

ASSIMILATORY AND SYLLABLE STRUCTURE PROCESSES IN KUSAAL

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Abstract

This paper expounds on some of the recurring phonological processes that are prevalent in Kusaal, a Mabia language spoken mainly in the north-eastern part of Ghana but also in the adjoining areas of Burkina Faso and Togo. Drawing on generative phonological theory, the study first examines the processes whereby one sound copies or behaves like another within a word or phrase (assimilation), and thereafter, discusses some of the processes that are evident in the structuring of syllables in the language. We find that the prevalent factors in the former include nasalization, homorganic nasal assimilation (HNA), labialisation, palatalization, glide formation and vowel harmony. As regards syllable structure processes, deletion, syllable truncation, aspiration and glottalization have critical functions and equally factor into the phonology of borrowed words in the language.

Keywords: Kusaal, Mabia, assimilation, syllable structures, loanword phonology

1.0 Introduction

In this study, we first examine the assimilatory processes observed in Kusaal. Kusaal is a Mabia language in northern Ghana that shares affinities with Dagbani, Mampruli, and Gurene. It has two main dialects, Agole and Toende, spoken in the eastern and western parts of the language, respectively. The second main objective of this study is to underscore syllable structure processes evident in the language and how these patterns emerge in the adoption of loanwords into the language. Fadairo (2014) posits that in a flow of utterance, that is, in spontaneous speech, segments are often reduced, altered, omitted, or combined with other segments to make pronunciation less difficult for speakers via a process known as hypoarticulation. Hayes (2009) notes that the sequencing and distribution of speech sounds within a word are not arbitrary but follow certain patterns that are determined by phonological considerations. The phonologies of many languages often show varied nuances of such complexities based on these phonotactics, as is described in the Mabia cluster of languages such as Dagbani (Hudu, 2013, 2018; *inter alia*), Musah (2010, 2018), and Akanlig-Pare (2005). These phonotactic constraints make it very difficult, if not impossible, for speakers of a language to simultaneously produce speech sounds from different places or manners of articulation (Freeman et al 2016). In view of this, language users often develop

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certain repair mechanisms to manage these constraints so that they can easily articulate sounds from different places and manners of articulation, as though they were from the same place or manner of articulation. The underlying phonological processes are used to manage phonotactic constraints in languages, such that speakers can form well-structured utterances and allow euphony in the pronunciation of words, phrases, and sentences (cf. Carr 1993, Fadaïro 2014, McCarthy & Smith 2003, Freeman *et al*). After segments undergo these phonological processes, they become phonologically permissible for a kind of sound sequencing that is underlyingly not permissible in the language (cf. Katamba 1989, Foulkes, 2006, Duanmu 2016). According to Keating (1996), as cited in McCarthy and Smith (2003), the distinction between phonetic and phonological processes is important. He avers that while phonetic effects do not involve the manipulation of features and are gradient, phonological processes involve the manipulation of features and are categorical. Two main types of phonological processes are posited, according to Hayes (2009), for the many languages of the world; *vis*: syllabic structural processes and assimilation processes.

The present study lends itself to the theory of Generative Phonology as espoused by Chomsky and Halle in their ground-breaking study on *The Sound Pattern of English* (1968) as an aspect of the larger “Generative Grammar” of language. Kenstowicz (2004:1) underscores the basic tenets of the theory succinctly thus: that ‘phonological structure reflects the linguistic competence of the individual native speaker to compute a phonetic representation for the potentially infinite number of sentences generated by the syntactic component of the grammar and further that this competence can be investigated in a serious scientific fashion.’ In line with the views inherent in this theory, grammar is viewed as a system of rules that relate sound creation to meaning conceptualization. Specifically, the framework stipulates that the sound a speaker can produce is a direct result of his/her linguistic competence (over his/her performance). This is a direct outcome of the underlying syntactic structures determined by the grammar of a particular language. A number of crucial components of the generative phonological framework are outlined by Kenstowicz and Kisseberth (1979). First, two levels of phonological representation are relevant to generative phonologists: underlying representation and phonetic representation. The former refers to the most basic form of a word or sound before it is subjected to any phonological rules or derivations and is tied to the speaker’s innate knowledge of what they want to say; the latter, the phonetic representation, refers to the form of the word that is heard or said - the actual pronunciations or speech forms. The second significant issue is the preponderance of phonological rules that seek to explain the ongoing mechanisms in the speech production process. These rules map the underlying representations onto phonetic forms and show various instances of insertions, deletions, or sequences of feature changes, among others. Third is the use of “distinctive features,” which notion, according to Cohn (2001:199), grows out of the work of Trubetzkoy (1890-1938), Jakobson *et al.* (1951) and Jakobson and Halle (1956). The essence of “distinctive features” is that they view segments as unique properties that are characterized by specific features. These features constitute the phonetic realities that are peculiar to the segments, thus marking them as different from one another. It also considers segments to be complete bundles of distinguishing features. The fourth component of this theory is phonological derivation. These comprise the set of stages or processes used to generate the phonetic form of a word from its underlying representation. Derivations are always influenced by phonological rules relevant to speech production processes. Linearity is an important final characteristic of generative phonology. Accordingly, a stream of speech

is viewed as a sequence of discrete sound segments, with each segment possessing features that occur simultaneously (Kenstowicz and Kisseberth, 1979).

This theory and its related philosophies see grammar as a system of rules that relate sound creation to meaning conceptualization. Specifically, it is more concerned with the levels of competence that speakers have when they use their language rather than their ability to simply perform in it. This approach was applied in the present study. It will be shown that the systematic grammar of Kusaal can be described adequately by many of the parameters (such as the phonological rules) outlined in the theory. The approach used in this study is multifaceted. First, in view of the fact that the researcher is a native speaker of Kusaal, native speaker intuition constituted the main source of data for the present study. However, to obtain accurate and conclusive results, the data used herein was further tested and validated by other native speakers and language experts in Kusaal. In addition, primary data was elicited from six respondents, three from each of the two main dialects of Kusaal. Their responses were captured on a digital recorder, from which transcriptions were then made to describe the phonology of the language. The six respondents comprised three males and females, while their ages varied greatly to capture the current state of affairs of the language as well as be fairly representative of the language as it obtains.

1.1 Kusaal phonological inventory

The phonological inventory of Kusaal comprises 24 phonemic consonants and 9 phonemic vowels. Musah 2010, 2018 *inter alia* make fair representations of the state of the art of these sounds, and we present these facts briefly here. With regard to consonants, Kusaal draws its consonantal system from seven places of articulation (bilabial, labio-dental, alveolar, palatal, velar, labio-velar, and glottal) as well as six manners of articulation strictures (plosive, nasal, fricative, approximant, lateral, and trill). Several of these also have voiced or voiceless counterparts.

	Bilabial	Labio-dental	Alveolar	Palatal	Velar	Labio-velar	Glottal
Plosives	<i>p b</i>		<i>t d[r]</i>		<i>k g</i>	<i>kp gb</i>	<i>ʔ</i>
Nasals	<i>m</i>		<i>n</i>	<i>ɲ</i>	<i>ŋ</i>	<i>n^w</i>	
Fricative		<i>f v</i>	<i>s z</i>	<i>ʃ</i>			<i>h</i>
Approximant				<i>j</i>		<i>w</i>	
Lateral			<i>l</i>				
Trill			<i>r</i>				

Table 1: The Kusaal consonant chart

With regard to the vocalic system, Kusaal features nine phonemic vowels [i, ɪ, e, ɛ, a, ɔ, o, ʊ, u] which all have corresponding long versions [i:, ɪ:, e:, ɛ:, a:, ɔ:, o:, ʊ:, u:]. In addition to vowel length, the vowels can be split into Advanced Tongue Root [+ATR] [i, e, o, u, a] and non-Advanced Tongue Root [-ATR] [ɪ, ɛ, ɔ, ʊ] components. The vowels are also categorized by tongue height: high [i, ɪ, u, ʊ], low [a], and mid [e, o, ɛ, ɔ] while there are five nasal vowels [ĩ, ẽ, õ, õ̃, ẫ], all -ATR. These facts are highlighted in the table below and are not quite dissimilar to the forms reported for many Mabilia languages including cognates such as Dagbani (Hudu 2016).

