NASAL STRENGTHENING

IN

NORTHERN SOTHO

BY

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DECLARATION

I, the undersigned, hereby declare that the work contained in this assignment is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

ABSTRACT

This study focuses on the phonological process of Nasal Strengthening in Northern Sotho. It sets out to employ two phonological models to describe the phenomenon in order to determine which model presents the most credible explanation for the phenomenon. The core elements of a classical linear model, the so called SPE model of Transformational Generative (TG) phonology is described and applied to the phenomenon. It is indicated that a number of phonological rules are actually involved in the process as a whole. It is argued that the following rules are in fact involved in the generation of appropriate phonetic outputs: a strengthening rule, a homorganic nasal assimilation rule and a nasal deletion rule. The previously inexplicable /k'/ insertion rule is shown to be nothing more than part of a more general process of glottal stop strengthening. This is indeed a new view with respect to the traditional stance on "vowel strengthening." Although the majority of the sound changes may be accounted for within a TG model, the formalism of the strengthening rule itself unfortunately does not reflect any phonetic explanation for the phenomenon. A second, non-linear, phonological model, i.e. a Feature Geometry model (FG) is described and applied to the same phenomenon. It appears that although the more contemporary FG model presents innovative ideas on the structure of phonological representations and processes, it can not account for the strengthening of voiced fricatives at all. At the most this model seems to be able only to account for voiceless fricatives being strengthened to voiced obstruents. It is clear that none of the models can present a complete and credible account of Nasal Strengthening in Northern Sotho.

OPSOMMING

Hierdie studie focus op die proses van Nasaalversterking in Noord Sotho. Twee fonologiese modelle word gebruik in die analise van die verskynsel ten einde te bepaal welke model die mees geskik is om 'n geloofwaardige verklaring aan te bied. Die hoofelemente van 'n lineêre Transformasioneel Generatiewe (TG) model word beskryf en toegepas in Noord Sotho. Daar word aangetoon dat die proses uit 'n verskeidenheid verwante prosesse bestaan en daar word geargumenteer dat die volgende reëls almal 'n rol speel: 'n verstekingsreël, 'n homorgane assimilasiereël en 'n nasaaldelesiereël. 'n Vorige onverklaarbare /k'/ invoegingsreël word geherinterpreteer as 'n glottale stop versterkingsreël wat nuwe verduidelikings bied vir die sg versterking van vokale. Alhoewel die meeste van die klankwisselinge verantwoord kan word binne 'n TG model, bied die format van die versterkingsreël ongelukkig geen fonetiese motivering vir die proses aan nie. 'n Tweede model, die sg Kenmerkgeometrie (KG), is vervolgens beskryf en toegepas. Dit het heel gou geblyk dat hierdie model, ten spyte van baie innovasies, nie in staat is om die versterking van stemhebbende frikatiewe te verantwoord nie. Dit kon slegs 'n sinvolle beskrywing van die versterking van stemlose frikatiewe moontlik maak. Uit hierdie studie blyk dit dat nie een van die twee modelle wat aangewend is 'n volledige en geloofwaardige beskrywing van die verskynsel van Nasaalversterking in Noord Sotho kan aanbied nie.

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1.1 INTRODUCTION

This study focuses on the analysis of the Nasal Strengthening process in Northern Sotho. This analysis takes place within the linear and non-linear phonological theories known as Transformational Generative (TG) and Feature Geometry (FG) respectively. The core concepts of these two phonological models will be investigated with the idea to determine which of these models provide a better understanding of the Nasal Strengthening process in Northern Sotho.

Both TG and FG models deal with sound changes in normal speech in which consonants are involved. These sound changes are normally the result of the application of a specific phonological process which may either be universal in character or language specific. Contemporary phonological theories by and large do not consider a phoneme as an indivisible unit, but rather as a composition of distinctive features. The manner in which distinctive features are assigned to a particular segment will be dealt with later within a number of phonological rules that derive the phonetic realisation of consonants from a specific underlying representation.

1.1.1 LINEAR PHONOLOGICAL MODEL

An example of a linear phonological model is a classical generative model proposed by Chomsky and Halle (1968). It is also known as "The Sound Patterns of English" or SPE – Model. This model constructs set of rules that constitute the phonological components of grammar, cf. Clark & Yallop (1990:154). The pioneers of this linear model launched a vigorous attack on phonemics and structuralism in general, cf. Clark & Yallop (1990:152).

The Transformational Generative model abandons the concepts of phonemes and allophones and introduced new concepts such as:

- distinctive features
- phonological rules
- underlying representation and
- phonetic representation.

All these concepts are the characteristics of a linear model, and they signify that the model is an input and output model.

The nasal strengthening process involves the / N + C / and the / N + $^?$V / sequence. / N / denotes a nasal segment that serves both as an objectival concord of the first person singular (1st p) as well as a class prefix of noun classes 8, 9 and 10. It originates from the Northern Sotho reflex of the UR- Bantu archetype prefix * ni – or * ne. It may be prefixed to a verb stem to form a verb.

Examples:

[1]   a.   / N + βɔn+ a/   →   [mp'ɔna]   "see me"

      b.   / N + ɤat'+ a/   →   [ŋkxhat'a]   "tread on me"

      c.   / N + ʃup'+ a/   →   [ɲtʃhup'a]   "point me"

      d.   / N + ɭɔm + a/   →   [nt'ɔma]   "bite me"

From examples [1] a – d, two phonological processes are crystal clear, namely: nasal assimilation and nasal strengthening. / N / is a nasal segment that undergoes assimilation. The consonants, / β /, / ɤ/, / ʃ / and / ɭ/ are examples of the initial consonants of the verb stem.

The / C / in the / N + C / combination signifies each initial consonant that is in juxtaposition with the nasal segment / N /. It conditions nasal strengthening and also acquire the place of articulation of the following consonants or spreads its features to the following consonant. This results in the nasal segment to assimilating and becoming homorganic to the initial consonant. For instance, [m], [ŋ], [ɲ] and [n] are homorganic to the initial consonants [β], [ɤ], [ʃ] and [l], respectively. These consonants [m, ŋ, ɲ, n] constitute a coherent class of phonetically similar sounds known as a natural class, cf. Katamba (1989:101). In most instances after the nasal assimilation process, the output is a nasal compound that is a resulting nasal segment from the nasal assimilation process and the initial consonant; e.g.

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The Transformational Generative model abandons the concepts of phonemes and allophones and introduced new concepts such as:

- distinctive features
- phonological rules
- underlying representation and
- phonetic representation.

[2] a. / N + β / → [mp']

  b. / N + ɣ / → [ŋkxh]

  c. / N + ʃ / → [ɲtʃh]

  d. / N + ɻ / → [nt']

From examples [1] and [2] the nasal / N / is retained on the surface level because it serves as an objectival concord of the first person singular. There are cases whereby it does not appear at the surface level, e.g.

[3] a. / N + β / → [p']

  b. / N + ɣ / → [kxh]

  c. / N + ʃ / → [tʃh]

  d. / N + ɻ / → [t']

Examples of the / N + ˀV / sequence:

[4] a. / N + ˀaraβ + a / → [ŋk'araβa] "answer me"

  b. / N + ˀɛlɛ + a / → [ŋk'ɛlɛla] "remember me"

  c. / N + ˀ ik'ilɛtʃ + a / → [ŋk'ik'ilɛtʃa] "forbid me"

  d. / N + ˀ uk'amɛl + a / → [ŋk'uk'amɛla] "look down at me"

The / ˀ V / in the / N + ˀ V / sequence signifies the glottal stop and a vowel which is in juxtaposition with the nasal segment / N /.

The examples in [4] have the glottal stop and vowels such as / a /, /ɛ/, /i/ and /u/ in the initial positions of the verb stems. They are examples of initial glottal stop and vowels of a verb stem. The nasal segment even in this case, still causes nasal strengthening to the following

consonant. Thus, the preceding nasal assimilates, and becomes homorganic to the glottal stop. This makes the nasal segment [ŋ] more similar to the glottal stop which is realised as strengthened [k'].

1.1.2 GENERAL REMARKS ON NORTHERN SOTHO PHONOLOGICAL DESCRIPTIONS

The phonological descriptions found in Northern Sotho are by large presented within a structuralist model. The central focus of the structuralist model is on the phoneme and allophone. Structuralist linguistics were preoccupied with systems of elements rather than the system of rules. They were concerned with the observation, collection as well as the description of information. Data is described in terms of segments (phonemes) facilitating a contrast between words e.g.

[5] / rɛta / vs / rɛna /

The word / rɛt'a / 'to praise' and / rɛna / "to govern", have identical sounds in all respects except for a single sound that occupies the same place in the sequence. Therefore the phonemes / t' / and / n / have to be regarded as contrastive sounds that ascribe the difference in meaning between / rɛta / and / rɛna / and are termed minimal pairs. Minimal pairs are two words which are identical except for one element in the sequence.

Most of Northern Sotho descriptions comprise lists of collected, classified and described data. They describe a process such as "palatalisation" by listing examples and postulating different 'rules'. They do not provide adequate **explanation** for the sound changes that take place. These descriptions invariantly also provide a number of "exceptions" without attempting whatsoever, to explain why these are exceptions.

The exceptions which were encountered by taxonomic linguists (pre-generativists), led to the development of a linear model that deals in considerable detail with the untenable assumptions of the pre-generativists. Pre-generativists described phonological processes such as nasal strengthening unsatisfactorily.

If ever a model describes phonological sound changes unsatisfactorily, it is necessary that other linguistic models that could provide an adequate explanations be developed.

1.1.3 NON-LINEAR PHONOLOGICAL MODEL

The Feature Geometry (FG) model is non-linear in nature and differs from a linear model on account that it (FG) provides for a hierarchical ordering of features. It organises features in a hierarchical tree known as a feature tree, cf. Gussenhoven & Jacobs (1998:172 – 173). It was pioneered by the phonologists such as Clements (1985) Sagey (1986) and McCarthy (1988), cf. also Gussenhoven and Jacobs (1998:175).

The nature and origin of Feature Geometry is anchored firmly in the tradition of non-linear phonology as an extension of a linear model, cf. Broe. (1992:149). Feature Geometry was proposed because a linear model was found incapable of dealing adequately with certain range of phonological issues such as simultaneous application of rules. The linear model did not account for simultaneous rule ordering which apply together to one string of representation.

The implicit assumptions of Transformational Generative that rules apply in a linear order, and that phonological features are unordered, lead to the postulation of Feature Geometry by Clements (1985) who has contributed to the development of Feature Geometry. He is regarded as the person coining the term "feature geometry" itself.

Feature Geometry organises features in a hierarchical tree. This implies that some features may be dominated by others whilst other may be holistically independent. The model describes the way in which phonological features are structured, and phonologists such as Clements, model features as a tree, designed to reflect the way in which features are interrelated, cf. Clark and Yallop (1990:381 – 82) and Gussenhoven and Jacobs (1998:172).

Before considering exactly how hierarchical trees are applied in phonological analysis, one typical model of such a tree will provisionally be employed to describe the segments of Northern Sotho in particular. Consider the following tree representation:

[6]   [pʰ]

root: [+ cons]
                                                       [- sonor]

structure:

cavity: oral   supralaryngeal

articulator: labial   glottal

terminal features: [+ spread]   [- voice]
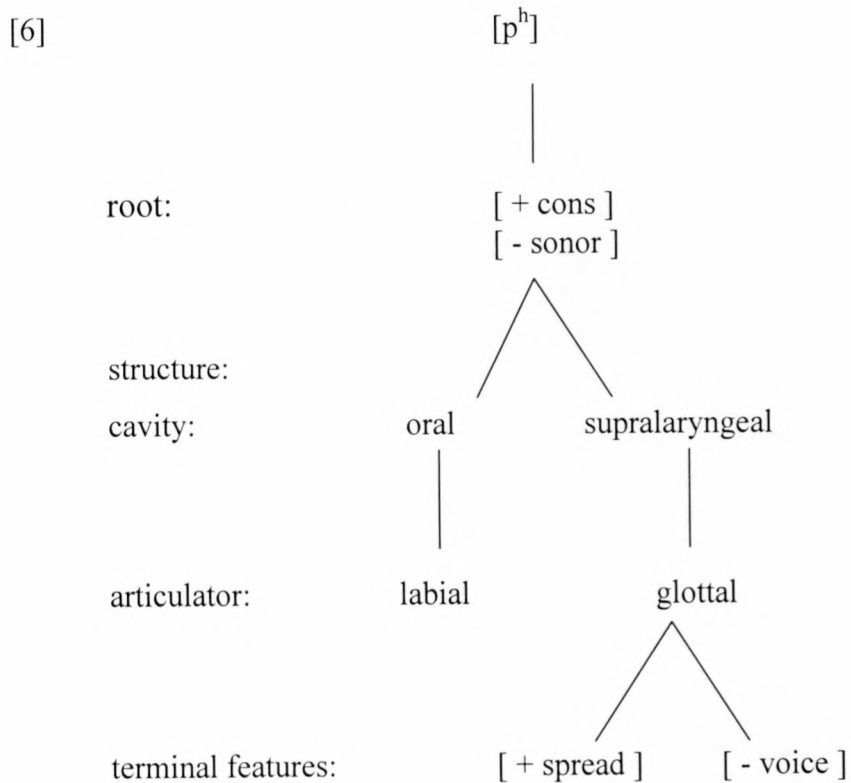
This tree or feature representation carries through to specifications of individual segments, so that the feature representation of / pʰ / for instance might be displayed rather than as a simple array of unordered features. This tree is also explained by Halle (1992) and Kenstowicz (1994:145 – 159).

Diverse models of these hierarchical representations were developed and applied in phonological analysis. The nature of the feature tree is determined by the way and the manner in which the components react in phonological analysis. Adaptations will be made in this study as well.

