also by morphology and syntax. In most cases, the vowel of the modifier is retained while the initial vowel of the head noun is deleted. However, an exception occurs in (93e) *kodwo ekye* → [kodʒuotɛɪ] 'little Kodwo', where the head vowel is preserved instead.

(94) Mid + Low: ε + a, ε + æ, e + a, e + æ, ɔ + a, o + a sequence in Esahie

Spelling	SR	Gloss
a. <i>atendɛ aben</i>	<i>atendɛ bɛn</i>	'flute'
b. <i>aleɛ asi</i>	<i>aliʝɛ si</i>	'crust'
c. <i>nandwie afu</i>	<i>nandʒuʝiʝe fu</i>	'hump (cow)'
d. <i>asie aleɛ</i>	<i>æsiʝe liʝɛ</i>	'cemetery'
e. <i>bobɔ anu</i>	<i>bobɔ nu</i>	'to crunch'
f. <i>mako ammui</i>	<i>mæko muʝi</i>	'pepper (green)'

Taking a glance at the Esahie data in (94), it is apparent that there is a pattern in sequences such as $/\varepsilon + a/$ and $/\text{ɔ} + a/$. In such cases the first vowel is retained, and the next one is eliminated. This occurs even when the sequence spans two words in a compound: the initial vowel of the second word elides, and final vowel of the first word remains.

For instance, in *atendɛ aben* → [atendɛ bɛn] 'flute', the final $/\varepsilon/$ of the first word is preserved, and the initial $/a/$ of second word is deleted. In *aleɛ asi* → [aliʝɛ si] 'to crust', there is a triple vowel sequence across the word boundary. The final vowel (the initial vowel of *asi*) is elided, and a palatal glide [j] is inserted between the first two vowels. The two remaining vowels form a morpheme-internal hiatus, which is resolved by glide insertion. There are other forms such as *nandwie afu* → [nandʒuʝiʝe fu] 'hump (cow)' and *asie aleɛ* → [æsiʝe liʝɛ] 'cemetery' that pattern the same way. In all the above cases, the vowel that ends the first part remains and the initial

vowel in the second word elides. This observation generalizes over the examples listed in Esahie, holding whenever a mid-vowel is succeeded by a low vowel in such sequences.

A comparison of the two languages reveals the different ways in which these vowel sequences are treated. In Esahie (94), sequences such as /ε + a/ and /ɔ + a/ retain the first vowel, while deleting the second. For example, *atende aben* → [atende ben] and *alee asi* → [aliɛ si] reveal that the vowel in the final position of an initial word remains, while a vowel appearing in first position of the second word is lost. In Nzema (86), however, this is not so for the same sequences. Forms like *ye ale* → [jali] ‘(that) we may eat’ and *wɔ ava* → [wava] ‘(that) they may take’ indicate that it is the first vowel which gets deleted and the second vowel retained.

Cumulatively, these instances show that Esahie and Nzema differ minimally in how they resolve mid + low-vowel sequences: both languages delete one of the two vowels, but they do not delete the same vowel. In Esahie, the first member of the sequence is retained, and hiatus is repaired by deletion of the second vowel, but if it happens that the first vowel is found within a possessive pronoun, it will behave similarly to Nzema. Looking at the Nzema data again, the initial vowel is deleted because the vowel falls within a pronoun, making it prone to elide. The second vowel is realised in the surface form. The sequence of the vowels might be the same, but the kind of vowel to elide in the data in both languages (Esahie and Nzema) depends on the word class of the words involved.

The other mid + low sequences in Esahie, /e + a/ and /o + a/, pattern in the same way as /ε + a/ and /ɔ + a/ sequences. In these examples, the initial vowel is retained, and the subsequent vowel is deleted. For instance, the word initial vowel of *bobɔ anu* → [bɔbɔnu] ‘to crunch’ is lost. Also, in *mako ammui* → [mækomuji] ‘pepper (green)’, the /o/ of word one is retained, while the second vowel elides.

Among these sounds, Esahie always preserves the initial vowel and drops the second in all sequences, both front and back vowels.

(95) High + Mid: u + ε, ɪ + ε, ɪ + e sequence in Esahie

	Spelling	SR	Gloss
a.	nzu eyee	ɲzujijɛ	‘hot water’
b.	bene eso	bɛnɪ sʊ	‘direction’
c.	twe enu	tɕɥɪ nu	‘to squeeze, to wring out’

There is a further pattern of vowel sequence and resolution for high + mid vowels in Esahie (95), as follows. When a high vowel in the preceding syllable is followed by a mid-vowel, the language often retains it to facilitate transition into the next vowel. Thus, in *nzu eyee* → [ɲzujijɛ] ‘hot water’, the back high vowel /u/ is preserved, the following mid vowel is deleted, and a palatal glide [j] emerges before the other mid vowel /ɛ/, thus providing a natural connection between the two vowels. In *bene eso* → [bɛɲɪ sɔ] ‘direction’, the front high vowel [ɪ] is preserved, and the following mid vowel /ɛ/ is deleted. In the same way, *twe enu* → [tɛɲɪ nu] ‘to squeeze, wring out’ retains the [ɪ] in *twe*. The pattern is constant in all these cases; the high vowel remains high and medial glides are inserted where necessary.

In Nzema, high + mid vowel sequences are handled differently from mid + low sequences, but a consistent pattern is still evident. When a high vowel occurs before a mid vowel, the first vowel is generally preserved, and the second vowel is deleted. For example, in *ɛzɛnɛ ɛdanlɛ* → [ɛzɛndanlɛ] ‘funeral cloth’, the high front vowel [ɪ] of *ɛzɛnɛ* remains, while the initial vowel /ɛ/ of *ɛdanlɛ* is deleted. Similarly, in *sane ɛtulu* → [santulu] ‘a broom is loosened’, the first vowel [ɪ] of *sane* is retained, and the initial vowel /ɛ/ of *ɛtulu* is deleted. No glide or other segment is inserted; deletion alone resolves the hiatus. Other forms, such as *bɔlo ɛde* → [bɔlɔdɪ] ‘a ball has burst’ and *bɔlo ɛbɔle* → [bɔlɔbɔlɛ] ‘football game’, demonstrate the same pattern for back vowels: the high back vowel [ʊ] of the first word is retained, and the initial vowel of the second word is deleted. In words like *ye ezukoa* → [jɪzukoʋa] ‘his money’ and *me ɛsumi* → [mɪsumi] ‘my pillow’, the first vowel is also retained, and the second vowel is deleted.

(96) High + Mid: i + ε, u + ε, ʊ + ε, ɪ + e, u + ε sequence in Nzema

Spelling	SR	Gloss
i. $\varepsilon z e n e \varepsilon d a n \varepsilon$	$\varepsilon z e n i d a n \varepsilon$	‘funeral cloth’

ii. sane etulu	sanitulu	‘a broom is loosened’
iii. bōlo ede	bōlōdɪ	‘a ball has burst’
iv. bōlo ebōle	bōlōbōle	‘football game’
v. ye ezukoa	jizukowa	‘his money’
vi. me εsumi	misumi	‘my pillow’
vii. etu edo	etudɔ	‘there is a gunshot’
viii. komu ewu	komuwu	‘a monkey is dead’

Turning to (97), we see the same type of solution to hiatus for low + mid vowel sequences. When a low vowel /a/ precedes a mid-vowel, the language maintains the first and drops the second. For example, in *sona ebue* → [sɔnabuwe] ‘side (of the body)’, the /a/ of the first word is retained, and the initial vowel of the second word is deleted, so that the two words are joined without any vowel sequence or hiatus.

In the form *kanea eyia* → [kanija jija] ‘sunshine light’, the first vowel in the second word *eyia* deletes to resolve hiatus. There is a glide insertion in both words. The resulting form, [kanija jija] thus shows no remaining vowel hiatus. Others such as *pira ɔnwo* → [piranwo] ‘hurt yourself’ and *ɔba ɔpani* → [ɔbapani] ‘first born’, exhibit the same second-vowel loss, but the first vowel is preserved again. Also, *ma εso* → [ma sɔ] ‘to lift, to pick up’ lies in the same line.

(97) Low + Mid: a + e, a + ɔ, a + ε sequence in Esahie

Spelling	SR	Gloss
a. sona ebue	sonabuwe	‘side (of the body)’
b. kanea eyia	kanija jija	‘sunshine light’
c. pira ɔnwo	piranwo	‘hurt yourself’
d. ɔba ɔpani	ɔbapani	‘first born’
e. ma εso	ma sɔ	‘to pick up, to lift, to raise’

The processing of the data from both Esahie and Nzema support previous scholarly claims that vowel hiatus is resolved by language-specific systematical devices. All cases can be described by these facts, such that elision does not occur at random but on the basis of predictable developing

patters influenced by vowel quality, direction and position. In this respect, the observed pattern in both languages is consistent with general cross-linguistic facts concerning hiatus resolution and it provides evidence that vowel interaction is subject to phonologically motivated principles.

4.3 [e] Coalescence

Having examined vowel elision and epenthesis as strategies for resolving hiatus in Esahie and Nzema, this section turns to coalescence. Unlike elision, where one vowel is removed, or epenthesis where a glide is inserted, coalescence involves the merging of two adjacent vowels into a single segment that shares features from both vowels. The discussion that follows explores the environments in which coalescence occurs, the types of vowel combinations involved, and how this strategy compares with elision and glide insertion in the two languages.

The data in (98) illustrate cases in which hiatus between a low vowel /a/ and a following mid front vowel /ɛ/ in Esahie is resolved through coalescence, rather than elision or glide insertion. In these forms, the two adjacent vowels do not surface independently; instead, they merge into a single vowel that reflects properties of both segments. In *adwuma ɛnu pani* → [æɖɥume nu pæni] ‘manager, director’, loss of either of the two vowels at the word boundary does not occur. Instead, the surface vowel [e] appears, which is relatively low like /a/ and fronter than /ɛ/, and the surface vowel is located at one syllabic position. The same pattern is also found in *gya ɛkunu* → [ɖɛkunu] ‘sole’. Once again, a mid-front vowel [e] takes over the place of the native /a + ɛ/ pattern. There is no indication of vowel elision or glide insertion at the surface level. The same is true in *sua ɛnu* → [suwe nu] ‘room’, where two neighboring vowels are combined into one vowel that does not suffer from hiatus. Similarly, in *agya ɛbo* → [aɖɛbo] ‘toe’, the low and mid vowels merge into [e] on the surface, showing that both vowels are involved in the resulting pattern. Across the examples in (98), coalescence occurs in noun forms in /a + ɛ/ sequences, producing a front vowel whose height reflects an intermediate value between the two input segments.

(98) a + ɛ sequence in Esahie

	Spelling	SR	Gloss
a.	<i>adwuma ɛnu pani</i> work + PREP + elder	æɖɥume nu pæni	‘manager, director’
b.	<i>gya ɛkunu</i> leg + PREP	ɖɛkunu	‘sole’
c.	<i>sua ɛnu</i> building + PREP	suwe nu	‘room’

d.	agya εbo	adzebo	‘toe’
	leg + child		

One way to make a useful generalization about the contrast between (97e) and (98) is based on word classes in each of the constructions. While the two datasets share the same vowel sequence /a + ε/, those are found in different grammatical environments, and that difference apparently matters for hiatus resolution. In (97e), *ma εso* ‘to pick up, to lift, to raise’, the sequence is found in a verbal construction, where *ma* as a verb precedes a vowel-initial complement. Here the latter vowel is lost. In (98) we have forms containing nominals, e.g., *agya εbo* ‘toe’ and *gya ekunu* ‘sole’. Here the /a + ε/ sequence does not cause deletion. Rather, the two vowels merge (coalesce) to give a front-mid vowel [e]. Why should nouns operate differently from verbs in this regard? Overall, the results in (97e) and (98) reviewed above are indicative that word class may be a factor in influencing hiatus resolution in Esahie. Despite having the same vowel sequence combination (/a + ε/), deletion is triggered in the verbal context, while in the nominal context the two vowels merge, resulting in a raised vowel [e]. Seen through this lens, what is explained by coalescing in a nominal environment can be seen as an instance of preserving the phonetic segment within a single lexical item, and elision in a verbal context seems to be tolerated without any loss of interpretability. Notwithstanding the need for additional data to substantiate this generalization further, these examples suggest a potential correlation between syntactic category and resolution of hiatus in the language.

The Nzema data in (99) display an analogous coalescent treatment of hiatus with the combination /a + ε/. Like in Esahie, the two vowels come together forming a single vowel, which contains properties of both input components and thus there is no hiatus, but no deleted vocalic segment is involved. In *baka εbu* → [bakebu] ‘a stick has broken’, /a/ and the next mid front vowel /ε/ coalesce to form [e]. This gives a vowel with the frontness of /ε/ and the lack of height of /a/, thereby merging the two vowels into one segment. No glide insertion and no vowel elision are found, which implies that coalescence is the operating rule in resolving hiatus.

A similar outcome is found in *awa εfiti* → [awefiti] ‘a bottle gourd has cracked’. Here again, the /a + ε/ sequence resolves into [e], with both vowels contributing to the surface form. The smooth

transition suggests that the shared front vowel quality facilitates merging rather than deletion. The same pattern applies in *anloma edu* → [anlomedu] ‘a bird has flown’. Although the surrounding vowels vary in quality, the /a + ε/ sequence consistently results in a mid-front vowel, showing that the process is stable across different lexical environments. Likewise, *bana ewie* → [banewije] ‘plantain has finished’ illustrates an application of coalescence and the overall prosodic structure. In (99), the /a + ε/ hiatus in Nzema is resolved by producing a single mid front vowel that incorporates features from both input segments.

This pattern also differs from the standard height coalescence described by Casali (1996), where a high vowel lowers to mid (e.g., /a + i/ → [e]). In the Esahie and Nzema data, the second vowel is not high but mid-low /ε/, and it undergoes raising rather than lowering as it does in /a + i/. The output [e] is a mid vowel, which suggests that this is a case of e-coalescence rather than ε-coalescence, since ATR harmony is not active in deriving the output. According to Casali (1996), coalescence is directed towards non-high vowels. As the output from the data shows, the output [e] shares the [-round] and [+front] features with both input vowels. So therefore, the sequence /a/ + /ε/ undergo coalescence and vowel raising to [e] in a natural compromise. These forms demonstrate that, like Esahie, coalescence is a productive process in Nzema which, alongside elision and glide epenthesis, constitutes part of the general system of hiatus resolution.

