Consonant mutation in Nzema and Esahie

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Abstract

This study examines consonant mutation particularly in Esahie[1] and Nzema. The reason for the study arises from the mutuality in the two languages. Again, previous studies have superficially treated this subject in the separate languages. However, the subject of consonant mutation is common in the above languages, yet the prevailing characteristics of the phenomenon are similar and dissimilar in the languages. Thus, this study compares and contrast consonant mutation in the two related languages to establish a correlation. In this vein, it discusses the mutational pattern, directionalities and voicing. Data for this study are assembled from four native speakers of each of the languages and literature of the respective languages. The data are analysed within the purview of Distinctive Feature Theory. The study identifies evidence to the relational effect that, the phonological environments in which the various realizations of mutation occurs also results in a harmony system. However, they differ in their mutational domains. The featural agreement normally forges between the vowel-consonant. Again, it is observed in Nzema and Esahie that, the common feature responsible for mutation in the alternant pairs, [k/x] and [k/g] is [dorsal]; [d/l] and [d/n] is [coronal]; [tɕ/ɕ] is [+strident] and [b/m] is [labial]. In both languages, harmonic assimilation is bidirectional.

1 Introduction

Mutation is generally a cover term in linguistics that refers to the various alteration, alternation and changes that occur in the stringing of sounds. It is often triggered by morphological or syntactic context yet it manifests crucial phonological undertones (cf. Chinebuah 1970). These alterations are phonologically grounded on the fact that the segmental inventory of the various natural languages has similar and dissimilar phonetic features. In the stringing of the segments to form larger units, the inherent segmental features play a major phonotactic role to allow or disallow the stringing. In linguistics, mutation is mostly driven by harmonic motivations. Hence, mutation is often synonymous with harmony systems (cf. Hansson 2001). It is mostly geared towards avoiding segmental antagonism but speech maximization and articulatory ease. Mutation and the resultant harmony systems are prominent phenomenon in most natural

[1] Esahie is also known as Sefwi, Sehwi, or Asahyue. In Ghana, the language is classified as part of the linguistic Akan group of the larger Akan dialects, even though it shares very close intelligibility with Nzema (a solely ethnographic Akan) than Twi and Mfantse (which are both linguistic and ethnographic Akan). Therefore, in this paper, we shall refer to both variants as separate languages.

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languages. As part of the language universals, mutation and the ensuing harmony systems are subjects that are well researched in the linguistics literature. Among the works on mutation and harmony systems in the existing linguistics literature in Akan alone includes Berry (1957); Clements (1985); Obeng (2000); Bakovic (2001); O'Keefe (2003); Abakah (2004); Dolphyne (2006); and Ballard (2010). To bridge the gap, therefore, it is not misplaced for further discussion on the subject, especially in under-researched sister Akan languages like Nzema and Esahie. Consequently, the present study compares the issue of mutation in the two related languages to identify the similarities and dissimilarities with respect to voicing or laryngeal harmony. This is against the backdrop that mutation and harmony systems are virtually linguistic universals, yet not all harmony systems operate on the same characteristics. For instance, mutation may spin over a string of multiple segments or may interact at a distance across an apparently unaffected segment or the reverse where a continuous string may have the mutational effect. Thus, the present study seeks to establish the relationship in the two languages by investigating into related subjects that embodies harmony systems such as triggers and targets, directionalities and harmonic domains. It ascertains whether or not and how these related issues are applicable in mutation for the two languages. Moreover, this study contributes to the ongoing discussion on sound mutation and voicing harmony in the two related languages.

Data for the study are gathered from both primary and secondary sources. The primary data are tapped from native speakers of Nzema and Esahie (Sehwi) who are undergraduates in the College of Languages Education, University of Education, Winneba. Their ages range between twenty-two and forty years. The respondents were purposively selected and semi-structured interview was used to elicit responses from them. Linguistic structures that involved sound alternation were given to them to read. The required data that showed up were then recorded and transcribed for the analysis of this study. The secondary data on the other hand, comprise forty corpora taken from a number of literature on both languages.