Compare the following illustration of a Feature Geometrical model by Sagey (1990):

[7]

Root

[strident]
[consonantal]
[continuant]
[lateral]
[sonorant]

Laryngeal

[constr] [spread] [stiff] [slack]

Supralaryngeal

soft palate   place

nasal   labial   coronal   dorsal

[round] [ant] [distr] [back] [high] [back]
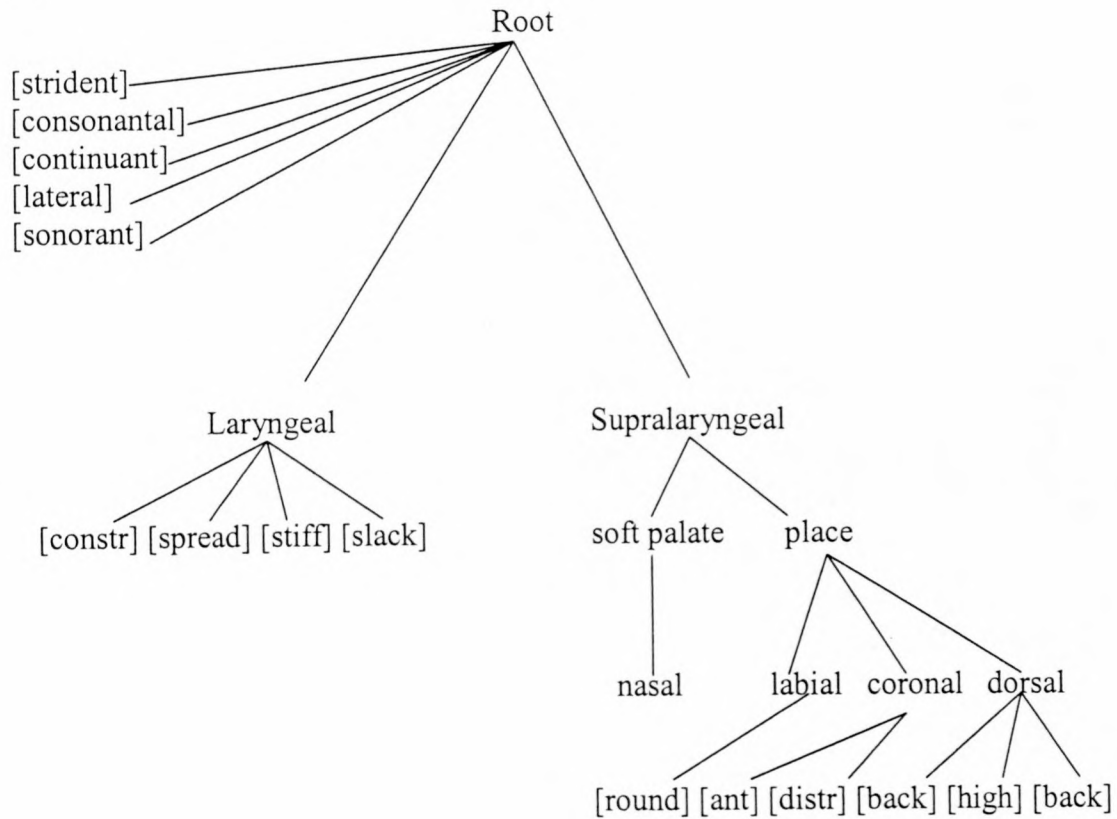
The core concepts that characterise the Sagey model are the following:

1.1.3.1 THE ROOT NODE

The root node dominates all features and denotes the coherence of the segment as a phonological unit. Both laryngeal and supralaryngeal features are dominated by the root node. The manner features [strident], [continuant], [consonantal], [sonorant] and [lateral] adhere to the root node. The root node is the topmost node of the tree.

1.1.3.2 THE LARYNGEAL NODE

The laryngeal node forms the second phase of the hierarchy which is attached to the first phase namely; the root node. The laryngeal node consists of the following vocal features:

(a)   [spread] :   indicates a spread glottis

(b)   [constriction]: indicates a constricted glottis

(c)   [stiff] :   refers to stiff vocal folds

(d)   [slack] :   refers to slack vocal folds

A rule applying to a laryngeal node would include all the features attached to it. The laryngeal features may spread and delink not only individually, but as a unit cf. Clements and Hume in Goldsmith (1995:269)

1.1.3.3 THE SUPRALARYNGEAL NODE

The supralaryngeal node is also the second phase of the hierarchy and is divided into soft palate and place node that in turn have their own dependants. A rule applicable to the supralaryngeal node would affect the soft palate with its constituents and the place node with its daughters.

1.1.3.4 THE PLACE NODE

The place node constitutes the third level of the hierarchy. It dominates the place features. Within the place node there are three articulator nodes such as [labial] that dominates [ant] and [distr]. The [dorsal] node dominates [high], [back] and [low]. A rule applicable to the place node would include the articulatory features and their dependants. The place and soft palate are twin sister nodes.

1.1.3.5 THE ARTICULATOR NODES

The articulator nodes refer to features [labial, dorsal, coronal]. The feature called labial has its own baby [round], [coronal] dominates [anterior] and [distributed] and [dorsal] dominates [high], [back] and [low]. A rule applicable to articulator nodes would affect their dependants.

1.1.3.6 THE SOFT PALATE

The soft palate is on the same level with the place node. It incorporates the feature [nasal]. A rule applicable to the soft palate would include the feature [nasal] since it is the baby of the soft palate, cf. Clements and Hume in Goldsmith, (1995:245 – 306), Crystal (1985) and Gussenhoven and Jacobs (1998:172 – 86).

1.2   THE AIM OF THE STUDY

The aims of this study are to:

(a)   analyse the phenomenon of Nasal Strengthening in Northern Sotho in terms of

      (i)   a Transformational Generative (TG) and

      (ii)   a Feature Geometry (FG) model,

in order to determine which of these two models presents a better understanding of the phenomenon;

(b)   illustrate that the previous treatment of the nasal strengthening phenomenon do not really present an explanation;

(c)   indicate the deficiencies that occur in previous treatment of the Northern Sotho Nasal Strengthening phenomenon in Northern Sotho.

CHAPTER 2

LINEAR ANALYSIS: NASAL STRENGTHENING IN NORTHERN SOTHO

2.1   INTRODUCTION

This chapter deals with:

(a)   A general exposition of the phenomenon of Nasal Strengthening in Northern Sotho.

(b)   The core concepts underlying a specific version of a linear phonological model.

(c)   An analysis of Northern Sotho data in terms of this model.

2.2   THE NATURE OF NORTHERN SOTHO NASAL STRENGTHENING DATA

2.2.1   GENERAL DEFINITION OF NASAL STRENGTHENING

Nasal Strengthening implies the intensification of a sound segment, i.e. the changing of a continuant consonant into a non-continuant consonant due to the influence of a nasal segment e.g.

[8]   / N + βɔn + a /   →   [mp'ɔna]   "see me"

A fricative continuant sound / β / is strengthened into a stop / p' /

Nasal Strengthening comprises two related phonological process because in example [8], there are two phonological processes that are emerging, i.e. nasal strengthening and nasal assimilation. e.g.

[9]   / N + β / > [Np'] > [mp']

From [8] and [9] / N / and / β / are two essential sound segments for Nasal Strengthening and Nasal Assimilation (NA) to take place in the environment / N + β /. The nasal consonant / N / influences the consonant / β / to strengthen into a stop [p'], and the labial consonant / p' / conditions the nasal / N / to assimilate into a homorganic labial nasal [m]. Thus in the case of NA / N / is a target and the labial consonant / p' / is a trigger.

From [9] it is clear that assimilation is a phonological process that refers to the influence exercised by one sound segment upon the articulation of another sound, so that the two sounds become identical or similar (cf. Crystal 1991).

Nasal Strengthening in Northern Sotho is a process whereby either an objectival prefix of the first person singular or the class prefix of classes 8, 9 10 influence the following segment juxtaposed to it to strengthen it into a stop.

2.2.2 NORTHERN SOTHO DATA

This section explicates the morphological structures underlying Nasal Strengthening in Northern Sotho.

Nasal Strengthening process in Northern Sotho takes place on the following sequences,

[10]   / N + C / or / N (i) + C / and / N + ?V / combinations

Compare the following data:

a.	mpona:	/ n + βɔn + a/	[mp'ɔna]	"see me"
b.	mpha:	/ n + f + a/	[mpha]	"give me"
c.	nthata:	/ n + rat' + a/	[nthat'a]	"love me"
d.	nkgata	/ n + ɣat' + a/	[ŋkxhat'a]	"tread me"
e.	nkhemiša	/ n + hɛm + iʃ+ a /	[ŋkhɛmiʃa]	"help me to breathe"
f.	ntšeŝa	/ n + ʒ +iʃ+ a /	[ŋtʃɛʃa]	"feed me"
g.	nkapara	/ n + ?ap'ar+ a /	[ŋk'ap'ara]	"attack me"
h.	nkeka	/ n + ?ɛk'+ a /	[ŋk'ɛk'a]	"betray me"
i.	phošo	/ n + fɔʃ +ɔ /	[phɔʃɔ]	"mistake"
j.	pono	/ n + βɔn +ɔ /	[p'ɔnɔ]	"vision"
k.	kholo	/ n + hɔl +ɔ /	[khɔlɔ]	"assistance"

l.	kgopolo	/ n + ɣɔp'ɔl + ɔ /	[kxhɔp'ɔlɔ]	"thought"
m.	temo	/ n + lɛm +ɔ /	[t'ɛmɔ]	"agriculture"
n.	pshatlo	/ n + fʃatl+ɔ /	[pʃhatl'ɔ]	"smashing"
o.	pšalo	/ n + βʒal+ɔ /	[pʃalɔ]	"planting"
p.	karabo	/ n + ˀaraβ+ɔ /	[k'araβɔ]	"answer"
q.	kepo	/ n + ˀɛp'+ɔ /	[k'ɛp'ɔ]	"crowbar"
r.	ipona	/ ni + βɔn+a /	[ip'ɔna]	"see oneself"
s.	ithata	/ ni + rat+a /	[ithat'a]	"love oneself"
t.	ikapeša	/ ni + ˀap'ɛʃ+a /	[ik'ap'ɛʃa]	"dress oneself"
u	ikoka	/ ni + ˀɔk'+a /	[ik'ɔk'a]	"nurse oneself"

From the data in [10] it is clear that there are different Northern Sotho words emanating from the use of the objectival concord of the first person singular and the class prefix of class 9, which has the plural form in class 10. The class prefix of class 10 is / Ɉi(n) / and is prefixed to the noun as in:

[11]	a.	dipono	/ Ɉi(n) + p'ɔn + ɔ /	→	[Ɉip'ɔnɔ]	"visions"
	b.	dikepo	/ Ɉi(n) + kɛp' + ɔ /	→	[Ɉikɛp'ɔ]	"crowbars"
	c.	dikgato	/ Ɉi(n) + ɣat + ɔ /	→	[Ɉikxhat'ɔ]	"steps"
	d.	ditemo	/ Ɉi(n) + tɛm + ɔ /	→	[Ɉit'ɛmɔ]	"farms"

For more information consider Appendix A entitled Northern Sotho data. This section should be viewed as a summary of the contents of this study as a whole, with the idea to represent all relevant morphological structures of Northern Sotho data as presented in the examples.

Also refer to the following set of distinctive features for Northern Sotho which will be used in this study.

2.3   **SET OF DISTINCTIVE FEATURES FOR NORTHERN SOTHO**

Sounds of a language may be analysed in terms of a set of distinctive features. For Northern Southo the following features are applicable:

2.3.1   **HIGH OR NON-HIGH: [+/- HIGH]**

High sounds are produced by raising the body of the tongue towards the ceiling of the mouth. Non-high sounds are produced without such a raising.

2.2.2   **BACK OR NON-BACK [+/- BACK]**

Back sounds are pronounced by retracting the body of the tongue in the direction of the rear wall of the pharynx and non-back sounds are produced without such a retraction.

2.2.3   **LOW NON-LOW: [+/– LOW]**

Low sounds are produced by lowering the body of the tongue to a level below the neutral position. Non-low sounds are produced without such a lowering.

The three features mentioned above are used for both consonants as well as vowels.

2.2.4   **CORONAL OR NON-CORONAL: [+/– COR]**

Coronal (cor) sounds are produced with the blade of the tongue raised from the neutral position.

Palatals, dentals, palato-alveolars an alveolars are marked [+ coronal] but velars, uvulars, labials and pharyngeals are marked [- coronal].

2.3.5   **ANTERIOR OR POSTERIOR: [+/- ANT]**

Anterior (ant) sounds are pronounced with a primary constriction located in front of the alveolar ridge. Posterior sounds are produced with a constriction behind the alveolar ridge.

Labials, alveolars and detals are marked [+ anterior] while velars, palatals, uvular and palato-alveolar are marked [- anterior].

2.3.6 **LATERAL OR CENTRAL [+/– LAT]:**

Lateral sounds are formed in such a way to stop the air stream from flowing outward through the centre of the mouth, but allow air stream to pass across the side of the tongue, while central sounds are not affected by such a constriction.

Fricatives, affricates and lateral sonorants are marked [+ lat] and all other sounds are marked [- lat].

2.3.7 **NASAL OR ORAL: [+/– NAS]**

Nasal sounds are formed by lowering the velum and allowing the air to pass outward through the nose, and are marked [+ nas]. Oral sounds are pronounced with the velum raised to prevent the passage of air through the nose, and are marked [- nas].

2.3.8 **CONTINUANT OR STOP: [+/- CONT]**

Continuant sounds are produced with a primary constriction which allows the air to flow through the mid-sagittal region of the vocal tract and are marked [+ cont] while stop sounds are produced with a sustained occlusion and are marked [- cont].

2.3.9 **VOICED OR VOICELESS: [+/- VOICED]**

Sounds produced with vibrations of the vocal cords and are marked [+ voiced] while voiceless sounds are produced with a glotal opening so wide that it will stop vocal vibration if air flows through it, and are marked [- voiced].

2.3.10 **STRIDENT OR NON-STRIDENT: [+/- STRID]**

Strident sounds are pronounced with a constriction forcing the air stream to strike two surfaces producing a high-intensity noise and are [+ strid]. Strident sounds differ from their non-strident counterparts by faster airflow and a rougher surface, and are [- strid]. Fricatives are normally regarded as strident sounds.

2.3.11 **DELAYED OR INSTANTANEOUS RELEASE: [+/- DEL REL]**

There are two ways in which a closure in the vocal tract may be released, either instantaneously as in the plosives or with a delay as in the affricates. In delayed release turbulence is generated in the vocal tract so that the release phase of affricates is acoustically quite similar to the cognate fricative.

2.3.12 SPREAD OR NON-SPREAD GLOTTIS: [+/- SPREAD]

Spread sounds are produced by a displacement of the arytenoid cartilages creating a wide glottal opening while non-spread sounds are produced without this gesture. Aspirated sounds result from a spread glottis.

2.3.13 CONSONANTAL OR NON-CONSONANTAL: [+/- CONS]

Consonantal sounds are produced with a constriction in the vocal tract at least equal to that found in the fricative consonants while non-consonantal sounds are produced without a constriction.

Current phonological theories by and large subscribe to the notion that a sound is composed of a set of distinctive features. Thus, instead of viewing segments such as / ɣ / and / k' / as unitary elements, they are rather regarded as bundles of features as depicted below in [12].