(99) a + ε sequence in Nzema

	Spelling	SR	Gloss
a.	baka εbu tree + break-PST	bakebu	‘a stick has broken’
b.	awa εfiti bottle + crack-PST	awefiti	‘a bottle gourd has cracked’
c.	anloma edu bird + fly-PST	anlomedu	‘a bird has flown’
d.	bana ewie plantain + finish-PST	banewije	‘plantain has finished’

The forms in (100) illustrate how Esahie resolves hiatus involving the sequence /a + i/ through coalescence rather than elision or glide insertion. In these examples, the two adjacent vowels merge into a single mid front vowel, eliminating the hiatus while preserving phonetic material from each input vowel. The vowel configuration is different, but they coalesce to [e]. The low vowel /a/ followed by the front high vowel /i/ replaced by [e], as in *mvramain* → [mvramen] ‘armpit’. The resulting vowel is a compromise between the two vowels’ height, being higher than /a/ but lower than /i/ and retaining frontness. The fact that neither vowel is deleted on the surface means that they form a single vocalic unit.

A similar pattern is observed in *mbain yeɛ* → [mben jɛɛ] ‘senile person’. Here, the /a + i/ sequence again yields [e], showing that the outcome is consistent across different lexical items and morphosyntactic contexts. The process applies even when the sequence spans word boundaries, suggesting that coalescence is not restricted to lexical compounds but operates more generally. Taken together, the data in (100) show that Esahie treats /a + i/ sequences just like /a + ɛ/, producing a mid-front vowel that reflects contributions from both vowels rather than favoring deletion or glide insertion.

(100) a + i sequence in Esahie

	Spelling	SR	Gloss
a.	mvramain	mvramen	‘armpit’
b.	mbain yeɛ	mben jɛɛ	‘senile person’

4.4 Adjacent Identical Vowels

While we have accounted for elision in the previous section, let us also have a glance at the phenomenon of vowel sequences formed by identical vowels. In Nzema and Esahie, hiatus between adjacent identical vowels does not result in vowel fusion or repair by glide epenthesis. Instead, the evidence suggests that in surface form the second identical vowel (especially if it carries a low tone) is deleted. The application of elision disturbs the tone sequence, in this case HLH, at a more abstract level than segmental. The deletion of the low tone bearing vowel is thus phonetically obvious. While the vowel itself is not pronounced, its tonal effect can be seen in the downstep of a subsequent high tone. The second high tone is therefore at a lower pitch than the

first and, hence, it arrives on a less high pitch target. Here, we have a downstep representing the floating low underlying tone that is no longer segmentally realized but has docked on the following high-toned vowel.

To help the analysis, pitch contours of the relevant forms were visualized through PRAAT. Instead of using numerical F_0 values, the analysis employs the blue pitch traces on the spectrograms. These pitch contours allow us to see the lowering effect on the second high tone and that they show that the lowering is against a backdrop of where the elided low-tone vowel would be. The visual evidence therefore lends phonetic support to the analysis of these cases as movement-induced tonal downstep. Following Abakah (2004), downstepped high tones are indicated by an exclamation mark (!) placed after the downstepped vowel (e.g., [á!]). This convention places the mark at the location where downstepping occurs. This notation captures the tonal effects of vowel elision, namely a lowering of the pitch of a high tone relative to a preceding high tone.

(101) a + a sequence in Esahie

Spelling	SR	Gloss
a. tena ase	tíná + àsí [tínás!í]	‘to sit, to be seated’
b. ngaka alee	ṅgàká + àlǐjé [ṅgàkál!ǐjé]	‘to feed (animal)’
c. alaka abœ	àláká + àbójí [àlákáb!ójí]	‘grave’
d. pea ati	pìjá + àtí [pìjât!í]	‘head of the arrow’

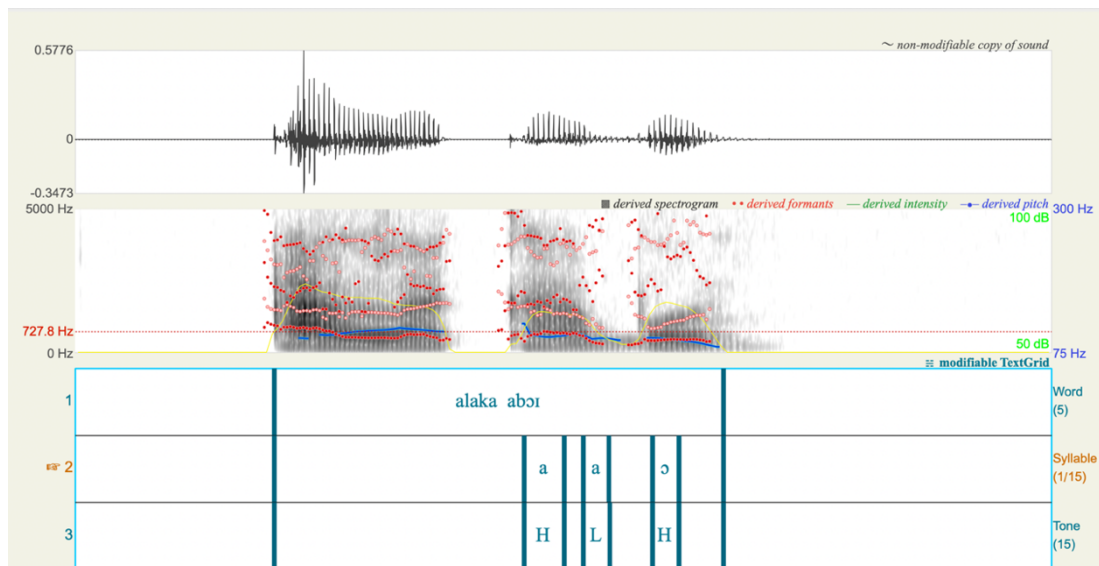
The facts in (101) show that Esahie deals with hiatus between /a + a/ under condition of the second vowel being low toned. In such forms, the like vowels should not coalesce to a long vowel and no glide intervenes. Instead, the second vowel as a low tone bearing unit gets elided. While the vowel is not present at the surface, its tone effect surfaces. In (101a) *tena ase* → [tínás!í] ‘to sit, to be seated’ the underlying low-toned vowel at the beginning of *ase* gets deleted. The deletion of this vowel breaks an HLH tonal pattern. Hence it is the second high tone that surfaces at a lower height, resulting in a downstepped high tone. The lowering of pitch is present even in the absence of the low vowel.

The same applies to (101b) *ngaka alee* → [ŋgàkál'íjé] ‘to feed animal’. Again, the second /a/, with a low tone, does not actually appear (its tone ‘floats’) at this moment. Its deletion and the resulting floating tone produce a downstep for the next high tone, leaving the rest of the segmental material unaltered. The tone change process provides the evidence that a low tone remains a part of phonological representation despite loss of the vowel host. In *alaka abɔe* → [àlákáb'ójí] ‘grave’ (101c), the same applies. The low vowel of the second word disappears, and the next high tone is realized at a lower pitch level. The downstep described here looks like those in the previous examples, which strengthens our claim about tonal uniformity in /a + a/ sequences. Finally, (101d) *pea ati* → [pìját'í] ‘head of the arrow’ indicates that this pattern is not restricted to a specific lexical item or structure. The second corresponding vowel is missing on the surface, but its tonal trace remains in the form of downstep. This demonstrates that the operation applies across disparate morphosyntactic environments.

In the examples in (101), the surface forms are consistent with an analysis where the hiatus of identical high- and low-toned vowels is repaired by vowel elision and phonetic downstep, as spelled out below. PRAAT pitch tracks for these forms demonstrate this pattern, displaying a reliable lowering of the second high tone after the elided low vowel. As can be seen from the spectrogram, vowels in this sequence that are identical are not mapped to the same pitch value, i.e., they have different tonal realization. This pitch contrast agrees with the claim that, despite segmental identity of the vowels, their tonal representations are different. The pitch trace shows a clear difference between the tones associated with each vowel (as seen in the blue line).

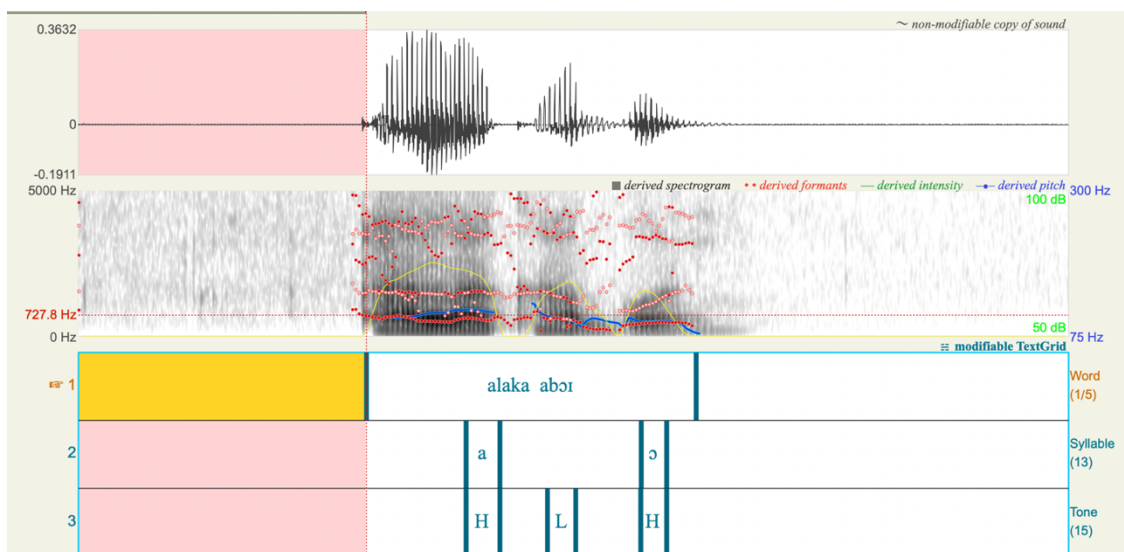
Attention can also be drawn to the following vowel /ɔ/ with a high tone, whose pitch is realized at a lower level than the preceding high tone. This lowering is analyzed as downstep, and it is visible especially in this recording where the word was uttered at a relatively slow speech rate. The lower pitch level of the high-toned vowel is maintained, though the tones applied to the sequence are identical (high and low tonal labels). The second instance presented in Figure (7) illustrates the same word in faster speech. By contrasting the two examples, we can already see here that speech rate has an effect in terms of phonetic realization of pitch while keeping the underlying tonal pattern constant.

Figure 6



PRAAT spectrogram showing pitch realization in an identical vowel sequence. The blue pitch contour indicates that the adjacent identical vowels are realized with different pitch values, reflecting distinct tonal specifications. The following high-tone vowel /ɔ/ is produced at a lowered pitch level, consistent with downstep triggered by the elision of a low tone bearing vowel.

Figure 7



PRAAT spectrogram of alaka abœ in Esahie produced at a fast speech rate. The pitch contour reveals a lowered realization of the second high tone, indicating downstep. Although the underlying tonal sequence remains HLH, the reduced pitch of the second high tone suggests the elision of the second vowel, with its low tone continuing to condition the surface tonal pattern.

This spectrogram represents the same form produced at a faster speech rate. In this example, the hiatus is not clearly realized segmentally, as the tonal value of the vowel is greatly reduced. Despite this compression, the tonal effects associated with the underlying vowel sequence remain visible in the pitch contour. Significantly, the vowel /ɔ/ is pronounced at less than a high pitch level of the preceding high tone. This lowering is treated as a downstep, suggesting that the tonal effect of the elided low tone remains regardless of whether hiatus is realized segmentally or not. The blue pitch trace exhibits a lowered pitch target for the high-toned vowel, in line with the downstep pattern heard in slower speech.

This is consistent with the analysis of downstep as a phonetic reflex of an underlying low tone that remains unexpressed segmentally in Abakah (2004). The current data consequently offer valuable evidence for the claim that tonal gestures are active in fast speech, even when segmental cues to hiatus are weak.

The data set in (102) provides evidence of the way hiatus is handled by Nzema between similar mid front vowels /ɛ + ɛ/. In these examples, the vowels do not merge, nor is a glide inserted between them. Instead, the second vowel in the sequence fails to surface. Given the description of (102a) *aleɛ ebe* → [àlǐjéb'í] ‘food is ready’, the initial vowel of the second word, which bears a low tone, is not realized in the surface form. The vowel itself is not attested, but its low tone gets left behind because of floating and the immediately following high tone sounds at a lower pitch height.

The result for (102b) also has an outcome *abele eya* → [àbèlǐj'á] ‘maize farm’. Once again, the second of the two identical vowels is not surface-attested, but high tone following it is lowered. In this way, the tonal pattern becomes exactly like that of (102a), reinforcing the view that the low-toned second vowel has been elided. The same tendency appears in (102c) *adele evalɛ* → [àdèlǐw'álé] ‘spoon taking’. The /ɛ + ɛ/ sequence is resolved without segmental merging, and the subsequent high tone exhibits the same pitch lowering due to downstep. Finally, (102d) *ewɔle ewu* → [èwòlǐw'ú] ‘a snake is dead’ further supports this analysis. The underlying tone effects of the second vowel do not appear in the surface, but they are evident through realizing an originally high tone as mid (downstepped).

These observations are supported by the PRAAT spectrograms. When the word is spoken slowly, the hidden HLH tone sequence can be read out without any evident pitch fall. In more rapid speech, however, the second vowel is no longer well-attested, although the subsequent high tone is predictably lowered. This contrast between speech rates helps to clarify that it is the second vowel, rather than the first, that elides in identical vowel sequences in Nzema, with downstep serving as the main phonetic cue to its absence.

