THE NATURE OF DHOLUO CONSONANT HARMONY

BY

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DECLARATION

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To my parents,

Marcel Okello and late Angeline Owade

And my lovely children,

Denzel, Milan and Angie,

For teaching me the power of hardwork and resilience.

ABSTRACT

Consonant harmony is complex phonological process which requires a theory-informed descriptive analysis to determine its occurrence patterns. Consonant harmony has previously been studied as an assimilatory process that involves feature spreading while recent studies describe consonant harmony as feature agreement that leads to correspondence. The current study aims to fill this gap in phonological research and specifically Dholuo phonology by studying consonant harmony. This would establish how Dholuo consonant harmony manifests and the phonological and phonetic properties determining the occurrences. The objectives of the study were: firstly, to establish the phonetic and phonological properties that define Dholuo consonant harmony, secondly, to explain the nature of correspondence in Dholuo consonant harmony and thirdly, to determine the directionality of assimilation in Dholuo consonant harmony. Prince and Smolensky's Optimality Theory (OT) was adopted. The domain of harmony is the word which therefore forms the unit of analysis. The analytical research design was adopted in analyzing qualitative data. Native speaker intuitions helped in data generation and data extraction. The study population consisted of five radio stations that broadcast in Dholuo and two texts written in Dholuo. The researcher purposively sampled Radio Lake Victoria which broadcasts in Dholuo and recorded conversations from a specific radio programme, *Duol*. A total sample of five episodes was recorded and transcribed. The words which exhibited consonant harmony were extracted, transcribed phonemically and organized thematically based on the articulatory features. The data was presented in a tableau for analysis as postulated by OT. Dholuo consonant harmony manifests as a root-internal occurrence. Coronal harmony and dorsal harmony are identified based on the phonological and phonetic properties. Coronal harmony is a co-occurrence restriction between dentals and alveolars which affects only those coronals that are contrastively alveolar or dentals. The feature distributed [dist] is distinctive between the dentals and alveolars. Despite the co-occurrence restrictions, cases were attested of dentals co-occurring with alveolars. Dorsal harmony affects velar nasal and palatal nasal which are contrasted in terms of the feature [back]. Some of the Dholuo morphophonemic alternations that come as a result of grammatical change lead to consonant harmonisation. The markedness constraints that support the structural wellformedness of output actually lead to identity effects. Feature agreement is better able to explain the nature of correspondence since the participating sounds are non-local. Directionality of assimilation is left-right for root-internal coronal harmony. The root-initial consonant in Dholuo words is constant therefore the rest of the consonants in a word follow the patterns of root initial ones. OT uses positional faithfulness to protect the word-initial consonant in Dholuo. This study aims to contribute to descriptive and theoretical linguistics by enriching the study of Dholuo phonology and linguistics.

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ABBREVIATIONS AND SYMBOLS

AGREE	Consonants Agree in a Specified Feature
ALIGN	Extend a Phonological Feature
ant	Anterior
ATR	Advanced Tongue Root
B-U	Boro-Ukwala
BACK	Distinctive Feature for Dorsal Consonants
C	Consonant
Ç	Devoiced consonant
cand	Candidate
CC	Consonantal Correspondence
CIE	Complete Identity Effect
CON	Constraint
cons	Consonantal
cor	Coronal
CORR	Correspondence
DEM	Demonstrative
DEP	Prevents insertion
dist	Distributed
DOR	Dorsum/Dorsal
ELLO	English Language and Linguistics Online
EVAL	Evaluator
F	Feature
Faith-CC	Faithfulness Consonant Correspondence
GEN	Generator
Gen.sg	Genitive Singular
Gen.pl	Genitive Plural
ID/IDENT	Identity
IO	Input-Output
KSN	Kisumu-South Nyanza
L	Left

LDAC	Long-Distance Agreement as Correspondence
M	Markedness
MAX	Maximize/Prevents Deletion
n̪	Dental nasal
nas	Nasal
NGP	Natural Generative Phonology
Nom.sg	Nominative Singular
Nom.pl	Nominative Plural
OBS	Obstruent
OT	Optimality Theory
PL	Place
pl	Plural
R	Right
sg	Singular
SS	Sibilant Clusters
TGG	Transformational Generative Grammar
TTCA	Tongue Tip Constriction Area
UG	Universal Grammar
V	Vowel
VOI	Voice
v.t	Transitive Verb
v.i	Intransitive Verb
*****	Constraint Violation/ Non-existent Form in the Language
!	Fatal Violation
☞	Optimal Output
[+]	Presence of a Feature
[-]	Absence of a Feature
↔	Correspondence
→	Rightwards arrow
←	Leftwards arrow

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CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

This was a study of the nature of Dholuo consonant harmony. Nature here refers to the manner in which consonant harmony is manifested in Dholuo. The study focused on the complex phonological assimilation process whereby two or more consonants in a word separated by at least a vowel, match in terms of phonetic or phonological features. This chapter gives a detailed introduction to the study. It also provides a general background on the consonant harmony phenomena. This includes statement of the problem, research questions, research objectives, the scope and limitations, justification for the study and the theoretical framework that has been used in analyzing data in this study. This section provided a context for the study.

1.1.1 Introduction to the Language of Study

The focus of this study is Dholuo, a language that belongs to the Nilo-Saharan family of languages, which is subdivided into six branches one of which is Chari-Nile. A sub-branch of Chari-Nile is Eastern Sudanic branch which has ten groups, one of them being Nilotic group of languages (Encyclopaedia Britannica, Vol. 22). According to Bender (1989), the Nilotic group is further subdivided into Western, Eastern and Southern branches. Amongst the Nilotic languages in Kenya, only Dholuo belongs to the Western Nilotic group. The other Western Nilotic languages closely related to Dholuo are Jur Colo, Anuak (Anywa), Shilluk and Luo of Southern Sudan; Acholi and Lang'o of Northern Uganda; Padhola found in Western Uganda, and Alur found in Northern Eastern Congo and West Nile Province, Uganda (Oduor, 2002) .

The speakers of Dholuo live predominantly in the Nyanza Province of Kenya. Although with the rural-urban migration in search of employment, education and better livelihood; the Luo are now found in various parts of the country like Nairobi, Mombasa, Nakuru, Eldoret and many other urban centres.

Stafford (1967) identifies two regional dialects, each spoken in a different region in the wider Luo Nyanza region. One of these varieties is referred to as Trans-Yala dialect and is spoken in Ugenya, Alego, Yimbo and parts of Gem Location (Central Nyanza). The second dialect, also referred to as the South Nyanza dialect, is spoken in various locations of former South Nyanza district as well as those excluded in the Trans-Yala group which are located in Bondo and Rarieda districts and include Uyoma, Sakwa and Asembo. According to Stafford (1967), the phonological, morphological or syntactic structure in the dialects is not significantly different. Stafford states that there are lexical differences but the differences are not significant enough to term them as different languages.

In another study of Dholuo dialects, Oduol (1990) confirms the existence of the two dialects and establishes the geographical spread of both dialects. There is Kisumu-South Nyanza hereafter KSN, spoken in a wider geographical area. These areas include Yala, Maseno, Kisumu, Winam, Muhoroni, Mbita, Ndhiwa, some parts of Migori, Macalder, Oyugis, Kendu and Bondo divisions (excluding Yimbo locations). The second dialect Boro-Ukwala (B-U) is spoken in Yimbo location of Bondo, Boro and Ukwala divisions.

According to Oduol (1990), the KSN variety is assumed to be the standard dialect since it is used as a medium of instruction in lower primary school in the rural set-up, especially where Dholuo is the dominant language. Many publications such as school readers and

the Dholuo Bible, '*Muma Maler*', have been published in this dialect which is assumed to be more representative. B-U, on the other hand, is rarely used in publications (Okombo, I982). The data in this research were not restricted to the KSN variety only and cases observed from B-U that showed significant variations in terms of articulation were noted as this could impact greatly on the general view of Dholuo consonant harmony.

1.1.2 Dholuo Consonants

This section focused on providing the general information about Dholuo consonants. It is on this basis that consonant harmony would be studied being a phonological assimilation process involving consonants. Mackenzie (2005) posits that the shape of consonantal inventory determines the participating segments in consonant harmony and therefore it is pertinent for the researcher to understand Dholuo phonemic inventory.

Dholuo has a total of twenty-six consonants; five of which are prenasalized compounds which may be regarded as clusters, especially in the underlying representations as they always function as unit phonemes. In Table 1, consonants are classified according to the manner of articulation, state of glottis and place of articulation. In each cell, the voiced sound is placed on the right whereas its voiceless counterpart is on the left.

Table 1: Consonantal Phonemes of Dholuo

Place / **Manner**	Bilabials	Labio-Dentals	Dentals	Alveolars	Palatals	Labio-velars	Velars	Glottal
Stops	p b			t d	c ɟ		k g	ʔ
Fricatives		f	θ ð	S				h
Nasals	m			n	ɲ		ŋ	
Laterals				l				
Trill				r				
Glides					j	w		
Prenasalized Stop	^{m}b		^{n}ð	^{n}d	^{n}ɟ		^{ŋ}g	

Adapted from Okombo (1982) and Tucker (1994)

The manner of articulation of dental sounds represented by the symbols [θ] and [ð] in table 1 is controversial in literature. They are referred to as interdental spirants (Odaga,1997), alveolar fricatives (Okombo, 1982), dental affricates (Maddieson, 1984), dental explosives (Tucker, 1994), dental stops (Hansson, 2001) and are represented with the phonetic symbols [t̪] and[d̪]. According Degenshein (2004) they are interdental affricates while Cable (2009) refers to them as affricate stops. It is not clear whether they are stops, affricates or fricatives. Degenshein (2004), explains the manner of articulation as domain initial strengthening with a difference in articulation in prosodically stronger versus weaker positions. The dentals display more stop-like characteristics in strong position than weak position. In phonological strength hierarchy, stops are the strongest while fricatives are the weakest (Katamba,1989). The researcher adopts the symbols [θ,ð] and refers to them as dental fricatives, since the sounds are articulated with the tip of the tongue moving to the upper teeth causing partial obstruction of air flow.

There are two palatal stops /c/ and /ɟ/ which occur in free variation with palato-alveolar affricate /tʃ/ and /dʒ/. This has also been observed by Odhiambo (1981), Okombo (1982) and Oduor (2002). In this study, the palatal stops are adopted.

Particular attention is paid to the inventory of consonantal phonemes as study focuses more on consonants. According to Hansson (2001) the consonants may not audibly be affected by the intervening vowels in consonant harmony. It would be important to investigate how consonants and vowels interact in a speech continuum since they both co-occur in words and are likely to have an effect on each other.

1.1.3. Phonological Processes involving Consonants

Okombo (1982) studied phonological processes in Dholuo. The study focused majorly on morphophonemic alternations prevalent in Dholuo. He argues that some of the alternations, for instance, change of a final consonant from /l/ to /nd/ in nominal forms cannot be explained by the morphophonemic rules and that there is no phonetically plausible evidence for this change, for instance, /bû:l/ 'drum' changing to /bù:ndè/ 'drums'. Okombo overtly called for further investigation into this type of alternation to explain the occurrence. An analysis of the similar and contrastive features between the consonants would provide a phonetically plausible explanation for the two forms. This change is not considered accidental since it has been attested in more than one word in Dholuo. Morphologically speaking, it would be termed as a regular and unmarked form since its occurrence is predictable (Okombo, 1982). It was necessary to investigate this phonological change in terms of the phonetic or phonological properties involved. There must be a natural rule to explain this kind of change which could be phonologically conditioned.

Tucker (1994) studied Dholuo consonants and observed that the dental and alveolar series are barred from co-occurring in a word. An examination of the dental and alveolar series would determine the reason behind the non-occurrence. The researcher needed to determine whether there were particular phonological and phonetic properties that motivated the occurrence of dentals with dentals only, while alveolars occurred with alveolars, and barred their co-occurrence within a word, yet dentals and alveolars share the property coronal. This fact motivated an in-depth analysis of the coronals.

Mackenzie (2005) attributes co-occurrence restrictions to the shape of the consonantal inventory. In the study of Bumo Izon, an Ijoid language, Mackenzie (2005) establishes that there is a co-occurrence restriction barring implosive and plosive stops from occurring in morphemes and this is attributed to the phonemic inventory . Mackenzie asserts that participating phonemes must contrast in a phonological property. The idea of contrast is then important in the investigation of consonantal phonemes. This could mean that the non-contrasting sounds are barred from participating in consonant harmony. The study of Dholuo consonant harmony may explain the co-occurrence restrictions that hold between dentals and alveolars.

1.1.4 Consonant Harmony and Vowel Harmony

The major types of harmony recognized in the existing literature on phonological theory are consonant and vowel harmony (Hansson, 2001).

Hansson (2001) defines consonant harmony as:

> Any assimilatory effect of one consonant on another consonant or assimilatory co-occurrence restriction holding between two consonants, where the two consonants are separated by a string of segmental material consisting of at the very least a vowel and intervening segments, in particular vowels are not audibly affected by the assimilating property (p.4).

This definition is limited enough to exclude phenomena which may be fundamentally different from consonant harmony, for instance, vowel-consonant harmony, intervocalic voicing and rounding harmony which affect both consonants and vowel at the same time. Consonant harmony being an assimilatory process implies that interacting elements ought to be alike either on phonetic or phonological aspects. Rose (2004) defines consonant harmony as a requirement that two or more consonants in a word separated by at least a vowel match for a certain phonological feature. Rose (2004) supports the idea of assimilation where two or more consonants in a word correspond and these matching consonants are separated by segmental material such as vowels and consonants. Consonant harmony is therefore defined as a phonological assimilation process which results into segments within words matching or agreeing in some phonetic or phonological aspect.

According to Hansson (2001), consonant harmony could also involve a co-occurrence restriction holding between consonants. It would be interesting to investigate sounds in Dholuo that co-occur and the motivation of the concurrence or co-occurrence, that is, the corresponding phonological property.

Hansson (2001) further asserts that in consonant harmony the intervening segments especially vowels are not 'audibly' affected. This assertion is contrary to what obtains in prosodic phonology whereby harmony extends throughout the relevant stretch of speech (Clark and Yallop, 1995). In view of this argument, harmony phenomenon is not limited to particular segments but extends to entire stretch of a word affecting both consonants and vowels in the continuum. The harmonizing feature should extend to all segments. These opposing view points raise a question on what segments are affected by the

harmonizing feature. The study of Dholuo consonant harmony sought to establish the phonetic and phonological properties leading to correspondence between consonants.

Shaw (1991) defines consonant harmony as a process that entails action-at-a-distance including both assimilatory and dissimilatory processes. This definition covers non-contiguous segments since it entails action-at-a distance. It was therefore important to investigate Dholuo words to establish how consonant harmony phenomenon is manifested, consequently, determine if the affected segments are contiguous or non-contiguous and which phonetic and phonological properties trigger or lead to this form of assimilation. This investigation was to help establish the mechanism that underlies consonant harmony in terms of how the correspondence occurs, especially if the segments affected are non-contiguous. Furthermore, it was important to investigate the intervening vowels and consonants to determine the reason for non-participation.

Shaw (1991) further observes that consonant harmonizing features are not adjacent because of the presence of intervening vowels. This assertion advances the issue of locality which needs to be addressed in the study of consonant harmony. Shaw (1991) further asserts that consonant harmony involves both assimilation and dissimilation processes. These two phonological processes are fundamentally different since assimilation makes neighbouring sounds to be more like each other for ease of articulation while dissimilation makes neighbouring sounds to be less like each other in order for the sounds to be more auditorily distinct and perceptible especially in rapid speech (Katamba, 1989). This raises a question on how consonant harmony can be achieved through dissimilation.

Based on the insights provided by these definitions, consonant harmony data in this study consists of consonants that agree or match or are similar in specific phonetic or phonological features. The focus of the study would also be on phonological processes that lead to consonant concurrence (agreement) and the co-occurrence restrictions that hold between consonants. Cases of dissimilation if attested would be analysed.

Some fundamental theoretical questions arise concerning the manifestation of consonant harmony in terms of the segments affected; whether consonants only or consonants and intervening vowels, and whether the correspondence is local or non-local; and the directionality of assimilation. Consonant harmony seems to operate within a word and therefore, the word forms the unit of analysis in the study.

1.1.4.1 Vowel Harmony

Vowel harmony has tended to receive more attention than consonant harmony (Hansson 2001). In fact the assumption in literature is that the two are similar or that they operate on a similar mechanism. This is debatable since vowels and consonants differ in major class features (Chomsky and Halle, 1968). Distinctive features that characterize vowels may not necessarily apply to consonants.

Vowel harmony is a process whereby within a word, all the vowels are required to share one or more phonological properties (Katamba, 1989). The vowels of a language are divided into two mutually exclusive sets and all vowels within a stipulated domain must be front or back, high or low and rounded or unrounded.

In Dholuo, the dominant harmony system is advanced tongue root (ATR) harmony. There are nine pure vowels in Dholuo. These nine vowels have been grouped into four pairs.

Each pair contains a [+ATR] (Advanced Tongue Root) and [-ATR] (Retracted Tongue Root) counterpart and a single vowel /a/ that is regarded to be neutral to tongue root distinction. However, Omondi (1982) and Tucker (1994) claim that /a/ also reflects a tongue root contrast, showing that a fifth pair exists. Vowel harmony has been documented by various studies in Dholuo Phonology (Oduol, 1981; Okombo, 1982; Tucker, 1994; Oduor, 2002; Were, 2007 and 2015 and Swenson, 2015). Table 2 illustrates Dholuo vowels.

Table 2: Dholuo Vowel Sounds

Front			Back		
Orthography	IPA Symbol		Orthography	IPA Symbol	
	[+ATR]	[-ATR]		[+ATR]	[-ATR]
High I, i	i	ɪ	U, u	u	ʊ
Mid E, e	e	ɛ	O,o	o	ɔ
Low A, a	a				

Adapted from Oduor (2002)

Were (2007) discusses vowel harmony in Dholuo as autosegmental feature spreading. This is an approach to vowel harmony that has been employed in the spread based analyses of consonant harmony. Swenson (2015) asserts that the [ATR] feature spreads regressively from right to left. This feature can only extend across one word. This assertion raises questions on nature of correspondence, domain of harmony and directionality patterns of harmony in general. Other vowel harmony systems include nasal harmony, backness harmony in Finnish, rounding harmony in Turkish and Khalkha Mongolian, while Hungarian has palatal harmony where every vowel has to be either

front or back (Polgardi, 2006). Unlike vowels, consonants have traditionally been classified in terms of manner or place of articulation and state of glottis. Consonants therefore differ significantly from vowels in terms of articulatory features and therefore cannot be assumed to operate under a similar mechanism. Consonant harmony needs to be analysed in terms of the phonological properties that define it, the nature of correspondence and the directionality of assimilation.

Dholuo phonemic inventory consists of consonants and vowels. The focus of the study is on the consonantal phonemes, however vowels must be included since they form the nucleus of the syllable, which in turn form words which are the unit of analysis in this study. The vowel is the tone bearing unit. Tone is focused on in this study because the language is tonal. There are four 'tones' or 'tonal melodies' in Dholuo. Table 3 illustrates the tones.

Table 3: The Tonal Melodies of Dholuo

	IPA	**Dholuo Orthography**	
High **[ˊ]**	/ mó:n/	mon	'women'
Low **[ˋ]**	/ lù:m /	lum	'grass'
Falling **[^]**	/ ɲâ:ɲâ/	nyanya	'tomato'
Rising **[ˇ]**	/ lă:w /	law	'dress'

In Table 3, the tonal melodies are represented just as they are in IPA. In Dholuo tone can be used to distinguish word meaning or draw grammatical distinctions such as change in word class or tense. A change in the tone of a word results into a change in meaning. For example, the word /kendo/ has three meanings which are differentiated by the tonal notations. [kèndò] means 'fireplace' , [kéndò] means 'again' while [kéndó]

means ‘to marry’. Tone can be used in distinguishing word classes, for example, the word /bɛr/ ‘good’ can be an adjective [bɛ̀r] or a noun [bɛ́r].

1.1.5 Approaches to the Study of Consonant Harmony

There are various approaches to the study of consonant harmony. However, studies on the harmony phenomena have tended to focus on vowel harmony systems. This could be because vowel harmony is more common cross linguistically than consonant harmony (Hansson 2001). Theoretical phonologists like Halle and Vergnaud (1981) assume that the two operate under a similar mechanism. Halle and Vergnaud adopt an analysis of harmony in terms of autosegmental feature spreading. Goldsmith (1976) defines autosegmental phonology as a non-linear approach that allows the phonological processes, such as tone and vowel harmony, to be independent of and extend (spread) beyond individual consonants and vowels and as a result the phonological processes may influence more than one vowel or consonant at a time.

This means that phonological features can be spread across elements within a word including consonants and vowels. It would be necessary to establish the mechanism behind the spreading and the phonological properties involved.

Autosegmental approach suggests that even vowels would be affected in the harmonisation process. If this happens then what would be attested is vowel-consonant harmony differing from definitions advanced by Shaw (1991) and Hansson (2001) which suggest action-at-a-distance and vowels being inaudibly affected. Analyses of consonant harmony that have employed the feature spreading include works of Shaw (1991) and Gafos (1996).

Feature spreading analyses of harmony consider locality of segments as an extremely important issue (Hansson, 2001). The class of target elements must be appropriately defined and all the intervening segments that are transparent to harmony must be unspecified on the tier which contains the spreading feature (F) otherwise harmony is blocked (Hansson, 2001).

Shaw (1991) analyzes Tahltan coronal harmony as autosegmental feature spreading and argues that when harmony is analyzed as feature spreading it is bound by strict locality requirement. All segments within a spreading domain are participants that are targeted by the spreading feature and there is no skipping of segments. In reality, however; there are systems which display segmental opacity whereby a set of non-participating segment blocks propagation of the harmonizing property. This approach to consonant harmony has been criticized by a series of works that investigate a wider typology of consonant agreement (Walker, 2000; Hansson, 2001; Rose and Walker, 2004).

Rose and Walker (2004) assert that the mechanism that underlies non-local agreement between consonants is not spreading but rather an identity effect that arises between the segments that are recognized to be similar. Rose and Walker further present a typology of long distance consonant agreement and demonstrate the importance of similarity between the interacting segments. The focus of the current study was to determine if Dholuo consonant harmony is feature spreading, where only local segments falling within the spreading domain are affected or feature agreement which involves action-at- a-distance where non-contiguous segments exhibit harmony phenomena. These two approaches to consonant harmony create a problem of theoretical significance since their mode of operation is funadamentally different. The researcher would therefore seek to determine

the nature of correspondence of consonants in Dholuo consonant harmony as either feature agreement or feature spreading or possibly both.

1.1.6 Classification of Consonant Harmony

The classification of consonant harmony is usually based on the harmonizing property (Hansson, 2001). Consonant harmony systems are classified in terms of the types of segments involved and the phonetic or phonological property defining the harmony. Hansson (2001) posits that a language may often exhibit more than one type of consonant harmony. This means that consonant harmony is not restricted to a single type within a language. Gafos (1996) in contrast argues that when consonant harmony is attested it is restricted to coronal consonants. This argument may limit the scope of study of consonant harmony to coronals yet other harmony systems have been attested which include dorsal harmony in Truku Seediq (Lee, 2009). It would be important to establish the types of segments involved in Dholuo consonant harmony.

Literature reveals that coronal harmony is more common than any other harmony involving place of articulation (Shaw, 1991 and Hansson, 2001). Coronal harmony refers to the patterns of agreement for features only relevant to coronals (Rose and Walker 2004). This type of harmony affects the coronal fricatives, such as /s/ and /ʃ/ in a word, requiring all the coronal fricatives in the word to belong to either [+ anterior] class (s-like sounds) or [– anterior] class (ʃ-like sounds). Such patterns are found in the Dene (Athabaskan) languages such as Navajo (Young and Morgan, 1987, McDonough, 2003), Tahltan (Shaw 1991), and Chumash (Campbell, 1997 and Rose, 2011). Various Austronesian languages exhibit consonant harmony among liquid consonants with [r] assimilating at a distance to [l] or vice versa.

Western Nilotic languages like Anywa and Pari have root internal coronal harmony (Hansson, 2001). This is a co-occurrence restriction on dental and alveolar obstruents and nasals. The focus of the current study was in observing if this phenomenon extends to Dholuo in as much as phonology is usually language specific. Languages may have similar inventory of phonemes but pattern differently phonologically.

There are other consonant harmony systems apart from coronal harmony. Rose and Walker (2004) establish that Guarani exhibits nasal harmony depending on whether the root includes a nasal (vowel or consonant) or not. For instance, the reflexive prefix is realized as oral /je-/ when preceding an oral stem like /juka/ 'kill', but as a nasal /ne-/ when preceding a nasal stem like /nupã́/ 'hit', where the /ã́/ makes the stem nasal. The root controls the shape of the affix: the affix assimilates to the stem. This would be pertinent in the investigation of directionality of assimilation in consonant harmony where matters of root control and stem control are pertinent.Some Finnish speakers find it hard to pronounce both [b] and [p] in foreign words, for example, /pubi/, so they voice to produce /bubi/ or devoice to /pupi/ (Goldsmith 1985). This Finnish data would imply that consonant harmony is an assimilation process that eases articulation especially in consonant clusters or contrasting sounds.

Okombo (1982) observes that Dholuo displays consonant change under certain morphorphonemic contexts. In plural marking, the final obstruent in a word changes from voiced to voiceless or vice versa, for instance, /guok/ 'dog' and /guogi/ 'dogs'. It would be important to investigate if these changes are motivated by consonant harmony. Okombo suggests that some changes are motivated by natural rules; however, some of

these changes are not phonetically plausible and would require further investigation. It is on this basis that a study of consonant-to-consonant interaction in Dholuo is undertaken.

