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Casablanca Moroccan Arabic Consonant Phonotactics

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Dedication

To The Memory of My Father …

Abstract

This thesis is mainly concerned with the consonant phonotactics of Casablanca Moroccan Arabic. I limited myself to the analysis of consonant phonotactics. I looked at the possible and impossible clusters w-initially and w-finally (i.e. onsets and codas). As far as I can tell, there is only one work on CMA syllable structure which was done by Abdedaziz Boudlal (2001). He dealt with it from a constraint-based perspective, but he didn't deal with CMA co-occurrence restrictions. To the best of my knowledge, there is no research done before on CMA phonotactics using feature geometry.

The purpose of this study is twofold. The main aim is to examine CMA co-occurrence restrictions using the following theoretical outlooks: syllable structure (i.e. sonority principle), autosegmental phonology (i.e. Obligatory Contour Principle) and constriction-based model of feature geometry. The focus is on feature geometry since it is the major model that is used in this study. The second aim is to describe and examine CMA syllable structure. I discussed the

role of sonority in assigning syllable structure to sequences of segments. Since syllable structure is so relevant to co-occurrence restrictions, I dwelt at length on CMA syllable structure which of course helps clarify CMA phonotactics. Given the purely descriptive and quantitative approach it adopts and the ample evidence it provides, the study is meant to be a detailed reference for researchers on feature geometry, syllable structure and autosegmental phonology.

Since my primary concern is empirical coverage, I dealt with the different phonological processes, namely epenthesis, vowel reduction, vowel lengthening, strengthening, weakening, diphthongization, and glide formation. I also made use of various tools with which I examined CMA consonant phonotactics such as a constriction-based model, Obligatory Contour Principle, a two- root theory of length, etc.

List of Abbreviations

CMA: Casablanca Moroccan Arabic

Con: Consonantal

C: Coda

ESAs: Emphatic Spreading Agents

F: Foot

Fem: Feminine

GL: Geminate Law

O: Onset

OCP: Obligatory Contour Principle

MA: Moroccan Arabic

Mas: Masculine

NNC: No Crossing Constraint

N: Nucleus

Pl: Plural

Pers: Person

PW: Phonological Word

Sg: Singular

Syl: Syllabic

Son: Sonorant

SSAA : Syllable Structure Assignment Algorithm

SSP : Sonority Sequencing Principle

List of Phonetic Symbols

Consonants

b Voiced bilabial stop

f Voiceless labiodental fricative

t Voiceless alveolar stop

d Voiced alveolar stop

s Voiceless alveolar fricative

z Voiced alveolar fricative

T Emphatic voiceless alveolar stop

D Emphatic voiced alveolar fricative

S Emphatic voiceless alveolar fricative

Z Emphatic voiced alveolar fricative

ʃ Voiceless palatal fricative

ʒ Voiced palatal fricative

k Voiceless velar stop

g Voiced velar stop

x Voiceless velar fricative

γ Voiced velar fricative

q Voiceless uvular stop

m Bilabial nasal

n Alveolar nasal

l Alveolar liquid

r Alveolar trill

R Emphatic alveolar trill

ħ Voiceless pharyngeal fricative

ʕ Voiced pharyngeal fricative

h Voiced laryngeal fricative

ʔ Glottal stop

w Labiovelar glide

y Palatal glide

Vowels

i High front unrounded

u High back rounded

a Low back unrounded

ə Mid central unrounded

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General Introduction

This thesis is mainly concerned with the consonant phonotactics of Casablanca Moroccan Arabic (henceforth CMA). I am going to limit myself to the analysis of consonant phonotactics. Hence, vowel phonotactics will not be dealt with in this research. I am going to look at the possible and impossible clusters w-initially and w-finally (i.e. onsets and codas). There are two main motivations for the choice of the topic (CMA consonant Phonotactics). The first motivation is to see how clusters in CMA are concatenated. The second motivation comes from the fact that CMA is not a well studied language. As far as I can tell, there is only one work on CMA syllable structure which was done by Abdedaziz Boudlal (2001). He dealt with it from a constraint-based perspective, but he didn't deal with CMA co-occurrence restrictions. To the best of my knowledge, there is no research done before on CMA phonotactics using feature geometry. In this research, CMA syllable structure will be dealt with from a feature geometry perspective; I will look at it from a different perspective so as not to replicate what has been done.

The purpose of this study is twofold. The main aim is to examine CMA co-occurrence restrictions using the following theoretical outlooks: syllable structure (i.e. sonority principle), autosegmental phonology (i.e. Obligatory Contour Principle, henceforth OCP) and constriction-based model of feature geometry. The focus will be on feature geometry since it is the major model that will be used in this study. The second aim is to describe and examine CMA syllable structure. I will discuss the role of sonority in assigning syllable structure to sequences of segments. Since syllable structure is so relevant to co-occurrence restrictions, I will dwell at length on CMA syllable structure which will of course help clarify CMA phonotactics. Together with the two main objectives mentioned above, I also aim to provide a better understanding of the three outlooks (i.e. syllable structure, autosegmental phonology, and feature geometry), and address other current theoretical issues within the previous theories.

Since my primary concern is empirical coverage, I will deal with the different phonological processes, namely epenthesis, vowel reduction, vowel lengthening, strengthening, weakening, diphthongization, and glide formation. I will also make use of various tools with which I will examine CMA consonant phonotactics such as a constriction-based model, OCP, a two- root theory of length, tier conflation, etc. Having said this, I will next present the organization of the thesis.

The thesis is organized into four main chapters. The general introduction states the purpose, and presents the organization of the study. Chapter one sketches the geographical and dialectal situation of Casablanca, and presents the methodology. Also, it will be devoted to some general aspects of CMA phonology and morphology. In this chapter, I will present the consonantal and vocalic system of CMA. It will examine the CMA morphology with examples. This chapter will shed light on root-and- pattern morphology. The discussion will involve both morphological processes, derivation and inflection.

The second chapter is a review of the theoretical tools that will be employed in the analysis of CMA phonotactics. The section about syllable structure will be concerned with the syllable, the sonority principle, extrasyllabicity, licensing and geminates. The review of the literature on syllable structure and other issues will mainly focus on the works done on Moroccan Arabic (hereafter MA). These works include: Abdelmassih (1973), Benhallam (1980), Benkaddour (1982), Keegan (1986), Hammoumi (1988), Al Ghadi (1990), Rguibi (1990), Boudlal (1993, 2001), and El Medlaoui and Dell (2002). The second section about autosegmental phonology will deal with the OCP, association convention, no crossing constraint (NCC), and the skeletal tier, etc. The last section in the first chapter will present the main issues in feature geometry such as an articulator-based model, a constriction-based model, and the root node, etc. The focus will be on the so-called constriction-based model.

In the third chapter, I will examine CMA syllable structure. This chapter will present the data which will be listed in terms of parts of speech (nouns, verbs, adjectives, adverbs, determiners, and prepositions). The words will also be classified with respect to their number of syllables (i.e. monosyllabic, disyllabic, and trisyllabic words). The data will also involve geminate words (initial, medial and final geminates) since I am going to devote a subsection to the treatment of geminates (i.e. both accidental and true geminates). In this chapter, I will look at the peak of CMA, and present the onset and coda restrictions. Finally, some syllable-related phonological processes such as vowel reduction, strengthening, lengthening, glide formation, epenthesis and deletion will be presented from a feature geometry perspective.

The fourth chapter is devoted to the examination of CMA consonant phonotactics. In this chapter, I will have two charts involving CMA consonants (sounds), and will look at the possible and the impossible clusters in both the onset and coda positions. The CMA phonotactics will be analyzed from feature geometry and autosegmental perspectives.

Finally, the conclusion will summarize the findings and state the limitations of the work. Having considered the purpose and organization of the study, the following section will give a general overview of the aspects of CMA phonology and morphology.

Chapter I: Some Aspects of CMA Phonology and Morphology

I.0. Introduction

This chapter aims to provide an overview of CMA phonology and morphology. I will start by presenting the variety (i.e. CMA) and the data. I will briefly examine some of the earlier phonological and morphological research on CMA. The third part will give an account of the consonantal system of the language under study. The fourth part concerns the vocalic system of CMA. The last part is devoted to the examination of some derivational as well as inflectional processes which are judged to be essential for the study of the CMA.

I.1. Geographical and Dialectal Situation of Casablanca

CMA has attracted the attention of a number of linguists like Moumine (1990), Imouzaz (1991), Nejmi (1993), Boudlal (1993/2001), to cite but a few. It is the language of a large number of people who live in Casablanca, a melting pot. The following two subsections sketch the geographical and dialectal situation of Casablanca.

I. 1. a. Geographical Situation

As far back as the 12th century, historians mentioned a Berber settlement on the Atlantic Coast of Morocco called Anfa[1]. Historically speaking, one striking event determined the future of Casablanca; Hurbert Lyautey the first French general in charge of the running of the country under the French protectorate (1912-1956), decided to enlarge the port of Casablanca to a world-class standard and make the city the economic pole of attention for the whole country (Moumine 1990 : pp.3-5).

Casablanca, the largest city, is considered the economic and business center of Morocco. It is the principal port and one of the main points of entry into the country. Casablanca is a coastal city placed within northwestern Morocco on the shores of the Atlantic Ocean. The city sits on the Chawiya plain and is located 95 kilometers (59 miles) Southwest of the Moroccan capital, Rabat (Srhir 2012: p. 126).

Concerning the population of Casablanca, the 2004 census recorded a population of 3,500,000 in the prefecture of Casablanca and 6,000,000 in the region of Grand -Casablanca (Aldosari 2012: p. 54).

Casablanca has a very mild Mediterranean climate. It is strongly influenced by the cool currents of the Atlantic Ocean, characterized by more moderate temperatures than some other location in Morocco. Having briefly sketched the geographical situation of Casablanca, I will, in the following subsection, shed light on the dialectal situation of Casablanca.

I.1. b. Dialectal Situation

As far as the linguistic situation in Morocco is concerned, there are four broad varieties of Moroccan Arabic that can be distinguished according to region: the Northern,

[1] Casablanca is *Anfa* in Berber. *Ad Dar al Bayda* in Arabic. Casablanca today.

Southern, Eastern, and Central varieties (Boudali 1987: p.14). The differences between the varieties in Morocco can be seen at the phonological and lexical level.

Some recent studies on Arabic dialectology suggest that CMA could be related to those Bedouin dialects which were introduced in Morocco during the subsequent massive immigration of the Arab Bedouin tribes (Moumine 1990: p.7). The Bedouin dialects are seen to be those Arabic dialects which do not conform to the settled dialects of the region and whose speakers consider themselves of Bedouin origin.

Apparently, CMA satisfies the Bedouin dialect description presented above since Casablanca has received a large number of new settlers, and the majority of them have come from Schawiya, Doukkala and Shyadma, bringing with them their rural dialects. The new settlers have tried to accommodate each other's dialect; they have reduced pronunciation and lexical dissimilarities so as to be integrated and avoid the stigma of being stereotyped and thus feel socially insecure. As a result of this long-term linguistic behaviour, an interdialect has emerged especially among the generations born in the city (ibid).

Boudlal (1993, 2001) states that the interdialect described above is what is known today as CMA whose native speakers could be identified throughout Morocco. As a matter of fact, CMA shares most of the grammatical features with the other varieties in the country but it differs from them with respect to some phonological and morphological aspects. The main purpose of this section (1.a and 1.b) was to provide a general overview of Casablanca geographically and linguistically. The next section will present the methodology.

I.2. The Data

The analysis presented in this study is based on CMA. The data was collected in Casablanca from family members and friends, in particular. In collecting the data, certain variables have been taken into consideration. The informants I have chosen were all born in Casablanca. Furthermore, their parents have been living there for a long period.

Additional data comes from published works on the grammar of Moroccan Arabic (hereafter MA) (Richard Harrell: 1962, 1966)[2]. Other sources of material include the substantial body of data on MA found in Rguibi (1990), Keegan (1986), and Elmedlaoui and

[2] Only the data identified by native speakers of CMA were included in the corpus.

Dell (2002). The data was taken from other works on CMA, particularly works such as Boudlal (1993, 2001).

I.3. The Consonantal System of CMA

The MA consonantal system has received different interpretations from different linguists. Both native and non-native linguists differ concerning the number of MA consonants. For instance, Harrell (1962) and Abdelmassih (1973) claimed that MA has thirty one consonant phonemes; whereas, Benkirane (1982) claimed that it is composed of twenty eight consonants including the emphatic consonants. The disagreement on the number of consonants is mainly due to the problem of determining the exact number of the underlying emphatic consonants.

For the purpose of our study, the following consonantal inventory of CMA will be adopted (Boudlal: 1993, 2001):

(1)

	Labial	Alveolar	Alveo-palatal	Velar	Uvular	Pharyn-geal	Glottal
Stop	b	t,d T, D		k, g k^w, g^w	q, q^w		(ʔ)
Fricative	f	s, z S, Z	ʃ, ʒ		x, ɣ x^w, $ɣ^w$	ħ, ʕ	h
Nasal	m	n					
Liquid		l r, R					
Glide	w		y				

The emphatic consonants that will be used in this present study are: /D, T, Z, S, R/. Linguists differ concerning the exact number of the underlying emphatic consonants. Abdelmassih (1973) listed /T, D, S, Z, R, L/ as the emphatic counterparts of the plain /t, d, s, z, r, l/.

Benhallam (1980), however, stated that the number of what he called Emphatic Spreading Agents (ESAs). These ESAs are /D, T, S and R/. Youssi (1986) set up five emphatic consonants in his phonemic inventory, which are /D, T, Z, S, R/. Having looked at the consonantal system of CMA, the following section will try to determine the vocalic system of the language under study.

I.4. The Vocalic System of CMA

As it is the case with all Semitic languages, the consonantal roots are combined with vocalic patterns. These vocalic elements generally indicate grammatical relations.

Generally, all the works agree on the fact that MA has the following three underlying vowels /i/, /u/ and /a/. Benkaddour (1982: p. 130) assumes that the Rbati dialect has four vowel phonemes which are /i/, /u/, /a/ and /ə/**.** However, Benhallam's (1987) basic assumption about MA vowels is that the full vowels /i/, /a/, and /u/ are underlying and that the schwa is epenthetic.

The crucial issue, which is the point of divergence, is the status of the schwa. The major debates concerning this sound in MA concern whether it should be assigned a phonemic or a phonetic status. Some linguists assume that the schwa is a non-phonemic short vowel with no semantic significance (Abdelmassih 1973: p. 83). Similarly, Benhallam (1980.) claims that the schwa in MA is purely phonetic; its function is break up impermissible consonant clusters as could be seen below:

(2)

bnat	'girls'	ləbnat	'the girls'
Dəħk	'he laughed'	təDħək	'you laugh'
wSəl	'he arrived	yəwSəl	'he arrives'

Benkaddour (1982: p. 130), on the other hand, distinguishes two schwas; the phonemic schwa and the phonetic one. He claims that all verb schwas are epenthetic while the schwas in nouns are phonemic. For him, the phonemic schwa serves as a morphological contrast between verbs and nouns as shown below:

(3) Noun Gloss Verb Gloss

qəlb	'heart'	qləb	'he turned'
Dəћk	'laughter'	Dћək	'he laughed'
ləʕb	'game'	lʕəb	'he played

In the present work, I assume that the vocalic inventory of CMA consists of three underlying vowels which are /i, u, a/ and a phonetic schwa. This vowel system is given in (4) below. The schwa is enclosed between parentheses to denote its epenthetic status.

(4)	High	i	u
	Mid	(ə)	
	Low	a	

Having looked at the phonemic inventory of CMA, let's have a look at the morphology of CMA, more specifically root-and- pattern morphology and derivational and inflectional processes.

I.5. CMA Morphology

This section deals with some aspects of derivational and inflectional morphology. First, the definition of the root and pattern will be given. Second, a distinction between inflection and derivation will be established in the light of CMA morphological data. Also, various examples of CMA derivational as well as inflectional operations will be provided.

I.5.1. Root- and- Pattern Morphology

According to Harrell (1962: p.23), most Moroccan words are built up on a basic consonantal skeleton called the root. This root occurs in patterns with various vowels and additional, non-root consonants. Keegan (1986: p.7) defines the root as "a set of segments with a fixed form and a broad semantic association, from which a larger set of words can be derived" .The root may be of any structure and length, but roots tend to be longer than affixes and they are indivisible. The root usually has some fundamental kernel of meaning which is expanded or modified by the pattern.

Harrell (ibid) distinguishes between three basic root types: triliteral, quadriliteral, and atypical. Triliteral roots are composed of three constituent elements; e.g. the /ktb/ 'write' of

/ ktab/ 'book'. Roots with four constituent elements are called quadrilateral; e.g. /TRʒm/ of/TəRʒəm/ 'he translated'. Roots with fewer three or more than four constituent elements are called atypical, as in the words /ma/ 'water' and/mərdədduʃ/ 'marjoram'. As stated above, the basic meaning of the root is modified by the pattern. For example, the root /sRəq/ means 'to steal',/səRqa/ 'theft' and /səRRaq/ 'thief'.

Harrell (ibid) states that triliteral and quadriliteral roots are further classified as strong and weak. Those which are composed entirely of consonants are referred to as strong; e.g. triliteral/ktb/ and quadriliteral /TRʒm/ of the examples above. Those which have a vowel element, usually variable and alternating with /w/ or /y/ , are called weak; e.g. the root ʃ (v) F of /ʃaf/ 'he saw' and /ka-iʃuf/ 'he sees'.

Having introduced this section with definitions of the basic terms used in the description of CMA morphology, in the following subsections, a distinction between derivation and inflection will be made.

I.5.2. CMA Derivational and Inflectional Operations

Morphology was established as an autonomous component of generative grammar by virtue of Chomsky's (1970) seminal paper "Remarks on Nominalization". Within this component, we distinguish between two types of morphology: inflection and derivation.

The relevant literature provides us with different views about the dichotomy between derivation and inflection. There is a disagreement among generativists on whether inflection should be involved in the morphological component together with derivation, or in some syntactic or phonological component. Some linguists, Mohanan (1986) more specifically, argue that the two types of morphology must be differentiated in that the distinction must be made clear in the lexicon so as to account for the way inflection and derivation interact with phonological rules. On the other hand, another view advocates that the major difference between inflectional affixes and derivational ones is that the features of the former are specified by syntactic mechanism, whereas those of the latter are not (Boudlal 1993: p.31).

What is important for us is that both inflectional and derivational rules are morphological rules that behave quite differently from syntactic rules. In the present study, we will assume that there is a distinction between inflection and derivation as could be seen in the subsections below.