(102) $\epsilon + \epsilon$ sequence in Nzema

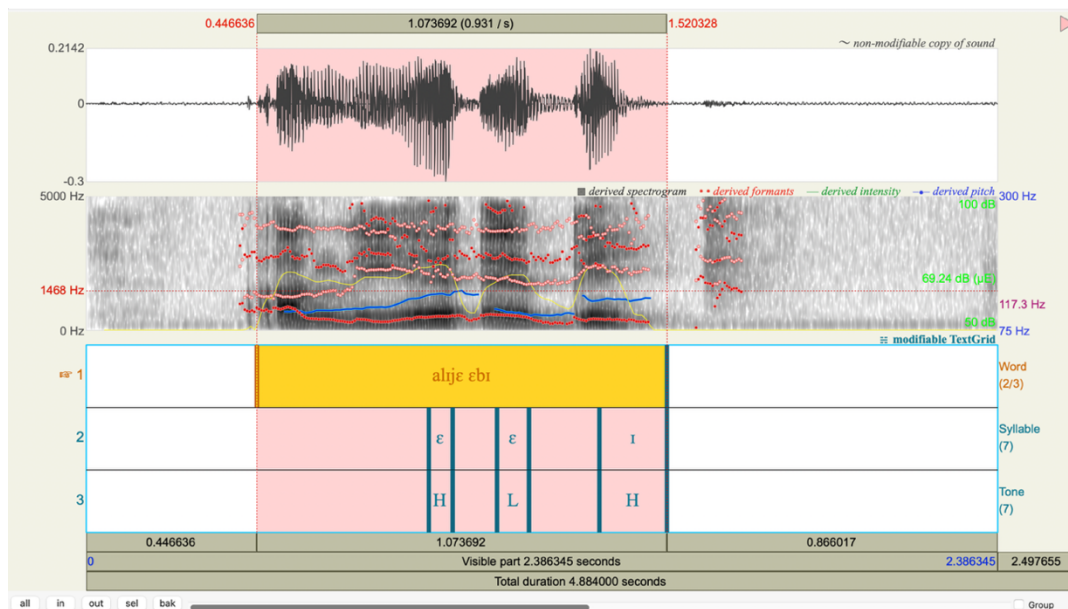
Spelling	SR	Gloss
a. <i>aleε ebe</i>	àlìjé + èbí [àlìjéb'í]	‘food is ready’
b. <i>abεle εya</i>	àbèlé + èjá [àbèléj'á]	‘maize farm’
c. <i>adele εvale</i>	àdèlé + èv'álé [àdèlév'álé]	‘spoon taking’
d. <i>εwóle εwu</i>	èwòlé + èwú [èwòléw'ú]	‘a snake is dead’

The following spectrograms represent the Nzema form *aleε ebe*, spoken at different speech rates. The first spectrogram (Figure 8) is for a slow-speech rendering of the word. In this instance, the sequence exhibits an HLH tonal pattern underlyingly, which agrees with what Abakah (2004) posits. The blue pitch trace demonstrates that the two high tones are produced at similar pitch heights, without a distinct lowering of the second high vowel. The tonal succession is unchanged.

A different picture emerges in the spectrogram (Figure 9), also showing the same word item spoken in a more rapidly paced speaking style. Here, the pitch contour indicates that the second H is produced at a considerably lower level than the first. This reduction can be seen in the blue trace and indicates a downstep. While the tonal designations are still HLH, the phonetic realization reflects a lowering of the pitch target of the second high tone.

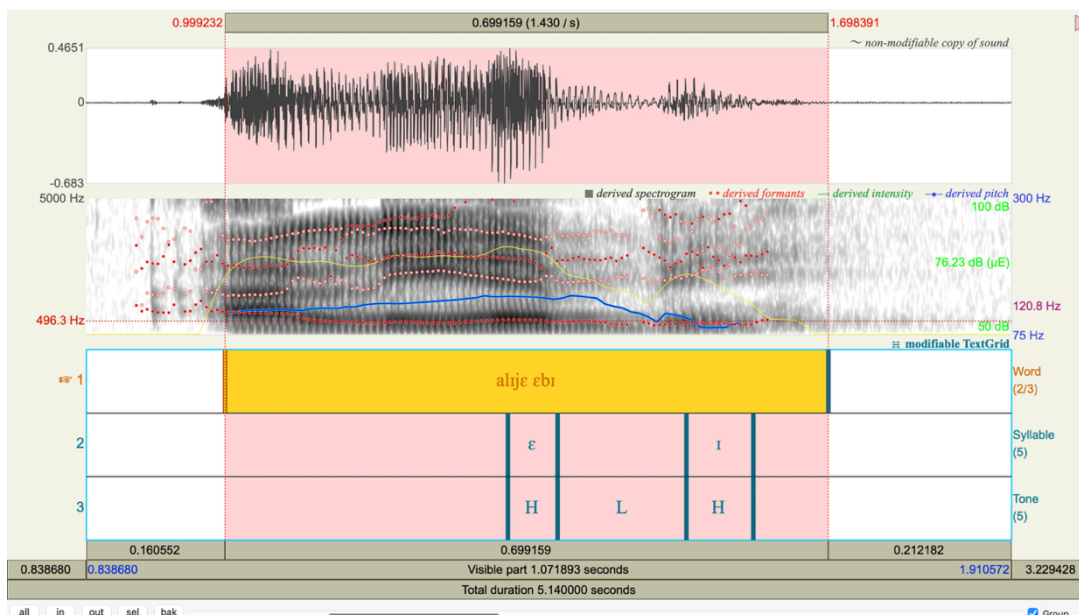
The two spectrograms support the claim that it is the second of the repeated vowels which elides and not the first. Although the vowel is not segmentally realized in rapid speech, its low tone still affects the tonal melody, with downstep occurring. Considered alongside the Esahie data, these Nzema forms are consistent with the conclusions reached in Abakah (2004) that tonal information can reflect vowel elision even when segmental cues to their presence are diminished or eliminated.

Figure 8



PRAAT spectrogram of aleε ebe in Nzema produced at a slow speech rate. The pitch contour (blue line) shows a clear HLH tonal sequence, with both high tones realized at comparable pitch levels. No downstep is observed in this token, indicating that the tonal pattern is fully realized when the identical vowel sequence is articulated clearly.

Figure 9



PRAAT spectrogram of aleε ebe in Nzema produced at a fast speech rate. The pitch contour reveals a lowered realization of the second high tone, indicating downstep. Although the underlying tonal sequence remains HLH, the reduced pitch of the second high tone suggests the elision of the second vowel, with its low tone continuing to condition the surface tonal pattern.

4.4 Conclusion

In this chapter, we have seen the strategies employed by Esahie and Nzema to overcome vowel hiatus across various phonological contexts. Based on both nominal and verbal data, the study has demonstrated that hiatus resolution in the two languages is not governed by a uniform mechanism. Rather, speakers employ a range of strategies such as glide insertion, vowel elision and coalescence based on the specific vowel combinations and their position within the grammatical context.

Glide insertion was found to be highly conditioned on the phonetic properties of the triggering vowel. The presence of a back rounded vowels always conditioned the appearance of the labial glide [w], whereas for front vowels it was the palatal glide [j]. Similar results were obtained for both Esahie and Nzema, across word classes, suggesting that the selection of a glide is based on articulatory structure.

The analysis of vowel elision showed that the rule is context sensitive. In certain contexts (usually including functional material), the first vowel was often dropped. In unrelated contexts, including between underlying forms or in like-segment sequences, the second vowel was dropped out from surface representation. Crucially, evidence derived from the tonal domain was critical in uncovering elision in these instances. Even when the vowel did not appear as a segment, its tonal effect was often preserved, most manifestly via downstep on a following high tone.

The chapter also demonstrated that coalescence plays an additional role in certain vowel sequences, enabling both the vowels to merge into a single surface vowel. The strategy showed that its application is sensitive to grammatical structure and word type. Hence, they can also be said to be part of a larger hiatus-resolution system that is not based on a single procedure through all possible environments. It can be seen that the hiatuses do not remain unchanged in either language, but repair must necessarily occur.

Overall, Esahie and Nzema confirm what has been observed in previous works on hiatus resolution in Kwa (and beyond), while emphasizing the relevance of tonology and grammatical organization in shaping surface representations. Enriched by instrumental data from PRAAT, this

chapter has pursued a detailed descriptive path, interlacing segmental analyses to capture how vowel hiatus is handled in the two languages; and it has laid out the stage for the theoretical discussion which will then follow in the next chapter.

CHAPTER FIVE

Theoretical Representations of Hiatus Resolution

5.0 Introduction

This chapter presents a theoretical account of the hiatus resolution patterns discussed in the previous chapters, drawing on both Optimality Theory (OT) and Autosegmental Representations. Based on data from Esahie and Nzema, the chapter demonstrates how the sorts of alternative repair strategies discussed in Chapter Four — glide epenthesis, vowel elision, and vowel coalescence — can be captured within these frameworks. The intent is not to bring in any new empirical correlations but rather to give a clearer theoretical account of the descriptive claims that have already been adduced.

The phenomenon of hiatus resolution is modeled as the result of interacting phonological constraints within the framework of Optimality Theory. Under this model, vowel sequences which cause hiatus are compared to markedness constraints against vowel-to-vowel contact and faithfulness constraints preserving the input segments and features. Variability in the surface expression of each segment is driven by constraint ranking across contexts, and the resulting variation in Esahie and Nzema patterns is therefore predictable without the need for language specific rules.

In addition to the OT analysis, Autosegmental Representations are used to illustrate how segmental and tonal elements are organized on separate tiers. This approach is useful for visualizing cases involving vowel elision and adjacent identical vowels, where tonal behaviors, such as downstepping and spreading play an important role. Autosegmental representations make it possible to show how tones remain linked to surviving vowels or are reassociated following segmental deletion, thereby complementing the constraint-based analysis.

The chapter begins with an outline of the constraints relevant to hiatus resolution and their roles in applying epenthesis, elision, and coalescence. The chapter will then present tableaux to help the discussion, alongside Autosegmental representations. Throughout the chapter, the analysis remains closely tied to the data from Esahie and Nzema and is intended as a formal extension of the descriptive findings presented earlier, rather than as a test of theoretical claims.

5.1 Constraint Inventory

This section introduces the set of constraints used in the Optimality Theory analysis of hiatus resolution in Esahie and Nzema. The constraints are drawn from well-established OT literature (cf. Kager, 1999) and are selected to capture the patterns of glide epenthesis, vowel elision, and vowel coalescence described in earlier chapters. No new constraints are proposed; rather, existing markedness and faithfulness constraints are adapted to the phonological data of the two languages.

The focus of the analysis is a markedness constraint that disfavors vowel sequences. Hiatus contexts occur when two vowels meet within a morpheme or across morpheme or word boundaries and the surface forms of both languages uniformly avoid them. This provides the motivation for the application of repair strategies that we are already familiar with from our study in Chapter Four. Here are the relevant constraints, which we will use from the theory.

Constraints

- i. ***V.V** – Adjacent vowels are prohibited in the output. This constraint compels the grammar to eliminate hiatus and is not overridden in contexts where repair is obligatory. Faithfulness constraints regulate how hiatus is resolved. In cases of glide epenthesis, the insertion of a consonantal segment violates constraints that require output forms to remain faithful to the input.
- ii. **AGREE[Place V₁]** – An epenthetic segment must agree in place features with the vowel to its left. AGREE constraints belong to the broader class of identity constraints—those that demand two segments to be alike with respect to the presence or value of some feature. In Danis’s (2017) formulation, identity constraints (both IDENT and AGREE) are constructed following a schema of Generalized Identity, which permits systematic variation along two parameters:
 - a. The relation between segments: input/output correspondence, surface correspondence (Agreement by Correspondence), or strict adjacency.
 - b. The location of place features in the geometry: within-category or cross-category (following Clements & Hume’s 1995 unified theory of place). Unlike DEP-IO and MAX-IO, which are faithfulness constraints governing input–output correspondence, AGREE[Place V₁] is a markedness constraint. It evaluates output

forms directly, penalizing sequences where adjacent segments disagree in place specification.

- iii. **DEP-IO** – Do not insert vocalic or consonantal segments. DEP-IO falls under faithfulness constraints which prohibit epenthesis—the insertion of segments in the output that lack corresponding input segments (McCarthy & Prince, 1995, 1999). It penalizes discrepancies where the output contains material which is not present in the input. It is the mirror image of MAX-IO, which penalizes deletion. Together, DEP and MAX ensure lexical integrity: the output should neither add to nor subtract from the underlying representation (Kager, 1999: 68–69). McCarthy & Prince (1995: 16) ground DEP-IO in Correspondence Theory, where input–output pairs stand in a correspondence relation. Epenthetic segments have no input correspondent, thus violate DEP. The constraint is universal and violable, ranked variably across languages. DEP-IO is low-ranked in languages that permit epenthesis for hiatus resolution, syllable structure repair, or cluster simplification. Its ranking is relative to markedness constraints such as ONSET, *COMPLEX, *V.V. When markedness dominates DEP-IO, epenthesis emerges as optimal (Prince & Smolensky, 1993/2004, pp. 17–21).
- iv. **UNIFORMITY** – One output segment must not correspond to multiple input segments. UNIFORMITY prohibits coalescence—the merging of multiple input segments into a single output segment (McCarthy & Prince, 1995, 1999). Formally defined within Correspondence Theory, UNIFORMITY requires that no output element have multiple input correspondents, thereby preserving a one-to-one mapping between underlying and surface forms (Kager, 1999, p. 68). As a faithfulness constraint, it belongs to the same family as MAX (no deletion) and DEP (no epenthesis), all of which evaluate segment count and input-output correspondence (Gouskova, 2023, p. 15). The ranking of UNIFORMITY relative to markedness constraints determines whether coalescence is an available repair strategy in each language. When markedness constraints such as *V.V or ONSET dominate UNIFORMITY, coalescence may emerge as optimal, as documented in Yoruba and various Bantu languages where vowel sequences fuse (Casali, 1997, pp. 511–512; Odden, 2015, pp. 45–47). Conversely, when UNIFORMITY is highly ranked, languages prefer alternative hiatus resolutions like epenthesis or deletion. This constraint crucially interacts

with feature preservation: coalescence violates UNIFORMITY but may satisfy MAX-IO constraints by preserving features from both inputs in the fused output.

- v. **MAX-IO(V₁)** – Every vowel in the input that corresponds to the first vowel (V₁) of a hiatus sequence must have a correspondent in the output. Deletion of V₁ violates this constraint. This positional faithfulness constraint favors preserving the first vowel over deleting it. It interacts with MAX-IO(V₂) and other markedness constraints to determine directionality of elision.
- vi. **MAX-IO(V₂)** – Every vowel in the input that corresponds to the second vowel (V₂) of a hiatus sequence must have a correspondent in the output. Deletion of V₂ violates this constraint. This positional faithfulness constraint favors preserving the second vowel. The relative ranking of MAX-IO(V₁) and MAX-IO(V₂) with respect to each other and to markedness constraints (e.g., *V.V, ONSET) decides which vowel is elided in each language or context.
- vii. **ONSET** – This constraint requires that syllables must not begin with vowels. Every syllable must have an onset.
- viii. **IDENT-[place]** – This constraint requires that the [place] feature specification (which could be labial, coronal, dorsal, etc.) of an input segment be preserved in the output
- ix. **INTERGRITY** – This constraint requires that no element in the input be associated with more than one element in the output. Each segment in the input corresponds to exactly one segment in the output.