1.2 Statement of the Problem

Consonant harmony is a complex phonological phenomenon that is relatively rare across many languages of the world. It was therefore important to investigate how it manifests, especially in Dholuo, with regard to the specific theoretical parameters. This called for a theory-informed descriptive analysis to determine its form by focusing on the constraints that determine the occurrence. It was important to establish if consonant harmony in Dholuo involves targeted consonants only or the intervening vowels are affected even if inaudibly. In the previous studies of consonant harmony, the issues of locality of segments and nature of correspondence present a theoretical problem. Traditional analyses regard consonant harmony as feature spreading while recent studies have analysed consonant harmony in terms of feature agreement that leads to correspondence.

There is need to investigate how consonant harmony manifests owing to the opposing view points in the phonological literature. Using data from Dholuo, the researcher sought to establish the phonetic and phonological properties defining consonant harmony which so far remains unexplained; the establishment of the exact nature of correspondence and determination of directionality of assimilation patterns. This would aid in creating an understanding of how Dholuo consonant harmony manifests.

1.3 Research Questions

The research was guided by the following questions:

1. Which phonetic and phonological properties define Dholuo consonant harmony?

2. What is the nature of correspondence in Dholuo consonant harmony?

3. What is the directionality of assimilation in Dholuo consonant harmony?

1.4 Objectives of the Study

The main objective of this study was to explain the nature of Dholuo consonant harmony. In relation to the research problem, the specific objectives of the study were to:

1. Establish the phonetic and phonological properties which define Dholuo consonant harmony.

2. Explain the nature of correspondence in Dholuo consonant harmony.

3. Determine the directionality of assimilation in Dholuo consonant harmony.

1.5 Significance of the Study

This study sought to give Dholuo consonant harmony a descriptive and theoretical perspective. Studies of Dholuo phonological processes have been done previously using Natural Generative Phonology framework (NGP), for example, Okombo (1982), who studied Dholuo morphophonemic alternations. Oduor (2002) employs other generative approaches like Autosegmental phonology and CV- phonology in the study of syllable weight and its effects in Dholuo phonology. Were (2007) uses autosegmental phonology in the study of vowel harmony. The current study is a departure from the generative approaches which have dominated phonological research in the past, instead the study adopts Prince and Smolensky (1993), Optimality Theory (OT) which is a constraint based framework.

OT which informs this study replaces these phonological rules, akin to generative approaches, with a set of constraints which compete with each other in the pursuit of an optimal form. Therefore, the study is a shift from conventional and traditional approaches that have been conducted in Dholuo. Research in consonant harmony endeavours to bridge this gap in knowledge and further enrich the study of Dholuo phonology and the study of language in general.

1.6 Scope of the Study

This was a synchronic study of Dholuo consonant harmony. The status of Dholuo vowel harmony has been established in previous studies and therefore was not focused on. The data collected in this study was not restricted to the KSN variety only, cases observed from B-U that showed significant variations in terms of articulation were noted, as this could impact greatly on the general view of Dholuo consonant harmony. The focus of the study is Dholuo as spoken in Kenya.

The study focused on consonants as they are presently and not in the diachronic perspective. In this thesis, any reference made to other Western Nilotic languages was to compare and contrast findings in Dholuo with an aim of providing an in-depth analysis of the consonant harmony data.

1.7 Theoretical Framework

This investigation was based on the Optimality Theory (hereafter OT), originally developed by Prince and Smolensky (1993/2004). Different scholars have adapted OT and further elaborated the original work (McCarthy & Prince, 1993; Rose & Walker, 2004 and McCarthy, 2002). OT is founded on the principles of Universal Grammar

(hereafter, UG). UG consists largely of a set of constraints on representational well-formedness and through these, individual grammars are constructed. The representational system employed is derived from generative phonology which is believed to be rich enough to support the set of constraints.

Prince and Smolensky (1993) assert that these constraints operating in particular languages are highly conflicting and they therefore propose a means of precisely determining which analysis of an input best satisfies a set of conflicting conditions. OT is therefore a linguistic model which proposes that observed forms of a language arise from the interaction between conflicting constraints. These set of conflicting constraints are present in all languages but languages differ in how they resolve these conflicts. A language specific grammar is regarded as a means of resolving the conflicts among the universal constraints.

The idea of constraint based model emanates from Universal Grammar. Constraints replace the rewrite rules as formulated in Transformational Generative Grammar (TGG) and Natural Generative Phonology (NGP). OT models grammars as systems that provide mappings from inputs to outputs. Typically the inputs are conceived as the underlying representations and the outputs as the surface realizations. The two structural levels which are the input and ouput are also derived from TGG by Chomsky (1965). The deep structure is an input to semantic component while the output is the surface realization which is the phonological component.

OT has three basic components: GEN (generator), CON (constraint) and EVAL (evaluator) McCarthy & Prince (1993). GEN generates an infinite number of candidate

forms based on the input; CON provides constraints which are used for evaluation by EVAL. EVAL is a system of constraints which select the candidate that best satisfies the constraint system as the actual output.

1.7.1 Input and GEN: The Candidate Set

The concept of GEN stems from generative grammar as propounded by Chomsky (1957) which states that a grammar is capable of generating an infinite number of constructions, each of which has a phonetic and a semantic representation**.** GEN the generator supplies or generates an infinite number of candidates, or possible realizations of an input. The candidates include forms identical to the input, slightly different from it, or seemingly unrelated ones. The candidates are possible output forms that are placed for evaluation or assessment using a system of constraints to select the optimal form (the one that best satisfies constraint set). OT supposes that there are no language-specific restrictions on the input which is referred to as the richness of the base. Every grammar can handle every possible input. The grammar of a language (the ranking of constraints) determines which of the infinite candidates will be assessed as optimal by EVAL. There are three principles underlying GEN which is expressed in (a) to (c) adapted from McCarthy and Prince (1993, p.20).

1) Principles of GEN

a) Freedom of Analysis

Freedom of analysis ensures that there are no specific rules or repair strategies needed. Any amount of structure may be posited. All the possible realizations of an input are placed for assessment. GEN must in effect anticipate all the possible ways that any given language could transform a given input, to ensure that all the options are supplied by the

candidate set (McCarthy, 2007). GEN has the potential of generating for any given input a large number of candidate analyses by freely exercising the basic structural resources of the representational theory (Prince and Smolensky, 1993).

b) Containment

Containment is related to monotonicity. No element may be literally removed from the input form. The input is thus contained in every candidate form. This prevents deletion of elements.

c) Consistency of Exponence

Consistency of exponence is a specific hypothesis about the morphology-phonology relationship, namely that the lexical specifications of a morpheme cannot be changed by *Gen.* No changes in the exponence of a phonologically specified morpheme are permitted. The lexical specification of a morpheme cannot be changed by GEN.

1.7.2 CON: The Constraint Set

CON in OT terms refers to the constraint set (rules) which is the same in every language. The universal nature of CON makes some immediate predictions about language typology. If grammars differ only by having different rankings of CON, then the set of possible human languages is determined by constraints that exist. OT predicts that there cannot be more grammars than there are permutations of the ranking of the CON. The number of possible rankings is equal to the factorial of the total number of constraints. Two languages could generate the same range of input-output mappings but differ in the relative ranking of two constraints which do not conflict with each other (Prince & Smolensky, 1993). Universal Grammar (UG) specifies the set of constraints, but the ranking is given on a language specific basis. Subsections 1.7.2.1 and 1.7.2.2 present two basic constraints of OT.

1.7.2.1 Faithfulness Constraints

Faithfulness constraints demand that the input and output structures are maximally similar. The observed surface form (the output) matches the underlying or lexical form (input) in some particular way, that is, these constraints require identity between input and output forms. This constraint is conservative since it requires the input structure to be preserved in the output. Some of the faithfulness constraints are illustrated in (2).

2) Faithfulness Constraints

a) MAX

Maximize all input segments in the output (this constraint prevents deletion). Whichever segments are presented in the input must also be presented in the output.

b) DEP

Output segments are dependent on having an input correspondent (this constraint prevents insertion).

c) AGREE

Consonants agree in places of articulation. The input and output must correspond in the place of articulation. A velar, alveolar or a dental input form should remain a velar, alveolar or a dental consonant, respectively, in the output form.

d) AGREE -L- [DOR] (Rose and Walker 2004)

A consonant following a nasal must be homorganic with it. For example, if the consonant is a bilabial /p or b /, then it should be preceded by a bilabial nasal/ m/.

e) IDENT (VOI)

This constraint demands that the identity of the voice specification should be maintained. If the consonant in the input is [-voice] then the output should have the same voice specification, [- voice].

The faithfulness correspondence constraint is illustrated below:

3) IDENT-CC (voice)

Let C_i be a consonant in the input and C_j be any correspondent of C_i in the output. If C_i is [+voice] then C_j is [+voice].

Figure 1: Consonantal Correspondence (CC) Model (Rose & Walker 2004)

Input /bepo/

↕

Output [bepo] I-O faithfulness

↗↖ CC faithfulness

Figure 1 shows that the faithfulness consonantal correspondence (Faith-CC) constraint applicable to the property voicing requires that if a consonant in the input is specified as [±voice], any corresponding consonant (C) in the output must match in voicing specification. If a change occurs in the voice specification in the output form, a disharmonic output is formed. For instance, an output should be in the form of either [pepo] or [bebo] otherwise it is disallowed since it violates the faithfulness constraint that demands correspondence of input and output forms in terms of voice specification. The optimal candidate must therefore agree with the input form.

1.7.2.2 Markedness Constraints

The other type of constraint is the markedness constraints which impose requirements on the structural well-formedness of the output. Each plays a crucial role in this theory. Faithfulness constraints prevent every input from being realized as some unmarked form, and markedness constraints motivate changes from the underlying form.

(4) Markedness constraints

a) NOCODA

This constraint prohibits syllables from ending in consonants. This constraint prevents languages with CV syllable type from generating output forms that end in consonants. Many Bantu languages are NOCODA languages.

b) SIBILANT

Sibilant clusters are ungrammatical.

The constraint can be used in selecting an optimal candidate especially with the English plural suffix "s", which has three phonological realizations based on the final sound of the root [s, z & ɪz]. This constraint helps in preventing root forms that end in sibilants from being realized as marked forms. For example, the plural form of the English noun bus /bʌs/, based on GEN which is unlimited in its generative capacity can produce these candidate forms: *[bʌss], *[bʌs] *[bʌsz] *[bʌsɪs] and [bʌsɪz]. The candidate form [bʌsɪz] is selected as the output because this constraint allows for epenthesis of [ɪ] where there is a sibilant cluster.

c) AGREE (VOI)

Agree in the specification of voice.

Following the illustration of English word *bus* [bʌs] in 4(c), the choice of the optimal form between the candidates [bʌsɪs] and [bʌsɪz] is made based on the voice specification. A vowel [ɪ] which is [+ voice] has been epenthesized to break the sibilant clusters, the following consonant must agree with the vowel in the [+voice] feature. The English plural morpheme applies the phonological process of voice assimilation (Katamba, 1989).

1.7.3 EVAL: The Definition of Optimality

EVAL the evaluator selects the candidate that best satisfies the constraint system as the actual output. The main proposal of OT is that constraints are violable and they are ranked such that a lower ranked constraint can be violated in the optimal output in order to satisfy some higher ranked constraint. Universal Grammar specifies the set of constraints, but ranking is on a language- specific operation. Best satisfaction (minimal violation) is defined in a two-fold manner. These include:

a. In case of a constraint conflict, the candidate which violates the lowest ranked constraint is the best.
b. In case of a gradient constraint, the candidate which ranks the least is the best.
c. In case of a tie, all the surviving candidates are tested recursively against the rest of the hierarchy. The optimal member of a set is the output.

Once the winner is found, the lower-ranked constraints are irrelevant. This can be illustrated by the following schema where the basic conventions of constraint tableau are listed as well.

Table 4: Basic Conventions of a Constraint Tableau

Candidates	A	B	C	D
Cand 1	*!			*
Cand 2		*!		
Cand 3			**!	
Cand 4 ☞			*	***

Adapted from McCarthy and Prince (1993, p. 6-7).

KEY

- Candidates 1, 2, 3 and 4 refer to the various inputs generated by GEN.
- A, B, C and D refer to constraints.
- Left-to-right order mirrors the dominance order of the constraints.
- A dotted line signals that the constraints in question are not ranked with respect to each other.
- Violation of a constraint is indicated by an asterisk *
- Satisfaction is indicated by a blank cell
- The symbol [!] indicates a fatal violation; this symbol represents a non-optimal candidate. It highlights the point where the candidate in question loses to other more successful candidates.
- The symbol ☞ indicates the optimal candidate
- Shading indicates the irrelevance of the constraint to the fate of the candidate. A loser's cells are shaded after the fatal confrontation and the winner's when there are no more competitors.

In an OT framework, the term loser refers to a non-optimal candidate while winner refers to the optimal candidate (Prince and Smolensky, 2003). OT works with the interaction of markedness and faithfulness constraints. Faithfulness constraints ensure that the output form corresponds with the input form, while markedness constraints ensure that the output is not realized as a marked form by imposing well-formedness requirements on the candidates.

How OT works can be illustrated by Nandelenga (2014), which is a study of Nasal Consonant (NC) effects in Lubukusu. According to Nandelenga, NC effects refer to phonological processes triggered whenever a nasal comes before a consonant in the onset position of the syllable across many languages in the world. Nandelenga establishes that no nasal can be followed by a voiceless plosive in the surface. Using OT in the analysis, the following constraints are used for evaluation:

a) *NC̥

This constraint prohibits the occurrence of a voiceless plosive after a nasal in the output. The onset cluster of the type (nasal followed by voiceless plosive) is considered marked.

b) IDENT-IO [voi]

This constraint demands input and output correspondence in terms of voice specification.

c) IDENT-IO [nas]

This constraint demands that the nasal specification in the input should remain so in the output. One violation for each candidate that does not correspond in [+nas] feature specification.

The interaction between the markedness and faithfulness constraints is shown in Table 5.

Table 5:*NC Effects in Lubukusu

Input N_1-t_2e.xa→ [$^{n}d_{12}$e.xa] "I boil"

N_1-t_2e.xa	*NC	IDENT- IO[voi]	IDENT-IO[nas]
a. ☞$^{n}d_{12}$e.xa		*	*
b. n_1t_2e.xa	*!		

Adapted from Nandelenga (2014, p.47)

The optimal candidate is (a) where the nasal has undergone assimilation to the following obstruent making the plosive to acquire its nasal and voice features. The archiphoneme prefix nasal (N) which is unspecified for the place feature assimilates to the place of articulation of the following consonant. The voiceless plosive [t] becomes a voiced pre-nasalized stop [^{n}d]. When the voiceless plosive takes the [+ voice] feature of the nasal, it violates the faithfulness constraint IDENT-IO [voi] that demands input-output correspondence in terms of the voice specification. It can also be noted that when the oral voiceless stop acquires the nasal feature, it violates IDENT-IO [nasal] faithfulness constraint. Candidate (a) has more violations than (b), this works against the principal of minimal violation which is a key tenet in OT, however, it still wins since it does not violate a higher ranked constraint [*NC] which demands that no nasal should be followed by a voiceless stop in the output .

To illustrate how the markedness and faithfulness constraints interact to realize an optimal form the English plural marker “s” is used. The English plural marker suffix has three different phonological realizations: [s, z & ɪz].

(5) a. /bæt/ + /z/ → [bæts] ‘bats’

b. /dɒg/ + /z/ → [dɒgz] ‘dogs’

c. /wɪʃ/ + /z/ → [wɪʃɪz] ‘wishes’

The following constraint set is considered in descending order of domination (M: markedness, F: faithfulness):

a) M: *SS

Sibilant clusters are ungrammatical. One violation for every pair of adjacent sibilants in the output.

b) **M: Agree (Voi)**

Agree in specification of [voi]: one violation for every pair of adjacent obstruents in the output which disagree in voicing.

c) F: Max

Maximize all input segments in the output: one violation for each segment in the input that doesn't appear in the output (This constraint prevents deletion).

d) F: Dep

The output segments are dependent on having an input correspondent. One violation for each segment in the output that doesn't appear in the input (This constraint prevents insertion).

e) F: Ident (Voi)

The identity of the [voi] specification should be maintained, one violation for each segment that differs in voicing between the input and output.

This is illustrated below:

Table 6: Input /wɪʃ + z/ to Output Form> [wɪʃɪz]

wɪʃ + z	*SS	Agree	Max	Dep	Ident
☞wɪʃɪz				*	
wɪʃɪs				*	*!
wɪʃz	*!	*			
wɪʃ			*!		
wɪʃs	*!				*

The English plural marker has three allophones and this leads to the generation of these possible wɪʃɪz, wɪʃɪs, wɪʃz, wɪʃ and wɪʃs which are evaluated against a set of constraints. /wɪʃɪz/ is the optimal candidate even though it violates Dep that prevents insertion.

Table 7: **Change from the Input /dɒg+z/ to the Output [dɒgz]**

dɒg + z	*SS	Agree	Max	Dep	Ident
dɒgɪz				*!	
dɒgɪs				*!	*
dɒgz					
dɒg			*!		
dɒgs		*!			*

In the 'dɒg + z' tableau, the candidate 'dɒgz' incurs no violations whatsoever. Within the constraint set given, 'dɒgz' bounds all other possible candidates. This is referred to as harmonic bounding (McCarthy, 2002).

Table 8: Change from Input / bæt + z/ > output [bæts]

bæt + z	*SS	Agree	Max	Dep	Ident
bætɪz				*!	
bætɪs		*!		*!	*
bætz					
bæt			*!		
☞ bæts					*

In table 8, [bæts] is the optimal candidate although it violates the IDENT [VOI] constraint which calls for maintaining of the voice specification between the input and output.

From the tableaux 6, 7 and 8, no matter how the constraints are re-ordered, the [ɪs] allomorph will always lose to [ɪz] as a result of harmonic bounding. The kinds of violations incurred by the candidate ‘dɒgɪz’ are similar to those of 'dɒgɪs' because of the epenthetic vowel which violates the constraint that prevents insertion (Dep). The changing the voicing of the plural morpheme from [z] to [s] is also a major violation of IDENT (voi) constraint.

1.7.4 An Overview of OT

OT model has three main components: GEN, CON and EVAL. GEN supplies candidate forms based on the input. There is no limit to GEN due to freedom of analysis. Despite the numerous candidate forms, there is no risk of the model being overgenerative since EVAL uses CON to select a member of this set to be the actual output of grammar. GEN, CON and EVAL are universal what brings a difference is the ranking of constraints which is language specific.

In view of Prince and Smolensky’s (1993) proposals, the basic tenets of OT model of grammar are constraint based selection, universal nature of constraints, language based ranking and violability of constraints. The output form is determined by well-formedness constraints that select some candidate sets based on underlying representation as input. Candidate sets are infinite but an optimal form is selected by the well-formedness constraints. These constraints are provided by universal grammar making them applicable

to any human language; however, each language differs in how the constraints are ranked. In principle, all constraints are violable since violation serves the purpose of satisfying a higher ranked constraint. Ranking and violability are central in OT and this is what makes it different from other grammars.

The OT model presents certain challenges to the analyst. These include determining the range of candidates that must be considered in evaluation and also determining the winning candidate especially when there is a conflicting constraint set, where there are two highly ranked constraints in competition. Prince and Smolensky (1993) believe that OT can adjudicate between the two constraints by ranking them with respect to each other.

McCarthy (2007) notes that introduction of new constraints would also be challenging. Furthermore, determining the constraint set applicable and how CON ranks them was indeed a challenge even to the researcher in the current study owing to the fact that CON is universal but the ranking is language specific.

There are claims that OT cannot account for phonological opacity (Idsardi, 2000) and therefore there have been a number of proposals designed to account for it. In the current research, Odden's (1994) views on transparency and opacity are adapted. OT is purely representational making it a suitable model for linguistic competence and is not modelled to explain the specifics of linguistic performance (McCarthy, 2007).

OT model does not operate in isolation rather it borrows from other models of generative phonology to give a full account of certain phenomena. This poses challenges to an

analyst as it requires a synthesis of different models in linear and non-linear phonology. The ideas proposed by Goldsmith (1975, 1990 and 1995) and Odden (1994) are applied in discussing issues of locality and transparency.

1.8 Conclusion

This chapter provided background information on Dholuo and also highlighted consonant harmony, the subject under study. The chapter therefore sets a stage for the ensuing discussions. Furthermore, the chapter provides a statement of the problem under investigation, the objectives, justification, the scope and significance of the research and the theoretical framework adapted for the analysis.The chapter also aided the researcher in highlighting the knowledge gap. The researcher identified Dholuo consonant harmony as a rich area of research based on the theoretical issues that arose in terms of nature and approach to harmony. OT which is a fairly recent model in linguistic study was to be tested in terms of applicability. This chapter provided a background which acted as an eye-opener to the debates in current research in phonology and optimality theory.

The next chapter focused on reviewing literature related to the research questions and objectives of the study with a view to exposing gaps in the area of consonant harmony.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter was to review relevant literature for the topic under study with a view to creating an understanding of the nature of consonant harmony generally, and also interrogating the theoretical issues around it. This chapter reviewed literature according to the objectives of the study, theoretical framework and general foundational works in phonology. The previous works in consonant harmony and OT guided and provided pertinent information to the study undertaken. These reviewed sources also helped to reveal gaps for the current study based on the debates by different scholars on issues and trends in the phonological theory.

2.2 Phonological and Phonetic Properties that Define Consonant Harmony

Literature reviewed in this section helped us in understanding consonant harmony in terms of the definition as provided by various scholars, the phonetic features that define it, and the phonological features and processes involved. This enabled the researcher to have an in-depth conceptualization of the consonant harmony as a phonological phenomenon, when the research was undertaken.

One of the earliest explicit discussions on consonant harmony was by the Danish scholar, Otto Jespersen (Jespersen, 1904, p.170-71 cited in Hansson, 2001, p.10). Jespersen considers consonant-harmonization to be equivalent to ‘vowel harmonization’. This is arguable since consonants and vowels are different in terms of the phonetic features that define them.

The term ‘consonant harmony’ was first proposed by Karl V. Teeter in a short article on Wiyot and Cree languages (Teeter, 1959). Teeter discusses this phenomenon using data from a number of Native American languages such as Wiyot, Cree, Navajo and Wishram which have consonant harmony and sound symbolism. Teeter (1959) notes that Navajo sibilant harmony is ‘purely morphophonemic’, which is phonologically rather than morphologically conditioned. The same phenomenon obtains in Wiyot (Teeter, 1959). Teeter’s definition relates consonant harmony to phonological conditioning. It would be important to establish if consonant harmony in Dholuo is a result of phonologically conditioned environment or it is motivated by other factors which determine the occurrence patterns.

Consonant harmony according to Hansson (2001) is defined as:

> an assimilatory effect of one consonant on another consonant or assimilatory co-occurrence restriction holding between two consonants, where: the two consonants are separated by a string of segmental material consisting of at the very least a vowel and intervening segments, in particular vowels are not audibly affected by the assimilating property (p.4).

Hansson suggests that consonant harmony involves assimilation whereby a consonant copies the phonological or phonetic features of a consonant adjacent to it. The definition highlights pertinent issues concerning consonant harmony like triggers and direction of assimilation, whether the assimilation is through spread or agreement of features, issues of locality and adjacency of the intervening material and co-occurrence constraints on consonants.

Hansson’s definition provokes a debate on the intervening materials and vowels which are unaffected by the harmonizing feature. Odden (1994) argues that the intervening

material may not be assimilated since the harmonizing features are unspecified in some segments. However, Odden's assertion is made with reference to vowel harmony whereby a feature spreads from vowel to vowel while consonants remain unaffected and this he says could be motivated by segregation of features of articulation in consonants and vowels. In Turkish labial harmony, for instance, 'only the vowels are affected by the rounding feature while labial consonants are skipped' (Odden, 1994, p.297). In the current study the focus was on consonants affected by harmonizing property and the triggers of the assimilation process.

Shaw (1991) defines consonant harmony as a phonological assimilation or dissimilation between consonants that are 'not necessarily adjacent in the surface string where the intervening vocalic or consonant segments do not interact with harmony in any way' (p.125). The understanding here is that consonant harmony applies not only to contiguous segments but also to non-contiguous segments. The question lies not just on the segments that are affected but also on the unaffected vocalic or consonantal segments. The factor that determines the participating and non participating segments was a question that was interesting to the researcher in the analysis of consonant harmony in Dholuo.

Mackenzie (2005) advances the notion of similarity and contrasts in consonant harmony systems. Mackenzie proposes that it is the underlying contrasts in a system which determines the similarity of segments and also determines which segments will participate in harmony processes. This notion departs from other schools of thought, for instance, Shaw (1991) and Hansson (2001) that view harmony in terms of similarity of segments only. The notion of contrasts results in a circularity of argument since the bottom line is the similarity of segments even if they contrast underlyingly. Hansson

(2007) concurs with the notion of similarity and asserts that the more similar two consonants are the more likely they are to become subject to agreement. The current study sought to investigate the phonetic properties that characterize harmony and in so doing establish how the degree of similarity leads to harmonization of consonants in Dholuo.

Consonant harmony may involve co-occurrence restrictions holding between consonants (Hansson, 2001). In some languages, certain consonants are barred from co occurring in words, for instance, Tucker (1994) says that dental and alveolar stops cannot co-exist in the same stem in Dholuo. Tucker discusses this based on the general segmental constraints in Dholuo without making reference to any model of grammar. This provides insights on the co-occurrence restrictions that prevail amongst Dholuo consonants. The researcher was interested in determining whether such co-occurence restrictions can be attributed to consonant harmonisation. The investigation involved establishing the distinctive property between dentals and alveolars that restricts their co- occurrence.