I.5.2.1. CMA Derivational Processes

Rguibi (1990) states that derivation in MA is somehow limited since it is not always possible to predict which processes will apply to any given root. Keegan (1986: p. 187) provides examples of some MA morphological operations which can apply to certain roots but not to others. For instance, the operation "Infix /+a+/ after the second radical" can be used to form not only nouns but verbs as well. The following examples involve other affixes apart from /+ a+/:

(5) **Noun Formation (Nominalization)**

Base	Gloss	Noun
xdəm	'to work	xədma 'work'
dar	'to do'	diran 'doing'
ħsəb	'to count'	ħsab 'counting'
kdəb	'to lie'	kdub 'lying'

(6) **Adjective Formation (Adjectivalization)**

Base:	Gloss	Adjective
brəd	' to be cold'	bərdan 'cold'
fRəħ	'to be happy'	fəRħan 'happy'
kbər	'to become big'	kbir 'big'
mRəD	'to be sick'	mRiD 'sick'

(7) **Verb Formation (Verbalization)**

Base	Gloss	Verb	Gloss
byəD	'white'	byaD	'to become white'

smin	'fat'	sman	'to become fat'
ħməq	'crazy'	ħmaq	'to become crazy'

(8) **Nisba**

Base	Gloss	Nisba
fas	'Fez'	fasi
taza	'Taza'	tazi
sla	'Salé'	slawi

(9) **Diminutive Formation**

Base	Diminutive	Gloss
kura	kwira	'ball'
xubz	xbiyyəz	' bread'
bənt	bnita	'girl'

(10) **Participle Formation**

Base	Active Participle	Passive Participle	Gloss
ktəb	katəb	məktub	'to write'
bna	bani	məbni	'to build'
xda	waxəd	məxyud	'taken'

(11) **Causative Formation**

Base	causative	Gloss
byəD	bəyyəD	'to make white'
fiq	fəyyəq	' to wake up'
gləs	gəlləs	'to set'

fhəm	fəhhəm	‘to make understand

I.5.2.2. CMA Inflectional Processes

Inflectional processes in CMA apply to verbs, nouns and adjectives. Verbs are inflected for tense, person, gender and number. As far as tense is concerned, there are three tenses: the perfect, the imperfect and the durative. The perfect tense indicates past action, the imperfect can refer to either present or future, and the durative tense is formed exactly in the same way as the imperfect. As for gender and number, there are two of each: masculine (mas.) and feminine (fem.) on the other hand, and singular (sg.) and plural (pl.), on the other. As far as person (pers.) is concerned, CMA distinguishes between first, second and third person. To put this discussion on a concrete footing, let’s look at the following examples:

(12)

Person and number	Perfective		Imperfective		Gloss
	Mas.	Fem.	Mas.	Fem.	
3rd pers. Sg.	baʕ	baʕət	ybiʕ	tbiʕ	‘to sell’
3rd pers. Pl.	ʃraw	ʃraw	yəʃriw	yəʃriw	‘to buy’
2nd pers. Sg.					
1st pers. Sg.	wʕiti	wʕiti	təwʕa	təwʕay	‘to wake up’
2nd pers. Sg.					
	ktəbna	ktəbna	nkətbu	nkətbu	‘to write’
	ʃwiti	ʃwiti	təʃwi	təʃwi	‘to roast’

Nouns in CMA inflect for number and gender. To begin with gender, it should be pointed out that there are two genders: feminine and masculine. Some nouns are inherently either masculine or feminine as in /ktab/ ‘book’ (mas.) and /ləħya/ ‘beard’ (fem.). Other nouns are marked for the feminine by adding the affix /+a/ to the masculine form like in the following example:

(13) Masculine	Feminine	Gloss
Dif	Difa	‘guest’

As far as number is concerned, CMA distinguishes between the singular and the plural. It is worth mentioning that in CMA there is a distinction between sound plurals and broken plurals. Sound plurals involve simple suffixation of one of the three plural morphemes /-in, -at, -a/ to the singular stem. Whereas, the formation of broken plurals involves the infixation of some vocalic patterns to the base forms as shown below:

(14) **Sound Plurals**

yədd	yəddin	'hand'
həʒʒala	həʒʒalat	'widow'

(15) **Broken Plurals**

xatəm	xwatəm	'ring'
sbəʕ	sbuʕa	'lion'

With respect to adjectives, it has been pointed out that most of them are participles in CMA. These adjectives are marked for number and gender. To begin with gender inflection, the masculine is often taken to be the base form to which is suffixed /–a/ to mark the feminine as could be seen below:

(16) Masculine	Feminine	Gloss
məʃri	məʃriy+a	'bought'

Concerning number, adjectives are inflected for number by adding the suffix /–in/ to the masculine and /–at/ to the feminine:

(17) Singular	Gloss	plural
xayəb	'ugly' (mas.)	xayəbin
xayəba	'ugly' (fem.)	xayəbat

I.6. Conclusion

To sum up, I briefly sketched the geographical and dialectal situation of Casablanca, and presented the methodology. A brief description of CMA derivation and inflection has been given. The purpose of this chapter was to introduce the consonantal and vocalic system of CMA with a brief discussion of the status of the schwa. Also, a distinction between derivation and inflection has been established, and the CMA morphological processes have been exemplified.

The following chapter is an attempt to provide a better understanding of the theoretical frameworks within which CMA phonotactics will be dealt with. Its main purpose is to describe the tools by which I will examine the CMA co-occurrence restrictions.

Chapter II: Review of the literature

II.0. Introduction

This chapter aims to present the theoretical outlooks within which the phenomenon of CMA phonotactics will be studied. The first section on syllable structure will present the definition of the syllable and the different theoretical views of it. I will also discuss the syllable types and constituents with examples from the language under scrutiny. This section will present the different ways of assigning syllable structure and the role of sonority in doing so. The phenomena of extrasyllabicity and licensing will be dealt with. Finally, I will devote a sub-section to the treatment of geminates with examples from CMA.

The second section on autosegmental phonology will shed light on the tools with which CMA co-occurrence restrictions will be examined. The focus will be on the OCP which will be exemplified.

The third section on feature geometry is an attempt to provide a general overview of the theory. The different feature classes will be presented along with the evidence in support of feature organization. Also, the distinction between an articulator-based- model and a constriction based model will be established, but the focus will be more on the constriction-based model since it is the one that will be adopted in the study.

II.1. Syllable Structure

This section will define the syllable, and present its types. The role of sonority in assigning syllable structure will be discussed. The phenomena of extrasyllabicity and licensing will be tackled together with the treatment of geminates in CMA. The following sub-section will provide a definition of the syllable and present the various views of it.

II.1.1. Definition and Traditional Views of the Syllable

a. Defining the Syllable:

As a matter of fact, there is no definition that phoneticians and phonologists currently agree upon. The same view has been advocated by Goldsmith (1990: p. 103) who claims that there is no agreement about the definition of the syllable. He points out that the disagreement about the syllable's definition comes from the fact that there are different opinions which range from those who denied its physical reality to those who have identified it psychologically with a chest pulse and acoustically with degrees of sonority.

Fery and Vijver (2003: p.3) state that the syllable has been a key concept in generative linguistics: the rules, representations, parameters, or constraints posited in diverse frameworks of theoretical phonology and morphology all make reference to this fundamental unit of prosodic structure. The syllable is connected with both segmental and suprasegmental levels. It is mainly the concern of metrical phonology. From a prosodic point view, the syllable is part of the prosodic hierarchy (i.e. Phonological word (PW), Foot (F), Syllable (σ) and Mora (μ)) (McCarthy: 2006).

Moreover, Goldsmith (1990: p.108) defines the syllable from a rather different angle. According to him, the syllable is "a phonological constituent composed of zero or more consonants, followed by a vowel, and ending with a shorter string of zero or more consonants". Using other terms, the syllable is a structural unit which is composed of a sequence of consonants (c) and vowels (v). However, this definition differs from Chomsky and Halle's (1968) opinion which has some skepticism on whether syllables are real linguistic units and relevant phonological entities.

Another view of the syllable claims that the syllable is a psychological entity which can be identified by the speakers of a language. Speakers are able to count the number of syllables in a word and can often tell where one syllable ends and the next begins (Fery and Vijver: 2003: p. 10).

To sum up, the lack of a definition of the syllable should not prevent us from studying syllables. In the following sections, I will reasonably answer some questions about CMA syllable structure such as the maximal syllable size, what is a possible onset, and how to determine syllable boundaries (onset and coda). Before that, the following sub-section will briefly present the different traditional views of the syllable.

b. Traditional Views of the Syllable

This sub-section will present two different views of the nature of the syllable. It will mainly summarize the major points about the syllable presented by Goldsmith (1990). Generally speaking, there have been two major traditional views of the syllable: the sonority theory and the phrase- structure theory. The first view looks at the syllable from an internal point view focusing more on the alternating crescendo and diminuendo of speech, the oscillating rises and fall of energy. That is, in many succession of phonemes there will be an up-and- down of sonority. Though the ups and downs in sonority are of great importance with respect to the phonetic structure of languages, they are not the basis of syllable formation. Sonority leads to the so-called transition network where any sequence of segments is well-formed if adjacent segments come from a different set (Obstruents, Vowels, Non-vocalic Sonorants). We cannot rely on the ups and downs since the sonority principle gives wrong predictions, and it is not a universal principle; rather it is the languages which decide the degree of sonority. Since the sonority principle[3] is not a solid background, we can resort to the syntactic view.

The second traditional view of the syllable is external, it is not based on the measurable energy of a phonetic manifestation as in the first view but it is based on a more syntactic approach (Goldsmith 1990: p. 106). Thus, the syllable is a constituent definable in familiar phrase- structure terms, quite like a sentence. A syllable is like a sentence which can be broken down into separate constituents which in turn can be divided into individual words. The word can be factored into separate syllables which can be factored into separate units such as onset, nucleus and coda. As far as I can tell, the rhyme behaves like a syntactic constituent, which involves some of the syntactic properties namely headedness, binarity and

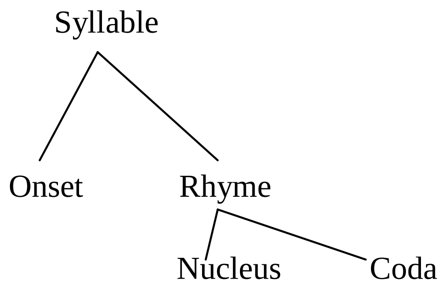
[3] For more details, see section II.1.3.

hierarchy. The rhyme is the head which branches into two immediate constituents, which are the nucleus and the coda. The rhyme hierarchically dominates the two constituents (i.e. the nucleus and the coda). The nucleus and the coda are sisters or daughters of the mother (i.e. rhyme).The following sub-section will discuss at more length the syllable constituents and types.

II.1.2. Syllable Constituents and Types

As far as the syllable constituents are concerned, Goldsmith (1990: p.109) points out that the syllable can be factored into separate units illustrated below:

(18)



The nucleus (or the peak) is by definition an obligatory unit, whereas coda (or the satellite) is optional. The nucleus and the coda (the sisters) form a unit called the rhyme (or the core). The syllable constituents will be presented below with examples from CMA:

a. The Onset:

The onset in CMA is obligatory. This assumption stems from the fact that V syllables are ungrammatical. This condition can be stated in the form of a negative constraint as shown below:

(19)

Clusters of two consonants are allowed, whether the two consonants are identical or different as could be seen below:

(20) mmi ‘my mother’ , DDaR ‘ the house’, sbəʕ ‘a lion’, qrəʕ ‘bald’

Clusters of three consonants are not allowed, unless the first two members are geminates:

(21) ssbəʕ ‘the lion’ nnmər ‘the tiger’

b. The Nucleus:

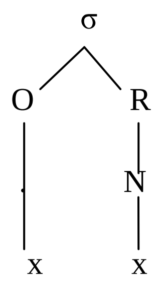
The nucleus in CMA syllables consists of the three underlying vowels (i, u, a), in addition to the epenthetic schwa.[4]

c. The Coda

Unlike the onset, the coda is optional in CMA. We may have words that are composed only of an onset and a nucleus, for instance/ma/ ‘water’; /sma/ ‘sky’ ,/kra/ ‘he rented’. But, a word whose nucleus is a schwa has to have an obligatory coda, for example /ʃədd/ ‘catch’, /bənt/ ‘girl’, /kəlb/ ‘dog’. The coda may consist of at most two consonants provided that the two consonants are identical, for example /hərr/ ‘tickle, /ʒəRR/ ‘pull’.

As far as the syllable types are concerned, Al Ghadi (1990) points out that the basic syllable type in MA is CV. Thus the syllable will contain a non-branching onset and a non-branching rhyme. The rhyme branches only in case the nucleus is a schwa. The schwa in MA cannot appear in open syllable. Thus the basic syllable template would look something like (Boudlal 1993: p.17):

(22)



All the syllabic patterns like CVC, CCV, CCV, CCVC, CCCVC, CVCC, CCVCC and CCCVCC are derived from the basic syllable type CV by syllabification rules.

MA syllables are of two types: open and closed. Open syllables (codaless) are composed either of CV, CCV or CCCV.

(23) a. CV b. CCV C. C¡ C¡ CV

[4] Unlike MA, Berber allows syllabic consonants as stated in Elmedlaoui and Dell’s (2002) work.

ʒa	‘he came’	bna	‘he built’	ssma	‘the sky’
ma	‘water’	bba	‘my father’	ddwa	‘medicine’

Closed syllables (checked) may end in one consonant, two different consonants or geminates:

(24) a. CVC b. CVCC c. CVC¡C¡

kal	‘he ate’	bənt	‘girl’	ʒəRR	‘he pulled’
gal	‘he said’	Dəħk	‘laughter’	ħəyy	‘alive
bab	‘ door’	DəRb	‘hitting’	ħarr	‘sour’

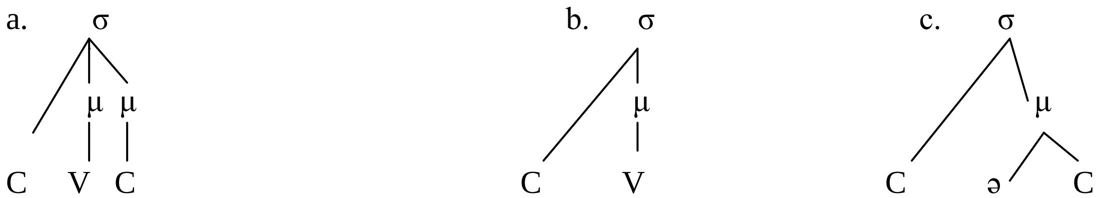
MA contains more complex types of syllabic patterns which can be summed up:

(25) a. CCVC ‘Dlam’ ‘dark’

b. CCVCC ‘mSafr’ ‘travelling’

Under the moraic theory, CMA distinguishes between bimoraic CVC heavy syllables, where V is different from the schwa (a); and monomoraic light syllables, which in turn fall into two types: one where the mora dominates one segment (b); the other where the mora dominates the schwa and another consonant (c) (Boudlal 2001).

(26)



Moreover, Goldsmith (1990: p.115) points out that there are three degrees of heaviness:

(27) (i). Simple open (CV) syllables are the lightest

(ii). Syllables with long vowels or diphthongs (CVV) are heaviest

(iii) Short closed syllables (CVC) are intermediate in weight

Finally, we distinguish between two types of syllables; a degenerate syllable (a minor syllable) and a major syllable. The minor syllable consists solely of a consonant (e.g. b.ka), whereas the major syllable is one whose nucleus is a schwa or one of the full vowels (i, u, a).

II.1.3. The Sonority Principle

Although phonologists agree on the role of sonority in the arrangement of segments within the syllable (the most sonorous segment occupies the peak position, while the less sonorous ones are relegated towards the syllable boundary), there is a lack of agreement on its nature and a hot debate on whether sonority scales are language- specific or there is a single scale common to all languages.

There has been little agreement on the question of what sonority is and how it should be defined. Phoneticians have proposed different phonetic parameters to characterize sonority. Based on intensity, Ladefoged (1993: p. 45) defines sonority as the perceptual saliency or loudness of a particular sound. In Selkirk (1984: p. 38), it is interpreted in terms of degree of opening; vowels are the most open, i.e. sonorous, sounds followed in decreasing order by liquids, nasals, fricatives and stops. Similarly, Goldsmith (1990: p. 110) defines it as " a ranking on a scale that reflects the degree of openness of the vocal apparatus during production, or the relative amount of energy produced during the sound- or perhaps it is a ranking that is motivated by, but distinct form, these notions."

The sonority principle can be used to predict the order of segments within the onset and within the coda. Goldsmith (ibid) states that the sonority principle is a principle in two mirror-image parts:

(28) (i) the segmental material in the onset of the syllable must be arranged in a linear order of increasing sonority from the beginning of the syllable to the nucleus of the syllable. For instance, /gməl/ 'lice', /qməR/ 'gambling'…etc.

(ii) the segmental material in the rhyme of a syllable must be arranged in a linear order of decreasing sonority from the nuclear vowel of the syllable to the final segment of the syllable. For instance, /dənb/ 'sin', /kəlb/ 'dog', /bərd/ 'cold', etc. The sonority of a sound is determined primarily by the size of the resonance chamber through which the air stream flows. The sounds which constitute the peaks of sonority are called Syllabic. It is traditionally believed that the organization of segments within the syllable and across syllables is guided by principles of sonority that rank segments from least to most sonorous.

As far as the sonority scales are concerned, there are a number of competing sonority scales in the literature that rank segment types in order of their sonority. The following sonority hierarchy is the one proposed by Goldsmith (1990):

(29) The Sonority Hierarchy (Goldsmith 1990):

Vowels
Low vowels
Mid vowels
High vowels
Glides
Liquids
Nasals
Obstruents
Fricatives
Affricates
Stops

Since the degree of sonority is of great importance in assigning syllable structure to segments, the following sonority hierarchy will be adopted in the present study:

Sonority Hierarchy (Hammoumi: 1988):

(30) Sonority Hierarchy

Sound	Sonority index
a	10
i,u,w,y	9
o	8

r,l	7
m,n	6
x, h, ħ, ʕ	5
z, ʒ, g, γ	4
s, S, ʃ,f	3
b, D, d	2
t, T, k, q	1

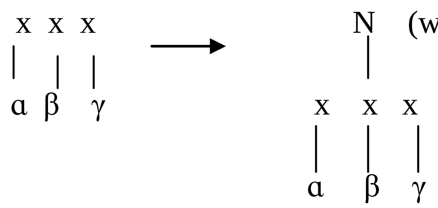
This subsection aimed at defining sonority and presenting the type of sonority scale that will be adopted in this study. The following sub-section will present the various ways of syllable structure assignment.