The rest of the work is organized as follows. Section 2 highlights the Distinctive Feature Theory. Section 3 discusses mutation in Nzema and Esahie with respect to triggers and targets, directionalities and harmonic domains. Section 4 is the conclusion of the study.

1.1 Nzema and Esahie

Nzema and Esahie are both Kwa (Central-Tano, Bia) languages which are spoken in Southwestern and Western North regions of Ghana respectively. They are Bia languages that have considerable influence from Akan languages especially Twi and Fante. Most of the Nzema live in Cote d'Ivoire. The population of Nzema in Ghana is 342,090 (cf. Ghana Statistical Service 2021).

About 580,000 Ghanaians speak Esahie, and it is very intelligible with Nzema, Ahanta, Brosa (Enchi), Chakosi, and Sanvi (spoken in La Cote d'Ivoire) (cf. Owusu Ansah 2020). This means that, to a larger extent, the two languages may belong to the larger Nzema language phylum.

A general account of the sound system and syllable structure in Esahie is given in Frimpong's (2009) work on the language's phonology. The language has twenty-four consonants, four contrastive nasal vowels, and ten (10) phonetic oral vowels. Nzema on the other hand, has six contrastive nasal vowels, ten oral vowels and twenty-nine consonants. Vowel harmony, reduplication, elision, and nasalization operate in the languages. There are three very productive phonological processes in the languages. These include consonant mutation, vowel harmony, and homorganic place assimilation (HNA) (cf. Boateng 2017).

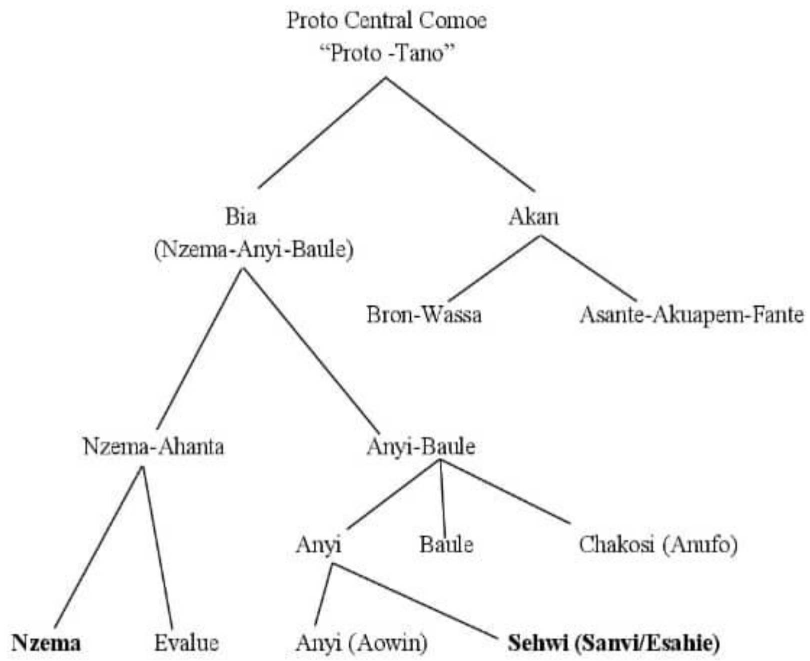


Figure 1: Kwa Language Family Tree (taken from Dolphyne/Kropp Dakubu 1988)

The family of languages that includes Esahie and Nzema is seen in Figure 1 together with other related languages. The graphic depicts the Bia and Akan language families. Nzema and Ahanta and Anyi and Baule initially divided into two groups within the Bia language family. Anyi, Baule, and Chakosi then separated from one another. Anyi (Aowin) and Sehwi or Esahie later separated into two different languages (cf. Frimpong 2009).