Dental harmony is a Western Nilotic phenomenon based on literature from Päri, Shilluk, Anywa (Reh, 1996 and Andersen, 1988). Literature from these languages provided insights on what obtains in Dholuo since languages related from a diachronic perspective tend to have similar morphemic structures. Rose and Walker (2004) speculate that a similar diachronic mechanism may lead to emergence of consonant agreement patterns.

Co-occurrence restrictions between phonemes could be analysed by investigating morphophonemic patterns in a language. Mackenzie (2005) studies consonant harmony in Bumo Izon using the theory of contrastive hierarchy. Mackenzie considers only those

features which seem contrastive by hierarchical ordering. In Bumo Izon, there is a ban on co-occurrence between implosive and plosives within a morpheme. Contrast is used in determining participating segments. The segments which participate include /b/, /d/, /ɓ/ and /g/ which are all voiced stops. The sounds /g/and /ɠɓ/ also share the property voiced stops, however, they do not participate in harmony as they are not specified for the feature [glottalic] which is the active feature in these restrictions. The ordering of contrastive feature results in different specification and different patterns in harmony and the co-occurrence restrictions.The co-occurrence restrictions between implosive and plosives in Bumo Izon can be illustrated in (1):

(1) Co-occurrence restriction between implosive and plosives in Bumo Izon (Efere, 2001)

a) búbú ‘rub’ (powder in the face)

b) bɪdɛ́ ‘cloth’

c) ɓʊɓaɪ ‘yesterday’

d) ɗɔ̃ːdɔ̃ ‘cold’

e) ɗăɓá ‘swamp’

The implosives /ɓ/ and /ɗ/ are barred from occurring with the plosives /b/ and /d/ in any combination and any order. The velar plosive /g/ and the labiovelar implosive /ɠɓ/, however, may freely occur with members of both plosive and implosive series.

(2) Co-occurrence with both plosives and implosive series (data adapted from Efere, 2001)

a) gódó ‘padlock’

b) ɗŭgó ‘to pursue’

c) ɠɓaɓu ‘crack (of a stick breaking)’

d) ɠɓódaɠɓóda ‘(rain) hard’

The plosive /g/ and labio velar /ɠɓ/ do not participate in the cooccurence restriction and this can be attributed to the Bumo Izon inventory. There is no implosive *[ɠ] at the velar place of articulation and no plosive labiovelar *[gb] as seen in Table 9.

Table 9: Bumo Izon Inventory of Plosives and Implosives (Efere, 2001)

	Labial	Alveolar	Velar	Labiovelar
Plosive	p b	t d	k g	kp *
Implosive	ɓ	ɗ	*	ɠɓ

In table 9, the voiced velar and labio velar stops do not participate because they lack a partner at the same place of articulation that differs in terms of pulmonic /implosive distinction (Mackenzie, 2005). There needs to be a contrasting sound for them to participate fully in the co-occurrence restriction. The lack of a voiced velar implosive /ɠ/ and voiced labiovelar [ɡb] is an accidental gap in Bumo Izon inventory. The participation in harmony seems to be motivated by contrast. The participants are required to contrast in their phonological property thus the shape of the consonantal inventory is important in determining participants of the harmony process. Mackenzie (2005) asserts that ‘segments participating in harmony are similar to one another since they form a natural class of segments contrastively specified for the harmonic feature’ (p. 169). The current research examined the phonemic inventory and the contrasts that exist in the phonological system. It was important to note that every language patterns differently and therefore Dholuo could manifest differently in the system of contrasts.

Literature shows different classes of consonant harmony being attested in various languages of the world. According to Gafos (1999) the only attested type of harmony in human language is coronal harmony and that it was the only possible type. This claim by Gafos would limit the scope of the study of consonant harmony to coronal systems yet other cases of harmony involving non-coronal gestures have been attested and these include voicing harmony, liquid harmony and nasal consonant harmony (Odden 1994; Hansson 2001 and Mackenzie 2005, among others). Various Austronesian languages exhibit consonant harmony among the liquid consonants with [r] assimilating at a distance to [l] or vice versa while Guarani shows nasal harmony. The scope of consonant harmony scope is thus extended beyond coronals.

Lee (2009) studies dorsal consonant harmony in Truku Seediq. She reports that dorsal consonant harmony involves two contrastive segments which are voiceless velar stop /k/ and voiceless uvular /q/. The underlying voiceless velar stop /k/is realized as voiceless uvular stop [q], whenever there is the uvular /q/ in the stem whereby the latter is derived in morphophonemic contexts. According to Lee, harmony operates between morpheme boundaries and also within morpheme roots. Dorsal consonant harmony in Truku dialect involves non-local correspondence rather than spreading of the dorsal feature [high] or [retracted tongue root]. Lee (2009) is significant to the current study as concurrence amongst dorsal consonants in Dholuo is being investigated.

Hansson (2001) conducts a similar study which looks at dorsal consonant harmony in Totonacan language family. In Misantla Totonac, the heteromorphemic sequences /k…q/ are harmonized to /q…q/. The domain in which dorsal consonant harmony applies is morphologically defined; it consists of the stem, which comprises the root and derivation

prefixes. The inflectional prefixes are outside the scope of harmony in Misantla Totonac and this is contrasts what obtains in Truku Seediq (Lee, 2009), where the both derivational and inflectional affixes are involved. Current study focuses on the word which is the domain of operation of consonant harmony.

MacEachernn (1999) in his study of dorsal consonant harmony in Bolivian Aymara establishes that it holds only as a co-occurrence restriction where velars and uvulars are not allowed to occur within roots, although each may combine freely with segments at other places of articulation.

(3) Root dorsal harmony in Bolivian Aymara (data from De Lucca, (1987), quoted in Hansson (2001, p.95))

a. /qelqa/ ‘document’

b. /q^hat$\int q^h$a/ ‘rough to touch

c. /q’enq’o/ ‘rough (ground)’

d. /kiki/ ‘similar/identical’

e. /k^husk^ha/ ‘common’

The illustration in (3) shows the occurrence of dorsal consonants in Bolivian Aymara where only /q…q/, /q^h…q^h/, /k…k/ and /k^h...k^h / sequences are attested. Just like Truku seediq (Lee, 2009); Misantla Totonac (Hansson, 2001), the co occurrence restriction between voiceless velar stop and voiceless uvular stop prevails. The only difference is that in Misantla Totonac it is restricted to derivational affixes only. These insights are

important in understanding the scope of operation in consonant harmony. Consonant harmony may be confined to the roots as in the case of Bolivian Aymara, or extend to derivational affixes only or to both inflectional and derivational affixes.

Apart from looking at contrasts in the system, similarity is also regarded as a factor in defining consonant harmony systems. According to Rose and Walker (2004) similarity determines which segments will participate in consonant harmony processes. This view is shared by Hansson (2001) and Mackenzie (2005). Rose and Walker (2004) argue that harmony is motivated by constraints that require surface segments to be in correspondence relation with one another. Rose and Walker propose a similarity based surface correspondence hierarchy:

(4) CORR- [T↔T] >> CORR-[T↔D] >> CORR-[K↔T]>> CORR- [K↔D]

Identical stops same place same voicing any oral stops

Adapted from Rose and Walker (2004)

This arrangement is based on ranking in a descending order. The more similar the consonants are, the higher ranked the requirement that they correspond. The first constraint CORR- [T↔T] enforces a correspondence relation between pairs of identical stops, for example, t↔t, d↔d and k↔k. The segments should have shared features in all aspects including manner place and voice features. It can be compared with MacEachernn (1997[1999] constraint BEIDENTICAL which demands total identity amongst segments for consonant harmony to occur. The second constraint, CORR-[T↔D] establishes a correspondence between a pair of oral stops that differ in voice

[±voi] but agree in other features. The third constraint CORR-[K↔T], establishes a correspondence between oral with same voicing regardless of place of articulation. While the fourth constraint CORR-[K↔D], establishes a correspondence relation between any oral stops. Rose and Walker similarity based surface correspondence constraints would be important in analyzing different levels of similarity in the study of Dholuo consonant harmony.

Lee (2009) discusses heteromorphemic alternations in Truku Seediq. This information is vital in understanding Dholuo phonology since consonants in Dholuo also alternate in certain morphophonemic contexts (Okombo, 1982). It was necessary to investigate if the morphophonemic alternations of consonants in Dholuo have an assimilatory effect on each other that can be viewed as consonant harmony just as manifested in Truku Seediq.

2.3 Nature of Correspondence in Consonant Harmony

Literature on various approaches to consonant harmony helped to understand how different scholars explained the nature of correspondence in consonant harmony. Literature shows analyses in terms of either feature spreading or featural agreement that leads to correspondence of sounds. Consonant harmony was traditionally analysed as feature spreading. Halle and Vergnaud (1981) adopt an analysis in terms of autosegmental feature spreading. Traditional analyses of consonant harmony have employed the feature spreading (Shaw 1991; Gafos 1996). This approach has been criticized by a series of works that investigate a wider typology of consonant agreement (Walker, 2000; Rose and Walker, 2004 and Hansson, 2001).

The current study seeks to determine the nature of correspondence in Dholuo consonant harmony; whether consonant harmony is as a result of feature agreement or feature spreading. Hansson (2001) and Polgardi (2006) further enrich the claim that consonant harmony is about feature agreement which leads to correspondence and not feature spreading as earlier studies claimed.

Rose and Walker (2004) debate the idea of action-at-distance, a characteristic of consonant harmony. Their focus is to establish if feature agreement is as a result of spreading or correspondence. In non-linear phonology, the featural agreement phenomenon has been analyzed as a product of spreading. Shaw (1991) in the study of Chumash coronal harmony analyzes agreement for coronal subsidiary features among sibilants in Chumash as the product of the spreading feature [anterior], a daughter of the coronal node. The example in (5) below shows a spreading of the anterior feature from right to left.

(5) **cor** s – api –tso- us ‘he has good luck’

• • •

| |

←---------- [+ ant]

(Adapted from Rose and Walker, 2004)

The representation above is a gapped configuration which refers specifically to structures where feature linkage gaps across an intervening segment of which it is not an associated property. Segments that are not specified for the harmonizing feature are skipped. This contradicts the assertion by Clark and Yallop (1995) that harmony phenomenon extends to the entire stretch of a word affecting both vowels and consonants in the continuum.

This raises a question on the scope of assimilation, the triggers and also the targets in consonant harmony processes. In the current study it would be important to analyse the participants in order to identify the harmonizing features that trigger consonant harmony.

Rose and Walker (2004) analyse Chumash sibilant harmony in terms of feature agreement and this differs from Shaw (1991) as illustrated in (6). Rose and Walker observe that the character of coronal fricatives and affricates is determined by the right most coronal sibilant. In example (6) a) agreement alters /s/ to /ʃ/ when preceding a root or suffix palato-alveolar and (b) conversely /ʃ/ is realized as /s/ when preceding [s], (c) the rightmost sibilant can occur in a root or affix.

(6) a) ʃ-api-tʃo-it 'I have good luck' s-api-tso-us 'he has good luck'

b) s-ixut 'it burns' ʃ-ilakʃ 'it is soft'

c) uʃla 'with the hand' usla-siq 'to press firmly by hand'

(From Shaw 1991, quoted in Rose & Walker 2004)

Rose and Walker (2004) approach consonant harmony as 'Long-Distance Agreement through Correspondence (LDAC)'. Their chief assertion is that agreement is determined by identity constraints which check feature matching in corresponding consonants, thereby obviating representations in which feature linkage skips over spans of neutral segments. Another key claim is that similarity plays a decisive role in identifying segments which stand in correspondence (Rose and Walker 2004). The configuration for LDAC as proposed by Rose and Walker (2004) is as represented in (7).

(7) LDAC Configuration

C_x V C_x V

| |

[αF] [αF]

↗ ↖

(Adapted from Rose and Walker, 2004).

In this structure a certain relation has been established between two consonants as indicated by coindexing. The featural agreement comes about through the activity of constraints that enforce identity between corresponding segments. In the current study

The current study was interested in establishing the manifestation of harmony. From the literature, featural agreement is better able to explain the skipping of intervening segments which remain unaffected by harmony since here the target is matching consonants and those which do not match are overlooked (Rose & Walker, 2004). Consonant correspondence due to featural agreement can therefore explain harmony affecting non-contiguous segments.

Rose and Walker (2004) proposed the following types of agreement based on LDAC. These include nasal agreement, liquid agreement, laryngeal agreement and coronal agreement. Nasal agreement over intervening vowels and consonants is found in Kikongo. The key property of nasal agreement that distinguishes it from nasal harmony is that the intervening vowels and other consonants are not nasalized.

(8) Nasal agreement in Kikongo perfective affix (adapted from Rose & Walker, 2004)

a) m-bud-idi	'I hit'	n-suk-idi	'I washed'
b) tu-kin-ini	'we planted'	tu-nik-ini	'we ground'

In Kikongo, a consonant suffix is realized as [d] or [l] when oral. The consonants that participate in nasal agreement are approximant consonants and nasals which share the property sonorant and voiced stops; and nasals which share the property of being voiced non-continuants. The intervening segments such as vowels and voiceless obstruents which are not specified for these features are unaffected. It can be said that Kikongo nasal agreement targets segments specified for the property sonorant (nasals and liquids) and [+ voice] stops. In the study of Dholuo consonant harmony it would important to understand the scope of operation of harmony and the triggers of assimilation.

The typology of LDAC by Rose and Walker (2004) includes nasal agreement found over intervening vowels and consonants in Kikongo (cited in Odden, 1994). It also includes liquid agreement which operates over intervening vowels and other non-liquids in Kipare (Odden, 1994). Laryngeal agreement is also observed whereby the laryngeal features are [voice], [spread glottis] and [constricted glottis] (Lombardi, 1991). Another LDAC involves coronal agreement for instance, sibilant agreement in Chumash and Navajo (Hayward, 1990) and dental agreement which is particularly prevalent in Nilotic languages such as Mayak (Andersen, 1999), Shilluk (Gilley, 1992), Anywa (Reh, 1996) and Luo (Tucker, 1994).

2.4 Directionality of Assimilation

Pater and Werle (2002) observe that in child language consonants often assimilate in primary place of articulation across intervening vowels while in adult language, primary place of articulation occurs between adjacent consonants. They further claim that the first consonant usually assimilates the second and that the standard analysis of directionality in local assimilation in OT uses positional faithfulness to protect the second consonant. Tucker (1994), on the other hand says that the initial consonant in Dholuo remains constant. This implies that change can only happen to the second or the final consonant under certain morphophonemic conditions.These observations which relate to directionality of assimilation provided insights to the analysis of Dholuo where the purpose was to determine the directionality and triggers of assimilation.

In Chumash sibilant harmony, the direction of assimilation is from right to left (Shaw, 1991; Rose & Walker, 2004). However, a large number of Austronesian languages record left-to-right nasal harmony. The harmony triggers are usually full nasals but individual languages differ in which types of intervening consonants are opaque to harmony (Hansson, 2001, p.191). This proposed study was interested in determining whether the assimilation is from left to right or vice versa. The study was also interested in noting the effect of harmony in case of affixes.

According to Hansson (2001), there are two types of directionality effects in consonant harmony systems which include stem control and absolute directionality. Stem-controlled harmony is sensitive to the distinction between derivational and inflectional affixes. Bidirectional harmony is an effect of stem control when both prefixes and affixes are present. Data from Kera in (9) shows a case of stem controlled voicing harmony where

the harmornizing is extended leftwards affecting the prefix and rightwards affecting the suffix.

(9) Stem controlled voicing harmony in Kera (data from Ebert, 1979, cited in Hansson 2001, p.186)

a) /k-ʤar-ka /	[gəʤar-gaŋ]	‘colourful’ coll.
b) /k-ʤir-ki/	[gi-ʤir-gi]	‘colourful’ masc.

In absolute directionality, harmony is operated either from right-to-left or left-to-right regardless of morphemic properties in between. Sibilant harmony in Ineseno (Applegate 1972, cited in Hansson 2001, p.189) displays this mechanism.

(10) Absolute right-to-left directionality in Iñeseno (Applegate, 1972 cited in Hansson, 2001)

a) /s-api-ʧho-it/	[ʃ-api-ʧhol-it]	‘I have a stroke of good luck’
b) /s-iʃ-tiʃi-jep-us/	[s-is-tisi-jep-us]	‘they show him’
c) /s-api-ʧho-us/	[s-api-tsho-us]	‘He has a stroke of good luck’

The data above shows right to left directionality. Lee (2009) observes that “it is the rightmost sibilant that targets the preceding sibilants and determines their feature qualities, thus an alveolar harmonises the preceding sibilants to be alveolar, or a palatal harmonizes the preceding sibilants to be palatal” (p. 579). Lee provides the criteria for directionality effect as illustrated in Table 10.

Table 10: Criteria for Directionality Effect in Consonant Harmony

	Stem/root control	Fixed direction
Infl. vs deriv	+	_
bidirectional	+	_

Adapted from Lee (2009, p.579)

Table 10 exemplifies that if the harmony is sensitive to derivational affixes or if bi-directionality is found then it is stem-controlled. Diachronic data may also shed light on the factors which trigger the operation.

Hansson (2001) in a survey of consonant harmony suggests that anticipatory (right-to-left) assimilation as the norm for consonant harmony process. Truku Seediq presents an instance of fixed right-to-left directionality (Hansson, 2001 & Lee, 2009). Whether there occurs default directionality or not in Dholuo was one of the concerns of this study.

2.5 Studies in Dholuo Phonology and Phonological Processes

Okombo (1982) investigates some of the morphophonemic alternations in Dholuo grammar in a generative framework. Okombo's work focuses on consonants and derives natural phonological rules that attempt to explain some of the alternations. He observes that in plural forms, the final obstruents change from being voiceless to voiced or vice versa while the final nasals change to nasal compounds. This study however cannot find a phonetically plausible explanation for the change from /l/ to /^{n}d/ that occurs in nominal forms.

(11) Morphophonemic alternations from /l/ to /nd/ (Okombo, 1982, p. 81)

	Nom.sg	Nom. Pl	
a.	/tɪɛlɔ/	[tɪɛ^{n}dɛ]	‘foot’
b.	/tɔ:l/	[tɔ:^{n}dɛ]	‘rope’
c.	/dwɔ:l/	[dwɔ:^{n}dɛ]	‘voice’
d.	/θuol /	[θuo^{n}de]	‘snake’

Okombo says that it is not readily obvious what phonological process could be responsible for this type of alternation and calls for further investigation of this change. Based on the phonetic properties of the alternants /l/ and /^{n}d/, the researcher argued that this morphophonemic alternation could be motivated by consonant harmony. It was important to establish their connection in terms of phonetic or phonological properties and whether the derived form (output) corresponds with the input in terms of phonetic features. This study goes beyond the establishment of rules in that it accounts for the computation process that yields the outputs.

Odhiambo (1981) and Okombo (1982) also investigate vowel phonological processes. A comprehensive description of Dholuo phonology can be attained if the focus shifts to consonant assimilation processes such as harmony, which the current study intends to investigate. Other studies involving vowels include Were (2007), which investigates vowel harmony in Autosegmental phonology framework which proposes feature spreading as the reason for harmony. The study of vowel harmony provided complementary information to the study of consonant harmony since it is in the harmony domain. The domain of harmony is the word and vowels and consonants make Dholuo words. The major vowel processes are of interest to the current study since vowels interact with consonants in a speech continuum. To sum up, this current study sought to

present and analyze data pertaining to consonant harmony with a view to providing a holistic understanding of the phonology of Dholuo. Tucker (1994) observes that all consonants in Dholuo can stand in word final positions in CVC stems except the voiced consonants [b, ð, g, j] which cannot terminate free forms. Final nasal compounds [mb, nð, nd, nɟ, ŋg] are possible however. This text information is useful in the understanding of the basic syllable structures and segmental constraints in Dholuo.

Working within Autosegmental and CV-phonology framework, Oduor (2002) focuses on the syllable weight and its effects on Dholuo phonology. This study also provides information on the syllable structure, phonetic inventory of consonants and phonological processes involving vowels like elision, compensatory lengthening and glide formation. This is important in providing a background to the study of consonant harmony which investigates the assimilatory effect of one consonant on another or co occurrence restrictions holding between two consonants.

2.6 Optimality Theory and Phonological Theory

Optimality Theory has its foundations in the earliest theoretical models of generative phonology. Generative phonology was created by Noam Chomsky and Morris Halle and it appears authoritatively in their book *'Sound Pattern of English'* (henceforth SPE) published in 1968. Generative phonology is closely linked to Generative Grammar, a model founded by Chomsky (1957) further expounded on in Chomsky (1965).Goldsmith and Laks (2012), present four central tenets of phonological research as proposed by Chomsky and Halle (1968).

These tenets provide a model through which OT grammar was constructed, they are as expounded below:

Firstly, that a researcher in working phonology has to come up with an explicit rule which generates surface forms (output in OT grammar) of a language and only those. If there are different manifestations of surface forms, then a rule must be developed to account for these. Goldsmith and Laks (2012) suggest that a formal simplicity was to be used in choosing amongst the accounts. OT stems from this as it makes an attempt, using EVAL, to select an optimal form from the various candidate forms presented by GEN. The multiple accounts (candidates) are realized because of GEN's unlimited generative capacity.

Secondly, as cited in Goldsmith and Laks (2012), the observed forms that the linguist wishes to account for are to be output of a sequence of phonological rules which act upon an underlying form. Prince and Smolensky (1993) model borrows these ideas since the optimal form is selected based on a constraint set which is universal. The constraints in OT replace the phonological rules in generative phonology.

Thirdly, according to Goldsmith and Laks (2012), segments are presented as binary features. A phone /sound segment may be seen as having or lacking a certain feature [±F], for example /m/ is described as [+nas] , having nasality while [b] as [-nas] lacking nasality. In OT, the constraints are defined in terms of the presence or absence of the feature. If applied to consonant harmony where the purpose is to investigate the phonological and phonetic features that define Dholuo consonant harmony, the focus would be on the presence or absence of the harmonizing property. The distinctive features that specify the participating segments would be discussed.

Lastly, Goldsmith and Laks (2012) observe that the discovery of deep rule ordering is an important aspect in phonological analysis such that for each pair of rules, there would be an attempt to establish that one and only one ordering of rules which is consistent with the data. Chomsky and Halle (1968) suggest that not all pairs of rules require ordering in a given language, but a generative phonological account with a given number rules should give a single strict ordering of these rules. The idea of ordering of rules is applied in OT in terms of hierarchical ranking of constraints. There are highly ranked constraints which if violated leads to fatality of the candidate form. Some constraints are termed as violable and therefore inconsequential in the selection of the optimal form.

Prince and Smolensky (1993) provided information on the basic principles of OT which were pertinent in the analyses of data in this study. OT models grammars as systems that provide mappings from inputs to outputs. The inputs are conceived as the underlying representations and the outputs as the surface realizations. OT is theory of phonology in which the rewrite rules as formulated in Transformational Generative Grammar (TGG) and Natural Generative Phonology (NGP) are replaced by constraints based on the output. In TGG which is a model of grammar proposed by Chomsky (1968) the phonological component consists of a set of phonological rules applying to underlying forms of the language (input) and yielding surface phonetic representations (output).

In NGP, Venneman (1972) proposed to rule out any underlying form that was not identical to its surface form; and if a morpheme showed no alternation, then its underlying form must be identical to the one on the surface; and if there was alternation the underlying form must be identical to one of the surface allomorphs. In OT however, there is an operational component GEN which produces a set of candidate output forms

which deviate from the input in various ways (Mc Carthy, 2007). More information about the theory is provided by McCarthy and Prince (1993) who expand on Prince and Smolensky's work. OT is a constraint-based framework of language which has been associated with its use in phonology, the area to which it was first applied. The theory is also applicable to other subfields of linguistics like syntax and semantics. OT is based on the principles of UG which consists of largely a set of constraints on representational well-formedness, out of which grammars are constructed. Polgardi (2006) studies vowel harmony in terms of Government and Optimality and provides pertinent information on data analysis using OT. Other scholars who adopt OT in their works include Hansson (2001) and Mackenzie (2005). These texts are important as they provide a background on how to apply OT in the analysis of consonant harmony.

2.7 Conclusion

The reviewed literature was based on previous research in the study of consonant harmony and phonological theories. Literature was also reviewed as per the objectives of the study in order to expose gaps in knowledge and also help provide answers to the research questions.

The information provided was essential in generating and building knowledge in phonological research. Consonant harmony is viewed as an assimilation process where consonants of a particular type match in some phonetic or phonological property. It can also be noted that the intervening vowels and consonants between the assimilating consonants show no observable effect of the assimilating property. Consonant harmony targets a number of segments which include dorsals, coronals, liquids and nasals, (Hansson, 2001; Rose and Walker, 2004; and Lee, 2009). Current research was focused

on establishing phonological properties that characterize consonant harmony in Dholuo. Literature indicates that it is an assimilation process and the focus was to establish if the assimilation is local or non-local; what triggers this assimilation; and what are the harmonizing properties are as far as Dholuo is concerned.

Literature review has helped further the debate on theoretical approaches and concerns of consonant harmony, notably feature spreading and feature agreement. Studies reveal that harmony occurs when there is a strong similarity between the harmonizing segments. Rose (2012) asserts that the consistent characteristic of consonant harmony is the high degree of similarity between the segments that interact.

On the issue of directionality patterns in consonant harmony, literature reveals that right-to-left assimilation is the default directionality. This may be true for some cases, though other studies provided contrary findings. This served as an eye-opener to the researcher who sought to determine directionality of assimilation in Dholuo consonant harmony. In the following chapter, research methodology is discussed in order to describe how the research was undertaken.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This was a study of the nature of Dholuo consonant harmony in terms of the occurrence patterns. The focus was on classifying Dholuo consonant harmony, establishing the phonetic and phonological properties that define it, establishing the nature of correspondence and determining the directionality of assimilation. The methods selected for this phonological study were dictated by the objectives of the study and the role of the researcher in data collection. This section describes the research design, sample and sampling techniques, data collection, data presentation and data analysis procedures.