II.1.4. Syllable Structure Assignment

The linguistic literature is rich in terms of the different approaches to syllabification. For instance, Benhallam (1990) proposes the so-called Syllable Structure Assignment Algorithm (SSAA). The SSAA starts from right to left in the following way:

a. Assign a vowel to a nucleus. Any of the segments [i, u, a] is susceptible to function as a nucleus. This rule operates as follows:

(31)

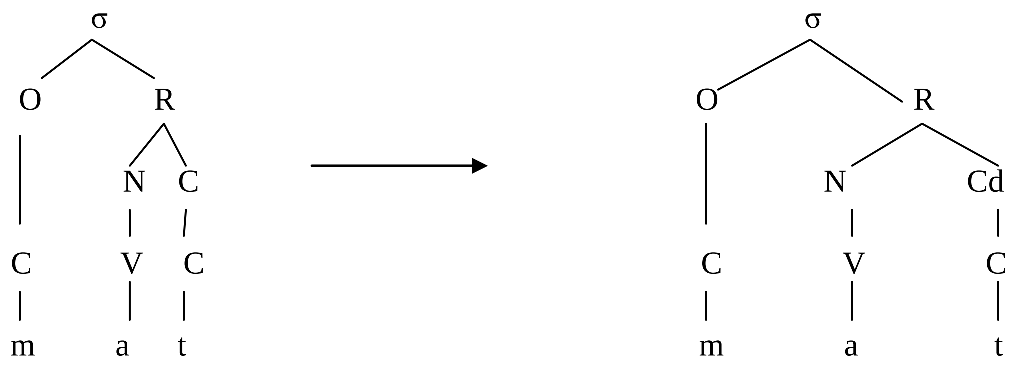


(where α, β, γ are melodic units and β is /i/, /u/ or /a/)

b. Onset and rhyme rule. This rule has the effect of assigning the segment which is immediately on the left of the nucleus as an onset. The nucleus node is dominated by a higher constituent called rhyme. Both the onset and rhyme are dominated by a syllable node.

c. Assignment of a non-syllabified C to the coda position of a codaless syllable:

(32)



d. Assignment of a stray C as premargin or postmargin to a following onset or a preceding coda.

Benhallam (1990) distinguishes two types of syllabification in MA: full-vowel syllabification (i, u, a), and schwa syllabification.

Goldsmith (1990: p.117) proposes two major principles that are of great importance; the first principle is Maximal Onset Principle and the second one is Directionality of syllable creation. However, there is a problem which comes from the fact that there are segments concatenated by the morphological component that cannot be parsed into successive permissible syllables. This problem can be solved by one of following three approaches (Goldsmith: ibid).

(33) (i). All-nuclei First Approach

(ii). The Linear Scanning Approach

(iii). The Total Syllabification Approach

The first approach builds up the nucleus (N), rhyme (R), and syllable (σ) structure from each syllabic element first. The second approach scans linearly, either from right to left or left to right, depending on the language, contracting syllables in such a way as to build the largest syllables (i.e. smallest number of syllables) consistent with the language's restrictions on possible syllables. Both the first and the second approaches result in some contingent extrasyllabic consonants unlike the third approach i.e. the total syllabification approach. In the third approach, syllable structure is imposed on consonants and on vowels, and if no segmental material is available to fill an obligatory position, then the structure is built anyway, with the nuclear position dominating no skeletal position.

For the purpose of the present study, the first approach i.e. all nuclei first will be adopted in the syllabification process. Having looked at the syllable structure assignment, the following sub-section will highlight the phenomenon of extrasyllabicity.

II.1.5. Extrasyllabicity

This sub-section will present the major points highlighted by Goldsmith (1990) about extrasyllabicity. According to him, many languages allow extra segmental material to appear at the end of a word. This extra material at the end has been called a termination, an appendix, or has been said to be extrasyllabic. This problem can be solved by the fact that each segment will belong to at least one syllable except for (word-initial) or word-final elements the language allows to remain extrasyllabic.

One type of extrasyllabicity is the so-called contingent extrasyllabicity in which consonants may fail to become syllabified during the syllabification procedure and thus be hanging at limbo, waiting for a syllable to come along for them. The notation Ć has been used to indicate a contingently extasyllabic segment. This type of extrasyllabicity has to be distinguished from the word –final status that languages may give to segments, which I shall call licensed extrasyllabicity. A further type of extrasyllabicity is prosodic licensing in which all segments must be part of a higher-level organization, such as the syllable; each segment is licensed by being a part of a larger unit. Segments permitted by licensed extrasyllabicity are part of the prosodic system at the word.

II.1.5. Licensing

Goldsmith (1990: p.123) distinguishes between two types of licensing which will be stated as follows. The first type is prosodic licensing which requires all segments to be a member of some syllable, or else be marked as contingently extrasyllabic. The second type is the so-called autosegmental licensing which shares a certain sense with the earlier notion of licensing, but with a quite difference in its specifics.

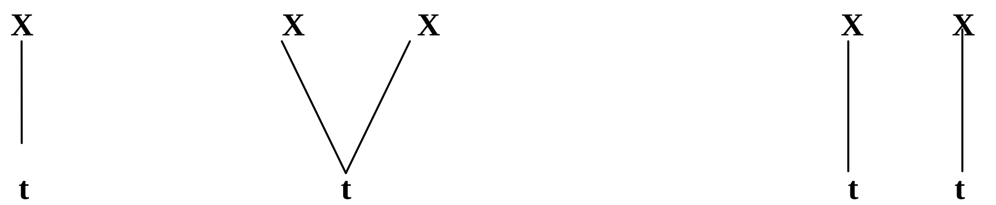
The controlling idea behind autosegmental licensing is that there are prosodic units that are licensers. For instance, the syllable node, the coda node and certain word-final morphemes are licensers. A licenser is endowed by the grammar of the language with the ability to license a set of phonological features or more precisely autosegments. All autosegmental material must be licensed at the level called by Goldsmith (1990) the W-level (the word-level). It is worth pointing out that the elements not licensed at this level will be deleted.

II.1.6. Syllable Structure and Geminates

This subsection aims to shed light on the phenomenon of gemination in MA. This phenomenon has been tackled by a number of linguists who have employed different approaches to represent geminate clusters either within linear phonology or non-linear phonology. For instance, geminates in some languages should have a sequential representation since they behave like a sequence of two identical consonants, whereas, in other languages, geminates are represented as a single segment.

The linguistic literature provides us with different definitions of the notion ‘geminate’. Rguibi (1990: p.124) defines a geminate as: “two segments which have the same feature specifications”. According to Elmedlaoui and Dell (2002: p. 40), a geminate is a single melodic unit (i.e. a single feature bundle) associated with two prosodic positions. Here are for instance the representations of (a) a simple t, (b) a geminate t (i.e. tt), and (c) a sequence of two simple ts:

(34) (a). t. b. tt c .t+t



For Elmedlaoui and Dell (ibid), a geminate refers to doubly associated feature bundles. Thus, each occurrence of x represents a prosodic position and the letter t stands for the bundle of distinctive features which defines [t].

Having considered the definition of a geminate, three types of geminates have to be distinguished. For Rguibi (1990), there should be a distinction between underlying and derived geminates, called otherwise tautomorphemic and heteromorphemic respectively. Examples of tautomorphemic geminates in MA are:

Words	Gloss
(35) a. məxx	‘brain’

b. bərrad 'teapot'

Examples of heteromorphemic geminates in MA are the ones which are the result of some morphological or phonological processes (e.g. assimilation), such as:

	Words	Gloss
(36)	DDaR	'the house'
	ssuq	'the market'
	ʃətt	' I saw '

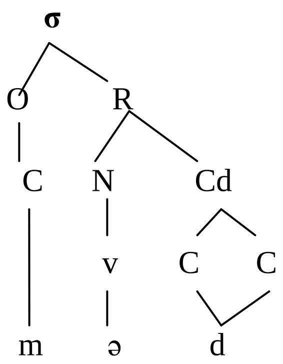
A further type of geminates in MA is the so-called 'Reduplicated Geminates' in which the second radical of a root is reduplicated to express causative as could be seen below:

	a. Base	Gloss	b.Causative	Gloss
(37)	drs	'to study'	dərrəs	'to teach'
	hrb	'to escape'	hərrəb	'cause to escape'

The relevant linguistic literature is rich in terms of the approaches to geminates. One of the main linguists who dealt with MA geminates is Benhallam (1980), who is mainly concerned with the type of rules which split up geminates. He suggests that one needs to take into account the rules that split up geminates, and that a sharp distinction between purely phonological rules and phonolexical ones is necessary. He assumes that geminates are broken up when we are dealing with some morphological operation. Benhallam (1980: p.141) proposes the so-called a Geminate Law stated as follows: "underlying geminates clusters can be split up by morphological (or morpholexical) rules but not by phonological rules" (p.141). Another Moroccan linguist who dealt with geminates is Saib (1977). He discusses Berber geminates assuming that there are geminates which function as two-like segments with respect to other rules. However, he gives evidence pointing out to the necessity of the sequential analysis. One piece of evidence can be drawn from a productive process of schwa epenthesis.

Concerning the recent non-linear approaches to geminates, McCarthy (1979, 1986) dealt with different languages trying to provide a better solution to the dual behavior of geminates by using the non-linear principles. He considers the Obligatory Contour Principle (henceforth OCP) as a constraint which prohibits two identical segments from occurring on the same tier (for more details about OCP, see the section below). For instance, the word /mədd/ ‘to pass’ will be represented as follows:

(38)



The only position for the schwa is between the first consonant and the second one and this in conformity with the OCP (McCarthy 1986) which prohibits two adjacent segments (See chapter II section 2.4.).

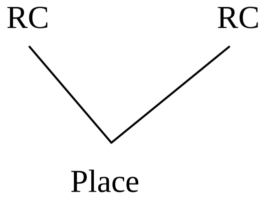
There is a number of theories about the representation of geminates. One of them is the One- Root Theory of Length proposed in McCarthy and Prince (1986). According to this theory, geminates are linked to a single root node as could be seen below:

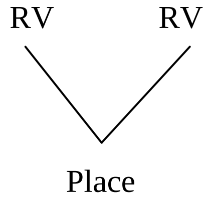
The One- Root Theory of Length:

(39) a. Geminate Consonant b. Geminate Vowel

Having looked at the One-Root Theory of Length, let’s now move to the second view about geminates which is expressed by the Two-Root Theory of Length of Selkirk (1990). According to this view, geminates are represented with two root nodes that share stricture and place features as can be seen below:

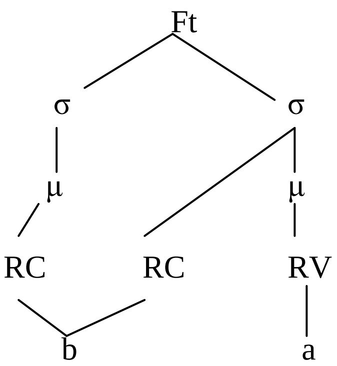
(40) a. Geminate consonant b. Geminate vowel





To put this discussion on a concrete footing, let’s consider the following example [bba] ‘my father’:

(41)



According to Selkirk (ibid), the representations above will allow for a straightforward distinction between full and partial geminates. Full geminates involve the sharing of all features, whereas partial geminates are structures where specifications for laryngeal features of nasality may differ in the two halves.

To sum up, it is the Two-Root Theory of Length that will be adopted in the present work for the analysis of the cases that involve geminates. This subsection aimed to shed light on the phenomenon of gemination, and show the different views of geminates’ representation. The following section will highlight the tools of autosegmental phonology.

II.2. Autosegmental Phonology

This section aims to highlight the theory of autosegmental phonology. I will shed light on the major aspects of autosegmental phonology, and I will look at the key concepts and phenomena in the theory. The main purpose of this section is to introduce the tools that will be employed in the analysis of CMA consonant phonotactics .The following sub-section will provide a general overview of the theory, and present the key concepts in it.

II.2.1. General Overview of Autosegmental Phonology

One of the most productive developments of phonology in the last decade has been the emergence of autosegmental phonology. What has been novel in autosegmental phonology is that the tones of an utterance are viewed as constituting an autonomous sequence of entities, separate from and equal to the sequence of consonants and vowels that make up what we shall call here the phonemic core of the utterance.

The relevant literature provides us with different definitions of autosegmental phonology. Autosegmental phonology is a multilinear representation which allows overlap among features. The emergence of it can be ascribed to John Goldsmith's (1976) thesis, which develops work carried out by William Leben and Edwin Williams in the early 1970s. According to Goldsmith (1976), autosegemental phonology is an attempt to supply a more adequate understanding of the phonetic side of the linguistic representation. For Coleman and Local (1991), autosegmental phonology is a theory of phonological representation, which employs graphs rather than strings as its central data structure.

Oostendorp (2005) points out that autosegmental phonology treats elements of phonology (features) as not being grouped together in segments. Underlying and surface forms comprise strings of segments arranged in two or more tiers (Goldsmith, 1979). Autosegmental phonology goes beyond the place and manner of articulation and focuses on stress, tone, vowels, and nasal harmony. The autosegmental framework was originally used to describe tone in tone languages. Clements (1976) developed the theory involving vowel harmony and nasal harmony. Then John McCarthy (1979) built upon this theory extensively in the verbal derivation of Classical Arabic.

Iggy (1994: p.8) provides us with some evidence in support of the theory. He dealt with the phonological evidence at length. The phonological evidence for autosegmental phonology is overwhelming, and there is at present no challenge to the idea that phonological representations must be autosegmentalized. The pieces of evidence in support of autosegmentalism are: length phenomena, reduplication, and harmony.

To sum up, autosegmental phonology is a theory of phonological representation which employs multi-tiered representations rather than strings. Each autosegmental tier contains a linearly ordered sequence of autosegments; different features may be placed on separate tiers, which can be associated by association lines .Building on these foundations, I will next have a look at the definition of autosegmental representations and segments.

II.2.2. Phonological Representations and Segments

Goldsmith (1990) states that autosegmental representations differ from familiar generative and traditional phonemic representations in that they consist of two or more tiers of segments. Phonological representations consist of several independent sequences (or tiers) of entities.

According to Local and Coleman (1991), a phonological representation consists of a number of phonological objects (segments, autosegments and timing slots) and a two-place relation, called association over those objects. The phonological objects are partitioned into a number of well-ordered sets, called tiers. Each tier itself consists of a string of segments, but the segments on each tier differ with regard to what features are specified in them. Each feature that plays a phonological role in a language will appear on exactly one tier; that is, features cannot appear on more than one tier. In addition to the segments on separate tier, an autosegmental representation includes association lines between the segments on the tiers. A pair of tiers, along with the set of association lines that relates them, can be defined as a chart.

The notion of segment is of great importance in autosegmental phonology. For this reason, a number of phonologists have tried to define it and identify its role in the theory. Central to this theory is the idea of relative autonomy of segments in any one tier with respect to elements in other tiers, whence the replacement of the label 'segment' with the blend neologism 'autosegment', and the dubbing of the theory itself as 'autosegmental' phonology.

Weijer (2006: p.126) defines a segment as an 'abstract (or mental) representation of a sound that is postulated in phonology'. In other words, a segment is a term for an indivisible unit ultimately a mental unit of organization. Segments can be split up into smaller units. According to Goldsmith (1979,) segments must be associated with any vowel, but there are cases where they are left unassociated. In this case, we say that the segments are floating (floating tones). Goldsmith (ibid) points out that segments can be deleted without affecting their corresponding vowel. There are rules which delete a segment located on one autosegmental tier without affecting an autosegment with which it was formerly associated. This effect is known as a stability effect, since it accounts for why an element such as a tone may display stability – a resistance to deletion- even when the vowel it was associated with is deleted phonologically. Similarly, a tone can be deleted without its corresponding vowel underlying deletion. It is worth pointing out that a segment will not be phonetically realized if it is not linked to a position in the skeletal tier. This condition is known in the literature as the linkage condition.

There are various types segments. The first type is the so-called simple segments, which capture the ordinary kind of segments and consist of a single state labeled with a singleton set. In general, when we employ a symbol like /b/ it will be interpreted as a simple segment. The second type is homogeneous segments which represent slots (like N) and members of templates (like CVCCVC), and consist of more than one state. Each state is labeled with a singleton set. The third type is heterogeneous segments which represent spreading autosegments, like [+high]. The automata have a single state which is labeled with a non-singleton set. The last type is hybrid segments that represent spreading autosegments that have Greek letter variables, like [ɑ place] or [ɑ high].

The main purpose of this sub-section was to highlight the two concepts, which are phonological representations and segments. Also, I have tried to introduce the major concepts in autosegmental phonology, such as tier, chart, floating tones, stability, and linkage condition. The next sub-sections will shed light on the key phenomena in the theory under scrutiny, namely association convention, contour tones, tone-bearing units, multiple association, spreading rules, OCP, well-formedness condition , No Crossing Constraint, compensatory lengthening, and the skeletal tier.

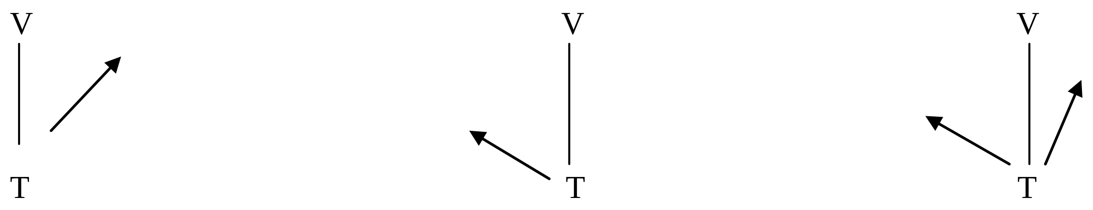
II.2.3. The Association Convention

The relevant literature on autosegmental phonology agrees on the fact that the association convention requires every tone be linked to some vowel. Similarly, Oostendorp (2005) states that no ‘floating’ tones are allowed on the surface, every tone needs to be linked to a vowel. The founder of the theory ,Goldsmith (1979), points out that when unassociated vowels and tones appear on the same side of an association line, they will be automatically linked in a one-to- one fashion, radiating outward from the association line.