2 Distinctive Feature Theory

The Distinctive Feature Theory is an aspect of Generative Grammar (cf. Kenstowicz/ Kisseberth 1977). This theory focuses on the inherent properties of speech sounds. Distinctive Features are the minimal contrastive units that make up a segment. They are a set of articulatory and acoustic features that are used to define and distinguish speech sounds. This theory is able to determine the phonetic characteristics of a sound. The proponents of the theory posit that sound features are universal and are relevant for the description of segments in languages around the world. The theory can also explain how segments behave in a phonological structure. Some distinctive features are binary in nature. The binarism shows the presence (+) or absence (-) of a feature e. g. [+/-voice]. Some of the features are, however, intrinsically unary, that is, they have a single value and specify only sounds that have them. The Distinctive features can be grouped into five basically in terms of phonetic specificality. These groups are major class features, place of articulation features, manner of articulation features, glottis, and tongue body features. The feature theory further makes it possible, with a small number of features, to specify adequately the nature of speech sounds and their behaviour in structure. For example, we can describe these sounds /m, ɱ, p, ɔ, u o/ as [+labial] and predict their functions. We employed this theory for the study because the distinctive features are used to formulate phonological rules that explain phonological processes that occur in languages.

3 Consonant Mutation in Nzema and Esahie

As already indicated in the introduction, this section is devoted to the phenomenon of consonant mutation in Nzema and Esahie. It considers some concepts in mutation as evidenced in the Nzema and Esahie languages. These related subjects include phonetic relation between the mutating and the mutant in the consonant alternation, domains of the mutation, phonological conditions triggering mutation, the resultant harmony in mutation and directionalities.

3.1 The Mutating Segment and the Mutant

Mutation is frequently attested in Nzema and Esahie. However, within these two languages, mutation is mostly limited to consonants. That is, the participating sounds in the alternation are consonants but not vowels. In the alternation of the consonants that form the mutation, the source consonant usually appears first in the pairing and referred to as the mutating consonant, whereas the target segment is the mutant. Nevertheless, consonant mutation is exclusive to few consonants in the inventory. The implication is that not all the consonants participate in the mutation process. There is often a shared phonetic property between the mutating consonant and the target mutant that influences and connects the alternation of the mutating segment and the mutant. According to Chinebuah (1970) the mutating and mutant in Nzema consist of k/ h[2], as pair of alternation and the others as: [h/g], [f/v], [t/d], [d/l], [d/n], [s/z], [n/l], [b/m], [k/g], [b/w/m], [kp/gb], [ʃ/ɟ], [ɣ/m], [b/ɣ], [kw/ʍ], [c/ʃ], [c/ɟ], [cw/ɟw]. Connecting each alternating pair to the source and mutant is a common feature of either apicality, labiality or dorsality. However, among the participating consonants in the mutation, it is only the bilabial stop [b] that has three possible mutated forms, that is [w, ɣ, m] but the first two alternations [b/w] and [b/ɣ] occur in a vowel environment whereas [b/m] occur in a different environment. Moreover, four other consonants that encompass the two stops; [k, d] and the two affricates; [c, cw] have two mutants or mutated forms each. That notwithstanding, the remaining consonants have one mutated or mutant. This highlights the extensiveness and organized nature of the mutation process. On the other hand, mutating consonants in Esahie include the following: [k/h], [k/g], [t/d], [k^w/g^w], [b/m], [p/m], [d/l], [s/z] and [tɕ/dʑ]. The following in dataset (1) below exemplifies a few of the mutating and mutant alternation in Nzema and Esahie.

(1)

	Mutant	Esahie		Nzema	
i.	k/h/x	*kʊ̃/a**h**ʊ̃*	'war/wars'	*ɛ**l**ɛ/a**x**ɛlɛ*	'blow/ blows'
ii.	k/g	*a**k**ʊa/ŋ**g**ʊa*	'slave/slaves'	***k**ʌkulʌ/ŋ**g**ʌkulʌ*	'child/children'
iii.	d/l	*kɔ + **d**i/ko**l**i*	'go eat'	***d**umʌ̃/ʌ**l**umʌ̃*	name/names'
iv.	d/n	***d**adıɛ/n**n**adıɛ*	'metal/metals'	***d**ukũ/n**n**ũkũ*	'headkerchief/ ves'