Together, these constraints form the basis for the OT analyses presented in the following sections. Their interaction and relative ranking are illustrated through tableaux that model glide epenthesis, vowel elision, and vowel coalescence in Esahie and Nzema.

5.2 Optimality-Theoretic Analysis of Glide Epenthesis

As is illustrated in Chapter Four, glide insertion is predictable when two vowels are adjacent and neither vowel is deleted or merged. Rather, a glide is added between the vowels which avoids the vowels from being in sequence and, by that process, it preserves the underlying vowels. The analysis assumes that hiatus contexts violate the markedness constraint *V.V, which prevents adjacent vowels in the output. To comply with this constraint, a repair strategy must be chosen. In

cases of glide epenthesis, this repair involves the insertion of a segment, which necessarily violates the faithfulness constraint DEP-IO. The occurrence of epenthesis therefore reflects a ranking in which *V.V dominates DEP-IO, making segment insertion preferable to leaving the hiatus unresolved.

Of interest, the Esahie and Nzema data also indicate that the source for epenthetic glide is not random. Front vowels always cause the insertion of the palatal glide [j], whereas back rounded vowels cause the insertion of the labial-velar glide [w]. This is captured by AGREE[Place V₁], which demands that the epenthetic segment must be in place agreement with the vowel to its left. Candidates in which the glide fails to agree with the preceding vowel incur violations of AGREE[Place V₁] and are therefore disqualified. In this way, glide epenthesis in Esahie and Nzema can be understood as the outcome of a ranked constraint system that is sensitive to vowel features.

a. Labial Glide Insertion in a monomorphemic word (Nzema)

The first tableau represents the insertion of a labial glide in Nzema with the form *efua* ‘(female) Friday-born’. The input consists of a vowel sequence with a back rounded vowel followed by a low vowel. Leaving the hiatus unresolved violates the markedness constraint *V.V. Inserting a labial glide [w] resolves the hiatus and satisfies the agreement requirement enforced by AGREE[Place V₁], since the glide shares place features with the preceding back rounded vowel. A candidate that deletes a vowel (e.g., *efu* or *efa*) would satisfy *V.V and AGREE[Place V₁] but would violate the remaining constraints fatally. Consequently, deletion is less optimal than insertion. The winning candidate [efuwa] therefore incurs only a violation of the lowest-ranked constraint DEP-IO. This violation is tolerated because DEP-IO is ranked lower than the rest of the constraints.

Input: /efua/

Output: [efuwa]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> DEP-IO

Tableau 3

efua	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	DEP-IO
a. efua	*!					
b. ɛ efuwa						*
c. efuja				*!		*
d. efu			*!			
e. efa		*!				

Candidate (a) fatally violates the highest-ranked constraint *V.V by maintaining the hiatus and is eliminated immediately. Candidate (c) inserts a palatal glide [j], which resolves the hiatus (satisfying *V.V) but fails the fourth-ranked constraint AGREE[Place V₁] because the glide does not share the place features of the preceding rounded vowel /u/; this is a fatal violation. Candidates (d) and (e) delete vowels to resolve the hiatus. Candidate (d) deletes /a/ (violating MAX-IO(V₂)) and candidate (e) deletes /u/ (violating MAX-IO(V₁)); both violate the second and third-ranked constraints respectively. Since MAX-IO(V₁) and MAX-IO(V₂) outrank AGREE[Place V₁] and DEP-IO. Candidate (b) inserts the labial glide [w], which resolves the hiatus and satisfies AGREE[Place V₁] by matching the preceding vowel's place features. Although it violates DEP-IO (insertion of a segment), this is the lowest-ranked constraint. Thus candidate (b) emerges as optimal.

The constraint ranking here demonstrates a crucial property of Optimality Theory: strict domination (Kager, 1999, p. 22). Violation of the higher-ranked constraint *V.V cannot be compensated for by satisfaction of lower-ranked constraints. The economy of epenthesis follows from the principle that constraints are violable, but violation must be minimal (Kager, 1999, p. 12). Candidate (b) incurs only a violation of the lowest-ranked constraint DEP-IO, making it the most harmonic output.

b. Labial Glide Insertion in a monomorphemic word (Esahie)

A similar pattern is observed in Esahie, as shown by the form of *hoa* ‘story’. The hiatus is repaired through the insertion of the labial glide, which also agrees with the preceding back rounded vowel just as it happened in Nzema. As in Nzema, the constraint AGREE[Place V₁] plays a crucial role in determining the quality of the epenthetic segment.

Input: /h_Ua/

Output: [h_Uwa]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> DEP-IO

Tableau 4

hoa	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	DEP-IO
a. hoa	*!					
b.  h _U wa						*
c. h _U ja				*!		*
d. h _U			*!			
e. ha		*!				

This tableau parallels the Nzema analysis. Candidate (a) is eliminated by the highest-ranked constraint *V.V, as it leaves the vowel hiatus unresolved. Candidate (c) inserts a palatal glide [j] after the back rounded vowel [u]; although this resolves the hiatus, it fatally violates the fourth-ranked constraint AGREE [Place V₁] because the inserted glide fails to share the place features of the preceding vowel. Candidates (d) and (e) delete vowels to avoid the hiatus. Candidate (d) deletes /a/ (violating MAX-IO(V₂)) and candidate (e) deletes /u/ (violating MAX-IO(V₁)); both violate high-ranked faithfulness constraints. As Kager (1999, p. 68) observes, MAX-IO is the “anti-deletion” constraint, ensuring that input segments have output correspondents. When MAX-IO(V₁) and MAX-IO(V₂) outrank AGREE[Place V₁] and DEP-IO, deletion incurs a more severe violation than insertion. Candidate (b) [h_Uwa] inserts the labial glide [w], satisfying *V.V and AGREE[Place V₁]. Although it violates DEP-IO and it is the lowest-ranked constraint. This violation is tolerated because it is less serious than violating a highly ranked constraint. Candidate (b) thus emerges as the optimal candidate.

c. Palatal Glide Insertion in a monomorphemic word (Esahie)

The next tableau illustrates palatal glide insertion in Esahie using the form *sia* ‘in-law’. In this case, the initial vowel is front and high, which influences the insertion of the palatal glide [j]. The candidate lacking any repair fails to meet the criterion *V.V, while the candidate with an inappropriate glide fails to satisfy the AGREE[Place V₁] constraint and the deletion in MAX-IO.

Input: /sia/

Output: [sija]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> DEP-IO

Tableau 5

sia	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	DEP-IO
a. sia	*!					
b. ɪ sija						*
c. siwa				*!		*
d. si			*!			
e. sa		*!				

Candidate (a) preserves the input faithfully but leaves the vowel sequence /i-a/ intact, incurring a fatal violation of the top-ranked markedness constraint *V.V. Candidate (c) attempts to repair the hiatus by inserting a labial glide [w]. While this strategy successfully eliminates the vowel sequence and preserves both input vowels, it violates AGREE[Place V₁]. The inserted glide must share the place features of the preceding vowel /i/, which is front and unrounded; [w] is back and rounded. This violation is fatal because AGREE[Place V₁] is ranked above the lower constraints. The choice of the epenthetic segment is not arbitrary but is governed by the featural requirement that “an epenthetic segment must agree in place features with the vowel to its left” (Danis, 2017).

Candidates (d) and (e) pursue deletion as a repair strategy. Candidate (d) deletes the second vowel /a/, and candidate (e) deletes the first vowel /i/. Both satisfy *V.V and avoid epenthesis, but they violate the positional faithfulness constraints MAX-IO(V₂) and MAX-IO(V₁) respectively. These constraints, belonging to the MAXIMALITY family, “require that input segments have output

correspondents” (Kager, 1999, p. 67) – in other words, no deletion. Because these constraints are ranked above AGREE[Place V₁] and DEP-IO, the grammar prefers insertion over deletion.

Candidate (b) emerges as the optimal output. It resolves the hiatus by inserting the palatal glide [j], which shares the frontness and place features of the preceding vowel /i/, thereby satisfying AGREE[Place V₁]. It incurs the fewest violations among all competitors, making it the optimal candidate with respect to the constraint hierarchy.

d. Palatal Glide Insertion in a monomorphemic word (Nzema)

In the next tableau, Nzema has a palatal glide insertion in the word *aleɛ* ‘food’. Similar to Esahie, the presence of a front vowel in the initial position triggers the insertion of [j]. The chosen output ensures that there is no hiatus while still maintaining agreement with the left-hand vowel.

Input: /aliɛ/

Output: [aliɛ]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> DEP-IO

Tableau 6

aliɛ	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	DEP-IO
a. aliɛ	*!					
b. ali aliɛ						*
c. alɪwɛ				*!		*
d. alɪ			*!			
e. alɛ		*!				

The tableau illustrates a familiar pattern of feature-sensitive hiatus resolution in Nzema. Candidate (a) preserves the input faithfully but retains the vowel sequence /i-ɛ/, incurring a fatal violation of the undominated constraint *V.V. Candidate (c) inserts a labial glide [w] to break the hiatus. Although this strategy successfully eliminates the vowel sequence and avoids deletion, it violates AGREE[Place V₁] because the epenthetic segment does not share the place features of the preceding vowel.

Candidates (d) and (e) pursue deletion as an alternative repair strategy. Candidate (d) deletes the second vowel /ɛ/ (violating MAX-IO(V₂)), and candidate (e) deletes the first vowel /ɪ/ (violating MAX-IO(V₁)). Both violate high-ranked faithfulness constraints. Candidate (b) emerges as optimal. It inserts the palatal glide [j], which shares the frontness and place features of the preceding vowel /ɪ/, thereby satisfying both *V.V and AGREE[Place V₁]. Candidate (b) demonstrates that even a dominated constraint like DEP-IO remains active – it is violated, but minimally, precisely because no candidate can satisfy all constraints simultaneously. The grammar selects the candidate that best satisfies the hierarchy, making [alɪjɛ] the optimal candidate.

e. Palatal Glide Insertion across a word boundary (two separate words) in Nzema

A comparable pattern is found in Nzema compound forms, as shown by *di alɛ* ‘eat food’. The hiatus created at the boundary between the verb and the noun is resolved through the insertion of [j], which agrees with the front vowel of the first word. Candidates that either leave the hiatus unresolved or insert a mismatching glide are excluded.

Input: /di alɛ/

Output: [dɪjalɪjɛ]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> DEP-IO

Tableau 7

di alɛ	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	DEP-IO
a. di alɛ	*!*					
b.  dijalɪjɛ						**
c. diwalɪwɛ				*!*		**
d. dilɪ			*!*			
e. dalɛ		*!*				

This tableau extends the analysis to hiatus across word boundaries, where two separate words come into contact. The input consists of the verb *di* ‘to take’ and the noun *alɛ* ‘food’, creating two hiatus sites that require repair. Candidate (a) preserves both vowel sequences faithfully, resulting

in two violations of the undominated constraint *V.V. The prohibition against adjacent vowels is absolute, so this candidate is immediately eliminated.

Candidate (c) inserts a labial glide [w] at the boundary between the verb and the noun. While this strategy resolves the hiatus between /i/ and /a/, it incurs multiple fatal violations of AGREE[Place V₁]. Since the preceding vowel /i/ is front and unrounded, the labial glide [w] is incompatible and is therefore ruled out.

Candidate (d) attempts deletion as a repair, specifically deleting the second vowel in the sequence, resulting in [dɪlɪ]. However, this incurs multiple violations of MAX-IO(V₂), a high-ranked faithfulness constraint that militates against the loss of input segments. Candidate (e) deletes the initial vowel /i/ of the verb, resulting in [dalɛ]. However, the candidate fatally violates the highly ranked constraint MAX-IO(V₁), and it is eliminated.

Candidate (b) emerges as optimal. It inserts the palatal glide [j] at both hiatus positions, satisfying *V.V and AGREE[Place V₁] because the inserted glides share the frontness and place features of the preceding vowels (/i/ and /ɪ/). The candidate violates only the lowest-ranked DEP-IO twice. Since no candidate can satisfy all constraints simultaneously, the grammar selects the one that incurs the least serious violations. Candidate (b) thus emerges as the optimal candidate.

f. Labial Glide Insertion across a word boundary (two separate words) in Esahie

Labial glide insertion in Esahie compounds is illustrated with *mbo anoa* ‘beach’. The first word ends in a back rounded vowel, which conditions the insertion of the labial glide [w] when followed by a vowel-initial word. This glide resolves the hiatus and satisfies AGREE [Place V₁].

Input: /mbʊ anʊa/

Output: [mbʊwanʊwa]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> DEP-IO

Tableau 8

mbʊ anʊa	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	DEP-IO
a. mbʊ anʊa	*!*					
b. mbʊ mbʊwanʊwa						**
c. mbʊjanʊja				*!*		**
d. mbʊnʊ			*!*			
e. mbana		*!*				

This tableau examines hiatus resolution across word boundaries in Esahie. The input *mbʊ anʊa* creates two hiatus sites requiring repair. Candidate (a) preserves both vowel sequences faithfully, resulting in two violations of the constraint *V.V and is immediately eliminated fatally. Candidate (c) inserts a palatal glide [j] at both hiatus positions. While this resolves the vowel sequences, it incurs multiple fatal violations of AGREE[Place V₁] because the preceding vowels /ʊ/ are back and rounded, making the palatal glide incompatible. Candidate (d) deletes the second vowels, violating MAX-IO(V₂), while candidate (e) deletes multiple vowels as well, violating MAX-IO(V₁). The ranking of MAX-IO(V₁) and MAX-IO (V₂) above DEP-IO indicates that Esahie prefers insertion over deletion at this point.

Candidate (b) emerges as optimal. It inserts the labial glide [w] at both hiatus positions, satisfying *V.V and AGREE[Place V₁] because the glides share the roundness and backness features of the preceding vowels /ʊ/. The candidate violates only the lowest-ranked DEP-IO twice, making it the optimal surface form.

g. Labial Glide Insertion across a word boundary (two separate words) in Nzema

The final tableau under epenthesis demonstrates labial glide insertion in Nzema forms using *bo aka* ‘beat Aka’. The back rounded vowel in the verb triggers the insertion of [w] before the vowel-

initial noun. As in the previous cases, *V.V dominates DEP-IO, and AGREE[Place V₁] ensures that the inserted glide matches the features of the preceding vowel.

Input: /bʊ aka/

Output: [bowaka]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> DEP-IO

Tableau 9

bo aka	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	DEP-IO
a. bʊ aka	*!					
b. bʊ bowaka						*
c. bʊjaka				*!		*
d. bʊka			*!			
e. baka		*!				

