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An autosegmental account of Zulu phonology

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AN AUTOSEGMENTAL ACCOUNT OF ZULU PHONOLOGY

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University of the Witwatersrand, Johannesburg
in fulfilment of the requirements for the
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Johannesburg 1987

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ABSTRACT

This thesis describes the segmental and tonal phonology of Zulu. The theoretical framework employed in this description is the non-linear framework termed autosegmental phonology. The claim of autosegmental phonology is that certain phonological units or segments can be thought of as existing in an ordered sequence on a separate, independent tier from other phonological units or segments. Hence tones belong to a tonal tier whereas vowels and consonants belong to a segmental tier. Syllabic structure is represented in two tiers viz. a syllable and a nucleus tier, while the phonetic content of phonological features for segments is arrayed on different tiers, viz. feature, laryngeal, manner and place of articulation tiers.

The restructuring of loan words revealed a principle that regulates the co-occurrence of non-click stops within a morphological root. This principle, termed Zulu consonant harmony, stipulates one laryngeal feature specification for all such stops.

The study of the phonological features needed to distinguish the natural classes and phonological processes of Zulu is supplemented by a study of syllable structure conditions - those principles that adjudicate on the well formedness of core syllables. The phonological features selected point to a natural division of Zulu segments into simple and complex segments - affricates and prenasalized stops falling under the latter.

Two major phonological processes of Zulu viz. vowel coalescence and palatalization are studied in detail. The conclusions reached are that vowel coalescence is best described in terms of two rules, viz. Vowel Lowering and Vowel Deletion. The palatalization of labials adjacent to and tautosyllabic with a palatal glide is phonologically conditioned, while that of alveolars and palatalization 'at a distance' is morphologically conditioned.

The Zulu tonal system is described in terms of one underlying tone, viz. the high tone, with the low tone supplied by a default rule. Tonal rules are divided into phonological, i.e. those that apply to high tones and vowels only, and phonetic i.e. rules that apply to high and low tones and to vowels and consonants.

Phonological rules are, in turn, divided into lexical rules, i.e. those that apply within the lexicon, and postlexical rules, i.e. those that apply after the syntactic component. The major lexical tone rules of Zulu are rules that shift or spread high tones either to the left or to the right, while two sets of postlexical tone rules are identified viz. those that apply phrase-medially and others which apply in phrase final position.

PREFACE

This study attempts to provide a full analysis of the segmental and tonal phonology of Zulu. The theoretical framework employed in the description is autosegmental phonology, with use also made of the theories of CV-phonology, Lexical phonology and Underspecification. The first chapter introduces these different theories and Chapter 2 discusses consonant harmony - the principle that regulates the types of non-click stops that may co-occur within a morphological root. Chapter 3 studies the distinctive features necessary for describing the natural classes and phonological processes of Zulu. Chapters 4 and 5 present the major segmental and tonal rules, respectively, of the language. This is the first full study of Zulu in which non-linear phonology is employed for the description.

I am grateful to very many people and to some institutions whose very generous assistance made it possible for me to complete this study but, unfortunately, I can name only a few of them. First of all, I wish to thank my supervisor, Professor A. Traill, for his time and patience during numerous time-consuming consultations. My thanks also go to my colleagues in the Department of African Languages who were extensively used as a sounding board in the course of my research. Mr. C.M. Dweba, together with my friend, Mr. P.N. Tshaka, assisted me in my study of Xhosa cognates of loan words. Our departmental secretary, Ms. Oliphant, typed many sections of this thesis, while Nicholas Kisseberth typed the first full draft. For the final draft, I am indebted to Mrs. Ames of our Linguistics Department.

There are two institutions I wish to thank - my university and the University of Illinois at Champaign-Urbana. It was the University of the Witwatersrand that procured and supplemented the funding that enabled me to visit the United States of America and spend some time conducting research at the University of Illinois. The latter university, in turn, offered me a generous research fellowship for

the second semester that I spent in Champaign-Urbana. I also have to thank the University of Illinois for having hosted me as a Visiting Scholar for their 1985-86 academic year and for placing at my disposal all the facilities I required for my research. In the Department of Linguistics, which was my host department, I wish particularly to thank the secretariat for all their assistance. I thank also the staff and students, particularly Professors Bokamba, Kim, Kisseberth, Kenstowitz and Morgan, and also to Visiting Professor Jerzy Rubach, who introduced me to lexical phonology. My thanks also go to Professor Charles Kisseberth and Ms. Farida Cassimjee who hosted and accommodated me for the year I spent in Champaign. I cannot mention by name all the people who opened their hearts and homes to me during my stay in the U.S.A. but I wish to thank them all.

Finally, I would like to thank my friends, Elkin and Reginah Sithole of Chicago, Mazisi and Mathabo Kunene of Los Angeles and my wife and family for all their assistance and understanding.

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CHAPTER ONE

PRELIMINARIES

1. Introduction

The goal of this study is to provide a description of Zulu phonology within the theory of generative phonology. The main aim is that of providing as complete a description of Zulu segmental and tonal phenomena as is possible within the confines of one study. The framework within which this whole description is set, is autosegmental phonology, with the theories of CV phonology, lexical phonology and under-specification employed in certain sections. We will outline each of these theories presently, indicating the aspects of the theories that will be assumed in our analysis. However, before doing that, let us review some of the earlier literature in Zulu phonology.

2. Earlier Descriptions

Curiously, the best description of Zulu phonology predates generative phonology - this is the description of Zulu phonetics, phonology and morphology provided in Doke (1926), (1927). The studies are so comprehensive that even today they still provide a solid base of data and description for the language. The next important contribution appears in Lanham (1960). This is the first major attempt at providing a phonological description of Nguni[1] tonal phenomena. However, the focus in this study is on comparative segmental and tonal phenomena in Nguni, with a bias for Xhosa tonology. After Doke, the first study that attempts a full description of Zulu phonology is Cope (1966). This study has two main weaknesses; on the segmental side, it fails to provide a sharp focus on the main phonological processes, such as palatalization, nasal strengthening, etc., while on the tonal aspect Cope's theory of "tonal morphology" lends no insights into the workings of Zulu tonology and significantly, no other scholar has been known to

pursue his line of research. Then a few significant but fragmentary studies are provided in Louw (1962) and Rycroft (1960), (1963), (1979), (1980a), (1980b), with a full tonal description of Zulu in Khumalo (1981, 1982). Two autosegmental descriptions of Zulu tone have also recently appeared in Laughren (1984) and Clark (forthcoming). Zulu segmental phonology, however, has been sadly neglected; greater interest has been displayed in the morphology rather than the phonology of Zulu. In most South African schools and universities, for instance, it is the morphology that forms the major component of any linguistic study of the Zulu language. This morphology is still largely based on Doke's analysis, which needs a lot of revision to fit it into present day models of description. The great difference, of course, is that Doke's morphological analysis had, as its goal, a proper description of the phonetic forms of the language. Nowadays our morphological analyses require the postulation of underlying and surface structures for morphemes, with rules that derive the latter structures from the former. This is the cause of the inadequacy of Doke's morphological analysis for present day descriptions, and it is to be regretted that so few of our scholars have paid any serious attention to the provision of a modern analysis of Zulu segmental phonology.

Of all the descriptions of Zulu phonology that have appeared so far, only those of Doke (1926), (1927); and Cope (1966) have attempted a full description of both the segmental and tonal aspect of the language; the others have described the one or the other or certain parts thereof. We have attempted to point out the inadequacies in both these analyses which make us feel the need for another attempt at providing a full description of Zulu phonology. Another reason is that the numerous tonal analyses that have appeared are so varied in perspective: some are tonetic while others are tonemic descriptions and all but Laughren (1984) and Clark (forthcoming) are linear descriptions. There couldn't be a better moment, we feel, for the appearance of a full unified

description of Zulu phonology.

Let us now consider some of the theories employed in this thesis:

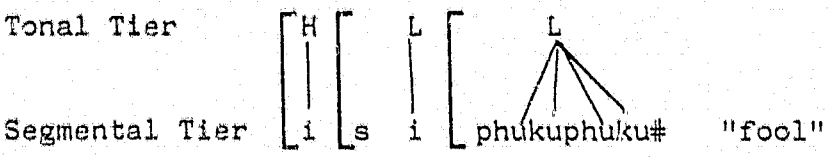
3. Autosegmental Phonology

"The major insight lying at the base of autosegmental phonology is that the phonological representation is composed not of a single sequence of entities roughly resembling a line of type, but rather that the phonological representation is made up of several parallel sequences of entities, resembling thus more a score for a musical ensemble than a single line of type." (Halle and Vergnaud (1981)). This theory allows for different units of phonology to be arrayed in sequences of separate, autonomous tiers related to one another by association lines.

3.1 Tonal and Segmental Tiers

In the representation of Zulu tonal phenomena, for instance, the tones could be arrayed on a separate autonomous tier, while the consonants and vowels are placed on a different tier:

(1). Example:



The autosegmental framework simplifies the task of describing certain tonal alternations within languages. In Zulu, for instance, the following alternations in high-toned stems are much easier to describe in autosegmental terms:

(2). a. úma bebô:na## "If they see"
b. úma ê:dla##[2] "If he eats"
c. uthénga ímbû:zi## "He buys a goat"
d. úma bebona abá:ntu## "If they see people"
e. úma edla úku:dlá## "If he eats food"
f. ímbuzi íya:dlá## "The goat is eating"
g. úma beboní:sa## "If they show"
h. úma kudlé:ka## "If it is edible"
i. uthénga ímbuzána## "He buys a kid"

A stage in the derivation of each of the verbs in the first two sentences and the noun in the third is reached where the final two vowels are co-linked to one high tone:

(3). a.



b.



c.



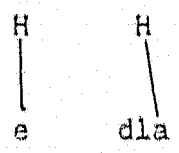
In (a), it may be achieved by underlying specification or by tone association or by a spread rule of the type:

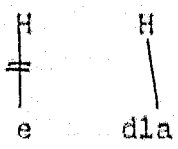
(4).



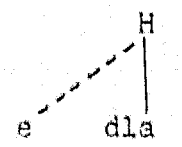
In (b), it is reached by the application of two rules discussed in Chapter 5 - Leftward Lowering and Leftward Spread:

(5).





Leftward Lowering



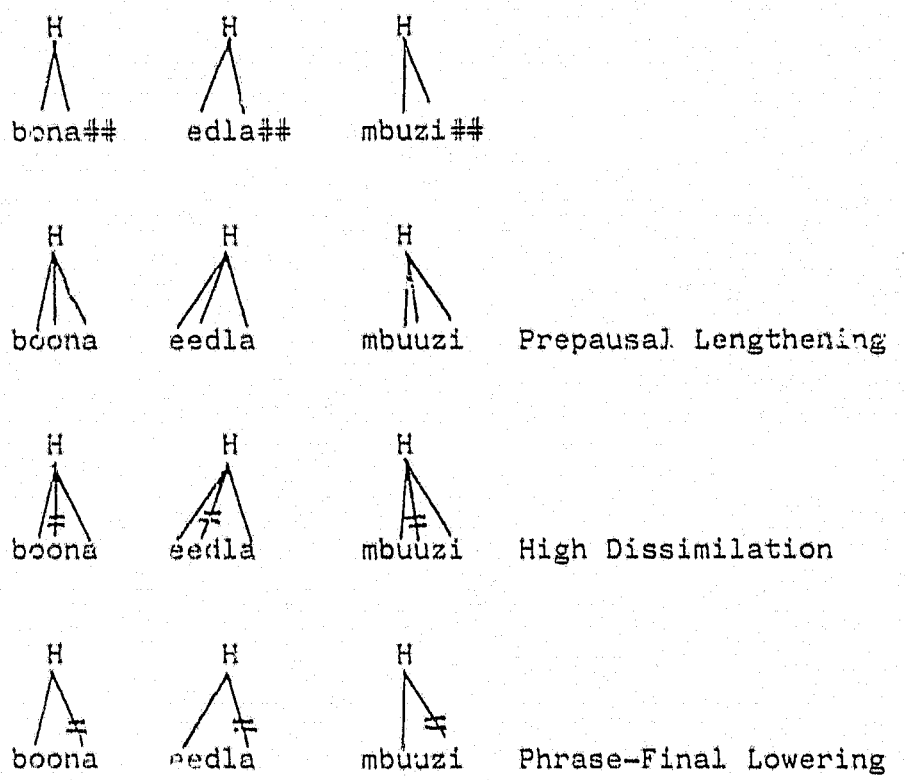
Leftward Spread

In (c), again it may be by underlying specification or by tone association or by Rightward Spread, as in (a).

(6). 

Once this stage has been reached the rules apply uniformly.

(7). Sample Derivations



Let us consider another set of examples:

(8). a. akâ:lwí## "he doesn't fight"
b. úma énga:lwí## "if he doesn't fight"
c. akâ:dlí## "he doesn't eat"

d.	úma éngadlí##	"if he doesn't eat"
e.	aká[1]gé:zi##	"he doesn't wash"
f.	úma éngage:zí##[3]	"If he doesn't wash"
g.	akahá:mbi##	"he doesn't go"
h.	úma éngahâ:mbi##	"if he doesn't leave"
i.	akáhlakú:li##	"he doesn't weed"
j.	úma éngahlakû:li##	"if he doesn't weed"
k.	akasebé:nzi##	"he doesn't work"
l.	úma éngasebê:nzi##	"if he doesn't work"

(each root is underlined for easy reference)

In the examples above, we have used three pairs of verbs. In each pair, the first verbal root is not associated with a high tone (in traditional terms - it is low toned), while the second member is underlyingly associated with a high tone. Each verb occurs first in the negative conjugation of the indicative, principal[4] sub-mood, then in the negative of the indicative, participial[4] sub-mood. The high tone associated with the suffix |i|, in the 'principal' forms is manifested in the penultimate syllable of polysyllabic stems, while in the 'participial' forms it manifests itself as part of the high-low tone cluster . In our analysis, the suffixal high tone shifts (i.e. spreads and then delinks from the vowel of original association) in the 'principal' forms while it spreads and does not delink in the 'participial' forms. After spreading, then its derivation is the same as that of the examples in (7).

The rules that apply in all the examples above will be discussed in detail in Chapter 5; the point of the present discussion is that the tonal representations and alternations illustrated here are much easier to represent and explain within the framework of autosegmental phonology. The single high tone in all the examples presented in (3), for instance, is associated with <u>two</u> segments, an impossible representation within the linear framework. It would be extremely complex within that framework to represent the high tone shift and high tone spread processes occurring in the examples in (8). More

examples could be brought to bear on the independence of the tonal tier from the segmental tier and the advantage of employing a framework based on that assumption, but let us rather pass on to a discussion of other types of tiers.

3.2 Class and Feature Tiers

After Clements (1985), we will array the phonetic content of phonological features for segments on different tiers:

a. Feature Tier - This will be a tier of individual phonological features.

b. Laryngeal Tier - This will contain the two phonological features we have in the laryngeal unit of features viz. [depressed] and [aspirated].

c. Manner Tier - This will be a tier of the manner unit of features, e.g. [consonantal], [continuant], [sonorant], etc.

d. Place Tier - This will be a tier of the place of articulation unit of features, e.g. the tongue-body features [high], [low] and other place of articulation features such as [labial], [anterior], [coronal], etc.

e. Supralaryngeal Tier - This tier will treat as one unit the manner features and the place of articulation features.

f. Segmental Tier - This tier takes in all the phonological features of a segment.

The claim in this hierarchical organization of phonological features is that in the application of certain rules, phonological features function as units, i.e. some rules will affect laryngeal features as a unit, to the exclusion of supralaryngeal features, for instance. Other rules on the other hand will affect place of articulation features as a unit, to the exclusion of all other features.

This claim is true for Zulu as the following examples illustrate. The first illustration comes from the alternations

that occur in a process generally referred to as palatalization (labial palatalization in some accounts). In Chapter 4, we claim that the underlying representation of the passive morpheme in Zulu is the form that occurs with monosyllabic verbal radicals viz. /iw/, and that a low level allomorphy rule converts it to /yw/ when it occurs with polysyllabic verbal radicals. It is this palatal glide in the passive allomorph, we claim, that triggers the palatalization of a preceding bilabial stop. This palatalization, in autosegmental terms, can be expressed in the form of a spread rule followed by a delinking rule, i.e. the palatal glide spreads its place of articulation features onto the preceding tautosyllabic stop which then sheds its own place of articulation features. The tautosyllabic palatal glide then deletes by a very general rule which we have termed Y-Deletion.