[12] / ɣ / / k' /

$$\begin{bmatrix} + \text{ high} \\ + \text{ back} \\ + \text{ voice} \\ + \text{ cont} \end{bmatrix} \qquad \begin{bmatrix} + \text{ high} \\ + \text{ back} \\ - \text{ voice} \\ - \text{ cont} \end{bmatrix}$$

There is no real ordering associated with features employed. It means that the feature [+ voice] may be listed before the feature [+ high] or vice versa. That is how a linear model organises features.

Both / ɣ / and / k / share many features, but differ in two features namely, [voice] and [continuant]. The features [voice] and [continuant] bring a contrast between the two segments and are specified either positively or negatively with due respect to a particular phonetic feature, cf. Durand (1990:58) and Kenstowicz (1994:60).

No two languages are phonologically identical or have the same set of specifications, and therefore the distinctive features must, to some extent at least be language specific, hence any language has a limited number of phonological oppositions, cf. Clark & Yallop

(1990:368). The above-mentioned distinctive features, compare segments for similarities as well as differences, cf. Chomsky & Halle (1968:177) and Shane (1973:24).

2.4 PREREQUISITES FOR AN ADEQUATE SET OF DISTINTIVE FEATURES

When deciding on a choice of distinctive features, the following three prerequisites need to be kept in mind:

a. Each distinctive feature must have a phonetic correlate.

It must refer to human speech communication phases e.g.

(i) the articulatory – e.g. [voice]

(ii) an acoustic – e.g. [grave]

(iii) an perceptual phase – e.g. [sonorant]

b. Each distinctive feature must have a function to distinguish between segments, e.g. the feature [voice] serves to distinguish between / ɣ / and / k' /.

c Each distinctive feature must be usable in phonological rules.

It is not legitimate to use features that are never used in formulation of a phonological rule depicting a phonological process.

2.5 DISTINCTIVE FEATURE MATRIX

Compare the following distinctive feature matrix that will be used in this study:

	β	p'	f	ph	fʃ	pʃh	βʒ	pʃ	ɬ	tlh	l	t'	ɭ	s	tsh	r	th	ɣ	kxh	ɦ	kh	ʃ	tʃh	ʒ	tʃ	k'	m	n	ɲ	ŋ	ʔ
Cons	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cont	+	-	+	-	+	-	+	-	+	-	+	-	-	+	-	+	-	+	-	+	-	+	-	+	-	-	+	+	+-	+	-
Ant	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	+	+	-	-	-
Cor	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Nas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-
Voice	+	-	-	-	-	-	+	-	+	-	+	-	+	-	-	+	-	+	-	-	-	-	-	-	-	-	+	+	-	+	-
Strid	+	-	+	-	+	-	+	-	+	-	+	-	-	-	-	+	-	+	-	-	-	+	+	+	+	-	-	-	-	-	-
Lateral	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asp	-	-	-	+	-	+	-	-	-	+	-	-	-	-	+	-	+	-	+	+	+	-	+	-	-	-	-	-	-	-	-
High	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	+	-	+	+	+	+	+	+	-	-	+	+	-
Back	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	+	-	-	-	+	-
del rel	-	-	-	-	+	+	-	+	-	-	-	-	-	-	-	+	-	-	-	+	+	-	+	-	+	-	-	-	-	-	-

A linear model describes the notion that a sound segment is composed of a set of distinctive features which comprise two possible values represented as plus (+) or minus (-) signs, cf. Kenstowicz (1994:19) and Clark & Yallop (1990:156). The consonantal sounds on the matrix have been placed horizontally while features are vertically on the left-hand side. Each consonant is specified either positively or negatively for each feature, cf. Kenstowicz, (1994:21) and Chomsky and Halle (1968).

No two consonantal segments have the same set of specifications. It is also eminent to note that there is no real ordering associated with the above-mentioned matrix for distinctive features. This means that the feature [voice] can be listed before the feature [cons] on the matrix or visa versa, hence there is no fixed order.

Abbreviations on the matrix system some of the abbreviations on the distinctive feature matrix are as follows:

- cons = consonant
- cont = continuant
- ant = anterior
- cor = coronal
- nas = nasal
- strid = strident
- asp = aspirated
- del rel = delayed release

2.6 CORE CONCEPTS IN TRANSFORMATIONAL GENERATIVE MODEL (TG)

The Transformational Generative model as espoused by Chomsky & Halle (1968), *inter alia,* seeks to explain phonological processes. The model is characterised by the following core concepts:

2.6.1 Distinctive features

The distinctive features are set of properties that show the relationship between segments by listing the features for each segment. Such features are not in a fixed order and are freely combined as in example [12] above.

2.6.2   Underlying representation

The underlying representation is the phonological structure that is a representation of the unpredictable elements in an utterance. It contains all unpredictable information for every lexical item. It expresses the phonological unitary of the morpheme's allophones. cf. Gussenhoven and Jacobs (1998:54) and Clark & Yallop (1990:60). The underlying representation from which phonetic representation is derived, needs one or more rules to map the underlying representation into a phonetic representation.

2.6.3   Phonological rules

Phonological rules are used to map the underlying representation into phonetic representation. Phonological rules constitute a central part of a linear model. They are applied to alter the phonological representation of the morpheme in particular phonological contexts, and are regarded as expressions that describe alterations in the phonological representations of words, cf. Gussenhoven and Jacobs (1998:45, 86) and Hyman (1975:12).

The order-rule hypothesis maintains that phonological rules must be ordered to ensure that their interaction is properly done. The application of the first rule operates on the underlying representation. It is crystal clear that each subsequently employed rule operates on the output of the preceding rule or on the structure resulting from the application of the preceding rule, cf. Katamba (1998:122 – 28) and Kenstowicz and Kisseberth (1978:313 – 314).

In SPE Chomsky and Halle propose that rules should be linearly ordered. This means that each phonological rule of a language is sequentially applied, with the exception of the first rule. Before rule two may be applied in the sequencing of rules, rule one must be applied so that rule two may operate on the output of rule one, cf. Chomsky and Halle (1968). If one rule creates conducive conditions for the application of another rule, such kind of rule relationship is known as Feeding Order. The other side of the coin is also true. For instance, if one rule does not create the structure that meets the input requirement of another rule, such type of a rule relationship is said to be Counter-feeding Order, (cf. Gussenhoven & Jacobs, 1998:125).

2.6.4 Phonetic representation

The final output of a linear model is called the phonetic representation of the surface structure, which is in a string of linearly ordered phonetic segments. It is derived from the underlying representation by the application of phonological rules.

2.7 TRANSFORMATIONAL RULES

To account for the variations in example [10], the following rules may suffice:

2.7.1 STRENGTHENING RULE

Strengthening occurs when a continuant segment changes into a non-continuant segment e.g.

[13] **Strengthening rule**

$$\begin{bmatrix} + \text{cons} \\ - \text{vowel} \\ + \text{cont.} \end{bmatrix} \longrightarrow \begin{bmatrix} - \text{cont} \end{bmatrix} \Big/ \begin{bmatrix} + \text{nas} \end{bmatrix} \quad (i) + \underline{\quad\quad}$$
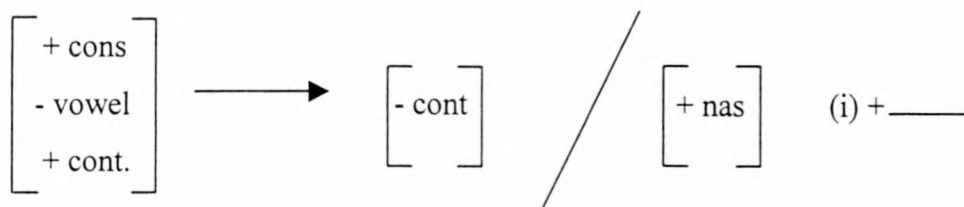
The rule states that the focus [+ cont, - vowel + cons] to the left of the arrow describes the input to the alteration as the continuant ([+ cont]) consonant. The output [- continuant] to the right of the arrow marks the feature change yielded by the rule.

The slash / marks the context in which the change takes place. The nasal [+ nas] represents any nasal preceding the consonant in a / N + CV / sequence. The reflexive morpheme (i -) is optional and as such the rule applies regardless of the presence or absence of any optional element. The reflexive morpheme denotes the reflexive object prefix of the first person singular. The plus sign (+) denotes the morpheme boundary and the dash "–" indicates the position of the segment undergoing the transformation, cf. Durand (1990:6), Kenstowicz (1994:21), Kenstowicz & Kisseberth (1979:34) and Katamba (1989:119).

2.7.2 HORMORGANIC NASAL ASSIMILATION

In the hormorganic nasal assimilation rule, the nasal takes on the characteristics of the following consonant e.g.

[14]   **Hormorganic nasal assimilation**

$$
[+\text{nas}] \longrightarrow
\begin{bmatrix}
\alpha \ \text{ant} \\
\beta \ \text{cor} \\
\gamma \ \text{high} \\
\delta \ \text{back}
\end{bmatrix}
\Big/ \quad \underline{\quad} +
\begin{bmatrix}
+ \ \text{cons} \\
\alpha \ \text{ant} \\
\beta \ \text{cor} \\
\gamma \ \text{high} \\
\delta \ \text{back}
\end{bmatrix}
$$
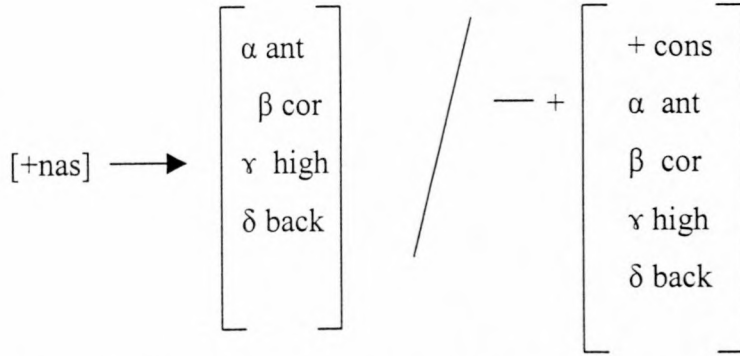
The nasal segment to the left of the arrow undergoes homorganic nasal assimilation to the right of the arrow and it assimilates to the place of articulation of the following consonant, cf.Van Rensburg, Van Wyk and Steyn (1973:87), Kipasky (1982:74), Katamba (1989:304) Wissing (1982:1982:174 – 186) and Ziervogel (1967:257).

In order to present the homorganic nasal assimilation rule, Greek letter variables such as α (alpha), β (beta), γ (gamma) and δ (delta) that range over both positive (+) or negative (-) values of an awarded feature are employed.

The Homorganic Nasal Assimilation rule has four sub-rules as in [15] below:

2.7.3 HOMORGANIC NASAL ASSIMILATION SUB-RULES

Homorganic nasal assimilation is divided into the following four sub-rules

[15]   a.
$$
\begin{bmatrix} + \ \text{nas} \end{bmatrix} \longrightarrow
\begin{bmatrix} + \ \text{ant} \\ + \ \text{cor} \end{bmatrix}
\Big/ \ \underline{\quad} +
\begin{bmatrix} + \ \text{cons} \\ + \ \text{ant} \\ + \ \text{cor} \end{bmatrix}
\qquad \text{Alveolar}
$$

b.
$$
\begin{bmatrix} + \ \text{nas} \end{bmatrix} \longrightarrow
\begin{bmatrix} + \ \text{ant} \\ - \ \text{cor} \end{bmatrix}
\Big/ \ \underline{\quad} +
\begin{bmatrix} + \ \text{cons} \\ + \ \text{ant} \\ + \ \text{cor} \end{bmatrix}
\qquad \text{Labial}
$$

c.
$$
\begin{bmatrix} + \ \text{nas} \end{bmatrix} \longrightarrow
\begin{bmatrix} + \ \text{high} \\ - \ \text{back} \end{bmatrix}
\Big/ \ \underline{\quad} +
\begin{bmatrix} + \ \text{cons} \\ + \ \text{high} \\ - \ \text{back} \end{bmatrix}
\qquad \text{Palatal}
$$

d.
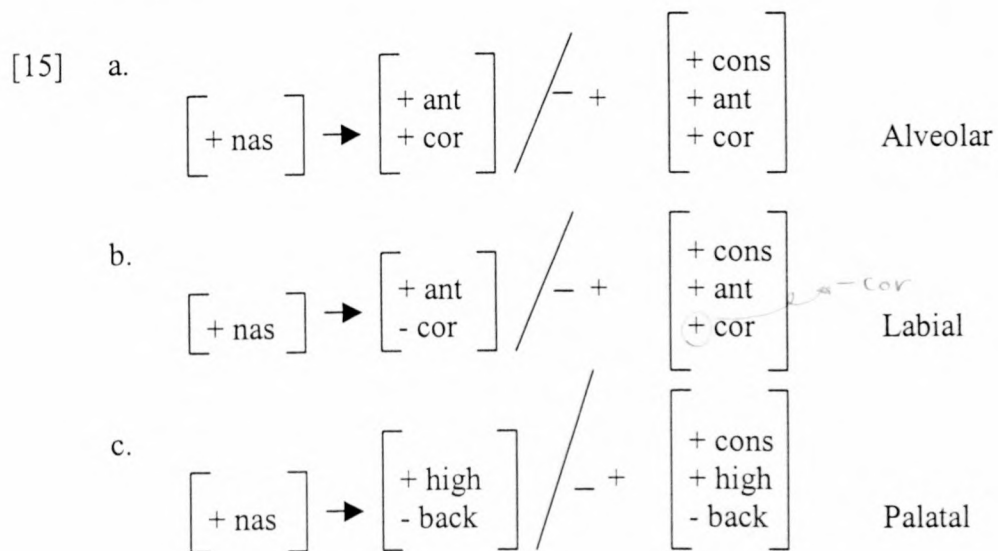
$$\begin{bmatrix} + \text{nas} \end{bmatrix} \longrightarrow \begin{bmatrix} + \text{high} \\ + \text{back} \end{bmatrix} \bigg/ \underline{} + \begin{bmatrix} + \text{cons} \\ + \text{high} \\ + \text{back} \end{bmatrix} \qquad \text{Velar}$$

The nasal of each sub-rule takes on the characteristics of the initial consonant of the verb stem. If the initial consonant of the verb stem is palatal (i.e. [+high]), then the nasal becomes palatal. It is realised as an alveolar when it is followed by an alveolar sound. It becomes velar when it is followed by a velar consonant and it becomes labial when it is followed by a labial consonant. Homorganic nasal assimilation sub-rules are responsible for the retention of homorganic nasal at the surface lever.

2.7.4   NASAL DELETION RULE

In this case the nasal is deleted at the surface level. In terms of nasal deletion rule, Schaefer assumes that nasal is always underlyingly present and it is deleted by rule if it is not stressed e.g.