3.2 Research Design

This study adopted the analytical research design. According to Kothari (2004), in analytical research, the researcher uses facts or information already available which is analysed to make a critical evaluation of the material. There is an in-depth study and evaluation of available information in an attempt to explain the complex phenomena. The researcher not only described the data as it is, but also attempted to analyse and explain the consonant harmony phenomena as it occurs. The researcher with the aid of the theory was able to describe, explain and document consonant harmony data. The researcher used qualitative data which included written and spoken forms.

3.3 Study Area

The focus of the study is Dholuo, a language of the Luo group in Kenya. The study was conducted particularly among native speakers of Dholuo who speak the KSN and B-U varieties. Therefore the descriptions and analyses in this research were based on data

drawn from these varieties. The researcher could not confine the study to only KSN variety which is the dialect spoken over a wider geographical area (Oduol, 1990), because the data drawn from digital audio recordings from Radio L. Victoria represent a wider area of Luo population including both dialects. The conclusions made in this study ought to be generalizable to both dialects.

3.4 Study Population

The study population included the five radio stations broadcasting in Dholuo and two texts written in Dholuo. The radio stations include *Ramogi* FM, *Dala* FM, *Mayienga*, *Nam Lolwe* and Lake Victoria which were selected because they broadcast in Dholuo. The belief was that the radio stations could provide speeches from native speakers of Dholuo. Dholuo consonant harmony data which consists of specific words can be extracted from Dholuo discourse. However, it should be noted that the occurrence of words that exhibit consonant harmony in discourse is not predictable

3.5 Sampling Procedure and Sample Size

The researcher purposively sampled Radio Lake Victoria. Purposive sampling is whereby a sample is selected based on the personal judgment of the researcher (Milroy, 1987; Dornyei, 2007). This technique enabled the researcher to consciously decide on what to include in the sample. The sample is based on what the researcher thinks would be appropriate for the study. Radio L.Victoria was purposively sampled since ninenty percent of the broadcasts are in Dholuo. The researcher was interested in discourse in Dholuo. The radio station has different programmes aired at different times. There were other radio stations that also broadcast in Dholuo like Ramogi FM and radio *Mayienga*. However, these radio stations were not selected since the interest and focus of the

research was in the language and not the source and therefore recordings from one radio station was assumed to be representative and adequate since language behaviour is deemed homogenous. It should be noted that data from spoken Dholuo was not likely to vary just because it had been recorded from different radio stations.

The researcher purposively sampled the programme *Duol* which is aired late in the evening. The programme involves discussions on various issues that affect the Luo people. Native speakers of Dholuo are invited and allowed to engage in discussions. The audience is also allowed to make interactive calls which are usually broadcast live. This form of discourse was important since the researcher was interested in naturally occurring conversations which could provide actual contexts of Dholuo in use and synchronic data of the language.

The audio recordings from these programmes provided spoken data which is deemed to be much more authentic in a phonological research. A sample of five episodes was recorded. The programme, *Duol*, usually lasted up to two hours. This constituted 10 hours of the discussions. It was expected that this sample size would provide sufficient data for the study together with data from written sources. According to Sankoff (1980) "large samples tend to be unnecessary in a linguistic survey because linguistic behavior (though not uniform) is generally homogeneous than other types of behavior studied in social survey" (p.2).

In language description, even when a single case is attested, it is all that is necessary in the analysis framework since frequencies are rarely important in qualitative research (Ritchie, Lewis & Elam, 2003).

Texts written in Dholuo were also purposively sampled. These texts provided additional data to complement the data collected from observation and introspection. These texts included Tucker (1994) which consists of a Dholuo word list and extracts from Weere (2007). The researcher purposively sampled nine extracts from Weere (2007) which were used in the study and these extracts provided complementary data. The raw data consisted of words written in Dholuo orthography which were then transcribed using IPA to determine the phonemes (sound units). The researcher being a native speaker of Dholuo and a phonologist was able to capture the phonological and phonetic details from the written corpus. Purposive sampling was necessary since not every word exhibited consonant harmony phenomena.

3.6 Data Collection Techniques

The researcher used a combined method in collecting data. This included mainly data from researcher's own intuitions as a linguist and native speaker of Dholuo; complementary data was collected from radio programme recordings and written sources. This triangulation was regarded by the researcher as necessary for obtaining a larger data input for the phenomenon in question. It was also to ensure that the data collected was valid and reliable.

3.6.1 Native Speaker Intuitions

The researcher who is a native speaker of Dholuo used her knowledge of the language to generate and extract the relevant data. According to Milroy (1987), a researcher studying a native language can directly access the language by means of his or her own linguistic competence in order to generate data for the study. Native speaker competence is based on Chomsky's view on competence and grammatical knowledge. According to Chomsky

(1957):

> the part of a speaker's knowledge of his language consists of knowing the lexical items of the language and based on this knowledge the native speaker is able to differentiate what is grammatical and what is not'' (p.12).

The researcher's native speaker competence aided not only in extracting data but also in verifying the data from audio recordings. Lai (2004) states that native speaker intuitions have enabled linguists to focus on relevant material with great ease and speed. Elicitation of intuitions is usually done through judgements of relevance. According to ELLO (2017), the native speaker needs to make judgements about acceptability of utterances which include judgement on whether a certain linguistic form belongs to a certain language or not. This method was relevant since the study was about Dholuo phonological structure which involved making judgements on the most harmonic forms based on constraints that are language specific.

Lai (2004) notes that native speaker intuitions are susceptible to bias and therefore cannot be used exclusively. To avoid the risk of native speaker bias, the researcher got complementary data by recording words in a note book and recording radio programs using digital audio recorders and use of secondary sources. Schutze (1996) argues that despite the criticisms on the validity of data from native speaker intuitions, mainstream linguistics continues to accept intuitions as the primary data source for grammatical studies.

3.5.2 Recording of Radio Programmes

Selected programs in a local radio station Radio Lake Victoria were recorded using digital audio recorder and listened to. This study being phonological benefitted a lot from

audio recordings. It involved listening to the recorded programs and extracting selected words. The digital audio materials proved useful since they could be replayed when it was deemed necessary. However, the process was tedious because the occurrence of words that exhibit consonant harmony was unpredictable (See appendix D).

3.5.3 Secondary Sources

The researcher also used secondary data to complement the primary data sources. This secondary data refers to readily collected data by another researcher and can be retrieved from published and unpublished sources (Kothari, 2003). Written sources such as Dholuo Dictionary, works on Dholuo grammar such as Tucker (1994) and extracts from Weere (2007) formed useful sources of written corpus. Tucker (1994) provides basic grammatical descriptions of Dholuo that are not based on any theoretical framework. The book contains a word list which has many Dholuo words but the researcher picks only those words displaying consonant harmony. Tucker is a non-native speaker of Dholuo but uses four native speakers to provide data for his book.

This book is selected on the strength that the data collected was based on different native speakers' input. (Appendix C) Weere (2007) is a book about the history of Luo tribe. It provides information about Luo geneaological links, clans and geographical distribution of the speakers. Furthermore, it gives information about culture, oral traditions, artifacts and material culture. This book was relevant since it is written in Dholuo by a native speaker. The words in book are therefore authentically Dholuo since the work is not based on some sort of translation; moreover, the author is a historian making him an authority in that field.

3.7 Data Analysis

Data analysis involves sifting, organizing, summarizing and synthesizing the data so as to arrive at the results and conclusions (Seliger and Shohamy, 1989). The data collected consisted of words which were selected, transcribed phonemically, and organized thematically according to the articulatory features. The qualitative data was arranged into themes using selected codes based on the research objectives and analyzed through content analysis employing the tenets of OT. In addition, the data were presented for evaluation of optimality in a tableau as stipulated by the theoretical framework. This is illustrated in section 1.8.3. The focus was on getting the optimal candidate in a given data set based on the proposed constraints in Dholuo. Furthermore, it involved an examination of various words which display consonant harmony in terms of the nature of correspondence and directionality effects. Library research was undertaken to collate the relevant information on the theoretical literature which helped in achieving the objectives of the study.

3.8 Reliability and Validity of Instruments

The researcher used triangulation of data collection instruments to ensure there was reliability and validity. The researcher who is a native speaker of Dholuo used the data from digital audio recordings, written sources from Tucker (1994) and Weere (2007) to complement data from introspection. These data collection instruments were validated before undertaking the research. There are three types of validity necessary when undertaking research: content, face and construct validity. Face validity is the degree to which a test appears to measure what it reports to measure. Face validity is secured by a panel of experts who judge the appearance, relevance and representativeness. Several

experts from Linguistics department and School of Arts and Social Sciences interrogated several aspects of this study before the research was undertaken to ensure face validity. The researcher evaluated the data elicitation techniques to establish the credibility, relevance, representativeness, accuracy and feasibility.

The researcher also measured construct validity. Construct validity refers to the degree to which a test measures what it claims, or purports to be measuring (Brown, 1996). This looks at the appropriateness of inferences made on the basis of observations or measurements. The area of study was consonant harmony and the researcher only focused on words that displayed consonant harmony.

3.9 Ethical Considerations

The researcher got clearance to conduct research from School of Graduate Studies, Maseno University. The research proposal went through Maseno University, Department of Linguistics Postgraduate committee and School of Arts Postgraduate commitee who assessed its acceptability, practicability and suitability in terms of the research methodolody. The data collection procedures did not involve direct contact with human subjects since researcher did not use questionnaires and direct interviews which would have required that the researcher to get informed consent and observe privacy, confidentiality and anonymity of the respondents.The data collected from electronic and print media was used only in relation to the objectives of the study. The print sources used were Tucker (1994) and Weere (2007) were acknowledged and referenced to avoid the risk of plagiarism.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter focuses on the data presentation, analysis and discussion of findings. This is a study of the nature of Dholuo consonant harmony. The research findings, analysis and discussions are presented objective by objective**.** The objectives of the study are as follows; firstly, to establish the phonetic or phonological properties that define consonant harmony in Dholuo, secondly, to explain the nature of correspondence in Dholuo consonant harmony, and thirdly, to determine the directionality of assimilation of Dholuo consonant harmony.

4.2 Phonetic and Phonological Properties that Define Dholuo Consonant Harmony

Consonant harmony is classified according to the harmonizing property. These properties include the articulatory features such as manner and place of articulation and state of glottis. Consonant harmony systems are classified in terms of the types of segments involved and the phonetic or phonological property defining the harmony. Literature reveals that one and the same language may often exhibit more than one type of consonant harmony (Hansson, 2001). These are listed separately as they may involve different harmonizing properties.

4.3 Dholuo Consonant Harmony

As defined in Chapter 1, Consonant harmony is a phonological phenomenon that requires that sounds within particular words match in terms of their phonetic or phonological properties. It also refers to a kind of assimilation, in which a segment affects another distant segment with similar features (Lee, 2009). Consonant harmony targets a range of

segments such dorsals, liquids and coronals, as well as segments differentiated by nasal and laryngeal features (Rose, 2012).

4.3.1 Coronal Harmony

Coronal harmony is attested in Dholuo based on research findings and this classification is based on the harmonizing property. According to Chomsky and Halle (1968) coronal sounds are produced with the blade of the tongue raised from its neutral position. Katamba (1989) describes coronals as sounds produced by the blade of the tongue raised towards the upper teeth, the alveolar ridge or the hard palate. In Dholuo, coronal harmony manifests in the co-occurrence restriction between the alveolars and the dentals whereby some alveolar sounds are constrained from co-occurring with dental sounds in a word. The alveolar sounds in Dholuo are / t, d, s, l, r, n, nd/ while the dental sounds are /θ, ð and nð/. In the subsequent sections, coronal harmony data is presented.

4.3.1.1 Dental to Dental Combinations

A dental consonant is articulated with the tongue against the upper teeth. The upper teeth acts as the passive articulator while the tip of the tongue as the active articulator, however, with interdentals, the airflow is restricted (impeded) when the tongue-tip is caught between the teeth (Ladefoged, 1975 and Katamba, 1989).

Dental sounds in Dholuo are /θ/ and /ð/ where the former is voiceless and the latter is voiced. Data set 1, 2 and 3 provide an illustration of coronal harmony amongst the dental sounds.

Data set 1

[θ-θ] Voiceless Dental Fricative Combination

Word	**Orthography**	**Gloss**
i) / **θ**ɔ̂:**θ**/	thoth	'many/much'
ii) /ɔ**θ**î:**θ**/	othith	'reed'
iii) /**θ**ié**θ**/	thieth	'treatment'
iv) /**θ**ô:**θ**/	thûth	'weevil:'

Key: all sounds in bold hereafter exemplify the phenomena in question

Data set 1 above illustrates the co-occurrence of the voiceless dental fricative across an intervening vowel. The voiceless dental fricative can occur in both initial and final position. The consonantal phonemes in data set 1 correspond in terms of manner, place of articulation and voice specification. This is what is referred to as consonant harmony. The data exhibits correspondence between consonantal phonemes spanning over an intervening vowel. The agreement patterns seem to emanate from the root forms since there are no affixes added to lead to these correspondences. Dholuo data provided fits the description of consonant harmony by Rose and Walker (2004) as the requirement that two or more consonants in a word separated by at least a vowel match for a certain phonological feature. With respect to data set 1 the consonants are identical in every aspect. The idea of separation by at least a vowel raises the issues of locality and adjacency which are discussed in objective 2 of this thesis.

Rose and Walker (2004) posit that in order to have consonant harmony, a language must have both highly ranked surface correspondence constraints and highly ranked IDENT-CC constraints that require surface segments in correspondence with one another to share

identical specifications for some feature. Rose and Walker propose [CORR-T↔T], a surface correspondence constraint that establishes a correspondence relation to be present between surface segments that are identical in every aspect. This constraint must be highly ranked to produce output as seen in the data set 1.

In an OT analysis, focus would be paid on features that distinguish dentals and alveolars. It should be noted that cavity feature distributed [dist] is distinctive between alveolars and dentals. According to Katamba (1989) distributed sounds are made with an obstruction extending over a considerable area along the middle-line of the oral , as a result there is a large area of contact between the articulators; while in non-distributed sounds there is a smaller area of contact. Dental consonants are distributed [+dist], while alveolars are non-distributed [-dist]. Surface correspondence constraints as proposed by Rose and Walker (2004) were posited together with the other faithfulness constraints in an OT analysis as follows:

(1) ID-CC [dist] adapted from Mackenzie (2005)

Surface segments in correspondence with one another agree for the feature distributed (dentals are [+dist] while alveolars [-dist]. One violation is noted for each segment with a different specification of [dist]. This ensures that coronal harmony and more specifically dental harmony are manifested. This constraint must be highly ranked if at all harmony is to be achieved.

(2) CORR [T↔T]

Surface segments be identical in all aspects (ensures that the dental-dental contrast is established). In this case correspondence should be established

between [θ↔θ].

(3) ID-CC [VOI]

The identity of voice specification should be maintained. One violation is incurred for each segment that differs in voicing between the input and output.

(4) ID-IO [+dist]

Input and Output correspond for feature [+ dist]. This demands that dental segments in the input are realized as dental segments in the output.

In OT terms, this can be illustrated using the input /θɔ̂:θ/ and based on this input, GEN the generator supplies the candidate forms as seen in a, b, c and d. which are then evaluated by a set of constraints. The constraint set is presented in a descending hierarchy as follows:

ID-CC[dist]>> CORR θ↔θ >>ID-CC[VOI]>>ID-IO[+dist].

Table 11: Input /θɔ̂:θ/ 'many/much'

θɔ̂: θ	ID-CC[dist]	CORR [θ↔θ]	ID-CC[VOI]	ID-IO[+dist]
a. [θɔ̂:t]	*!	*		*!
b. [θɔ̂:ð]		*	*	
☞**c**. [θɔ̂:θ]				
d. [ðɔ̂:ð]		*	*	

In the Table 11, (a) fails because it violates ID-CC [dist] which constrains dentals from occurring with alveolars in the output. Dholuo restricts this occurrence especially where there are contrastive dental or alveolars. A fail in this highly ranked constraint results into a fatal violation because a form like (a) cannot be termed as harmonic since it also violates surface correspondence in the feature [+dist]. This candidate has no chance of

winning even if it is faithful to lower ranked constraint which in this context is ID-CC [VOI] which requires agreement in the voice specification between the segments. Candidate (a) has three violations, two of which are fatal. Candidate (b) is faithful to the dental feature [+dist], however, fails to satisfy surface correspondence constraints between the input and the output in terms of place of articulation and voicing (CORR θ↔θ) and ID-CC [VOI], (c) [θɔ̂ːθ] is the optimal candidate as it incurs no violations in input-output correspondence in terms of voice specification and the property [+dist].

This supports assertions by Rose and Walker (2004) that harmony results when highly ranked faithfulness constraints are satisfied especially those that demand surface segment should be in correspondence relations with each other. Candidate (d) incurs violations on the constraint that demands input-output correspondence in terms of voicing, so it is outranked by (c) in that front. In OT terms, the candidate with the least violation wins based on the principle of minimal violation as proposed by Prince and Smolensky (1993). The winner must be the best candidate available and this is according to how the candidates fare against each other. GEN can supply an infinite number of candidate forms but EVAL will select the best based on the constraint set. In this case [**θɔ̂ːθ**] is the best out of the candidate set being a faithful candidate since it does not violate surface correspondence constraints that demand that the output and input match in the feature distributed, it is faithful to the input in terms of voice specification.

Candidate (d) [ðɔ̂ːð] fails in the faithfulness constraint that demands input-output correspondence in voice specification. This violation is not considered fatal since there is data from Dholuo that attests to the co-occurrence between voiced dental fricatives. This is illustrated by data set 2.

Data set 2

[ð-ð] Voiced Dental Fricative Combination

Word	**Orthography**	**Gloss**
a) /**ðɔ̀**:**ðɔ̀**/	dhodho	‘ suckle’
b) /**ðé**:**ðé**/	dhedhe	‘kind of a bird’
c) /**ðè**:**ðò**/	dhedho	‘make a bonfire’
d) /ɔ**ðà**:**ðò**/	odhadho	‘mudfish’

The data set 2 illustrates the co-occurrence of voiced dental fricatives /ð-ð/. The data presented here are root forms which have not undergone any morphological change that could be motivated by grammatical processes. The surface correspondence CORR-T↔T (Rose and Walker, 2004), applies here too, however, it constrains output to only the voiced dental segments thus [ð↔ð], surface segments in correspondence relations must be voiced dentals. In a tableau analysis, ID-CC constraints are applied as in (4) which are faithfulness constraints.

Table 12: Input [ðɔ̀:ðɔ̀] ‘to suckle’

/ðɔ̀:ðɔ̀/	ID-CC[dist]	CORR-[ð↔ð]	ID-CC[voi]	ID-IO[+dist]
a. ðɔ̀:dɔ̀	*!	*!		*!
☞b. ðɔ̀:ðɔ̀				
c. ðɔ̀:θɔ̀		*	*	
d. θɔ̀:θɔ̀		*	*	

In table 12 (a) incurs many violations the worst of them being ID-CC [dist] that requires segments to agree with one another for the feature distributed and in this case, both must be [+dist] but /d/ is [-dist] creating a disharmonic form. Candidate (b) is the winner as it satisfies ID-CC[dist] that demand that surface segments agree on the feature distributed

[+dist] which calls for dental segments only and surface correspondence constraints on voice specification (ID-CC[voi]). Candidate (c) and (d) though faithful to the feature distributed [+dist] lose out due to failure to correspond to the input-output voice specification and the surface voice specification demands.

According to Rose and Walker (2004), surface correspondence constraints CORR-T↔T that demands surface structures should be identical, must be the highly ranked faithfulness constraint if harmony is to be achieved. These constraints ensure that all consonants are in total correspondence in terms of place, manner and voicing creating total or complete harmony. The occurrences in data sets 1 and 2 are supported by constraints that demand for complete identity between the consonants in a word. MacEachern (1997) asserts that consonants should be identical in all respects for harmony to be attested.

This concurs with the proposition by Rose and Walker (2004) about surface correspondence. MacEachern (1997) proposes a constraint referred to as BEIDENTICAL that explicitly demands total identity between consonants. Dholuo data sets 1 and 2 attest to this fact. He posits that Complete Identity Effects (CIEs) arise when multiple different IDENT-CC constraints work together so that disagreement on any feature leads to dissimilation.

These assertions can be true if the researcher limits the findings to data sets 1 and 2, however, Dholuo data reveals that dentals can interact within a word but may not necessarily be identical in every sense and still lead to harmony. Data set 3 reveals the co occurrence between voiced and voiceless dental segments.

Data set 3

[θ-ð] and [ðɔ̂:θ] co occurrence of voiced and voiceless dental fricative

Word	**Orthorgraphy**	**Gloss**
a) /**θ**è:**ð**ò/	thedho	'forge iron'
b) / **θ**ì è**ð**ɔ̄/	thiedho	'to treat'
c) /**ð**ɔ̀:**θ**/	dhoth	'suckling'
d) /**ð**ù:**θ**/	dhuth	'causing conjunctivitis'

Data set 3 illustrates the co-occurrence of the voiced and voiceless dental fricatives in both initial and final positions in a word. These two sounds are contrastive in that /θ/ is voiceless while /ð/ is voiced. The phonology of the language permits this occurrence. Therefore, the surface segments need not correspond in all features and but at least some. Rose and Walker (2004) support this argument and posit that coronal harmony is as a result of identity in some respects and not necessarily complete identity. Here surface correspondence constraints that demand complete identity are ranked least. Rose and Walker (2004) propose another surface correspondence constraint:

(5) CORR [T↔D]

This constraint demands correspondence between segments that have same manner and place but differ in voicing (adapted from Rose and Walker, 2004).

Table 13: Input [θè:ðò] 'to forge iron'

[θè:ðò]	ID-CC[dist]	ID-IO[+dist]	ID-CC[voi]	CORR-[T↔D]	CORR-C↔C
a. θè:dò	*!	*!		*!	*
b. ðè:ðò			*	*	
c. ☞θè:ðò					*
d. θè:θò		*	*	*	

Candidate (a) violates most constraints, therefore a fatal candidate based on principle of minimal violation. It violates co-occurrence constraint ID-CC[dist] which in this context must be highly righly ranked if dental harmony is to occur, it further violates the surface correspondence constraints on the feature distributed which demands that surface segments should agree on the feature distributed. Candidate (b) is unfaithful to input-output correspondence in voice specification and surface correspondence demands on contrast on voice specification while in (c) the demand on complete identity is violated though it is not highly ranked since surface forms from Dholuo data reveal that voice contrasts between dentals within a word have been attested. Candidate (c) is thus the winner since it is faithful to ID-CC constraints which require dentals in the input to be realized as dentals in the output. For harmony to be achieved, ID-CC [dist] must not be violated. Candidate (d) loses out on input-output correspondence in voice specification.

Based on the data presented, it can be concluded that as long as the demands of place of articulation constraints are met, the phonology of the language permits disagreement in voice specification between the surface forms. CORR [T↔D] is less stringent than CORR [T↔T] since it does not demand total identity of the segments. With CORR [T↔T] even morphophonemic alternants of a word would be considered disharmonic, for instance thieth /θièθ/ 'treatment' alternates to thiedh /θieð/ 'treat'.

The alternant cannot be optimal due to the failure to meet total identity demands. The researcher also noted that amongst the Dholuo speakers of B-U dialect the word *thieth* /θièθ/ 'treatment' is articulated as *chieth* /cièθ/. The words /cièθ/ vs. / θièθ/ both mean'treatment'. This gives a contrast of [c- θ] rather than [θ-θ]. The dialectal variant

causes dissimilation because a palatal contrasts with a dental. Dissimilation is a phonological process whereby sounds which are similar and therefore difficult to articulate are made more auditorily distinct or perceptible. This dissimilation causes disharmony as the two consonants no longer match in the phonological properties. The phonemes /c/ a palatal stop and /θ/ dental fricative have both been used in the same context (word-initial) to bring the same meaning. Let [θìèθ] 'treatment' be the input as illustrate in Table 14.

Constraint hierarchy: ID-CC[dist]>> CORR- [θ↔θ]>>ID-IO[dist]>>ID-CC[voi]

Table 14: Input [θìèθ] 'treatment'

θìèθ	ID-CC[dist]	CORR- [θ↔θ]	ID-IO[dist]	ID-CC[voi]
a. ☞ θìèθ				
b. cìèθ	*	*!	*!	

In Table 14, (a) reveals a harmonic output since the initial and final consonant correspond in terms of place of articulation /θ↔θ/. It is an optimal output since it does not violate highly ranked surface correspondence constraints. Data in (b) reveals a disharmonic output where a palatal contrasts with a dental /c↔θ/. It violates the faithfulness constraint that demands input-output correspondence in terms of the feature distributed. It violates all the surface correspondence constraints except ID-CC [voi] that demands input-output correspondence in terms of voice specification. The shaded box shows that the constraint that demands input-output correspondence is irrelevant in the ranking since it's a low ranked faithfulness constraint. Coronal harmony can occur even when the consonants do not correspond in the voice specification as long as they correspond on place of articulation. The phonemes /c/ and /θ/ are in free variation in this context since the use of

either of them does not result into a change in meaning. This free variation is attested only in B-U dialect. In a different context, /c/ and /θ/ are distinct phonemes (resulting into a difference in meaning), as can be seen in the minimal pairs /cô:θ/ 'completely' and /θô:θ/ 'weevils'. The dissimilation attested in BU could have been due to divergence. The disharmony in /ciêθ/ 'treatment' makes the initial and final consonants auditorily distinct as separate phonemes /c/ and /θ/. Shaw (1991) defines consonant harmony as action-at-a distance which entails assimilation and dissimilation processes. In this context, dissimilation does the converse in that it creates disharmony as the consonants no longer match in terms of place of articulation.