(9).Examples:

a.	lob-iw-a → lob-yw-a → lotsh-yw-a → lótshwa	"write(pass.)"
b.	gubh-iw-a → gubh-yw-a → guj-yw-a → gujwá	"dig(pass.)"
c.	phuph-iw-a → phuph-yw-a → phush-yw-a → phushwá	"dream(pass.)"
d.	tap-iw-a → tap-yw-a → tatsh-yw-a → tátshwa	"collect(pass.)"
e.	lum-iw-a → lum-yw-a → luny-yw-a → lúnywa	"bite(pass.)"
f.	pomp-iw-a → pomp-yw-a → pontsh-yw-a → pontshwá	"pump(pass.)"
g.	thumb-iw-a → thumb-yw-a → thunj-yw-a → thunjwá	"capture(pass.)"

In all the examples above, the alternations do not apply to manner and laryngeal features, they affect place of articulation features only. (In example (a) above, the lenis voiced /b/ converts to voiceless /tsh/, but the laryngeal feature [voiced] is not a phonological feature in our analysis. Phonological and phonetic laryngeal features will be discussed in detail in Chapters 2 and 3.)

The rule that expresses the spread of the place of articulation features of the palatal glide onto those of the tautosyllabic bilabial stop which then delinks from its own place of articulation features may be formalised as follow:

(10). Palatalization

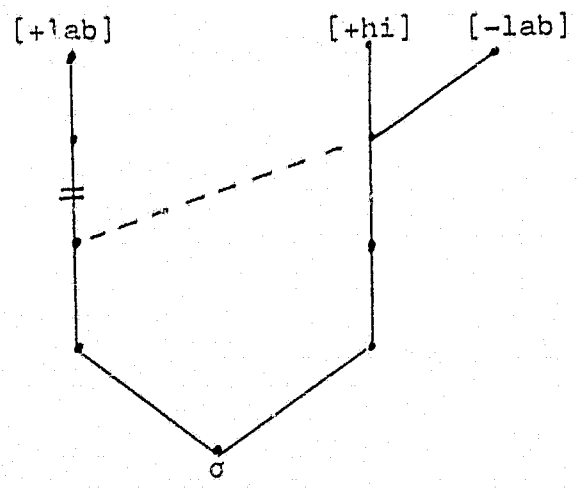
Feature Tier

Place Tier

Supralaryngeal Tier

Segmental Tier

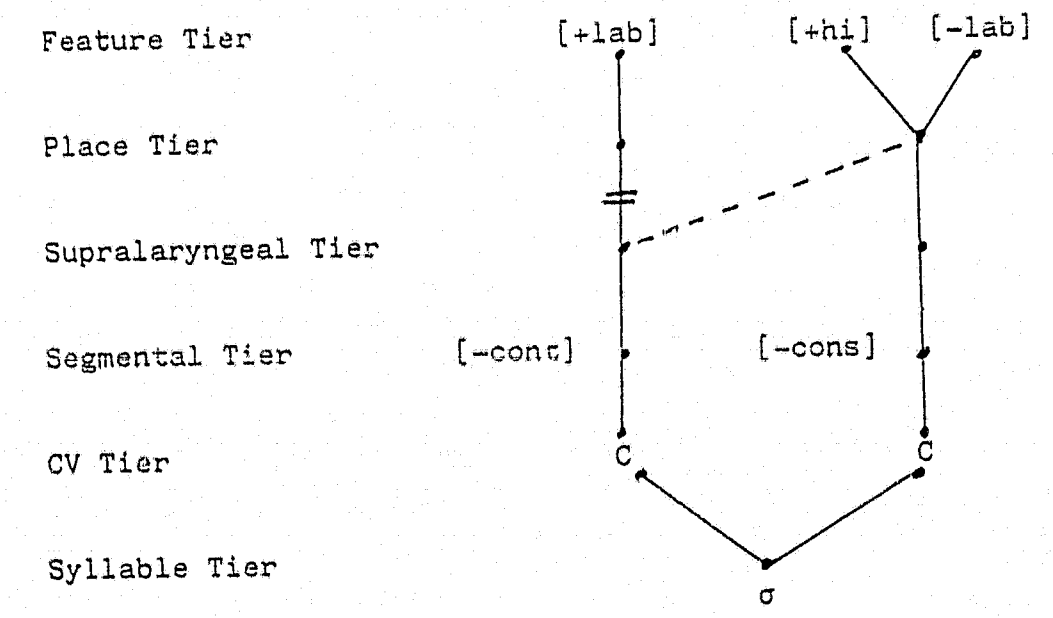
Syllable Tier



Condition: The first segment must be associated to a [-cont] manner feature and the second to a [-cons] manner feature

The rule in (10) tells us that a [+hi][-lab][-cons] segment, i.e. a palatal glide spreads its place of articulation features onto the supralaryngeal node of a [-cont][+lab] segment, i.e. a bilabial stop, which delinks from its own place of articulation features. The two segments are tautosyllabic. This is a typical example where a phonological rule has applied to the place of articulation features to the exclusion of all others. It is important to note that, because of the three-dimensional nature of the figure representing this hierarchical organization of phonological features, we will not always be able to present a complete figure of feature organization. In such cases, we will specify features elsewhere, usually on the segmental node, to be understood to represent the nodes missing which connect to those features, e.g. the figure above will sometimes be represented as follows, particularly if we need to indicate other tiers such as the CV tier and syllable tier.

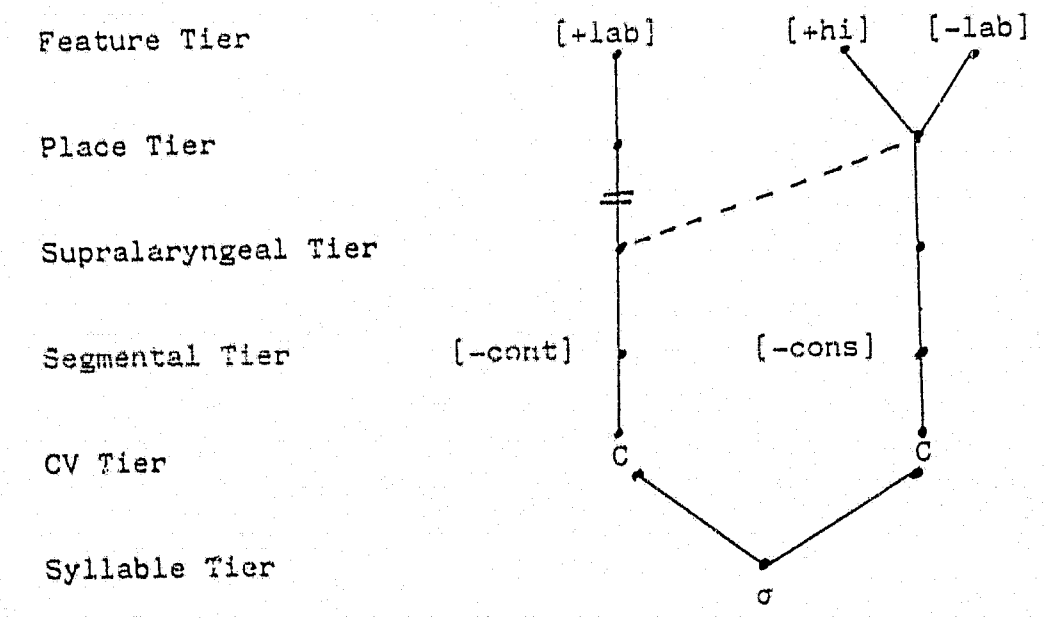
(11). Palatalization



The second example that illustrates how, for purposes of certain phonological processes, some features function as a unit comes from the application of what we term consonant harmony. We claim that for laryngeal features, stop segments have one feature for certain types of stops within a root. This feature then spreads to all such stops within the root. We use the letters P, T, K, to represent the laryngeally unspecified labial, alveolar and velar stops.

In the verbal roots /pheth/ "conclude" and /bhed/ "talk nonsense", for instance, we argue that the stops within the roots are unspecified for laryngeal features - it is the roots that are specified [+aspirated][5] and [+depressed] respectively. These root specifications then spread by rule to all designated segments.

(11). Palatalization



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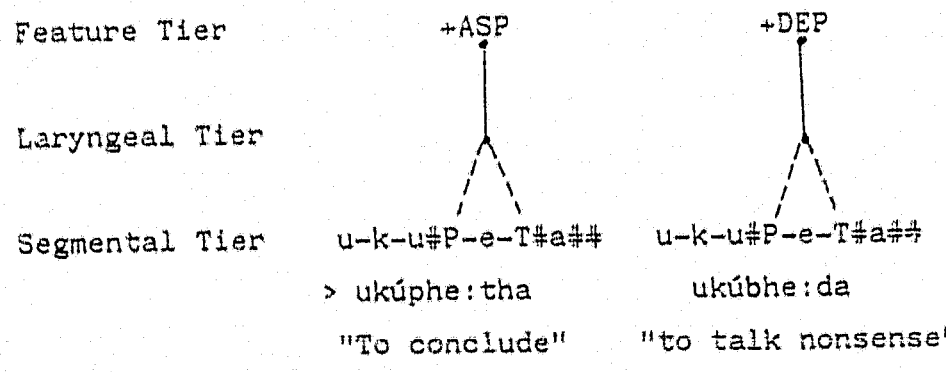
(12). Consonant Harmony



In the examples in (12), we see a phonological rule apply to laryngeal features, to the exclusion of all others.

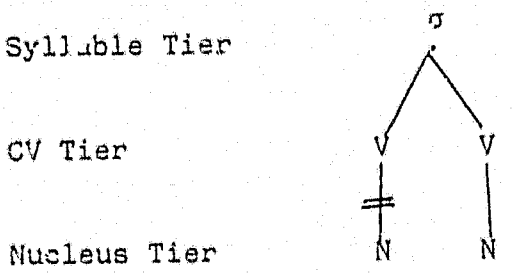
4. CV Phonology

The theory of CV-Phonology as developed by Clements and Keyser is a three-tiered theory of the syllable: "syllable trees consist of three-tiered representations, in which each tier has a certain vocabulary associated with it. The vocabulary of the first, or σ-tier, consists of a single element σ. The vocabulary of the second, or CV-tier, consists of two elements C, V; and the vocabulary of the third, or segmental tier consists of single-column phonetic matrices characterising consonants and vowels in the usual manner." (Clements and Keyser 1983: 25).

"Units of the CV-tier ... define functional positions (peak versus non-peak) within the syllable. In this respect the CV-tier can be seen as subsuming the function of the earlier feature [syllabic]. However, the elements of the CV tier are not merely analogues of the features [+syllabic] and [-syllabic], but serve the additional and equally important function of defining the primitive units of timing at the sub-syllabic level of phonological representation ... Thus, ... What are normally regarded as single segments (both simple and complex) correspond to single instances of C or V on the CV-tier, while geminate or bimoric sequences correspond to two units on the CV-tier" (ibid. p.11).

Assuming this theory, it is no longer necessary to distinguish between vowels and glides since a [+hi][-cons] segment dominated by a 'C' unit of the CV-tier will automatically be realised as a glide. On a few occasions, however, we will require an extra tier - permitted in Clements and Keyser - viz. the Nucleus-tier. A vowel, then, will be a [-cons] segment associated to a 'V' slot associated to a nucleus node. This distinction, for instance, we require when, in the course of a derivation, two vowels become juxtaposed. Since both vowels will be associated to 'V' slots and to nucleus nodes, the leftmost vowel, in Zulu, delinks from its nucleus node, and any 'V' slot unassociated to a nucleus node is realised as a 'C' slot. If this leftmost vowel is [+hi], then it is realised as a glide, otherwise it deletes. This Nucleus Delinking rule would be formulated as follows:

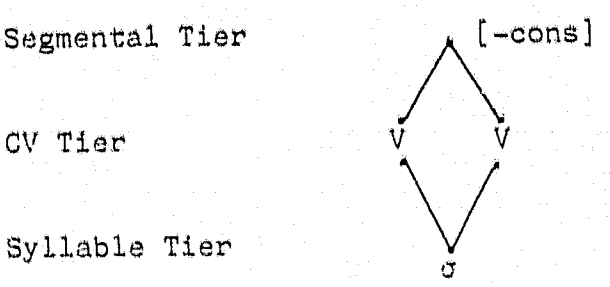
(13). Nucleus Delinking



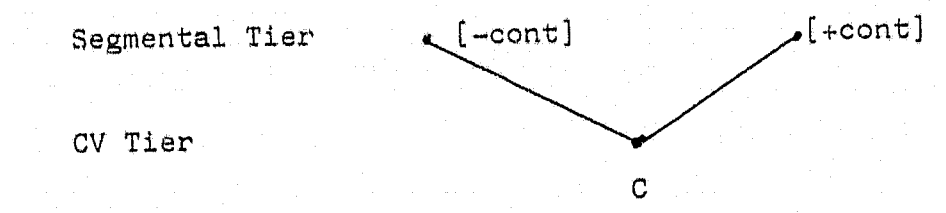
Complex segments in Zulu, as we will argue in Chapter 3, will be represented as follows:

(14). Complex Segments

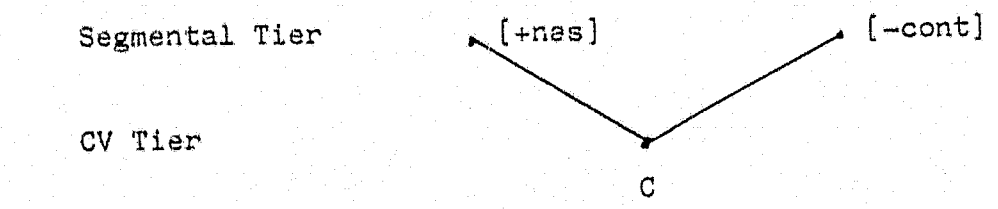
a. Bimoric or Geminate Vowel



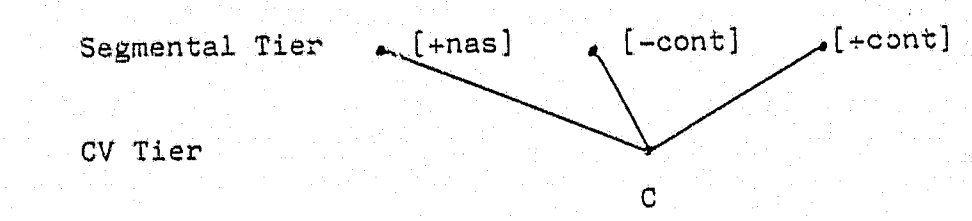
b. Affricate



c. Prenasalized Stop



d. Prenasalized Affricate



Clements and Keyser propose the following primary set of core syllabic types:

a. CV
b. V
c. CVC
d. VC

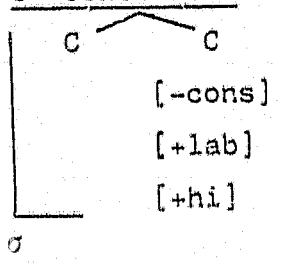
Based on their choice of core syllabic types, languages may be classified into the following types:

Type 1: CV
Type 2: CV, V
Type 3: CV, CVC
Type 4: CV, V, CVC, VC

Judged against these language types, Zulu is a Type 2 language, i.e. its core syllables are CV and V. What this really means is that the only syllables admissible are open syllables, i.e. syllables without a coda. Since Zulu allows more than one segment in the syllable onset, and more than one vowel in its peak, it may be defined by the formula $C^2 V^2$ in terms of its maximal syllable. This means that a Zulu syllable may have a maximum of two 'C's and two 'V's in its structure. Remember that complex segments occupy one 'C' slot, which means that the maximal Zulu syllable comprises a simple or complex segment plus the glide /w/, while the peak may either be a short or a bimoric vowel. The formula $C^2 V^2$ stands for CCVV.

"Constraints on co-occurrence within the syllable are represented, in the present theory, by <u>positive</u> and <u>negative</u> syllable structure conditions which, taken together, generate the set of well-formed syllables for each language. The positive syllable structure conditions (PSSCs) state the general canonic form of well-formed consonant or vowel clusters in terms of sequences of natural classes... The negative syllable structure conditions (NSSCs), applying to the output of the PSSCs, specify certain subsequences within the syllable as ill-formed thus performing a filtering operation." (Clements and Keyser 1983: 31). An example of a positive syllable structure constraint is the C^2 Constraint:

(15). <u>C^2 Constraint</u>

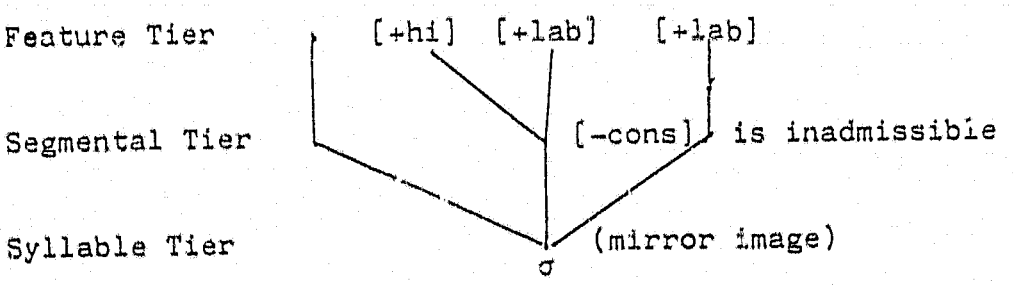


is admissible

The constraint stipulates that if the onset is maximally filled, then the segment in the second 'C' slot must be the labial glide.