[16]   **Nasal deletion rule**

$$\begin{bmatrix} + \text{nas} \end{bmatrix} \longrightarrow \emptyset \quad \begin{cases} \underline{}(i) + (CV)^4_2 & (i) \\[2ex] \underline{} + (CV)^4_2 + \text{ɔ} \# & (ii) \end{cases}$$

Thus the first rule is interpreted as: a nasal is deleted or becomes zero when it is followed by an optional reflexive morpheme and the morpheme boundary with the minimum of two and maximum of four syllables within the brackets.

The second rule states that a nasal is deleted when it is followed by morpheme boundary and the minimum of two and the maximum of four syllables within the brackets with the vowel ending / ɔ / before the word boundary (#). The second rule is by and large responsible for the class prefix of class 9, even though there are exceptional cases which are not covered by this rule.

2.7.5 **STOP RULE / GLOTTAL STOP RULE**

The glottal stop rule is whereby a glottal stop / $^{?}$ / is realised as / k' /. It is followed by a vowel in / N + $^{?}$V / combination as in:

[17] **Glottal stop strengthening**

$$
\begin{bmatrix}
+ \text{cons} \\
- \text{and} \\
- \text{cor} \\
- \text{back} \\
+ \text{ejective}
\end{bmatrix}
\longrightarrow
\begin{bmatrix}
+ \text{back}
\end{bmatrix}
\bigg/
\begin{bmatrix}
+ \text{nas}
\end{bmatrix}
\quad (i) + \underline{\quad}
$$
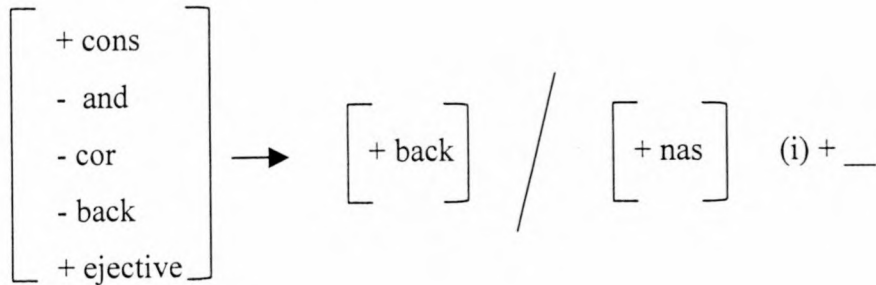
This means that a consonant which is [- ant], [- cor], [- back] and [+ ejective] becomes [+ back] when is preceded by a nasal, and optional reflexive morpheme and morpheme boundary.

2.8 **THE EXISTENCE OF A GLOTTAL STOP**

A glottal stop is underlyingly exists in the initial position of a verb stems commencing with vowels. Consider the following example:

[18] $^{?}$a | ra | βa

  CV CV CV
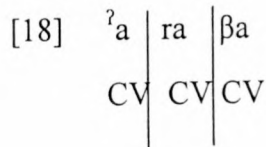
This example adequately describes that Northern Sotho has a / CV / syllable structure. Khan (1985:188) states that when verb stems starting with vowels are formulated, they result in the use of a glottal stop / $^{?}$ / for the consonant / k' /.

Therefore in a slow deliberate speech in Northern Sotho, the following is encountered:

Ke a e araba

[k'ε$^{?}$a$^{?}$ε$^{?}$araβa] "I am answering it"

In fast speech it will become   [k'εjajεɦaraβa]

In Northern Sotho the verbs starting with a vowel is underlyingly / CV / where / C / is / $^{?}$ /.

In slow speech the glottal stop is produced in the vocal folds when vocal folds are brought together. But in a rapid speech the glottal stop is produced as a vocalic glide / j / or / ɦ /.

In order to feel that, just press the larynx with two fingers and start articulating [k'ɛʔaʔɛʔaraβa] in slow speech and the same sentence in rapid speech. You will feel either a glottal stop in case of a slow speech or vocalic glide in case of a rapid speech in the vocal tract.

Therefore the glottal stop represents the activity within the vocal tract, cf. Khan (1985:188).

2.9   SAMPLE DERIVATIONS

The derivations that follow display four environments in which the strengthening rule and the homorganic nasal assimilation rule respectively take place. In order to identify which homorganic nasal is responsible for each homorganic nasal assimilation rule, study the homorganic nasal assimilation sub-rules in the preceding paragraphs. The placeless / N / represents both an object concord of the first person singular as well as the class prefix of class 9 as in [19].

2.9.1   OBJECTIVAL CONCORD OF THE FIRST PERSON SINGULAR

The objectival concord of the first person singular takes on various shapes depending on the initial consonant of the verb stem e.g.

[19]	a.	/ n + βɔn + a /	→	[mp'ɔna]	"see me"
		/ n + rat' + a /	→	[nthat'a]	"love me"
		/ n + ɣat' + a /	→	[ŋkxhat'a]	"tread me"
		/ n + ʃup' + a /	→	[ɲtʃhup'a]	"point at me"

Thus, it is argued that when saying a word such as mpona, 'see me', the mother tongue speaker of Northern Sotho goes through the following process:

[20]a. INPUT: Underlying representation   / n +βɔn + a /

rule 1:strengthening: β   p'

rule 2: homorganic: n   m

OUTPUT: Phonetic representation   [mp'ɔna]   "see me"

b. INPUT :   Underlying representation   / n + rat + a /

rule 1: strengthening: r   th

rule 2: homorganic: n   n

OUTPUT   Phonetic representation   [nthata]   "love me"

c. INPUT: Underlying representation   [n + ɤat + a]

rule 1: strengthening:ɤ   kxk

rule 2: homorganic: n   ŋ

OUTPUT: Phonetic representation   [ŋkxhata]   "treat me"

d. INPUT: Underlying representation   / n +ʃup'+ a /

rule 1: strengthening: ʃ   tʃh

rule 2: (hormorganic: n   ɲ

OUTPUT: Phonetic representation   [ɲtʃhup'a]   "point me"

The rule converting both / β /⟶/ p'/, / r / ⟶ / t h /, / ɤ/ ⟶/ kxh/ and /ʃ / ⟶/ tʃh /, does not adequately account for the change that took place, it has to be complemented by the homorganic nasal assimilation rule.

The labial fricative / β / can yield into a plosive [p']. It results from the strengthening process, because the labial nasal [m], aveolar nasal [n] , palatal nasal [ɲ] and the velar nasal [ŋ] all have an influence in this process because they are the causes of nasal strengthening.

2.9.2 DEVERBATIVE NOUNS IN OF CLASS 9

Deverbative are nouns derived from verb stems, also follow set rules of derivation, e.g.

[21]a. INPUT: Underlying representation / n +βɔn + ɔ # /

                 rule 1:strengthening: β   p'

                 rule 2: nasal-deletion: n   Ø

        OUTPUT: Phonetic representation   [pɔnɔ]   "vision"

   b. INPUT : Underlying representation / n + rɛk' + ɔ # /

                 rule 1: strengthening: r   th

                 rule 2: nasal-deletion: n   Ø

        OUTPUT Phonetic representation   [thɛk'ɔ]   "price"

   c. INPUT: Underlying representation / n + ʃup' +ɔ # /

                 rule 1: strengthening:ʃ   tʃh

                 rule 2: nasal-deletion: n   Ø

        OUTPUT: Phonetic representation   [tʃhup'ɔ]   "sign"

   d. INPUT: Underlying representation / n +ɣat' + a # /

                 rule 1: strengthening: ɣ   kxh

                 rule 2: nasal-deletion: n   Ø

        OUTPUT: Phonetic representation   [kxhat'ɔ]   "step"

In the case of deverbative nouns the nasal segment is deleted after it has caused nasal strengthening. The nasal deletion rule is obviously morphologically determined as no phonetic explanation exist for its deletion.

The examples in [21] are different Northern Sotho words from class 9. The plural forms of those words are found in class 10, i.e. as / ɺi(n) /

[22] (a) / ɺi(n) + βɔn + ɔ # / → [ɺip'ɔnɔ]   "visions"

     (b) / ɺi(n) + rɛk' + ɔ # / → [ɺithɛk'ɔ]   "prices"

     (c) / ɺi(n)+ ʃup' + ɔ # / → [ɺitʃhup'ɔ]   "signs"

     (d) / ɺi(n) + ɣat'+ # / → [ɺikxhat'ɔ]   "steps"

27

In all of these cases strengthening took place due to the presence of the underlying nasal after which the nasal was deleted to conform with the (morpho-) phonological surface structure.

2.9.3 **THE REFLEXIVE FORMATIVE / i - /**

The reflexive morpheme / i - / causes nasal strengthening (due to an underlying nasal N) when it is placed before a verb stem to form a reflexive verb, e.g.

[23] a. INPUT: Underlying representation / Ni + ɣɛl + a /

rule 1:strengthening: ɣ kxh

rule 2: nasal deletion: n Ø

OUTPUT: Phonetic representation [ikhɛla] "draw oneself"

b. INPUT: Underlying representation / Ni + lɔm + a /

rule 1:strengthening: l t'

rule 2: nasal deletion: n Ø

OUTPUT: Phonetic representation [it'ɔma] "bite oneself"

c. INPUT: Underlying representation / Ni + rat' + a /

rule 1:strengthening: r th

rule 2: nasal deletion: n Ø

OUTPUT: Phonetic representation [ithat'a] "love oneself"

d. INPUT: Underlying representation / Ni + βɔn + a /

rule 1:strengthening: ɣ p'

rule 2: nasal deletion: n Ø

OUTPUT: Phonetic representation [ip'ɔna] "see oneself"

From the examples in [23] it is not known why the reflexive morpheme is retained while the nasal / N / is deleted.

The observation made in this instance is that the reflexive morpheme indicates that the action expressed by the reflexive verb stem is carried out on the subject of the verb. The

reflexive morpheme is not concordial in nature unlike the subject and the object concord. This means that it does not have a different form for each and every person and class hence there is only one reflexive morpheme. The reflexive morpheme originally must have incotporated a nasal, which is deleted after it has caused nasal strengthening, cf. Ziervogel et al (1967:268) who support this idea because he has this to say, "plosivering word gewoonlik deur 'n nasal veroorsaak".

2.9.4   THE CAUSATIVE SUFFIX

The causative suffix / - i ʃ - / appears at first sight to cause strengthening when it is used after verb stems that end in / - na /. e.g.

[24]   (a)   / - tsɛna /   "enter"   →   [tsɛ̃ntʃha]   causative of   / - tsɛna /

    (b)   / - t'ɔna /   "cold"   →   [tɔ̃ntʃha]   causative of   / - tɔna /

    (c)   / βɔna /   "see"   →   [βɔ̃ntʃha]   causative of   / - βɔna /

In this examples, a mid-low vowels become raised before some of palatal consonants such as / ɲtʃh / in the causative stems.

The following derivational process takes place to derive the causative forms in [24]:

[25]   a.   **Underlying representation (causative form)**   / - tsɛn + iʃ + a /

        Vowel raising   / - tsɛ̃n + iʃ + a /

        Vowel deletion   / - tsɛ̃n + - ʃ + a /

        Strengthening (ʃ > tʃh)   tʃh

        Homorganic nasal   ɲ

        Phonetic representation   [- tsɛ̃ntʃha]

b. **Underlying representation (causative form)** / tɔn + iʃ + a /

Vowel raising / - tǫn + iʃ + a /

Vowel deletion / - tǫn + - ʃ + a /

Strengthening (ʃ > tʃh) tʃh

Homorganic nasal ɲ

Phonetic representation [t'ǫntʃha]

c. **Underlying representation (causative form)** / - βɔn + iʃ + a /

Vowel raising / - βǫn + iʃ + a /

Vvowel deletion / - βǫn + - ʃ + a /

Strengthening (ʃ > tʃh) tʃh

Homorganic nasal ɲ

Phonetic representation [- βǫntʃha]

The high vowel / i / in the underlying representation of the examples in [25] causes the raising of the preceding mid-low vowels i.e. [ɛ] & [ɔ] respectively. After it has exerted its raising function it is deleted creating an environment for nasal strengthening to take place. This in turn, is followed by homorganic nasal assimilation.

2.9.5 ADJECTIVES OF NOUNS IN CLASSES 8/9/10

Nasal strengthening also occurs in the adjectives, which qualify nouns of class 9 e.g.

[26] a. / -ɤɔlɔ / "big" → [kxhɔlɔ]

b. / - huβɛlu / "red" → [khuβɛlu]

c. / - sɛsɛ / 'thin' → [tshɛsɛ]

The following derivational process takes place to derive [kxhɔlo], [khuβɛlu] and [tshɛsɛ]

e.g.

[27] a. **Underlying representation** / N + ɣɔlɔ /

strengthening (ɣ → kxh) kxh

nasal deletion (N > Ø) -

Phonetic represenation [kxhɔlɔ] "big"

b. **Underlying representation** / N + huβɛɭu /

strengthening: (h > kh) kh

nasal deletion: (N > Ø) -

Phonetic represenation [khuβɛɭu] "red"

c. **Underlying representation** / N + sɛsɛ /

strengthening (s > tsh) tsh

nasal deletion: (N > Ø) -

Phonetic representation [tshɛsɛ] "thin"

The first rule one states that the initial consonant in example [27] becomes strengthened due to the influence of the nasal segment. But it does not state clearly why such a change occurs, and also there is no phonetic motivation for nasal deletion. Ziervogel and Mokgokong, (1975:119) stated that the change is not caused by the nasal, but "it is assumed that the change occurs on the analogy of class 10".

The usage of the adjectival stems in examples [28] in plural form.

[28] a. [ɭimpsha tsɛ kxhɔlɔ] "big dog"

b. [ɭik' ɛfa tsɛ khuβɛɭu] "red hats"

c. [ɭinalɛtɛ' ɛtsɛ tshɛsɛ] "thin needles"

What has to be observed in the above examples is that the adjectival prefix / ɭi - / of class 8/10 is optional in the case of above examples, however, the influence of the nasal segment is also felt.

2.9.6   **NUMERALS**

When numerals are formulated in Northern Sotho, nasal strengthening takes place in the same manner in the adjectival stems in example [26] e.g.

[29]   a.   / - rarɔ /   "three"

         b.   / βɛli /   "two"

         c.   / ɬanɔ /   "five"

Their derivational process is as follows.