		Front	Central	Back
High		<i>i</i>		<i>u</i>
		<i>ɪ</i>		<i>ʊ</i>
Mid	High	<i>e</i>		<i>o</i>
	Low	<i>ɛ</i>		<i>ɔ</i>
Low			<i>a</i>	

Table 2: The Kusaal vowel system

The remainder of this paper is organized as follows. In the first main section, §2.0, we discuss two types of phonological processes with evidence from other languages in the existing literature. The subsequent subsections then deal in detail with the processes of nasalization (§2.1), labialization (§2.2), palatalization and glide formation (§2.3), and vowel harmony (§2.4). Section 3 considers Kusaal syllable structure processes, specifically deletion and syllable truncation (§3.1), vowel truncation (§3.2), consonant deletion (§3.3), aspiration (§3.4), and glottalization (§3.5). Subsection §3.6 finally considers loanword phonology, especially with respect to Hausa and English loanwords. §4.0 provides a summary of the findings.

2.0 The assimilatory processes

Assimilation has received significant scholarly attention in many languages worldwide. The term assimilation is defined by Katamba (1989) as the modification of a sound to make it look more similar to some other sounds in its phonological neighbourhood. This means that assimilation has to do with the changes that a sound takes to look like the sounds closer to it. Hansson (2017) posited that assimilation refers to sound patterns in which co-occurring segments are required to agree with some phonological properties (features) when they are adjacent to each other. Given these arguments, assimilation is considered a phonological task that ensures that two or more segments with different features are produced simultaneously with less difficulty. This means that at least one of the sounds has to change its phonetic feature specifications to resemble the other segment with which they are co-articulated. Schane (1973:49) states that in “assimilatory processes, a segment takes on features from a neighbouring segment.” In this manner, one sound segment influences the articulation of another such that the two sounds become more alike or identical (Crystal 1997: 30). Assimilation is a widespread phenomenon in languages of the world. Segments that undergo changes may be either partially or completely assimilated. In the first case, the major features of the assimilated segment may linger on, whereas in the second case, they are completely lost. The assimilation process may also relate to the ‘direction’ of the influence or ‘contiguity’ of the segments involved. In terms of direction, the process may be regressive (anticipatory) or progressive (preservatory); that is, a preceding segment may cause another to change its qualities, or a segment that comes after another may condition the change. In relation to contiguity, the segments involved are either directly in contact or in an assimilatory relationship, or they may influence each other from a distance across intervening segments (which triggers consonant harmony)⁴ (Lass 1984: 171). The sets of data in (1) representing

⁴ Although this representation is accurate, as one anonymous reviewer notes, it represents one conceptualisation of assimilation as a broad category of phonological processes under which a process

consonant nasalization in Buli and (2) representing homorganic assimilation in Kusaal are used to illustrate this point.

(1) Buli

/sa:b/	‘TZ’	+ /mu/	‘DET’	→	/sa:m + mu/	→	[sa:mu]	‘the TZ (meal)’
/na:b/	‘cow’	+ /mu/	‘DET’	→	/na:m + mu/	→	[na:mu]	‘the cow’
/biri/	‘seed’	+ /ni/	‘DET’	→	/bir + ni/	→	[binni]	‘the seed’
/beli/	‘river’	+ /ni/	‘DET’	→	/bel + ni/	→	[benni]	‘the river’

(Adapted from Akanlig-Pare 1994: 111-2)

From the data in 1, it is quite easy to determine that the last two examples are cases of assimilation in Buli, as the boundaries between the nouns and definite markers can be seen in the surface forms. In the case of the first two examples, however, when UR is compared to the surface form, one can simply conclude that the final [b] in /sa:b/ and /na:b/ is deleted, thereby pointing to a case of deletion but not assimilation. However, although this would appear as such, it must be noted that ongoing in Buli is first a case of the bilabial plosive in sa:b assimilating the nasal features of the determiner which subsequently triggers a deletion of one of the bilabial nasals as the examples point out.

(2) Kusaal

/pʊʔab/	‘women’	+ /la/	‘DET’	→	[pʊʔappa]	‘the women’ ⁵
/da:p/	‘men’	+ /la/	‘DET’	→	[da:ppa]	‘the men’
/da:m/	‘drink’	+ /la/	‘DET’	→	[da:mma]	‘the drink’
/sa:g/	‘broom’	+ /la/	‘DET’	→	[sa:gga]	‘the broom’
/kuʔob/	‘farming’	+ /la/	‘DET’	→	[kuʔoppa]	‘the farming’
/sid/	‘husband’	+ /la/	‘DET’	→	[sidda]	‘the husband’
/saʔab/	‘TZ’	+ /la/	‘DET’	→	[saʔappa]	‘the T.Z’

From the datasets in (1) and (2), a number of facts emerge. First, all the data exhibit assimilation between contiguous segments. That is, the conditioning factors for various renditions are a result of the closeness of the underlying segments. Non-contiguous assimilatory processes are special features of vowel harmony across morphemes or word boundaries. Second, while the set of examples in Buli are instances of progressive assimilation (the second consonant segments in the nouns assimilate the nasal qualities of the definite determiner *mu*) the Kusaal data exhibit a regressive assimilatory process where the definite determiner *lá* assimilates the features of the syllable final consonant. A final observation is that all the examples in both sets are cases of incomplete or impartial

like harmony can be appropriately captured. Indeed, we concede that not everyone uses ‘assimilation’ in this sense as assimilation is often used ‘traditionally to mean a segment taking the features of another segment that it is adjacent to’.

⁵ The definite determiner in Kusaal is underlyingly a *la* particle. Independent evidence that shows that the determiner is underlyingly “la” could be culled from the singular forms of a few lexical items. For instance, the singular form of ‘women’ is pua ‘woman’ while that of ‘men’ is dau ‘man’. Phonetically transcribed with the determiner [la], the forms surface as [poa la] ‘the woman’ and [dau la] ‘the man’ respectively.

assimilation; that is, the assimilated segments do not completely lose all of their inherent properties in order to take on new ones. Rather, the segments /b/, /l/, and /r/, which undergo mutation in the Buli data, lose only their oral nature, while retaining their voicing, labial, sonorant, and anterior properties. Kusaal also yields several geminate consonants in (2) as a result of complete assimilation, whereby the UR form [l] becomes an exact copy of the triggering segment, as shown in the data. Sections that follow some of the assimilatory processes in language are discussed in detail. Assimilation occurs in several languages. According to Hayes (2009), assimilation can be partial or complete, and can be treated as a process of labialization, palatalization, nasalization, homorganic nasal assimilation, and vowel assimilation, among others. The following sections discuss the various types of assimilation and how they occur in Kusaal and to a larger extent than other Mabilia languages.

2.1 Nasalisation

The feature [+nasal] is the *bonafide* property of segments such as /m/, /n/, /ŋ/, /ɲ/ and /ŋʷ/ because of the nature of their articulation – with a lowering in the position of the velum so as to allow the mass of airstream to exit through the nasal cavity to produce nasal sounds. As a pervasive method of assimilation, however, it entails “a process whereby an oral segment acquires nasality from a neighbouring segment” (Katamba 1989: 93). This neighbouring segment, which is usually a nasal sound, may or may not be specified overtly. In this regard, all [-ATR] vowels are candidates for nasalization in Kusaal, particularly when they occur before or after nasal segments in the language. Vowel nasalization in Kusaal, as in Buli (Akanlig-Pare 1994: 104), occurs only at the level of the syllable in three specific environments: (i) before nasal consonants; (ii) after nasal consonant; and (iii) in environments that are degenerate of pre-existing nasalised consonants. The following datasets in (3) through (8) provide examples of such nasalization processes in the realization of hitherto oral segments. The oral vowel segments are produced with a marked difference as a result of the nasal ‘colouring’ spread from the adjoining nasal segments onto them. The following are illustrative examples⁶:

(3)	N	N		
	[nĩŋ]	‘body’	[ɲòʔ̃m]	‘burn (v)’
	[nĩʔ̃m]	‘meat’	[nɔ̃:m]	‘type of soup’
	[nɛ̃:m]	‘nothing’	[nãŋ]	‘scorpion’
	[mɛ̃ŋ]	‘self’	[mãm]	‘me’
	[mɔ̃n]	‘to stir (v)’	[ɲàn]	‘shame’
	[mĩm]	‘to shake’	[ɲãʔ̃ãm]	‘yawn’
	[nãʔ̃ãm]	‘chieftaincy’	[nɛ̃n]	‘jealous’

We observe that all vowels occurring in this set of data are [-ATR]; that is, they are produced with a retracted tongue root. This is the case in most environments where nasalization occurs. The consonants /ɲ/ (written ny in the orthography) and /ŋ/ are also mutually exclusive of each other because they are in complementary distribution. While the former occurs only in syllable or word-initial positions, the latter occurs only in syllables. For the above, the rule in (4) is representational:

⁶ In this paper, we mark the tilde underneath nasalised segments in order to avoid these marks from getting in the way of the markings on tone.