This tableau also examines hiatus resolution across word boundaries in Nzema. The input *bʊ aka* creates one hiatus site requiring repair. Candidate (a) preserves the vowel sequence faithfully, resulting in a violation of *V.V. This is a fatal violation. Candidate (c) inserts a palatal glide [j] at the hiatus position. While this resolves the vowel sequence, it incurs a fatal violation of AGREE[Place V₁]. Candidate (d) deletes the second vowel /a/, violating MAX-IO(V₂). Candidate (e) deletes the first vowel /ʊ/ as well. Both are eliminated fatally. Candidate (b) emerges as optimal. It inserts the labial glide [w] at the hiatus position, satisfying *V.V and AGREE[Place V₁] because the glide shares the roundness and backness features of the preceding vowel /ʊ/. The candidate violates only the lowest-ranked DEP-IO, making it the winner (optimal).

5.3 Optimality-Theoretic Analysis of Vowel Elision

This section presents an OT analysis of vowel elision as a strategy for resolving hiatus in Esahie and Nzema. Elision applies in contexts where one of the vowels in a hiatus sequence is systematically deleted, rather than preserved through epenthesis or merged through coalescence. The choice of elision as a repair strategy reflects a different balance between markedness and faithfulness constraints.

As with glide epenthesis, hiatus contexts incur violations of the markedness constraint *V.V, which prohibits adjacent vowels. In elision environments, however, hiatus is resolved not by inserting a segment, but by deleting one of the vowels. This means that candidates with vowel deletion violate faithfulness constraints, particularly those that require the preservation of input segments. The faithfulness constraint that determines which of the vowels to be deleted, either the first or the second under the application of vowel elision is:

MAX-IO [Vowel] - Do not delete vowels.

Elision necessarily violates MAX-IO, since one vowel from the input fails to surface in the output. The selection of elision therefore implies a ranking in which *V.V dominates MAX-IO, making vowel deletion preferable to maintaining hiatus. Directionality plays an important role in determining which vowel is deleted. The descriptive analysis showed that elision in Esahie and Nzema is not random, but patterned: in many contexts, either the first vowel (V₁) or the second vowel (V₂) is consistently targeted, depending on vowel quality, tone, and morphological structure. This directional preference can be modeled through the interaction of faithfulness and positional constraints, which regulate which segments are more protected from deletion. In contexts where the second vowel is consistently deleted, candidates that preserve the first vowel but delete the second incur fewer serious violations than candidates that delete the first vowel. Conversely, in contexts where first-vowel deletion is observed, the opposite ranking pattern applies. In both cases, the OT system derives directionality through constraint interaction. The tableaux in the following section illustrate these patterns using representative examples from Esahie and Nzema, showing how vowel elision is applied through constraint interaction.

a. V₁ Elision in Esahie

Input: /jɛ apina/

Output: [japina]

Ranking: *V.V >> DEP-IO >> MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> MAX-IO(V₁)

Tableau 10

jɛ apina	*V.V	DEP-IO	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	MAX-IO (V ₁)
a. jɛ apina	*!					
b. jewapina		*!		*		
c. jɛjapina		*!				
d. jɛpina			*!			
e. jɛ japina						*

This tableau illustrates first vowel elision in Esahie for the input *jɛ apina* ‘our bat’, where the vowel of the pronoun /jɛ/ deletes before the vowel-initial noun. Candidate (a) preserves both vowels faithfully, resulting in a fatal violation of *V.V. Candidates (b) and (c) insert glides ([w] and [j] respectively) to resolve the hiatus. Both incur violations of DEP-IO, which is ranked above the lower constraints. Candidate (b) additionally violates AGREE[Place V₁] because [w] does not share the front feature of the preceding vowel /ɛ/. Candidate (d) deletes the second vowel /a/, violating MAX-IO(V₂), a high-ranked constraint. Candidate (e) deletes the first vowel /ɛ/, producing [japina]. This satisfies *V.V and avoids epenthesis and deletion of the second vowel. The only violation incurred is against the lower ranked MAX-IO(V₁). Candidate (e) thus emerges as optimal.

b. V₁ Elision in Nzema

Input: /jɛ ale/

Output: [jalɪ]

Ranking: *V.V >> DEP-IO >> MAX-IO(V₂) >> AGREE[Place V₁], UNIFORMITY >> MAX-IO(V₁)

Tableau 11

jɛ alɪ	*V.V	DEP-IO	MAX-IO (V ₂)	AGREE [Place V ₁]	UNIFORMITY	MAX-IO (V ₁)
a. jɛ alɪ	*!					
b. jɛwalɪ		*!		*		
c. jɛjalɪ		*!				
d. jɛ lɪ			*!			
e. jɛ jalɪ						*

This tableau illustrates first vowel elision in Nzema, parallel to the Esahie pattern. The input /jɛ ale/ contains a hiatus between the pronoun *jɛ* and the noun *ale*. Candidate (a) preserves both vowels faithfully, resulting in a fatal violation of *V.V. Candidates (b) and (c) attempt to resolve the hiatus through glide insertion. Candidate (b) inserts [w], which violates AGREE[Place V₁] because the labial glide does not share the front feature of the preceding vowel /ɛ/. Candidate (c) inserts [j], but both insertion candidates violate DEP-IO, which is ranked above the lower constraints. Candidate (d) deletes the second vowel /a/, violating MAX-IO(V₂), a high-ranked constraint. Candidate (e) deletes the first vowel /ɛ/, producing [jale]. This satisfies *V.V and avoids epenthesis and deletion of the second vowel. The only violation incurred is against the lower ranked MAX-IO(V₁). The ranking of MAX-IO(V₂) over MAX-IO(V₁) indicates that Nzema, like Esahie, preferentially deletes the first vowel rather than the second when resolving hiatus. Candidate (e) thus emerges as optimal.

c. V₂ Elision in Esahie

Input: /atendε aben/

Output: [atendε ben]

Ranking: *V.V >> DEP-IO >> MAX-IO(V₁) >> AGREE[Place V₁], UNIFORMITY >> MAX-IO(V₂)

Tableau 12

atendε aben	*V.V	DEP-IO	MAX-IO (V ₁)	AGREE [Place V ₁]	UNIFORMITY	MAX-IO (V ₂)
a. atendε aben	*!					
b. atendε waben		*!		*		
c. atendε jaben		*!				
d. atend aben			*!			
e.  atendε ben						*

This tableau demonstrates a case of second vowel elision in Esahie, where the initial vowel of the second element is targeted for deletion. Candidate (a) maintains the hiatus and is immediately ruled out by the undominated constraint *V.V. Candidates (b) and (c) pursue glide insertion as a repair strategy. Both violate DEP-IO, which is ranked relatively high in the hierarchy. Additionally, candidate (b) inserts [w] after the front vowel /ε/, incurring a violation of AGREE[Place V₁]. Candidate (d) deletes the first vowel, which is the final vowel of *atendε*, incurring a fatal violation of MAX-IO(V₁). The grammar strongly resists deleting the first vowel, as reflected in the high ranking of this constraint. Candidate (e) deletes the second vowel, the initial vowel of *aben*, producing [atendε ben]. This candidate satisfies *V.V, avoids epenthesis, and preserves the first vowel. The only violation incurred is against the lower ranked MAX-IO(V₂). The ranking MAX-IO(V₁) >> MAX-IO(V₂) shows that Esahie prefers to delete the second vowel when the first vowel is part of a lexical word. Candidate (e) thus emerges as the optimal output.

d. V₂ Elision in Nzema

Input: /wɔ ɛkpa/

Output: [wɔkpa]

Ranking: *V.V >> DEP-IO >> MAX-IO(V₁) >> AGREE[Place V₁], UNIFORMITY >> MAX-IO(V₂)

Tableau 13

wɔ ɛkpa	*V.V	DEP-IO	MAX-IO (V ₁)	AGREE [Place V ₁]	UNIFORMITY	MAX-IO (V ₂)
a. wɔ ɛkpa	*!					
b. wɔ wɛkpa		*!				
c. wɔ jɛkpa		*!		*		
d. wɛkpa			*!			
e. wɔ wɔkpa						*

Nzema resolves hiatus through second vowel elision in this instance, as illustrated by the input /wɔ ɛkpa/. The optimal candidate [wɔkpa] emerges after evaluating several competing repair strategies. The constraint *V.V immediately eliminates candidate (a), which leaves the vowel sequence intact. Glide insertion proves unsuccessful for candidates (b) and (c). Both incur violations of DEP-IO. Candidate (c) additionally fails AGREE[Place V₁] because the palatal glide [j] does not match the rounded feature of the preceding vowel /ɔ/. Candidate (d) takes a different approach by deleting the first vowel /ɔ/, but this violates the high-ranked MAX-IO(V₁). The grammar strongly resists deleting the first vowel, as indicated by its ranking above the lower constraints.

Candidate (e) successfully deletes the second vowel /ɛ/, yielding [wɔkpa]. This candidate satisfies *V.V, avoids insertion, and preserves the first vowel. The only violation incurred is against the lower ranked MAX-IO(V₂). The ranking MAX-IO(V₁) over MAX-IO(V₂) reveals that Esahie preferentially deletes the second vowel when the first vowel belongs to a lexical word. Candidate (e) therefore emerges as the optimal output. This pattern mirrors the behavior observed in Esahie, confirming that both languages share the same constraint ranking for second vowel elision.

The tableaux in this section demonstrate how the ranking of the constraints contributes to deriving an optimal candidate in both languages. The core markedness constraint is *V.V. The choice of

which vowel is deleted is determined by two positional faithfulness constraints MAX-IO(V_1) (preserve the first vowel) and MAX-IO(V_2) (preserve the second vowel).

- First-vowel deletion follows from the ranking $*V.V \gg \text{DEP-IO} \gg \text{MAX-IO}(V_2) \gg \text{AGREE}[\text{Place } V_1], \text{UNIFORMITY} \gg \text{MAX-IO}(V_1)$. Here, deleting V_1 violates the lower ranked constraint, while deleting V_2 or inserting a glide violates higher constraints.
- Second-vowel deletion follows from the mirror ranking $**V.V \gg \text{DEP-IO} \gg \text{MAX-IO}(V_1) \gg \text{AGREE}[\text{Place } V_1], \text{UNIFORMITY} \gg \text{MAX-IO}(V_2)$. Here, deleting V_2 is the lowest ranked constraint, while deleting V_1 or inserting a glide violates higher-ranked constraints.

The same constraint set and a reranking of the hierarchy potentially (varying across languages or contexts) account for both patterns.

5.4 Optimality-Theoretic Analysis of Coalescence

This section shows a theoretical approach in resolving hiatus through coalescence. As shown in the preceding chapters, certain vowel sequences in Esahie and Nzema surface with a single vowel replacing both vowels of the hiatus but not identical with either of them rather than with an intervening segment or vowel deletion. The aim of this section is to account for these surface forms within an Optimality Theory framework by identifying the constraint interactions that favor this outcome. The OT analysis focuses on how faithfulness to input segments interacts with constraints that regulate feature preservation and output structure. The discussion remains closely tied to the data and does not assume that this strategy applies uniformly across all hiatus contexts. The analysis proceeds by introducing the constraints relevant to this repair strategy and showing how their relative ranking derives the observed surface forms. These constraints are drawn from standard OT literature and are applied consistently with the approach adopted in earlier sections of this chapter.

Constraints Relevant to Coalescence

- *V.V**- Adjacent vowels are prohibited in the output.
- MAX-IO(V_1)** - Every input segment must have a correspondent in the output. Thus, no deletion of the first vowel.

- c. **MAX-IO(V₂)** - Every input segment must have a correspondent in the output. Thus, no deletion of the first vowel.
- d. **DEP-IO** - Do not insert segments.
- e. **UNIFORMITY**- One output segment must not correspond to multiple input segments.
- f. **AGREE[Place V₁]** - Glide agrees to first vowel place of articulation

a. Vowel Coalescence in Esahie (a + ε)

Input: /agya εbo/

Output: [adzebo]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> DEP-IO >> AGREE[Place V₁],
UNIFORMITY

Tableau 14

adza εbo	*V.V	MAX-IO (V₁)	MAX-IO (V₂)	DEP-IO	AGREE [Place V₁]	UNIFORMITY
a. adza εbo	*!					
b. adza wεbo				*!	*	
c. adza jεbo				*!	*	
d. adza bo			*!			
e. adz εbo		*!				
f. ad adzebo						*

This tableau illustrates vowel coalescence in Esahie, where the sequence /a + ε/ merges to produce [e]. The input /agya εbo/ contains a hiatus, which is between the final vowel of *agya* and the initial vowel of *εbo*. Candidate (a) preserves both vowels faithfully and is immediately eliminated by constraint *V.V, which prohibits adjacent vowels. Candidates (b) and (c) attempt to resolve the hiatus through glide insertion. Candidate (b) inserts [w], and candidate (c) inserts [j]. Both incur violations of DEP-IO, which penalizes insertion.

Candidates (d) and (e) apply elision as the repairing strategy. While candidate (d) deletes the vowel /a/, candidate (e) deletes the vowel /ε/ in the sequence, violating MAX-IO. Both candidates are eliminated by these high-ranked faithfulness constraints. Candidate (f) emerges as optimal. It resolves the /a + ε/ hiatus through *e*-coalescence, merging the two vowels into [e]. The candidate satisfies *V.V. and the other highly ranked constraints. The violation incurred in candidate (f) is UNIFORMITY, which is ranked low in the hierarchy.

b. Vowel Coalescence in Nzema (a + ε)

Input: /baka εbu/

Output: [bakebu]

Ranking: *V.V>> MAX-IO(V₁), MAX-IO(V₂) >> DEP-IO >> AGREE[Place V₁], UNIFORMITY

Tableau 15

baka εbu	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	DEP-IO	AGREE [Place V ₁]	UNIFORMITY
a. baka εbu	*!					
b. baka wεbu				*!	*	
c. baka jεbu				*!	*	
d. baka bu			*!			
e. bak εbu		*!				
f.  bakebu						*

Nzema resolves the hiatus in /baka εbu/ through vowel coalescence, as shown in this tableau. The optimal candidate [bakebu] emerges after evaluating several competing repair strategies. The constraint *V.V immediately eliminates candidate (a) because the violation is fatal. Glide insertion proves unsuccessful for candidates (b) and (c). Both insert a glide to break the hiatus but fatally violates the higher ranked constraint DEP-IO. Deletion strategies also fail in candidate (d) and (e). Candidate (d) deletes the second vowel /ε/, violating MAX-IO(V₂), while candidate (e) deletes /a/, violating MAX-IO(V₁).