[2] The phonetic sound of /h/ is [x]. It must be noted that, most of the sounds Chinebua (1970) used are not currently in use. Sounds such as [c], [ʃ], [cw] and [kw] are replaced with [tɕ], [ɕ], [ɕɥ] and [tɕɥ] respectively. The analysis will therefore not dwell on the sounds used in Chinebua (1970).

v.	tɕ/dʑ/ tɕɥ/dʑɥ	*tɕɪa/ndʑɪa*	'dog/dogs'	*tɕɥɪa/ndʑɥɪa*	'dog/dogs'
vi.	b/m / b/w	***b**raa/m**m**ra*	'woman/ women'	***b**ʊka/ a**w**ʊka*	'hill/hills'

The examples in (1) illustrate that the consonants [k/h/x], [k/g], [d/l], [d/n], [tɕɥ/dʑɥ], [tɕ/dʑ], [b/m, b/w] are part of the alternating consonants in the mutation process. However, in the pairing, /k, d, tɕ, b/ are the source consonants whereas the counterparts /h/x, g, l, n, dʑ/dʑɥ, m/w/ respectively are the mutants. The feature that drives mutation in the alternant pairs; [k/h/x], [k/g], [d/ l], [d/n], [tɕ/ɕ], and [b/m, w], respectively is dorsal, coronal/apical, strident and labial. Like the organized pairing of the alternant, mutation in Nzema and Esahie occurs in specified morphophonological processes as outlined in the following discussion.

3.2 Mutational Domains in Nzema and Esahie

Consonant mutation is a productive yet consistent phenomenon in Nzema and Esahie. It occurs in several domains that comprise morphosyntax with phonological underpinnings. Among the domains of mutation is pluralization, verbal nominalization, reduplication and tense/aspect formations. Mutational occurrences in the tense/aspect forms contribute to the distinction between them. These include the present, past, perfect, future I and future II affirmative (Nzema) and negative forms. Nevertheless, consonant mutation in Nzema is not limited to only the above domains, but also manifests in some relational kinship terms. Especially, when it is expressed in a genitival construction in the context of a preceding pronominal possessive prefix as demonstrated below in dataset (2).

(2)

i.	*sɪlɛ*	'father'	|	*mɪzɪ*	'my father'	representing the [s/z] alternation
ii.	*kũlî*	'husband'	|	*jexũ*	'our husband'	representing the [k/x] alternation

The above mutation in genitival constructions aside, other domains of mutation occur in pluralization, verbal nominalization, reduplication and tense aspect forms as already indicated. The examples in (3) and (4) illustrate pluralization in Nzema and Esahie respectively.

(3) Nzema

	Singular		**Plural Form I**		**Plural Form II**	
i.	*kilʌ*	'mouse'	k/x: *ʌxilʌ*	'mice'	k/g: *ŋgilʌ*	'mice'
ii.	*kʊasɪa*	'fool'	k/x: *axʊasɪa*	'fools'	k/x/g: *ŋgʊasɪa*	'fools'
iii.	*bʊka*	'hill'	b/w: *awʊka*	'hills'	b/m: *mmʊka*	'hills'
iv.	*dosinli*	'tree stump'	d/l: *ʌlosinli*	'tree stumps'	n: *nnosinli*	'tree stumps'
v.	*ʌbusuʌ*	'family'			b/m: *mmusuʌ*	'families'

(4) Esahie

	Singular		**Plural**	
i.	*dosin*	'tree stump'	d/n: *nnosinli*	'tree stumps'
ii.	*abusua*	'family'	b/m: *mmusua*	'families'
iii.	*jɔbʊɛ*	'stone'	j/ɲ: ɲɔbʊɛ	'stones'

It can be observed from the above data that, apart from (3v), the remaining examples in (3i-iv) have two plural realizations which occur in distinct environments that are specified in their phonological conditions. That is to say, whereas in the plural form I, the mutants /l, x, w/, occur after vocalics, those in plural form II occur after nasal consonants. However, Esahie has one plural realization of the various alternations in which the mutants also occur after nasal consonants as illustrated in (1) and (4). Also, mutation occurs in verbal nouns as shown in (5).