A negative syllable structure condition which functions as a filter to the output of the C^2 Constraint is the Labial Glide Constraint.

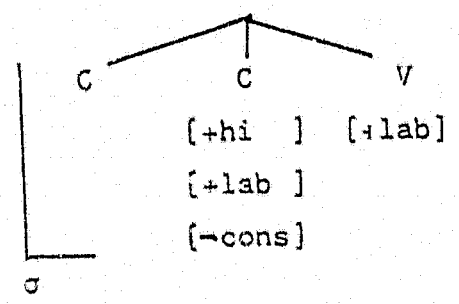
(16). Labial Glide Constraint



Since the glide /w/ has already been admitted into C^2 position, this negative syllable structure condition bars:

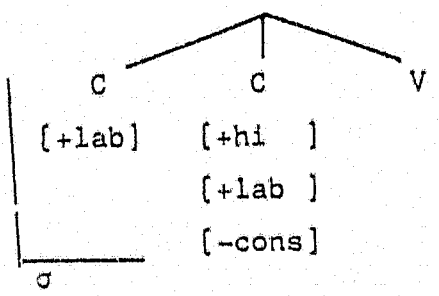
(17).

a.



or

b.



Stated simply, the labial glide may not occur with a labial vowel if C^1 is filled, but also, irrespective of the quality of the vowel, the labial glide may not occur with a labial consonant in C^1 position. This means that Zulu does not permit sequences such as [*C w u], [*C w o], [*b w V], [*m w V] etc. in its syllables.

5. Underspecification Theory

The theory of underspecification is employed in only one section of this thesis. In our description of consonant harmony, we find it necessary for the purpose of explanation to

underspecify the laryngeal features associated with roots and with segments. The theory of underspecification stipulates that generalisations about the sound pattern of a language which can essed by rule are omitted from underlying represent'a As we pointed out earlier, for instance, we claim that within a root all stops (except the lenis-voiced /b/ and /k/), have one phonological laryngeal feature. In the underlying representation, therefore, stops are unspecified for laryngeal features; these features they acquire through the application of the consonant harmony rule. We posit two phonological laryngeal features viz. [aspirated] and [depressed]. Stops may either be unspecified, i.e. [o depressed][o aspirated], (where o = unspecified), or they may be depressed, i.e. [+dep] [oasp], or aspirated, i.e. [+asp] [odep]. Fricatives and affricates on the other hand, may either be unspecified or be depressed, i.e. [+dep][oasp]. There are no aspirated fricatives and affricates in Zulu.

6. Lexical Phonology

It is a major claim of lexical phonology that "the phonology should be divided into two major components - a LEXICAL component, wherein rules apply to words, and a POSTLEXICAL one, where rules apply not only to the strings formed by the concatenation of morphemes but also to larger strings formed when the lexical items are inserted into phrase markers" (Kaisse and Shaw, 1985). In Zulu also, we need to distinguish between rules that apply between morphemes only, i.e. lexical rules, and those that apply to words occurring in phrases, i.e. post lexical rules. In Chapter 4, for instance, we will claim that Vowel Lowering - a rule that converts to a mid vowel, a high vowel to the immediate right of a non-high vowel - is a lexical rule. This means that the rule will apply between morphemes, as the following examples illustrate:

(18). Examples:

a. [[e[nyama]]ini]→ e-nyama-eni → enyámeni "meat (loc.)"

b. [[e[si[kole]]]ini]→ e-si-kole-eni→ ésikóleni "school (loc.)"

c. [[e[dolo]]ini]→ e-dolo-eni→ e-dolw-eni- edolwêni "knee (loc.)"

d. [na[u[mese]]] → na-o-mese → nómesé "with a knife"

e. [nga[iN[khathi]]] → nga-eN-khathi → ngenkâthí "at the time"

But it will not apply across word boundaries, as the following examples illustrate:

(19.) a. [i[be^{6}]]+[i[[sebenz]a]] → ibisebénza "it was working"

b. [u[se^{6}]]+[u[[sebenz]a]] → usúsebénza "you already work"

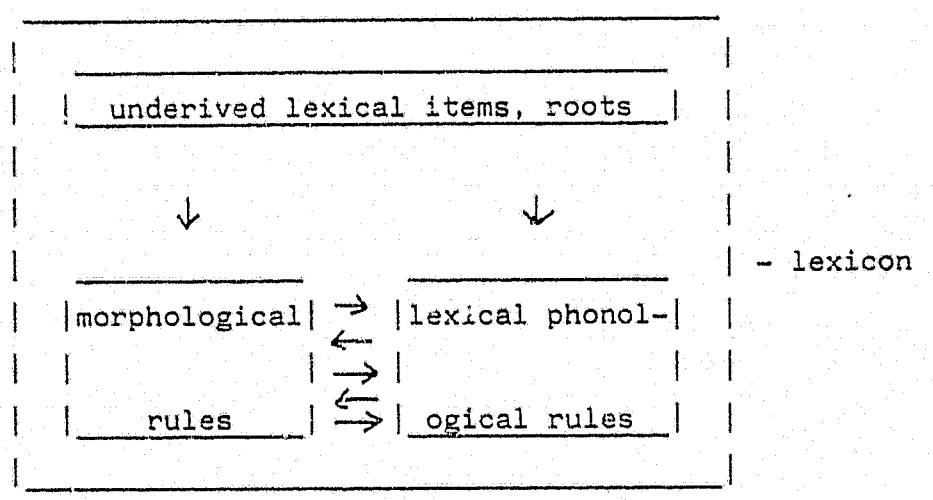
c. [iN[gane]]+[i[[fun]a]]+[u[ku[[khal]a]]] →
ín!gánif'ún!'úkukhâla "the child wants to cry"

In Chapter 5, we will divide Zulu tone rules into two types, viz. lexical rules, i.e. those that apply in the derivation of words and postlexical rules, i.e. those that apply to words in their syntactic context, i.e. when they occur phrase-medially, phrase finally etc.

The basic claim of lexical phonology is that "morphological" rules and word level phonological rules are interspersed. A rule of word phonology (i.e. a lexical phonological rule, which exclusively applies within words) may apply as soon as the required environment for its application

has been created by some morphological rule. That is: 'morphology and phonology go hand in hand' (Booij and Rubach 1984: 1). There are many models of lexical phonology, but in this study we will follow that proposed in Kiparsky (1982).

(20). Model of Lexical Phonology



In Kiparsky's theory all lexical rules are cyclic rules, i.e. they apply in derived environments only. The following example from Zulu illustrates the cyclic application of lexical rules following the application of a morphological rule, i.e. a word formation rule:

(21). Sample Derivation

[a[u[lu[a[i[si[ne]]]]]]][7]

-a-i-si-ne	Possessive Affixation
-a-i-si-ne	Syllable Delinking
-a-i-si-ne	Nucleus Delinking
-a-e-si-ne	Vowel Lowering
-Ø-e-si-ne	Vowel Deletion
lu-e-si-ne	SP Affixation
lu-e-si-ne	Syllable Delinking
lu-e-si-ne	Nucleus Delinking
lw-e-si-ne	Vowel/Glide Realisation
a-u-lw-e-si-ne	Indep. Poss. Affixation
a-u-lw-e-si-ne	Syllabie Delinking
a-u-lw-e-si-ne	Nucleus Delinking
a-o-lw-e-si-ne	Vowel Lowering
-Ø-o-lw-e-si-ne	Vowel Deletion
ólwesí:ne-	"fourth, Thursday"

The lexical rules applying in (21) will be discussed in detail in Chapter 4. In this study, we do not employ the subtheory of level ordering[8] because we can find no support for it in Zulu.

In conclusion, we wish to point out that it has not been the aim of this study to explore the full consequences of the application of the theories of underspecification and lexical phonology in the phonological analysis of the Zulu language. We believe that a focus on the application of each theory would constitute a full study on its own, and we hope that such studies will soon be forthcoming. What we have tried to do in this study is to employ the theories of autosegmental and CV phonology in the description of Zulu phonology, with minor detours into the fields of underspecification and lexical phonology in order to illuminate the phonological processes of the language.

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NOTES TO CHAPTER 1

1. Nguni is a sub-family of South Eastern 'Bantu'. The languages in this sub-family are Zulu, Xhosa, Swazi and Ndebele. The term 'Bantu', however, is offensive to most South African Blacks, and whenever we are compelled to use it to specify the language family, we will qualify it, otherwise we will use the term 'Sintu'.

2. The consonant /dl/ is one of the so-called depressors. These are discussed in Chapters 3 and 5, where we associate a depressor with an extra-low tone which derives from the tonal and segmental features [+ Low tone] and [+depressed] respectively. This extra-low tone clusters with the tone(s) associated with the vowel resulting in extra-low-low, extra-low-high, and extra-low-high-low clusters where the vowels are associated with low, high and high-low tones respectively. The extra-low tone is not indicated in these and other examples, it will only be consistently marked in the tone chapter, i.e. Chapter 5, where its cluster with a low tone will be represented by a single low tone sign, viz. "ˋ". Its cluster with a high tone will be represented by the low-high tone cluster sign "ˬ" while its cluster with a high-low tone cluster will be represented by the sign "ˆ". The examples on the left below indicate the tone-marking used in this and other chapters where the extra-low tone is not indicated while those on the right indicate the tone marking employed in Chapter 5, where the extra-low tone is indicated:

ê:dla	ê:dlà
ímbû:zi	ímbǔ:zì
úku:dlá	úku:dlǎ

3. The spread of the suffixal high tone to low toned CVC radicals like /gez/ is blocked, see (57)

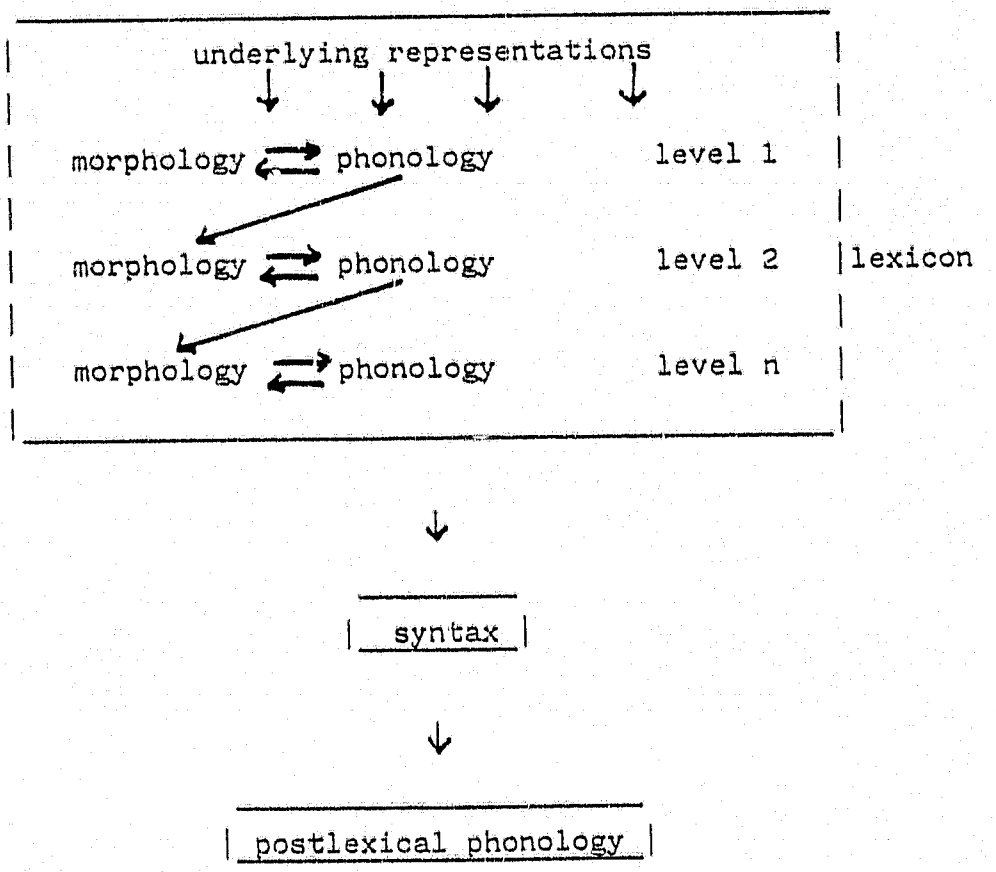
4. See Appendix for a discussion of 'principal' and 'participial' tenses of the indicative mood.

5. We are aware that the feature [aspirated] has generally been replaced by [spread] in recent descriptions, but for our description of consonant harmony, the features [aspirated] and [depressed] seem much closer to the terminology applied in the study of the languages displaying these features.

6. We claim that the surface verbal prefixes /se/, /be/, etc. are underlying deficient verbs. For a more detailed discussion, see 2.1.4.1 of Chapter 5.

7. To save time and space, we will not indicate the application of a morphological rule (i.e. word formation rule) which does not trigger any phonological rule(s).

8. Lexical phonology adopts the concept of level-ordered morphology: items from the lexicon are subjected to certain morphological processes and phonological rules, then they are resubmitted to the next stratum of morphological rules, as shown below:



CHAPTER TWO

CONSONANT HARMONY

1. Introduction

Of the different harmony processes that have been described, consonant harmony is, as a general rule, rare. Vowel harmony systems, on the other hand, abound. In vowel harmony systems, the harmonic feature, i.e. the feature whose distribution is regulated in specific segments of a word is, in the majority of the languages that have been studied, a tongue-body feature. Vowel harmonies on the whole, may thus be specified as: "backness" harmony (i.e. where designated vowels within a particular domain will either all surface as [+back] or as [-back]); roundness harmony; height harmony; advanced tongue root harmony etc.

Another harmony process that has been described in the literature is nasal harmony. According to Hyman, languages have two choices to make in the ways in which nasality will be manifested: "(a)they must situate nasality paradigmatically and designate a set of features which may co-occur with the specification [+nasal]; and (b)they must situate nasality syntagmatically and establish a sequential domain within which a single [+nasal] specification may reside." (Hyman 1982: 111).

The third type of harmony process is consonant harmony. Of the two readily available descriptions of consonant harmony, one has a tongue-body harmonic feature while the other has a place of articulation feature. The consonant harmony system with a backness harmony is described for Turkish in Clements and Sezer (1982):"The selection between /k,g,l/ and /k̂,ĝ,l̂/ is partly determined by the harmonic structure of the word in which they occur. In general ... /k,g,l/ appear in back vowel words and /k̂,ĝ,l̂/ appear in front vowel words. This so-called "consonant harmony" cannot be considered a redundant effect of vowel harmony since disharmonic consonants may appear in regular harmonic words while harmonic consonants may appear in

disharmonic words." (p.233) Anterior harmony, on the other hand, is described for Navaho in Halle and Vergnaud (1981) in the following terms: "In this language, the feature [anterior] in coronal affricates and continuants is determined by the right-most coronal affricate or continuant in the word: where the latter is [+anterior] (alveolar) so are all those to its left; when it is [-anterior] (palatal), the same is true of the other coronal affricates and continuants in the word" (p.9).

Consonant harmony in Zulu displays an uncommon set of harmonic features - the laryngeal features of aspiration and "depressor" phonation. (There is a class of segments in Zulu which are referred to as depressors. In their production there is "an unusual degree of shortening of the vocal chords with a consequent lowering of their rate of vibration" (Traill et.al. (forthcoming)). When we wish to be specific about the harmonic feature employed in the consonant harmony, we will use the terms 'aspiration' harmony and 'depression' harmony.

2.0 Zulu Obstruents

2.1 Laryngeal Features and Underspecification

In this analysis, we posit only two laryngeal specifications in the phonology viz. [aspirated] and [depressed]. The other laryngeal features such as [voiced], [ejected], etc. apply after the phonology has been completed. Only obstruents have phonological laryngeal specification (we shall see later that a small class of resonants may, exceptionally, be lexically specified for [+depressed]) although this is not assigned uniformly for all obstruents.

Let us explain that in this analysis, we will be employing the theory of underspecification as outlined in Kiparsky (1985). In this theory, only the marked value of a phonological feature is specified in the underlying representation, the unmarked value is supplied by a redundancy

rule termed a 'default' rule. Stops, as we indicated earlier will, on the whole, not be specified for laryngeal features underlyingly, but it will be the roots in which they occur that will be specified with the marked value of the laryngeal feature. This means that the roots incorporating stops will be marked [+asp] or [+dep] or be left unspecified for either feature. It is our claim that the laryngeal specification spreads by the consonant harmony rule to all designated stops within the root.