(4) Rule 1: V → [+nasal] / [+nasal] ____ [+nasal]

The rule explicitly states that a vowel (V) becomes nasalized when it occurs between two nasal segments. In the set of words in (5), vowel segments occurring immediately after the nasal consonants are also realized with some nasal quality in their nature. Kusaal nasal vowels are drawn from [-ATR] vowel set while all vowels can receive a nasalized coloration in contrastive positions with nasal consonants as evidenced by the examples for ‘drink,’ ‘human being’ and ‘rice’ below.

(5)	<u>N</u> _____			
	[mà̃]	‘mother’	[nyɛ̃]	‘see’
	[mɛ̃]	‘build’	[nɪ̃d]	‘human being’
	[n ^w ɛ̃]	‘beat’	[nɔ̃bɔ̃g]	‘grow’
	[nỹ]	‘drink’	[m ^w ĩ]	‘rice’
	[m ^w à̃]	‘suck’	[à̃nɛ̃]	‘to be’

The data in the set above highlight the influence of adjoining nasal segments on vowels. Here, the nasalizing effect is from left to right and is restricted to the syllable level, as stated earlier. For instance, the last example, à̃nɛ̃ ‘to be,’ consists of two syllables, so the impact of nasalization is not realized on the vowel in the first syllable, but in the second. This was also described as progressive nasal assimilation. We formulate rule (6) below to capture the foregoing: The statement in the rule is that, generally, a vowel becomes nasalized when it occurs after a nasal consonant at the syllable boundary (the syllable boundary is indicated by the dollar sign \$).

(6) Rule 2: V → [+nasal] / [+nasal] ____ \$

A third point at which oral segments may become nasalized in Kusaal is when they precede nasal consonants but occur in the same syllable. Instances of this process are varied, and many are also restricted, primarily to [-ATR] vowels. The examples in (7) make this more explicit:

(7)	_____N			
	[pà̃ŋ]	‘strength’	[gbɪ̃n]	‘buttocks’
	[bɔ̃n]	‘thing’	[sɔ̃ŋ]	‘mat’
	[tã̃]	‘sand’	[dã̃:m]	‘pito’
	[ɔ̃:n]	‘dry season’	[kpã̃ʔɔ̃ŋ]	‘guinea fowl’
	[bɛ̃n]	‘end’	[kpɛ̃:m]	‘elder’

Nasalization of the oral segments is instantiated from right to left in a regressive assimilation process. The vowels, in an anticipatory assimilatory process, take on some of the qualities of the adjoining nasal consonants and are thus produced with some degree of nasality. Therefore, nasal assimilation in this case was regressive. This is because nasal consonants have a final syllable. We formulate the rule in equation (8) to explain this process. This rule states that a vowel acquires nasality if it is contiguous with a syllable final nasal consonant.

(8) Rule 3: V → [+nasal] / ____ [+nasal]

Finally, a number of vowels with nasal constriction were produced in Kusaal. This relates to “contrastive nasalisation” where some vowel forms occur in environments that have no nasal consonants. In such cases, the nasal vowel is marked with a tilde to indicate that there is no overtly conditioned nasal segment. These nasalized forms are probably the result of a diachronic process of nasal assimilation, whereby the hitherto overt nasal consonants are lost over time. Many examples can be found in the language and, as in all the cases of nasalization identified in this study, the [-ATR] vowels are the ones that are usually influenced by this process. The following exemplifies Kusaal nasal vowels:

(9)	[tɪ]	‘vomit’	[gɪ:l]	‘vein’
	[gɛ]	‘tired’	[ɛ:]	‘yes’
	[tɔ]	‘kick’	[gɔʔɔs]	‘thorns’
	[sɔ:r]	‘anger’	[fɑ:r]	‘inheritance’
	[tʌs]	‘shout’	[pɪ]	‘cover’

While we may state that the above may once have had nasal consonants operating in the underlying environment, this fact does not come up readily in the above data except in the example for ‘rings’ *bã:s*. Evidence for the deleted nasal in this case is adduced from the singular form *bán* ‘ring.’ The process thus highlights an instance of first nasal spreading, then nasal deletion, and finally vowel lengthening to compensate for the deleted consonant. At rest, the conditioned nasal segments were not present.

2.2 Homorganic nasal assimilation (HNA)

Generally, when a nasal consonant precedes an obstruent sound in Kusaal, the two consonants become homorganic; they agree in articulation (Lass 1984: 48). When homorganic nasal assimilation (HNA) occurs, the final consonant segments in the first syllable assimilate the nature of the next consonant so that they make for ease and economy in the process of communication. Perhaps the most important point at which HNA is very pervasive in the language is when two morphemes or roots are put together to create a new word. As the word final nasal is placed next to the initial consonants in an adjoining word, it usually assimilates the place of articulation of the following consonant. Consider the following examples in (10):

(10) HNA in compound words

i.	/tán/	+	/pīèl/	→	[tàm̩pèl̩gim]		
	‘sand’	+	‘white’		‘ash’		
ii.	/bón/	+	/gīŋ/	→	[bóngíŋ]		
	‘thing’	+	‘short’		‘short thing’		
iii.	/bón/	+	/bíl/	→	[bómbíl]		
	‘something’	+	‘small’		‘small thing’		
iv.	/nwán/	+	/pá:l/	→	[nwámpá:l]		
	‘calabash’	+	‘new’		‘new calabash’		
v.	/tēŋ/	+	dá:n/	→	[tēndā:n]		
	‘land’	+	‘owner’		‘custodian of land’		
vi.	/tēŋ	+	/tan/	+	/biis/	→	[tētāmbĩʔisi]
	‘land’	+	‘sand’	+	‘children’		‘fine sand’

In the last example (10vi) *tēntāmbī?īsi* ‘fine sand’ for instance, HNA assimilation is observed at the first two syllable levels. The first nasal is homorganic with the voiceless alveolar /t/, whereas the second conforms to the voiced bilabial articulation of /b/. Many such nasal metamorphoses abound in the language. In possessive constructions in Kusaal, as observed by Akanlig-Pare (1994) for Buli, too, the possessive pronoun *mām* ‘my’ becomes the bilabial nasal *m̐* in most natural occurring speech. This nasal is also the first-person pronominal form, and in all instances, it assimilates the place of articulation of the initial consonant of the following noun (in the case of possessives) or verb (in the case of the pronoun). Examples (11) and (12) illustrate this phenomenon.

(11) HNA in possessive constructions

a.	<i>m̐</i>	<i>zùk</i>	→	[n̐ zùk]
	1SG.PRO	head		‘my head’
b.	<i>m̐</i>	<i>fù:g</i>	→	[m̐ fù:g]
	1SG.PRO	dress		‘my dress’
c.	<i>m̐</i>	<i>dì:b</i>	→	[n̐ dì:b]
	1SG.PRO	foot		‘my foot’
d.	<i>m̐</i>	<i>nɔ̀bìr</i>	→	[n̐ nɔ̀bìr]
	1SG.PRO	leg		‘my leg’
e.	<i>m̐</i>	<i>kpān</i>	→	[ŋ̐ kpān]
	1SG.PRO	arrow		‘my arrow’

(12) HNA in 1st person pronominal usages

a.	<i>m̐</i>	<i>dòg.nè</i>	→	[n̐ dògnè]
	1SG	cook.PST		‘I cooked’
b.	<i>m̐</i>	<i>ná nù</i>	→	[n̐ ná nù]
	1SG	FUT drink		‘I will drink’
c.	<i>m̐</i>	<i>kpé bʊvʊn la</i>	→	[ŋ̐ kpè bʊvʊn la]
	1SG.	enter storage.room	DET	‘I have entered the storage room.’
d.	<i>m̐</i>	<i>pōn di</i>	→	[m̐ pōŋ di]
	1SG.	already eat.PST		‘I have eaten already.’