(5)	**Verb**		**Nzema**		**Esahie**	
i.	*di*	'to eat'	*ɛ**l**ilɛ*	'eating'	*ɛ**l**ilɛ*	'eating'
ii.	*da*	'to sleep'	*ɛ**l**alɛ*	'sleeping'	*ɛ**l**alɛ*	'sleeping'
iii.	*kɔ*	'to go'	ɛ**x**ɔlɛ	'going'	ɛ**h**ɔlɛ	'going'
iv.	*fa*	'to take'	*ɛ**v**alɛ*	'taking'	*ɛ**f**alɛ*	'taking'
v.	*fʊ*	'to climb'	*ɛ**v**ʊlɛ*	'climbing'	*ɛ**f**ʊlɛ*	'climbing'
vi.	*fili*	'to buy on credit'	*ɛ**v**ililɛ*	'to buy on credit'	*ɛ**f**ililɛ*	'to buy on credit'
vii.	ba	'to come'	*ɛ**ɣ**alɛ*	'coming'	*ɛ**w**alɛ*	'coming'
viii.	*bɔ*	'to hit'	*ɛ**b**ɔlɛ*	'hitting'	*ɛ**b**ɔlɛ*	'hitting'
ix.	*ʤa*	'to marry'	ɛʤalɛ	'marriage'	ɛʤalɛ	'marriage'

Example (5) shows that in Nzema and Esahie, verbal nominalization takes similar pattern. It can be observed in (5i) and (5ii) that, voiced alveolar stop /d/ mutates to alveolar lateral /l/. In (iii) however, voiceless velar stop /k/ mutates to voiceless velar fricative and voiceless glottal fricative, /x/h/, respectively. It is interesting to note from (5iv-vi) that, voiceless labiodental fricative /f/ mutates to voiced labiodental fricative /v/ in Nzema, but not in Esahie. However, the environment where /f/ mutates to /v/ in Esahie is when /f/ is preceded by a labiodental nasal /ɱ/ as shown in (6) below. Example (6) illustrates negation involving voiceless labiodental fricative /f/ in Nzema and Esahie.

(6)	**Verb**		**Nzema**		**Esahie**	
i.	*fa*	'to take'	*ɱva*	'not to take'	*ɱva*	'not to take'
ii.	*fʊ*	'to climb'	*ɱvʊ*	'not to climb'	*ɱvʊ*	'not to climb'
iii.	*fili*	'to buy on credit'	*ɱvili*	'not to buy on credit'	*ɱvili*	'not to buy on credit'
iv.	*fɛlɛ/frɛ*	'to call'	*ɱvɛlɛ/ɱvlɛ*	'not to call'	*ɱvɛlɛ/ɱvlɛ*	'not to call'

From (6), voiceless labiodental fricative /f/ mutates to voiced labiodental fricative /v/ in Esahie when preceded by voiced labiodental nasal /ɱ/[3].

Tense/aspect forms, that involve the consonant [d/l] alternation mutate. They include the following in Nzema: ***da*** 'sleep', *mɪ**l**a* 'I have slept' or the n/l alternation in; ***n**ʊ* 'drink', *mɪ**l**ʊ* 'I have drunk (it)'. However, both languages use [d/l] alternation to mark perfective as illustrated in (7).

(7)	**Nzema**		**Perfective**		**Esahie**		**Perfective**	
i.	*di*	'to eat'	***l**i*	'has eaten'	*di*	'to eat'	'a**l**i'	'has eaten'
ii.	*da*	'to sleep'	***l**a*	'has slept'	*da*'	'to sleep	'a**l**a'	'has slept'

Example (7) shows that the non-lateral occurring at the level of the input in phonological representation is substituted for a lateral because it is intervocalic. This is phonemic in Nzema and

[3] There are some nouns in Esahie that follow similar pattern. For instance, ***ɱv**ʊsʊɛ* 'mistate', ***ɱv**ɔɲinli* 'picture', ***ɱv**rama* 'air', ***ɱv**ifile* 'sweat'. The voiced labiodental nasal /ɱ/ functions as a negative maker as in (6), and as a noun prefix in some nouns.