Fricatives and affricates, on the other hand, <u>are</u> underlyingly specified for laryngeal features. They can only be specified [+depressed] or be left unspecified since there are no aspirated fricatives or affricates in Zulu.

To sum up, stops after the application of consonant harmony, will be specified [+aspirated] or [+depressed] or left unspecified, and when the default rule applies [+aspirated] stops will be fully specified as [+asp ; -dep], while [+depressed] stops will be [+dep ; -asp] and unspecified stops will be [-asp ; -dep]. Specified fricatives and affricates will only be [+dep ; -asp] while their unspecified counterparts will be [-dep ; -asp]. In Kiparsky's terms: "every feature specification entered in the lexical representation of a morpheme is really an instruction that some particular 'default' rule is not to apply. Thus the specification [+voiced] in the first segment of 'bit' blocks the universal rule that makes obstruents [-voiced]." (Kiparsky 1985: 92).

The following charts then indicate the laryngeal specifications for Zulu obstruents after the application of consonant harmony to the stops:

(1).

a.

Non-Click Stops	p'	t'	k'	ph	th	kh	bh	d	g	b	k
Aspirated	0	0	0	+	+	+	0	0	0	0	0
Depressed	0	0	0	0	0	0	+	+	+	0	0

b.

Click stops	c	q	x	ch	qh	xh	gc	gq	gx
Aspirated	0	0	0	+	+	+	0	0	0
Depressed	0	0	0	0	0	0	+	+	+

c.

Fricatives	f	v	s	z	hl	dl	sh	h	hh
Depressed	0	+	0	+	0	+	0	0	+

d.

Affricates	ts'	tsh'	j	kl'
Depressed	0	0	+	0

(0 = Unspecified)

2.2 Non-Click Stops

Non-click stops present a problem which is clearly illustrated by a comparison with their click counterparts. Chart 1(b) clearly indicates the phonetic form of [+aspirated] click stops, [+depressed] click stops and unspecified click stops. Chart 1(a), on the other hand, while clearly distinguishing the phonetic form of specified non-click stops, presents two phonetic forms for unspecified stops, viz. the ejected series /p', t', k'/ and the voiced series /b, k/. In Chapter 3, we will argue that since in many environments, the voiced stops /b/ and /k/ pattern out with sonorants rather than obstruents, a [+sonorant] specification for these stops provides a more explanatory analysis. For that reason, we will use the feature [+sonorant] to distinguish /b, k/ from /p', t', k'/. It will be indicated later, in Chaper 3, that low-level rules will specify [+sonorant] segments [+voiced], and [-dep ; -asp ; -son] stops [+ejected].

Let us conclude this section by summarizing our terminology referring to segments where the theory of underspecification is employed. As we indicated earlier, all non-click non-affricated stops are underlyingly unspecified for laryngeal features; it is the roots that are specified.

Roots incorporating non-click stops will either be specified [+aspirated] or [+depressed] or be left unspecified. Non-click stops can, therefore, only be described as specified or unspecified after the application of consonant harmony, i.e. the rule that spreads the root laryngeal specification on to the stops occurring within the root. Before the application of the default rule that defines these stops, specified stops are either [+aspirated ; o depressed] or [+ depressed ; o aspirated] and unspecified stops are [o aspirated ; o depressed] while after the application of the default rule specified stops are [+ aspirated ; - depressed] or [+ depressed ; - aspirated] while unspecified stops are [- aspirated ; - depressed].

3.0 Consonant Harmony

In most cases, when a morpheme is made up of non-click stops, such stops will have the same laryngeal feature specification, i.e. they will either all be [+aspirated] or all will be [+depressed] or all will be unspecified.

(2). a. ukúkhetha "to choose"
isíthupha "thumb"
úkuphátha "to hold"

b. ukúbheda "to talk nonsense"
ukúgubha "to dig"
ukúdeda "to give way"

c. úkut'áp'a "to collect" (honey, clay etc.)
ukúk'ak'a "to encircle"
ukúp'et'a "to dig up"

We claim that it is not a coincidence, but the result of the application of a rule of the language that in the examples above there is only one laryngeal feature specification for all the stops within the root. This rule we term consonant harmony. In support of this claim, we will, in Section 4, supply data from loan-words which will

illustrate the application of consonant harmony in the restructuring of foreign roots. Consonant harmony is a rule that supplies one laryngeal feature to be shared by all designated segments within a specified domain. Before endeavouring to formalize the rule of consonant harmony, let us try to answer the question: What type of harmony process is Zulu consonant harmony?

3.1 Harmony Type

According to Halle and Vergnaud: "Harmony processes fall into two different types depending on whether the harmonic features propagate in one direction only, or whether the propagation occurs in both directions. We shall term the former type, directional harmony, and the latter type, dominant harmony" (Halle and Vergnaud 1981: 1).

It is not possible to fit Zulu consonant harmony into either of the types stipulated above since, as we shall see in 3.2.3, this harmony is restricted to the root only, whereas Halle and Vergnaud are thinking of directional harmony in terms of propagation from root to suffixes or from root to prefixes, and dominant harmony in terms of propagation from root to affix or from affix to root. And yet Zulu consonant harmony is still closer as a type, to dominant harmony than it is to directional harmony. According to Jonathan Kaye: "Dominant harmony has the following properties:

i. it is non-directional (it may propagate in either direction)
ii. there is no identifiable triggering segment
iii. opaque segments do not trigger their own harmony."

(Kaye 1982: 386)

Zulu consonant harmony satisfies all three conditions stipulated by Kaye for characterizing dominant harmony.

The last word comes from Kiparsky: "The distinction between 'directional' and 'dominant' harmony has already lost

some of its importance with the realisation that autosegments spread by rules and not by virtue of well-formedness conditions ... From the present point of view, the distinction breaks down into two independent parameters. Harmony is directional or bidirectional, depending on whether the spreading rule goes in one direction or both. Harmony is 'dominant' (in the Halle and Vergnaud sense) if it is non-feature-changing, i.e. spreads an autosegment only to segments which are not already linked to a contradicting autosegment." (Kiparsky 1985: 134) In this sense, as we shall see later, Zulu consonant harmony is 'dominant'.

3.2.0 An Autosegmental Analysis

Two models are currently employed in the description of harmony systems: the autosegmental framework or metrical trees (the latter not nearly as widely employed or accepted). Halle and Vergnaud propose that the autosegmental framework be employed in the description of dominant harmony, and that directional harmony be described employing metrical phonology. We will adopt this proposal.

Following the model designed by Clements (1981) and Clements and Sezer (1982), consonant harmony in Zulu may be accounted for by defining the following autosegmental system which spreads either the 'aspiration' or 'depressor' feature onto any [-sonorant] or [-suction] stop within the same root.

(3). Consonant Harmony

P-segments: [+ASP], [+DEP]

P-bearing units: [+cons, -son, -cont, -suct]

Domain: root

Transparent segments: segments not associated to laryngeal node

Opaque segments: segments associated to the laryngeal node.

Now, let us in turn discuss each of the parameters of consonant harmony.

3.2.1 P-Segments

The feature that is not assigned to individual segments, but which spreads to all designated segments within a specified domain is termed the P-segment. In other words P-segments, sometimes referred to as melody units, constitute the autc segmentally-represented harmony features (P-segments are transcribed in upper casing). Let us review the examples that were provided in 2(a), (b) and (c):

In 2(a), the P-segment is [+ASP]; in 2(b) it is [+DEP]; and in 2(c) there is no P-segment. What we are claiming is that in the underlying structure, the stops in the roots of examples 2(a), 2(b) and 2(c) are all unspecified for laryngeal features. Two of the sets of roots, however, are specified viz. the roots in 2(a) are specified [+ASP], and the roots in 2(b) are specified [+DEP] while the roots in 2(c) are unspecified. The claim, therefore, is that the laryngeal feature [+ASP] spreads to all the stops of the roots in 2(a), while the feature [+DEP] similarly spreads to all the stops of the roots in 2(b). The roots in 2(a) therefore through consonant harmony acquire the specification [+asp], and then by default they are suppli with the unmarked specification [-dep], while the opposite occurs in stops in the roots in 2(b) viz. they acquire the laryngeal specification [+dep] by consonant harmony and by default they are specified [-asp]. The stops in the roots of 2(c), however, receive no laryngeal specification since the roots in which they occur are unspecified for laryngeal features. Consequently, these stops acquire their laryngeal specification by the application of a default rule, and they leave the phonology with the specification [-asp] [-dep]. A phonetic realization rule[1] to be discussed later (in Chapter 3) then converts these stops into ejectives.

3.2.2 P-Bearing Units

The class of segments onto which the harmonizing feature spreads are termed P-bearing units or melody-bearing units. Such units in this analysis are the non-click stops that are specified [-son]. This specification is intended to exclude the two [+son] stops, viz. /b/ and /k/. Consonant harmony does not spread to these two stops, as the following examples illustrate:

(4).

a.	ɪ:gabâ:de	"A clod of soil"
	ukubhukû:da	"To swim"
b.	úmphákathí	"the community"
	i:khábethe	"cupboard"

In the examples above, we notice that the P-segment [+DEP] in (a) and [+ASP] in (b) spreads onto the stops in the initial and final syllables of the root - which are P-bearing units, but it fails to spread onto the stops in the second syllables of the roots, because these stops - specified [+son] - are not P-bearing units.

Stops functioning as P-bearing units are, in our analysis, unspecified for the features which function as P-segments. Such an analysis differs from Kaye's analysis of vowel harmony in Vata, in which "Each appropriate segment has a specification from the autosegmental feature at the segmental tier." (Kaye 1982: 387) The difference between the two analyses is that in ours when the harmonizing feature spreads it immediately becomes the specification of the P-bearing unit, whereas in Kaye's analysis where the P-bearing unit already has a specification for the P-segment, he has to appeal to the principle: "Autosegmental features take precedence over segmental features" (Kaye 1982: 387). We feel that the analysis where the P-bearing units are unspecified for the P-segment is simpler in avoiding the complication of having different specifications for the same segment, and having to

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decide with which one to associate the P-bearing unit.

To sum up, the P-bearing units in Zulu are all the non-click stops excluding the [+son] stops /b/ and /k/. These P-bearing units will be three in number, corresponding to the three points of articulation of stops in Zulu. P-bearing units will be transcribed in upper casing as follows: P, T, K representing the labial, alveolar and velar points of articulation, respectively.

3.2.3 Domain

The root of the word is the domain of consonant harmony. Many roots in Zulu seem to be counter examples to consonant harmony until one looks closely at their etymology. Many such roots turn out to be made up of one original root, which is perfectly regular in terms of consonant harmony, and one or more affixes which do not participate in consonant harmony. Here are a few examples:

(5).

a.	phakáde	"for ever"
b.	ukúdepha	"to be deep"
c.	úkugigithê:ka	"to laugh, giggle"

Nowadays the word /phakade/ might at first glance be regarded as a root, and yet it clearly derives from the adjectival root /de/ "long, deep"; and the manner adverb prefix /ka/ (which occurs in many adverbs such as /kahle/ "well", /kakhulu/ "a lot", /kabi/ "badly"); and the locative prefix /pha/ which occurs in many other locatives such as /phandle/ "outside", /phakathi/ "inside" etc.

The 'root' /deph/ in (b) derives from the same adjectival root /de/ "long, deep," now occuring with the suffix /ph/ which is used in deriving verbs from nominal/adjectival stems. Other examples of such derivations are:

(6).

ukúbipha	"to make a face"	<	adj. root /bi/ "ugly"
ukúthopha	"to praise"	<	noun root /tho/ "limb"

The stem /gigithek/ in 5(c) derives from the ideophonic root

/gigi/ "giggling, tittering"; the verbal suffix /th/ which occurs in many stems derived from ideophones e.g. /nhlanhlath/ "deviate", /mfimfith/ "suck"; and the neuter extension /-ek-/.

The morphological structure of these seemingly 'disharmonic' roots is:

(7).

a. pha(pref.)-ka(pref.)-de(root)

b. de(root)-ph(suff.)

c. gigi(root)-th(suff.)-ek(suff.)

In each case the roots viz. /de/ and /gigi/ are perfectly regular with regard to consonant harmony. These examples illustrate that many apparently disharmonic roots are completely harmonic on closer inspection.

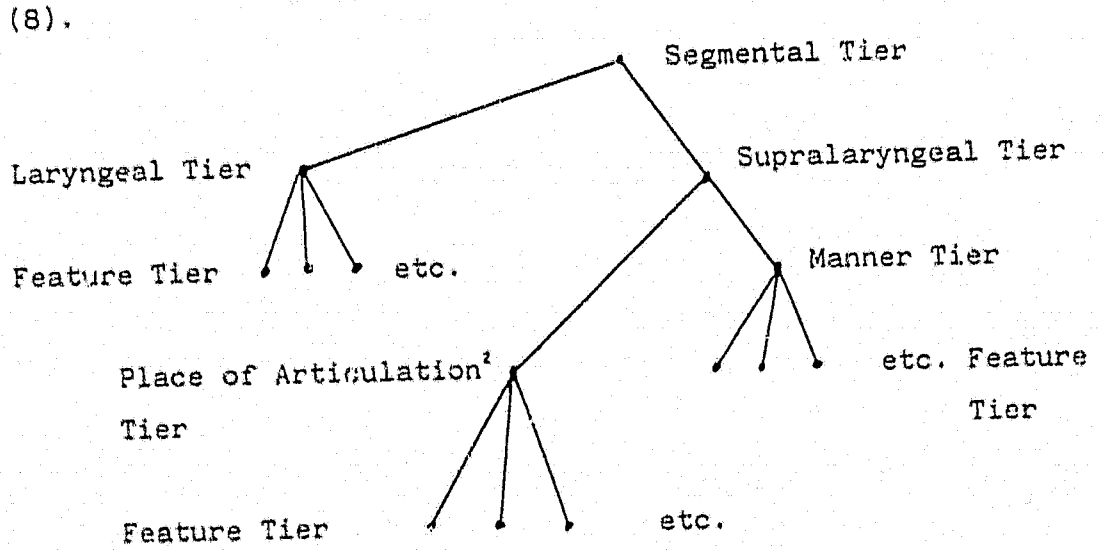
3.2.4 The Framework

Now that we have identified the P-segments, P-bearing units and the domain of consonant harmony, let us take some time to describe the framework we will be employing, so that we may formalize consonant harmony and then consider the remaining parameters in terms of derivations.

The autosegmental theory incorporating the different types of tiers has already been introduced in Chapter 1. What we now wish to supply are the details of the model of feature organization proposed in Clements (1985) which we will be employing. Clements makes a claim for the hierarchical organization of phonological features. This means that in addition to their individual identity, a group of features may also function as a unit: laryngeal features may function as a unit to the exclusion of supralaryngeal features and vice versa; place of articulation features may undergo a rule to the exclusion of manner features and vice versa. In order to capture this hierarchy, Clements proposes that the phonetic content of segments be arrayed on two different types of tiers, viz. feature tiers and class tiers. Class tiers comprise functional units of features such as laryngeal features, place

of articulation features etc. All the phonological features of a segment functioning as a unit, the so-called phoneme, would also form a class tier termed the segmental tier. The hierarchical organization proposed by Clements which we follow here may be represented diagramatically as follows:

(8).

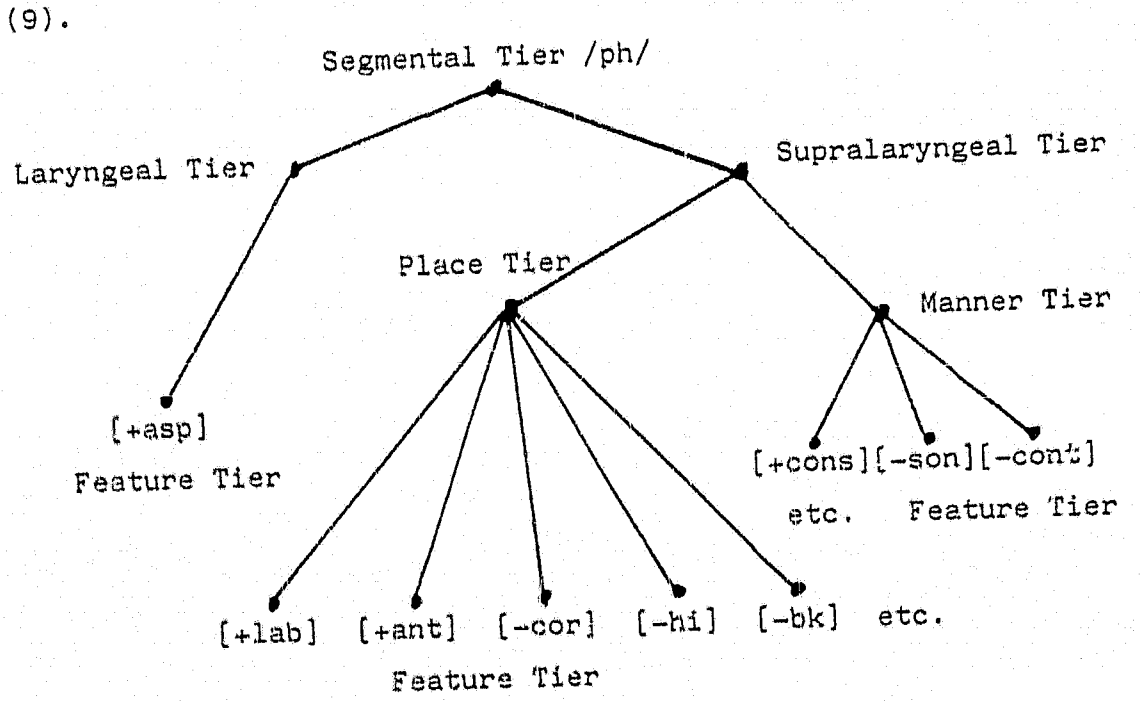


The representation is, of course, three dimensional, and the segment is associated to the CV tier, which in turn is associated to the syllable tier.