One important notion mentioned above is the so-called floating tones. Goldsmith (ibid) claims that a floating tone refers to two things. First, it refers to a morpheme that is underlyingly only tonal, that is, composed of segments only on a tonal tier. Second, the term used to stand for segments which, at a given moment in the derivation, are not associated with any vowel. If a vowel should come to be deleted, then the tone associated with it may be said to become ‘floating’ in the second sense, though not in the first. If a tone ‘floats’ when it has no vowel associated with it, we can say that the process of associating a floating tone is ‘docking’ (Goldsmith 1976: p.45).

With these foundations in hand, let’s now discuss another crucial issue in autosegmental phonology, which is spreading rules. According to Goldsmith (1979), a tone that is associated with a single vowel will in certain languages, be spread, or doubled, to an adjacent vowel. Spreading, or assimilation, can occur in tonal or other autosegmental structures which spread the association of a tone as far as possible in a given direction. The autosegment will be associated with all unassociated accessible segments on the opposite tier in one direction or the other, and so will be associated to all those unassociated segments to which it can link without crossing any association lines. This kind of spreading is indicated by an arrow in the autosegmental rule, pointing out to the right for unbounded rightward spreading, or to the left for unbounded leftward spreading, or with two arrows for spreading in both directions:

(42) a. b. c.



Having looked at floating tones and spreading rules, I now move to highlight another important notion related to tones, which is known in the literature as ‘contour tones’. Contour tones or dynamic tones are the rising and falling tones (Goldsmith 1979:p.39). In a language with high and low tones, it is common to find falling and rising tones. In languages with more than two levels of tones, rising and falling tones can generally have their starting and ending points tonally identified with one of the level tones of the language.

Generally speaking, tones associate with vowels in two different ways. First, the association convention, in a quite general fashion, specifies that tones universally will freely associate with vowels when both the tone and the vowel in question are unassociated. Second, all the other rules of tonal association and reassociation have the specific property of associating tones with vowels, rather than consonants. It is worth pointing out that segments which do not involve specifying on each of the two tiers of a chart, are considered Freely

Association Segments (Goldsmith ibid: p. 45). Having said this, the following sub-section will discuss briefly the so-called OCP.

II.2.4. Obligatory Contour Principle (OCP)

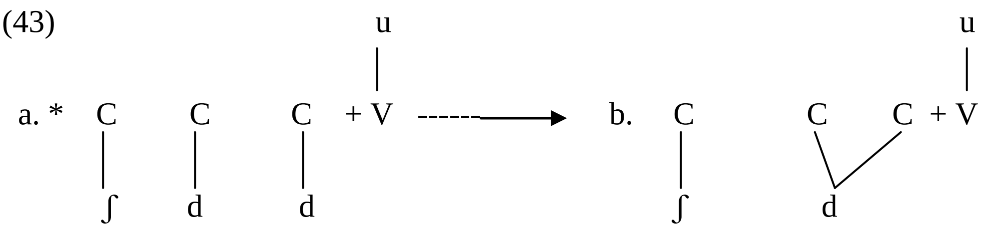
The Obligatory Contour Principle (OCP) was first proposed by Leben (1973), in which it was formulated as a morpheme structure -constraint precluding sequences of identical tones from underlying representations. In autosegmental phonology (Goldsmith 1976), with articulated conceptions about associations between featural melodies and skeletal units the OCP was considered to be relevant to adjacent singly linked melodies but not to doubly linked melodies.

The OCP was originally proposed to account for the distribution of tones in West African languages (see Leben 1973; Goldsmith 1976). It has been extended to a wider range of phenomena, leading to McCarthy's formal definition of the principle: “At the melodic level, adjacent identical elements are not permitted”. That is, McCarthy (1981) revises this principle and states that adjacent identical elements are prohibited not only at the tonal tier but at any autosegmental tier as well.

In more recent work (McCarthy 1986a), the OCP is conceived of not only as a constraint on lexical representations, but as responsible for a number of phonological processes. An example of such processes is antigemination, which prohibits syncope rules from creating geminates.

To see how the OCP works in Moroccan Arabic, consider the representation of the word [ʃəddu] ‘they caught’:

(43)



The representation in (b) is allowed while the one in (a) is ruled out exactly as predicted by the OCP. Having presented the definition of OCP and seen how it works in MA, the following sub-section will briefly present another mechanism which prohibits the crossing of association lines[5].

II.2.5. No Crossing Constraint (NCC)

As a matter of fact, the No Crossing Constrain is one of the main principles of the so-called Well-formedness Condition. The core principles of this condition can be sketched as follows:

(44) i. All tones must be associated with (at least) one syllabic element.

ii. All syllabic elements must be associated with (at least) one tone

iii. Association lines do not cross (NCC)

In autosegmental phonology, each autosegmental tier contains a linearly ordered sequence of autosegments. When an articulatory gesture is interrupted by another distinct gesture, one has to start a new in order to resume the gesture. Let's consider the following example:

(45

Representation (a) is ruled out because the same tone H cannot be associated with the first and third syllable when another tone (L) follows on the second syllable. Crossing is forbidden and a separate H tone must be posited.

Coleman and Local (1989) argue that NCC does not, in fact, constraint the class of well-formed autosegmental representations. The NCC is not a constraint at all since it doesn't restrict the class of well-formed phonological representations. The core of their arguments can be briefly sketched as follows. The first argument is that a distinction must be drawn between autosegmental phonological representations and diagrams of those autosegmental phonological representations. The NCC is a constraint on diagrams, not autosegmental phonological representations. Another argument is that the NCC is a constraint on pictures, not on phonological representations, since straightness of lines is a property of pictures, not linguistic

[5] See Local and Coleman's article: The "No Crossing Constraint" in Autosegmental Phonology.

representations. That is, no crossing constraint is an incoherent concept in autosegmental phonology because there is no mathematical justification for insisting on straight lines.

To sum up, NCC is not that simple as it seems to us from the very beginning. For the purpose of this study, what should be borne in mind is that association lines should not cross. Having presented the phenomenon of NCC, I now move to discuss the skeletal tier and other issues, namely compensatory lengthening and the behavior of geminates.

II.2.6. The Skeletal Tier

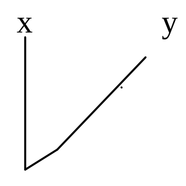
Goldsmith (1990) has dealt at length with the skeletal tier. According to him, the skeletal tier is the CV-tier or the timing tier, which represents Cs and Vs. The elements on the skeletal tier are often called slots, or V-slots and C-slots. They are the segments to which vowels and consonants must associate if they are to be realized. A single tonal autosegment can be associated with more than one vowel. Autosegments are the segments which are not on the skeletal tier.

II.2.6.1. Compensatory Lengthening

Goldsmith (1990: p.73) defines compensatory lengthening as 'a process of lengthening a segment'. Generally, there are two points that are of importance with respect to compensatory lengthening. The first point concerns the characteristics of autosegmental representation that are helpful in understanding compensatory lengthening. The second point is about the role that syllable structure plays in understanding the phenomenon under scrutiny (i.e. compensatory lengthening).

To put this discussion on a concrete footing, let's have a look at the following examples. The example in (a) below is an example of compensatory lengthening since it contains two segments x and y which are on the skeletal tier, and M is on a phonemic tier. In this representation, M and x are associated to each other, and y is not associated to any element on M's tier.

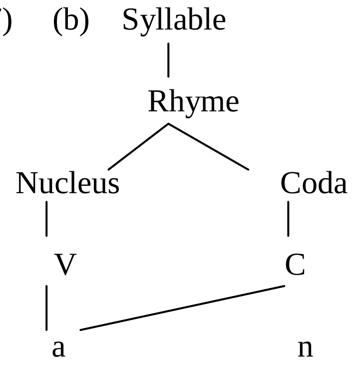
(46) (a)



M

A further example of lengthening will be given with respect to syllable structure. If a sonorant at the end of a syllable is deleted, and the preceding vowel is lengthened, we have a representation as in (b). This is a case of compensatory lengthening. The lengthening of the vowel in this case consists not of a feature change, but of the addition of an association line.

(47) (b)



When a single consonant appears between vowels, it is always syllabified as part of the onset of the syllable that contains the vowels on the right, rather than as part of the coda of the syllable containing the vowel on the left. Furthermore, if two consonants appear between a pair of vowels, the consonants belong to separate syllables: the first consonant forms the coda of the syllable to the left, while the second consonant forms the onset of the syllable to the right.

II.2.6.2. The Special Behavior of Geminates

Researchers have tried to investigate several general characteristics of geminate consonants as well as long vowels. They aimed to look at them from an autosegmental perspective. As a matter of fact, rules that are sensitive to syllable weight, or that establish syllable weight, treat geminate consonants as if they were two consonants (Goldsmith, 1991).

Generally speaking, geminate consonants act like sequences of consonants rather than a single consonant marked [+ long]. This generalization receives a natural explanation within an autosegmental- metrical theory of phonology, since metrical structure is built on the skeletal tier, and geminate consonants involve two positions on the skeletal tier.

A second generalization that can be established is that geminate consonants frequently are allowed in positions where sequences of the different consonants are not allowed. In this respect, geminate consonants do not seem to behave like sequences of consonants; somehow, it is as if their first half were not there.

A third generalization involves rules of epenthesis which insert a vowel in order to break up impermissible sequences. These rules generally fail to apply if their application would separate the halves of a geminate consonant. This characteristic has been said to reflect the integrity of geminate consonants, and suggests another way in which geminate consonants do not act like normal sequences of consonants.

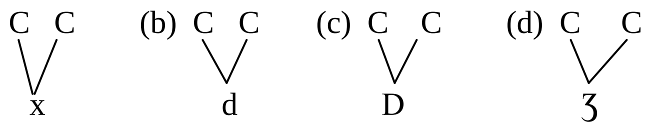
A fourth generalization that has been noted is that rules that modify the segmental quality of consonants frequently fail to apply to geminates. This inalterability of geminate consonants has been the subject of much debate.

The relevant literature on geminates makes a distinction between two types of geminates. The first type is the so-called true geminates, and the second type is apparent geminates. True geminates are multiply associated consonants, for example:

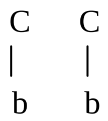
(48)	a. məxx	'brain'	b. sedd	'close'
	c. ʕəDD	'bite'	d. ʒʒmel	'the camel'

The geminates above have the following structure:

(49)

(a) 

Apparent geminates behave like simple clusters, for instance[6]:

(50) 

These two structures cannot be distinguished phonetically; the distinction is phonological. All geminates that are internal to a single morpheme (tautomorphemic

[6] The difference between true and apparent geminates will be discussed and exemplified in chapter III, section 7.

geminates) are true geminates, and all geminates formed across a morpheme boundary are only apparent geminates, at least underlyingly. Having considered the special behavior of geminates, the following sub-section will tackle the morphological uses of the skeleton.

II.2.7. Morphological Uses of the Skeleton

In the previous sub-section, we have seen the relevance of the skeletal tier to a number of phonological phenomena, such as compensatory lengthening and the behavior of geminate consonants. In the present sub-section, I will look at the relevance of the skeletal tier to morphology. I will limit our discussion to Classical Arabic.

Goldsmith (1990) aims at showing how the autosegmental skeletal tier allows a simple and direct statement of the patterns found in the Arabic verb system. He dealt with an important question which concerns whether morphological structure can directly influence the number of autosegmental tiers that exist in a given language, and whether the morphological status of an item is reflected by its position in the autosegmental structure of the word. The suggestion has been made that each morpheme in Arabic appears on a separate tier.

The Arabic verb consists of two components: the stem and the inflectional affixes marking agreement. It consists of three components: the vocalic pattern (vocalism); the consonantal pattern (or consonantism); and the organization of each of these into patterns of syllable structure. Having said this, there are fifteen conjugations (structures) in Classical Arabic. The conjugations are formal categories which have strict formal phonological and rough semantic definitions. The conjugations are patterns of vowel and consonant positions[7].

In the analysis of the fifteen conjugations, a basic problem appears on the surface about how to deal with the association of consonants to the skeleton when one or more of the consonants are morphologically conditioned by the choice of the conjugation. There are three ways in which this kind of distribution of consonants may be treated, and which of these we choose depends on the resolution of certain theoretical issues of much broader scope. Let us consider each in turn.

The first approach is to let the consonantism associate in the normal fashion, but to make those C-position (s) that will host the conjugation specific consonants as being inert (C). After association of the lexical consonantism, this will leave the inert C-positions unassociated; and

[7] For more details, see Goldsmith's (1990) paper, page 97.

morphologically controlled consonant insertion rules can then fill in the needed consonants. This approach will be presented as follows:

```
(51) C  (C)  V  C  V  C
     |   |      |     |
     k   t      t     b
```

The second approach to the Arabic consonantism drops the assumption entirely, and places the conjugation- specific material on the skeletal tier along with the C- and V-slots. The fully specified elements on the skeleton would then be specified as not being members of the set of Freely Associating Segments. Let’s consider the following example:

```
(52)      C  t  V  C  V   C
          |        |      |
          k        t      b
```

The third approach differs from the second approach in that it allows for consonants to be specified on more than one phonemic (non-skeletal) tier. In this case, this means putting the conjugation-specific t on one tier, and the root consonantism on a separate phonemic tier. The vowel tier is left off the diagram; it would require a three-dimensional representation to express it clearly. For clarity, let’s consider the following example:

```
(53)     t
         |
    C    C   V  C  V  C
    |           |     |
    k           t     b
```

In brief, the third approach has been defended by a principle called the ‘Morpheme Tier Hypothesis’, in which separate morphemes must appear on separate tiers at a deep phonological level. Having presented the core phenomena in autosegmental phonology, the following sub-section will present a different theory called Feature Geometry.

II.3. Feature Geometry

In this section, I will present the major phenomena in the theory of feature geometry. I will start by defining features, and presenting the major classes of features. Also, I will provide some evidence in support of feature organization. This section will present the feature organization of consonants and vowels in which I will look at two different models (i.e. an articulator-based model vs. a constriction-based model). A distinction between simple, complex, and contour segments will be established. Last but not least, this section will briefly present some phonological processes, and provide a general overview of the so-called root node. Having said this, the following sub-section will provide a definition of the notion 'feature'.

II.3.1. General Overview of Features

One of the scientific questions that can be asked about language is: what is a possible speech sound? As a matter of fact, no language employs hand-clapping, finger-snapping, or vibrations of the hand and cheek caused by release of air from the mouth as mechanisms to create speech sounds. To answer the question mentioned above, Halle (1988) defines speech as an acoustic signal produced by the anatomical structures which have been termed the vocal tract. The anatomical structures refer to the six articulators i.e. the larynx (specifically the glottis), the soft palate, the lips, the tongue blade, the tongue body and the tongue root. In producing speech, each of the six articulators executes a limited set of behaviours which are termed features.

Features are defined by Clements and Hume (1995: p.245) as psychological and cognitive entities which allow us to identify tones, intonations …etc. Features are the basic units of phonological representation. They constitute speech sounds, which are the lumps or bundles of distinctive features (Halle 1988). Features are the building blocks not only of speech sounds, but also of language in general.

Features play a vital role in linguistics in general, and in phonology in particular. They are so important in the sense that they provide a means for classifying speech sounds into natural classes, for instance [ptk] create a natural class of voiceless stops (Clements and Hume: 1995: p.245). Another important role of features is that they provide answers and explanations to patterns of acquisition, language disablement and language change. As far as language acquisition is concerned, features make the job easier for children to acquire any language. They are mainly used for learnability and simplicity reasons. As for language disorders, they allow the doctor to detect the type of problem the patient has, and which sound the patient cannot articulate. For instance, when a patient cannot pronounce coronals, it is automatically the feature 'coronal' which is affected. As far as historical change is concerned, features allow the researcher to specify the type of change in a very economical fashion.

II.3.2. Distinctive Features

As has been stated above, speech sounds are created by the six articulators i.e. the larynx (specifically the glottis), the soft palate, the lips, the tongue blade, the tongue body and the tongue root. In producing speech, each of the six articulators executes a limited set of behaviours which are referred to as features (Halle 1988). Features can be classified into separate classes. As a matter of fact, the major class features are concerned with the distinction between consonants and vowels. The features which differentiate between vowels and consonants are syllabic, sonorant, and consonantal. Syllabic (Syl) forms a syllable peak (and thus can be stressed). Sonorant (son) sounds are produced with a vocal tract configuration in which spontaneous voicing is possible. Consonantal (con) sounds are produced with a major obstruction in the vocal cavity.

Following Halle (1988), the first type of features is the so-called stricture features. Stricture features involve features which can be sketched as follows. The first type of sounds is consonantal sounds, which are produced with a constriction in the central passage through the oral cavity. The second type of sounds is sonorant sounds, which are produced with a pressure build-up inside the vocal tract. The third type is continuant sounds, which are produced without an interruption in the air flow through the vocal tract. The fourth type of sounds is trident sounds, which are produced so as to generate maximum turbulence. The last type of features in stricture features is lateral sounds, which are produced by lowering one or both sides of the tongue margins.

Having seen stricture features, I now move to look at another type of features, and which has been called laryngeal features. Laryngeal features involve stiff vocal cords (voiceless), in which sonorants produced with stiff vocal cords have higher pitch then those produced without stiff vocal cords. They (i.e. stiff vocal cords) are always contrasted with the so-called slack vocal cords (voiced), in which sonorants produced with slack vocal cords have lower pitch than those produced without slack vocal cords. In addition, laryngeal features involve two more features, which are spread glottis and constricted glottis. Sonorants produced with spread glottis have ‘breathy voice’, whereas sonorants produced with constricted glottis have ‘creaky voice’.

Moreover, another type of features is Advanced Tongue Root (ATR). This feature controls the advance and retraction of the tongue root. Having said this, Dorsal (tongue body) Features involve three features, which are high, low, and back. In high sounds the tongue body is raised above its central position. In low sounds, the tongue body is lowered below its neutral position. In back vowels, the tongue is retracted towards the rear wall of the pharynx.

The three remaining types of features can be summarized as follows. Coronal (tongue blade) features involve three major features, which are anterior, distributed, and Incisor cavity. Anterior sounds are produced with a constriction in front of the alveolar ridge. Distributed sounds are produced with a constriction that extends for a considerable distance along the root of the mouth. The controlling idea behind incisor cavity is that the excitation of the sublingual cavity counted at the front by the lower incisors produces the characteristic hushing sound that is absent where the cavity is not excited. The two last features are labial (lip) features and soft palate features. Labial features involve one feature, which is rounded in which sounds are produced with a constricted lip aperture. Soft palate features involve one feature, which is nasal in which sounds are produced with a lowered soft palate which allows air to flow through the nasal cavities.