Esahie but not in Akan. Lateralisation in Akan is as a result of free variation. For instance, *awa**d**eɛ/awa**l**eɛ* 'marriage', *fɛ**l**eɛ/fɛ**d**eɛ* 'shyness' have the same meaning. All the above examples in the various domains indicate that consonant mutation is a phonological process that occurs at morpheme boundaries in Nzema and Esahie. The constituent at the boundary in the case of pluralization is plural prefix that can be realized as either a vowel or nasal consonant followed by the nominal stem as in (3) and (4). However, in the formation of verbal nouns, the boundary is the vowel prefix followed by the verb stem as the above shows. In reduplication as occurs in Nzema, mutation occurs at the boundary of the reduplicant and the verbal base that ends with a vowel or nasal consonant. Finally, mutation in the domain of tense aspect forms usually occur at the boundary of a pronominal prefix. Immediately following this item is the verb stem or tense prefix that ends in a vowel plus the last element being the verb stem.

3.3 Phonological Conditioning in Mutation

Consonant mutation in Nzema and Esahie is defined within some specific phonological environment. From the illustrated examples, it is obvious that mutation is marked for occurrence at the stem initial position. That is, it is the stem initial consonant that undergoes mutation.

For example, in the stem; *ʌ**b**usuʌ* 'clan' that pluralizes as *mbusuʌ* or *m**m**usuʌ* 'clans' in Nzema and *ɛkra* 'cat' as *ŋgra* 'cats' in Esahie, it is the stem initial consonants [b] and [k] in the singular form that mutate to the bilabial nasal [m] and voiced velar plosive [g] in the plural form. The realization of the other consonants [s] is retained both in the plural and the singular forms in *ʌbusuʌ* 'clan', but same [**s**] in ***s**uʌ* 'house' mutates to [**z]** in *ʌzuʌ* 'houses' in the plural form. Thus, it confirms that mutation in these languages usually occurs at the stem initial.

Two phonological environments that influence mutation are discussed below. One of them is that mutation occurs after a vowel prefix at stem initial. An example is the [k/x] alternation in *kilʌ/ʌxilʌ* 'mouse/mice', *kira/ahira* 'wear/has worn' in Nzema and Esahie respectively. This mutation is induced by the presence of the plural formative vowel prefix; [ʌ, a].

Also, there is t/d alternation in Nzema reduplication. For example, *tiʌ/tiediʌ* 'walk/walk continuously', *ti/tindi* 'pinch/pinch continuously'. The above examples confirm that in Nzema, voiceless alveolar plosive /t/ in the base always mutates to its voiced counterpart /d/ in the reduplicant.

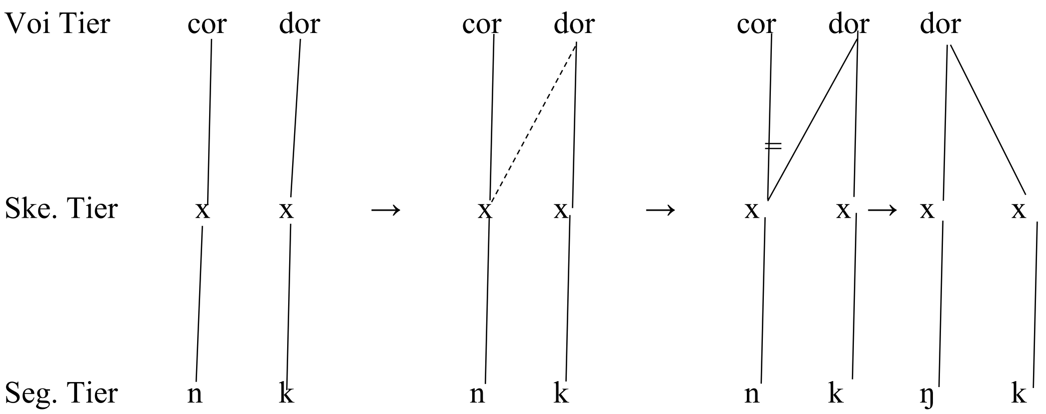
Furthermore, mutation takes place after a preceding consonant prefix at stem initial. An example is the k/g alternation as in *kilʌ/ŋgilʌ* 'mouse/mice', *ɛkra/ŋgra* 'cat/cats' in Nzema and Esahie respectively. This mutation is induced by the presence of the plural formative nasal prefix; [ŋ]. It is noteworthy that the noun *kilʌ* 'mouse 'has two plural realizations. These are; *ʌxilʌ* and *ŋgilʌ*, 'mice'. [k/x] alternation in *kilʌ/ʌxilʌ* is the product of the vowel influence and occurs in vowel environment whereas the other version in k/g alternation occurs in the environment of a nasal consonant. Thus, it can be observed that mutation of the stem initial consonant is triggered by either a plural vowel prefix or a nasal consonant prefix.