[31]   a.   **Underlying representation**   / n + rarɔ /

              strengthening (r > th)   th

              Nasal deletion: -

              Phonetic representation   [tharɔ]

         b.   **Underlying representation**   / n + βɛl i /

              strengthening (β > p')   p'

              Nasal deletion   -

              Phonetic representation   [p'ɛli]

         c.   **Underlying representation**   / n + ɬanɔ /

              strengthening (ɬ > tlh)   tlh

              Nasal deletion   -

              Phonetic representation   [tlhanɔ]

2.10   **SUMMARY**

In this chapter, a linear phonological model and its core concepts were outlined as well as the Nasal Strengthening process. It has been observed that Nasal Strengthening occurs in a number of circumstances with, inter alia, the objectival concord of the first person singular. Northern Sotho data explained so far, yield diverse types of nasal segments which constitute a coherent class of phonetically similar sounds known as a natural class, cf. Katamba (1989:101). All those nasal segments acquire the place of articulation of the following consonant in the / N + CV / sequence. This will be dealt with again in the application of the Feature Geometry model in the following chapter.

In terms of the core concepts of a linear model it was observed that a linear model is an input and output model because it has at its core the assumption that the human brain works linearly, that is, the first rule creates the environment for the second rule, then other rules in generating a particular utterance follow. The rule order will never be violated because rule one and two could not apply simultaneously hence the environment of rule two is created by rule one.

The observation was made in this chapter that some phonological rules are inadequate in that they do not necessarily present a phonetic explanation. This is one of the reasons why linear models were followed by non-linear models. A non-linear model argues implicitly that the brain could just as well process all these rules simultaneously, that is, in a non-linear fashion.

CHAPTER 3

NON-LINEAR ANALYSIS: FEATURE GEOMETRY THEORY AND ASSIMILATION

3.1   INTRODUCTION

The Feature Geometry model (Clements and Hume, 1985) supports the idea that features are arranged in a hierarchical tree graph. This makes a distinction between linear and non-linear models. In this theory some features may be dominated by others whilst other may be independent. The nature of the tree is very much determined by the manner in which the constituents behave in phonological analyses.

Non-linear phonology model discards many traditional concepts such as rules as well as rule ordering. In Feature Geometry as a tree representation, it is argued that should two or more of these representations co-occur, features at different node levels may interact with one another. Nodes may be spread from the one to the other or nodes may be deleted (cf. Kenstowicz, 1994). Feature Geometry Theory organises features in separate tiers that are also arranged hierarchically so that they may be dependent on others or be independent from others. For instance, The tongue body features [anterior] and [distributed] are grouped together under the coronal tier because they both form one articulatory unit dominated by the dorsal tier. Feature Geometry also deals with spreading, de-linking as well as disassociation of features unlike linear phonology. Feature Geometry is regarded as a new development in the extension of the principles of autosegmental phonology which is developed to deal with tonal phenomena (Goldsmith 1976).

This chapter intends the following:

i.   to show which of the previous linear analyses were problematic, and

ii.   to analyse Nasal Strengthening within a Feature Geometry model.

3.2   SAGEY MODEL: FG-THEORY

3.2.1   AN OUTLINE

The Sagey version of Feature Geometry originates from the Clements' (1985) FG-model which states that features are organised in a hierarchical tree structure. The significant property of such a tree structure is the relationship of dominance. A root node is the highest point in the tree graph and it dominated a laryngeal node and the supralaryngeal node whilst the manner node and place node dependent on a supralaryngeal node. This means that the nodes that dominate other node in the FG-model are the root node, laryngeal node and place node. Sagey (1986) provides arrow pointing from the root node to the relevant articulators. She made a slight change on the feature Geometry model of Clements (1985) by omitting the manner nodes from the feature tree, saying that they do not constitute a class on their own because either spreading or deletion of the place node or the laryngeal node does not affect manner node. Therefore, each manner feature is treated individually due to the class it belongs. In her model Sagey treats the feature [nasal] individually from the other manner features and connects it under the feature soft palate, which is on the same level with the laryngeal node. In this model of Sagey, features are executed by articulators and have special affinity because they work together in rules, and as such constraints are no longer mysterious.

In the Feature Geometry model, several hierarchical distinctions are introduced among the features. The terminal features are connected to the SPE major class features namely, [sonorant] and [consonantal]. The features [sonorant] as well as [consonantal], constitute the root of the tree structure via two intermediate levels of structures, namely: the six articulators and the three nodes to which they are appointed.

In the model presented in chapter 1, (example [7]), the stricture features [continuant], [lateral] and [strident] combine freely and thus are not bound to a particular articulator as the terminal features do. The representation of the Feature Geometry model indicates vividly that vowels are [-consonantal, + sonorant], sonorant consonants are [+consonantal, + sonorant] and obstruents are [+ consonantal] and [-sonorant].

The feature hierarchical tree can be regarded as a segment generator because segment can be generated by choosing the relevant articulator and dependent feature, and also the cavity in which the articulator constitute a stricture.
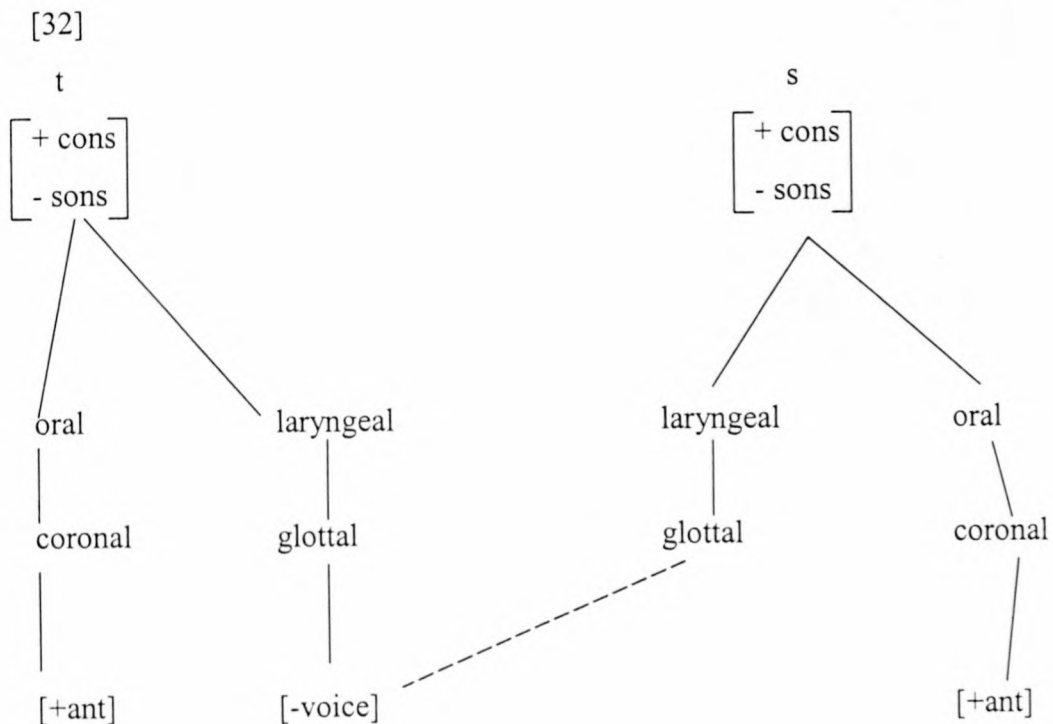
3.3   ASSIMILATION

3.3.1   OUT LINE

Assimilation is the continuation of a feature to an adjacent position in the linear string of segments, cf. Kenstowicz (1974:310). Assimilation is shown by a dotted line joining the features of the source to the focus of the rule, cf. Kenstowicz (1994) and McCarthy (1988). Assimilatory processes are characterised by a disassociation of some features and the acquisition of a corresponding feature from an adjacent segment in its neighbourhood through the spreading of the node.

3.3.2   THREE COMMON TYPES OF ASSIMILATION PROCESSES.

Three kinds of assimilation process are distinguished in the languages of the world, (cf. Broe 1992, Clements 1985 and Kenstowicz 1994). Such assimilation processes are as follows:

a. Single feature assimilation

Single feature assimilation refers to the spreading of a single feature. Thus, it is only the terminal feature that spreads e.g.

[32]

When ever the assimilating segment is unspecified for the specific feature, then it easily acquires the specification of the source segment. The [s] stands for a dental fricative unspecified for voicing. It means that two successive segments terminate at the same leaf node, and this explains voicing assimilation in English, viz. cats and dogs.

b. Total / complete assimilation

The spreading element in total assimilation takes place at the root node. Therefore such spreading involves the whole set of features below the root hence a root node is the highest node in the hierarchy. e.g

[33]
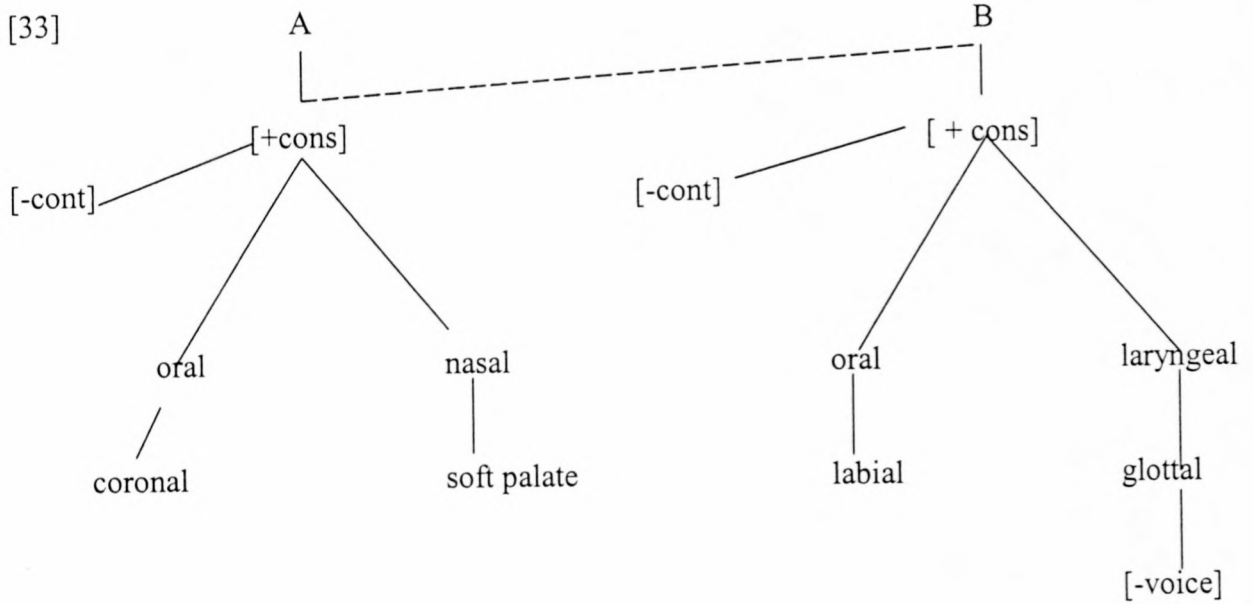
This example ([33]) expresses the authenticity of total assimilation because no trace of the original segment is left but just its position that is filled by the spreading segment.

c. Partial assimilation

In this case the spreading element takes place at some intermediate node in the tree. This intermediate node is a class node that spreads to the adjacent position e.g.

[34]
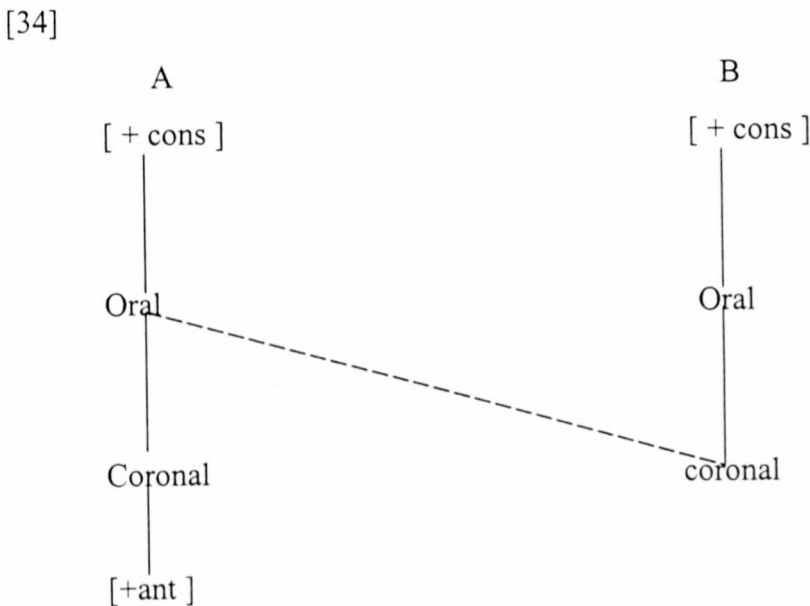
3.3.3 DIVERSITY OF ASSIMILATION PROCESS

The diversity of the three kinds of assimilation processes explained so far, rest on the nature of the segment that is affected as in the following:

i. Feature - filling / structure- building

Feature filling affects the rule that spreads only a feature that is unspecified in a target. It is applicable to single feature assimilation hence the unspecified segment which acquires the specification of the source segment are called feature-filling, cf. Kenstowicz (1984:150).

ii. Feature – changing

In contrast to the feature – filling, feature changing involves the rule applied to the segment, which is already specified for the spreading feature. It affects a segment in both a partial and complete assimilation.

In the following section the process of Nasal strengthening and nasal assimilation will be treated in an integrated manner within the mechanisms of FG theorgy.

3.4 PHONOLOGICAL OPERATIONS

a. In a feature tree de-linking of the original feature is indicated by "=" in a tree structure. A dotted line connecting the feature of the source to the target or focus of the rule represents assimilation. e.g.

[35]
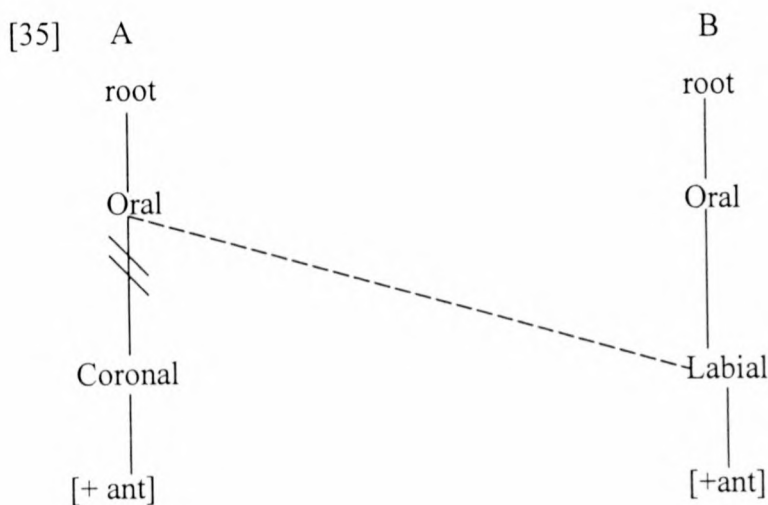
In this example it is indicated that the A segment takes on the labial feature of segment B while it simultaneously de-links its own coronal features.