From the above, one can observe the widespread assimilation of nasal sounds to the places of articulation of adjoining consonants. In the first set of data (11), possessive nasal consonants consistently assimilate into the place of articulation of the following consonants, and the same is true for (12), which exemplifies various usages of the first-person pronominal form. The particle that is used to express future time - *ná* - ‘will’ also influences the nature of the pronoun in the last example in (12d). Like many Mabilia languages such as Dagaare (Ali et al. 2021:19), Dagbani (Sheini 2022), and Gurene (Atintono 2004 *inter alia*), there is a system of marking various degrees of past time. Three different particles were used to express the hodiernal immediate past (indicated with *pā:*), the recent past (indicated with *sā:*), and the remote past (indicated with *dā:*). In all of these instances, the first-person pronominal form is homorganic with initial consonants. These occurrences are exemplified in the data in (13) below.

(13) HNA in past time marking

- a. \dot{M} $p\bar{a}:$ $ny\bar{e}$ $b\bar{i}:g$ la [m pá?á jè bī:g la]
1SG HOD.PST see child DET. ‘I saw the child a short while ago’
- b. \dot{M} $s\bar{a}$ $t\bar{i}s$ \bar{o} $d\bar{i}:b$ [n̄ sá tís ō dí:b]
1SG.SUB.REC.PST give 3SG food ‘I gave him her food yesterday’
- c. \dot{M} $d\bar{a}:$ $k\bar{e}n\bar{a}$ [n̄ dā: kīnā]
1SG. SUB.REM.PST come ‘I came (at a certain time beyond yesterday)’

The particles $p\bar{a}:$, $s\bar{a}:$, and $d\bar{a}:$ are used to mark various degrees of past time reference in Kusaal. In (a), the meaning conveyed by particle \bar{e} is that of an action that occurred in the course of today prior to the point of speaking, but not yesterday or the day before. The particle $s\bar{a}:$ in (b) indicates that the act of killing was carried out only yesterday, whereas $d\bar{a}:$ in (c) refers to an activity that was undertaken at a time point before yesterday. HNA is evident only in the first-person pronominal form in all cases because it is realized as a sonorous consonant in some instances.

2.3 Labialisation

Labialization refers to the rounding of the lips when a sound is produced (Dolphyne 1988). It is a secondary articulatory process in Kusaal, which accounts for the rounding or labialization in the features of certain consonants in the language. Rounding may be caused by either the rounded vowels, which are all [+back], or by the labial-velar approximant /w/, which lend their rounding nature to the segments they co-occur with in syllables. All consonants occurring before rounded vowels in the syllable initial position are realized with some degree of lip-rounding. The following examples in (14) are used to illustrate, while we formulate the rule in (15) to explain this secondary labialization process in the language..

- (14) a. /sɔɔr/ [s^wɔ:r] ‘liver’ /dɔɔg/ [d^wɔ:g] ‘room’
b. /nu’us/ [n^wuʔús] ‘hands’ /lɔŋ/ [l^wɔŋ] ‘frog’
c. /pɔ’a/ [p^wɔ’á] ‘woman’ /mɔa/ [m^wɔa] ‘suck’
d. /tuon/ [t^wuɔn] ‘front’ /ku’om/ [k^wuʔòm] ‘water’

- (15) Rule 4: C C V
[-round] → [+round] / [+round]

Stated simply, (15) means that an unrounded consonant sound (C) becomes rounded before a rounded vowel (V). Spratt and Spratt (1968:37) note that labialization is an important level at which differences are evident in the Agole and Tonde dialects of the language. The fact remains that presently, while speakers of the former dialect may labialize certain onset consonants, speakers of the latter do not add any such features to onset consonants. Consider the following, which are adapted from Spratt and Spratt (ibid) in Example (16) below:

- (16) UR Agole Tonde Gloss
/boak [b^wák] [bók] ‘split’
tɔa [t^wà] [tò] ‘pound’
zɔa [z^wá] [zó] ‘friend’

kʷak	[k ^w á]	[kɔ̀k]	‘hug’
vʷa	[v ^w ā]	[vɔ̃]	‘uproot’
dʷa	[d ^w ā]	[dɔ̃]	‘to give birth’

In the above data, two separate means of labeling segments in Kusaal are exemplified. In the first set, which relates to Agole, labialization is caused by the high round vowel /u/ operating generally after initial consonant segments of syllables. In Tonde, however, the labializing process involves a merger (coalescence) of the vowel sequences in the underlying forms, transposing them to the mid-low round vowel in analogous positions as Agole.

2.4 Palatalisation and glide formation

Palatalization is an articulatory process that involves two specific phenomena. The first, primary palatalization, results from a process whereby the body of the tongue is raised toward the hard palate in the production of some consonants or where “the primary articulation is changed so that it becomes more palatal” (Ladefoged & Johnson 2010: 234). Second, secondary palatalization is the effect that front vowels or the palatal approximant /j/ have on adjoining consonants, that is, the effect that the “addition of a high front tongue position has on another articulation” (Ladefoged *ibid*). This process has been attested cross-linguistically and in many Ghanaian languages. For instance, Dolphyne (1988:143-7) and Akanlig-Pare (1994:116-125) describe this process in Akan and Buli, respectively. In Kusaal, this phenomenon did not differ. However, it is not as widespread as in Akan or Buli, wherein alveolar fricatives, for instance, mutate to post-alveolar or palatal fricatives (primary palatalization). This is because the language constrains the occurrence of post-alveolar fricatives altogether, and thus their absence from the phonological chart of consonants. The palatal fricative /j/ is also quite restricted, occurring only in a few lexical items. In the language, the process is related only to the secondary form, whereby consonant sounds occurring before the high front vowels are produced with the body of the tongue rising toward the hard palate. These consonants are often alveolar or velar. We provide examples in (17) to explain the effect of the high front vowel on consonants:

(17)	UR	SR	GLOSS
	/tɪak/	[tʰià:k]	‘to exchange’
	/kɪa/	[kʰià:]	‘to cut’
	/sɪak/	[sʰià:k]	‘agree’
	/sɪal/	[sʰià:l]	‘to meet up’

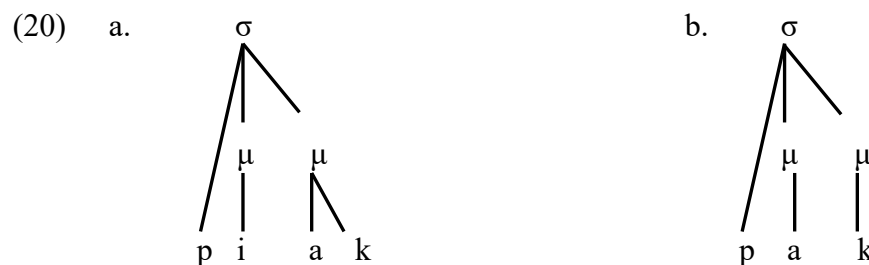
The recurring vowel in the data is the retracted high-front vowel. The contiguity between the vowel and the relatively low consonants results in an increase in the tongue body toward the roof of the oral cavity. We observe also that a glide formation process replaces /ɪ/ with a glide thus transforming /tɪak/ > [tjak] while a secondary process causes the high front vowel to palatalize the preceding consonant. Following the palatalization process, the high front vowel is deleted thus: /tɪak/ > [tʰià:k] invariably leading to compensatory lengthening of the vowel of the low vowel /a/, which fact can further be investigated using acoustic measurements. The statement in (18) serves to simplify the above and states that, as the feature [high] applies to vowel sounds, a non-high consonant sound can be produced with some degree of articulation toward the palate (raised heightening) when it occurs before a high front vowel.