The diagram above illustrates that phonological features are initially organized into three functional units viz. a laryngeal unit, a place of articulation unit and the manner unit. The place of articulation unit and the manner unit form a higher unit termed the supralaryngeal unit. The laryngeal unit and the supralaryngeal unit, in turn, form a higher unit termed the segment.

Let us now demonstrate how such a feature organisation would represent some of the phonological features of the voiceless aspirated bilabial stop /ph/ after Consonant Harmony:

(9).



In this segment, the laryngeal tier is associated to one feature viz. [+asp]. The supralaryngeal tier is associated to the place of articulation tier and the manner tier. The place of articulation tier is associated to [+lab], [+ant], [-cor], [-hi], [-bk], etc. Finally, the manner tier is associated to the feature [+cons], [-son], [-cont] etc.

The rule of consonant harmony is then stated very simply:

(10).

Consonant Harmony



Laryngeal node

P-bearing segment

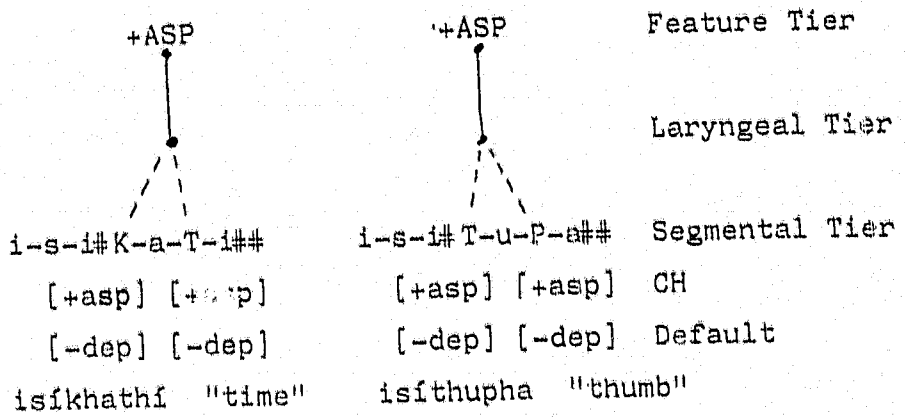
The rule states that the laryngeal node spreads onto any syllable - initial P-bearing segment which is exhaustively dominated by the syllable - initial "C" slot. The unassociated line to the left of the line associating the "C"

slot with the syllable indicates that there is no tautosyllabic segment to the left of that associated with the "C" slot, i.e. the segment associated with the "C" slot is syllable-initial. The fact that only one segmental node is associated to the "C" slot defines the P-bearing segment as a simple segment since a complex one eg.an affricate or prenasalized stop would have at least two segmental nodes associated to the "C" slot. The P-bearing segment could, however, be linked to different "C" slots. The laryngeal node, of course, will be associated to a laryngeal feature, i.e. either [+ASP] or [+DEP], and so when it spreads onto a P-bearing segment, it spreads the laryngeal feature it is associated to. The P-bearing unit, it will be remembered, is in the segmental tier. In the majority of derivations that we shall concern ourselves with, we will restrict our feature organisation to these three tiers, viz. the segmental tier, the laryngeal tier and the feature tier. We will introduce other tiers only when we need them.

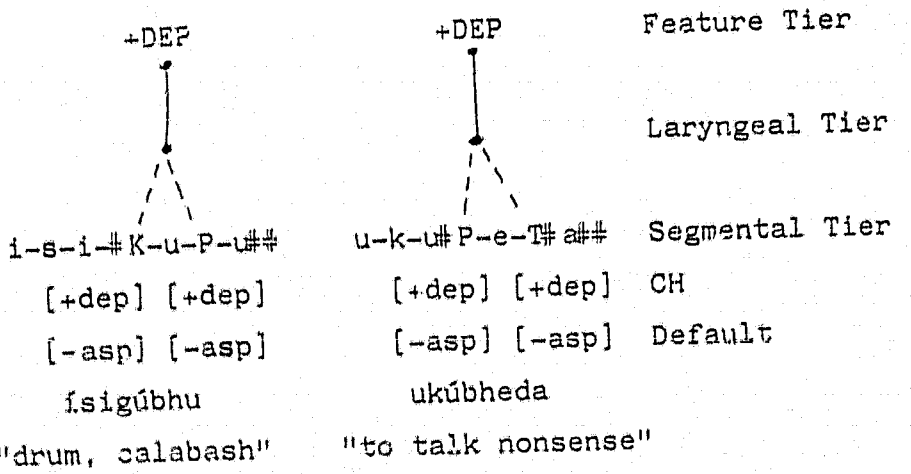
Before starting to work out a few derivations, let us warn the reader that our attention is focussed only on consonants within the root. A general study of all the segments of Zulu will be conducted in Chapter 3. The following examples illustrate consonant harmony:

(11).

a.



b.



In 11(a) and (b), the individual stops within the root are unspecified for laryngeal features, and the laryngeal specification is that of the root:

(12).

a. [KaTi] N, [+ASP] "time" [TuPa] N, [+ASP] "thumb"

b. [KuPu] N, [+DEP] "drum, calabash" [PeT] V, [+DEP] "talk nonsense"

The stops then acquire their laryngeal specification through the application of Consonant Harmony (CH), and the unmarked specifications are supplied by default rules.

Now let us consider the derivation of stops occurring in roots unspecified for laryngeal features:

(13).

u-u#P-a-T-a##		u-k-u-#T-e-T#a##		
[-asp]	[-dep] [-asp] [-dep]	[-asp]	[-dep] [-asp] [-dep]	Default
[+ej]	[+ej]	[+ej]	[+ej]	Ejection
ú:p'at'a		ukút'et'a		
"corn preserved underground"		"to carry on the back"		

The stops in the roots in (13) do not get associated to the laryngeal tier since the roots are unspecified for laryngeal features. The stops consequently receive their

laryngeal specification viz. [-asp] & [-dep], by default. Thereafter, the phonetic realization rule, Ejection - to be formalized later - supplies the stops with the phonetic feature [+ejected].

We are now ready to move onto the remaining parameters of consonant harmony.

3.2.5.0 Transparent Segments

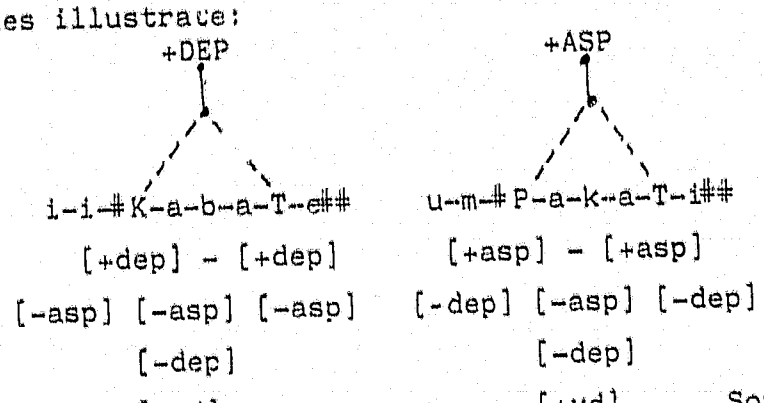
Transparent segments are segments that are neutral to consonant harmony, i.e. they neither participate in it nor do they block it. In Zulu, all consonants which are not P-bearing units, and which also are not underlyingly associated to the laryngeal tier are transparent segments. Consonants underlyingly associated to the laryngeal tier couldn't possibly be transparent segments since the P-segment couldn't spread across them without violating the autosegmental principle that association lines should not cross.

Transparent segments in Zulu then will be sonorants and voiceless fricatives. Let us discuss each in turn:

3.2 5.1 Sonorants

The sonorants we want to consider first are the lenis-voiced bilabial stop /b/ and the lenis-voiced velar stop /k/. Recall that we classified these two stops [+son]. These two stops are neutral to consonant harmony since they neither participate in it nor do they block it, as the following examples illustrate:

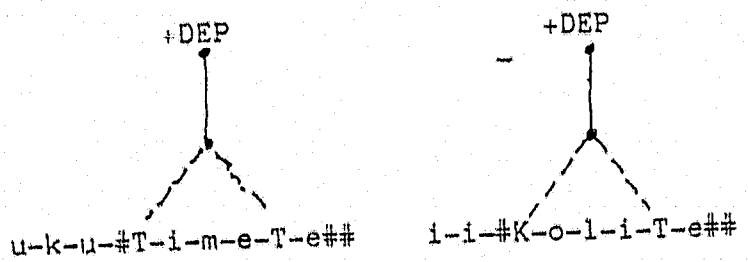
(14).



ĩ:gabâde "a clod of soil" úmphákathí "community"

The next two examples illustrate the transparency of nasals and liquids:

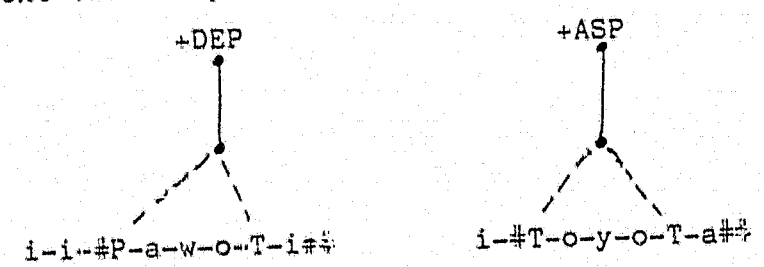
(15).



ukudimêde "to simply, merely.." íːgolíde "gold"

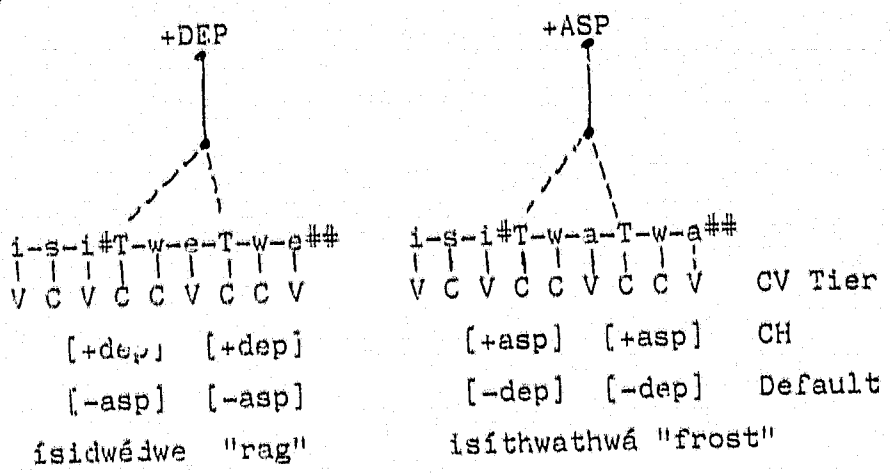
The next two examples illustrate the transparency of glides:

(16).



When the backglide occurs in a cluster with a P-segment, it (the glide) still functions as a transparent segment:

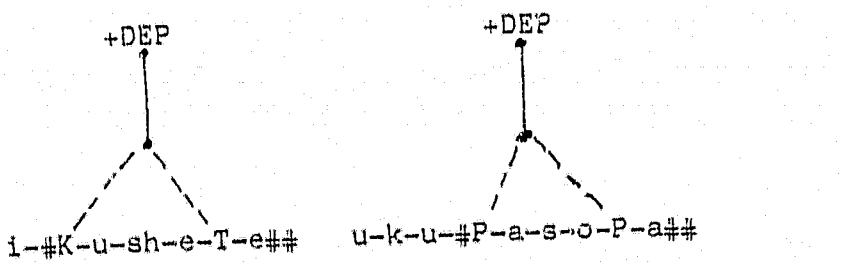
(17).



3.2.5.2 Voiceless Fricatives

Most examples illustrating the transparency of voiceless fricatives come from loan words:

(18).



íg..shéde "goods' shed" ukúbhasóbha "to look after"

In conclusion, we wish to point out that in a number of roots incorporating stops and fricatives, [+dep] stops pair up with [+dep] fricatives, and [+asp] and unspecified stops pair up with voiceless fricat..es, e.g.

(19). ukúgeza "to wash"
ukúduva "to waste time"
ukúbhodla "to burp"
ukúphosa "to throw"
ukúkhwifa "to spurt with liquid"
ukúphehla "to churn"
ukúbasa "to make fire"
úmbéfe "asthma"
ukúbohla "to sc! :ide"

Faced with so many Zulu roots that pair up stops and fricatives in the manner illustrated above, one might be tempted to argue for consonant harmony, i.e. 'depressor' harmony in monomorphemic stops and fricatives. There are, however, quite a number of reasons that argue against such an analysis. The first is that if fricatives were classified as P-bearing segments then how would we explain the derivation of roots that incorporate voiceless and [+dep] fricatives such as the second in each of the following pairs:

(20)a. úkusísa "to loan out for milking"
úkusíza "to help"
b. ukúhlofa "to be rough"
isíhlavà "stalk borer"
c. úkufísa "to long for"
úkufúza "to resemble"

In each of the three pairs above, the first example would present no problem since it would be argued that the root in each case is unspecified. The second example in each pair, however, would present a problem. If it was argued that the laryngeal specification was a root specification (instead of an individual segment specification like we are claiming), then what prevents the P-segment from spreading onto the first fricative of the root?

Other reasons come from our study of Zulu loan words. The first is, if fricatives are P-bearing segments in Zulu, then why does consonant harmony not apply to fricatives in foreign roots? In other words, why are loan words like the following the norm and not the exception?

(21). f:bhási < "bus"
úgési "electricity" ("gas")

The second reason is why are there so many loan words which display fricatives not blocking consonant harmony?

(22). umbhishôbhi < "bishop"
ukúdasída < "to dust"

All these arguments are in favour of classifying voiceless fricatives as transparent segments. It seems that Zulu shows only a tendency that the fricative underlyingly associated to the [+dep] feature should occur in a [+dep] root.

To sum up, in this section we have tried to demonstrate that all consonants which are not P-bearing units, and which also are not underlyingly associated to the laryngeal tier function as transparent segments i.e. segments that are neutral

to consonant harmony. These segments are the lenis-voiced bilabial stop /b/, the lenis-voiced velar stop /k/, and all other resonants and all voiceless fricatives.

3.2.6.0 Opaque Segments

Opaque segments do not participate in consonant harmony because, according to Clements and Sezer (1982), they are "underlyingly associated with autosegmentally-represented features." (p.214) Voiced fricatives and affricates, prenasalized stops and clicks will be characterized 'opaque' in this sense only (in the discussion that follows we will keep indicating that we can find no examples to illustrate that opaque segments in Zulu also block the spread of the harmonizing feature). This characterization provides an explanation why opaque segments are the only segments that may be associated to a laryngeal feature different from the P-segment, i.e. the root laryngeal feature.
Let us begin our discussion with clicks.

3.2.6.1 Clicks

There are three types of click influxes in Zulu, the dental click /c/ [/]; the alveolar click /q/[!], and the lateral click /x/[//]. Laryngeal specification for click stops and non-click stops follows the same pattern, as the charts in (1a) and (1b) clearly illustrate. For the benefit of easy reference, let us bring forward the chart in (1b) as (23).

(23).