Candidate (f) successfully coalesces /a + ε/ into [e]. This candidate satisfies *V.V. despite violating UNIFORMITY. This is the only violation incurred in the competition. This pattern parallels the coalescence observed in Esahie, confirming that both languages share the same constraint ranking and output for /a + ε/ coalescence.

c. Vowel Coalescence in Esahie (a + i)

Input: /mvramain/

Output: [mvramen]

Ranking: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> DEP-IO >> AGREE[Place V₁] >> UNIFORMITY

Tableau 16

mvramain	*V.V	MAX-IO (V ₁)	MAX-IO (V ₂)	DEP-IO	AGREE [Place V ₁]	UNIFORMITY
a. mvramain	*!					
b. mvramawin				*!	*	
c. mvramajin				*!	*	
d. mvraman			*!			
e. mvramin		*!				
f.  mvramen						*

This tableau illustrates vowel coalescence in Esahie, where the sequence /a + i/ merges to produce [e]. This coalescence pattern is attested in Esahie but not in Nzema, representing a key phonological difference between the two languages. The input /mvramain/ contains a hiatus site between /a/ and /i/. Candidate (a) preserves both vowels faithfully and is immediately eliminated by the higher ranked constraint *V.V. Candidates (b) and (c) attempt glide insertion but violate DEP-IO fatally. Candidates (d) and (e) delete the first and the second vowels respectively. Both candidates violate MAX-IO(V₁) and MAX-IO(V₂).

Candidate (f) emerges as optimal. It resolves the hiatus through *e*-coalescence, merging /a + i/ into [e]. This candidate satisfies *V.V because the coalesced output is [e]. The only violation incurred is against UNIFORMITY, which is ranked low in the hierarchy.

The coalescence tableaux reveal both shared and divergent patterns between Esahie and Nzema. Both languages employ the same constraint ranking for vowel coalescence: *V.V >> MAX-IO(V₁), MAX-IO(V₂) >> DEP-IO >> AGREE[Place V₁], UNIFORMITY. This ranking explains why both languages prefer coalescence over glide insertion or deletion when resolving hiatus involving /a + ε/ sequences. However, a notable difference emerges in the treatment of /a + i/ sequences. While

Esahie extends coalescence to this environment, merging /a + i/ to [e], Nzema does not exhibit this pattern. The constraint ranking nonetheless remains stable across both languages, with UNIFORMITY ranked lower to ensure that coalescence outputs surface as [e]. Despite these attempted constraint rankings, a complete OT account would require a fixed ranking of constraints that derives all attested patterns without reranking. Developing such an account is beyond the scope of this dissertation, which focuses on descriptive and typological coverage.

5.5 Autosegmental Analysis of Identical Vowel elision

This section turns to an Autosegmental representation of hiatus involving adjacent identical vowels in Esahie and Nzema. As already established in the descriptive analysis, sequences of identical vowels do not undergo glide epenthesis or vowel coalescence. Instead, the second vowel in the sequence, which typically bears a low tone, is elided. This segmental loss has clear tonal consequences, particularly for the following high tone, which surfaces as downstepped.

This theory provides a useful framework for representing this pattern, as it allows segmental and tonal tiers to be represented independently. By separating vowels from their tonal specifications, it becomes possible to show how vowel deletion does not necessarily entail tone deletion but may instead trigger tonal re-association or downstep. This approach is especially relevant for Esahie and Nzema, where tone plays an active role in distinguishing surface forms.

In the case of identical vowel sequences, the representations show that the two vowels are underlyingly associated with separate tonal units, typically forming an HLH tonal sequence across a morpheme boundary. When the second vowel is elided, the low tone associated with it does not surface as an independent tone-bearing unit. Instead, its presence is reflected in the phonetic realization of the following high tone, which is lowered relative to the preceding high tone. This lowering is interpreted as downstep (Abakah, 2004).

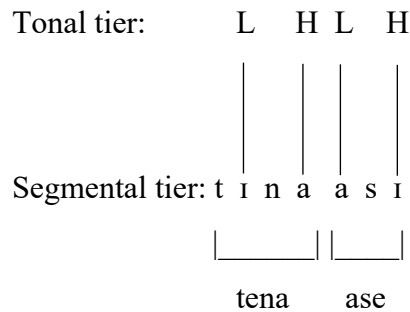
In both Esahie and Nzema, the autosegmental evidence supports the view that it is the second vowel in identical vowel sequences that is targeted for elision, with tonal effects providing independent evidence for this process.

Step-by-step Autosegmental representation:

i. tena ase → [tɪnás'í]

(a) Underlying representation (before elision)

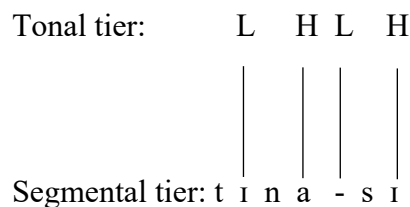
At the morpheme boundary, the sequence involves identical low vowels /a + a/, each linked to its own tone. The tonal pattern across the morpheme boundary is H-L; the second vowel (the initial vowel of *ase*) bears a low tone. The following vowel in *ase* bears a high tone, which is within the same morpheme.



Each vowel is a tone-bearing unit (TBU) and is associated with a tone. At this stage, both vowels are fully pronounced, and hiatus is present. The sequence L-H-L-H is observed at this stage. As evident, none of the vowels has been elided. Observe the mapping of each tone to a vowel.

(b) Elision of the second identical vowel

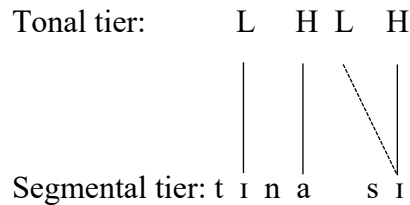
The second vowel /a/ (the initial vowel of *ase*), which carries a low tone, is deleted. This removes its segmental anchor but leaves its tonal effect in the representation.



The low tone loses its vowel host and becomes floating.

(c) Tonal reconfiguration and downstep

The floating low tone docks between the two high tones now, triggering downstep on the following high tone. The final high tone is realized at a lower pitch level.



(d) Surface representation

The surface form reflects:

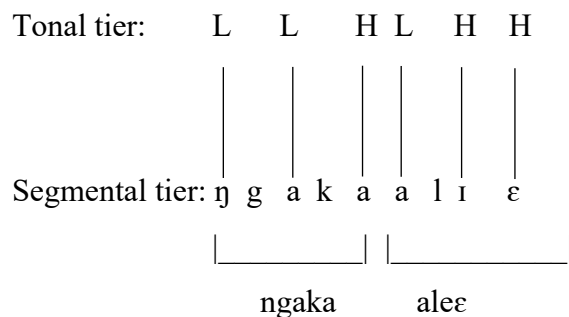
1. deletion of the second identical vowel
2. retention of tonal contrast
3. downstepping of the following high tone

The output then becomes [tínás'í] ‘to sit, to be seated’.

ii. ngaka alee → [ŋgákál'íjé]

(a) Underlying representation (before elision)

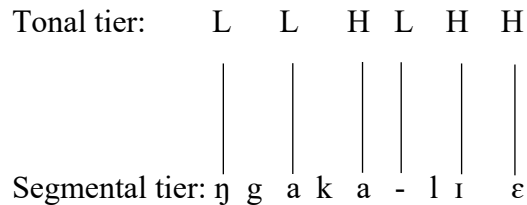
At the morpheme boundary, we encounter a similar sequence of a + a as we observed above. Each vowel is associated with its own tone. The tonal pattern across this boundary remains H-L-H, with the second /a/ carrying a low tone. Consequently, the tonal sequence is L-L-H-L-H-H, all tones of which are linked to their respective tone-bearing units.



At this stage, both identical vowels are present, and hiatus is clearly visible at the boundary.

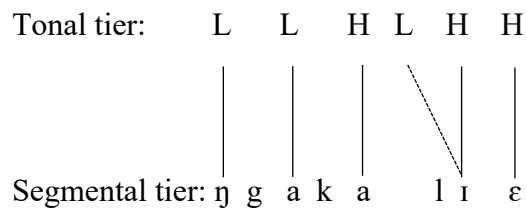
(b) Elision of the second identical vowel

The second vowel /a/, which is the initial vowel of *alee* and carries a low tone, is deleted. Its tone loses its segmental anchor and becomes floating. The low tone remains in the tonal tier without a vowel to associate with.



(c) Downstep triggered by the floating low tone

The floating low tone now lies between two high tones. It then docks on the following vowel (on /i/) to be realized at a lower pitch level, producing downstep.



The tonal contrast is preserved, but the pitch height of the second high tone is reduced or lower than the actual tone value.

(d) Surface representation

The surface form shows:

1. deletion of the second identical vowel,
2. with a palatal glide insertion,
3. downstepping of the following high tone.

[ŋgàkál'íjé] 'feed (animal)' is the output. Note that the palatal glide [j] is not present in the underlying representation; it is inserted by epenthesis during the derivation.

Autosegmental analysis of identical vowel sequences in Nzema

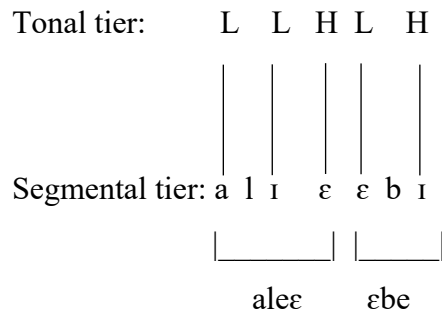
Nzema shows the same general behavior observed in Esahie when identical vowels occur across a morpheme boundary. Rather than merging the vowel or triggering glide insertion, the second vowel in the sequence deletes, and its tone plays a crucial role in shaping the surface tonal pattern. This can be illustrated in the steps below.

Step-by-step representation:

i. $ale\epsilon\ ebe \rightarrow [\text{àlijéb'í}]$ ‘food is ready’

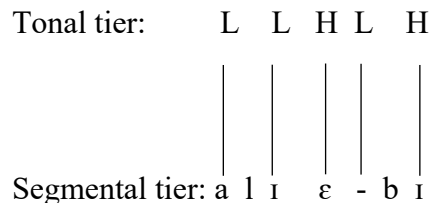
(a) Underlying representation

At the boundary between *ale ϵ* and *ebe*, there is an $\epsilon + \epsilon$ sequence. Each vowel is linked to its own tone, producing an H-L-H tonal configuration across the boundary.



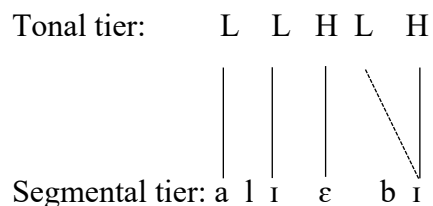
(b) Elision of the second identical vowel

The second / ϵ /, which is the initial vowel of *ebe* and bears a low tone, is deleted. Its tone remains in the tonal tier as a floating low tone. The underlying tonal environment includes a low tone between two high tones (HLH). After elision of the low-toned vowel, the low tone remains as a floating tone.



(c) Downstep of the following high tone

The floating low-pitched tone affects the following high tone, which is pronounced on the vowel of /bɪ/. Consequently, the second high tone is affected by downstep.



(d) Surface representation

The final output shows:

1. loss of the second identical vowel,
2. change of syllable structure,
3. downstepping of the following high tone.

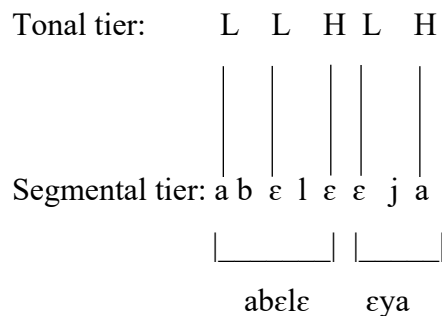
Output: [àlìjéb'í] ‘food is ready’

The palatal glide [j] is not present in the underlying representation; it is inserted during the derivation process through epenthesis.

ii. $ab\epsilon l\epsilon \epsilon ya \rightarrow [\grave{a}b\grave{e}l\acute{e}j'\acute{a}]$ ‘maize farm’

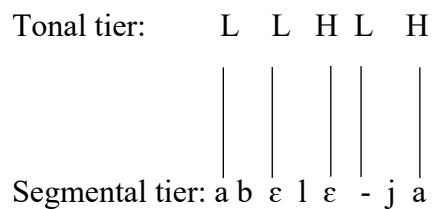
(a) Underlying representation

The sequence involves $\epsilon + \epsilon$ across a morpheme boundary: the final vowel of *ab ϵ l ϵ* and the initial vowel of *ϵ ya*. Each vowel is associated with its own tone, yielding an H-L-H tonal pattern.



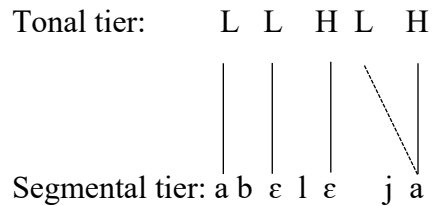
(b) Elision of the second identical vowel

The initial vowel of the second word *ϵ ya*, which bears a low tone, is deleted. Its tone remains on the tonal tier as a floating low tone. The deletion removes the segmental hiatus but leaves a tonal trace.



(c) Downstep of the following high tone

The floating Low tone triggers downstep on the following high tone linked to /a/. Although the tone remains high, it is realized at a lower pitch level.



(d) Surface representation

The final output reflects:

1. loss of the second identical vowel,
2. downstepping of the following high tone.

Output: [àbèlɛ́j'á]

These two examples represent different syntactic structures: a full clause ‘food is ready’ and a noun-noun compound ‘maize farm’. The consistent application of elision and downstep across both types confirms that the process is not syntactically restricted.

We can see the consistency in all the sequences of identical vowels in the two languages. This highlights that there is no difference in accounting for the fate of identical vowels in both languages. Based on these observations, it is reasonable to propose that in both Esahie and Nzema, identical vowel sequences across morpheme boundaries are resolved through second-vowel elision, with tonal reassociation producing downstep rather than complete tonal loss. This proposal aligns with earlier observations in Akan, particularly those discussed in Abakah (2004), while extending the analysis to Esahie and Nzema.