Assimilatory processes (such as Nasal Assimilation) are therefore characterised by acquisition of a corresponding feature from a segment in its neighbourhood through node spreading and /or a dissociation of a certain feature or features, e.g. in a /N + C/ sequence whereby the nasal segment takes on the features of the following consonant which is influenced by the preceding nasal to become a stop (Nasal Strengthening), compare the following representations of the objectival concord of the first person singular In Northern Sotho:

[36]   **Labials**

Input / N+β /
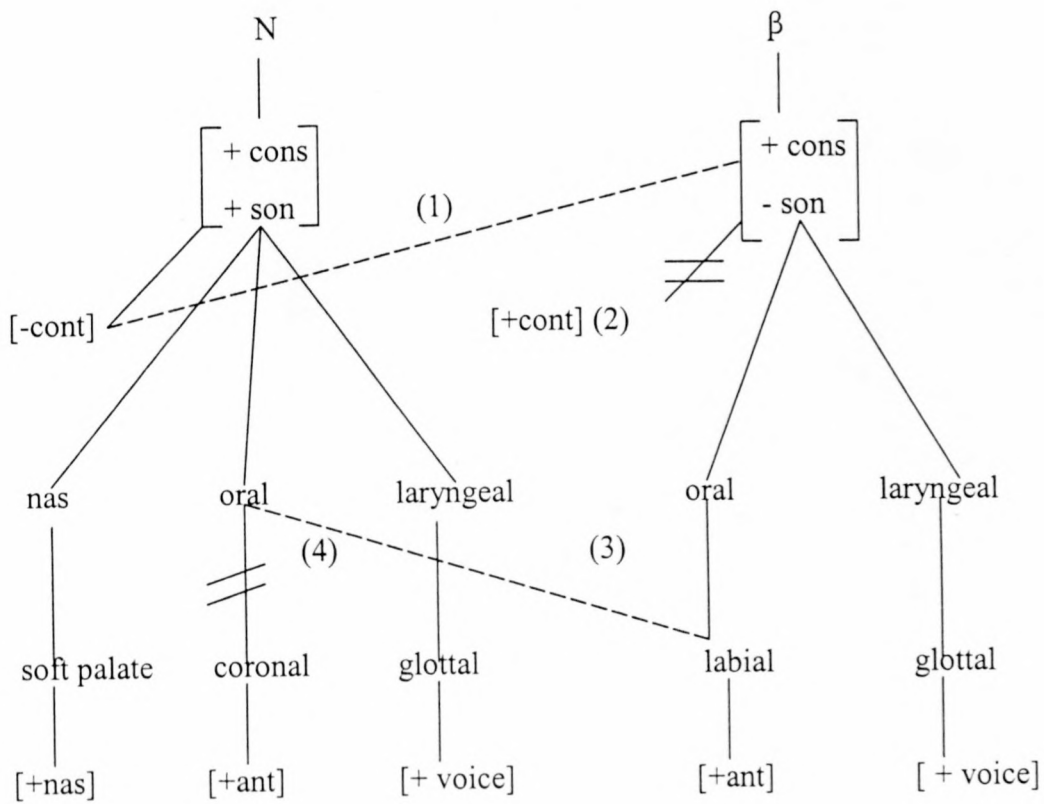
Output: *[mb] in stead of [mp']

[37]   **Velars**

Input: / N + ɤ/
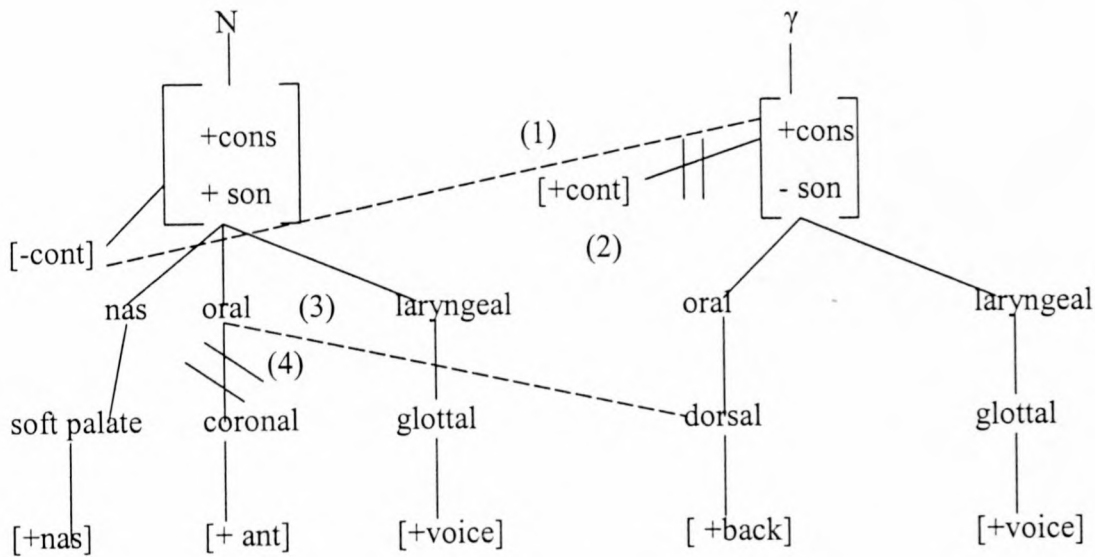
Output: * [ŋg] in stead of [ŋkxh]

According to the representations in examples[36] and [37], the nasal (1) spreads its [-continuant] feature to the root node of the consonant /β/ or /ɤ/ and / β/ or /ɤ/ de-links (2) [+ continuant] feature of / β/ or   / ɤ/ changing it to a stop, hence /p'/ or /kxh/. This means that it changed the bilabial fricative or dorso-velar fricative to a non-continuant segment. In the representation, the stop (3) spreads its features to the [coronal] or [anterior] oral node and de-links its place of articulation (4) to become a bilabial nasal [m] or dorso-velar nasal [ŋ]. In this representation, however, the feature [+ voice] cannot spread from any side. Thus, it is impossible with this model to account for voiceless [p'] or [kxh] in the output. There is nothing in the representation that can justify / β/ → [p'] or /ɤ/ → [kxh]. It is therefore only possible for this model to explain this change partially. In other words, while it accounts for the process of homorganic nasal assimilation in full, it cannot generate the final output for Nasal Strengthening – it fails to account for voicing feature.

If, on the other hand, the consonant following the nasal is voiceless, the model will be able to handle it quite elegantly:

[38]   **Voiceless palatals**

Input: /N+ʃ/
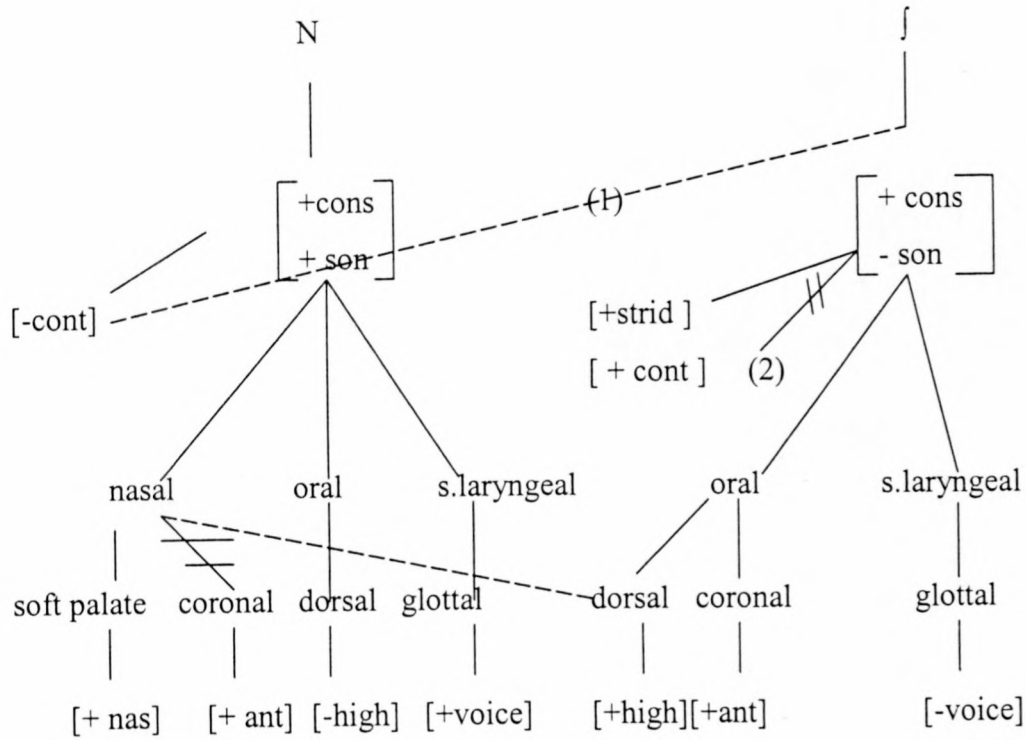
Output:[ɲtʃh]

STRIDENT

(1) The nasal spreads its [-continuant] feature to the root node of / ʃ/ and the [+continuant] feature
(2) of the consonant /ʃ/ changes into a stop with [+strident] feature (i.e. tʃ). By the same token the

dorsal [+high] feature of the palatal consonant spreads to the nasal causing it (nasal) to de-link its

own dorsal feature, i.e. changing it into a palatal nasal [ɲ].

In this example, the model is quite adequate to explain the changes that took place.

A nasal de-linking in terms of the class prefix of class 9 is represented in example [39] below.

This example covers a derivation such as / N + ʃup' + ɔ / > [tʃhup'ɔ] "sign".

[39]

Input: /N+ ʃ/
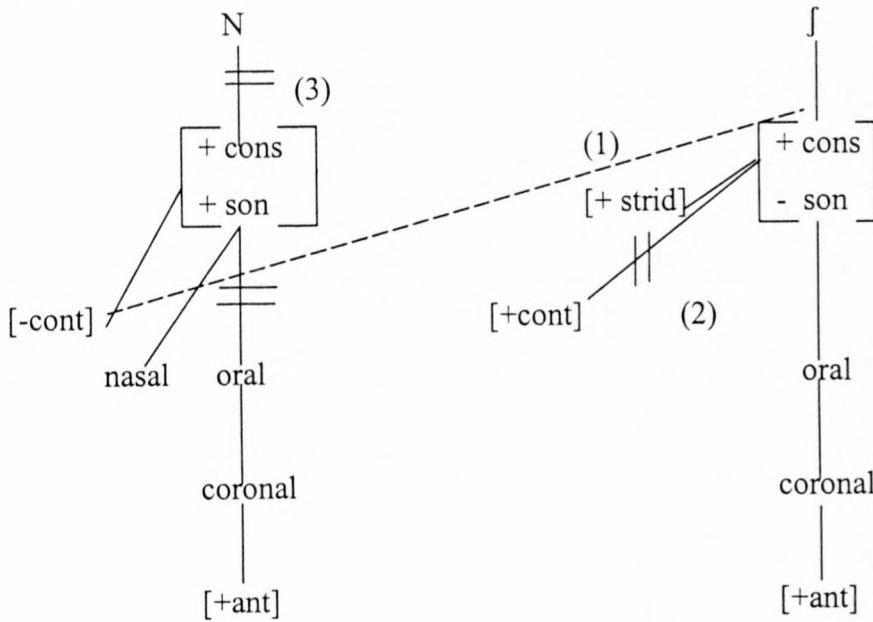
Output: [tʃh]

In this representation, the nasal spreads its [-cont] feature to the root node of the consonant / ʃ / (1), which in turn de-links its [+cont] feature (2) to become a strident stop, i.e. the afficate [tʃh]. The next step will be for the nasal to de-link itself at root node allowing for Nasal deletion (3).

It is clear that although some changes may be effected to the input, a temporal ordering of events seem to be necessary. This action, however, is not part of F.G. theory.

The case of the reflexive morpheme can be represented as below. This is to account for the following / Ni + ʃup' + ɔ / > [itʃhupa] "point (to) oneself" (see Appendix for more examples).

[40]
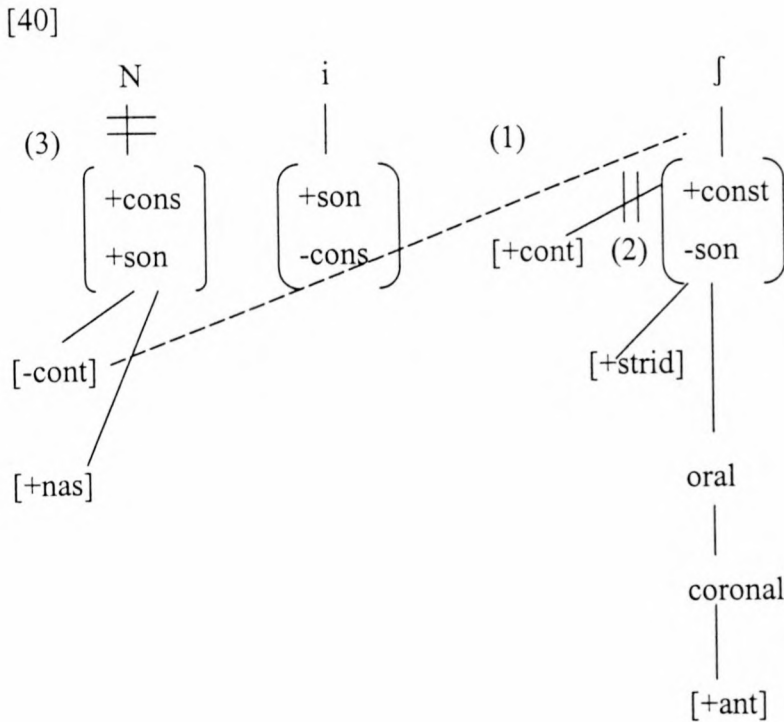
In this case the same process as in [39] takes place, however, it ignores the intervening vowel, i.e. the nasal spreads its [-cont] feature to the consonant [ʃ] (1), whilst the fricative de-links it [+cont] feature in order the surface as [tʃh] which is [-cont] [+strid], which is typical of afficates (after de-linking (2) has taken place). As in the previous case, the nasal is deleted through de-linking (3).

3.5 SUMMARY

In this chapter the theme was to apply the Feature Geometry model to Nasal Strengthening in Northern Sotho. The representation of the Feature Geometry theory has not necessarily offered a better understanding for the problem encountered by the linear model. The Feature Geometry model works partially to account for the changes that take place in the Nasal Strengthening process and it was realised that the feature [+voice] cannot spread from any side of the input and the environment, and as a result it is impossible for the model to account for the voiceless consonants which are the realisations of nasal strengthening process, e.g [t'] or [p'].