Click Stops	c[/]	q[!]	x[//]	ch[/h]	qh[!h]	xh[//h]	gc[/]	gq[!]	gx[//]
Aspirated	0	0	0	+	+	+	0	0	0
Depressed	0	0	0	0	0	0	+	+	+

The claim we are making for clicks is that they are underlyingly associated with the laryngeal feature. In the case of unspecified clicks, they are associated with a laryngeal node associated with no laryngeal feature, while aspirated

clicks are underlyingly associated with a laryngeal node associated the [+asp] feature and the extra low-toned, i.e. depresso.' click is underlyingly associated with a laryngeal node associated with the [+dep] feature. Like all other such segments, the unspecified click is supplied with the unmarked values of the laryngeal features viz. [-asp] or [-dep] by default rules. No phonetic realization rules apply to unspecified clicks, consequently they surface simply as voiceless unaspirated clicks.

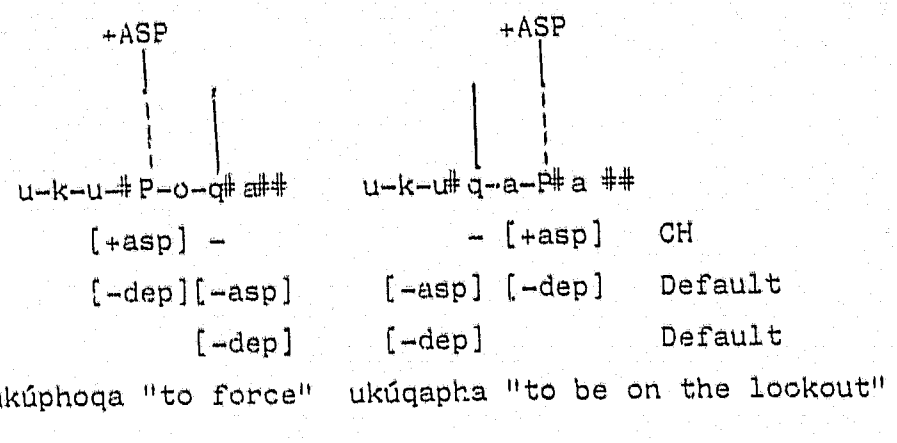
The following examples illustrate that clicks do not participate in consonant harmony:

(24). (a). ukúphoqa "to force"
ukúqapha "to be on the lookout"
(b). ukúgaqa "to crawl"
ukúxega "to be loose"
(c). í:xhegu "an old man"
î:qhúde "rooster"

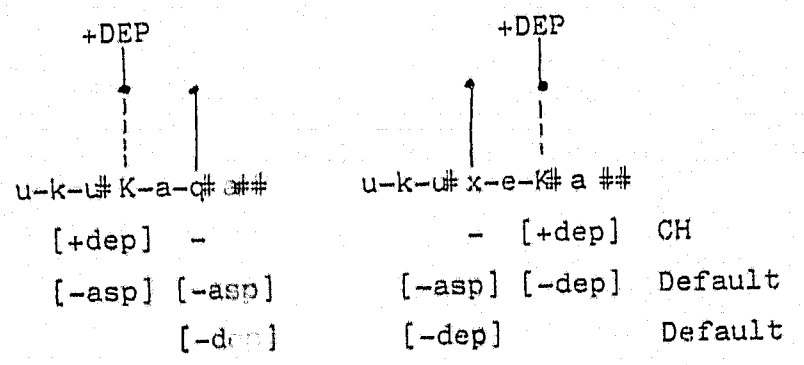
If the roots in which the stops occur are the ones specified for laryngeal features, as we are claiming, then the examp'·- in (a) and (b) suggest that the laryngeal autosegment does not spread to the click stop.

In (a) and (b), we claim that the root laryngeal specification is [+ASP] and [+DEP] respectively, but that the feature does not spread to the co-occurring click because the latter is underlyingly associated to an unspecified laryngeal node.

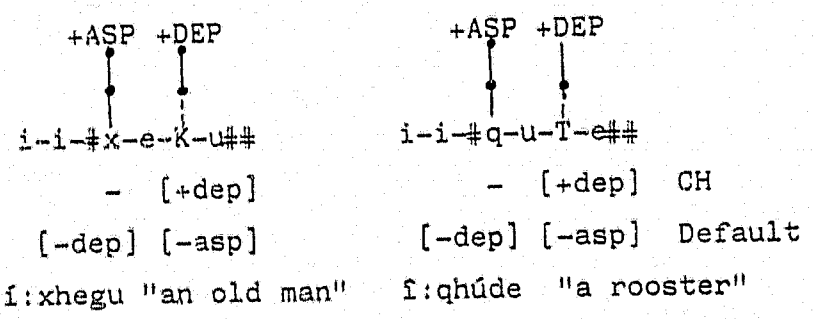
(25).(a).



b.



In the examples in (24c), the clicks are associated with an autosegment contradictory to the harmonizing feature: (26).



Pseudo-harmonic roots incorporating click and non-click stops, therefore, will be understood to be associated with different laryngeal nodes which, however, are associated to the same laryngeal feature.

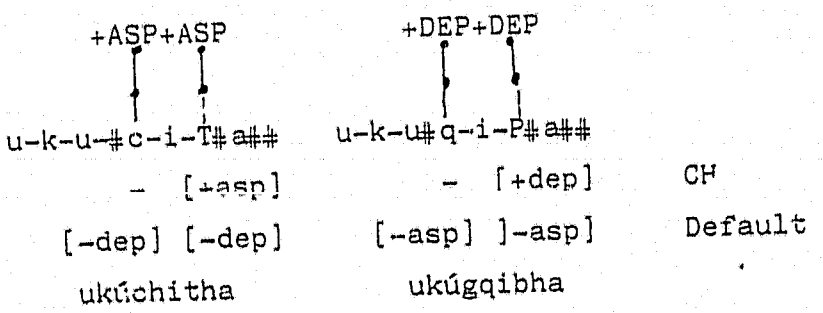
(27).

a. ukúchitha "to throw out (liquid)"
ukúxhopha "to get into the eyes"
ukwéqhatha "to set on each other"

b. ukúgqibha "to breathe heavily"
ukúgcabha "to abuse"
ukúgxabha "to simmer"

Let us take one example from each set and lay out its possible derivation:

(28).



"to throw out (liquid)" "to breathe heavily"

Very severe restrictions on the distribution of specified clicks apply in Zulu and these will be fully discussed in Chapter 3. Mention is made of these restrictions here because they limit the types of examples that have a bearing on consonant harmony, for instance specified clicks may not occur in non-root initial position unless root initial position is filled by a click of the same type. However, these and other constraints on all Zulu segments will be the subject of Chapter 3.

All the examples we have discussed so far have illustrated that clicks, since they are underlyingly associated to the laryngeal tier, do not participate in consonant harmony. We are unable to come up with even one example that would demonstrate that a click also blocks consonant harmony. In other words, we cannot find even one example of a trisyllabic or longer specified root with a click in medial position and non-click stops on either side. This is possibly a consequence of the restrictions cited in the previous paragraph. However, the status of clicks as opaque segments still seems indisputable.

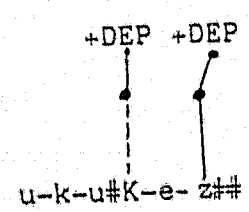
3.2.6.2 Voiced Fricatives

The voiced fricative, which we characterize as underlyingly associated to a laryngeal node linked to the [+dep] feature, functions as an opaque segment in Zulu:

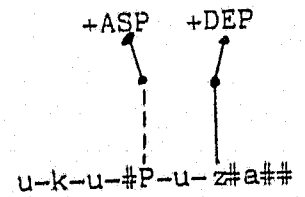
(29). ukúgeza "to wash"
úkuphúza "to drink"
úbhová "bull dog"
úthuví "excrement"

In the pairs of examples above, if we claimed that consonant harmony, i.e. depressor harmony, applied in the first of each pair of examples, then how would we explain the second example in each pair? In the second example the root laryngeal specification is,in our analysis,[+ASP], then how would we get the fricatives to be [+dep] except by specifying them as such? Let us work out a possible derivation for two of these examples:

(30).



ukúgeza "to wash"



úkuphúza "to drink"

We could not find examples that illustrated that voiced fricatives blocked consonant harmony, but there are also no examples that illustrate that they do not.

3.2.6.3 Affricates

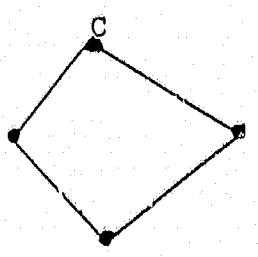
A detailed description of segments is given in Chapter 3 but we feel that without any insight into the phonological structure of affricates, the reader will not find it easy to follow the discussion here. We will, therefore, start by describing the affricate.

An affricate is a segment which has two nodes on the segmental tier linked to one node in the CV tier. The two segmental nodes are in turn linked to one node on the laryngeal tier.

31. CV Tier

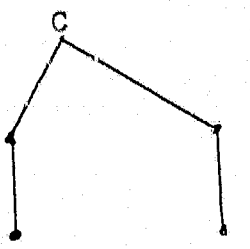
Segmental Tier

Laryngeal Tier



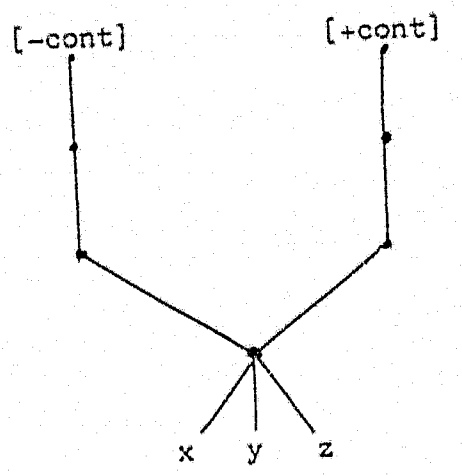
The two segmental nodes (remembering that this representation is three dimensional) are also linked to two nodes on their supra- laryngeal tier.

(32). CV Tier



The supralaryngeal tier, in turn, is linked to one node on the place of articulation tier, and to two separate nodes on the 'manner' tier, the first node associated to the feature [-cont], and the second to the fricative [+cont], as represented below:

(33). Feature Tier



This manner of representing affricates in Zulu demonstrates why an affricate in this language is a complex segment made up of a sequence of two articulations which differ in manner but are one laryngeally and are also homorganic.

There are two consequences of the claim that the two segmental nodes are linked to one laryngeal node. The first is that since all affricates are underlyingly linked to the laryngeal tier (i.e. even the unspecified ones), then they all function as opaque segments to consonant harmony. Secondly, rules that apply to the laryngeal tier like Ejection etc. will now apply to both components of the affricate. In other words, Ejection will apply to affricates, and, as noted earlier, to stops.

The following examples illustrate that affricates do not participate in consonant harmony:

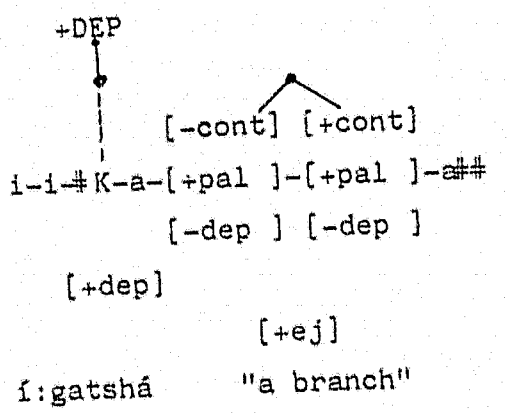
(34).

í:geja	"hoe"
í:gatsh'á	"branch"
í:gékl'e	"reed whistle or pipe"

Here are possible derivations for two of the examples above:

(35).

a.

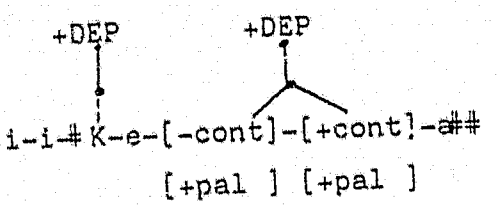


CH

Ejection

í:gatshá "a branch"

b.



CH

í:geja "hoe"

In the derivations above, the features stand for the complete phonological organization that would end in those features i.e. [-cont], [+cont] represent the supralaryngeal tier linked to the manner tier linked to each feature, while the feature [+pal] also represents the supralaryngeal tier linked to the place of articulation tier linked to the feature [+palatal].

3.2.6.4.0 Prenasalized Stops and Affricates

There is much disagreement on the status and analysis of prenasalized stops and affricates in Zulu. Are they clusters or

unit phonemes? Are they phonological clusters but phonetic units? Are click prenasalized stops and non-click prenasalized stops to be treated uniformly or otherwise? What are the underlying structures of prenasalized stops and prenasalized affricates? These questions we will address in Chapter 3. In this section, we will only present our answers to some of these questions.

3.2.6.4.1 Prenasalized Stops

We propose that all prenasalized stops be treated uniformly. There is sufficient evidence to support the analysis that click prenasalized stops and non-click prenasalized stops pattern together in Zulu, and that they should be analysed as one type of segment. In all our statements of consonant harmony then, what is true for click prenasalized stops will, on the whole, be equally true for non-click prenasalized stops. We also propose to treat prenasalized stops (and prenasalized affricates later) as underlying clusters constituting one timing unit on the CV-tier. This means that in the segmental tier the prenasalized stop will occupy two slots, one for the nasal consonant and one for the stop consonant. Since we are discussing laryngeal features only in this chapter, and we have not yet explored the other feature units, we will only use [+nasal] to represent the nasal consonant while the stop consonant will have all its phonological laryngeal features arrayed on the relevant node. The two segmental nodes will then be linked to one "C" slot in the CV-tier in the following manner:

(36). Feature Tier

Laryngeal Tier

Segmental Tier [+nas] [-cont]

CV Tier C

For prenasalized stops, we propose two underlying structures:

(37). Feature Tier (a) ASP (b) +DEP

Laryngeal Tier

Segmental Tier [+nas] [-cont] [+nas] [-cont]

CV Tier C C

Our claim here is that prenasalized stops are underlyingly associated to the laryngeal tier and this, of course, characterizes them as opaque segments. In the derivation of prenasalized stops with the underlying structure represented in (a), a very general nasal deaspiration rule applies:

(38). Nasal Deaspiration

+ASP

[+nas]

C

This rule states that any aspirate which is linked to the same 'C' slot as a preceding nasal loses its aspiration. The following examples illustrate the application of Nasal Deaspiration (ND), and they also demonstrate the correctness of treating click and non-click prenasalized stops uniformly:

(39).	ínqubo	"procedure"	[iN[[qhub]o]]
	ínkósi	"chief"	[iN[khosi]]
	incázelo	"explanation"	[iN[[[chaz]el]o]]
	ímpátho	"treatment"	[iN[[phath]o]]

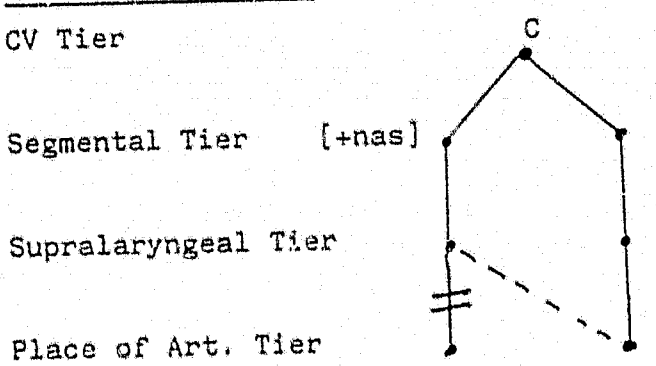
In the examples in (40), the prenasalized stops are not underlying segments, but they are formed in the course of the derivation. Nasal deaspiration, however, applies normally:

(40).

+ASP	+ASP	
i-[+nas]#q-u-o#o##	i-[+nas]#K-o-s-i##	
[+asp]	[+asp]	CH
i-[+nas]qhu-bo	i-[+nas]kho-si	Syllabification
i-[+nas]qu-bo	i-[+nas]ko-si	ND
-	i-[+nas]k'o-si	Ej
ínqubo "procedure"	ínkósi "chief"	

Before continuing with this discussion, let us introduce the rule that specifies the articulation of the nasal component of the prenasalized stops:

(41). Nasal Assimilation



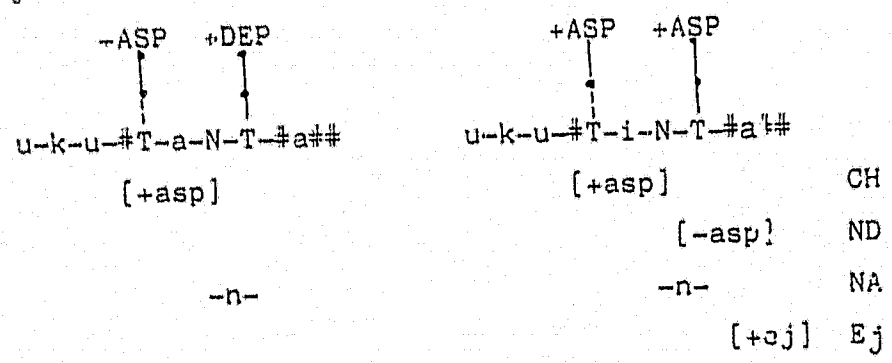
This rule states that when a nasal and a following segment are linked to the same 'C' slot, then the nasal delinks from its place of articulation tier and links onto the place of articulation tier of the tautosyllabic consonant. This rule will enable us now to use "N" to represent [-nasal], and orthographic /n/ which will stand for any of the following: alveolar, palatal, velar; and /m/ which will represent bilabial or labiodental. The correct phonetic shapes will only be discussed in Chapter 3.