The manifestation in B-U dialect could also be a case of different ranking of constraints. In this context, B-U dialect gives dissimilation priority over assimilation. If these constraints are ranked differently probably a different winner is obtained, for instance, the constraints that demand same identity in voice specification are given priority over those that demand identity in place of articulation.

Constraint set includes the following:

(6) AGREE [voi]

This constraint demands that consonants agree in voice specification.

(7) ID-CC [voi]

The identity of voice specification needs to be maintained between the consonants. One violation is incurred for each segment that differs in voicing.

(8) CORR [c↔θ]

A correspondence relation is to be established between segments with differing place and manner of articulation but same voicing.

(10) ID-IO [place]

The input and output should correspond in terms of place.

Table 15: Input [θiêθ] using a Different Set of Constraints

θiêθ	CORR[c↔**θ]**	ID-CC[voi]	AGREE [voi]	ID-IO[place]
a. **θ**iê**θ**	*!			
b. ☞ **c**iê**θ**				*

When priority is given to voice specification and correspondence is established between segments which contrast in manner and place, then the result is the output [ciêθ]. The candidate with differing manner and place of articulation wins since requirement is on same voicing but different places. In BU dialect of Dholuo, in the manifestation of the word [ciêθ] dissimilation is prioritized over assimilation. CORR [c↔θ] is a constraint establishes a correspondence where manner and place differ but voicing is the same and in this case it is highly ranked.

Data set 4: Alveolar Combinations

Word	**Orthography**	**Gloss**
(a) /**t**ò:**t**ò/	tutu	‘pus’
(b) /**t**è:**tn**ì/	tet-ni	‘shivering’
(c) /**t**è:**d**ò/	tedo	‘to cook’

(d) /**d**ò**d**ò/	dodo	‘kind of music’
(e) /**d**ò:**d**ò/	dudo	‘to spin’
(f) / **d**é:**d**é/	dede	‘locust’
(g) /**d**ù**t**ō/	duto	‘all’

In data set 4 (a) and b) illustrate /t-t/ co-occurrence, while (c) illustrates /t-d/, then (d), (e) and (f) illustrate /d-d/ and (g) illustrates /d-t/. This can be summed up as: /d-t/, /t-t/, /t-d/, and /d-d/ contrasts which are all allowed in Dholuo in both initial and final positions.

This manifestation in Dholuo is significant. In some Bantu languages, there is a phonological rule that requires that a stem initial consonant to disagree in voicing with a stem final one. Therefore the expectation is that if the initial consonant is voiced the next consonant should be voiceless. This rule is referred to as Dahl’s law (Katamba, 1989 and Lee (1988). According to Katamba (1989), Dahl’s law states that ‘a voiced stem initial segment requires a voiceless consonant in the prefix and a voiceless stem-initial segment requires a voiced consonant in the prefix’ (p.95). In OT terms, this dissimilation rule is not active in Dholuo since disagreement in voice specification constraint is not highly ranked in the language as consonants are not required to disagree in voice.

The data sets 1,2 and 3 reveal that dentals co occur with dentals while data set 4 shows alveolars co occur with alveolars. For instance, /t-d/ and /θ-ð/ contrast but not */t- ð/ or */θ-d/ in words like, /te:do/ and /θe:ðo/ but not */θe:do/ or */te:ðo/ respectively. Occurrence patterns of Dholuo words /te:do/ ‘to cook’ and /θe:ðo/ ‘to forge’ emanate from the root form of the word. This occurrence pattern is not a result of a phonological or morphological process; it is a root-internal occurrence. It is the deep structure

manifestation and not a derived form that could be based on some phonological process.

(11) A summary of co-occurrences patterns between alveolars and dentals

a. d-t t-t t-d d-d

b. ð-θ θ-θ θ-ð ð-ð

c. *d-θ *t-θ *t-θ *d-ð

d. *ð-t *θ-t *θ-d *ð-d

From the summary (a) and (b) are allowed combinations while (c) and (d) are disallowed if consonant harmony is to manifest. However, there are some compound words in the language which permit certain disallowed combinations. This has been attested in the language and the forms follow morphophonemic patterns in the language (Appendix B, extract 9). The extract demonstrates the morphophonemic alternations of the compound word *dhoot 'doors/clans'*.

Data set 5: Alveolar and dental combinations

Word	Orthography	Gloss
(a) /**ð**ɔ̀:ó**d**ì/	dhoudi	'clans/doors'
(b) /**ð**ɔ̀:**t**/	dhoot	'clan/door'
(c) /**ð**ɔ̀:**d**/	dhood	'clan/door' poss.sg
(d) /**ð**ɔ̀:ó**t**/	dhout	'clans/doors' poss.pl
(e)/ /**ð**ɔ̀:ó**d**ìgo/	dhoudigo	'those clans/doors' dem.pl

Data from Dholuo reveal different morphophonemic alternations of *dho-ot* /ðɔ́:ɔt/ 'clans' a compound word in Dholuo. Here there is no consonant harmony since they differ in place of articulation. These combinations */ð-t/ and */ð-d/ violate the co-occurrence

restrictions between the dental and alveolars. This could be explained by the fact that the words are formed from two different words in (a) dhoot which is derived from dhog ot ‘ house’s mouth’ literally which means ‘ a door’ as a compound noun while (b) is the plural form dhog udi ‘houses’ mouths’ which means ‘doors’. In the compound word, when /g/which is the final consonant in the first compound is elided then the vowel /ɔ/ is lengthened to compensate for the loss of the consonant /g/ and vowel / ɔ/, /ðɔ: **g-ɔt**/ becomes /ðɔ:t/. .

4.3.1.2. Contrastive Patterns of Alveolars and Dentals

Dentals co-occur with dentals while alveolars with alveolars, however, in the nasals and liquids series there are alveolars /l, r, n/ and yet no dentals */l̪, r̪, n̪/ to contrast with. The idea of contrast is important in consonant harmony because the participating segements are selected based on how they contrast in the system. This assertion is based on Mackenzie (2005) contrast based hierarchy who asserts that the contrasts in the inventory determine the participating segments. Table 15 shows the contrastive patterns between the dental and alveolars.

Table 16: Contrastive Patterns of Alveolars and Dentals in Dholuo

	Dentals	Alveolar
voiceless	θ	t
Voiced	ð	d
Prenasal stop	^{n}ð	^{n}d
Nasal		n
Liquids		r, l

From the inventory in Table 16, it should be noted that amongst the nasal and liquids

there are only alveolars but no dentals to contrast with. Cases of alveolar nasal and alveolar liquids co-occurring with the dentals were attested in this study.

Data Set 6:

	Word	**Orthography**	**Gloss**
a)	/**θ**ò:**n**ɔ̀/	thuno	'breast'
b)	/**ð**á:**n**ɔ́/	dhano	'human being'
c)	/**θ**ù:**ð-n**ò/	thudhno	'numbness'
d)	/**l**ò :**θ-n**ì/	lothni	'to be loose'
e)	/**l**ò:**ð-n**ì/	ludhni	'to be in want'

The data reveals that the nasals and liquids are non-participants in the consonant harmony process since the alveolar nasal freely co-occurs with the dentals. In (a) /**θ**ó:**n**ɔ̀/ in the sequence [**θ-n],** the initial dental consonant does not spread the dental features to the nasal which remains redundantly alveolar, this is also the case in (b). In (c) /**θ**ù:**ð-n**ò/ in the sequence [**θ-ð-n**], the first and second dentals sounds do not spread the dental feature nor influence the phonological shape of the following consonant to be a dental nasal. In (d) and (e) /**l**ò:**θ-nì**/ and /**l**ò:**ð-n**ì/, respectively, the medial dental consonants [θ] and [ð] remained uninfluenced by the alveolar lateral /l/ at the beginning and the alveolar nasal at the end. The following sequences are attested based on data set 6 on dental and alveolar combination.

(12) A summary of dental and alveolar combinations

a) [θ-n] dental - alveolar

b) [ð-n] dental –alveolar

c) [θ-ð-n] dental-dental-alveolar

d) [l-θ-n] alveolar-dental-alveolar

e) [l-ð-n] alveolar- dental-alveolar

The nasal [n] freely co-occurs with both dentals and alveolars without incurring any violation of the co occurrence restrictions. Dental nasals are not realised in Dholuo even in morphologically complex forms where an alveolar nasal appears close to a dental sound as in examples (d) and (e). The contrastive alveolar consonants [t d] will trigger harmony unlike the redundantly alveolar sonorants like [n], [l] and [r]. The notion of contrast as proposed by Mackenzie (2005) applies only if there is a contrastive sound in the inventory.

The absence of a dental nasal in Dholuo inventory blocks the propagation of co-occurrence restriction between the denatls and alveolars. An alveolar nasal therefore co-occurs with dentals as seen in data set 6. Literature on Bumo Izon an Ijoid language revealed that the voiced velar and labio velar stops do not participate because they lack a partner at the same place of articulation that differs in terms of pulmonic /implosive distinction (Mackenzie, 2005). Consonant harmony therefore depends on the phonemic inventory of a language. Anywa may be a Western Nilotic language just like Dholuo but its system of contrasts differs in that a dental nasal allophone is created to contrast with alveolar nasal. In Anywa contrast is a factor and phonological processes such as assimilation are language specific. A phenomenon may obtain in one language but may be unattested in another. The two languages are related in a diachronic perspective but their phonemes pattern differently.

In Anywa, a Western Nilotic language, [n] may not occur with a dental stop , rather a dental nasal [n̪] appears allophonically in roots that contain the dental stops (Reh,1996).

(13) Dental vs. alveolar contrasts from Anywa (Reh, 1996)

a) n̪uḏo	'to lick'	c) nuudo	'to press something down'
b) t̪uḏ	'ropes'	d) tuud	'pus'
e) oḏoon̪	'mud'		

The subscript [̪] is used for dentalized sounds and in the case of Anywa and Päri , the symbol is used with dental stops [t̪, ḏ , n̪] in contrast with alveolar stops [t, d, & n].

(14) Dental / alveolar contrast in Päri (Andersen, 1988)

a.	t̪ʊɔn̪	'male'
b.	n̪ɔt̪	'sucking'
c.	ḏa:n̪-ɛ	'person,ergative'

The data from Anywa and Päri show that the nasal is not barred from participating in the dental /alveolar harmony like in the case of Dholuo, instead an allophone, the dental nasal [n̪] is realized. The dental nasal therefore contrasts with the alveolar nasal. Contrast is therefore an important factor in selecting participants in consonant harmony as proposed by Mackenzie (2005). The notion of contrasts applies to a great extent in Anywa and Päri but not in Dholuo. Dholuo does not have a dental nasal counterpart to contrast the alveolar, however, it does not create an allophone therefore allowing 'disharmonic' forms when the alveolar nasal becomes neutral thereby blocking the propagation of harmony property. The absence dental nasal in Anywa is an accidental gap, that means it is required by the system of contrasts in the language while the lack of a dental nasal in

Dholuo is a systematic gap and structure preservation will rule out the creation of a [+ distributed] dental nasal (Mackenzie, 2005). Dholuo does not initiate changes in the root. The forms presented emanate from the structural description (deep structure). There is no phonological rule in Dholuo that can convert an input [n] to output [n̪] in the context of data set 6. In OT terms, the alveolar – dental nasal occurrence can be analysed as follows:

Constraint set: *n̪>> ID-CC [dist]>> ID-IO [+dist]>> ID-IO [-dist]>> CORR -[θ/ð-n]

Table 17: Input /ðá:nɔ̀/ 'person/ human being'

[**ð**á:**n**ɔ̀]	*n̪	ID-CC[dist]	ID-IO [+dist]	ID-IO[-dist]	CORR[θ/ð-n]
a. /**ð**á:**n̪**ɔ̀/	*!			*!	
b./**d**á:**n**ɔ̀/			*!		
☞ c. /**ð**á:**n**ɔ̀/		*!			*

In table 17, candidate (a) has dental consonants while candidate (b) has alveolar consonants and so no violation is incurred for the ID-CC[dist] constraint which demands that surface segments in correspondence with another agree for feature distributed which must be undominated if at all coronal harmony is to be achieved. Candidate (a) loses out as it violates [* n̪] which prohibits dental nasals; this is a markedness constraint that ensures structural well-formedness of the output. Candidate (c) is faithful to the input form but fails to satisfy ID-CC [dist] since it has both dental and alveolar consonants, however, it wins having satisfied [* n̪]. It is a disharmonic form but wins having satisfied structural wellformedness constraint. Candidate (a) is harmonic but it predicts a non-existent form in the language [**ð**á:**n̪**ɔ̀]. The interaction of markedness constraint here has ensured that the non-existent form does not become the optimal form.

In a prenasalized dental stop [ⁿð], the nasal is articulated at the dental region thereby creating a dentalised nasal [n̪] in that environment. As a unit phoneme, the two parts of this complex segment cannot be separated in order for one to claim that a dental nasal exists in Dholuo. This cluster since is phonologically conditioned. Data set 7 illustrates the context of occurrence of prenasalized dental stop.

Data set 7:

	Word	**Orthography**	**Gloss**
a)	**n̪ð**à:ðò	ndhadhu	'taste'
b)	**n̪ð**ì:**n̪**ðò	ndhindho	'to feel pins and needles'
c)	ò**n̪ð**ò:ðò	ondhudho	'bone marrow'

A dentalised nasal occurs in a prenasalized cluster [n̪ð], it does not occur outside this environment. This occurrence is due to homorganicity where the nasal assumes the place of articulation of the consonant that follows it; and in this case it is followed by a dental consonant [ð]. It adheres to the homorganic nasal assimilation rule (Katamba, 1989).

According to Rose and Walker (2004), contrast cannot be the determining factor in selecting participating segment rather all the segments that participate should be highly similar as a factor for their participation. The researcher was interested in establishing the phonological property that allows this co-occurrence.

It was important to determine the shared or similar phonetic/ phonological properties that lead to harmony. A distinctive feature matrix for the dentals [θ, ð]) and alveolars [t, d, n] helped in revealing these phonological properties.

Table 18: A Distintive Feature Matrix for Dentals and Alveolars (Adapted from Chomsky and Halle, 1968)

+voice	d	ð	n
-voice	t	θ	
Continuant	-	+	-
Strident	-	-	-
Distr	-	+	-
Labial	-	-	-
Cor	+	+	+
High	-	-	-
Low	-	-	-
Back	-	-	-

The distinctive feature matrix table reveals that the dentals [ð, θ] and alveolars [d, t , n] are coronals. Moreover, they are similar in all the other properties (strident, labial, high, low, back) and what sets them apart is the property continuant and distributed. The alveolars [t, d, n] are [- cont, - dist] to mean they are stops while dentals [ð, θ] are [+ cont, + dist] being that they are fricatives and +distributed. Considering the property continuant the study hypothesizes that /n/ is neutralized being [-cont] co-occurring with [+ cont]. The occurrence of the dentals with the liquids based on the property continuant is not disharmonic. The liquids share the property [+ cont] with the dentals. The alveolar [n] co-occurs with dentals to mean that the co occurrence restriction is not factored. According to Rose and Walker (2004) harmony is the result of surface correspondence constraints which requires output segments to be in correspondence with one another.

4.3.1.3 Root-internal Coronal Harmony

Root-internal coronal harmony refers to harmony processes motivated by changes in the structure of the root. Some root-final alternations in Dholuo lead to coronal harmony. Data from Dholuo reveals that in some words, before the stem undergoes any morphophonemic change, coronal harmony is not realized. These morphophonemic alternations of the root final consonant are motivated by grammatical change for number

and genitive forms.

Data set 8: Root-Final Alternations

Nom.sg		Nom pl.		Gen. sg		Poss.
(a) tìɛ̀lɔ́	'foot'	**t**ie**^{n}d**e	'feet'	**t**ie**^{n}d**	[t..^{n}d]	'foot'
(b) tɔ̀:l	'rope'	**t**ɔ̀:**^{n}d**ɛ̀	'ropes'	tɔ:**^{n}**d	[t..^{n}d]	'rope'
(c) dwɔ̀:l	'voice'	**d**wɔ̀:**^{n}d**ɛ̀	'voices'	dwɔ̂ :^{n}d	[d...^{n}d]	'voice'

The root final consonant which is the alveolar lateral /l/ changes to a prenasalized alveolar stop [^{n}d] to match with initial alveolar stops /t/ and /d/. The shared features for the consonants are [- continuant, - distributed] while /l /is [+ continuant, - distributed]. The harmonizing phonological property is the feature [-continuant] which is the distinctive property for stops. This concurs with Okombo (1982) who observes that the root final stops are a result of morphophonemic alternations in the grammar of Dholuo. Okombo (1982) was not able to explain the change /l/ to [^{n}d] using NGP. He calls the change phonetically implausible.

However, it can be argued in phonetic terms that the stop feature of the root initial consonant is matched with or spread to the root-final whereby the harmonizing feature here is [-cont]. Most Western Nilotic languages make use of the root-final alternations in their inflectional and derivational morphology (Andersen 1988, 1999; Tucker 1994; Reh 1996; Okombo, 1982). The root final stops are a product of final mutation and when combined with affixation, they match the dental or alveolar property of the initial stop. Some of these morphophonemic alternations are an attempt by the phonology of Dholuo to harmonize consonants within a word. The consonants become more similar in their

phonological properties and in this case both initial and final consonants are stops due to the alternations.

4.3.2.0. Dorsal Consonant Harmony

Dorsal consonant harmony refers to assimilatory interactions involving dorsal consonants. Dorsal consonants (+ dorsal) are produced with the body of the tongue, for example, palatals and velars. The palatals are produced with the body of the tongue touching the hard palate (j, ɲ), while velars are produced with the back of the tongue touching the velum or the soft palate (k, g, ŋ). In Dholuo, consonant agreement patterns between palatal nasal (ɲ) and velar nasal (ŋ) can be attested. This can be exemplified by the data below:

Data Set 9: Palatal- Velar ɲ-ŋ (ny-ng') Co-occurence

a) **ɲì:ŋg**	nying	'name'
b) **ɲà:ŋ**	nyang'	'crocodile'
c) **ɲɔ̀:ŋɔ̀**	nyong'o	'knead/squeeze to soften'
d) **ɲɔ̀:ŋɔ́ŋ**	nyong'ong'	'eye glasses'

The data set 9 exemplifies the occurrence of /ɲ/ with /ŋ/, the palatal nasal at the root initial position and velar nasal at the root final position and it spans over an intervening vowel. The occurrence of palatal nasal and velar nasal in root-initial and final positions is not constrained as exemplified in Data set 9 and Data set 10.

Data Set 10: **Velar- Palatal [ŋ-ɲ] (ng'-ny)**

a) **ŋè:ɲ**	ng'eny	'plenty'
b) **ŋà:ɲɔ̀**	ng'anyo	'to strike'
c) **ŋì:ɲɔ̀**	ng'inyo	'to shred'

In data set 10, the velar nasal occurs at the initial position and the palatal nasal at the root final position. This means that both velar and palatal nasals can occur at initial and final positions; the palatal–velar and velar–palatal sequences are attested in Dholuo. This results to dorsal harmony since the two consonants share the feature dorsal [+ dor]. The palatal nasal and velar nasal are distinct phonemes in Dholuo. In the occurrences in data sets 9 and 10 a correspondence relation is established between segments with same voicing and manner of articulation but with differing place of articulation. In Truku Seediq, dorsal consonant harmony involves the voiceless velar stop /k/ and the voiceless uvular /q/. The underlying voiceless velar stop /k/ is realized as a voiceless uvular stop /q/, whenever there is a uvular /q/ in the stem (Lee, 2009). This is derived in morphophonemic contexts.

According to Hansson (2001), dorsal consonant harmony in Misantla Totonac, the heteromorphemic sequences /k…q/ are harmonized to /q…q/. Dorsal consonant harmony in Truku Seediq and Misantla Totonac involves a co-occurrence restriction between the voiceless velar stop and voiceless uvular stop while in Dholuo it involves velar nasal and palatal nasal consonantal agreement. Dorsal consonant harmony in Dholuo operates quite differently. The featural specifications of velar nasal and palatal nasal are as seen in Table 19.

Table 19: A Distinctive Feature Matrix for Velar Nasal and Palatal Nasal

+ Voi	**[ŋ]**	**[ɲ]**
Consonantal	+	+
Son	+	+
Continuant	-	-
Nasal	+	+
Labial	-	-
Dorsal	+	+
High	+	+
Low	-	-
Back	+	-

Adapted from Chomsky and Halle's 1968 distinctive feature matrix for nasals

The featural specifications in Table 19 indicate that velar nasal and palatal nasal are similar in the features consonantal, sonorant, nasal, dorsal and high but differ in the tongue body feature back. Back sounds are produced with the body of the tongue retracted from neutral position while non-back are produced with the back of the tongue either in a neutral position or pushed forward (Katamba, 1989). Velars are back [+back] while palatals are non-back [-back]. If consonant harmony is to occur, a correspondence must be established between segments that a similar. Surface correspondence constraint CORR-[ŋ-ɲ] would be posited for an OT analysis as it establishes a correspondence between segments with differing place but similar manner of articulation and same voice specification.

According to Rose and Walker (2004), a correspondence relation can be established between segments with the same voicing regardless of place of articulation, although this was with reference to oral stops. In the following analysis a correspondence will be established between nasals with differing place of articulation. The constraint set below is used in an OT analysis of the dorsals:

(15) CORR- [ŋ-ɲ]

This constraint establishes a correspondence between segments with differing place but similar manner of articulation and same voice specification.

(16) IDENT [VOI]

The identity of voice specification between input and output should be maintained.

(17) ID-CC [BACK]

Surface segments in correspondence with one another agree for the feature back. This ensures that in the output forms there are only velar-velar [ŋ-ŋ] sequences or palatal-palatal [ɲ-ɲ] sequences.

(18) ID-IO [BACK]

Place feature in the input must be the same as the one in the output. This ensures that the velar/ palatal in the input, corresponds with the one in the output.

(19) IDENT [nas]

This constraint demands that the nasal segment in the input is the same as the nasal in the output.

Constraint hierarchy is as follows:

CORR-[ŋ-ɲ]>>ID-CC [BACK]>>ID-IO [BACK]>>IDENT [nas]>> IDENT [VOI]

Table 20: Input /ŋè:ɲ/ ng'eny "plenty/many"

ŋè:ɲ	CORR-[ŋ-ɲ]	ID-CC[BACK]	ID-IO [BACK]	IDENT[nas]	IDENT [VOI]
a.**ŋè: ŋ**	***!**		*****	*****	
☞b.**ŋè:ɲ**		*****			
c. **ɲè:ɲ**	***!**		*****	*****	

In table 20, candidate (a) and (c) violate a highly ranked constraint that establishes correspondence between nasals with differing place of articulation which is considered a fatal violation. Candidate (a) and (c) also violate the IDENT [nas] having a different nasal specification in the output. They fare well in ID-CC [BACK] having same feature back specification in the output where (a) has [+back] as it has velar segments while (c)

has [-back] having palatal segments. IDENT [VOI] is shaded and is deemed irrelevant in the ranking since velar and palatal nasals being sonorants are redundantly voiced and there is no possibility of having voice contrasts for them.

Candidate (b) is the winner as it does not violate the CORR-[ŋ-ɲ] and a correspondence is establish between the velar and palatal segment. In candidate (b) there is input-output correspondence for feature back, voice and nasal and the only violation incurred is on surface correspondence relations between the segments (ID-CC [BACK]). Basing the analysis on one of the OT tenets of minimal violation, candidate (b) wins. Candidate (b) also remains faithful to input- output correspondence and does not violate a highly ranked constraint.

In a critical view of table 20, the fate of the candidates is likely to change when the ranking of constraints is changed. If ID-CC [BACK] that demands same identity of surface segments is ranked above CORR-[ŋ-ɲ] that establishes correspondence relations between segments with differing place, then candidates (a) and (c), which have same identity, will rank above (b) which has different place of articulation. Data from Dholuo reveals that forms that contain velar-velar sequences like candidate (a) and those containing palatal-palatal sequences like (c) are attested. Data sets 11 and 12 exhibit velar to velar and palatal to palatal occurrences, respectively. The consonant segments are in perfect harmony due the high ranking of ID-CC [BACK] that establishes complete identity between the segments.

Data Set 11: Velar to Velar /ŋ..ŋ/ ng'-ng'

a) **ŋ**ó:**ŋ**ó ng'ong'o 'make faces'

b) **ŋ**à:**ŋ** ng'ang' 'argue'

c) **ŋ**è:**ŋ** ng'eng' 'to be in a daze'

d) **ŋ**è:**ŋ** ng'eng' 'plenty' B-U dialect

Data Set 12: Palatal to Palatal Combinations / ɲ..ɲ/ ny-ny

a) **ɲ**â:**ɲ**â nyânyâ 'tomato'

b) **ɲ**i:**ɲ**ɔ̀ nyinyo 'leprosy'

The data set 11 and 12 exemplify velar-velar and palatal- palatal co occurrences, respectively. The root-initial and root-final phonemes are exactly the same which leads perfect dorsal consonant harmony. To establish palatal-to-palatal and velar-to-velar sequences surface correspondence constraint that demand same identity of segments need to be posited. This is illustrated in Table 21.

Table 21: Input /ɲâ:ɲâ /"tomato"

ɲâ:ɲâ	**ID-CC[BACK]**	**CORR-[ɲ- ɲ]**	**ID-IO[-BACK]**	**IDENT[nas]**
☞a.**ɲ**â:**ɲ**â				
b.**ɲ**â: **ŋ**â	*!	*	*	*
c.**ŋ**â: **ŋ**â		*	*	*
d. **ŋ** â:**ɲ**â	*!	*	*	*

In table 21, constraints that demand total identity are too stringent if highly ranked. Any segment that has a difference in phonetic properties cannot win. Rose and Walker (2004) posit that for consonant harmony to occur the surface correspondence constraints imposing similarity on segments must be highly ranked to rule out segments with

different specifications. Candidate (b) loses for having segments with differing [back] features and also being unfaithful to input-output correspondence in terms of back and nasal feature. Candidate (c) is an unfaithful output since it contains velar segments though it fares well with the highly ranked constraint. Candidate (d) just like (b) is unfaithful to input-output correspondence and the segments have different [back] feature specifications. Candidate (a) wins because it does not violate highly ranked ID-CC constraint and is faithful to [-back] and nasal specification.