Having looked at the major types of features, I move now to distinguish between articulator-free features and articulator- bound features. Generally speaking, the articulator features are called 'place' features, because they link the place constituent in the feature hierarchy. The articulator-bound features depend on a specific for their execution, whereas the articulator-bound features are restricted to a specific articulator. According to Clements and Hume (1995), articulator-free features designate the degree of stricture of a sound, independent of the specific articulator involved. Stricture features are articulator-free features. I have now presented the major types of features, the following sub-section will present the main evidence in support for feature organization.

II.3.3. Evidence for Feature Organization

Clements (1985) states that much recent work has suggested that some sort of hierarchical organization must be attributed to feature organization. Such organization is required in two senses:

(54) (1) that of the sequential ordering of features into higher-level units, as proposed in autosegmental and metrical phonology.

(2) that of the simultaneous grouping of features into functionally independent sets.

McCarthy (1988) points out that one module of the theory that has emerged quite recently is called feature geometry. This theory addresses one important problem: how are the different distinctive features classified by phonological processes?

Clements and Hume (1995: p. 246) state that feature bundles used to have no internal organization at all. Features were organized in a linear fashion. No internal organization of speech sounds. The matrix formalism has strong arguments in its favor:

(55) 1. It is conceptually simple

2. It is mathematically tractable

3. It imposes powerful constraints on the way features can be organized in representations.

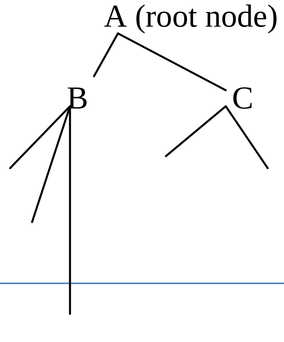
This model has two important inadequacies (Clements and Hume: ibid):

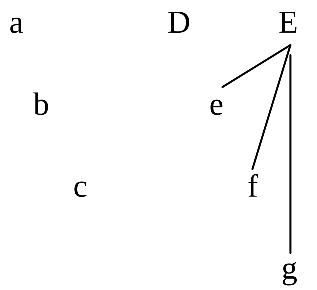
(56) 1. In such models all features defining a phoneme stand in a bijective (one-to- one) relation; each feature value characterizes just one phoneme, and each phoneme is characterized just one value from each category. It is a challenge for linear approach a small set of prosodic or superasegmental speech properties including tone, stress, and intonation.

2. A second problem inherent in a matrix-based approach is its implicit claim that feature bundles have no internal structure. Each feature is related to any other. No features are grouped into larger sets.

Features are grouped into higher-level functional units. They are organized with respect to their function and not structure, they are functional entities. A considerable amount of evidence that features are grouped into higher-level functional units, constituting what might be called 'natural classes' of features in something very like Trubezkoy's notion of 'related classes'. A general model of feature organization has been proposed in which features that regularly function together as a unit in phonological rules are grouped into constituents. To put our discussion on a concrete footing, let's consider the following example (Clements and Hume 1995: p. 249):

(57)





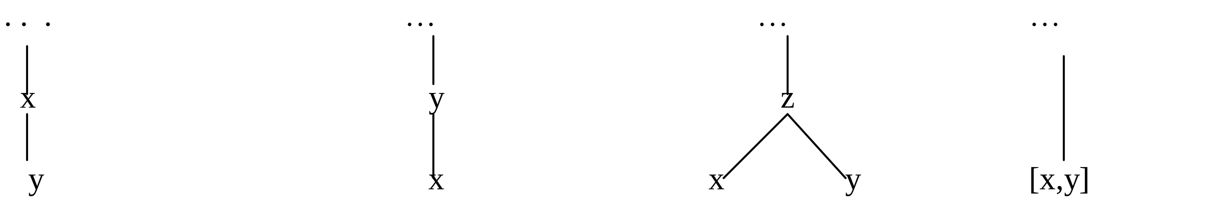
Using some syntactic terms, the root node (A) is the head which hierarchically dominates B, C, D, E, a, b, etc. It branches into two immediate constituents, B and C. B and C are sisters or daughters of A. C c-commands B, a, b and c. B in turns c-commands C, D, E, e, f and g. D and E asymmetrically c-commands C because it is higher than D and E. Generally, the structure in (57) involves some of the syntactic properties namely headedness, binarity and hierarchy.

In this approach, segments are represented in terms of hierarchically organized node configurations whose terminal nodes are feature values and immediate nodes represent constituents. This approach to feature organization makes it possible to impose strong constraints on the form and functioning of phonological rules. A phonological rule might affect the set of features d,e,f and g by performing a single operation on constituent C; however, no rule can affect nodes c,d, and e alone in a single operation since they don't form a constituent.

The most important evidence is the operation of phonological rules. If a phonological rule can be shown to perform an operation (spreading, delinking, etc.) on a given set of features to the exclusion of others, I assume that the set forms a constituent in the feature hierarchy. For instance, x and y are two features which can be grouped into constituents in four ways, as shown below (Clements and Hume 1995: p. 267):

(58)

x dominates y | y dominates x | x and y are sisters | x and y form one node



If an operation on x always affects y, but not vice versa.

If an operation on y always affects x, but not vice versa.

If x and y can be affected independently of each other.

If an operation on one always affects the other. They perform a single node.

Another criterion for feature organization is the presence of OCP-driven co-occurrence restrictions. Any feature or set of features targeted by such constraints must form an independent node in the representation.

A further criterion is node implication. If a node x is always linked under in the universal feature organization, the presence of (non-floating) x implies the presence of y. since the feature [anterior] is universally linked under the [coronal] node, we predict that all [+/- anterior] segments are coronal (ibid).

One further criterion for feature organization consists of transparency and opacity effects, e.g. laryngeal transparency. In many languages, vowels assimilate in all features to adjacent vowels, but not to nonadjacent vowels, exceptionally laryngeal glides [h, ʔ] are transparent to this assimilation.

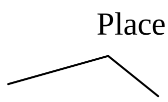
Having considered the evidence for feature organization, the following sub-section will present the feature organization of vocoids. The main purpose of this sub-section is to make a sharp distinction between two conflicting models (i.e. an articulator-based model and a constriction-based model). The focus will be mainly on the constriction-based since it is the one that will be adopted in the present study of CMA co-occurrence restrictions.

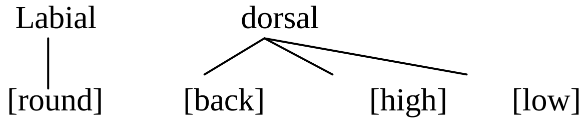
II.3.4. Feature Organization of Vocoids

II.3.4.1. An Articulator-based Model

In the earlier of these approaches, Sagey (1986) retains the SPE features [high], [low], [back], and [round]. She integrates them within the articulator-based framework by treating them as articulator-bound features, linked under the appropriate articulator node. [high], [low], and [back] are features executed by the tongue body, and linked under the dorsal node. [round] is a feature executed by the lips, and assigned to the labial node as shown below:

(59)





In this model, all consonants and vocoids formed in the oral tract are characterized in terms of an appropriate selection from the set of articulator nodes and their dependents, although coronal, reserved for retroflex vowels, is usually nondistinctive in vocoids. One of the central predictions of this model is that the set [back],[high] , and [low] has a privileged status among subsets of vowel features, in that it alone can function as a single phonological unit.

II.4.2. A Constriction-based Model

This model is based on the preliminary observation that any segment produced in the oral tract has a characteristic constriction, defined by two principal parameters: constriction degree and constriction location. This model proposes to represent constrictions by a separate node of their own in the feature hierarchy. The parameters of constriction degree and location are also represented as separate nodes which link under the constriction node.

The constriction of a vocoid is represented by its vocalic node, its constriction degree by an aperture node, and its constriction location by a place node. Place nodes of consonants and vocoids which occur on different tiers are designated as 'C-place' and 'V-place'.

A further innovation of this model is that the features [labial], [coronal], and [dorsal], occurring under the V-place node in vocoids, are sufficient, to distinguish place of articulation in vowels, and replace the traditional features [back] and [round]. Labials involve a constriction formed by the lower lip. Coronals involve a constriction formed by the tongue. Dorsals involve a constriction formed by the back of the tongue.

The constriction-based model predicts that front vowels can form a natural class with coronal consonants, and back vowels with dorsal consonants. While Sagey's model predicts that all vowels form a natural class with dorsal consonants and no others.

The constriction-based model predicts that the aperture features – the V-place features, or the aperture and v-place features together can function as single units in phonological rules. While Sagey's model predicts that only the dorsal features [high, back, low] can do so.

The constriction-based model predicts that dorsal consonants will be transparent to rules spreading any two or more vowel features. While Sagey's model predicts that dorsal consonants are opaque to such rules, which must be spread the dorsal node.

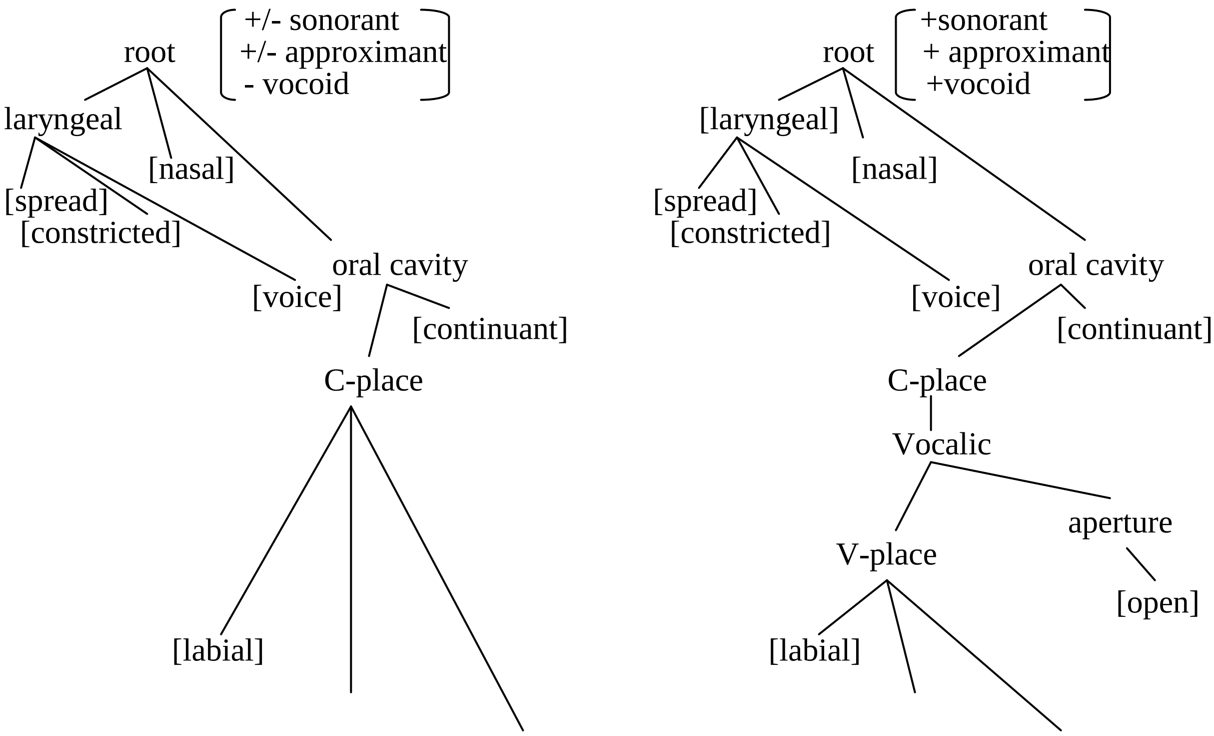
The constriction-based model predicts that not only dorsals but all consonants will be transparent to rules spreading lip rounding together with one or more vowel features. While Sagey's model predicts that all intervening consonants will be opaque to such rules, which must be spread the place node. Having presented the feature organization of vocoids, the following sub-section will present three types of segments i.e. simple, complex, and contour.

In short, I will make use of the constriction- based model with which I am going to examine both CMA syllable structure and co-occurrence restrictions. The model can be briefly presented as follows:

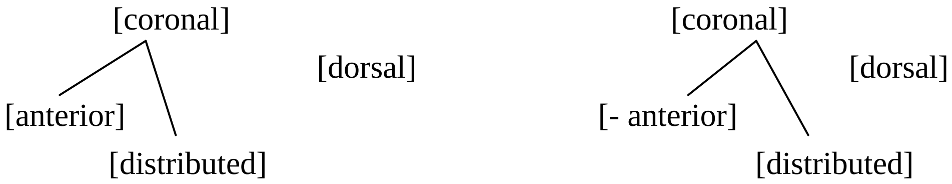
Clements and Hume (1995: p. 292)[8]

(60)

(a) Consonants: (b) Vocoids:



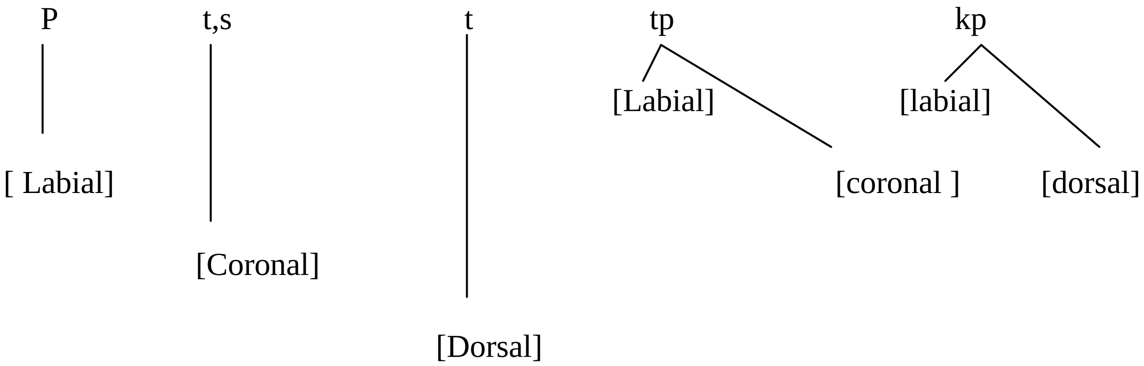
8 I presented the feature geometry of vocoids since I am going to deal with glides as well.



II.3.5. Simple, Complex, and Contour Segments

Clements and Hume (1995: p.253) have made a distinction between simple, complex, and contour segments. A simple segment is a root node characterized by at most one oral articulator feature. For example, the sound [p] is simple since it is uniquely [labial]. A complex segment is a root node characterized by at least two different oral articulator features, representing a segment with two or more simultaneously oral tract constrictions. For instance, the labio-coronal [tp], the labiovelar stop [kp]. The following examples are of simple and complex segments:

(61)



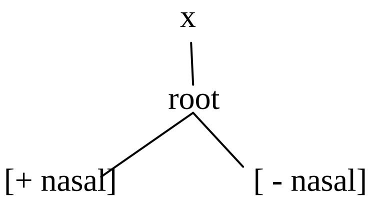
According to McCarthy (1988), complex segments are characterized at two separate points in the vocal tract. McCarthy (ibid) states that there are two crucial observations about complex segments that any theory must account for:

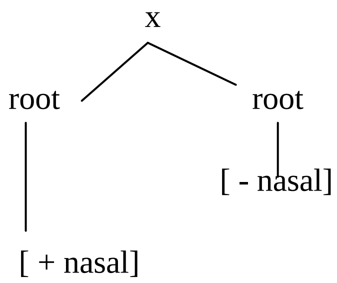
(62) (i). the two constrictions are formed by distinct articulators

(ii) the two constrictions are phonologically unordered, even though they may be sequenced in speech production.

Contour segments contain sequences (or ‘contours’) of different features. There are two views on how such segments can be characterized (Clements and Hume 1995: p.254);

(63) a. One –root analysis b. Two- root analysis





In the one- root analysis (a), contour segments are characterized by a sequence of features linked to a single higher node. In the two-root analysis (b), contour segments consist of two root nodes sequenced under a single skeletal position. So far I have presented three types of segments, the following sub-section will shed light on some major phonological processes, namely assimilation and dissimilation.

II.3.6. Phonological Processes

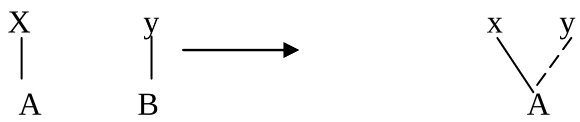
Some phonological processes support the claim that features are hierarchically organized. Clements (1985) has drawn attention to the fact that assimilation and other phonological processes of various kinds provide evidence that the features of different sounds are not simple lists, but instead reflect a highly specific hierarchical organization. Clements (ibid: p.226) argues that “if we find that certain sets of features consistently behave as a unit with respect to certain types of rules of assimilation or resequencing, we have a good reason to suppose that they constitute a unit in phonological representation …”. For instance, total assimilation, i.e. gemination, occurs when the highest node of the tree is spread to adjacent timing slots.

In brief, the feature hierarchy was determined by Clements (1985) on the basis of considerations that did not directly involve the articulatory character of the features, but only their behavior in phonological rules. Having said this, let’s look at the first phonological process (i.e. assimilation).

II.3.6.1. Assimilation

Clements (1985) describes assimilation as the spreading of an element of one tier to a new position on an adjacent tier. In this view, assimilation has the following schematic character, where A is the spreading:

(64)



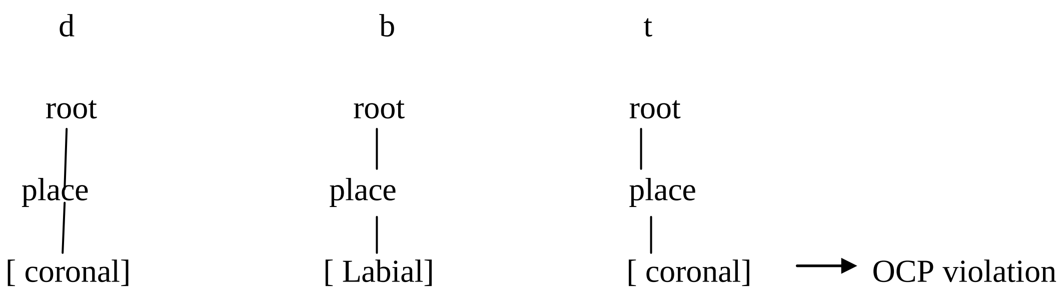
In the output structure, A is associated with two positions on the related tier, and B thus been eliminated from the representation.