Now let us consider the following words which incorporate underlying prenasalized stops:

(42). úkuthánda "to like, love"
ukúthinta "to touch"
ukúcenta "to scuffle the ground"
úkucánda "to chop"

Consider the first two examples. Both roots, to us, are specified [+ASP]. We don't, however, want the harmonizing feature to spread to the prenasalized stop, because if it did we would not be able to explain why it spread onto the second example but not to the first. We are saved all this complication by assuming that all prenasalized stops are underlyingly associated to the laryngeal tier.

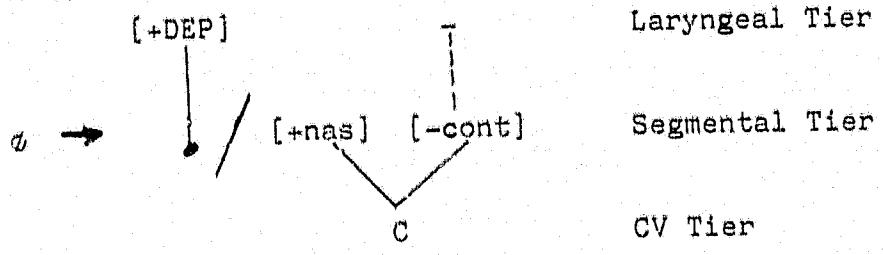
(43).



úkuthánda "to like, love" ukúthinta "to touch"

Now since some [+DEP] prenasalized stops are formed in the course of a derivation, it is necessary to formulate a rule that converts an unspecified stop into a [+DEP] stop if it is in the same cluster with a nasal. Such a rule will have to be ordered to apply before Nasal Deaspiration otherwise it would apply to the output of the latter rule. We will term this rule Nasal Depressing:

(44). Nasal Depressing



This rule states that an unspecified stop co-linked to the same 'C' slot with a preceding nasal becomes associated with a laryngeal node associated to the [+dep] laryngeal feature. This rule is ordered to apply before Nasal Deaspiration.

This rule predicts that all unspecified stops occurring

in nasal clusters, not as a result of Nasal Deaspiration, will be [+dep]. As the next set of examples will illustrate, this will be true for clicks (i.e. unspecified clicks become [+dep] in nasal clusters), for lenis-voiced bilabial stop /b/ (recall that it is unspecified for laryngeal features). The lenis-voiced velar stop /k/ does not occur in this environment. The evidence regarding ejectives in nasal clusters is not conclusive, but on the whole it supports this analysis[5]. This is a counterclaim to Doke's, which is quoted in Herbert 1977(b): "...in Zulu (Doke 1926), implosion is lost after nasals, but ejectives remain as such." (p.384) We agree on the loss of 'implosion' but we claim that a prenasalized stop that surfaces as an ejective prenasalized stop, was underlyingly an aspirate prenasalized stop; an underlying [+dep] prenasalized stop surfaces as such and an unspecified prenasalized stop created in the course of a derivation surfaces as a [+dep] prenasalized stop. Here are some examples:

(45).	ímbongi	"poet"	<	[iN[[bong]i]]
	Ingqondo	"brain, mind"	<	[iN[[qond]o]]
	íngxoxo	"discussion"	<	[iN[[xox]o]]

Zulu orthography is misleading in representing some prenasalized stops. The digraph /mb/ in the first example for instance, represents a [+dep] prenasalized stop, which would have been better represented as /mbh/:

(46).

+DEP	+DEP	
i-N-#b-o-N-K#i##	i-N-#q-o-N-T#o##	
i-Nbo-Ngi	i-Nqo-ndo	Syllabification
[+dep]	[+dep]	NDP
-m-	-n-	NA
ímbongi "poet"	íngqondo "brain"	

Support for Nasal Depressing also comes from loan words, where nasal clusters perceived as 'unspecified' in foreign morphemes are converted to [+dep] prenasalized stops in Zulu:

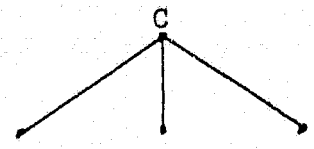
(47). úsiménde < "cement"
ĩ:bhánge < "bank" (< bank, Afrikaans)
ĩ:thánge < "tank" (< tank, Afrikaans)
ínkámbu < "camp" (< kamp, Afrikaans)
ísitémbu < "stamp"

To sum up, prenasalized stops are underlyingly associated to the laryngeal tier, consequently they are opaque to consonant harmony.

3.2.6.4.2 Prenasalized Affricates

On the surface, a prenasalized affricate is an affricate linked to the same "C" slot as a preceding nasal. In the following representation, we will use manner features to indicate that the segments are also linked to nodes in the supralaryngeal tier which are, in turn, linked to the manner feature we have used:

(48). CV Tier



Segmental Tier

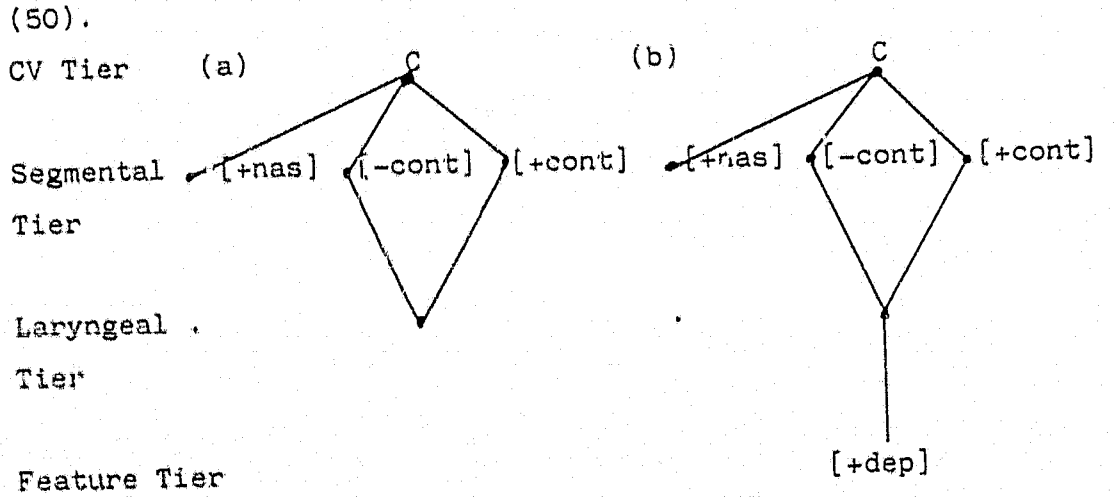
[+nas] [-cont] [+cont]

On the surface, prenasalized affricates have two forms: either they are ejective or they are [+dep]:

(49). íntshebe "beard"
úhuntshú "tall, rough man"
í:nkónjané "a swallow"
ukúthunjwa "to be captured"

In the underlying structure, prenasalized affricates are also either unspecified or [+dep].

(50).



In (a) above, the two root nodes of the affricate share one laryngeal node which is not linked with any laryngeal features. In (b), however, the two root nodes of the affricate share a laryngeal node which is linked to a [+dep] feature.

The representations in (50) demonstrate that both the unspecified prenasalized affricate and the [+depressed] prenasalized affricates are underlyingly associated with the laryngeal node, which qualifies them for classification as opaque segments to Zulu consonant harmony.

The majority of prenasalized affricates in common usage are those that have been formed by the coming together of a nasal and a fricative in the course of a derivation. Such prenasalized affricates cannot provide evidence one way or the other on the opacity of such segments. We will provide a few examples that illustrate that the root laryngeal specification does not spread onto a prenasalized affricate:

(51)

a.	ɬ:bhá:ntshi	"jacket"
b.	ukúpho:ntsha	"to have a puncture"
c.	ɬntshí:di	"misfortune"
d.	ukwéntsha:tha	"to carry on the back"

In our analysis, the root laryngeal specification in (a) and (c) is [+depressed] but this feature does not spread onto the prenasalized affricate within the same root. If the harmonizing feature had spread in this case one would have expected the roots in these examples to surface as /*ɬ:bhá:nji/ and /*ínjí:di/.

We could come up with no examples of trisyllabic or longer roots where prenasalized affricates had stops on either side, to demonstrate that they blocked consonant harmony.

3.3.1 Exceptional Forms

A very careful study of regular disyllabic roots in Zulu has revealed no counter-examples to consonant harmony. We use the adjective 'regular' above because we are excluding counter-examples that occur in the ideophone construction. This is an exceptional construction which violates many segmental and tonal rules of the language. Many ideophones violate consonant harmony, and as a result, words derived from such ideophones will also violate consonant harmony, like the list provided below:

(52). dephu — ideophone indicating tearing off, biting out

índephú	"shred, piece torn out"
isídephú	"torn piece, shred, tatter"
ukudephûka	"to get torn off, or bitten out"
ukudephûla	"to tear off, bite out a piece"
indephúndephu	"anything in shreds or torn to pieces"

3.3.2 Trisyllabic and longer Roots

The majority of trisyllabic and longer roots in Zulu are not original roots. Here are some such roots:

(53). ukuthungatha "to trail by scent, follow the trail"
ukusingatha "to support, look after"
ukudingida "investigate, enquire into"

There are many such roots, we have selected only a few to make our point. A first glance at the first and third root would suggest that the root laryngeal feature, [+ASP] and [+DEP] respectively had spread to the third syllable in the root, which would classify the prenasalized stop in the middle syllable as a transparent segment - contrary to our classification. A closer inspection, however, reveals that the first two examples incorporate a fossilized suffix /atha/, which is listed also in Doke (1927). This analysis has semantic support because the regular CVC roots, /thung/ and /sing/ mean "sew" and "look intently in" respectively. The third example would seem to have a similar derivation. Although Doke does not list /-da/ among the fossilized suffixes in Zulu, we believe that it is so. It does occur in a few roots, e.g.

(54). ukúshwabáda "eat ravenously"
ukubhukûda "to stab/swim"

The root /shwaba/ is an archaic ideophonic root indicating "eat ravenously", and the noun "ubhuku" refers to a marsh. In the root /dingida/ we think the original disyllabic root was the same as in /indingi/ "a circular object". "To investigate, enquire into" would mean to go round and round a matter.

3.3.3 A Small Class of Exceptions

Finally, we wish to list four words which are exceptional and for which we have no explanation. These four words are so rarely used that we only got to know of the existence of three of them from Doke & Vilakazi (1948):

(55). ìbhóti "genitals of a girl"
ìdáta "indigenous species of potato"
ídaté "indigenous species of potato"
úmdatí "ceremonial affair"

None of these four stems is in common usage; in fact we have never heard a single Zulu use any except one of them. We have heard the form /imidati/, although most Zulus use the variant /imidanti/. (/Imidanti/ is perfectly regular since it incorporates a prenasalized stop which is opaque. This example may suggest that perhaps the ejective stops in the examples above started off as prenasalized stops.) In the second and third example, we find it surprising that unmistakable variants deriving from a similar root should have different tonal patterns. Be that as it may, we can offer no explanation for the failure of Depressor harmony to spread onto the second stop of each of the roots above.

4.0 Loan Words and Consonant Harmony

4.1 Hyman states that "Both in syntax and in phonology, one of the chief concerns in the process of linguistic analysis is the justification of grammars." (Hyman 1970: 1) He then quotes Kipa_sky (1968): "what we really need is a window on the form of linguistic competence that is not obscured by factors like performance..." (p.174). Hyman then concludes "I would like to suggest that borrowing provides one such window." (p.6)

Loan words provide just this window for the psychological reality of consonant harmony for stops in Zulu. Consider the following examples:

(56). a. i:bhakêde < "bucket"
b. i:phákethe < "packet"
c. úmbhídi – "conductor" (< 'beat' time)
d. íkhôtho < "court"

There is need for a principled manner of explaining why the final "t" in a foreign root whose other stop is perceived as a depressor stop, is also restructured as depressor stop /d/

whereas a similar final "t" in a root incorporating an aspirate is restructured as the aspirate stop /th/. We claim that this segment is perceived in terms of a general principle that governs the distribution of stop types within a Zulu root. The examples in (a) and (c) are, in terms of the principle of Zulu consonant harmony, classified as [+DEP] roots, while those of (b) and (d) are classified as [+ASP] roots. Thereafter, for purposes of specifying the laryngeal features of the stops within the roots, consonant harmony applies in the usual manner.

The question may arise whether the initial stop in the root should not be considered the triggering element of the harmony. The position, we think, is that the Zulu speaker uses all the stops he hears to determine the laryngeal class of the root, and thereafter he applies all the relevant rules in restructuring the root. The most important of these rules, however, is the Consonant Harmony rule.

(57).

+DEP		+ASP		
i-i-#P-a-k-e-T-e##		i-i-#P-a-k-e-T-e##		
[+dep]	[+dep]	[+asp]	[+asp]	CH
[+vd]		[+vd]		SV
i:bhakêde "bucket"		i:phákethe "packet"		

These derivations provide extra support for the notion that "borrowings are perceived in terms of the native structure of the recipient language." (Rubach 1984: 49). In Chapter 3, we will learn that the velar aspirate stop /kh/ is restricted to root-initial position. In the foreign roots from which the examples above derive, /kh/ occurs in the unpermitted middle syllable of the root. A Zulu speaker cannot conceive of that segment in that position and consequently he does not perceive it to be there, but rather he perceives a closely related segment, in this case the unaspirated lenis-voiced velar stop /k/, to be there.

Here are three more examples:

(58). i:kháphethe < "carpet"
imákethe < "market"
i:khábethe < "cupboard"

The roots in these three examples are all classified [+ASP] and then consonant harmony applies. In the first example, consonant harmony applies to all three stops because they all occur in permitted positions. In the second example, the /kh/ in the unpermitted position is perceived as /k/. In the final example consonant harmony does not apply to the medial stop because the /b/ of the foreign root is, as is the case with most medial or intervocalic /b/'s perceived as the lenis-voiced /b/. More examples like the last one are the following:

(59). i:thébula < "table" (maths)
ínjolóba < "eraser" (= India-rubber)
inabúkeni < "napkin"

4.2 Certain phonological rules sometimes escape our notice until their application in the restructuring of foreign morphemes forces the reality of such rules to our attention. Such was the case with consonant harmony. It was not until we had to explain the difference between such nouns as /ibhakêde/ "bucket" and /iphákethe/ "packet" that it dawned on us what was going on. Let us now consider the following data:

(60). isít'aládi < straat (Afrikaans) "street"
ínk'inóbho < knoop (Afrikaans) "button"
ík'ilógo < klok (Afrikaans) "clock"
isík'olóbho < skrop (Afrikaans) "a part-time job"

In the donor language, viz. Afrikaans, a South African language, the stops in the examples in (60) are voiceless, unaspirated stops, and yet when they are rendered into Zulu,

the final stop becomes [+dep]. This reanalysis suggests the application of a phonological rule. This rule which we term Final Depressing is not formalized in this thesis. It is the rule that applies in a few isolated words in Zulu:

(61). ú:talágu "heat waves, shimmering of heat"
î:kíkilígi "stomach of a bird"

This rule was suggested to us by the restructuring of the foreign roots in (60). Without that insight, we would have been unaware of such a rule and we would have complicated our analysis of consonant harmony by treating the examples in (60) and (61) as counter examples.

5. CONCLUSION

In this chapter, we have considered the laryngeal features that, in this analysis, have phonological status, and these are two in number viz. [+aspirated] and [+depressed]. Non-click stops within a root usually have the same laryngeal specification, and we ascribe this to the application of a rule we term consonant harmony. Non-click stops, we claim, are underlyingly unspecified for laryngeal features; it is the morphological roots in which they occur which are laryngeally specified. This 'root' laryngeal specification spreads by rule to all [-son] non-click stops within the root. Resonants and voiceless fricatives, in this analysis, function as transparent segments while clicks, affricates and prenasalised stops function as opaque segments.