Candidate (c) is a possible output in the language but it cannot be the optimal form because it violates faithfulness constraints. It should be noted that velar-to-velar sequences are possible as seen in data set 11. However, for a correspondence to be established, identity constraints supporting [+ back] features must be posited. Dorsal co-occurrence is established however, the property back which is distinctive must be lowly ranked if a correspondence relation is to occur. Focus should be on similar features that characterize dorsals, rather than those that distinguish the palatal nasal and velar nasal. Dorsal co-occurrence is motivated from the input of the word. It does not involve a phonological assimilation process. It can be argued as a feature agreement that leads to correspondence relations.

(20) A Summary of Velar Nasal and Palatal Nasal Co-occurrences

a) Velar –palatal /ɲ..ŋ/

b) Velar-velar /ŋ..ŋ/

c) Palatal- palatal /ɲ..ɲ/

d) Palatal- velar /ŋ..ɲ/

The co-occurrences between the palatals and velars reveal a high degree of similiarity. This is further proven by the fact that the two: velar nasal and palatal nasal occur in free variation even though they are distinct phonemes. Free variation is the interchangeable relationship between two phones in which the phones may substitute another sound in the same environment without causing a change in meaning and without being considered incorrect by a native speaker (Roach, 2002). This variation is dialectal in Dholuo and thus depends on the regional dialect of the speaker. This can illustrated as:

Data Set 13: Free Variation of Velar Nasal and Palatal Nasal /ɲ~ŋ/

a)	**ŋ**ê:**ɲ~ŋ**ê:**ŋ**	ngeny (BU &KSN)~ng'eng' (BU)	'many/ plenty'
b)	**ɲ**Íðɔ ~**ŋ**Í:ðɔ	nyidho (BU &KSN)~ ng'idho (KSN-Nyando)	'to drizzle'
c)	**ɲ**â:l~**ŋ**â:l	nyal (KSN)~ng'al (BU & KSN)	'rust'
d)	**ɲ**iso~**ŋ**iso	nyiso (BU)~ ng'iso(KSN)	'to tell'
e)	**ɲ**ɪɛw~**ŋ**ɪɛw	nyiew ~ng'iew (BU& KSN)	'buy' v.t

The two sounds velar nasal and palatal nasals are mutually interchangeable in certain contexts as exemplified. Free variation has often been considered a marginal phenomenon affecting individual or very small sets of words (Mompean, 2008). When phonemes occur as free variants this implies that they occur as allophones of the same phoneme and are no longer distinct phonemes.

In Dholuo, velar nasal and palatal nasal can occur in free variation in certain contexts yet in other contexts they occur as separate phonemes. According to Katamba (1989), the best test for identification of phonemes is to contrast the sounds in an analogous environment or conduct a minimal pair test to help distinguish the two sounds as separate

phonemes. A minimal pair refers to two words which are similar except for a single sound difference (Katamba, 1989). Data set 14 provides minimal pairs for the velar nasal and palatal nasal.

Data set 14: Minimal Pair Tests for Palatal and Velar Nasals.

a) **ŋ**ɔ̀:**ŋ**ɔ̀	ng'ong'o	'to make face/stare/glare'
b) **ɲ**ɔ̀:**ŋ**ɔ̀	nyong'o	' to soften/knead'
c) θì:**ɲ**ɔ̀	thinyo	'squeeze out'v.t
d) θì:**ŋ**ɔ̀	thing'o	'to smell'v.t

In data set 14 (a) and (b) are minimal pairs while (c) and (d) are another set of minimal pairs. Unlike in data Set 13, the phonemes here are contrastive since they lead to a change in meaning.Velar and palatal nasals can manifest as distinct phonemes as shown by the minimal pairs or as free variants. A native speaker knows in data set 13 the words are mutually interchangeable as they have the same meaning and that in data set 14, the words have a different meaning. Whenever a minimal pair can be established, then the two sounds are phonetic manifestations of two different phonemes (Hyman, 1975). Velar and palatal nasal as attested in Dholuo exhibit a high level of similarity to the extent that they can occur as free variants (mutually interchangeable) in some contexts. Segments participating in harmony are highly similar (Rose & Walker, 2004). Velar nasal and palatal nasal almost always co-occur in words. This is what leads to harmonization. These two sounds are highly similar that it can be concluded that they are allophones of the same phoneme in some contexts according to the data on free variation in data set 13.

4.4 Nature of Correspondence

In the analysis of nature of correspondence amongst consonants in consonant harmony, literature argues for spread of phonological features (Goldsmith, 1975 and Halle & Vernaugd, 1981) and agreement of features leading to correspondence (Rose & Walker, 2004). The current study sought to determine nature of correspondence in Dholuo consonant harmony.

Consonant harmony is a phonological phenomenon that requires that sounds within particular words match in terms of their phonetic and phonological properties. Consonant harmony also refers to a kind of assimilation, in which a segment affects another distant segment with similar features (Lee, 2009). The question therefore would be how this happens especially in Dholuo.

4.4.1 Long Distance Assimilation

Long distance assimilation involves action-at-a-distance where assimilation process spans over vowels and/or consonants. Dholuo consonant harmony data reveals that features affected by the harmonizing property are non contiguous. Dholuo consonant harmony is non-local and therefore issues of locality are pertinent in understanding the consonant harmony process.

(21)	a) /**ð**ɔ:**ð**ɔ/	dhodho	‘suckle’
	b) /**d**é:**d**é/	dede	‘grasshopper’
	c) /**t**à:**d**ò/	tado	‘roof’
	d) /**θ**ù**ð**nò/	thudhno	‘numbness’

From the data of coronal harmony, only the targeted elements are assimilated. The

targets are in bold which include (a) dentals (b-c) alveolars (d) dentals only. Data in 20 (d) presents an interesting case since the alveolar nasal violates the co occurrence restriction in the language and occurs with dentals. The alveolar nasal is transparent to harmony and therefore not a participant. It is not amongst the targeted elements. Transparent elements are those segments not similar enough to be affected by the harmonizing property or not similar enough to be target of the assimilation. It patterns in the schema:

(22) Action at a distance i) $C_x V_y C_z > C_z V_y C_z$ consonant harmony

ii) $C_x V_y C_z C_x > C_z V_y C_z C_x$ transparent element

In consonant harmony as depicted in 22(i), only the consonants are targeted by the harmonizing feature, the vowels in between remain audibly unaffected. The coindexation after the change has occurred depicts the affected elements. For example, /**ðɔ**ː**ðɔ**/ *dhodho* which means 'suckle', has the $C_xV_yC_xV_y$, where the vowels which are the intervening segments do not seem to be affected. Schema 22 (ii) shows that some consonants are assimilated by the harmonizing feature yet other consonants remain unaffected which are referred to as transparent elements, for instance, /**θ**ù**ð**nò/ *thudhno* 'numbness' has the schema $C_xV_yC_xC_zV_0$, where the first two consonants are co-indexed because they have similar features. The third consonant which is the alveolar nasal [n] is transparent and therefore remains redundantly alveolar. The fact that the assimilation targets other elements and leaves others out gives rise to the debate on nature of correspondence; could it be a matter of feature matching or spreading? If it is feature matching then only the targeted elements are affected; if feature spreading then all the elements within the spreading domain are affected such that those that remain unassimilated are considered to

be blocked. This is discussed as objective 2 in this thesis.

(23) Continuous harmony $C_xV_yC_z > C_zV_zC_z$ vowel consonant harmony

In continuous harmony, all the elements assimilate to the harmonizing feature including the vowels. Harmony where contiguous elements are affected is referred to as vowel-consonant harmony (Hansson, 2001). It is only in feature spreading that all elements will be affected. This phenomenon is not attested in Dholuo.

4.4.1 Feature Spreading

Feature spreading refers to a process where phonological features are extended beyond individual consonants and vowels and as a result of this phonological process, more than one consonant may be influenced at a time (Goldsmith, 1975). Feature spreading affects all segments except those transparent to harmony. When harmony is analysed as spreading it involves the autosegmental feature spreading (Goldsmith, 1990). Each harmonizing feature occurs on its own tier. A feature connection with a segment is represented using an association line which links the feature to the rootnode.

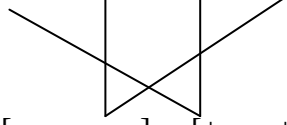
(24) Feature spreading and feature agreement

[te:do] 'to cook'

(a) t e d o Feature Agreement

[+cor,+cons] [+cor,+cons]

(b)*t e d o Feature spreading



[-cor,-cons] [+cor, +cons]

In feature agreement in 24 (a) the segments with similar phonetic features are matched. The target here is coronal consonants and the association lines are straight. The segments that are not in correspondence are non-participants since they are unspecified for the harmonizing feature. In 24 (b) the coronal node spreads its feature skipping the intervening segment which is a vowel. Feature spreading predicts the possibility that harmony may be blocked by intervening segments that cannot undergo spreading. Coronal harmony only targets coronal consonants. If the intervening segments are specified for another feature it may lead to crossing of lines as illustrated. The association lines must not be crossed based on the No Crossing Constraint (NCC), (Goldsmith, 1976, and Coleman and Local, 1989).

The NCC prohibits the spreading over of a feature specified on the same tier. The intervening vowels and consonants are subject to blocking since they are not specified for the features [+cor] and [+cons]. The blocker (opaque segments) prevents harmony since it is not specified for the harmonizing property. In coronal harmony in Dholuo, there is a co occurrence restriction between dentals and alveolars. However, the alveolar nasal does not get affected by the harmonizing property. It remains transparent to harmony when it co-occurs with a dental. Cases of alveolar nasal co-occurring with the dentals have been attested. This is illustrated as follows:

(25) Co occurrence of alveolar nasal with dentals

(a)	/**θó**:**nɔ̀**/	thuno	‘breast’
(b)	/**ð**á:**n**ɔ̀/	dhano	‘human being’
(c)	/**θ**û:**ðn**ō/	thudhno	‘numbness’

The data above shows the alveolar nasal co-occurring with dental consonants, for instance in 25 (c) there are two dental consonants but the dental feature is not extended to the alveolar. The propagation of harmony is blocked and the nasal remains redundantly alveolar. There is no dental nasal allophone created to harmonize with the dentals. This supports the assertion that autosegmental spreading is inadequate as a general model of consonant harmony (Hansson, 2001 & Rose and Walker, 2004). It does not adequately address the transparency of vowels and other consonants.

An Optimality theoretic analysis of feature spreading is modeled under strict locality requirement on the segments. Feature spreading only occurs between the root adjacent segments. Any and all segments falling within the harmony domain are participants (Hansson, 2001). Spreading basically involves the extension of one articulatory gesture and skipping of segments is therefore impossible. Ni Chiosain & Padgett (1997) posit that harmony is driven by alignment constraints such as [ALIGN-L] and [ALIGN-R]. This constraint requires the feature in question to be extended as far as possible toward a particular edge of some morphological or phonological domain. The domain of harmony in Dholuo is within a word. Any segment incompatible with the spreading feature [±F] will block the propagation of harmony.

(26) Data on Dholuo Coronals

a.	/**d**è:**d**è/	dede	‘grasshopper’
b.	/**t**à:**d**ò/	tado	‘roof’
c.	/**θ**ù:**ðn**ò/	thudhno	‘numbness’
d.	/**θ**è:**ð**ò/	thedho	‘forge iron’

The illustrations in (26 a), (b) and (d) are harmonic however in (26 c) the dentals co-occur with the alveolar nasal which remains unaffected with the dental property. The tongue tip gesture is not extended to the entire word, it is blocked by the nasal therefore the harmonizing feature is not fully propagated.

Gafos (1996) suggests the constraint ALIGN (TTCA,Word,L); this constraint is intended to spread an underlying Tongue-Tip Constriction Alignment (TTCA) specification to the left towards the beginning of the word, this is in relation to the discussion on Tahtlan Coronal harmony. If adapted to Dholuo coronal harmony, the researcher suggests the constraint ALIGN (TTCA, Word, R). The alignment is to the right toward the end of the word since directionality is left to right (as discussed in objective 3), whereby the root-initial consonants affect the following consonants. Consider the following constraint set in an OT analysis:

(27) ALIGN R[TTCA]

Align to the right the property responsible for harmony. The harmonizing property is to be extended rightwards.

(28) FAITH [TTCA]

Faithfulness TTCA [NAS] [OBS]. This constraint demands that the nasal and obstruent in the input should correspond to the ones in the output. Obstruents refer to non-sonorants such as plosives, fricatives and affricates, for example in the data [θ], [ð], [t] and [d] are obstruents while [n] and [n̪] are nasals.

Constraint hierarchy: ALIGN R [TTCA]>> FAITH[OBS]>> FAITH[NAS]

Table 22: Input /θû:ðnò/ 'numbness'

[θû:ðnò]	ALIGN R [TTCA]	FAITH[OBS]	FAITH [NAS]
a. θû:dnò	*!	*	
b. tû:ðnò	*!	*	
c. θû:ðnò	*!		
☞d. θû:ðn̪ò			*

From the tableau a, b, c lose due to the constraint that spreads the harmonizing feature ALIGN [TTCA, R] d, wins based on this constraint. The harmonizing property when spread to the right creates a dental nasal [n̪] and the result is a harmonic output [θû:ðn̪ò], however, this violates the faifhfulness constraint FAITH [NAS] that demands that the nasal in the input should correspond to the output one. Dholuo inventory does not have a dental nasal and therefore the optimal candidate is non -existent form in the language . Candidate c) [θû:ðnò] is the output attested in the language though it is a disharmonic form as it violates the co-occurrence restrictions between dentals and alveolars in Dholuo. Feature spreading in this context leads to harmony vacuously which results into non-existent forms. This means that in Dholuo, the alveolar nasal is transparent to harmony as it blocks the propagation of the harmonizing feature and remains redundantly alveolar.

Modelling Dholuo coronal harmony as feature spreading predicts non-existent forms such as [θû:ðn̪ò]. If ALIGN R [TTCA] is highly ranked it leads to marked forms. Faith [NAS] if ranked higher than ALIGN R [TTCA], then a different output is produced as the optimal candidate. A markedness constraint must be posited to resolve the problem. The constraint *[n̪] which prohibits dental nasal segments must be highly ranked to ensure structural well-formedness. A different analysis with a different ranking is as follows:

Constraint hierarchy: *n̪>> FAITH[NAS]>> ALIGN R[TTCA]>> FAITH [OBS]

Table 23: Analysis of input /θû:ðnò/ 'numbness' with the *n̪

/θû:ðnò/	*n̪	FAITH [NAS]	ALIGN R [TTCA]	FAITH[OBS]
a.[θû:dnò]			*	*
b. [tû:ðnò]			*	*
☞c.[θû:ðnò]			*	
d.[θû:ðn̪ò]	*!	*		

In the Table 23, candidates (a) and (b) fair well in the two highly ranked constraints: *n̪ which prohibits dental nasals in the output and FAITH [NAS] which demands input-output correspondence in the nasal feature. However, they violate the low ranked constraint ALIGN-R [TTCA] and FAITH [OBS] by having both dental and alveolar segments. Candidate (c) violates ALIGN R [TTCA] since the dental feature is not extended rightwards to the nasal which remains redundantly alveolar. This constraint is violable and is irrelevant in determining the optimal form. Candidate (c) wins based on the principle of minimal violation since it incurs a single violation. Candidate (d) is non-optimal since it violates the two highly ranked constraints : [* n̪] that prohibits dental nasals and FAITH [NAS], which demands input-output correspondence on the nasal feature specification. ALIGNR [TTCA] which is a feature spreading constraint cannot be highly ranked in Dholuo since it will predict non-existent output, as seen in the case of *[θû:ðn̪ò].

4.4.2.0 Feature Agreement as Motivation for Consonant Harmony

Feature agreement involves feature matching of segments that have similar phonetic features. Similarity determines which segments will participate in consonant harmony

processes (Hansson, 2001; Rose and Walker, 2004 and Mackenzie, 2005).

In OT, agreement is determined by identity constraints which check feature matching in corresponding consonant (Rose and Walker, 2004). In Dholuo, coronal harmony involves the dental/ alveolar co-occurrence restrictions. Dentals are prohibited from co-occurring with alveolar and vice versa. The property distributed [dist] is the defining factor. The alveolar are [- dist] while dentals [+dist]. Consonant harmony results when the sounds agree in the property distributed. This can be exemplified using the following constraint set.

(29) ID-CC [dis] adapted from Mackenzie (2005)

A faithfulness constraint that requires that surface segments are in correspondence with one another agree in the specification of the feature [distributed].

(30) ID-IO [+dis]

Input and Output correspond for feature [+ dist]. This demands that dental segments in the input are realized as dental segments in the output.

(31) ID-IO [-dis]

Alveolar segments in the input are realized as alveolar segments in the output.

Constraint hierarchy: ID-CC [dis]>> ID-IO [+dis] >> ID-IO [-dis]

Table 24: Input [tè:dò] 'to cook'

/te:do/	**ID-CC [dis]**	**ID-IO [+dis]**	**ID-IO [-dis]**
☞a. [te:do]		*	
b. [θe:do]	*!	*	*
c. [te:ðo]	*!	*	*
d. [θe:ðo]		*	*

In Table 24, candidate (a) is the winner since it does not violate the co-occurrence

restriction between dentals and alveolars, both initial and second consonant are specified for the feature [- dist] which is a highly ranked constraint in the language. Both (b) & (c) fail to satisfy ID-CC which leads to a fatal violation therefore cannot win; (d) satisfies the highly ranked constraint but fails in the ID-IO [-dis], a faithfulness constraint which demands for input-output correspondence in the feature [-dis] which accounts for alveolar in the input therefore loses out to (a).

The winning candidate is the one with least violations. Harmony is motivated by constraints which require surface segments to be in a correspondence relation with one another (Hansson, 2001 & Rose and Walker, 2004). This correspondence is between input and output segments. A correspondence relation is established between the alveolar consonants in the input and the output. For this correspondence to prevail between the input and output there has to be faithfulness constraints which demand the identity between the corresponding segments. Highly ranked faithfulness constraints will result to consonant harmony (Hansson, 2001; Rose & Walker, 2004 and Mackenzie, 2005). The data (a) is in harmony since it satisfies a highly ranked faithfulness constraint ID-CC [dist] and ID-IO [-dis]. Another faithfulness constraint that may be responsible for the harmony between coronals is the constraint AGREE.

(32) AGREE

Consonants agree in the place of articulation.

It specifies that the dentals occur with only dentals and alveolars with alveolars. An additional column has been created in the table 23 to exemplify the constraint AGREE.

Table 25: Input /te: do/ 'to cook' to illustrate AGREE

/te:do/	AGREE[pl]	ID-CC [dis]	ID-IO [+dis]	ID-IO [-dis]
☞a. [te:do]			*	
b. [θe:do]	*!	*!	*	*
c. [te:ðo]	*!	*!	*	*
d. [θe:ðo]			*	*

In Table 25, candidate (a) is still the optimal candidate based on IO correspondence, moreover, both the first and second consonants agree in the place of articulation which is alveolar, (b) and (c) incur a violation since there is a dental and alveolar and they therefore lose, (d) does not incur a violation on the highly ranked constraint AGREE because there are only dentals in the stem but cannot be the winner because it violates ID-IO, which is an input-output correspondence constraint. The faithfulness constraint AGREE is not satisfied when dentals co-occur with alveolars. Consequently, consonant harmony cannot take place as its effects are blocked. There are words in Dholuo which violate this constraint AGREE.

The alveolar nasal [n] is transparent to harmony. It does not participate in harmony since it is not affected by the co-occurrence restriction between dentals and alveolars.

4.4.2.2 Consonantal Agreement in Dorsal Consonant Harmony

Dorsal harmony refers to assimilatory interactions amongst dorsal consonants. Dorsal consonants include palatals and velars. In Dholuo, dorsal consonant harmony occurs when the velar nasal and palatal nasal interact in a word. Feature agreement between the two consonants leads to correspondence and not feature spreading as earlier studies claimed (Polgardi, 2006). Agreement is determined by identity constraints which check feature matching in the corresponding consonant. In Dholuo, the root-initial consonant is

always constant while the root final consonant changes due to grammatical reasons (Okombo, 1982). This therefore could mean either that the second consonant that agrees with the first consonant in phonetic or phonological property, or that the root-initial consonant spreads its features to the other consonants in order for harmony to occur. The purpose of this study was to determine if the correspondence in Dholuo consonant harmony is as a result of feature agreement or feature spreading. This is illustrated using dorsal consonant harmony data.

(33) Singular Plural

ɲa:ŋ nyang' **ɲe:ŋ-ge** nyenge 'crocodile'

The root final consonant velar nasal /ŋ/ changes to prenasalised velar stop /ŋg/ due grammatical change from singular to plural. This leads change in the phonemic structure but the relevant phonetic details remain; [ŋ] and [ŋg] still share the features [+back, -continuant] which are the feature velar and stop, respectively. This implies that harmony between the initial and final consonant is maintained in both singular and plural forms of the words. The final consonant in the plural form [ŋg] duplicates the features of the singular form /ŋ/ in order to agree with the initial consonant /ɲ/and thus retains the harmony between the final and initial consonant. This would therefore imply that harmony is determined by the features from the initial consonant. According to Pater and Werle (2002), the first consonant usually assimilates the second and that the standard analysis of directionality in local assimilation in OT uses positional faithfulness to protect the second consonant. The converse is true about Dholuo. The first consonant remains but the second one is altered though the relevant phonetic properties remain.

In conclusion, Dholuo consonant harmony can be analysed as feature agreement rather than feature spreading. Feature agreement achieves better descriptive adequacy. It is better able to explain the intervening segments which are not affected by the harmonizing property.

4.5 Directionality of Assimilation

Directionality refers to the assimilation patterns within a word which could be progressive or regressive. Assimilation can be described in terms of whether a sound becomes more like either the sound that precedes it or the sound that follows it. If a sound becomes more like the sound that precedes it, the process is called progressive assimilation; if, on the other hand, a sound becomes more like the sound that follows it, the process is referred to as regressive assimilation. In Dholuo, consonant harmony results when consonants agree in a particular feature. The researcher was interested in determining whether assimilation is regressive (right-to-left) or progressive (left-right).

4.5.1 Consonant Assimilatory Processes

In Dholuo generally, consonants may occur in initial and second position in CVCV stems but dental and alveolar sounds co-occurrence in the same stem is restricted if at all harmony is to be achieved. This is evident based on the coronal harmony data presented in the first objective. In Dholuo, sound change in consonants takes place in the second position in a word stem (Tucker, 1994, p.34). The initial consonants in a word are always constant. This therefore means that in terms of directionality, the second consonant is more likely to copy phonetic properties of the first. In terms of consonant harmony, the second consonant agrees or matches the properties of the first.

The second consonant in a word stem may undergo the following sound changes under certain grammatical conditions (Tucker, 1994, p. 34, Okombo, 1982, p.50-98). In the data provided in (34), the change of a noun from singular to plural leads to the following consonant alternations:

(34) Change in the final consonant

(a) Voiced to corresponding voiceless counterpart and vice versa

i) -t->-d- alɔ:t> alɔdɛ .pl ‘vegetable’

ii) –d- > -t- kidi>kite .pl ‘stone’

b) Change from /w/ to /p/

(i) go**w**i>go**p**e .pl ‘debt’

(ii) pa**p**>pe**w**e .pl ‘field’

c) Change of nasals or liquids to corresponding nasal compounds

i.	-m>-^{m}b-	kɔ̂:**m**>kɔ:$^{\mathbf{m}}$**b**ɛ	‘chair’
ii.	-n->-^{n}d-	kuó**ǹ**>kúó$^{\mathbf{n}}$**d**è	‘maize pap’
iii.	-l->-^{n}d-	tɔ̂:**l**>tɔ:$^{\mathbf{n}}$**d**ɛ́	‘rope’
iv.	-ɲ->ɲɟ	pâ**ɲ**>pé$^{\mathbf{n}}$**ɟ**é	‘mortar’
v.	-ɲ->ɲɟ	cɔ̂**ŋg**>cɔ́$^{\mathbf{ŋ}}$**g**ɛ́	‘knee’

The data above indicates that the phonological change is witnessed only in the second consonant. This change is not confined just to coronal and dorsals but applies to all Dholuo words. In (c) the nasal in the compound shares place of articulation with the consonant that follows it. The place of articulation of the stops is determined by the nasal before it. This is progressive assimilation. The data in 34 (c) shows that:

(i) The bilabial nasal changes to a pre-nasalized bilabial stop [m]> [^{m}b].

(ii) The alveolar nasal changes to a pre-nasalized alveolar stop [n]> [^{n}d].

(iii) The alveolar lateral changes to a pre-nasalized alveolar stop [l]> [^{n}d].

(iv) The palatal nasal changes to pre-nasalized palatal stop [ɲ]> [^{ɲ}ɟ].

(v) The velar nasal changes to pre-nasalized velar stop [ŋ]> [^{ŋ}ɟ].