(18) Rule 5: $[-\text{high}] \longrightarrow [+high] \text{ --- } \left[\begin{array}{l} +\text{high} \\ -\text{back} \end{array} \right]$

A process that is similar though not the same as palatalization is „glide formation“. This process is triggered in syllables with a sequence of vowels occurring after consonant onsets. In such sequences, the first vowel, if it is a high-front vowel [i or ɪ], is transposed to the palatal approximant /j/. Situations of pervasive glide formation in one dialect and none in the other are another point at which Agole and Tonde diverge slightly from each other. A comparison of the forms adapted from Spratt and Spratt (1968:38) highlights this development. Although their study views these examples as situations of palatalization, the spread of data instantiates the formation of a glide, represented by the superscripted palatal approximant [j]:

(19) UR	Agole	Tonde	Gloss
tiak	[tʰiàk]	[tèk]	‘change’
wiak	[wʰiàk]	[wèk]	‘hatch’
sia	[sʰiá]	[sé:]	‘waist’
sisiɛm	[sʰisʰiám]	[sʰisɛm]	‘wind’
ziãʔa	[zʰiãʔà]	[zɛʔè]	‘red’
kɪam	[kʰiám]	[kèʔɛm]	‘cut’
sɪãk	[sʰiãk]	[sək]	‘strangle’
piãk	[pʰiãk]	[pək]	‘carry under arm’

From the foregoing, it is observed that Agole adopts a systematic approach to dealing with vowel sequences of the type HFV + V (high front vowel + vowel). This is accomplished by the transformation of a high vowel into a glide before more open vowels. However, this is not the case in Tonde. The dispreference for glides in Tonde manifests in the selection of the low central vowel segment in environments where Agole selects for the high front vowel with another vowel. Sequences of vowels are also simplified regularly to vowels or less frequently to long vowels. Although the surface forms appear different, their respective phonological depictions are the same: they constitute heavy bimoraic syllables. The point at which they diverge from each other is that, while the coda consonant in Agole (20a) is adjoined to the preceding mora, in keeping with Hayes (2009:257), it constitutes a moraic segment on its own in Tonde (20b)⁷. The following syllable trees illustrate this phenomenon:



⁷ Stated more explicitly, /piak/ is bimoraic and heavy. It is monomoraic and light when it is realized as [pjak]. Therefore to maintain its integrity as a heavy syllable, compensatory lengthening is triggered to lengthen [a] into [a:] so that the syllable is bimoraic and thus heavy as the input.

2.5 Vowel Harmony

Vowel harmony is pervasive in many languages worldwide and refers to the phenomenon whereby vowels in a phonological word co-occur with each other. This underlying pattern of vowels is noted both within and across morpheme boundaries in such languages. Katamba (1989) stated the following:

...vowel harmony is a process whereby, within a certain designated domain, usually the word, all vowels are required to share one or more phonological properties. [Usually] the vowels of a language are divided into two mutually exclusive sets, and all vowels within a stipulated domain must be, say, either front or back, high or low, rounded or unrounded (1989:211).

Accordingly, Kenstowicz (1994:347) opines that it is “a phonological state in which the vowels in a given domain harmonise for a particular feature.” To this end, Bodomo also refers to it as a kind of “co-occurrence restriction involving contiguous and non-contiguous vowels” (1997:10) in the organization of words (see also Hudu 2013, 2016 *inter alia*). The kind of harmonisation between vowels that is evident in Kusaal is described as Cross Height Vowel Harmony (CHVH). CHVH implies that in a language such as Kusaal, which has four height specifications for the various vowels, harmony between these vowels in words transcends the respective heights and is tied to the position of the root of the tongue, which is not restricted to specific heights. In this section, the ATR harmony, ATR, and rounding harmony are discussed.

2.5.1 ATR harmony

Stewart (1967) discusses this type of harmony in some Ghanaian languages using evidence drawn from an Akan corpus of data. The approach he adopts in that study is to describe the harmony between the vowels in Akan words with respect to the position of the tongue root, that is, whether the vowels are produced with an advancement or retraction in the position of the tongue root. Advanced tongue root [+ATR] implies that the vowel sound in question is produced when the root of the tongue is pushed forward, while the un-advanced (retracted) tongue root [-ATR] vowels are produced with the root of the tongue drawn further back from the normal position of the tongue. The nine-vowel system of Kusaal can also be divided into [+ATR] and [-ATR] oppositions. Based on this distinction, vowels that occur in a word are usually selected almost exclusively from only one of the sets and not from the two sets at the same time. The sets are given by (21).

- (21) [+ATR]: [i, e, o, u].
[a]
[-ATR]: [ɪ, ɛ, ɔ, ʊ]

In the structuring of words in a language, there is adherence to this systematic patterning of vowels. Thus, stems or words that appear on the surface not to follow this [+/-ATR] opposition can actually be shown to harmonize with each other at the phonetic level. Several examples can be used to highlight this, including those in (22).

(22)	[+ATR]	GLOSS	[-ATR]	GLOSS
	[kúruŋ]	‘trousers’	[kòròŋ]	‘old’
	[kòlòŋ]	‘bag’	[kólòŋ]	‘river’
	[pèpsìm]	‘air’	[kòbír]	‘bone’

[sápídíg]	‘rib’	[sábílík]	‘black’
[pīsī]	‘twenty’	[vɛ̀lòm]	‘beauty’

From these examples, it is not difficult to identify the constraints on which vowels can occur in the organization of various words. As stated earlier, the kind of co-occurrence restriction that occurs in Kusaal is confined to the relative position of the tongue root with regard to vowels. In some examples, vowels were drawn from different tongue heights. This highlights the cross-height-selective properties of vowels in this language. For instance, the mid-low front vowel [ɛ] selects for the high back vowel [ɪ] in the word for ‘beauty’ [vɛ̀lòm]. What is common to the two vowels [ɛ] and [ɪ] is not their height, but the position of the tongue root in their respective articulations; in this case, they are both [-ATR]. Harmony between vowels is also evident in multiple forms of words in the language. Usually, in the singular, the co-occurrence restrictions do not come up readily because such forms may involve only one vowel segment or one segment that is lengthened. The harmony in each situation of Kusaal pluralization is with respect to the position of the tongue root. Examples of such occurrences are shown in (23):

(23)	Singular	Plural	Gloss
	[kpán]	[kpáná]	‘arrow’
	[ná:f]	[nī:gī]	‘cow’
	[pō:r]	[pōyá]	‘stomach’
	[būlūg]	[būlūs]	‘well (noun)’
	[sɔ̀:r]	[sɔ̀yà]	‘liver’

Further, in words that involve sequences of vowels, cross-height patterning of vowels is also pervasive, so it is common to find [+ -ATR] oppositions operating systematically in the language. Consider the following examples in (24):

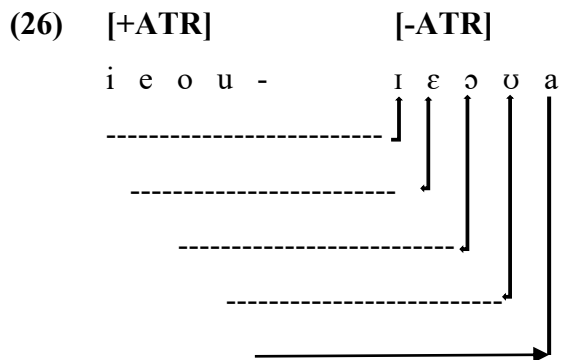
(24)	[+ATR]	GLOSS	[-ATR]	GLOSS
	[túòn]	‘front’	[pɛ̀õg]	‘basket’
	[àyópóí]	‘seven’	[tói]	‘difficult’
	[pī:]	‘ten’	[díáʔãd]	‘dirt’

For sequences of vowels to occur in Kusaal, it is imperative that such segments are produced with a similar movement of the tongue root. Otherwise, there is a spread of [+/-ATR] from one syllable to the next. This situation is observed with evidence from many dialectal variations between Toende and Agole in the language, and is exemplified in the sets of data in (25) for Toende and Agole in the + and – ATR sets, respectively:

(25)	[+ATR]	[-ATR]	Gloss
	[pɛ̀ʔõk]	[pɛ̀ʔõg]	‘sheep’
	[béúk]	[bɛ̀ug]	‘tomorrow’
	[bùmbõk]	[bòmbóg]	‘hole’
	[géllá]	[gélá]	‘eggs’

From the above, we can explain that the [ATR] feature is usually very consistent in words in Kusaal; if the first segment is produced with an advanced or un-advanced tongue root, the

ensuing vowel segment(s) will assimilate this feature. This regularity of harmony between vowels is widespread in languages. Any disparities that may arise will result from the nature of the low central vowel /a/, which appears in both the advanced and retracted tongue root oppositions, as in the last example in (25) above. The low central vowel /a/ is usually produced by retraction of the root of the tongue, thereby making it a [-ATR] vowel. However, it is not uncommon to find this vowel co-occurring with all [+ATR] vowel segments in the production of some words, as exemplified above. Historical evidence that may be adduced to posit the merger of an advanced and un-advanced low vowel is not readily available because of the lack of documented material on the development of the language. Synchronically, however, it is common to find that speakers of a language resort to producing words with more vowels drawn from the un-advanced tongue root classification than from the advanced class. In the data collated on the current state of language use among people, the propensity of the respondents to produce more words from the retracted tongue root system is noteworthy. Although this may be a marked cross-linguistic phenomenon, it is unmistakable in Kusaal. However, it may shed light on the “missing” [+ATR] low central vowel and point further to the process of vowel merger in the language. The schematic representation in (26) establishes the extent to which the two sets of vowels merge. Arrows indicate the direction of merging.