In the *kilʌ/ŋgilʌ*, *ɛkra/ŋgra* example, the change in the surface realization of the words is voicing. Thus, [-voice] sound [k] becomes [+voice], [g] due to the presence of the nasal consonant [ŋ]. Using the distinctive feature, it can be explained that the phonological process taking place in the example above is place and voice assimilation. The phonological rule below can be generated for this process in the two languages:

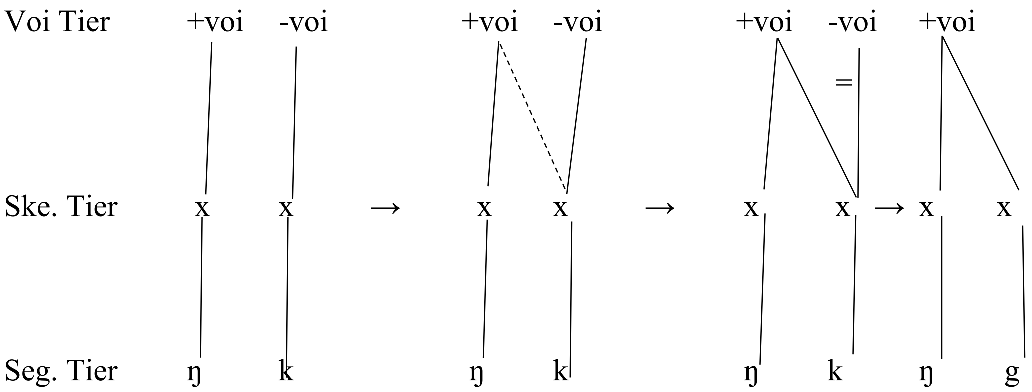
1. Place assimilation rule: [+nasal] → [αPlace] /____ [α Place]
2. Voicing rule: [-voice] → [+voice] / [+voice] _____

These rules are not ordered; rule 2 can apply before rule 1. This is a feeding order. The rules can further be presented on the Autosegmental Theory as shown below:

Rule 1: Place Assimilation



Rule 2: Voicing



3.4 Resultant Harmony in Mutation

A kind of harmony system manifest in the phonological environment in which the various realizations of mutation occur. The featural agreement that is normally forged between the vowel-consonant and the consonant-consonant sequence as a product of mutation, reflects the underlining agreement. It is often observed that there is an agreement of the vowel-like feature in the first two segments occurring in the environment of a vowel. That is, following the vowel prefix is a vowel-like consonant in the realization as a glide or approximant. In the other environment, it is the agreement in the place of articulation and voicing that take effect. The following examples in dataset (8) illustrate this point in Nzema.