CHAPTER 4

CONCLUSION

The aim of this study was to analyse Nasal Strengthening in Northern Sotho with special reference to phonological theories known as Transformational Generative and Feature Geometry, in order to investigate which of these two models can best provide a better understanding of the intricacies of the process. It was observed that the previous descriptions of Northern Sotho nasal strengthening by the structuralists were inadequate because they did not present an adequate account for the phonological changes. An application of the FG theory of phonology to the process of Nasal Strengthening lead to the postulation of a number of phonological rules, i.e. a Strengthening rule, a Honorganic nasal assimilation rule, a Nasal deletion rule, as well as a new Glottal stop strengthening rule. These rules seem to interact in a natural way in generating appropriate surface structures. At the same time they seem to present credible explanations for the attested sound changes.

Although the introduction of the FG theory of phonology is aimed at addressing inadequacies in linear FG theory, it only succeeds partially to account for a process such as Nasal Strengthening in Northern Sotho. In particular, it has been demonstrated that there is no principled way to derive voiceless stops from voiced continuants in Northern Sotho. Thus, while this theory has certain obvious advantages, it can not do justice to the explanation of certain sound changes in Northern Sotho.

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APPENDIX A

NORTHERN SOTHO DATA

N+ˀV	Example	Glass	UR	PR
N + ˀa > kʼa	kalogo	'end of circumcision'	/n+ˀalɔɤ+ɔ/	[kʼalɔɤɔ]
	kalolo	'spread'	/n+ˀalɔl+ɔ/	[kʼalɔlɔ]
	kaloso	'dismissal of initiated'	/n+ˀalɔʃ+ɔ/	[kʼalɔʃɔ]
	kamego	'affected'	/n+ˀamɛɤ+ɔ/	[kʼamɛɤɔ]
	kamogo	'depriving'	/n+ˀamɔɤ+ɔ/	[kʼamɔɤɔ]
	kamogelo	'reception'	/n+ˀamɔɤ+ɛl+ɔ/	[kʼamɔɤɛlɔ]
	kamologano	'separation'	/n+ˀamɔlɔɤan+ɔ/	[kʼamɔlɔɤanɔ]
	kamuso	'suckle'	/n+ˀamuʃ+ɔ/	[kʼamuʃɔ]
	kano	'swear'	/n+ˀan+ɔ/	[kʼanɔ]
	kanego	'narrate'	/n+ˀanɛɤ+ɔ/	[kʼanɛɤɔ]
	kanyo	'sucking'	/n+ˀaɲ+ɔ/	[kʼaɲɔ]
	kaparo	'dress'	/n+ˀapar+ɔ/	[kʼapʼarɔ]
	kapeo	'cookery'	/n+ˀapɛ+ɔ/	[kʼapɛɔ]
	kapeso	'cause to dress'	/n+ˀapɛʃ+ɔ/	[kʼapʼɛʃɔ]
	kapogo	'clearing up'	/n+ˀapɔɤ+ɔ/	[kʼapʼɔɤɔ]
	karabo	'answer'	/n+ˀaraβ+ɔ/	[kʼaraβɔ]
	karogo	'parting'	/n+ˀarɔɤ+ɔ/	[kʼaraβɔ]
	karoganyo	'division'	/n+ˀarɔɤaɲ+ɔ/	[kʼarɔɤɔ]
	karoso	'cause to stray'	/n+ˀarɔʃ+ɔ/	[kʼarɔʃɔ]
	katafalo	'increase'	/n+ˀatafal+ɔ/	[kʼataɟalɔ]
	katlo	'kiss'	/n+ˀatl+ɔ/	[kʼatlɔ]
	katlafalo	'prosperous'	/n+ˀatlafal+ɔ/	[kʼatlaɟalɔ]
	katlatso	'spread out'	/n+ˀatlatʃ+ɔ/	[kʼatlatatʃlɔ]
	kakelo	'happiness'	/n+ˀakɛl+ɔ/	[kʼakʼɛlɔ]
	katlego	'prosperity'	/n+ˀatlɛɤ+ɔ/	[kʼatlɛɤɔ]

N+ˀɛ >kˀe	Example	Glass	UR	PR
	kebolo	'peeling'	/n+ˀɛβɔl+ɔ/	[kɛβɔlɔ]
	kedimolo	'yawn'	/n+ˀɛɺimɔl+ɔ/	[kˀɛʎimɔlɔ]
	kefogo	'dodging'	/n+ˀɛfɔɤ+ɔ/	[kˀɛfɔɤɔ]
	kefolo	'relieve'	/n+ˀɛfɔl+ɔ/	[kˀɛfɔlɔ]
	kefotso	'remove'	/n+ˀɛfɔlʃ+ɔ/	[kˀɛˀɔʃɔ]
	keko	'betray'	/n+ˀɛk+ɔ/	[kˀɛkɔ]
	keketso	'increment'	/n+ˀɛkɛtʃ+ɔ/	[kˀɛkˀɛtʃɔ]
	kekiso	'imitating'	/n+ˀɛkiʃ+ɔ/	[kˀɛkˀiʃɔ]
	kelo	'measure'	/n+ˀɛl+ɔ/	[kˀɛlɔ]
	kelelo	'remembrance'	/n+ˀɛlɛl+ɔ/	[kˀɛlɛlɔ]
	keletso	'advice'	/n+ˀɛlɛtʃ+ɔ/	[kˀɛlɛtʃɔ]
	kemelo	'advocacy'	/n+ˀɛmɛt+ɔ/	[kˀɛmɛlɔ]
	kemelelo	'stand up'	/n+ˀɛmɛlɛl+ɔ/	[kˀɛmɛlɛlɔ]
	keno	'oath'	/n+ˀɛn+ɔ/	[kˀɛnɔ]
	kenywa	'fruit'	/n+ˀɛɲw+ɔ/	[kˀɛɲwa]
	kepo	'crowbar'	/n+ˀɛpˀ+ɔ/	[kˀɛpˀɔ]
	kemedi	'delegation'	/n+ˀɛmɛɺ+i/	[kˀɛmɛɺi]
	ketelo	'journey'	/n+ˀɛtɛl+ɔ/	[kˀɛtˀɛlɔ]
	keto	'visit'	/n+ˀɛt+ɔ/	[kˀɛtˀɔ]
	kethimolo	'sneeze'	/n+ˀɛthimɔl+ɔ/	[kˀɛthimɔlɔ]
	ketsiso	'imitation'	/n+ˀɛtʃitʃ+ɔ/	[kˀɛtʃiʃɔ]
	keletsego	'advisable'	/n+ˀɛlɛtʃɤ+ɔ/	[kˀɛlɛtʃɛɤɔ]
	kepelo	'bury'	/n+ˀɛpɛl+ɔ/	[kˀɛpɛ̧lɔ]
	kemaemo	'unsetle'	/n+ˀɛmaɛm+ɔ/	[kˀɛmaɛmɔ]
	kediso	'cleanliness'	/n+ˀɛɺiʃ+ɔ/	[kˀɛɺiʃɔ]

N+ʔi >k'i	Example	Glass	UR	PR
	kidibalo	'fainting'	/n+ʔiɺiβal+ɔ/	[k'ɛɺiβalɔ]
	kidibatso	'cause to faint'	/n+ʔɺiβatʃ+ɔ/	[k'ɛɺiβatʃɔ]
	kilelo	'abstain from'	/n+ʔilɛl+ɔ/	[k'iβɛlɔ]
	kiletso	'forbidden'	/n+ʔilɛtʃ+ɔ/	[k'ilɛtʃɔ]
	kilolo	'revive by medicine'	/n+ʔilɔl+ɔ/	[k'ilɔlɔ]
	kimo	'become pregnant'	/n+ʔim+ɔ/	[k'imɔ]
	kimelo	'burden'	/n+ʔimɛl+ɔ/	[k'imɛlɔ]
	kimetso	'overload'	/n+ʔimɛtʃ+ɔ/	[k'imɛtʃɔ]
	kimiso	'cause to be pregnant'	/n +ʔimiʃ+ɔ/	[k'imiʃɔ]
	kimollo	'be relieved of one's burden'	/n +ʔimɔl+olt+ɔ/	[k'imɔllɔ]
	kino	'put in water'	/n+ʔin+ɔ/	[k'inɔ]
	kinamo	'bow down'	/n+ʔinam+ɔ/	[k'inamɔ]
	kinamiso	'cause to bend'	/n+ʔinamiʃ+ɔ/	[k'inamiʃɔ]
	kinelo	'soak'	/n+ʔinɛl+ɔ/	[k'nɛlɔ]
	kiso	'take to'	/n+ʔiʃ+ɔ/	[k'iʃɔ]

N+ʔɔ>k'ɔ	Example			
	kobo	'bend down'	/n+ʔɔβ+ɔ/	[k'ɔβɔ]
	kobamo	'bend forward'	/n+ʔɔβam+ɔ/	[k'ɔβamɔ]
	kobego	'become bent'	/n+ʔɔβɛɤ+ɔ/	[k'oβɛɤɔ]
	kohlo	'spin'	/n+ʔɔɬ+ɔ/	[k'ɔɬɔ]
	koko	'nurse'	/n+ʔɔk'+ɔ/	[kɔk'ɔ]
	kobamelo	'overseeing'	/n+ʔɔβamɛl+ɔ/	[k'ɔβamɛlɔ]
	kokeletso	'increament'	/n+ʔɔk'ɛlɛtʃ+ɔ/	[k'ɔk'ɛlɛtʃɔ]
	koketso	'supplement'	/n+ʔɔk'ɛtʃ+ɔ/	[k'ɔk'ɛtʃɔ]
	koketsego	'become added'	/n+ʔɔk'ɛtʃɛɤ+ɔ/	[k'ɔk'ɛtʃɛɤɔ]
	kokobalo	'subside'	/n+ʔɔk'ɔβal+ɔ/	[k'ɔkɔβalɔ]
	kokobatso	'cause to subside'	/n+ʔɔk'ɔβatʃ+ɔ/	[k'ɔkɔβatʃɔ]
	kokolo	'take the upper part'	/n+ʔɔk'ɔl+ɔ/	[k'ɔkɔlɔ]
N+ʔi>k'i	kolelo	'gather up with hands'	/n+ʔɔlɛl+ɔ/	[k'ɔlɛlɔ]

	klogo	'roll down'	/n+ˀɔlɔlɤ+ɔ/	[k'ɔlɔɤɔ]
	koloso	'winnow'	/n+ˀɔlɔʃ+ɔ/	[k'ɔlɔʃɔ]
	komo	'dry up'	/n+ˀɔm+ɔ/	[k'ɔmɔ]
	komiso	'cause to dry'	/n+ˀɔmiʃ+ɔ/	[k'ɔmiʃɔ]
	komano	'scold'	/n+ˀɔman+ɔ/	[k'ɔmanɔ]
	komelelo	'drought'	/n+ˀɔmɛlɛl+ɔ/	[k'ɔmɛlɛlɔ]
	komoso	'make warm'	/n+ˀɔmɔʃ+ɔ/	[k'ɔmɔʃɔ]
	komosego	'become warmed up'	/n+ˀɔmɔʃɛɤ+ɔ/	[k'ɔmɔʃɛɤɔ]
	konalo	'become old'	/n+ˀɔnal+ɔ/	[k'ɔnalɔ]
	kopafalo	'become barren'	/n+ˀɔp'aɟal+ɔ/	[k'ɔpaɟalɔ]
	kopafatso	'sterilise'	/n+ˀɔp'aɟatʃ+ɔ/	[k'ɔp'aɟatʃɔ]
	kopediso	'conduct'	/n+ˀɔp'ɛʎiʃ+ɔ/	[k'ɔp'ɛʎiʃɔ]
	kopelo	'hymnbook'	/n+ˀɔp'ɛl+ɔ/	[k'ɔp'ɛlɔ]
	koro	'bask in the sun'	/n+ˀɔr+ɔ/	[k'ɔrɔ]
	koretso	'fumigate'	/n+ˀɔrɛtʃ+ɔ/	[kɔrɛtʃɔ]
	kotlo	'punishment'	/n+ˀɔtl+ɔ/	[k'ɔtlɔ]
	kotlollo	'stretch out'	/n+ˀɔtlɔlol+ɔ/	[k'ɔtlɔllɔ]
	kotlologo	'become stretched out'	/n+ˀɔtlɔlɔɤ+ɔ/	[k'ɔtlɔlɔɤɔ]
	kotselo	'slumber'	/n+ˀɔtsɛl+ɔ/	[k'ɔtsɛlɔ]

N+ˀu>k'u	kubulo	'snatch away'	/n+ˀuβul+ɔ/	[k'uβulɔ]
	kutollo	'revelation'	/n+ˀutɔl+ol+ɔ/	[k'utɔllɔ]
	kutamo	'hide'	/n+ˀutam+ɔ/	[k'utamɔ]
	kutso	'theft'	/n +ˀuts+ɔ/	[k'utsɔ]
	kupo	'drive away evil spirit'	/n +ˀup+ɔ/	[k'upɔ]
	kukamelo	'look upon'	/n +ˀukamɛl+ɔ/	[k'uk'amɛlɔ]

Ni +ˀa>ik'a	ikalela	'dress bad for oneself'	/ni+ˀalɛl+a/	[ik'alɛla]
	ikamoga	'retrive oneself'	/ni+ˀamɔɤ+a/	[ik'amɔɤa]
	ikapesa	'dress oneself'	/ni+ˀap'ɛʃ+a/	[ik'ap'ɛʃa]
	ikabela	'share for oneself'	/ni+ˀaβɛl+a/	[ik'aβɛla]
	ikeka	'betray oneself'	/ni+ˀɛk'+a/	[ik'ɛk'a]

	iketela	'visit oneself'	/ni+ʔɛtɛl+a/	[ik'ɛtela]
	ikepela	'dig oneself whole'	/ni+ʔɛpɛl+a/	[ik'ɛpɛla]
	ikaraba	'answer oneself'	/ni+ʔaraβ+a/	[ik'araβa]
	ikoka	'nurse oneself'	/ni+ʔɔk+a/	[ik'ɔk'a]
	ikopela	'sing oneself'	/ni+ʔɔpɛl+a/	[ik'ɔp'ɛlɛla]
	ikopelela	'sing oneself'	/ni+ʔɔp'ɛlɛl+a/	[ik'ɔp'ɛlɛla]
	ikokotlela	'learn oneself'	/ni+ʔɔk'ɔtlɛl+a/	[ik'ɔk'ɔtlɛla]
	ikuna	'fast oneself'	/ni+ʔun+a/	[ik'una]
	ikota	'cut oneself's hair'	/ni+ʔɔt+a/	[ikɔt'a]
	ikutamisa	'hide oneself'	/ni+ʔutamiʃ+a/	[ik'ut'amiʃa]
	ikotla	'punish oneself'	/ni+ʔɔtl+a/	[ikɔtla]