It is worth pointing out, if the rule spreads only feature (s) that are not already specified in the target, it applies in a feature-filling mode. If the rule applies to segments already specified for the spreading feature (s) replacing their original values, the rule applies in a feature-changing mode. If the root node spreads, the affected segment will require all the features of the trigger. In the feature-changing mode, this result, often called complete or total assimilation. If a lower-level class node spreads, the target acquires several, but not all of the features of the trigger (partial or incomplete assimilation). I have now considered assimilation, I will next see dissimilation and OCP.

II.3.6.2. Dissimilation and OCP

Clements and Hume (1995: p. 261) describe dissimilation as the process by which one segment systematically fails to bear a feature present in a neighbouring segment. Many features undergo dissimilation ([coronal], [labial], [dorsal], etc) are one-valued. Dissimilation can be expressed as an effect of delinking i.e. a feature is delinked from a segment. One important question that has been addressed with respect to dissimilation is why delinking so commonly has a dissimilatory function. The answer comes from the so-called OCP (Adjacent segments are prohibited). For the sake of clarity, let's consider the following example:

(65)



OCP violations are resolved in other ways as well, such as the merger or assimilation of adjacent identical nodes, the blocking of syncope rules that would otherwise create OCP violations, and also the insertion of epenthetic segments.

McCarthy (1988) provides an example of the OCP, which ensures that a geminate consonant like /pp/ is represented as a single segment from a featural standpoint that branches to two syllabic positions, occupying the space of a cluster.

McCarthy (ibid) discusses the universality of the OCP which is a matter of controversy. He claims that it is possible that languages differ in the domain of the OCP (syllable, word, etc.); or its persistence through the derivation (where it holds simple morphemes, word phonology, or phrase phonology). Having considered the two phonological rules, and briefly presented the OCP, the following sub-section will shed light on the so-called root node.

II.3.7. The Root Node

Clements and Hume (1995: p 268.) claim that the root node, dominating all features, expresses the coherence of the 'melodic' segment as a phonological unit. They provide some evidence in support of the root node. For instance, that processes of total assimilation in languages such as Ancient Greek can be expressed as the spreading of the root node from one skeletal position to another. Without the root node such processes would have to be expressed as the spreading of several lower-level nodes at once. Root nodes bear the major class features, which we take to be [sonorant], [approximant], and [vocoid].

McCarthy (1988) points out the features immediately dominated by the Root Node include the manner features [continuant], [nasal], and [lateral] as well as the major class feature [sonorant]. Also, we add the major class feature [consonantal]. The two major class features [sonorant] and [consonantal] differ from all other features in one important respect. They arguably never spread, delink, or exhibit OCP effects independently of all other features. Therefore, the major class features should not be represented on separate tiers as dependents of the Root Node. All the other features are said to be in a dependency relation with the major class features. This means, any operation on the major class features-spreading for example implies an operation on the features subordinate to the root.

II.4. Conclusion

This chapter aimed to present the theoretical outlooks within which the phenomenon of CMA consonant phonotactics will be studied. The first section on syllable structure presented the definition of the syllable and the different theoretical views of it. I discussed the syllable types and constituents with examples. This section presented the different ways of assigning syllable structure and the role of sonority in doing so. The phenomena of extrasyllabicity and licensing were dealt with. Finally, I devoted a sub-section to the treatment of geminates with examples from CMA.

The second section on autosegmental phonology highlighted the tools with which CMA co-occurrence restrictions will be examined. Also, I tackled the major phenomena in the theory, namely association convention, NCC, and compensatory lengthening, etc. The focus was on the OCP which was exemplified.

The third section on feature geometry was an attempt to provide a general overview of the theory. The different feature classes were presented along with the evidence in support of feature organization. Also, the distinction between an articulator-based- model and a constriction based model was established, but the focus was more on the constriction-based model since it is the one that will be adopted in the study. Having presented the theoretical outlooks within which CMA consonant phonotactics will be studied, the following chapter will deal with CMA syllable structure.

Chapter III: Syllable Structure in CMA

III.0. Introduction

Languages of the world differ in their syllable phonotactics. Some languages are extremely restrictive and only allow CV sequences; others allow more complex structures both in the peak and margins. The complex segments can be either identical (i.e. geminates) or different. Across languages, segments are organized into well-formed sequences according to universal principles of segment sequencing. The organization of segments within the syllable, and across syllables, is assumed to be driven by principles of sonority.

Having said this**,** the main concern of this chapter is to shed light on the above phenomena and others. I will start by looking at the onset restrictions. I am going to present the previous findings on MA onset restrictions using the constriction-based model. I will be looking at the complex and contour segments. The discussion of CMA onset restrictions will be extended in the last and main chapter of analysis.

In the third section (i.e. the peak of CMA syllables), I am going to deal with the major syllable-related phonological processes, namely vowel reduction, vowel strengthening, diphthongization, and glide formation. These processes will be dealt with within the theory of feature geometry. In the fourth section, I will present the coda restrictions together with the coda types (e.g. simple and complex codas word-medially and word-finally). I will also provide the distinctive features of segments in both the onset and coda positions.

In the fifth section, I will be using the All-Nuclei First Approach in the syllabification process. We will see that CMA allows different sequences, namely: CV, CVC, CCV, C¡C¡CV, CCVC, C¡C¡CVC, CVCC, CCVCC, etc. These syllabic patterns and others are derived from the basic syllable type CV by syllabification rules. I will look at the role of sonority in assigning syllable structure, and present some possible clusters that obey or violate the sonority hierarchy in the onset and coda positions. A list of the possible clusters that obey or violate the sonority hierarchy in both the onset and coda will be given in the last chapter of analysis.

In the last two sections, I will discuss the phenomenon of schwa epenthesis. Schwa epenthesis, the most productive process of the language, can be best described in terms of the syllable. We will see that noun schwa syllabification depends on the sonority hierarchy, whereas verb and adjective schwa syllabification is not governed by the sonority principle. I will present some nouns that do not conform to the sonority principle taken from the data I collected. I will mainly base my discussion of schwa epenthesis on Benhallam (1980) and Al Ghadi's (1990) findings.

Last but not least, I will devote a section to the treatment of geminates since there is a need to distinguish between the types of geminates and the types of rules that apply to geminate clusters. .In this section, I will be using the two-root theory of length in the representation of geminates. The main concern of this section is to dwell at length on two types of geminates (i.e. true vs. apparent), and look at their representations. The distinction between true and apparent geminates will be best made clear within the theory of feature geometry. I will also present the so-called Geminate Law, and its new version. The geminate law says simply that geminate clusters can be split up by morphological or phonolexical rules, but not by phonological rules. Benhallam (1980) revises it and gives a new clear detailed version[9]. I will conclude the last section with a brief discussion about the special behaviour of medial geminate clusters. I will try to present some answers to one important question about word-medially geminates whether they are codas of the first syllable, or they are the coda of a syllable and the onset of the second syllable.

Before looking at all the above phenomena, I will present the data which will be listed in terms of parts of speech (nouns, verbs, adjectives, adverbs, determiners, prepositions). The words will be classified with respect to their number of syllables (i.e. monosyllabic, disyllabic, and trisyllabic words). The data will also involve geminate words (initial, medial, and final geminates). This data will also help me present the possible and impossible clusters in the onset and coda positions. It will be used to discuss and examine CMA syllable structure, and look at the co-occurrence restrictions in CMA.

III.1. CMA Data[10]

(66) **Nouns**

a. *Monosyllabic*

fəRx	‘bird’	qəRd	‘ monkey’
ʃəmʃ	‘sun’	γərs	‘plant’
DəRb	‘hitting’	ħəRb	‘war’
ləʕb	‘game’	qəlb	‘heart’
ktəf	‘shoulder’	nəħs	‘ bad luck’

[9] Underlying geminate clusters can be split up by morphological, or phonolexical rules, but not by phonological rules.

Derived geminate clusters can be split up by phonological rules.

[10] See the appendix

smən	'preserved butter'
sdər	'chest'
dənb	'sin'
bərd	'wind'
STəl	'bucket'
bənʒ	'anesthetic'
buq	'loudspeaker'
bənt	'girl'
kəlb	'dog'
kərʃ	'stomach'
rʒəl	'leg'
wdən	'ear'
bəRʒ	'fort'

b. *Disyllabic*

ʃərʒəm	'window'
tənbər	'stamp'
məħbəq	' flower pot'
SəmTa	'belt'
DəRba	'a hit'
xədma	'job'
bərdʕa	'saddle- bag'
limun	'oranges'
Rəmla	'sand'
fərmli	'nurse'
banyu	'bathtub'
bəγli	'mortar'
bubRis	'gecko'
buʒi	'crane'
dənya	'life'
mədfəʕ	'canon'
fəndəq	' hotel'
məsləm	'Muslim'
mʕəlqa	'spoon'
zəbda	'butter'
sənsla	'zip'
məlyun	' a million'
mγərfa	'ladle'
mbəxRa	'censer'
banka	'bank'
baRba	'beet'
bəsbas	'fennel'
buglib	'cholera'
bəZTam	'wallet'
dərhəm	'dirham'

c. *Trisyllabic*

taraza	'turban'	zzituna	'olive'
tarazat	'turbans'	manDaRin	' clementine'
limuna	'an orange'	ʕinina	'our eyes'
minʒara	' sharpener'	gənDuRa	'a Moroccan glow'
baliza	'suitcase'	baRaka	'blessing'
diwana	'customs'		

(67) **<u>Verbs</u>**

a. *Monosyllabic*

xrəʒ	'leave'	qtəl	' murder'
dxəl	'enter'	gʕəd	'sit down'
tqəb	'pierce'	gləs	'sit down'
DRəb	'hit'	lʕəb	'play'
ʃRəb	' drink'	qləb	'return'
Dħək	'laugh'	Trəʃ	'slap'
ħləm	'dream'	lħəs	'lick'
Rkəb	'ride'	bka	'cry'
ʒa	'he came'	mʕək	'kneed'
bna	'to build'	mRəD	'to be sick'
dbəħ	'to slaughter'		

b. *Disyllabic*

salat	'she finished'	bərgəg	'he spied on'

fərtət	'he broke into fritters'	ʕəntət	'he showed stubbornness'
ħənZəZ	'he gazed at'	mazal	'he is still …'
kalkum	'he ate you (pl.)'	DRəbhum	' he hit them'
walmək	'it (mas.) suits you'	daruh	'they did it (mas.)'
məlməl	'she shook (sth)'	nawya	'intending (fem.)'
fəyyqu	'they woke up'	xəddmu	'they operated'
ʃəftək	'I saw you'	bəqbəq	'to gurgle'
dəγdəγ	'to tickle'	dəkkəs	'to press'
dəʃʃən	'to inaugurate'		

c. *Trisyllabic*

DəRbatu	'she hit it/ him'	kətbatu	'she wrote it'
səRqatu	'she stole it'	qətlatu	'she killed it/him'
banyaha	'she built it'	mərmədnak	'we trailed you'
walmukum	'they fit you'	lawyinhum	'they are twisting them'
rubəlkum	'he disturbed you'	mqulbinək	'they are deceiving you'

(68) **Adjectives**

a. *Monosyllabic*

ħwəl	'cross-eyed'	kħəl	'black'
SfəR	'yellow'	Smək	'deaf'
xDəR	'green'	zRəq	'blue'
ʕrəʒ	'lame'	Trəʃ	'deaf'
zwin	'good'	nqi	'clean'

məRR	‘sour’	ħrəʃ	‘rough’
ħəyy	‘alive’	byəD	‘white’
mləs	‘soft’	Sgəʕ	‘stubborn’
smin	‘fat’	ħməq	‘crazy’
bləq	‘very white’	bnin	‘delicious’

b. *Disyllabic*

məzyan	‘nice’	smawi	‘sky-blue’
DRawi	‘from the Plain Dra’	bəhlul	‘stupid’
basəl	‘tasteless’	slawi	‘from Salé’
baTəl	‘free’	bəldi	‘homegrown’

c. *Trisyllabic*

widadi	‘widadi’	biDawi	‘from Casa’
kazawi	‘from Casa’	raʒawi	‘rajawi’
tadlawi	‘from the Plain Tadla’	buhali	‘simple-minded’
balawat	‘ace/whiz’		

(69) **Adverbs**

a. *Monosyllabic*

dRuk	‘now	bəʕda	‘already’
hna	‘here’	mən	‘since’

b. *Disyllabic*

bzərba	'quickly'	bəʃwiya	'slowly'
bəkri	'early'	bəzzəz	'by force'
bəħRa	'just'	daba	'now/immediately'
dayman	'always'	dəγγa	'quickly'
dima	'always'	fuqaʃ	'when'
b-tədqiq	'accurately'	ħaqqən	'actually'
barəħ	'yesterday'	bih-fih	'immediately'

c. *Trisyllabic*

tamamən	'absolutely'	bəlʕani	'deliberately'
b-suhula	'easily'	bəʃʃwiya	'slowly'
bəllati	'slowly'		

(70) **Determiners**

a. *Monosyllabic*

yla	'if'	baʃ	'so that'
had	'this'	bla	'without'
lli	'who, which'	bhad	'with this'
ʔana	'I'	nta / nti	'you'
hit	'since'	γir	'only'
bħal	'the same as'	dak	'that'
kəll	'all'	gaʕ	'at all'

bəʕD	‘some’	baʃ	‘in order to’
aʃ	‘what’		

b. *Disyllabic*

dyalu	‘his’	bəzzaf	‘ a lot’
hada	‘this’	huwa	‘he’
hiya	‘she’	huma	‘they’
waħd-axəR	‘another one’	wəlla	‘or’

c. *Trisyllabic*

ʃi-ħaʒa	‘anything’	ʃi-waħəd	‘anybody’
walakin	‘but’	bəʕDiyat	‘each other’

(71) **<u>Prepositions</u>**

a. *Monosyllabic*

təħt	‘under’	ħda	‘next to’
fuq	‘ over’	wra	‘behind’
bəʕd	‘after’	ħətta	‘till’
qbəl	‘before’	qrib	‘near’
bʕid	‘far’	mən	‘from’
ʕla	‘on’	fdak	‘in that’
bin	‘between’	wəST	‘middle’

b. *Disyllabic*

fiha	‘in it’	ʕlayən	‘about’
mqabəl	‘across’	gəddam	‘next to’
hnaya	‘here’	daba	‘now’
bəRRa	‘outside’	bəlli	‘that’

(72) **Geminates**

a. Initial Geminates

Verbs		Nouns	
ddir	‘you do’	DDaR	‘the house’
DDRəb	‘you hit’	ssma	‘the sky’
nnʕəs	‘he slept’	nnas	‘the people’
dda	‘ he took’	bba	‘my father’
		mmi	‘my mother’
		DDu	‘light’
		ssbəʕ	‘the lion’
		nnmər	‘the tiger’
		ʒʒməl	‘the camel’
		nnhar	‘the day’

b. Medial Geminates

Verbs		Nouns	
kəttəb	‘make somebody write’	bərrad	‘teapot’
dəxxəl	‘make somebody enter’	mərrakəʃ	‘Marrakech’
rəkkəb	‘make somebody ride’	gəzzar	‘butcher’
gəlləs	‘make somebody sit down’	ħəddad	‘blacksmith’

bəyyəD	'make something white'	Səbbaγ	'painter'
kaysəddu	'they close'	xərraz	'shoe maker'
bəzzaf	'a lot'	həʒʒala	'widow'

c. Final Geminates

Verbs

mədd	'give'	ħəTT	'put down'
ʕəDD	'bite'	həzz	'lift'
məss	'touch'	dəqq	'knock at'
ʒəRR	'pull'	ħəll	'open'
sədd	' close'	Dənn	'to think'
γəʃʃ	'to deceive'	kəbb	'to pour'

Nouns

bəqq	' bugs'	məxx	'brain'
dəmm	'blood'	nədd	'a kind of incense'
fəmm	'mouth'	fəkk	'jaw'
yədd	'hand'	ħarr	'sour'

III.2.Onset Restrictions

As far as the onset is concerned, CMA syllables always begin with C. Onsetless syllables are prohibited by the language. Syllables starting with V are not allowed (i.e. / #V…/). Therefore, VC syllables are not accepted as could be seen below:

(73)

*VC Gloss

a. *dar.**uh** ‘they did it’

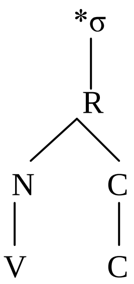
b. *bəzz.**af** ‘a lot’

c. *maz.**al** ‘he is still …’

d. *sal.**at** ‘she finished’

This can be represented as follows:

(74)



CMA does not only prohibit VC syllables, but it also prohibits V-syllables (i.e. Syllables without onsets and codas) as illustrated below:

(75)

*V Gloss

a. *had.**a** ‘this’

b. *dyal.**u** ‘his’

c. *huw.**a** ‘he’

d. *hum.**a** ‘they’

This can be formalized as follows:

(76)

V

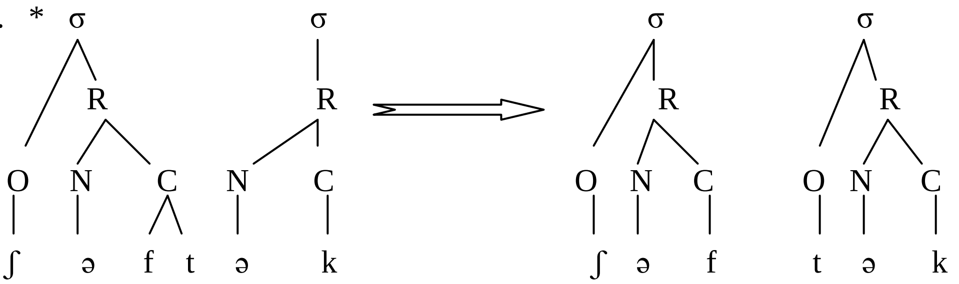
The major challenge that CMA faces in this regard is how to prevent onsetless syllables from surfacing. As far as I am concerned, the language resorts to the so-called resyllabification in order to cope with this problem as can be illustrated below:

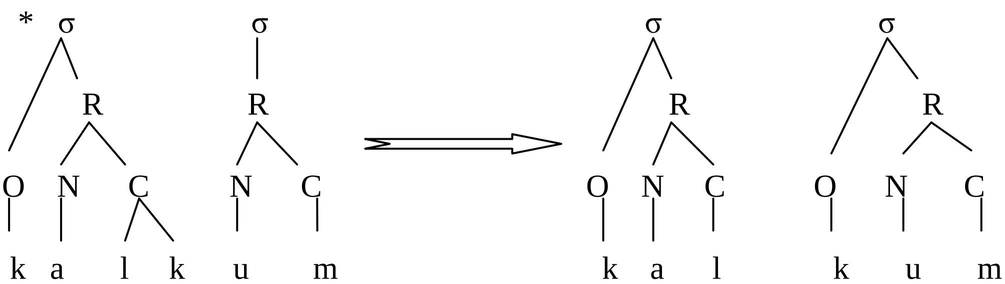
(77)

UR	SR	Gloss
a. ʃəft.**ək**	ʃəf.tək	‘I saw you’
CvCC.vC	CvC.CvC	
b. kalk.**um**	kal.kum	‘they ate you (pl.)’
CVCC.VC	CVC.CVC	
c. dar.**uh**	da.ruh	‘they did it (mas.)’
CVC.VC	CV.CVC	

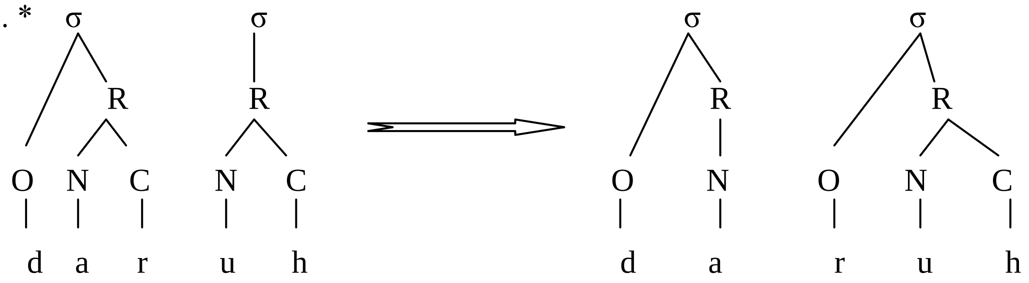
For the sake of clarity, let’s look at the syllabification of the above examples:

(78)

a. 

b. 

c. *



In (a) and (b) examples, the underlying onsetless syllables (i.e. /.ək/ and /.um/) surface with an onset by resyllabifying the second member of the previous syllable coda. Similarly, the coda of the first syllable in the word /da**r**.uh/ becomes the onset of the second syllable /**r**uh/. Resyllabification is used as a way to prevent onsetless syllables which the language prohibits.