(8)	**Singular**		**Plural Form I**		**Plural form II**	
i.	*kilʌ*	'mouse'	k/x: *ʌxilʌ*	'mice'	k/g: *ŋgilʌ*	'mice'
ii.	*kʊasɪa*	'fool'	k/x: *axʊasɪa*	'fools'	k/g: *ŋgʊasɪa*	'fools'
iii.	*bʊka*	'hill'	b/w: *awʊka*	'hills'	b/m: *mmʊka*	'hills'
iv.	*duku*	'headgear'	d/l: *ʌluku*	'headgears'	d/n: *nnuku*	'headgears'

The above examples show that the mutant consonants in the CV sequence [x, w, l] share their feature with the initial V. This condition also operates in Esahie as well. This is enforced in the examples in the plural forms. It is also found in perfective forms such as *kira* 'wear' which becomes *ahira* 'has worn'; *di* 'eat' which becomes *ali* 'has eaten'. However, in the plural realizations in form II, it is the same place and voicing agreement that are observed in the initial CC sequence. The shared feature is either in the velar region as in (8i) and (8ii), or labiality as in (8iii) or apicality as in (8iv). It is also noteworthy, that this form of agreement resides in the initial CC sequence and not transferable beyond this unit.

4 Conclusion

The paper discussed mutation in Nzema and Esahie. It has shown that the phonological environment in which mutation takes effect results in a possible harmony system in Nzema and Esahie. However, they differ in the mutational domains. There is a greater similarity in mutational pattern in the domain of pluralization, perfective, and negation in both languages. In nominalisation, however, the difference lies in f/v alternation where Esahie consistently maintains /f/ both in the input and the output forms. The featural agreement that normally forges between a vowel-consonant and a consonant-consonant is a product of mutation. Moreover, it has been shown in Nzema and Esahie that, the common feature driving the mutation in the alternant pair [k/h/x], [k/g], [d/ l], [d/n], [tɕ/ɕ], and [b/m, w] is [dorsal], [coronal], [+strident] and [labial] respectively. In both languages, harmonic assimilation is bidirectional, particularly progressive.

References

Abakah, Emmanuel Nicholas (2004): "Elision in Fante". *Asian and African Languages and Literatures* 4: 181–213.

Ballard, Lee Wilson (2010): *Akan vowel harmony in optimality theory.* Master's thesis, University of Florida.

Bakovic, Eric (2001): "On the logic of conditional grounding". *Rutgers Optimality Archive*. roa.rutgers.edu/files/340-0899/roa-340-bakovic-2.pdf [16.06.2023].

Berry, Jack (1957): "Vowel harmony in Twi". *Bulletin of the School of Oriental and African Studies* 19/1: 23–67.

Boateng, Emmanuel (2017): *A morphophonological analysis of nouns in Esahie*. Master's thesis, University of Education, Winneba.

Chinebuah, Isaac Kwadwo (1970): "Consonant mutation in Nzema". *Journal of West Africa Languages* 2: 69–84.

Clements, Nikerson George (1985): "Akan vowel harmony: A non-linear analysis". *Harvard Studies in Phonology* 2. Bloomington: Indiana University Linguistics Club.

Dolphyne, Florence Abena (2006): *The Akan (Twi-Fante) language: Its sound systems and tonal structure.* Accra: Ghana Universities Press.

Dolphyne, Florence Abena/Kropp Dakubu, Mary Esther (1988): "The Volta-Comoe languages". In: Kropp Dakubu, Mary Esther (ed.): *The languages of Ghana*. London, Kegan Paul International: 50–90.

Frimpong, Victoria (2009): *Aspects of Esahie phonology: An Autosegmetal Analysis*. Master's thesis, University of Ghana.

Ghana Statistical Service (2021): *Population and housing census*. statsghana.gov.gh [16.06.2023].

Hansson, Gunnar Olafor (2001): *Theoretical and typological Issues in Consonant Harmony*. Doctoral dissertation, University of California, Berkeley.

Kenstowicz, Michael/Kisseberth, Charles (1977): *Topics in Phonological theory*. New York: Academic Press.

Obeng, Samuel Gyasi (2000): "Vowel harmony and tone in Akan toponyms". *Studies in the Linguistic Sciences* 30/2: 173–83.

O'Keefe, Michael (2003): *Akan vowel harmony*. Bachelor's thesis, Swarthmore College, Swarthmore.

Owusu Ansah, Victoria (2020): "Elision in Esahie". *Ghana Journal of Linguistics* 9/2: 22–43.