N+ʔV>ŋk'a	nkakanyetsa	'plan for'	/n+ʔakaɲetʃ+a/	[ŋk'ak'aɲetʃa]
	nkakarela	'embrace me'	/n+ʔakarɛl+a/	[ŋk'ak'arɛla]
	nkakaretsa	'include me'	/n+ʔak'arɛtʃ+a/	[ŋk'ak'arɛtʃa]
	nkakela	'become happy'	/n+ʔak'ɛl+a/	[ŋk'ak'ɛla]
	nkakgela	'throw for me'	/n+ʔakxhɛl+a/	[ŋk'ak'xhɛla]
	nkakgola	'assist me'	/n+ʔakxhɔl+a/	[ŋk'ak'xhɔla]
	nkakgoletsa	'relieve me'	/n+ʔakxhɔlɛtʃ+a/	[ŋk'ak'xhɔlɛtʃa]
	nkalafa	'cure me'	/n+ʔalaɸ+a/	[ŋk'alaɸa]
	nkama	'concern me'	/n+ʔam+a/	[ŋk'ama]
	nkamoga	'deprive me'	/n+ʔamɔɣ+a/	[ŋk'amɔɣɔ]
	nkamogela	'welcome me'	/n+ʔamɔɣɛl+a/	[ŋk'amɔɣɛla]
	nkamusa	'cause me to suck'	/n+ʔamuʃ+a/	[ŋk'amuʃa]
	nkanya	'suck me'	/n+ʔaɲ+a/	[ŋk'aɲa]
	nkapara	'attack me'	/n+ʔapar+a/	[ŋk'apara]
	nkapeela	'cook for me'	/n+ʔap'ɛɛl+a/	[ŋk'ap'ɛɛla]
	nkapola	'undress me'	/n+ʔapɔl+a/	[ŋk'ap'ɔla]
	nkapoga	'abandon me'	/n+ʔap'ɔɣ+a/	[ŋk'apɔɣa]
	nkaraba	'answer me'	/n+ʔaraβ+a/	[ŋk'araβa]
	nkarosa	'mislead mee'	/n+ʔarɔʃ+a/	[ŋk'arɔʃa]
	nkata	'rape me'	/n+ʔat+a/	[ŋk'ata]

	nkatisa	'train me'	/n+ˀatiʃ+a/	[ŋkˈatiʃa]
	nkatla	'kiss me'	/n+ˀatl+a/	[ŋkˈatla]
	nkadima	'borrow me'	/n+ˀaʎim+a/	[ŋkˈaʎima]
	nkagela	'build for me'	/n+ˀaɣɛl+a/	[ŋkaɣɛla]
	nkahlola	'judge me'	/n+ˀaɸɔl+a/	[ŋkˈakɔla]
	nkebola	'cut me serverely'	/n+ˀɛβɔl+a/	[ŋkˈɛβɔla]
	nkefoga	'dodge me'	/n+ˀɛfɔɣ+a/	[ŋkˈɛfɔɣa]
	nkefola	'relieve me'	/n+ˀɛfɔl+a/	[ŋkˈɛfɔla]
	nkefosa	'alert me'	/n+ˀɛfɔʃ+a/	[ŋkˈɛfɔʃa]
	nkeka	'betray me'	/n+ˀɛk+a/	[ŋkˈɛkˈa]
	nkekisa	'imitating me'	/n+ˀɛkˈiʃ+a/	[ŋkˈɛkiʃa]
	nkelela	'remember me'	/n+ˀɛlɛl+a/	[ŋkˈɛlɛla]
	nkeletsa	'advise me'	/n+ˀɛlɛtʃ+a/	[ŋkˈɛlɛtʃa]
	nkemela	'represent me'	/n+ˀɛmɛl+a/	[ŋkˈɛmɛla]
	nkepa	'derogate me'	/n+ˀɛp+a/	[ŋkˈɛpˈa]
	nkepela	'bury me'	/n+ˀɛpˈɛl+a/	[ŋkˈɛpˈɛla]
	nketela	'visit me'	/n+ˀɛtˈɛl+a/	[ŋkˈɛtɛla]
	nketsa	'imitate me'	/n+ˀɛtʃ+a/	[ŋkˈɛtʃa]
	nkilela	'mourn for me'	/n+ˀilɛl+a/	[ŋkˈilɛla]
	nkiletsa	'forbidden me;	/n+ˀilɛtʃ+a/	[ŋkˈilɛtʃa]
	nkimetsa	'overload me'	/n+ˀimɛtʃ+a/	[ŋkˈimɛtʃa]
	nkimolla	'off load me'	/n+ˀimɔltolt+a/	[ŋkˈimɔlla]
	nkisa	'transport me'	/n+ˀiʃ+a/	[ŋkˈiʃa]
	nkubula	'pull me away'	/n+ˀuβul+a/	[ŋkˈuβula]
	nkusa	'cause me to fail'	/n+ˀuʃ +a/	[ŋkˈuʃa]
	nkutolla	'reveal me'	/n+ˀutɔl+ol+a/	[ŋkˈutɔlla]
	nkutswa	'snatch me'	/n+ˀutsw+a/	[ŋkˈutswa]
	nkoba	'bend me down'	/n+ˀɔβ+a/	[ŋkˈɔβa]
	nkopelela	'sing for me'	/n+ˀɔpɛlɛl+a/	[ŋkˈɔpˈɛlɛla]
	nkobeletsa	'trying to reach me'	/n+ˀɔβɛlɛltʃ+a/	[ŋkˈɔβɛlɛtʃa]

	nkoka	'nurse me'	/n+ˀɔk+a/	[ŋk'ɔk'a]
	nkoma	'trying to hit me'	/n+ˀɔm+a/	[ŋk'ɔma]
	nkomanya	'scold me'	/n+ˀɔmaɲ+a/	[ŋk'ɔmaɲa]
	nkomeletsa	'cause me to dry'	/n+ˀɔmɛlɛtʃ+a/	[ŋk'ɔmɛlɛtʃa]
	nkomosa	'make me warm'	/n+ˀ +a/	[ŋk'ɔmɔʃa]
	nkopedisa	'conducting me'	/n+ˀ ʎiʃ+a/	[ŋkɔpɛʎʃa]
	nkoretsa	'fumigate me'	/n+ˀ +a/	[ŋk'ɔrɛtʃa]
	nkotla	'punish me'	/n+ˀɔtl+a/	[ŋk'ɔtla]
	nkopa	'striking me'	/n+ˀɔtl+a/	[ŋk'ɔp'a]
	nkotlolla	'stretch me out'	/n+ˀɔtlɔl+ol+a/	[ŋkɔtlolla]
	nkopafatsa	'sterilise me'	/n+ˀɔpaʃatʃ+a/	[ŋkɔp'aʃatʃa]
	nkobamisa	'cause me to bend'	/n+ˀɔβamiʃ +a/	[ŋk'ɔβamiʃa]
	nkokamela	'supervise me'	/n+ˀɔkamɛl+a/	[ŋk'ɔk'amɛla]
N+CV	mpala	'read me'	/n+βal+a/	[mp'ala]
	mpelega	'carry me'	/n+βɛlɛɣ+a/	[mp'ɛlɛɣa]
	mpitsa	'call me'	/n+βitʃ+a/	[mp'itʃa]
	mpona	'see me'	/n+βon+a/	[mp'ɔna]
	mpuna	'beat me severely'	/n+βun+a/	[mp'una]
	ntisa	'take care of'	/n+tiʃ+a/	[nt'ʃa]
	ntumisa	'praise me'	/n+t'umiʃ+a/	[nt'umiʃa]
	mpha	'give me'	/n+f+a/	[mpha]
	mphepa	'nurse me'	/n+fɛp'+a/	[mphɛp'a]
	mphisa	'burn me'	/n+fiʃ+a/	[mphiʃa]
	mphosetsa	'throw to me'	/n+fɔʃɛtʃ+a/	[mphɔʃɛtʃa]
	mphulela	'pick for me'	/n+fulɛl+a/	[mphulɛla]
	nkgata	'tread me'	/n+ɣat+a/	[ŋkxhata]
	nkgela	'draw water for me'	/n+ɣɛl+a/	[ŋkxhɛta]
	nkgitla	'strike me'	/n+ɣitl+a/	[ŋkxhitla]
	nkgutla	'pushed me by elbow'	/n+ɣutl+a/	[ŋkxhutla]

	nkhemisa	'cause me to breath'	/n+hɛm+iʃ+a/	[ŋkhɛmiʃa]
	nkhola	'assist me'	/n+hɔl+a/	[ŋkhɔla]
	nkhumisa	'enrich me'	/n+humiʃ+a/	[ŋkhumiʃa]
	ntsesa	'feed me'	/n+ʒɛʃ+a/	[ntʃɛʃa]
	ntahla	'forsake me'	/n+ɬak+a/	[nt'aka]
	nteka	'test me'	/n+ɬɛk'+a/	[nt'ɛk'a]
	ntoma	'bite me'	/n+ɬɔm+a/	[nt'ɔma]
	ntumula	'uproot me'	/n+ɬumul+a/	[ntumula]
	nthata	'love me'	/n+rat+a/	[nthata]
	ntheta	'praise me'	/n+rɛt+a/	[nthɛta]
	nthipela	'cut for me'	/n+rip'+ɛl+a/	[nthip'ɛla]
	nthobela	'break for me'	/n+rɔβ+ɛl+a/	[nthɔβɛla]
	nthuta	'teach me'	/n+rut+a/	[nthuta]
	ntshemela	'lie on me'	/n+samɛl+a/	[ntshamɛla]
	ntsheba	'back bite me'	/n+sɛβ+a/	[nthɛβa]
	ntshilekisa	'irritate me'	/n+silɛkiʃ+a/	[ntshilɛkiʃa]
	ntshola	'blame me'	/n+sɔl+a/	[ntshɔla]
	ntshilela	'grind for me'	/n+ʃil+ɛl+a/	[ɲtʃhilɛla]
	ntshomela	'work for me'	/n+ʃom+ɛl+a/	[ɲtʃhɔmɛla]
	ntshupa	'point me'	/n+ʃup'+a/	[ɲtʃhup'a]
	ntlhaba	'stab me'	/n+ɬaβ+a/	[ntlhaβa]
	ntlheka	'pamper me'	/n+ɬɛk+a/	[ntlhɛka]
	ntlhokomela	'look after me'	/n+ɬɔk'mɛl+a/	[ntlhɔkɔmɛla]
	nkhwela	'died for me'	/n+fi+w+ɛl+a/	[nkhwɛla]
	mpsha	'new'	/n+fsa/	[mpsha]
	mpshatla	'slap me'	/n+fʃatl+a/	[mpʃhatla]
	mpsalela	'plant for me'	/n+fʃɤr+a/	[mpʃalɛla]

	palelo	'pillar'	/n+βalɛl+ɔ/	[pʼalɛlɔ]
	petlo	'carving'	/n+βetl+ɔ/	[pʼatlɔ]
	piletso	'dictation'	/n+βilɛtʃ+ɔ/	[pʼilɛtʃɔ]
	pono	'vission'	/n+βon+ɔ/	[pʼɔnɔ]
	putsiso	'question'	/n+βutʃiʃ+ɔ/	[puʼtʃiʃɔ]
	tiso	'herding'	/n+ɬiʃ+ɔ/	[tʼiʃɔ]
	mpho	'gift'	/n+f+ɔ/	[mphɔ]
	phepo	'feeding'	/n+fɛpʼ+ɔ/	[phɛpʼɔ]
	phiso	'burning'	/n+fiʃ+ɔ/	[phiʃɔ]
	phoso	'mistake'	/n+fɔʃ+ɔ/	[phɔʃɔ]
	phulelo	'picking'	/n+fulɛl+ɔ/	[phulɛlɔ]
	kgato	'step'	/n+ɣat'+ɔ/	[kxhatʼɔ]
	kgetho	'choice'	/n+ɣɛth+ɔ/	[kxhɛthɔ]
	kgopolo	'thought'	/n+ɣɔpʼɔl+ɔ/	[kxhɔpʼɔlɔ]
	tshebo	'gossip'	/n+sɛβ+ɔ/	[tshɛβɔ]
	tsholo	'criticism'	/n+sɔl+ɔ/	[tshɔlɔ]
	kgolo	'big'	/n+ɣɔl+ɔ/	[kxhɔlɔ]
	khubedu	'red'	/n+ɦuβɛɬ+u/	[khuβɛɬu]
	tharo	'three'	/n+rar+ɔ/	[tharɔ]
	tshese	'thin'	/n+sɛs+ɛ/	[tshɛsɛ]
	ntsho	'black'	/n+sɔ/	[ntshɔ]
	tshweu	'white'	/n+su+w+ɛ+u/	[tʃhwɛu]
	tlhano	'five'	/n+ɬan+ɔ	[tlhanɔ]

Ni + C	ipalela	'read for oneself'	/ni+βal+εl+a/	[ip'alεla]
	ipitsa	'call oneself'	/ni+βitʃ+a/	[ip'itʃa]
	ipona	'see oneself'	/ni+βɔn+a/	[ip'ɔna]
	ipusa	'govern oneself'	/ni+βuʃ+a/	[ip'uʃa]
	ipha	'give oneself'	/ni+fa/	[ipha]
	iphepa	'feed oneself'	/ni+fεp'+a/	[iphεp'a]
	iphisa	'burn oneself'	/ni+fiʃ+a/	[iphiʃa]
	iphora	'full oneself'	/ni+fɔr+a/	[iphɔra]
	ikgata	'tread oneself'	/ni+ɣat+a/	[ikxhata]
	itlheka	'pamper oneself'	/ni+ɬεk'+a/	[itlhεk'a]
	itlhaba	'stab oneself'	/ni+ɬaβ+a/	[itlhaβa]
	ithata	'love oneself'	/ni+ rat+a/	[ithata]
	itheta	'praise oneself'	/ni+ rεt+a/	[ithεta]
	ithipa	'cut oneself'	/ni+ rip'+a/	[ithip'a]
	ithuta	'teach oneself'	/ni + rut+a/	[ithuta]
	itshola	'blame oneself'	/ni + sɔl+a/	[itshɔla]
	itshema	'rest one's head'	/ni+ sεm+a/	[itshεma]
	itshilela	'grind oneself'	/ni+ ʃilεtʃ+a/	[itʃhlεla]
	itshupa	'point oneself'	/ni+ʃup'+a/	[itʃhup'a]