The point above is to state that the process of merging is ongoing (represented by the broken arrows) from the [+ATR] to the [-ATR], except in the case of the low central vowel, which has been completely coalesced (shown by the unbroken arrow). Straight lines map the overt representations of vowels in the process of merging. We cite the examples in (25) again to explain that, although it is possible to articulate any of the words from the different sets of vowels, it is more widespread to hear the forms produced with the [-ATR] vowels. Over time, it is possible that the nine-vowel system of Kusaal may be further reduced to fewer than seven, with the [-ATR] counterparts surviving the process.

2.5.2 ATR and Rounding harmony

In the literature, it has been shown that besides the types of harmony that involve only one feature, there are languages that demonstrate a combination of multiple harmonic features. Krämer (2003) noted, for instance, that in the Turkic language Turkish, backness harmony occurs with roundness harmony. Similarly, in Mabia languages such as Gurene and Dagaare, ATR harmony occurs with rounding harmony such that in Gurene, the vowel of the deverbal noun does not only agree with the final vowel of the verb in ATR, but also in rounding (Adongo, 2018). Bodomo (1997) states that in Dagaare, the imperfective suffix *-ro*, *-ro*, *-re*,

-re, *-ra* alternates not only with respect to ATR but also with respect to roundness. A similar situation of rounding harmony goes with ATR harmony in Kusaal, and reveals that a vowel in the suffix alternates with respect to the vowel in the root in rounding and ATR harmony. This is exemplified by the following datasets.

(27) ATR and [-round]	ATR and [+round]
(a) [tiig-in] ‘in the tree’	(b) [bulug-un] ‘in the well’
[nidib-in] ‘in the people’	[fuug-un] ‘in the shirt’
[di:b-m] ‘eating’	[pó:g-on] ‘inside’
[kɔlibɪr-m] ‘in the bottle’	[kɔlɔg-on] ‘in the stream’
[nɛ:r-ɪn] ‘grinding’	[gbe’og-un] ‘on the forehead’
[zak-m] ‘in the yard’	[dɔɔg-on] ‘in the room’

The data shown above demonstrate the ATR and rounding harmony in Kusaal. The suffixal vowel alternates with respect to the nearest vowel in the root. In the examples in set (a), all the vowels in the suffix are unrounded following unrounded vowels in the root as well as harmonizing with ATR, while the examples in set (b) have rounded vowels in the suffix following roots containing rounded vowels, which also occur with ATR harmony. This indicates a root-controlled harmony system, in which the vowel in the root determines the vowel in the suffix. It is significant to note that all target vowels, as observed in the suffix, are high vowels.

3.0 Syllable structure processes

Syllable structure processes relate to the processes that characterize the organization of syllables in Kusaal. In this section, we discuss some of these processes, including syllable truncation, aspiration, and glottalization. In the latter part of this section, we provide evidence from loanword phonology to buttress the point of the unique syllable structure processes in Kusaal.

3.1 Deletion and syllable truncation

A productive means of creating novel lexical items in a language is to combine two or more underlying stems through a process of compounding. These concatenated stems usually generate new forms after they have undergone syllable-structure processing. In the resulting output forms, some features of the combined stems are often truncated or even deleted. While long vowels or a sequence of vowels is usually shortened, some consonants are also deleted, especially when they occur at morphemes or root boundaries in compound words.

3.1.1 Vowel truncation

We observe that when a syllable containing a long vowel such as a monophthong [i:] or a diphthong [aʊ] combines with the stem of another syllable in Kusaal, there is usually a shortening of the vowel segments in the first syllable. Thus, for vowel truncation to occur in the language, there must be either long vowels or a sequence of vowels in a heavy-weight bimoraic syllable that terminates in vowels. The candidate that is shortened for the compounded form to arise is always the second vowel segment. The examples in (28) below are illustrative: in all examples, the second vowel segments are truncated, thereby shortening the lengths of the first syllables and subsequently reducing their weights from heavy bimoraic

stems to light monomoraic stems. This system of syllable truncation is systematic in the language and is occasioned whenever two adjoining vowels, whether long or a sequence, compound with existing stems in the language.

(28)	dáó	‘man’	+	sáj	‘moment’	→	[dāsāŋ]	‘young man’
	nòà	‘fowl’	+	bíl	‘small’	→	[nòbíl]	‘chick’
	póàp	‘woman’	+	nyāʔāŋ	‘back’	→	[ponyāʔāŋ]	‘old lady’
	lá:	‘bowl’	+	yālīŋ	‘wide’	→	[lāyáliŋ]	‘wide bowl (basin)’
	mūi	‘rice’	+	pièlik	‘white’	→	[mūʔūpiálik]	‘white rice’ ⁸

The discussion above is formalized in (29), which states that in a sequence of vowels [V₁] and [V₂], syllable truncation eliminates [V₂], leaving behind [V₁] at the syllable final position of the first stem of compounded forms.

(29) Rule 6: [V₁][V₂] → [V₁]

3.1.2 Consonant deletion

In compounded forms, all consonants in the syllable final position in the first stem are usually deleted, while the initial and final consonants in the second syllable are left behind. However, the behavior of syllable final nasal consonants in the first stem deserves comment. When they occur after long vowels in the first stems, they are often deleted in compounded forms. However, when they occur after short vowels, they become homorganic with the initial consonants of adjoining (second) stems, thereby evading deletion (c.f. 3.2.2, above on HNA). The following (30) exemplifies final consonant deletion in Kusaal:

(30)	/jír/	‘house’	+	/dáa:n/	‘owner’	→	[jídá:n]	‘landlord’
	/kók/	‘seat’	+	/bíl/	‘small’	→	[kóbíl]	‘stool’
	/lór/	‘lorry’	+	/māʔásír	‘fresh’	→	[lómáʔásír]	‘fresh car’
	/kút/	‘metal’	+	/dók/	‘pot’	→	[kúdók]	‘metal pot’
	/dó:g/	‘room’	+	/kpīn/	‘layer’	→	[dōkpīn]	‘wall’

In the examples above, the final consonant segments in the first stems are truncated to allow for a smooth transition in the novel usages in the language after these original stems have

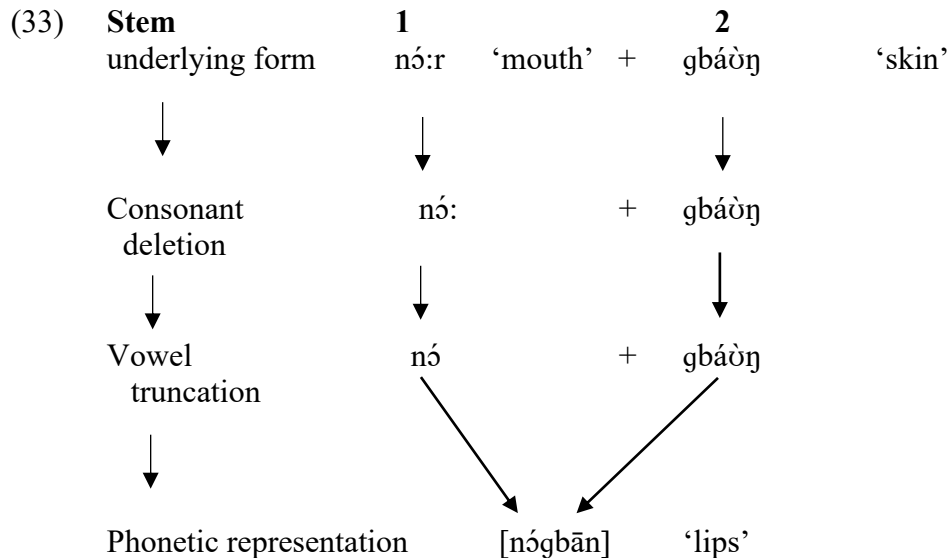
⁸ A reviewer notes that perhaps the second vowel in the first word is a suffix that makes the noun singular and if so, it can be argued that the suffix, a different morpheme from the root, is not part of the compounding. Following from this, the reviewer moots the idea that the compounding in the data set brings together only the root of the first word and the second word, so that there is no phonological deletion taking place. While this may appear to be a fair argument, particularly from a morphological perspective, we consider this ‘vocalic suffix’ a clitic, and as such as part of the stem. In this case then, a phonological consideration is the most probable trigger of deletion in the compounded forms. In addition, while the singular for ‘bowl’, for instance, is *laa* [la:], the plural for same is *laas* [la:s]; and a compounded form with *yaliŋ* ‘wide’ would yield the new forms *layaliŋ* ‘wide bowl’ and *layalis* ‘wide bowls’ with the marker of plurality being borne not by the nominal but the adjective. This patterning does not thus lend credence to the view that the second vowel is the marker of singularity or otherwise in Kusaal.