The change witnessed here is homorganic since the nasal shares the place of articulation with the consonant that follows it. This is a grammatical change but with phonological consequences. It is grammatical because of the move from singular to plural forms, and phonological due to the change from a nasal or a liquid to a prenasalized compound. This change is phonologically conditioned since the nasal influences the consonant that follows it. The stop agrees in place of articulation with the nasal. This contradicts the view by Durand (1994) that nasals are underlyingly unspecified for the feature [place] and that the nasal consonant will therefore assimilate the feature [place] of the consonant following it. In Dholuo, the data presented shows that the nasal is already specified for the feature [place], consequently, influences the consonant after it. In OT terms, the markedness constraint AGREE supports this assimilation. AGREE works together with other constraints in order to realize the optimal form.

(35) AGREE

Consonants agree in place of articulation.

This constraint specifies that the stop must be homorganic with the consonant before it (Lombardi, 1999). This is a highly ranked constraint in Dholuo. Thus compounds like these are attested [mb, nd, nð, ɲɟ, ŋg] and never [* md, nb,nj, ɲg, ŋð] within the same syllable.

(36) IDENT-IO [place]

This constraint demands an input-output correspondence in place of articulation.

(37) DEP

This constraint demands that output segments are dependent on having an input correspondent. This constraint prevents insertion.

(38) MAX

All the segments in the output should be maximized. This constraint prevents deletion. All the segments in the input must be represented in the output.

Input kɔ̂:m + ɛ → kɔ:^{m}bɛ "chair''

Agree[PL]>>Ident-IO>>Max>>Dep in descending order of domination.

Table 26: Input kɔ̂:m + ɛ "chair'pl.

/kɔ̂:m + ɛ/	AGREE [PL]	Ident-IO[PL]	Max $_{I-O}$	Dep $_{I-O}$
a. kɔ̂:m	*!		*!	
b. kɔ̂:mɛ	*!			
☞c. kɔ̂:^{m}bɛ		*		*
d.kɔ̂:mdɛ	*!	*		*

In the Table 26 candidates (a), (b) and (d) lose out to (c) as they violate AGREE, a highly ranked markedness constraint. Candidate (a) is an unfaithful output as it violates the anti-deletion constraint. Candidate (b) fairs well in the two faithfulness constraints; the anti-deletion [max $_{I-O}$] and anti-epenthesis [Dep $_{I-O}$] but violates AGREE which is a highly ranked constraint that supports the structural wellformedness of the output as seen in (c). In (c) the change of input form from /m/ to [^{m}b] is unfaithful to the correspondence

relation between the input and output, and when coalescence is formed between [m + b] to form a prenasalized cluster [^{m}b], it violates DEP which is against epenthesis. However, this is not a serious violation because the output form satisfies AGREE [PL] which is undominated in the constraint hierachy.

The nasal /m/ is homorganic with the the following consonant /b/ being that they are both bilabials. Candidate (d) violates anti-epenthesis by inserting [d] after the bilabial nasal which in turn violates AGREE [place]. In nasal compounds, the stop that follows the nasal must be homorganic with it. This assertion supports Lombardi (1999) and Durand (1994) that the nasal and the consonant that follows must be homorganic.In terms of directionality, the nasal consonant based on the analysis of [kɔ:**^{m}b**ɛ] determines the shape of the consonant that follows it. This is left-to-right assimilation C1→C2, where C1 is the nasal while C2 is the stop that follows it.

Pater and Werle (2002) posit that for the AGREE constraint to produce directionality effect; the triggers of assimilation must be specified. Targets and triggers in harmony processes must share major stricture features such as [sonorant] and [continuant] (Rose and Walker, 2004 and Hansson, 2001). From the data in 34(c), the stops share the feature [- continuant] [-sonorant] while the nasals share the property [-continuant] [+ sonorant]. The target of assimilation here is the property [- continuant]; participating segments share this feature. The target has to be a stop and not any other stop but a homorganic stop.This is further proved by the data in c (iii) /l/>/nd, the alveolar lateral / tɔ̂:**l** / in singular form which is a [+ continuant] assimilates to /d/ an alveolar stop [-continuant] in order to participate.

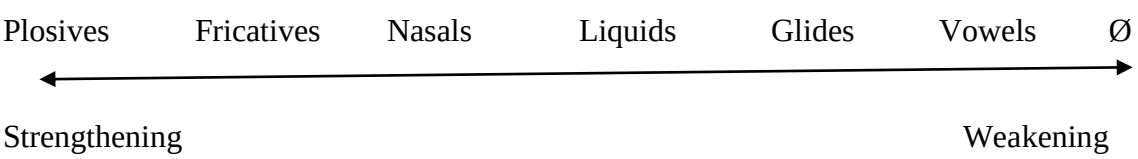
Moreover, this morphophonemic change leads to coronal harmony in the words /tɔːl/ > tɔːndɛ/ ‘ropes’. The initial consonant /t/ and final consonant /nd/ share the property [-continuant, - distributed] unlike /l/ which is [+ continuant, +distributed]. This kind of harmony is root-controlled. The [+continuant] assimilates to [-continuant]; the directionality is from left to right. The second consonant assimilates the first in terms of the phonological property. In this assimilation, the correspondence relation is such that C1 → C2. This is in contrast with the assertions by Hansson (2001) that regressive directionality defines properties of consonant harmony. Dholuo root coronal harmony does not obey the default directionality of right-left.

Okombo (1982) asserts that the phonological process that changes an alveolar lateral to a prenasalized alveolar stop in nominal is not readily obvious. This change is attested in more than one word. This therefore means that the change is not accidental. This is illustrated in (39).

(39)	Nom.sg.	Nom. pl	Genitive sg.	Gloss
a)	bu**l**	bu**ⁿd**e	buⁿd	‘drum’
b)	tɔː**l**	tɔː**ⁿd**ɛ	tɔːⁿd	‘rope’
c)	tɪɛ**l**ɔ	tɪɛ**ⁿd**ɛ	tɪɛ**ⁿd**	‘foot’
d)	d**ǿ**ɔ̀l	d**ǿ**ɔ̀ⁿdɛ	d**ǿ**ɔ̀nd	‘voice’

The change from alveolar lateral to prenasalized alveolar stop is described as hardening. When a liquid /l/ moves to a stop /ⁿd/ it involves strengthening.

(40) Phonological strength scale



The movement of a liquid to a plosive involves a strengthening process. According to the phonological strength scale, weakening can result to the eventual loss of a sound. A similar phonological process is attested in Lubukusu where liquids harden to prenasalized stops (Nandelenga, 2014).

(41) Nasal-liquid sequence in Lubukusu (Nandelenga, 2014)

	Input	**Output**	**Gloss**
a)	/N-lima/	[^{n}dima]	'I dig'
b)	/N-loma/	[^{n}doma]	'I speak'
c)	/N-rura/	[^{n}dura]	'I depart'

In Lubukusu, the archiphoneme /N/ morphologically stands for first person singular morpheme prefix (an equivalent of English 'I'). It has different surface forms depending on the following consonant's place of articulation. The expected surface form in (41) would be *[nlima], *[nloma] and *[nrura], respectively. However, Lubukusu does not tolerate an onset cluster of nasal-liquid sequence therefore [nl] undergoes a repair process by taking on the homorganic prenasalized alveolar stop [^{n}d].

Dholuo just like Lubukusu has segmental constraints that disallow *[^{n}l] clusters. The forms in)*bu**^{n}l**e, *tɔ: **^{n}l**ɛ, *tɪɛ**^{n}l**ɛ and *dǿɔ̀^{n}lɛ are unattested. An onset cluster of nasal-liquid sequence is prohibited. The articulation of the two sounds (nasal-liquid) which are

sonorants would require spontaneous voicing for an extended period of time. This is practically impossible as it contradicts ease of articulation principles that govern the sequencing of consonants in a cluster. Speech is supposed to be effortless and that's why assimilation processes come in. The stop feature of the nasal is extended progressively to the liquid which is [+ continuant] and it changes to a prenasalized alveolar stop [- continuant].

In OT analysis, the following constraint is posited in constraining nasal-liquid cluster.

(42) *NC̥: This prohibits the occurrence of a voiceless plosive after a nasal in the output.

(43) *SSP: This bans segments from the same manner to occur in an onset cluster. The two sonorants (liquid and the nasal) cannot constitute an onset cluster. It would be impossible to articulate.

(44) IDENT I-O $_{[NAS]:}$ This demands input-output correspondence in the nasal feature specification.

(45) IDENT –IO$_{[SON]:}$ Input- Output correspondence in the feature sonorant. Nasal and liquids are sonorant.

(46) UNIFORMITY-IO: This constraint assesses the coalescence. There should be a correspondence between the input and output segments.

Constraint hierarchy : * NC̥ >> *SSP>>IDENT I-O $_{[NAS]}$ >> IDENT I-O $_{[SON]}$ >> UNIFORMITY-IO

Table 27: Input bùl 'drum' → bù^{n}dē 'drums

bul→bunde	***NÇ**	***SSP**	**IDENT-IO [NAS]**	**IDENT- IO [SON]**	**UNIFORMITY- IO**
a. bunle		*!		*	
b. bulne		*!			*
c. ☞bu^{n}de				*	*
d. bu^{n}te	*!			*	*

In Table 27, (a) and (b) violates has a nasal and liquid cluster which violates the ban of nasal and liquid cluster which would require spontaneous voicing for a long period which is virtually impossible to achieve. Candidate (b) further violates UNIFORMITY-IO by forming coalescence where the liquid precedes the nasal /ln/. Due to segmental constraints such liquid-nasal sequences are unattested in Dholuo. Candidate (c) and (d) have a nasal and plosive, this does not violate the sonority constraint *[SSP]. Candidate (d) loses to (c) as it violates *NÇ that prohibits voiceless occurring after nasal in the output. The change from /l / to /nd/ is therefore phonetically plausible since /l/, /n/ and /d/ are all alveolar sounds. The coalescence of [^{n}d] rather than *[nl] is permitted for ease of articulation.

4.5.2 Left-to-Right Assimilation

Hansson (2001) posits that consonant harmony process generally obey a fixed right-to-left directionality and when this does not happen, it is normally a by-product of stem-control whereby the direction of assimilation falls out from the morphological constituent structure. He suggests that synchronic data can be used to determine morpheme internal consonant harmony. This view is supported by Bakovic (2000). Data from Dholuo reveals that consonant harmony in Dholuo is confined within the root which is the main participant of harmony. The data set in (47) illustrates morphophonemic alternations that lead to coronal harmony. The data set also indicates the consonants affected and the

direction of assimilation.

(47) Directionality in coronal harmony

	Applicative	**Qualitative Forms**		**Alternations**
a)	/ te:do / ‘to cook’	[te:to]	‘cooking’	[t-d] > [t-t]
b)	/θe:ðo / ‘ to forge (iron)’	[θe:θo]	‘ forging’	[θ-ð] > [θ-θ]
c)	/θie/ðo/ ‘ to treat/cure’	[θieθo]	‘curing/treatment’	[θ-ð] > [θ-θ]

Dholuo words alternate for certain grammatical functions, for instance the change from applicative to qualitative form leads to change in the final consonant from voiced to voiceless as seen in (47 a), (b) and (c). The morphophonemic alternations that affect the second consonants in the data above lead to complete identity between the first and the second consonant. This supports proposals by MacEachern (1997) that segments should be identical in all respects. Morphophonemic alternations can lead to complete identity between the consonants or dissimilation. The coronal harmony data above indicate agreement in terms of place and voicing. The morphophonemic alternation rule is such that voiceless obstruents become voiced and vice versa. Here directionality of assimilation is from left to right. The second consonant becomes completely like the first. This operates in the schema C1→C2 whereas default directionality patterns are right to left, C1←C2 based on Hansson (2001) assertions. However, this violates faithfulness constraints that demand input-output correspondence in terms of voice specification. Any changes on the output lead to a violation.

MacEachern proposes a constraint BEIDENTICAL that explicitly demands total identity between consonants. Complete Identity Effects (CIEs) arise when multiple different

IDENT-CC constraints work together so that disagreement on any feature leads to dissimilation. Identity effects are not inherently tied to complete identity that is agreement. In Dholuo coronal harmony, if the first consonant is alveolar then the second consonant is alveolar and the same applies to dentals. This is in line with AGREE constraint (consonants agree in place of articulation).

In Dholuo however, the faithfulness constraints that demand input output (IDENT-IO) correspondence constraint will be violated as markedness constraints demand a change on the final obstruent such that a voiced obstruent changes to voiceless and voiceless becomes voiced. Such alternations lead to dissimilation. Bennett (2013) posits that alternations can lead to disagreement in the output.

Derivational prefixes do not have an effect on consonant harmony, for example the agentive prefix /ja-/ does not influence and is not affected by consonant harmony.This can be illustrated in data set 15.

Data set 15: Derivational prefix /ɟa-/ in combination with data of Dholuo coronals.

a. /ɟa-**ð**ɔ́:**t**/ ja-dhoot ‘clansman’

b. /ɟa-**t**e:**d**o/ ja-tedo ‘cook’

c. **/** ɟa-**θ**iê**θ/** ja-thieth ‘doctor’

The prefix /ɟa-/ which literally means ‘a person of’ is an agentive prefix used to derive the agent/ doer of a specified activity. This prefix does not fall into the consonantal patterns or features of the stem or does it affect the stem. It can be noted then that

consonant harmony is confined to the roots. In contrast, certain language present patterns of absolute directionality where harmony operates either from left to right or right to left affecting inflectional and derivational affixes. According to Hansson (2001) Iñeseno exhibits absolute right-to-left directionality.

(48) Absolute right-to-left directionality in Iñeseno (Applegate, 1972 cited in Hansson, 2001)

a) /s-api-ʧho-it/	[ʃ-api-ʧhol-it]	'I have a stroke of good luck'
b) /s-iʃ-tiʃi-jep-us/	[s-is-tisi-jep-us]	'they show him'
c) /s-api-ʧho-us/	[s-api-tsho-us]	'He has a stroke of good luck'

Iñeseno exhibits right-to-left directionality where the rightmost sibilant targets the preceding sibilants and determines their phonetic properties. In (a) the palatal harmonizes the preceding sibilants to be palatal, while in (b) and (c) the alveolar harmonizes the preceding sibilants to be alveolar.

Languages pattern differently with regards to consonant harmony process. In Dholuo, consonant harmony is root confined and if there are any changes in the phonological shape of consonants, they are still motivated from the root. This further strengthens the thesis that Dholuo consonant harmony whether coronal or dorsal is based on agreement patterns where a correspondence is established between similar segments rather than assimilation. In Iñeseno, the correspondence could be influenced by feature spreading. Hansson (2001) believes that right-to left assimilation is the default directionality but data from Dholuo reveals a different pattern. The left-most consonant influences the consonants that follow. This is progressive assimilation.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This was a study of the nature of Dholuo consonant harmony. This chapter is an overview of the study based on the research findings as discussed in Chapter Four. The objectives of the study were: to establish the phonetic and phonological properties which define Dholuo consonant harmony; to explain the nature of correspondence of Dholuo consonant harmony; and to determine the directionality patterns in Dholuo consonant harmony.

The chapter provides a summary of findings, conclusion, recommendations and suggestions for further research based on the findings of the study of Dholuo consonant harmony. Subsection 5.2 below is a summary of these findings.

5.2 Summary of Findings

In the study of the nature of Dholuo consonant harmony, the focus was consonant-to-consonant interactions and how these interactions lead to consonant harmony. Dholuo consonant harmony involves non-local agreement as it spans over vowels and consonants that are not specified for the harmonizing feature. This sub-section provides a summary of key findings of the study of the nature of consonant harmony phenomenon in Dholuo.

5.2.1 Phonetic and Phonological Properties that Define Dholuo Consonant Harmony

Consonant harmony is a phonological process whereby two or more consonants match in terms of phonological or phonetic property. Using the harmonizing property, two types of consonant harmony patterns were identified: coronal and dorsal harmony. Coronal

harmony in Dholuo involves dental and alveolar consonants. The co-occurrence of alveolar and dental consonants is restricted to root forms. This confirms the assertion by Tucker (1994) that all consonants may appear in first or second position in CVCV stems; however, dental and alveolar stops cannot coexist in the same stem. Participating sounds include dentals [ð and θ] and the alveolars [t and d]. Alveolars like [l, r, n and s] are not participants in consonant harmony since they do not have a dental counterpart in Dholuo phonemic inventory. They co-occur with dentals and alveolars.

The key finding here is that the co-occurrence between dental and alveolars is restricted but it is not impossible because cases were attested of such co- occurrences. The co-ocurrence restriction of dentals and alveolars is a Western Nilotic phenomenon as seen Päri (Andersen, 1988), Shilluk (Gilley, 1992) and Mayak (Andersen, 1999). Päri has dental nasal [n̪] counterpart for the alveolar nasal [n]. Anywa creates an alveolar nasal allophone (Mackenzie, 2005). This therefore means that the alveolar nasal participates in the co-occurrence restriction unlike Dholuo where the alveolar nasal is blocked from participating since there is no dental nasal counterpart. There being no dental nasal counterpart for the alveolar, the alveolar nasal blocks the propagation of harmony property, /n/ is consistently alveolar and is neutral to coronal harmony since it co-occurs with dentals.

Consonant harmony in Dholuo is confined to the root domain. It does not extend to affixes whether derivational or inflectional. For instance, in Dholuo coronal harmony some disharmonic sequences have been attested such as [ð-d] in / **ð**ɔ́:ó**d**ı/,/**ð**ɔ́:**d-n**ɔ/, /**ð**ɔ́:ó**d**ı/ and /**ð**ɔ́:**d/** “door”, this could be because /ðɔ́:t/ is a compound word derived from *dhog* ‘mouth’ and *ot* ‘house’, it may never occur in this form were it a root form of the

word. Coronal harmony affects only roots and not suffixes especially in derivational morphemes. Manifestations as seen in Data sets 1 and 2 where dentals co-occur and in data set 4 where alveolars co-occur is a result of agreement which leads to correspondence. Such occurrences are motivated from the root form of the word. There is no morphological or phonological process involved that leads to the correspondence.

For consonant harmony to occur, the interacting segments need to be similar in most features. This is a view held by Hansson (2001) and Rose and Walker (2004). Similarity does not necessarily refer to complete identity effects as posited by MacEachern (1999); the consonants should agree or be similar in only some respects. Data from Dholuo shows that due to morphophonemic alternations, the second consonant changes in voice specification especially amongst the obstruents. This does not inhibit harmony phenomena even though there is disagreement in voice specification. The property distributed [dist] is the defining factor in realizing coronal harmony. Consonant harmony results when the sounds agree in the property distributed.

In data analysis in the OT framework, Rose and Walker (2004) surface correspondence constraints are posited. It can be observed that dentals and alveolars cannot co-occur in a stem if the surface correspondence constraints that demand identity in all respects are highly ranked (CORR-T↔T). However, data from Dholuo reveals that coronal harmony can occur even when the segments have different voicing specification as long as they agree in place of articulation features (CORR-T↔D). In this instance the faithfulness constraints that demand identity in voice specification are ranked least while those that demand input-output correspondence for feature distributed are highly ranked. Feature distributed is distinctive between dentals and alveolars. Dental sounds are [+ dist] while

alveolars are [-dist]. Using CORR [K↔T], correspondence can also be established in Dholuo words where dentals and alveolars co- occur in a word. The focus would be on voice specification rather than place and manner of articulaton features.

In the analysis of Dholuo coronals, the researcher employed the following faithfulness constraints ID-CC [dis] where in order to realise harmony the output segments had to agree in the property [dist] any violation of this leads to a disharmonic output. In this case [teːdo] 'to cook' agrees in the property [-dist] while [θieðɔ́] agrees in the property [+dist] which is the defining property for dentals. The occurrence of [+dis] and [-dist] segments leads to disharmonic roots. This faithfulness constraint which highly ranked in Dholuo works in conjunction with other faithfulness constraints. ID-IO [-dis] constraint demands input-output correspondence in the feature [-dis]; the alveolar segments in the input are also realized as such in the output. ID-IO [+dist] constraint demands input and output correspondence in the property [+dist] which realizes dentals.

Harmony is motivated by constraints which require surface segments to be in a correspondence relation with one another (Hansson, 2001 & Rose and Walker, 2004). This correspondence is between input and output segments. For this correspondence to prevail between the input and output, there has to be faithfulness constraints which demand the identity between the corresponding segments. Highly ranked faithfulness constraints will lead to consonant harmony (Hansson, 2001; Rose & Walker, 2004 and Mackenzie, 2005).

AGREE is another faithfulness constraint that is responsible for the harmony between coronals. AGREE demands that consonants agree in the place of articulation. This

specifies that the dentals occur with only dentals and alveolars with alveolars. The faithfulness constraint AGREE is not satisfied when dentals co-occur with alveolars. Consequently, consonant harmony cannot take place as its effects are blocked. There are words in Dholuo which violate this constraint AGREE. The alveolar nasal [n] is transparent to harmony. It does not participate in harmony since it is not affected by the co-occurrence restriction between dentals and alveolars.

Coronal harmony is as a result of identity in some respects and not necessarily complete identity. The consonants need not be completely identical to be in agreement. As long as they meet AGREE constraints the phonology of the language permits disagreement in voice specification (IDENT-CC [VOI]). Agreement in place is more highly ranked than agreement in voicing in consonant harmony patterns.

Dholuo has two distinct dialects the B-U and KSN varieties. Dialectal differences results in free variation. This is when two phones are found in the same context and no difference in meaning results. The study reveals that /c/ and /θ/ are free variants in the dental harmony data /θieθ/ and /cieθ/ 'treatment'. The former is attested amongst KSN speakers, while the latter amongst B-U speakers thereby creating a disharmonic form. It can be noted that in the selection of [cieθ] rather the harmonious form [θieθ], B-U dialect prioritizes dissimilation rather than assimilation.

It can be noted that some morphophonemic alternations of root final segements lead to consonant harmony. These morphophonemic alternations are an attempt by the phonology of Dholuo to harmonize consonants within a word.

The consonants become more similar in their phonological properties and in this case both initial and final consonants become stops due to the alternations. In investigating harmony in Dholuo consonants, dorsal consonant harmony was also attested. Dorsal harmony refers to assimilatory interactions involving dorsal consonants where the property is involved. Dorsal consonant harmony in Dholuo occurs between velar nasal and palatal nasal. These two sounds exhibit a high level of similarity to the extent that they can occur as free variants (mutually interchangeable) in some contexts. They almost always co-occur in words. This phenomenon is referred to as dorsal concurrence. In dorsal harmony data, palatal nasal /**ɲ**/ and velar nasal /**ŋ**/ are separate phonemes since a minimal pair can be established; they also occur as free variants due to dialectal variations. The feature [back] is distinctive between palatal nasal which is [-back] while velar nasal is [+ back]. Surface correspondence constraints that establish a correspondence between segments with different place but the same manner and voice specification must be posited to realize velar nasal and palatal nasal co-occurrence.

5.2.2 Nature of Correspondence

The researcher sought to establish whether consonant harmony in Dholuo was due to feature spreading or feature agreement. The study established that consonant harmony in Dholuo is due to feature agreement leading correspondence relations between surface forms rather than autosegmental feature spreading. Only those segments with similar features are targeted. The segments that are unaffected are said to be non-participants to the harmony rather than blockers as autosegmental phonology posits. Coronal harmony is a co-occurrence restriction between dentals and alveolars. Non-coronals and vowels which do not match are overlooked since they are not targets of consonant harmony and

are unspecified for the harmonizing feature. A correspondence relationship is created between similar segments based on the feature [distributed] amongst the coronals. This correspondence based approach allows similar consonants to agree at a distance; transparent ones are those not similar enough to participate in harmony, for instance, the alveolar nasal does not participate in the co occurrence restriction since there is no dental nasal to contrast with.

Dholuo coronals exhibit instances where intervening segments are unaffected by the agreement feature. This can be best explained by correspondence based approach. In the study, a similarity based surface correspondence hierarchy by Rose and Walker (2004) is adopted for analysis. A correspondence relationship is established between non-contiguous consonants that are similar in all aspects; such manifestations amongst coronals lead to total harmony. This can be seen in data sets 1 and 2 in Chapter Four of this thesis. Segments incompatible with the spreading feature are blocked from participating. The alveolar nasal /n/ is unaffected by harmony. Other redundantly alveolar segments like [l, r, and s] are also non- participants in harmony.

Feature agreement is determined by similarity of segments while spreading is determined by locality since skipping of segments is disallowed based on No-Crossing constraint as suggested by Coleman and Local (1989).

5.2.3 Directionality of Assimilation

Consonant harmony is a form of assimilation where consonants of a particular type agree in a particular phonetic or phonological property. Dholuo coronals and dorsals in their root forms exhibit coronal harmony. There are patterns of agreement manifested in words

which cannot be attributed to an assimilation process, rather that is how they occur from the input form. In the absence of evidence of assimilation, it can be concluded that Dholuo consonant harmony is motivated from the root based on agreement in phonetic features that leads to correspondence relations being established between the participating segments. However, some morphophonemic alternations in Dholuo which cause changes to the root-final consonant lead to consonant harmony. In such instances assimilation process is noted. The first consonant in Dholuo words is normally constant, while the second consonant is usually affected by grammatical changes. Changes observed like /l/ changing to [nd] seem to be motivated by the phonetic properties of the initial consonant which seem to obey left-to-right directionality. This differs with the view of Hansson (2001) who terms the right to left harmony as the default directionality where most harmony systems fall.

5.3 Conclusions

Dholuo exhibits two types of harmony: coronal harmony and dorsal consonant harmony. Coronal harmony operates between dental and alveolars, including nasals even if there is no dental nasal contrast in Dholuo. Dholuo coronal harmony operates at the word level and affects the roots and the stem. Alveolar nasal does not block the propagation of harmony amongst dentals; it co-occurs with the dental roots and remains consistently alveolar.

Dholuo consonant harmony manifests as a root internal co-occurrence. Only roots participate in harmony. Any changes manifested in the segments is triggered fom the roots.