It was our study of loan-words that first suggested the occurrence of consonant harmony in Zulu, and it is the restructuring that occurs in these forms that lends support to the psychological reality of consonant harmony. In our formulation of the consonant harmony rule, it is only the marked laryngealfeatures (i.e. [+aspiration] and [+depressed]) that 'harmonize'. It is a feature of the analysis that the stems unspecified for laryngeal features are not formally

demonstrating consonant harmony, yet the stops in these stems do "harmonize" in a pre-systematic sense (unspecified [-son] non-click stops surface with the phonetic feature [+ejected]). These stems, therefore, may be regarded as showing harmony by default under the present analysis. This is not recoverable from the analysis and suggests that further investigation might yield a more complete formalization than the one we have explored.

However, what is not in dispute is the psychological reality of consonant harmony. This study also lends strong support to Clement's (1985) claim of the hierarchical organization of phonological features. Consonant harmony under any formalization, is a rule that applies to laryngeal features to the exclusion of supralaryngeal features. Nasal Assimilation, which we met in this chapter also, lends further support by illustrating the application of the rule to the place of articulation features only.

Finally, we wish to reiterate that underspecification was employed only in order to illustrate consonant harmony, and that in the ensuing chapters segments will be fully specified for all features under consideration.

Chapter 2 - Notes

1. Ejection is a low-level rule that specifies [-asp; -dep; -son; -cont.] segments [+ejected]. It will be discussed at length in Chapter 3.

2. It became clear only after the completion of the thesis that for this feature geometry to account for all assimilations and distributional constraints, the place of articulation unit had to have both a secondary and a primary node following E.C. Sagey, The Representation of Features and Relations in Non-Linear Phonology - MIT - Ph.D Thesis 1986 (unpublished).

3. Sonorant Voicing is a low-level rule that specifies [+sonorant] segments [+voiced]. It will be discussed in greater detail in Chapter 3.

4. For the phonetic transcription of the depressed click, we associate the transcription for the unspecified click with a low tone.

5. A few plural forms of class 10 nouns with stems commencing in ejectives are exceptional in that the ejectives do not convert to depressors after the nasal of the noun prefix. Fortunately, these plural forms, which are all to be found in Doke and Vilakazi (1948), are not in current usage, and they are so few that, if necessary, they can be listed as exceptions to Nasal Depressing. Here are a few examples:

ú:k'etsh'e	"thin, watery substance"	->	izink'êtsh'e
ú:t'ekú	"jesting, joking talk"	->	izint'êkú

CHAPTER THREE

Zulu Segments and their Distinctive Features

1. Introduction

In the last chapter, we discussed the laryngeal features for Zulu segments. In this chapter, we will go over the ground again, and supply the details which did not suit the focus of the last chapter. But in this chapter we will discuss all the distinctive features for all Zulu segments, and also the majority of the distributional constraints that apply to Zulu segments.

It should be emphasized that our concern here is to provide a classification of Zulu segments that will serve as an adequate basis for understanding and formulating the segmental and tonal processes of Zulu (cf. Chapters 4 and 5). In other words we will select only those features that serve best "to describe the natural classes in rule application and to differentiate the underlying forms" (Keating 1984: 287).

Before discussing the different classes of segments, let us first consider the major class features. These are the manner features that distinguish the major classes of segments. There will only be three such features since [syllabic] will now be determined by syllable structure. The distinctive features then for the major classes of segments will be as follows:

(1)

	Vowels and Glides	Resonants	Stops	Fricatives
Consonantal	-	+	+	+
Sonorant	+	+	-	-
Continuant	+	+	-	+

'Stops' in the table above specifies obstruent stops since the lenis-voiced stops /b/ and /k/ are specified [+ sonorant] (see Chapter 2). Obstruent stops, therefore, are [+ cons; - son; - cont] while the two sonorant stops will be [+ cons; + son; - cont].

Affricates, prenasalized stops and prenasalized affricates are complex segments carrying the specification of their component parts.

We will now discuss the classes of segments in this order:
vowels and glides, nasals, liquids, non-click stops, click stops, fricatives, affricates, prenasalized stops, and prenasalized affricates.

2. Vowels and Glides

2.1 The following phonological features suffice in the formulation of rules involving vowels:

(2)

	i	e	a	u	o
Consonantal	-	-	-	-	-
High	+	-	-	+	-
Back	-	-	-	+	+
Low	-	-	+	-	-
Labial	-	-	-	+	+

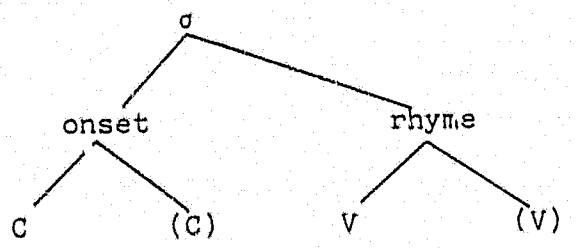
In the hierarchical organization of phonological features that we are employing in this analysis, the features [high], [back], [low] and [labial] are place of articulation supralaryngeal features.

We do not require both features [back] and [labial]; in fact we need only one of them to distinguish vowels and glides

but we shall see later on that some general rules can only be formulated in terms of the feature [back] while others have to be formulated in terms of the feature [labial]. For that reason, we will retain both features for specifying vowels and glides. The feature [- consonantal] distinguishes vowels and glides from all true consonants i.e. obstruents, nasals and liquids.

The high vowels /i/ and /u/ will only be distinguished from their corresponding glides viz. /y/ and /w/ respectively by their position within the syllable. Recall that we indicated in the introduction that Zulu syllables are all open syllables of the following structure:

(3).



Only vowels may occur in the rhyme-slot, glides and all other consonants may only occur in the onset. This means that segments with the specifications [-cons][+hi] will surface as vowels or glides depending on their syllable position. A [-cons] segment linked to the nucleus node is realized as a vowel, otherwise its realization is dependant on whether it is [+hi] or not.

2.2 Vowels in Juxtaposition

2.2.1 Adjacent Vowels and Geminate Vowels

Two or more [-cons] segments each associated with a nucleus node may not occur in juxtaposition within a Zulu morpheme.

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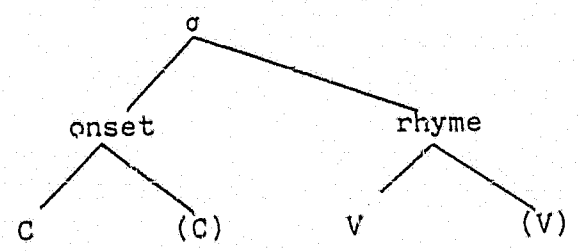

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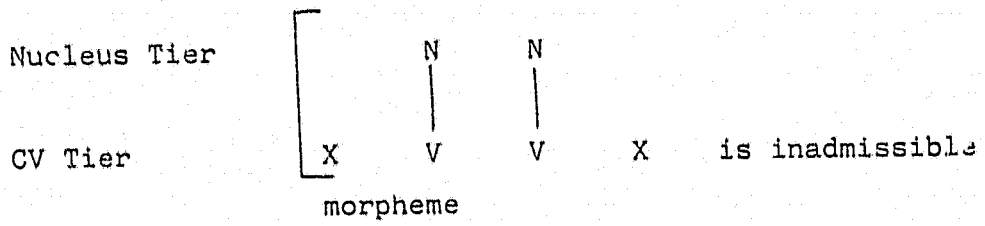
(4). Vowel Sequence Constraint



(We are using the nucleus tier rather than the rhyme tier because Zulu syllables, as we have already indicated, are open syllables. A rhyme refers to a nucleus and possible coda, which is not part of Zulu syllable structure).

Even across morpheme boundaries, this sequence is still unpermitted. Yet, in the course of a derivation, it does get created. In such an event, a syllabification rule - Syllable Delinking - will delink the leftmost vowel from its syllable node and link it onto the syllable node of the vowel to the right. Then a rule - Nucleus Delink - will delink the vowel to the left from its nucleus node.

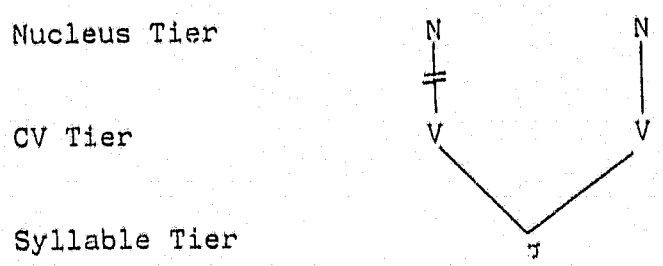
In (4) of Chapter 1, we indicated that the CV tier consists of two members viz. "C" and "V". Let us now define these two members:

(a) The element "V" is one linked to the nucleus tier and which forms the syllable peak.

(b) The element "C", on the other hand, is not linked to the nucleus tier, and it forms the onset to the syllable.

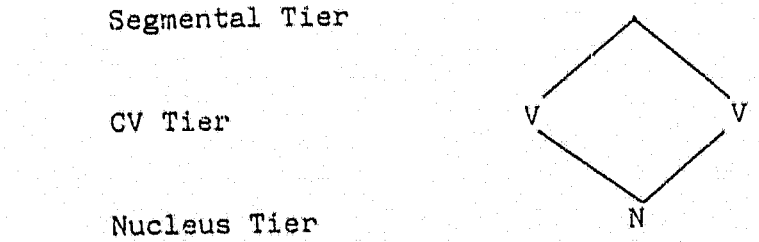
Delinking a "V" slot from the nucleus tier actually means converting it to a "C" slot.

(5). Nucleus Delink

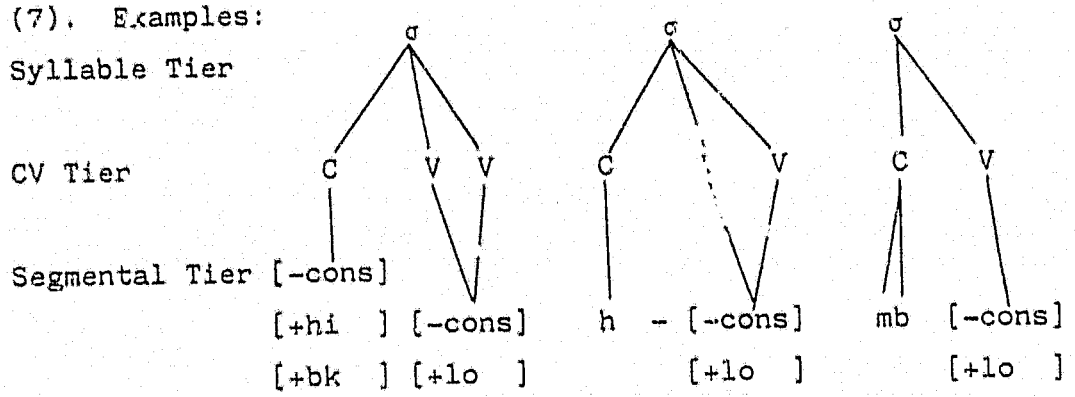


The application of this rule will be illustrated later, for now let us consider some vowels in juxtaposition which the language permits. Such vowels are identical vowels linked to one segmental node:

(6). Geminate Vowel



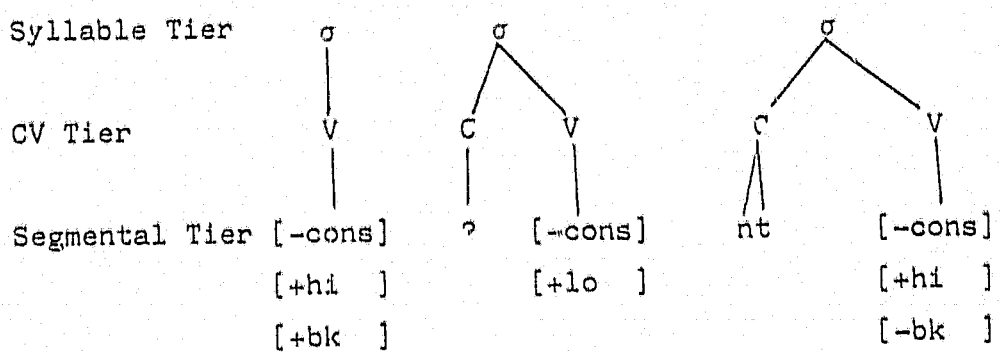
(7). Examples:



wâ:hâ:mba "he left"

Syllables in juxtaposition may be separated by a glottal stop which then functions like a consonant.

(8). Examples:



úʔantí "aunt"

2.2.2 The Feature [labial]

The feature [labial] is used to cross classify [+bk] vowels and labial segments. In (19) of this chapter, we will discuss a rule that epenthesizes a [+lab][+hi] vowel to break up a cluster with a labial consonant. This epenthesized vowel, we argue, assimilates to the labial quality of the preceding consonant.

(9). Examples:

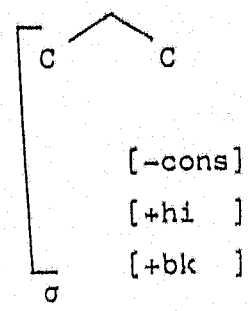
inabúkeni	<	napkin	
úsitáfunési	<	staff-nurse	"a nursing sister"

More such examples are supplied in (20) of this chapter. Another example of [+lab][+hi] vowels being cross-classified with labial consonants we shall see presently when we consider the Labial Glide Constraint.

2.2.3 Two Syllable Structure Conditions

Two constraints[1] apply to glides: the C^2 Constraint and the Labial Glide Constraint. The first is a positive syllable structure condition which admits only the glide /w/ in C^2 position.

(10). C^2 Constraint

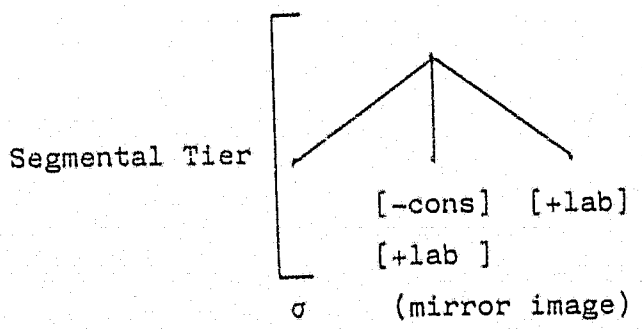


is admissible

The second constraint is a negative syllable structure condition functioning as a filter to the first one. The first constraint admitted the glide /w/ in C^2 position. The second

one bars the co-occurrence of the labial glide in C^2 position with another labial. This constraint will be called the Labial Glide Constraint.

(11). Labial Glide Constraint



is inadmissible

Let us illustrate these two syllable structure conditions. By admitting only the /w/ glide, the C^2 Constraint bars the glide /y/ and any other consonant in that position. Here are examples to illustrate this:

(12). Examples:

(a) ísalukázi sídla ínyama "The old lady eats some meat"
(b) ísalukázi sákha índlu "The old lady builds a house"
(c) ínkosi ídla ínyama "The king eats some meat"
(d) ínkosi yákha índlu "The king builds a house"

In sentence (a), the subject prefix /si/ surfaces in full when it immediately precedes a consonant-commencing verbal radical, while in sentence (b) where it is in juxtaposition with the vowel-commencing radical /akh/ it only surfaces as /s/. Before a consonant-commencing radical, the class 9 subject prefix surfaces as /i/ while before a vowel-commencing radical, it surfaces as the glide /y/. Our claim is that in both example (b) and (d), the /i/ vowel of the subject prefix becomes juxtaposed to

the initial vowel of the verbal radical. Syllable Delink and Nucleus Delink apply, triggering Vowel/Glide Realization. In both cases, we claim, the vowel /i/ is realized as the glide /y/. This glide surfaces in example (d), but in example (b) a rule we will meet later, termed Y-Deletion, deletes it, otherwise it would violate the C^2 Constraint (i.e. it would display the inadmissible sequence "sya").

The next set of examples illustrates the application of some rules motivated by the Labial Glide Constraint:

(13). Examples:

(a)	úkudla ínyama	"to eat meat"
(b)	úkwakha índlu	"to build a house"
(c)	ukósa ínyama	"to roast meat"
(d)	úm!fána údla ínyama	"the boy eats some meat"
(e)	úm!fána wákha índlu	"the boy builds a house"
(f)	úm!fána wósa ínyama	"the boy roasts some meat"
(g)	úhlanya lúdla ínyama	"the madman eats some meat"
(h)	úhlanya lwéba ínyama	"the madman steals some meat"
(i)	úhlanya lósa ínyama	"the madman roasts some meat"

In examples (a), (d) and (g), the prefix vowel /u/ surfaces because it immediately precedes a consonant. In all the other examples Vowel/Glide Realization applies and it is realized as the glide /w/, which surfaces only in examples (b), (e), (f) and (h) where it does not violate the Labial Glide Constraint.

In examples (c) and (i), the inadmissible sequence is resolved by the application of rules discussed in detail in Chapter 4.

Many of these rules will be motivated by the syllable structure conditions discussed in this section. The Labial Glide Constraint lends further support for the need for the feature [labial] since no other feature classifies the labial [-cons] segments with their [+cons] counterparts.

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