5.6 Revisiting vowel elision in light of tonal evidence

The autosegmental analysis presented in §5.5 demonstrated that in sequences of adjacent identical vowels, the tonal specification of each vowel—specifically, the presence of a low tone on the second vowel, thus determines the direction of elision. When the low-toned second vowel is

deleted, its tone does not disappear but rather floats and triggers downstep on the following vowel. This section extends this tonal approach to cases of non-identical vowel elision discussed earlier in §5.3. It is proposed that the direction of elision in all hiatus contexts, whether the vowels are identical or not, is conditioned by the underlying tonal melody, with the deletion of a low-toned middle vowel in an HLH sequence consistently producing downstep. This theoretical generalization unifies the treatment of vowel elision across both languages and generates testable predictions about tonal behavior in non-identical sequences.

5.6.1 The Tonal Generalization

The analysis of identical vowel sequences in §5.5 established a clear tonal generalization: deletion of the middle element in an HLH tonal sequence, invariably a low-toned vowel, leaves behind a floating low tone that associates with the following high tone, producing downstep. This principle is not limited to adjacent identical vowel sequences. It is a tonal generalization that should apply whenever an HLH sequence occurs across a morpheme or word boundary, irrespective of whether the vowels are identical or not. The following subsections demonstrate how this generalization can be applied to the non-identical vowel elision data. The crucial factor, then, is not whether the vowels are segmentally identical, but rather their position within an HLH tonal sequence:

- If the first vowel of an HLH sequence (the high-toned vowel) is deleted → No downstep.
- If the middle vowel of an HLH sequence (the low-toned vowel) is deleted → Downstep on the following high-toned vowel.

Applying this tonal generalization to the non-identical vowel elision data from §5.3 reveals a consistent pattern. Consider the first-vowel elision examples in (103) and (106).

At the morpheme boundary between *yε* and *asoε*, the sequence involves a high-toned vowel /e/ from the pronoun *yε* followed by a low-toned vowel /a/ from *asoε*. The tonal pattern across this boundary is H-L, with the following vowel in *asoε* bearing a high tone, yielding a full HLH sequence.

Autosegmental representation showing: H-L-H linked to jé + àsóé [jàsújé]

This autosegmental representation below illustrates first-vowel elision in Esahie, using the example *yε asoε* → [jàsújé] ‘to obey’. In the underlying representation (a), the input consists of

(a) Underlying representation

(b) First vowel elision

(c) Tone floating

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(d) Surface representation

1. loss of the first vowel,
2. no downstepping.

Output: [jàsójé]

The deletion of the first vowel, which bears a high tone (the first element of the HLH sequence), should not produce downstep. Following the generalization established in §5.5, the deletion of a high-toned vowel leaves behind a floating high tone, which does not condition a lowering effect on the following tones. As Abakah (2004) notes for similar Fante data, the deletion of a high-toned vowel in an HLH sequence does not result in downstep. The surface forms in (103) and (105) bear this out: no downstep is observed on the following high tone, confirming that the tonal generalization applies equally to non-identical sequences.

In contrast, consider the second-vowel elision examples from (104) and (106). At the morpheme boundary between *nzu* and *eyeε*, the sequence involves a high-toned vowel /u/ from *nzu* followed by a low-toned vowel /e/ from *eyeε*. The tonal pattern across this boundary is H-L, with the following vowel in *eyeε* bearing a high tone, yielding a full HLH sequence.

Autosegmental representation showing: H-L-H linked to ñzú + èjíé [ñzúj'íjé]

This autosegmental representation illustrates second-vowel elision in Esahie, using the example *nzu eyeε* → [ñzúj'íjé] ‘hot water’. In the underlying representation (a), the input consists of *nzu* (bearing a high tone on /u/) followed by *eyeε* (which begins with a low-toned /e/ and continues with a high-toned vowel, yielding an HLH tonal sequence across the morpheme boundary. In (b), the second vowel /e/, which bears a low tone, is deleted from the segmental tier, leaving its low tone without a segmental anchor. In (c), this low tone floats on the tonal tier and docks on the following high-toned vowel, triggering downstep, which is realized as a lowered pitch on the following high tone. The surface output in (d) shows the loss of the second vowel with downstepping on the following high tone, confirming that when a low-toned vowel is deleted (the middle element of an HLH sequence), its floating tone triggers downstep, whereas deletion of a high-toned vowel does not.

(a) Underlying representation

Tonal tier: L H L H H

 | | | | |

Segmental tier: η z u ε j I ε

 | | | | |

 nsu eyee

(b) First vowel elision

Tonal tier:	L	H	L	H	H
Segmental tier:	ŋ	z	u	-	j
				j	ɛ

(c) Downstep configuration

Tonal tier: L H L H H

 | | | |

Segmental tier: η z u j i j ε

(d) Surface representation

1. loss of the second vowel,
2. downstepping.

Output: [ɲzúj'íjé]

In these cases, the deleted vowel is the second vowel of the hiatus, which is the middle element of an HLH sequence and bears a low tone. According to the generalization, deletion of this low-toned vowel should leave behind a floating low tone that triggers downstep on the following high tone.

(103) First vowel elision (Esahie)

Spelling	SR	Gloss
a. yε asoε	jé + àsúé [jàsújé]	‘to obey’
b. yε apina	jé + àpíná [jàpíná]	‘our bat’
c. wo asiwa	wó + àsíwá [wàsíwá]	‘your betrothed’

(104) Second vowel elision (Esahie)

Spelling	SR	Gloss
a. bowie εkunu	bòwíé + èkúnú [bòwíjék'únú]	‘bone marrow’
b. nzu eyee	ḥzú + èj́íé [ḥzúj'íjé]	‘hot water’

(105) First vowel elision (Nzema)

Spelling	SR	Gloss
a. yε ale	jé + àlí [jàlí]	‘(that) we may eat’
b. yε akuma	jé + àkúamá [jàkúamá]	‘our axe’
c. yε etu	jé + ètú [jètú]	‘our gun’

(106) Second vowel elision (Nzema)

Spelling	SR	Gloss
a. wɔ εkpa	wó + èkpá [wók'pá]	‘your mat’
b. ezene εdanle	èzèní + èdánlɛ [èzèníd'ánlɛ]	‘funeral cloth’

In summary, the autosegmental analysis presented in this chapter offers a unified account of vowel elision in Esahie and Nzema. By separating segmental and tonal tiers, it becomes possible to see that the direction of elision is conditioned not only by vowel quality or morphological structure but also by the underlying tonal melody. The deletion of a low-toned vowel in an HLH sequence consistently produces a floating tone, which manifests as downstep on a following high tone. This tonal trace provides crucial evidence for determining which vowel has been elided, particularly in cases where the two vowels are segmentally identical. The analysis thus complements the constraint-based account offered by Optimality Theory, demonstrating that a complete

understanding of hiatus resolution in these languages requires attention to both segmental and suprasegmental structure.

This analysis has implications for the broader study of hiatus resolution in Kwa languages, suggesting that tonal structure may play a more significant role in determining phonological alternations than has previously been recognized. Future research should investigate whether similar tonal conditioning of vowel elision is found in other Kwa languages, and whether the tonal generalizations proposed here extend to other phonological processes in Esahie and Nzema.

CHAPTER SIX

Summary, Findings, Recommendations and Conclusion

6.0 Summary of the Study

In this thesis we examined similar processes in Esahie and Nzema, two Kwa languages spoken in Ghana. The aim was to describe how vowel sequences are resolved both morpheme-internally and across morpheme boundaries. The study was concerned with various vowel combinations found in lexical items, compound constructions and grammatical environments including both lexical and functional material. Based on the elicited data, the research analyzed phonological strategies to repair hiatus, such as glide epenthesis, vowel elision, coalescence, and the behavior of adjacent identical vowels. Apart from the descriptive analysis, Optimality Theory and Autosegmental Phonology were used to explain such patterns and their tonal manifestations. Acoustic evidence was also used to corroborate the tonal analysis, when downstepping on identical vowels was observed, using PRAAT. It revealed common patterns of approach as well as language-specific idiosyncrasies in hiatus resolution and contributed to a broader typology of vowel interaction in Kwa phonology.

6.1 Major Findings

This section reports the main findings of the study, following from a descriptive or theoretical analysis of hiatus resolution strategies in Esahie and Nzema. Based on phonological evidence from both languages, we studied epenthesis, elision, coalescence, as well as the treatment of sequences of identical vowels as a subcase of vowel elision. We thus examined how these four factors interact in determining surface realizations. Collectively, these results offer new insights into the phonological behavior of vowel clusters in Esahie and Nzema.

6.1.1 Analysis of Glide Epenthesis in Esahie and Nzema

The comparative analysis of the CUa sequence indicates a phonological difference between Esahie and Nzema with respect to vowel quality and epenthetic glide choice. Although the two languages share the same trigger for phonological alternation, their derivational paths are not nearly so similar.

6.1.1.1 Derivational Complexity in Esahie

In Esahie, the derivation of the CUa sequence is highly complex. The language exhibits horizontal vowel shift (delabialization) and palatalization that change the vowel quality, before epenthesis will apply.

- **Mechanism:** This complex derivation explains the insertion of a palatal glide rather than a labial one.
- **Scope:** Notably, this epenthetic process is consistent across lexical categories, appearing in both nouns and verbs.

6.1.1.2 Standard Glide Insertion in Nzema

Conversely, Nzema approaches the CUa sequence with less derivational overhead. The language does not subject the vowel to prior palatalization or horizontal vowel shift (delabialization).

- **Mechanism:** Instead, the sequence undergoes standard glide insertion.
- **Outcome:** Consequently, in labial contexts, a labial glide is epenthesized, reflecting the inherent qualities of the sequence without the complex vowel shifts observed in Esahie.

6.1.1.3 Shared Trigger Directionality

Despite the differences in the resulting glides (palatal vs. labial), the underlying trigger mechanism remains consistent across both languages.

- **Directionality:** In both Esahie and Nzema, the first vowel in the sequence serves as the primary trigger for the phonological change.
- **Symmetry:** This indicates a shared structural behavior regarding the direction of the process, even though the internal derivational requirements of each language lead to different surface forms.

6.1.2 Patterns of Vowel Elision

Vowel deletion in Esahie and Nzema involves directionality, meaning that both the first and the second vowel can elide. Selection of the target vowel (as first or second) is determined by both morphological category and the exact phonetic nature of the vowels in question.

6.1.2.1 First Vowel Elision (V₁ Elision)

In certain syntactic and morphological environments, the first vowel (V₁) in a sequence is targeted for deletion:

- **Possessive Constructions:** In Esahie, V₁ elision specifically targets possessive pronouns.
- **Compound Formations:** When forming compound words in Esahie where the second element begins with the vowel /a/, the final vowel of the first word is automatically elided.
- **Nzema Variants:** A similar pattern is observed in Nzema, though the trigger set is broader; V₁ is elided if the initial vowel of the second word is either /a/ or /ʌ/.

6.1.2.2 Second Vowel Elision (V₂ Elision)

The preservation of ‘modifiers’ is a primary factor in second vowel elision for both languages. However, distinct divergences appear in specific vowel sequences:

- **Head Word deletion:** In second vowel elision, the modifier (the first word) is preserved, while the head (the second word) loses its initial vowel. This pattern holds for both Esahie and Nzema, as shown in examples (92) and (93). However, there was an exceptionality of head word preservation in (93e) in Nzema.
- **The /ɔ + a/ Sequence:** A sharp contrast between the two languages is found in the treatment of the /ɔ + a/ sequence:
 - **Esahie:** Targets the second vowel (V₂) for deletion.
 - **Nzema:** Targets the first vowel (V₁) for deletion, thereby preserving the second vowel.

6.1.3 Vowel Coalescence

The phonological interaction of specific vowel sequences in Esahie and Nzema further reveals how these languages resolve hiatus through merging.

6.1.3.1 Coalescence of Front Vowels

In both languages, specific front vowel sequences undergo coalescence, where two distinct vowels merge into a single vowel that shares features of both.

- **Mechanism:** When the low vowel /a/ or a similar open vowel interacts with front vowels such as /ɛ/ or /i/, they merge to become the mid-front vowel /e/.

- **Outcome:** This process reduces the syllable count while preserving the fronting feature of the original sequence in a single segment.

6.1.4 Resolution of Identical Vowel Sequences

The apparent patterns of sequences of adjacent identical vowels for Esahie and Nzema from the data support the claims by Abakah (2004). In such cases, hiatus is not resolved through glide insertion or by treating the sequence as an underlying long vowel; rather, tonal structure determines which vowel is elided. The tonal structure of the two identical vowels helps to know which of them is deleted.

- **Tonal Asymmetry in Elision:** Tone plays the decisive role in determining which vowel in an identical pair is elided.
 - **Target:** The second vowel bearing a low tone is the primary target for elision.
 - **Preservation:** The first vowel carrying a high tone is preserved.
- **Downstep Effects:** This tonal preservation explains the downstep effects observed on subsequent high tones in the surface forms of both languages.

6.1.5 Optimality Theory and Autosegmental representation

Finally, the analysis through Optimality Theory showed that the language specific patterns could be accounted for with different rankings of constraints. The tableaux demonstrate that strategy-based variation is reranking variation, rather than the existence of different sets of constraints, and the Autosegmental representations allow for the description of tonal behavior which cannot be captured by a segmental analysis.

6.2 Recommendations

It is suggested that future studies consider carrying out detailed acoustic investigation of the F1 and F2 values for the vowels in this category through PRAAT software. This would serve as empirical, frequency-driven evidence for the vowel quality shifts in Esahie.

More extensive study is required to record the ‘downstep effects’ on high tones after identical vowel resolution. Notwithstanding, the tone level of the next vowel after the application of a resolution strategy has to be considered for future research as well. This asymmetrical tonal

relationship is important for a comprehensive tone map of the two languages. Subsequent research should consider the specific environment types of these processes, and why epenthesis in Esahie applies to both nouns and verbs, while other elision processes are restricted to a particular word class, possessive pronouns.

Lastly, the theoretical modeling could be further extended by probing alternative constraint hierarchies (within OT) or contrasting analyses based on OT with those framed in other theories to evaluate the adequacy of the proposed Vowel-Structure-Resyllabification constraints. This would allow researchers to weigh theoretical explanations of the role different phonological processes play in resolving hiatus in tone languages.