been combined. We formulate the rule in (31) below to explain consonant deletion in Kusaal. The rule states that syllable final consonants in the first stem become empty at the stem boundaries in compounded forms:

(31) Rule 7: [stem1, +cons#] → Ø ____ \$\$

In addition, the phonology of compounded forms in the language follows a systematic pathway and always proceeds in a specific pattern. For instance, when two existing stems are combined, speakers of the language methodically delete both vowel and consonant segments to allow for an agglutination that fits into the syllable structure of the language. In the following examples, syllable truncation proceeds in a feeding order that specifies first that final consonant segments in first stems are deleted and then that long vocalic segments are truncated to short ones. Reversal of this order yields an ungrammatical form. In (32), we establish the order of the truncation process, whereas in (33), we formulate a feature tree to further illustrate the process:

- (32) /kpá:m/ ‘oil’ + /mḕɲìr/ ‘real’ → [kpāmḕɲìr] ‘shea butter’
 /bī:g/ ‘child’ + /póá/ ‘woman’ → [bīpóá] ‘daughter in-law’
 /nó:r/ ‘mouth’ + /gbáò̀ɲ/ ‘skin’ → [nógbán] ‘lips’
 /nū’ūg/ ‘hand’ + /bīl/ ‘small’ → [nū’ūbīl] ‘finger’
 /sá’áb/ ‘T.Z’ + /tó:l/ ‘hot’ → [sá’átó:l] ‘hot T.Z’



In addition to the deletion of final consonants in the first stems of compound words, some consonant segments may also be deleted in Kusaal. Specifically, in simple nominal stems that have the voiced velar stop /g/ occurring in the syllable final position, the stop can usually be deleted if two special conditions are met: (i) if the stem is a heavy syllable and; (ii) if the vowel segments occurring in the syllable are long but not a sequence of vowels. These facts are captured in examples (34a and b), which are acceptable variants of the same lexical items. However, the forms in (35) are not admissible in Kusaal because they do not pass criterion (ii) above:

(34)	UR	A	B	Gloss
	/bī:g/	[bī:g]	[bī:]	‘child’
	/tí:g/	[tí:g]	[tí:]	‘tree’
	/fó:g/	[fó:g]	[fó:]	‘remove’
	/bá:g/	[bá:g]	[bá:]	‘dog’
	/dé:g/	[dé:g]	[dé:]	‘pig’
(35)	UR	A	B	Gloss
	/páòg/	[páòg]	*[pa:]	‘bark’
	/péug/	[péug]	*[pɛ:]	‘basket’
	/síàk/	[síàk]	*[sí:]	‘agree’

3.4 Aspiration

In the production of sounds, a stronger degree of force is exerted on the airstream mechanism. This process is known as aspiration and is usually associated with voiceless stops. As Bodomo (1997:12) reports for Dagaare, in Kusaal too, “voiceless plosives are usually aspirated when they occur in primary syllable initial position.” In particular, consonants [p, t, and k] are candidates that are produced with a greater degree of force when they occur at the beginning of syllables. This was initiated because of the spread of the glottis. Examples are provided in Table (1) below. The labiovelar plosive/kp/ is not specified in the table because it occurs only in the syllable initial position in all cases. This is always realized as an aspirated sound.

Table 1 Aspirated and un-aspirated sounds.

Sound	ASPIRATED		UN-ASPIRATED		
p	[p ^h éŋ]	‘borrow’	[sáp ^h írìg]	‘rib’	
	[p ^h òròg]	‘share’	[tāmp ^h ī: g]	‘hill’	
t	[t ^h árim]	‘weak’	[bónt ^h ít ^h ār]	‘sg big’	
	[t ^h án]	‘sand’	[t ^h ò:mà]	‘work’	
k	[k ^h ó:r]	‘funeral’	[k ^h ín]	‘walking’	
	[k ^h òm]	‘hunger’	[k ^h õrõg]	‘slaughter’	
				[béòk]	‘tomorrow’
				[lòák]	‘pave way’

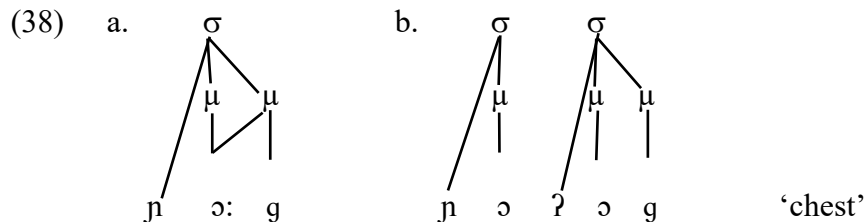
Aspirated syllables are indicated by the superscript h. While the set to the left highlights the environments in which the voiceless plosives are aspirated, the second shows the non-aspiration of the consonants in syllable final positions. The phonological rule in (36) captures the facts in table above. It states that a voiceless stop (p, t, k) is initially aspirated when it occurs only in syllables.

(36) Rule 8:
$$\left[\begin{array}{l} +\text{cons} \\ -\text{voice} \end{array} \right] \longrightarrow [+spread\ gl] / \$ \text{---}$$

3.5 Glottalisation

Glottalization is yet another important syllable structure process in Kusaal and many of the related Mabilia languages such as Buli, Dagbani, and Dagaare. It refers to a “process where the primary supralaryngeal articulation is accompanied by a secondary stricture at the glottal level” (Laver 1994: 330). This process occurs with reference to the realization of the glottal stop /ʔ/ in certain positions within syllables. The glottal stop is produced by the closure of the vocal folds, thereby impeding the flow of the pulmonic airstream out of the vocal tract. It is realized only as a voiceless consonant. In the English language, some speakers may glottalise or pre-glottalise stops such as the voiceless alveolar /t/ in words like ‘city’ [sɪʔɪ]. At other times, oral stops may be completely replaced by the glottal stops as in the example for ‘Britain’ pronounced [brɪ:ʔən]. The case of the glottal stop in Kusaal is different from the previous case. Specifically, it does not co-occur with any consonants nor does it replace them. Glottalization in Kusaal occurs intervocally. At such positions, and as noted by Ladefoged and Maddieson (1996:75) a complete glottal closure is not achieved but rather “some compressed form of creaky voice or some less extreme form of stiff phonation” is realized between sequences of vowels, the glottal stop is usually inserted to simplify the length of the vowel segments. These sequences could be either long vowels or a sequence of two separate vowels. By inserting the glottal stop, the sounds may be pronounced, as though they were two syllables, with the glottal occurring at the syllable initial position in the second syllable. The glottal stop /ʔ/ is indicated by an apostrophe (') in the orthography, as shown in the data in (37). Glottalization is more pronounced in the Agole dialect of language than in Tonde. In (38), we exemplify the way lexical items are re-syllabified in the language after glottal insertion has occurred in keeping with moraic theory (see Hayes 1989).