As far as the onset types are concerned, we distinguish two types of onsets in CMA: simple and complex onsets.

(79) Simple Onsets:

a. Word-initially:

Sound	Distinctive features	Word	Gloss
/f/	+cons -son + cont +ant -cor -voi	**f**əRx	‘bird’
/d/	+cons -son - cont +ant +cor +voi	**d**ənb	‘sin’
/b/	+cons -son - cont +ant -cor	**b**ənt	‘girl’

	+voi		
/k/	+cons -son - cont -ant -cor -voi +high -low +back	**k**ərʃ	‘stomach’
/m/	+cons +son - cont +ant -cor + nas	**m**a	‘’water’

b. Word-medially:

Sound	Distinctive features	Word	Gloss
/ʒ/	+cons -son +cont -ant +cor +distr +voi	ʃər.**ʒ**əm	‘window’
/b/	+cons -son - cont +ant -cor +voi	tən.**b**ər	‘stamp’
/s/	+cons -son +cont +ant +cor -voi	sən.**s**la	‘zip’
/m/	+cons +son - cont +ant -cor +nas	fər.**m**li	‘nurse’
/n/	+cons +son - cont +ant +cor	limu.**n**a	‘an orange’

	+nas		

Using feature geometry terminology, simple onsets can be considered as simple segments. Simple segments consist of a root node characterized by at most one oral articulator feature (Clements and Hume: 1995, p.253). Let's take the above segments as examples:

(80)

a. m, f, b
place
|
[labial]

b. s, d, ʒ, n
place
|
[coronal]

c. k
place
|
[dorsal]

(81) Complex Onsets word-initially:

In CMA, clusters of two consonants are allowed word-initially, whether the two consonants are identical or different. The following are words with two identical consonants in the onset:

Geminate Clusters	Distinctive features	Word	Gloss
/nn/	+cons +son - cont +ant +cor +nas	**nn**as	'people'
/bb/	+cons -son - cont +ant -cor +voi	**bb**a	'my father'
/dd/	+cons -son - cont +ant +cor +voi	**dd**a	'he took'
/mm/	+cons +son	**mm**i	'my mother'

	- cont +ant -cor +nas		
/dd/	+cons -son - cont +ant +cor +voi	**dd**ir	'you do'

Words with two different consonants in the onset position are the following:

(82)

Clusters	Sound (1)	Distinctive features	Sound (2)	Distinctive features	Word	Gloss
/bn/	/b/	+cons -son - cont +ant -cor +voi	/n/	+cons +son - cont +ant +cor +nas	**bn**at	'girls'
/nm/	/n/	+cons +son - cont +ant +cor +nas	/m/	+cons +son - cont +ant -cor +nas	**nm**ər	'tiger'
/ml/	/m/	+cons +son - cont +ant -cor +nas	/l/	+cons +son + cont +ant +cor +lat	**ml**əs	'soft'
/kt/	/k/	+cons -son - cont -ant -cor -voi +high -low +back	/t/	+cons -son - cont +ant +cor -voi	**kt**əf	'shoulder'
/zb/	/z/	+cons -son	/b/	+cons -son	**zb**əl	'rubbish'

		+cont +ant +cor +voi		- cont +ant -cor +voi		

CMA involves a number of words that start with two different consonants in the onset. Some of them are listed below:

(83)

a. Verbs	GLoss	b. Nouns	Gloss
tqəb	‘pierce’	**sd**ər	‘chest’
xrəʒ	‘leave’	**qf**əz	‘cage’
dxəl	‘enter’	**wd**ən	‘ear’
qtəl	‘murder’	**qb**əR	‘tomb’

c. Adjectives	Gloss	d. Prepositions	Gloss
xDəR	‘green’	**qb**əl	‘before’
SfəR	‘yellow’	**bʕ**id	‘far’
ʕrəʒ	‘lame’	**qr**ib	‘near’
Smək	‘deaf’	**ħd**a	‘next to’
zRəq	‘blue’		

Three consonants are not allowed word-initially in CMA .The only exception to this generalization is when the first two members of the cluster are geminates as could be seen below:

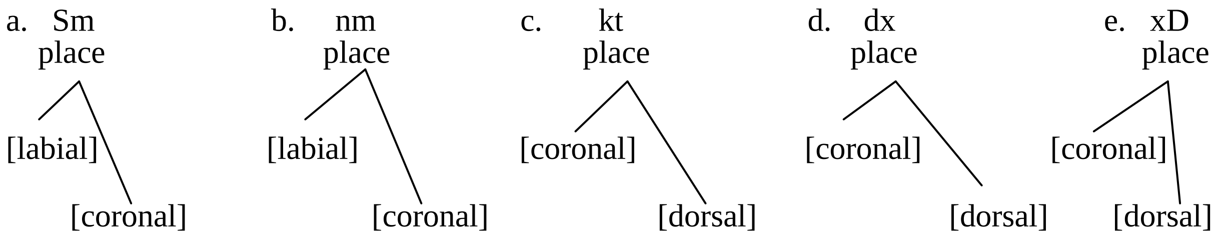
(84) /#CiCiC/

a. Verbs	Gloss	b. Nouns	Gloss
DDRəb	‘you hit’	**nnm**ər	‘the tiger’
nnʕəs	‘we sleep’	**ssm**a	‘the sky’

nnhar 'the day' **ssb**əʕ 'the lion'

The above complex onsets can be treated as complex segments. Clements and Hume (1995) describe a complex segment as a root node characterized by at least two different oral articulator features, representing a segment with two or more simultaneous oral tract considerations. This can be illustrated as follows:

(85)



Segments within MA roots are known to be subjects to a variety of co-occurrence restrictions. According to Benhallam (1980), any phonotactic constraints have to be stated in terms of the syllable since the restrictions on the consonantal combinations are actually restrictions on onsets and codas[11]. For instance, Benhallam (ibid) states that labials cannot occur in contiguity both in the onset and coda positions. Concerning alveolar, no combination is allowed in initial position. In final positions, the same restrictions hold. In initial position, the following combinations are not attested:

(86) dz- , Dz- , Dk- , Dg- , Ts- , Tz- , TS- , Tʃ- , Tʒ- , Tk- , Tg- , Tx- ,Tγ- , and Th-.

In final position, the following combinations do not occur:

(87) -dʒ, -Ds , -Tk , -Tg , -Tx and –Tq

Similarly, Bellout (1987) dealt with the MA syllable structure in relation to the phonotactic constraints. Her main statements concerning this topic can be summarized in (88) below:

(88)

a. Apart from homorganics, all segments occur in syllabic initial and final positions.

[11] The negative constraints on onsets presented in this section may equally be used for codas.

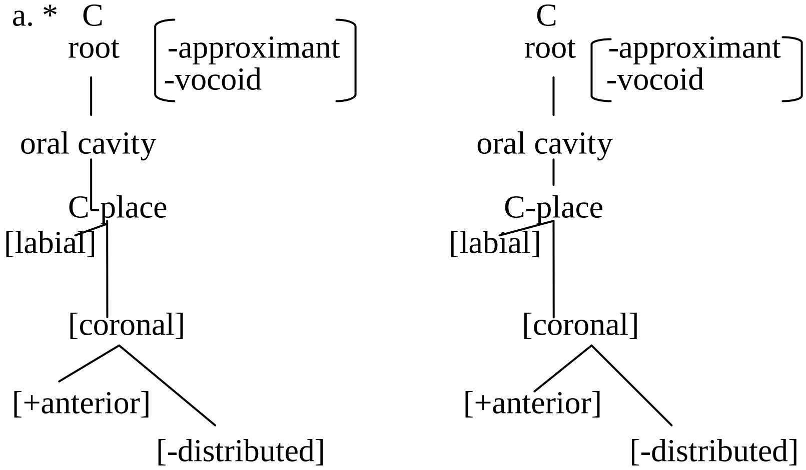
b. Excluding homorganics, almost all consonants occur in the roots C_1 and C_2 of the syllable codas including geminates.

c. Sounds forming consonant clusters tend generally but not always to be from distant articulatory regions.

Benkaddour (1982) supplements the general template by a set of phonotactic constraints to avoid the ungrammatical forms such as *fmər and *dtər. The negative constraints on syllabic onsets that may equally be used for codas are according to him five in number (Benkaddour: ibid, p.159):

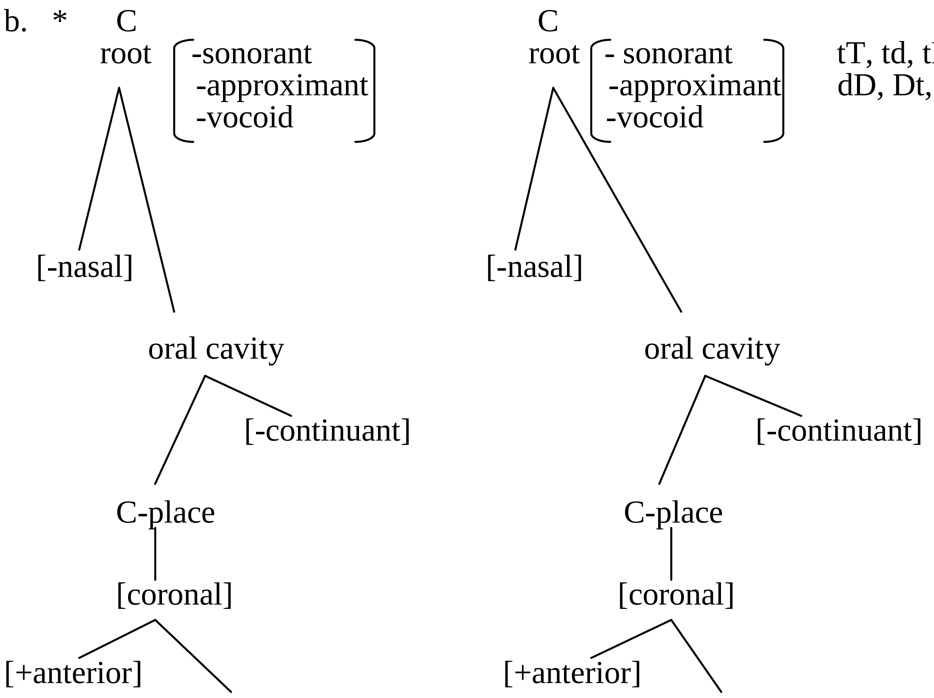
(89)

a. *



bm, bf, fb, fm, mb, mf.

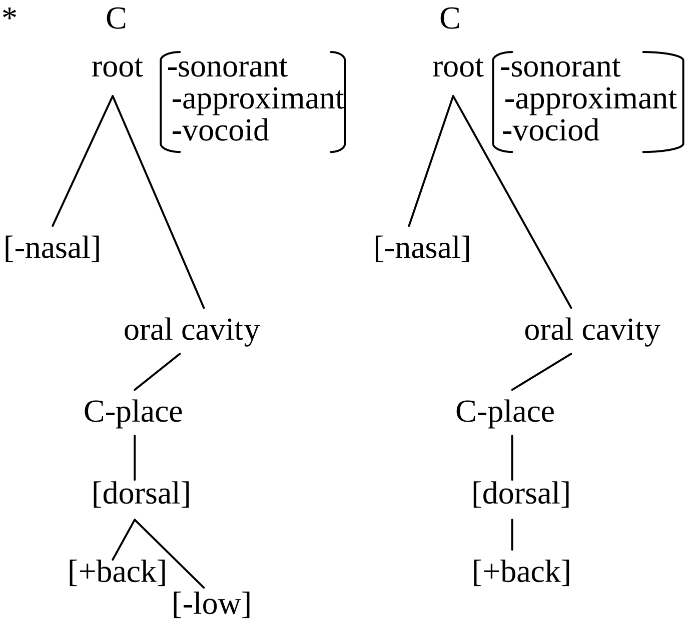
b. *



tT, td, tD, Tt, Td, TD, dt, dT, dD, Dt, DT, Dd.

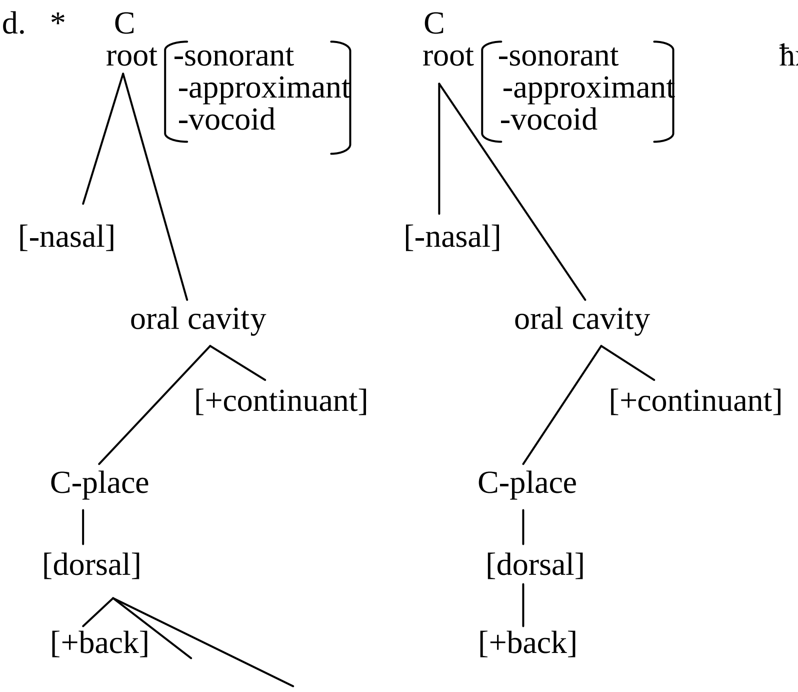
[-distributed] [-distributed]

c. *



gk, qk, xk, γk, kg, gg, qg, xg γg, kq, gq, qq, xq, γq, kx, gx, qx, xx, γx, kγ, gγ, qγ, xγ, γγ, xħ, γħ, xʕ, γʕ.

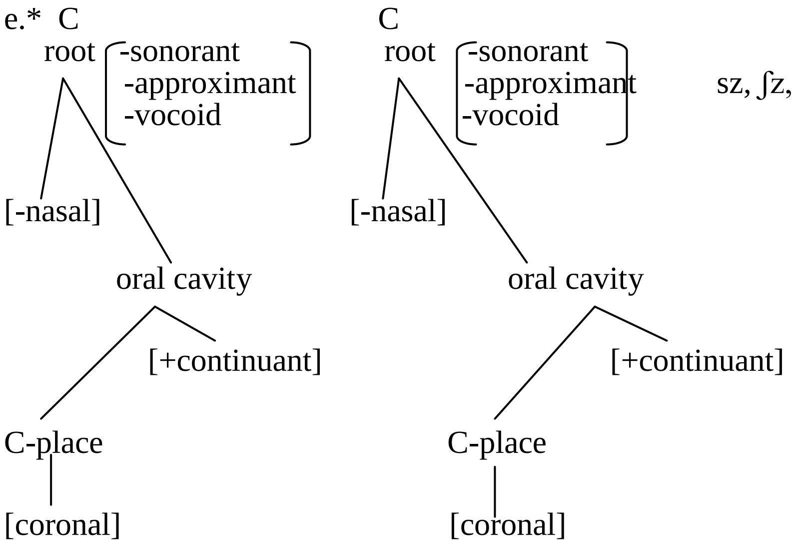
d. *



ħx, ħγ, ħħ, ħʕ, ʕx, ʕγ, ʕħ, ʕʕ.

[-high]
[+low]

e.*



sz, ʃz, ʒz, sʃ, zʃ, ʒʃ, sʒ, zʒ.

For the (a) constraint, /mb/ is a possible cluster in CMA, for instance /mbəxra/ ‘censer’[12].

Keegan (1986: pp. 63-67) limited his search to triliteral roots and to the first two radicals of other roots. His findings are more or less similar to Benkaddour’s findings.

(90)

a. Voiced-Voiceless Restriction:

*ʕħ	*ħʕ	*dt	*td	*bf	*fb
*xγ	*γħ	*DT	*TD		
*kg	*gk	*sz	*zs		

He provided one exception which is /ʃʒ/. He did not include *mf and *fm in the above list of voiced-voiceless restrictions.

b. Velar-Uvular Restriction:

He did not find any case where a velar consonant is adjacent to a uvular consonant:

*qg *kq

[12] This example and others will be discussed in the last chapter of analysis.