The study notes that consonant harmony occurs when there is a higher degree of similarity between the interacting segments. The more similar the participating segments are the more they are likely to co-occur. Dholuo coronal harmony manifests even with diminishing degree of similarity of features amongst the interacting consonants. Cases were manifested of coronal and even dorsal segments where complete harmony is exhibited amongst the consonants. Faithfulness constraints that create total identity effects were posited.

The constraints that establish a correspondence between identical segments was seen to be too stringent because some data from the language fit into this for example data sets 1 and 2 in the study, while there are those words in the Dholuo where the consonants are identical in manner and place of articulation but differ in voice specification.

In consonant harmony, correspondence is through feature agreement which involves non-local assimilation. Coronal harmony affects only the consonants appropriately specified for feature distributed which is distinctive between dentals and alveolars. Dholuo coronal harmony exhibits instances where the intervening segments are unaffected by the harmonizing feature. Feature agreement is better able to explain the transparent segments which remain unaffected in consonant harmony.

In Dholuo, the alveolar nasal [n] and other redundantly alveolar sounds like [l], [r] and [s] are also non-participants in harmony. These sounds do not have a dental contrast and are therefore blocked from participating. In terms of directionality, the patterns of co-occurrence manifested in Dholuo is not as a result of a process, rather it is based on agreement patterns that lead to correspondence. The root-internal occurrences are not

triggered by assimilation. Directionality can only be argued for in the morphophonemic alternations where nasal compounds are formed. It was observed that the consonant segments are homorganic with the nasal before it. There is left-to-right assimilation where the place feature of the nasal consonant is extended to the consonant that follows it C1→C2. In this instance feature spreading can be argued for; where bilabial nasal /m/ becomes a prenasalized bilabial stop [^{m}b] and the labial features are extended rightwards.

5.4. Recommendations

The study sought to establish phonological and phonetic properties that define consonant harmony**.** The study established that the phonological properties that define harmony are agreement patterns that lead to correspondence, similarity of segments and contrasts in the system which determine the participants in consonant harmony process. The intervening segments like vowels and nasals which are non-participants have no effect since they do not block the propagation of consonant harmony. In the study of consonant-to-consonant interactions focus should be on similar features since the more similar the consonants are the more they are likely to interact.

This study discussed the nature of correspondence in Dholuo consonant harmony. It was noted that instances of consonant harmony reported in Dholuo were not alike in their typological characteristics. Some cases observed amongst the dorsals and coronals in Dholuo are as a result of similarity of features which are not triggered by a process but are root motivated, while others are triggered by phonological assimilation as seen amongst the morphophonemic alternants which can be viewed as feature spreading. The study recommends that in the analysis of consonant harmony it is important to analyse

each case individually rather than categorize generally as feature spreading or feature agreement leading to correspondence. In the study of directionality of assimilation, cases where Dholuo coronal harmony involved assimilation, left-to-right directionality was noted. This is in contrast to the right-to-left assimilation which Hansson (2001) refers to as default directionality. The study recommends researchers to analyse each instance separately as default patterns may not present in individual languages. The language constraints may be universal but each language ranks them differently to ensure structural well-formedness.

5.5 Suggestions for Further Research

Based on the limitations, objectives, findings and conclusions reached in this study, the following are the suggestions for further research:

1. The current study focused on phonetic and phonological properties that define harmony. This study established that consonant harmony results when participating segments are similar in phonetic properties. The higher the degree of similarity the higher the correspondence. Dholuo consonant harmony manifests with diminishing degrees of similarity. Further studies should be undertaken in Bantu languages using similarity based correspondence models to contribute further in the field of descriptive linguistics.

2. The current study sought to establish the nature of correspondence in Dholuo consonant harmony. The researcher established that coronal harmony is determined by feature agreement rather than feature spreading. Further research may be undertaken using correspondence based models to further interrogate the nature of correspondence in consonant harmony as a phenomenon generally. This

could now be shifted to studies in Bantu Phonology the researcher having undertaken a study in a Western Nilotic language.

3. The current study investigated directionality patterns. Since Dholuo consonant harmony is determined by feature agreement rather than feature spreading; directionality patterns may be redundant. In feature agreement an analysis of triggers of assimilation would be more relevant. Directionality patterns are more relevant in spread-based analyses of consonant harmony and in languages where absolute directionality patterns are attested. A comparative study of consonant harmony systems can be undertaken amongst Nilotic languages and this would further enrich language description in Nilotic studies.

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APPENDICES

APPENDIX A: EXTRACTS FROM WRITTEN TEXTS

Dhoudi moko mag Luo (Weere, 2007)

Extract 1

Weche motelo adapted from Weere (2007,p.2)

Weche ma**thoth** machon mane wayudo kuom wegewa gi kwerewa magin bende ne giyudo kamano ok winjore lal ni tieng'makinde gin kod tieng'mabiro. Kata wasetemo ndiko ekinde mokadho e buga mokuongo mabe wandiko gi migosi Zablon Okola, kendo kata asekonyo wagosni ma**thoth** ndiko , weche mathoth ne aneno ni podi odong'. Kuom mano akawo **thuoloni** mondo andik mago manyalo, kata kamano weche ma**thoth** naweyo ni nyithindo, kaka an bende kod jodongo mamoko ne oweni weche makoro wandikogi. (Paragraph one)

Nyithindo masani nigi lwenje kaka mag somo, makawo higni madirom piero adek eka gikwan ni isomo mong'ith. E hignigi gionge gi thuolo malong'o mar bedo gi jonyuol mondo *ging'e* weche mago machon. Bang'somo gin giwegi bende gikendo kendo gibedo gi **nyithindo** ma onego gi puonj, omiyo lwenje magingodo makamagi ok wenigi **thuolo** malong'o mar ng'eyo weche machon. Katakamano manin ok onyiso ni lonygi onego gik kuom weche mawelo kende, nikech lony malong'o en ng'eyo weche mawa wawegi moloyo kaka wang 'eyo weche mawelo. Mani eka inyalo bedo gi sunga ni in wuod oganda. (Paragraph 3)

Data from extract 1

tho**th**- dental harmony

thuo**l**o**n**i- dental–alveolar co-occurrence

gi**ng'**e- dorsal concurrence

nyi**th**i**nd**o- dental/alveolar co-occurrence

thuo**l**o- dental alveolar co-occurrence

Extract 2

Ochieng' Odhuno (Weere, 2007, P. 28)

Kuom mano ka ne koro gidhi, jo moko noluwo yor Wath Okiyo to moko oluwo Wath **Nyamdhunia**. Ochieng'manyakwar Kager Walthach notelo lomo wath ka tut mit oyudo ka **odhuno** pi gi bor. Ka oneno kamano nokoni yagi modong' oko ni "pigni **adhuno** gi bor , kadhuru akadha". Chakre chieng'no yagi nochake ni , Ochieng' **Odhuno**"nikech no**dhuno** pi gi bor mi yagi nokalo Wadh **Nyamdhunia.**

Data from extract 2

Nyam**dh**u**n**ia- dental/alveolar co-occurrence

o**dh**u**n**o- dental/alveolar co-occurrence

Extract 3

Boro Nogero Boro Ei Alego (Weere, 2007:30)

Boro nogero kama kawuono ong'ere ni Boro ei Alego. Kanyo e ma nodakie kod yawuote – Othuondo, Ragak,Nyada, Moya gi Tewno. Nyikwa Nyada e Jokanyada ma ti odak loka Milambo Asego. Tewno nonywolo Uburi ma nonywolo Udongo gi Wamari. Jogi e ma tinde ong'ere kaka Josamia kendo gi e oganda mapek ei Samia. Moko kuomgi ni e bwo

loch ma Uganda. Ka ne Jougenya pod odak Alego, Tewno nohero dhi limo Josamia ma ne jo**thedh** kwe. nene odhi waro kwe kuomgi mit negihere ahinya mit gimako kode osiep. Mani nomiyo chieng'ma nyikwa Boro ne pogere e pap Boro, en nowalo mondo odhi odag kod osiepene nikech noherogi kendo nohero pinyno. Jo**theth** kwe ma nene osiepenego ne gin Bang'are. Jogi pod jo**theth** e i Samia nyaka kawuono. Osiep Tewno maduong' ne en Hayodi ma Jaulala . Jalo e ma notere kuom Bang'are modak Lwambwa.

Nyikwa Ragak e jokakan modak Alego nyaka koroni. Mani e **dhoodgi** Ruoth Ng'ong'a Odima gi ruoth Ahenda Ogutu. Mani e kane Raila Agwambo maka Oginga Odinga.
Yawuot Olw al nopogore ka nyathi Nyada nomwonyo tik **Othuondo** mit Boro **Othuondo** nedwaro mondo Nyada ochule ma tike owuon gi wang'e. Limini ma kamano nomiyo Nyada oriedo i **nyathine** mogolo tike mochulo Boro. Bang' timo kamano nowacho ni ominene ni en koro nodhi witore oko, koro noonge wat kod **Othuondo** chutho. Nokawo **nyathine** modhi yiko kama kawuono iluongo ni Kajulu manie kind west Kano gi Kisumo *Nyang'or*. Kamane oriedoe i **nyathine** podi ong'ere nyaka kawuono ni Bar**nyathini** ei Siaya Alego.

Data From extract 3

jo**thedh** – dental harmony

jo**theth-** dental harmony

dhoodgi -dental /alveolar contrast

othuondo -dental alveolar contrast

nya**thine -** dental/ alveolar contrast

Barnya**th**i**n**i- dental/alveolar contrast

Extract 4 (Weere, 2007:36-37)

Lweny Uholo gi Jomagoya nochakre kama: Chieng'moro Jamanyala nodhi wendo Nyajayi ma ruodh Kakeny mit Nyajayi no**tedo**ne mana aluru. Bang'e wendono noa kuom nyajayi modhi limo Muhoma ma ruodh Jomagoya. Jali no**tedo**ne rech mar **odhadho** . Mani omiyo ne ochayo Nyajayi to opwoyo Muhoma nikech no**tedo**ne **odhadho.**

Data from Extract 4

No**te**d**o**ne- cooked for him dental/alveolar contrast

odha**dh**o – mudfish dental harmony

Extract 5

Omoro Kanyango Wangoya – Omoro Wang' Nyang' maneno e pi (Weere, 2007:41)

Jabind Kager ni Omoro 'wang' *nyang'* ne okoro wach ni jomoko biro ma**dend**gi yom chalo **dend** nyathi maeka onyuol . Jogi nobi kendo nolo piny duto. Jogi nobed gi ludhe mwito mach manegoji man mabor . Mani Omoro ne okoro higni ma**thoth** ka Wasungu ne podi ok obiro. Ka Waswaili nochopo ir Mumia, notemo kodgi Kager, to Kager nonegogi nikech nene gin gi bunde aroka. Koro waswaili ma nodong' nodhi okeloni Mumia Wasungu. Jogi e ma koro nonego moturo Kager chutho. Nene giloyo Ugenya mangima, kendo ne gin e hap Kawango.

Data from extract 5

nyang' – "crocodile" -dorsal harmony

ma**dend**gi "their skin" -coronal harmony

dend – 'Skin' poss. n coronal harmony

mathoth – "many/ much of " -dental harmony

Extract 6

Karuoth (Weere, 2007:63)

Kabura ka oriwore kaachiel kod Sigoma, Mahola, uradi gi Uranga eka koro iluongo ni Kisodhi. Mano riwore kod Ager, Ogelo gi omenya. to *nying'no* nobedo kama: Ka Owiny nosepogore kod Adhola owadgi, **dhoudi** ma nene gikedo godo mi giloyo e ma nochakogi ni Ruoth nikech koro nobedo kaka ruodhgi.

Data from extract 6

nying'no 'that name'- dorsal harmony

dhou**di**- dental/ alveolar contrast

Extract 7

Jokarapul (Weere, 2007:72)

Karapul gin Jopwoyo , kendo kwargi *nyinge* en Kwena. Jouyawa nogamogi kanegi a Pwoyo. ka Jouyawa ne gamo Kwena e wadh Wuoproya, negiwacho niya: "kwonguru goyo mana rwath marapulno mondo okal aoro eka dhok moko one". Nyaka a chieng'no Jouyawa nochako luongogi ni "Karapul" mit mano e *nyinggi* mong'ere e i Alego nyaka kawuono.

Data from extract 7

nyinge "his/her name'' dorsal harmony

nyinggi 'their name" dorsal harmony

Extract 8

Osir **Odhodho** Nyamuok (Weere, 2007, p.209)

Ka gem gi eme noturo Kisumo, negiriembo dhok ni ya Seme moko ma nene gingéyo kaka wede magi, to yago nolal gi dhok mi manok kuomgi e ma noyudore ka koro piny

nokuwe. To ka ya Kisumo nodak Ruma, Uyoma, oro nowuok maduong' ahinya mi pi notwo ahinya mit dhok ma**thoth** notho. E ndalogo ma ya Kisumo nodak Uyoma, e ma Osir ma wuod Ochuka ma Jakogony nohonore gi wuoth kuom kuom loko ohala mar ndawa. Nowuotho mochopo ir Tolo ma jakanyuto ma nodak gi Kanemage. Jogemgo neodak Tieng're nyaka Mboto, to Osir nedhiyoga nyaka ir Nying'oche **ng'iewo** ndawa. Ka nene Osir oduogo notero wach ni **Otiende** mit Otiende ka nowinjo wach Osir noluongo jodongo duto mi Osir nonyisogi kaka wuodhe nobet. To jodongo ka nowinjo kamano, negioro Osir gi yawuowi moko mondo odhi onon wach no maber mondi, eka gidwok wach.

Data from extract 8

O-**dh**o**dh**o	'has suckled	dental harmony
Tho**th**	'many'dental	
ng'iewo	to buy	dorsal (free variant)
Otiende	name of a person	coronal (alveolar)

Extract 9

Milambo Weere (2007:270)

Dhoudi moko modak milambo gin magi: Kaguria, Kamgundho, Nyameda, Wahundha, Kamremba, Wamiembe, Waondo, Komenya gi Wapondi. Magi e **dhoudi** mag Luo modak Milambo kod loka Tanzania. Kuom ogendni makwano malogo, Kamgundho en **dhoot** mane owuok kuom dhood Ugenya Masat.

Dhout Luo molal makoro ong'ere kod pinje mane gidhiye bende **thoth**. **Dhoudigo** gin kaka Bonchari ei Kisii kod **dhoudi mathoth** man Nyamira, Nyang'ombe ei Tanzania,

Wanyore gi kawango ei Western, Josamia **mathoth** majoka Tewno, jomanyala uburi, Kamrembo gi Kanyinek kod moko.

Data from extract 9

Dhou**di**	‘ clans’	dental- alveolar
dhoo**t**	**‘**clan/doors’	dental-alveolar
thoth	‘many’	dental
dhoudigo	‘those clans/ doors’DEM.	dental-alveolar

APPENDIX B: Applicative and qualitative forms

Coronal harmony adapted from Tucker (1994)

Applicative forms	Qualitative forms
1.**Dhedho** mach 'make a bon fire	**Dhetho**
2.**dudo** ngeta ' to spin the ngeta seeds'	**Duto**
3. **thatho** buom 'to flutter wings'	**Thetho**
4. **thatho** tielo 'to kick legs'	**Thetho**
5.**toto** mo e del 'to smear oil on the skin'	**Toto**
6.**tuto** ng'ato ' to harass somebody'	**Tuto**

APPENDIX C: Dholuo –English word list sample of coronal and dorsal harmony data Adapted from Tucker(1994, p. 491-544)

word	**gloss**	**harmony type**
1. dede	locust(s)/grasshopper(s) *n.*	coronal/ alveolar
2. dendo	'to praise' *n.*	coronal/ alveolar
3. dhano	'person' *n.*	coronal (dental/ alveolar)
4. dhedhe	'kind of a bird' plural dhe.dhni *n.*	dental harmony
5. dhedhni	'to glow (as of red hot iron)	dental
6. dhedho mach	'make a bonfire' *vt.*	dental
7. dhodho	'to suckle'	dental
8. dho thuno	'nipple'	dental/alveolar
9. dhuth	'to have conjunctivitis'	dental
10. dhutho	'to cause conjunctivitis'	dental

11. diedo	‘to balance,to be balanced’(on the head) v. alveolar	
12.dudni	‘to spin like a top’	alveolar
13. dudo	‘to spin’	alveolar
14. ja-**tedo**	‘cook’	alveolar
15. ja-theth	‘smith’	dental
16. ja-thieth	‘medicine man’	dental
17.lidondo	‘albino’	alveolar
18. nyanya	‘tomato’	dorsal
19. nyaŋ	crocodile pl. nyeŋge	dorsal
20. nyaŋgeta	‘testicle’ nyaŋgetni pl.n.	dorsal
22. nyango	‘ to put out to dry’	dorsal
23. nyangu	‘circumcision’ n.	dorsal
24. nyidho, ŋidho	‘to drizzle’	dorsal
25. nyinyo	‘leprosy’ n.	dorsal
26. nyinyo	‘to soar’ v.	dorsal
27. nying	‘name’ n.	dorsal
28. nyiso/ng’iso	‘to show’	dorsal (free variants)
29. nyong’o	‘to soften’ v.	dorsal
30. ng’ang’â	‘ibis’ n.	dorsal
31. ng’eng’	‘to daydream’	dorsal
32. ng’eny	‘many, plenty, much’ adj.	dorsal
33. ng’iewo/nyiewo	‘to buy’v.	dorsal (free variants)
34. ng’inyi ng’inyi	‘stark naked’ ideo.	dorsal

35. ng'wony	' to shrink' v.i	dorsal
36. ng'wonyo	to shrink' v.t	dorsal
37. odhadho	'mudfish' n	dental
38. odundu	'reed' n.	alveolar
39. ondhudho	'bone marrow' n.	dental
40. othitho	'small thing' pl.othithe n.	dental
41. tedo	'to cook' v. 'cookery'n.	alveolar
42. tol	'rope' n.	alveolar
43. thathni	'to struggle uselessly'	dental- alveolar
44.thiedho	'to cure'	dental
45. thoth	'many/a lot of ' adj.	dental
46. thuno	' breast' n.	dental-alveolar
47. thedho	'to forge'	dental
48. tielo	'foot' n. tiende pl.	alveolar
49. tielo	'to press down' v.	alveolar

APPENDIX D: DIGITAL AUDIO RECORDING

RADIO LAKE VICTORIA

PROFILE INFORMATION

Radio L. Victora broadcasts on 92.1 FM. It is owned and operated by Osiepe nam Lolwe - Osienala (Friends of Lake Victoria), a local non-governmental organization operating in the Lake Victoria region in Kenya. The group originally focused on environmental issues but diversified into other issues like HIV and AIDS, primary healthcare, human rights, socio-economic issues and politics. The station's slogan is '*Duond joka nyanam*' which translates to voice of the lake people. Up to 90 percent of the broadcasts on Radio Lake Victoria are in Dholuo. The target audience is three million people mostly Luos. Other local radio stations that broadcast in Dholuo include Ramogi FM owned by royal media services and KBC has also a vernacular wing. (Source : www.redorbit.com and www.osienala.org/rlvfm.html)

Transcripts from Radio L. Victoria (Nam Lolwe)

Radio Lake Victoria duond Joka Nyanam

8th August 2011: Radio Transcript.

Jaduong Ogara Taifa:

Mae Radio L. Victoria **duond** Jokanyanam e chenro ma odiechieng' ma kawuono. Anywola, jowinjowa, wadwoko ne uru erokamano kuom winjowa odiechieng' ma kawuono. Anywola ochare, to koro anywola gi, be nitie kama ber moro nitiere? Kose gichare achaya throughout? To kok kamano to rach gi en mane to ber gi en mane? Onge gima Nyasaye ochweyo ma onge ber ne to gi rach ne. Chon ne (anyuola) gi chal nade kaka ne gi dak to sani gi chal nade? Anywola ma chon ema ne rach kata ne gi ber? Koro

mae ema wadwaro tungo iye mosmos ma ng'ato moro winj ma mi kipoo mana koloro redio nikech seche moko anywola ne odare kuma **noninde.**

" Iselawo **nindo** ahinya e dala na ni, koro ariembi!"

Yawa jodongo opuonjo gi ma naneno kuma nadak.

"Ki dak e yi anyuola ere ber mineno e anywolani no?"

"Iwinjo wach?" (*Jaduong Ogara Taifa asks*)

Eeh wawinjo wach. Kaka wan jodongo angwen". *(The audience responds)*

Jaduong' Cosmas Juma konya. Jaduong' ka wachako mokwongo daher ni iket ni jokanyanam, ni anywola **tiende** nang'o? Anywola oting'o jomage?

Jaduong' Cosmas Juma:

"Agoyo erokamano kimiya ni mondo alerni jo piny mondo jothurwa ong'eye gima anywola ne en, kaka anywola monywolore kochako ka joka kwaro chon. Ji ne oherore e yo machalo kama: ji gedo kanyachiel, ji nodak kanyachiel, kendo ne gitiyo kanyachiel. Ne ok ji opogore. Joka ng'ato ne gi dhi gi chokore. Naneno kwara kuma kwerewa ochokore. Ochola Nyarndiga gi wuonwa miluongo ni Gabriel Onyach ne gi chokore kanyachiel".

Jaduong Ogara Taifa:

Jaduong' Cosmas koro lerne jokanyarnam mokwongo , **tiend** anywola.

Jaduong' Cosmas:

Anyuola ni, anywola ni oriwo joka wuone, to gi mine, to gi yowuote mane ji obet kanyachiel. mano iluongo ni anywola. Joka ngáne joka kwere moriwore kanyachiel, ne gi dak kanyachiel chon ka joka ng'áto. Ji opogore ka ji mako lope. Chon mineno ji ne oherore, tich mane gitiyo ne gitiyo kanyachiel. Konyo ng'ato e wach . Ingeyo gi ma ne

ber gi anywola ka chandruok odonjo e dala ji ne riwore to gi tiyo kanyakla. Ji tee ne bet kendo gitedo chiemo ma ji chamo kanyachiel. Ne onge gimoro mowe go ng'ato. Chiemo ne aa oko to ji nekonyore jirani machiegini gi machiegini. Ne **tedore** chiemo, ne ruwore nyuka, ne **nyonyore** nyoche, ikelo ne ji kanyo. Anywola ne bet kanyachiel , anywola nok pogore . Lowo ne ok lar, loo ne **thoth**, lowo ne **ng'eny** nikech jokang'ato ne gi loso dalagi, gi dak adaka kanyachiel, nyaka koro nochopo kama koro gimanyo lope e ka ji ochako wach lope.

Ng'ato ne leng'óre to dhi e bungu kamoro to obeto. Piny ne lach. Oweyo jaode, obedo abeda kuro, otiyatiya , ogero mana abiche moro. To chon anywola ne bedo wang' achiel , ne ok gipogore koro omiyo ber anywola gin mane? Ne giherore ka chandruok odonjo e dala gi kanyo, to gikawo to ne gitiyo kanyachiel. Ka ng'ato dwa kendo to gi luwore kaka ne gin. Ng'ama **ng'óngo** kwongo kendo kas to ng'a machielo luwe. Ng'ato ne wuok gi jaode kas to odhi omako lowo. Ng'ani dhi goyo dala ne, ng'at machielo bende. Mano **nyiso** ni anywola ne oherore. **Tedo** kanyachiel, tiyo kanyachiel.

Anywola **tinende** ni gi wach moro. Anywola ma sani opogore, ma sani ngáto ogar mana kende owuon. Saa moro inyalo…. iweya aweya be ok idwar anywola… Ber anywola machon ok onego wee. Ng'ato ok onego we anywola. Anywola ni gi weche ma**ngény** . Anywola ka chandruok odonjoni mar tho ok many ng'at machielo. Ipenjo ni anywola ni ere to anywola ni en mane. Ka tho odonjo gin ema imanyogi mondo gi kaw ting'. Ing'eyo ni ka ng'ato tuo kabisa , anywola lworo, donjo kama intie. Anywola dhi adhiya, anywola ber. Ne aneno e dala gi Sikuku . Sikuku no ema imanyo ni Jakom ere? En obedo kaka Jakom mar gi josodo emomiyo . Ma en koro anywola ok dware , mano ineno ka gi ng'ado rieko moro.

Anywola makare en anywola mawinjore mabedo piny to pimo wach. Anywola mabedo piny to ngado buchgi kendgi , kendo gi loso gik makonyo. Emomiyo wapuonjo wachni. Ji odog e wach machon ma wach hera. Mae e ber anywola machon mane wan godo, emomiyo ji onego dog e hera machon. Joluo odog e tim machon mane gin go nikech chon ne wan kanyachiel to ne wakonyore. Rach mantiere sani; ma jowa biro wacho kaka awache.

Data from the radio transcript

	Word	**Gloss**	**consonant harmony type**
1.	**d**uo**nd**	'voice of' poss.	coronal- alveolar/alveolar
2.	**n**o-**n**i**nd**e	'that slept'	coronal (alveolar combination)
3.	**n**i**nd**o	'sleep'	coronal
4.	**t**ie**nd**e	'meaning'	coronal
5.	**t**ie**nd**'	'meaning of' (poss)	coronal
6.	**t**e**d**o	'cooking'v.i	coronal
7.	**ny**o**ny**ore	'ideophone'	dorsal
8.	**th**o**th**	'many'	coronal
9.	**ng'**e**ny**	**'**plenty/a lot'	dorsal
10.	**ng'ongo**	big/elderly	dorsal
11.	**nyiso**	tell	dorsal / free variation data

APPENDIX E: Chomsky and Halle's distintive feature matrix for nasals.

	m	n	ɳ	ɲ	ŋ
Cons.	+	+	+	+	+
Cont	_	_	_	_	_
Nas	+	+	+	+	+
Lat	_	_	_	_	_
Lab	+	_	_	_	_
Ant.	+	+	_	_	_
Cor.	_	+	+	+	_
High	_	_	_	_	+
back	_	_	_	_	+

Adapted from Katamba (1989, p.54)