6.3 General Conclusion

In this research, vowel hiatus resolution in Esahie and Nzema has been explored regarding epenthesis, deletion, coalescence and same-vowel-sequences. By means of a descriptive analysis, Optimality Theory and Autosegmental representations, it was demonstrated that hiatus resolution in both languages is phonologically accounted for and conditioned by vowel quality, tonal structure and morphological boundaries. The major contributions of this study are summarized as follows:

- **Divergent Paths in Epenthesis:** Although both languages use the first vowel in the sequence as the trigger for epenthesis, Esahie exhibits a more derivationally complex patterning that involves horizontal vowel shift (delabialization) and palatalization, which results in palatal glide insertion. In Nzema, however, standard glide insertion is used, and in labial contexts the resultant glide is a labial one.
- **Bi-directionality of Elision:** Vowel elision in the two languages is a double-edged mechanism, motivated by morphological structure and individual vowel identity. Though both languages have the same concern for preserving modifiers, they differ in certain sequences (e.g. /ɔ + a/, where Esahie deletes the second vowel while Nzema deletes the first one).
- **The Behavior of /a/ in Hiatus Resolution:** The study reveals that /a/ is consistently preserved and never deleted. Regarding epenthesis, /a/ is not involved in this process at all, as glide epenthesis is triggered only after high vowels, where the epenthetic glide shares

the place features of the preceding vowel. In terms of coalescence application, it shares a feature with the derived vowel /e/ when after the merger.

- **Tonal Supremacy:** Tonal considerations supersede other resolution patterns in sequences of adjacent identical vowels. The high-toned vowel that must be preserved over the low-toned one is not there only to resolve hiatus, but this choice also explains the kind of downstepping phenomenon which happens in phonetic representation.

In the final analysis, these findings serve to highlight that although they are closely related languages, Esahie and Nzema phonological rules exhibit distinct internal logic—most particularly with respect to derivational depth. This work provides a groundwork for additional acoustic validation that is more thoroughly quantified with software like PRAAT.

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Appendix A

Epenthesis

Esahie

Spelling	SR	Gloss
abɛmua	abɛmuja [abɛm ^u ija]	‘a boy’
aburasia	æburasija	‘sixty’
abusuanie	æbusujaniɛ [æbus ^u ijaniɛ]	‘relative’
adoe	adoji	‘monkey’
adwufua	ædzɔfɔfɔja [ædzɔf ^u ija]	‘word’
ahurusie	æhurusije	‘to rejoice’
akatusa	akætɔja [akæt ^u ija]	‘pay’
akɔniaba	akɔnijaba	‘to swing’
akyideɛ	ætɛidɛ	‘forbid’
amrokua	amrokuja [amrok ^u ija]	‘mouse, squirrel’
asoe	asowɛ	‘ear’
awɛen	awɛjin	‘horn’
awisea	æwisija	‘nephew’
ayisia	ajisija	‘orphan’
bayie	bæjije	‘witchcraft’
bia nzue	bija ŋzuwe	‘to swim’
boa	bowa	‘to assemble, to pack’
bodua	bodɔja [bod ^u ija]	‘amulet, charm’
boin	bɔjin	‘nose’
bokyea	bɔtɛja	‘cooking stone’
bosea	bɔsija	‘to lend, to borrow’
brasua	bræsɔja [bræs ^u ija]	‘woman’
bremsua	bremsɔja [brems ^u ija]	‘male, man’
bu animtia	buwanimtija	‘to disdain, to despise’
bua	buja [b ^u ija]	‘a pot’
bubuanie	bubujaniɛ [bub ^u ijaniɛ]	‘cripple’
bue	buwe	‘nest’

buebua	buwebuja [buweb ^u ija]	‘to cover (v)’
buluo	buluwo	‘yam’
dua	duja [d ^u ija]	‘plant, tree, tail’
dwodwo ahone	dzɔdɔdzɔwahonɪ	‘calm (oneself)’
ebiale	ebijalɛ	‘to wash’
esurein	easurejin	‘to fear’
ewiase	ewijasɪ	‘world’
eyein	ejejin	‘firewood’
ɛboe	ɛboɟɪ	‘to shell (groundnuts) (v)’
ɛsoen	ɛsojin	‘elephant’
ɛsue	ɛsuwɛ	‘to cry’
ɛwɔfoe	ɛwɔfowɛ	‘guest, visitor’
foa	fowa	‘to chase’
gua nza	g ^u ija nza	‘to pour libation’
gyedie	dzɪdije	‘belief’
hia	hija	‘need’
hoa	howa	‘story’
hua	huja [h ^u ija]	‘smell’
hue	huwe	‘chest’
hue	huwɛ	‘husband’
hwie gua	ɛɟije guja [ɛɟije g ^u ija]	‘to pour’
kotoa nyamaa	kɔtowa ɲama:	‘umbilical cord’
kuanie	kujanije [k ^u ijanije]	‘farmer’
kunanie	kunanije	‘widow’
kyiremvua	tɛiremvija [tɛiremv ^u ija]	‘egg’
mboanoa	mbowanɔwa	‘beach’
moa	mɔwa	‘to fold, to squeeze’
mviasee	mvijasije	‘to start, to begin’
ndeamue	ndijamuwɛ	‘to shout, to cry out’
nimdeɛ	nimdije	‘knowledge’
nɔboakoma	nɔbowakɔma	‘maggot’

nsusui	nsusuji	‘suggestion’
nwu amanee	nwuwamanije	‘to suffer’
nyɔkowa	ɲɔkɔwa	‘grinding stone’
nzoa peɛ	ɲzɔwa peɛ	‘to insult’
nzoen	ɲzɔjin	‘ashes’
nzu ehoin	ɲzuwehɔjin	‘(be) thirsty’
nzoa	ɲzɔwa	‘to insult’
nzue	ɲzuwe	‘water, dam’
obuo	obuwo	‘to obey’
pe yia	pe jija	‘to surround’
pia	pija	‘to push’
prakasua	prakasuja [prakas ^ɥ ija]	‘harmattan’
sia	sija	‘in-law’
soa	sɔwa	‘to swell’
sɔ nea	sɔ nija	‘to try’
sua	suja [s ^ɥ ija]	‘to learn’
suesua	suwes ^ɥ ija	‘to imitate’
tu atee	tuwatɪ:	‘to travel’
tua	tuja [t ^ɥ ija]	‘to close, to shut’
tui	tuji	‘gun’

Nzema

Spelling	SR	Gloss
abialeɛ	ʌbijʌlije	‘bathroom’
aboa	abɔwa	‘animal’
abusua	abusuwa	‘family’
abuwa	ʌbuwʌ	‘smoke pipe’
aduoba	ʌduwɔbʌ	‘guava’
aleɛ	alije	‘food’
aloa	alɔwa	‘lily’
amgbɛɛ	amgbije	‘a shellfish’

amie	Λmije	‘to curve’
azie	Λzije	‘sepulcher’
bia	bijΛ	‘to bathe’
bie	bije	‘to urinate’
bo aka	bɔwaka	‘beat Aka’
boani	bɔwani	‘sheep’
bua	buwΛ	‘to cover something’
debie	debije	‘something’
di aleε	dijalije	‘eat food’
die	dije	‘to take’
dua	duwΛ	‘to plant’
ebia	ebijΛ	‘chair’
ebue	ebuwe	‘shed’
efua	efuwa	‘name- Friday born (fem)’
elue	eluwe	‘yam’
ezukoa	ezukowa	‘money’
εmialeε	εmijΛnle	‘hardship’
kua	kuwΛ	‘to gather’
kyea	tɛija	‘to bend’
moa	mɔwa	‘a place (far)’
nea	nija	‘to look’
nealeε	nijalije	‘mirror’
pia	pijΛ	‘to push’
soa	sɔwa	‘to carry’
soa	sɔwa	‘to send’
su ahule	suwΛhule	‘to fetch groundnut’
sua	suwΛ	‘house’
te aluna	tijΛluba	‘to harvest groundnut’
tea	tija	‘to shout’
tia	tija	‘to walk’
tiboa	tibowa	‘conscience’

tie	tije	‘to listen’
tua	tuwΛ	‘to pay’
tuokε	tuwoke	‘hernia’

Appendix B

Elision

Esahie

Spelling	SR	Gloss
abura ɛnu	æburenu	‘fifty’
agyaa asi	adzæ:si	‘heel’
aleɛ asi	aliɛ si	‘to crust’
asie aleɛ	æsije liɛ	‘cemetery’
atendɛ abɛn	atendɛ bɛn	‘flute’
awuro ano	æwuranɔ	‘house door’
ayire atɛɛ	æjiretɛ:	‘poison (on arrow)’
bakaa afia	bakæfija	‘trunk (tree)’
bayie eyeɛ	bæjije jeɛ	‘to cast spell, to bewitch’
bɛnɛ ɛso	bɛnɪ sɔ	‘direction’
bobɔ anu	bubɔ nu	‘to crunch’
bowie ɛkunu	bowijekunu	‘bone marrow’
bɔ onu ase	bɔnu asɪ	‘to bow’
ɛsɛɛ aseɛ	ɛsɪɛ siɛ	‘grassland’
ka ɛnum	ka num	‘to stir’
kanea eyia	kanija jija	‘sunshine light’
kyenɛɛ apiri	tɛmijɛ piri	‘big(gest) drum’
kyerɛkyerɛ emu	tɛrɛtɛrɛ nu	‘to explain’
kyɛ ebie	tɛɛ bijɛ	‘to prevent’
kyɛ enu	tɛɛ nu	‘to divide, to separate’
ma ɛso	ma sɔ	‘to pick up, to lift, to raise’
mako ammui	mæko muji	‘pepper (green)’
me agyapadɛɛ	madzapadiɛ	‘my property’
mia ɛnu	mija nu	‘to fasten’
nandwie afu	nandzuijɛ fu	‘hump (cow)’
no ahore	nahore	‘his/her truth’
nzu eyeɛ	ɲzuijɛ	‘hot water’

nzue asee	ηzuwasije	‘to marsh’
nzue atole	nzuwatole	‘to draw water’
ɔba ɔpani	ɔbapani	‘first born’
ɔbɔɔ ɛbunu	ɔbɛ:bunu	‘adult’
pɛ anu	pænu	‘to cut open (fruit)’
pira ɔnwo	piranwo	‘to hurt yourself’
sie ebue	sijebuje	‘small of back’
sona ebue	sonabuje	‘side (of the body)’
te ɛfi enu	ti fi nu	‘to subtract, to take away’
toa ɛso	towa so	‘to continue’
twe enu	tɛɥi nu	‘to squeeze, to wring out’
wo agyina	wædzina	‘your decision’
wo alie	walije	‘your food’
wo asiwa	wæsiwa	‘your betrothed’
wo aye	waje	‘you have’
wura enu	wura nu	‘to enter, to go in’
yɛ apina	japina	‘our bat’
yɛ asetena	jasitina	‘our life’
yɛ asoe	jasuje	‘to obey’
yɛ asuesua	jæsujes ^u iija	‘we have imitated’

Nzema

Spelling	SR	Gloss
agyale ezukoa	adzalezukowa	‘bride price’
ahule eluale	ʌhuleluwale	‘groundnut sowing’
baka ebule	bʌkebule	‘a piece of stick’
bana edwenle	banadzɥɪnli	‘plantain farm’
bɛ adɔma	badɔma	‘their baby’
bɛ asɔne	basani	‘their church’
bɛ azele	bazili	‘(that) they may laugh’
bɛ azu	bʌzu	‘(that) they may cry’

bolo ebale	bolobale	‘football game’
bolo ede	bolode	‘a ball has burst’
butule eya	butuleja	‘quarrel plant (fern)’
etu edo	etudo	‘there is a gunshot’
ezule edo	ezuledo	‘it has rained’
ehone ehuele	ehoneile	‘to fast’
ezene edanle	ezenidanle	‘funeral cloth’
kodwo ekye	kodzotei	‘little Kodwo’
komu ewu	komuwu	‘a monkey is dead’
manza eba	manzaba	‘a personal name (fem)’
me ale	mali	‘(that) I may eat’
me anlōga	manlōga	‘my grandchild’
me ava	mava	‘(that) I may take’
me esumi	misumi	‘my pillow’
me eyeba	mijeba	‘my earthenware pot’
nane ewulu	naniwulu	‘an animal has jumped’
ndo ekpa	ndokpa	‘Indian mat’
sane etulu	sanitulu	‘a broom is loosened’
wō abele	wabele	‘your corn’
wō ava	wava	‘(that) they may take’
wō azele	wazele	‘your land’
wō ekpa	wokpa	‘your mat’
ye ado	jado	‘(that) he may buy’
ye aho	jaho	‘(that) I may go’
ye ezukoa	jizukowa	‘his money’
ye adu	jadu	‘our guns’
ye akenla	jakenla	‘his sugarcane’
ye akuma	jakuma	‘our axe’
ye ale	jali	‘(that) we may eat’
ye etu	jetu	‘our guns’

Appendix C

e- Coalescence

Esahie

Spelling	SR	Gloss
adwuma ɛnu pani	ædʒɥume nu pæni	‘manager, director’
agya ɛbo	adʒebɔ	‘toe’
asaa ɛkɔm	ase:kɔm	‘wrist’
asaa ɛkunu	ase:kunu	‘palm (of hand)’
bakaa ɛboin	bake:bojɪn	‘tree bark’
gya ɛkunu	dʒekunu	‘sole’
mbain yɛɛ	mben jɛɛ	‘senile person’
mvramain	mvramen	‘armpit’
sua ɛnu	suwe nu	‘room’
abura ɛnu	æburenu	‘fifty’
asatea ɛkaa	asatjɛ ka:	‘ring (finger)’

Nzema

Spelling	SR	Gloss
anloma ɛdu	ʌnlɔmedu	‘a bird has flown’
awa ɛfiti	ʌwɛfiti	‘a bottle gourd has cracked’
baka ɛbu	bʌkebu	‘a stick has broken’
bana ɛwie	bʌnewije	‘plantain has finished’
aka ɛhɔ	akehɔ	‘Aka has gone’

Appendix D

Identical Adjacent Vowel

Esahie

Spelling	SR	Gloss
adaka abɔe	adakabɔɪ	‘grave’
anoa ate	anɔwatɪ:	‘doorway’
da aseɛ	dasɪɛ	‘lying down’
ma ate	matɪ	‘to allow, to permit’
ngaka alee	ŋgakaliɛ	‘to feed (animal)’
pea ati	pijati	‘head of the arrow’
tena ase	tɪnasɪ	‘to sit, to be seated’
wura ataadeɛ	wurata:diɛ	‘to wear cloth’

Nzema

Spelling	SR	Gloss
abele ɛya	abele ja	‘maize farm’
adele ɛvale	adele vale	‘spoon taking’
aleɛ ebe	aliɛ bi	‘food is ready’
ɛwɔle ɛwu	ɛwɔle wu	‘a snake is dead’