(37)	nyɔ̄'ɔ̄g	[nɔ̄ʔɔ̄g]	‘chest’
	bɔ̄n'ɔ̄g	[bɔ̄ʔɔ̄g]	‘valley’
	sù'ós	[sùʔós]	‘yesterday’
	bē'ét	[bēʔéd]	‘bad’
	sí'èl	[síál]	‘meet’
	wá'ádir	[wáʔádir]	‘cold’



3.6 Loanword phonology

Across languages, lexical items are constantly being borrowed, and their forms give credence to a group of words approximately referred to as loanwords. Thus, a loanword is copied from another language at some point in its history, either by adoption or retention (Haspelmath & Tadmor, 2014). As a result of this natural factor, a large number of linguistic items are borrowed from English and Hausa, which are two of the most dominant languages in the Kusaas traditional area and are often from Akan. When these loanwords arrive in Kusaal, they are configured such that they fit snugly into the linguistic systems of indigenes without

deviating from what is the case in the language. The process of nativising incoming segments is systematic and aligns with phonotactic considerations of the receiving language. In the words of Hsieh (2017:624-5) ‘loanword phonology is the study of how nonnative forms are adapted to conform to the segmental, phonotactic, suprasegmental and morphophonological restrictions of the borrower language.’ The following are some of the important strategies used to incorporate borrowed items into Kusaal:

3.6.1 Consonant deletion/replacement and compensatory lengthening

Complex consonant or vowel systems in borrowed lexical items are often deleted or replaced to simplify them so that they fit into the borrowing language. Through a process of re-syllabification, unfamiliar consonant clusters or vowel sounds in the source language are reconfigured such that they conform to the internal organization of syllables in the target language. To compensate for such deleted segments, original consonants are replaced, or new vowel segments are provided through a process of compensatory lengthening that generates either long vowels or diphthongs to make up for the deleted sounds. The British English borrowings in (39) and (40) below provide examples of this process of re-syllabification triggered by insertion/epenthesis to break consonant clusters.

(39)	English	Kusaal	gloss
	[dɒktər]	[dóʔátà]	‘doctor’
	[bʌkɪt]	[bòʔátà]	‘bucket’
	[laɪt]	[lā:it]	‘light’
	[taɪt]	[tā:t]	‘tight’
	[lɔ:ri]	[lór]	‘lorry’
	[taɪm]	[tā:m]	‘time’
	[fɜ:st]	[fɛ:s]	‘first’
	[ma:stər]	[mása]	‘master’
(40)			
	[ʃʊgər]	[sikkɪt]	‘sugar’
	[ʃɒks]	[sógús]	‘shock’
	[ʃɔ:t]	[sō:t]	‘short’
	[tʃɜ:tʃ]	[ké:k]	‘church’
	[fɪʃ]	[fɪs]	‘fish’
	[kɪtʃɪn]	[kíkɪn]	‘kitchen’
	[tʃɪkɪn]	[kíkɪn]	‘chicken’
	[steɪʃɪn]	[sítésɪn]	‘station’

The examples in (40) also illustrate another process of commuting lexical items from other languages to Kusaal. This involves replacing consonant systems in the source language with the nearest consonants in the target language because of the absence of such consonants in the target language. This is often not without hilarious renderings. Forms like these are „shortcuts“ that speakers of Kusaal including some of the literate English users, adopt when they attempt to give renditions of words that contain the post-alveolar fricatives /ʃ/ and /ʒ/ which are conspicuously missing from the Kusaal consonant chart.

3.6.2 Epenthesis

The fourth process, which is probably one of the most important in Kusaal loanword phonology, is epenthesis. Epenthesis entails inserting vowels to break ill-preferred consonant clusters in new lexical items. Clusters occurring at syllable initial, medial, or final positions are often simplified through the insertion of one vowel sound or the other (see Sandow, 2021 for a discussion on the quality of the epenthetic vowel). Examples of such occurrences are widespread in the language and are found in examples (39) and (40). We use the following in (41) to illustrate the process further.

(41)	English	Kusaal	Gloss
	[sku:l]	[sākúr]	‘school’
	[hɒspɪtl]	[sìbìtī]	‘hospital’
	[teɪbl]	[té:bū]	‘table’
	[stri:t]	[sítírít]	‘street’
	[fɪlm]	[fílím]	‘film’
	[bleɪd]	[bílèd]	‘blade’
	[kla:k]	[kólōk]	‘clock’

The phonological rule for vowel epenthesis is formulated in (42). The rule states that an underlying cluster with a vowel must be split and projects that all consonant clusters are repaired by vowel epenthesis.

(42) **Rule 9:** $\emptyset \rightarrow V _ C _ C$

Hausa loanwords (many of which trace their origins to Arabic forms) are treated in similar processes, such as consonant deletion, consonant replacement, and epenthesis. Some examples are provided in (43).

(43)	Hausa	Kusaal	Gloss
	[kerfe]	[kèríf]	‘hour’
	[ʃa:fi]	[sá:fi]	‘key’
	[dʒummah]	[azūma]	‘Friday’
	[al-sabat]	[àsībi]	‘Saturday’
	[al-hadʒi]	[àlá:zi]	‘Alhaji’

3.7 Other loanword processes

In addition to the loanword processes described in Section 3.3.4. (1-2) above, borrowed lexical items are subjected to the assimilatory and syllable structural processes discussed in the preceding sections. We draw on the examples in (39-42) for the discussions in this and subsequent sections. In (44), for instance, a labializing effect is produced in Kusaal to compensate for the absence of the low back and mid-low central vowels in the first and second examples, respectively. This process results in vowel glides from high to low position. In the third example, the schwa vowel /ə/ which features as a variation in the second syllable of table [teɪbəl], is replaced by the high round vowel. This resulted in the rounding of the voiced bilabial and alveolar plosives, which hitherto were unrounded.

(44)	English	Kusaal	Gloss
	[dɒktər]	[d ^w óʔátā]	‘doctor’
	[bʌkɪt]	[b ^w ōʔātā]	‘bucket’
	[teɪbl]	[té:b ^w ūl]	‘table’

Long vowel occurrences in borrowed lexical items are also subject to the process of glottalization. In the following examples, glottal stop insertion is realized between long vowels. This leads to restructuring of the syllable, with the result that the glottal stop goes into the onset position of the second (new) syllable. In the first three examples, the process was much more pronounced than in the last one.

(45)	English	Kusaal	Gloss
	[laɪt]	[lāʔát]	‘light’
	[taɪt]	[táʔát]	‘tight’
	[taɪm]	[tāʔām]	‘time’
	[fɜːst]	[fɛʔés]	‘first’

In the last set of examples in (44), voiceless plosives in borrowed items are produced with a degree of aspiration in Kusaal when they occur in the syllable initial position. The syllable final plosives were not aspirated. This trend is consistent with the following data.

(46)	English	Kusaal	Gloss
	[hɒspɪtl]	[síp ^h ít ^h í]	‘hospital’
	[tʃɪkɪn]	[k ^h ík ^h ìn]	‘chicken’
	[steɪʃɪn]	[sít ^h é:sɪn]	‘station’
	[taɪt]	[t ^h á:t]	‘tight’

4.0 Conclusion

This paper has discussed some assimilatory and syllable structure processes in the Kusaal language and identified nasalization, homorganic nasal assimilation (HNA), labialization, palatalization, and vowel harmony as important assimilatory processes. It was established that [-ATR] vowels are candidates for nasalization in Kusaal, and it was also observed that labialization is caused by the high back vowel /u/ operating generally after initial segments of syllables in Agole; however, in Toende, labialization processes involve a coalescence of the vowel sequences in the underlying forms, transposing them to the mid-low vowel. With regard to vowel harmony, ATR harmony is the most common type of vowel harmony observed in Kusaal, and speakers of the language commonly resort to producing words with more vowels drawn from the un-advanced tongue root [-ATR] classification than from the advanced class [+ATR]. Regarding syllable structure processes, syllable truncation occurs whenever two adjoining vowels, whether long or a sequence, compound with existing stems in the language. Consonant deletion occurs in the stem boundaries of compound words to allow for smooth transition in the novel usages; the language has been put together by putting these original stems, and mostly the final consonant of the first stem is deleted, while in loanwords, consonant deletion modifies complex clusters to suit the syllable structure of Kusaal. In addition, vowel epenthesis is a major syllable structure process found in Kusaal loanword phonology, and it is often employed to ensure that loanwords meet the syllable

structure requirements of the language. Other syllable structure processes examined in this study include aspiration and glottalization. In aspiration, voiceless plosives [p, t, k] are usually aspirated when they occur in the primary syllable position, and glottalization occurs only intervocalically.

Abbreviations used

1	First person	PROG	Progressive
2	Second person	PST	Past Time
3	Third person	REC	Recent
C	Consonant	REM	Remote
DEF	Definite	SG	Singular
DET	Determiner	SR	Surface Representation
FUT	Future	SUB	Subject
HNA	Homorganic Nasal assimilation	UR	Underlying representation
HOD	Hodiernal	V	Vowel
IDEO	Ideophone	.n	noun
N	Nasal	.v	verb

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Acknowledgements

This paper is drawn from sections of the first author's MPhil thesis submitted to the Legon University of Ghana. We acknowledge the contributions of the editor and reviewers in shaping the analysis and bringing it up to the standard. Certainly, any errors that persist in content or form remain our own.