*qg *gq

*xg *gx

*γk *kγ

c. Emphatic –Velar Restriction:

*Dk *Dg

*Tg *Tk

The one exception is /Sg/ in /Sgəʕ/ ‘stubborn’.

d. Alveolar-Sonorant Restriction:

*ln *nl

*nr *lr *rl

e. Emphatic-Non-emphatic Restriction:

There is a restriction against a sequence of an emphatic consonant and a non-emphatic one which has the same place of articulation features:

*Tt	*tT	*Sd	*sD
*Dd	*dD	*Ts	*tS
*St	*tS	*Ds	*dS

In addition to these constraints, Keegan (ibid) adds more restrictions which affect the co-occurrence of consonants within the onset and coda. These restrictions can be presented as follows:

(91)

a. Words cannot end in a sequence of two consonants, the last of which is a sonorant;

b. Words cannot begin with a sequence of two consonants, the first of which is a glide.

Concerning the (b) constraint above, I believe that we do have words beginning with a cluster of two consonants whose first consonant is glide. Examples of such words include:

(92)

wtəd	‘peg’	wdən	‘ear’	wsəx	‘dirt’
wħəl	‘to get stuck’	wSəl	‘arrive’	wzən	‘weigh’
wTar	‘guitar’	wʒəʕ	‘pain’	ybəs	‘to get dry’

The above impossible clusters can be best accounted for by the OCP[13]. It applies to any two identical features or nodes which are adjacent on a given tier. The OCP prohibits two identical segments like the ones below:

(93)

a. * b m
root root
place place
[labial] [labial]

b. *m f
root root
place place
[labial] [labial]

c. *t d
root root
place place
[coronal] [coronal]

d. *g k
root root
place place
[dorsal] [dorsal]

e. * D d
root root
place place
[coronal] [coronal]

The illformedness of the above representations is due to the violation of the OCP on the [labial], [coronal] and [dorsal] tiers. It is worth pointing out that the OCP applies at all levels. It does not only prevent segments with the same place node like the ones above, but it also prevents segments with the same features such as nasality, continuancy, etc. As far as the possible clusters are concerned, CMA involves segments which obey the OCP on the place node tiers. For instance:

(94)

a. S f
root root
place place
[labial]

b. x D
root root
place place
[coronal]

c. ħ d
root root
place place
[coronal]

d. q b
root root
place place
[labial]

[13] Adjacent identical segments are prohibited unless they are separated by a word boundary.

[coronal]	[dorsal]	[dorsal]	[dorsal]

In the last chapter of analysis, I will list all the possible clusters that obey or violate the OCP in both the onset and coda. I will also devote a section to the autosegmental representation of geminates, and will see how the OCP works in CMA.

III.3. The peak of CMA Syllables

In this section, I am going to shed light on some of the major syllable-related phonological processes, such as vowel reduction, vowel lengthening, schwa strengthening, diphthongization, and glide formation. The constriction-based model will be employed whenever I feel it is needed. Having said this, let's first consider vowel reduction.

III.3.1. Vowel reduction

The nucleus in CMA syllables may, in addition to the epenthetic schwa, consist of any of the full vowels /i, u, a/. This claim excludes the possibility of having consonants, in the language, which may function as syllabic segments as is the case with some Berber dialects[14].

All the underlying vowels [i, a, u] are reduced to a schwa in closed syllables. In CMA, some schwas are derived from the reduction of Classical Arabic (henceforth CA) full vowels in closed syllables. This phenomenon is referred to in the linguistic literature as ***vowel reduction***. Vowel reduction reduces a full vowel before two consonants and is therefore altering the internal structure of a syllable. Let's consider the following examples:

(95)

CA	CMA	Gloss
a. N**a**ʒma	Nəʒma	' a star'
b. ħ**u**fra	ħəfra	'a hole'
c. q**i**ndiil	qəndiil	'oil lamp'
d. m**u**sl**i**m	məsləm	'Muslim'
e. q**i**rd	qərd	'monkey'

[14] See Elmedlaoui and Dell (2002)

f. ʃ**a**ms ʃəmʃ ‘sun’

As it has been stated above, the full vowels [i, a, u] are reduced to a schwa in closed syllables. This can be formalized as follows:

(96) Vowel reduction (Benkaddour 1982:p.138):

[+syllabic] → ə [-high, -low, +back, -round] / ___ C]$

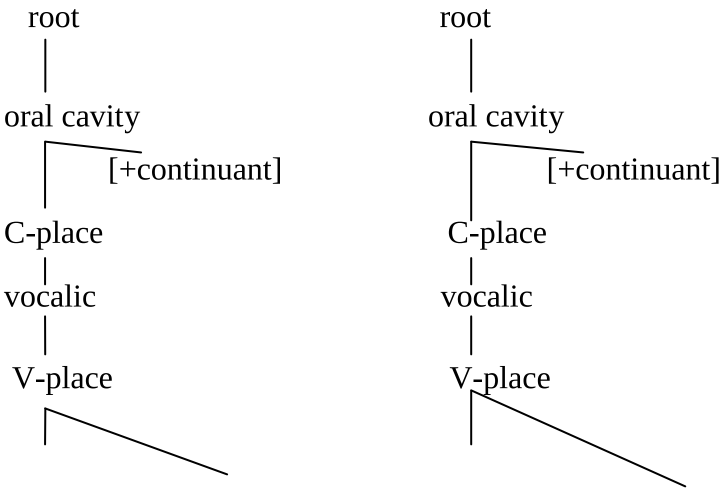
Full vowels remain distinct from the schwa in terms of pronunciation and morphological characteristics. There are some cases where full vowels are reduced word- finally. The following examples illustrate this process (i.e. V-reduction):

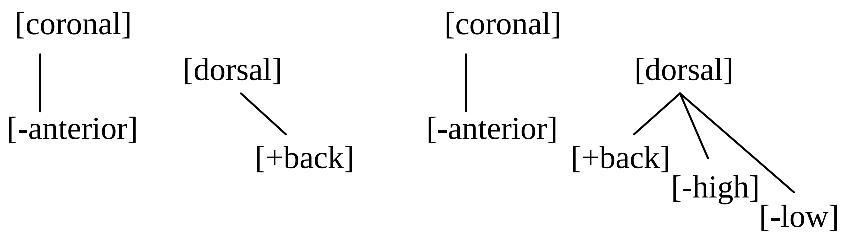
(97) Singular	plural	gloss
a. mənʃ**a**r	mnaʃ**ə**r	‘saw’
b. duww**a**r	dwaw**ə**r	‘village’
c. fərr**u**ʒ	frar**ə**ʒ	‘rooster’
d. qənf**u**d	qnaf**ə**d	‘hedgehog’

Thus, the full vowel in the final syllable of each word is apparently reduced when an infix consisting of a full vowel is inserted in the preceding syllable. This can be formalized into the following rule:

(98) Vowel reduction

a,u → ə / VC ___ C





Some schwas are believed to have a morphological and semantic function. The reduction of the full vowels results in a change in the meaning and in the syntactic category as well. This can be illustrated below:

(99)

Full vowel	gloss	Reduced vowel	gloss
d**a**q (N)	‘taste’	d**ə**q (V)	‘knock at’
ʕ**a**m	‘year’	ʕ**ə**m	‘uncle’
x**a**l	‘uncle’	x**ə**ll	‘vinegar’
ktub (N)	‘books’	kt**ə**b (V)	‘he wrote’

III.3.2. Vowel lengthening

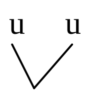
The nucleus in CMA may consist of two syllabic elements (i.e. long segments). CMA allows for the so-called ***vowel lengthening*** which can be illustrated in the following examples:

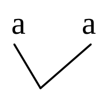
(100)

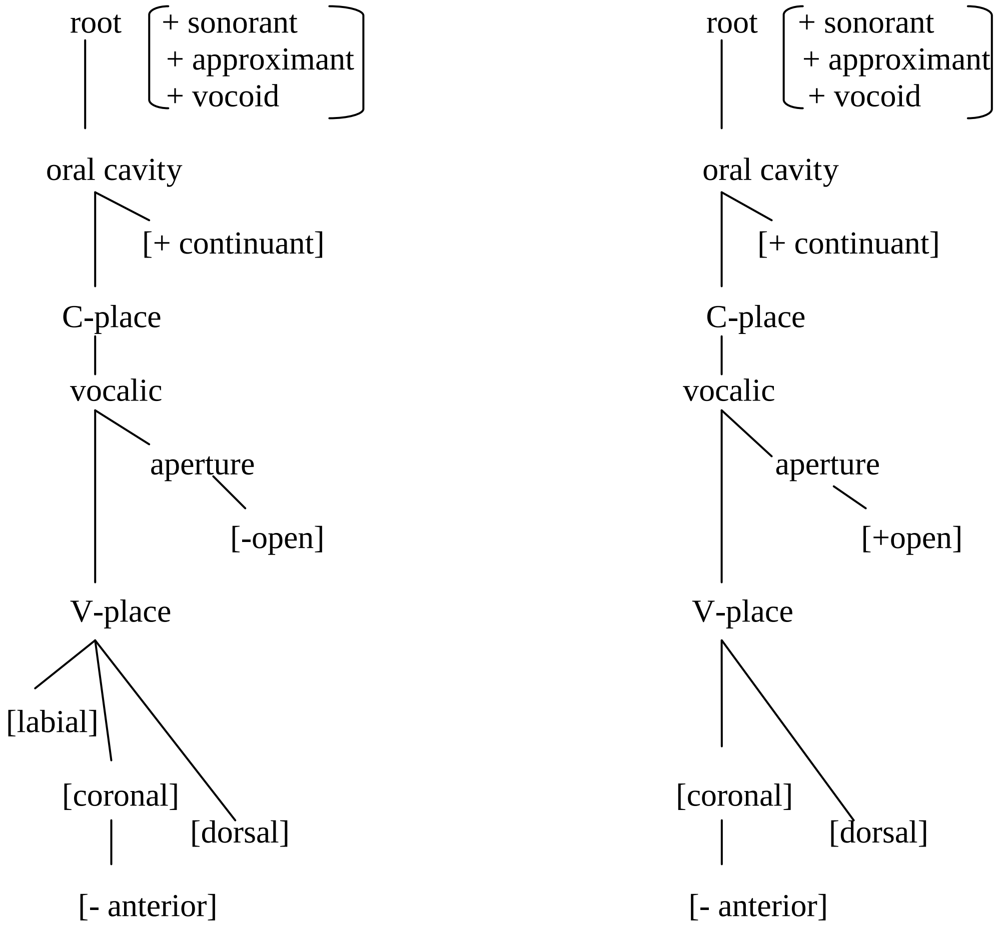
məmd**uu**d	‘lying down’	məħl**uu**l	‘opened’
məml**uu**k	‘owned’	xd**uu**d	‘cheeks’
məsd**uu**d	‘closed’	mx**aa**x	‘brains’

A long vowel is represented as a root node linked to two units of quantity, as shown below:

(101)

a. 

b. 



To sum up, Benkaddour (1982:p. 139) points out that a full vowel is usually lengthened in final closed syllables, as shown below:

(102) Vowel lengthening:

$$[+\text{syllabic}] \longrightarrow [+\text{long}] \;/\; \underline{\quad\quad} \; C \#\#$$

III.3.3. Schwa strengthening

Some of the Moroccan linguists namely Benhallam (1998) and Rguibi (1990) dealt with the so- called **schwa strengthening**. Schwa strengthening refers to the situations of variation between the schwa and the full vowels [i, a, u] found in the northern and less urban central areas of Morocco. Let's consider the following examples taken from Boudlal (2001:p.9):

(103)

	CMA	Northern MA	
a.	məqla	m**a**qla	'frying pan'

lmuDəʕ lmuD**a**ʕ 'the place'

mxədda mx**a**dda 'cushion'

b. nəSS n**u**SS 'half'

qəTRa q**u**TRa 'drop'

γəzlan γ**u**zlan 'gazelles'

c. waħəd waħ**i**d 'one'

lqərd lq**i**rd 'the monkey'

RRaʒəl RRaʒ**i**l 'the man'

In 103a, the schwa alternates with the vowel /a/; in 103b, it alternates with the vowel /u/; and in 103c, it alternates with the vowel /i/.

The data in (103) involves another phonological process which has been discussed above, V-reduction. Full vowels are reduced to a schwa, as shown below:

(104)

Northern MA	CMA	Gloss
a. m**a**qla	məqla	'frying pan'
b. q**u**TRa	qəTRa	'drop'
c. waħ**i**d	waħəd	'one'

In 104a, the full vowel /a/ alternates with the schwa; in 104b, /u/ alternates with it; and in 104c, /i/ alternates with it. The alternation between the schwa and the full vowels shows clearly that there is a dialectal variation among the different varieties of MA. It shows also that northern varieties of MA use full vowels whereas other varieties use the schwa. Having briefly looked at schwa strengthening, I will next consider at the so-called ***diphthongization.***

III.3.4. Diphthongization

Diphthongization is the phenomenon whereby high vowels alternate with the corresponding diphthongs. It involves both vowels and glides. It turns a full vowel into a glide after another vowel, i.e. /a/. For illustration, consider the following examples taken from Boudlal (2001:pp.9-10):

(105) a. lf**u**Da lf**aw**Da 'disorder'

b. DD**u** DD**aw** 'light'

(106)

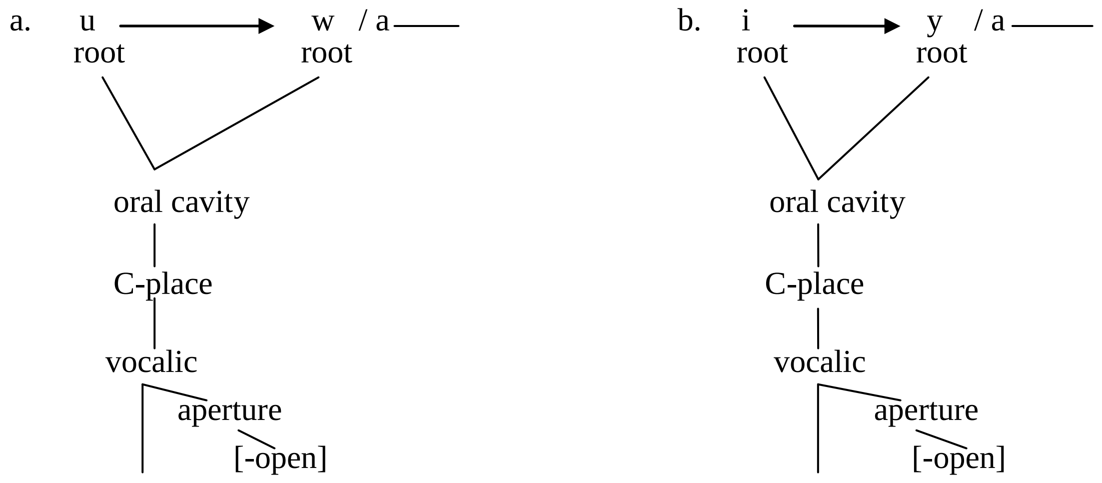
a. zz**i**tun zz**ay**tun 'olive'

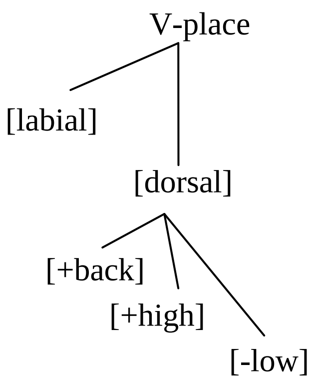
b. b**i**Da b**ay**Da 'Wight'

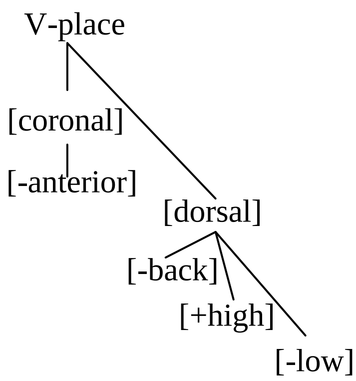
c. ST**i**la ST**ay**la 'small bucket'

In the above data, there is an alternation between the full vowels [u, i] and the glides [w, y]. In 105a and b, the full vowel /u/ turns into [w] which agrees with it in height, backness, and roundness. The high back round /u/ becomes the high back round glide [w] after the low back vowel /a/, as shown in (107a). In 106a, b and c, the full vowel /i/ turns into [y] which agrees with it in height, fronting, and non-roundness. The high front non-round /i/ becomes the high front non-round glide [y] after the low back vowel /a/, as shown in (107b):

(107) Diphthongization

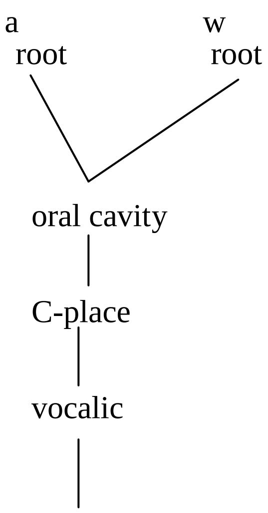






Last but not least, (Benhallam 1980: p. 68) describes diphthongization as a process which turns a full vowel into a glide after another vowel that agrees with it in backness but not in height. As far as I am concerned, this definition calls for one major comment, which concerns backness. In the 105a and b examples, /a/ agrees with /w/ in backness but not height as shown in (108) below. In the 106a, b, and c examples, /a/ does not agree with /y/ neither in backness nor in height, but they agree only in non- roundness. /y/ has the feature [+coronal] since it is front.

(108)



V-place
|
[dorsal]
|
[+back]

Diphthongization is characteristic of rural varieties, such as the variety spoken in El jadida. In other varieties of MA, such as the southern variety of MA, the diphthongs are monophthongized. This process can be attributed to the influence of Amazigh where diphthongs are inexistent (Boudlal: 2001, p.10).

III.3.5. Glide formation

There has been a debate about the status of glides in the relevant linguistic literature (see Benhallam (1980), Rguibi (1990), Boudlal (1993), to cite but a few). While some authors have treated glides as basic underlying segments, others claim that glides and vowels are simply phonetic reflexes of the same phonological set and that no distinction exists at the underlying level between the syllabic and the nonsyllabic elements.

Benhallam (1980) dwelled at length on the analysis of glides in Standard Arabic (henceforth SA). He tried to show whether glides are underlying or are they the result of a diphthongization process which is triggered by the contiguity of two or more vowels. In the end, he opted for a vowel-based approach since it is more economic in that it involves fewer rules than that which takes glides as underlying units.

(109)

/la.qa.ya/	lqa	'he found'
/ʃa.ra.ya/	ʃra	'he bought'
/ʃa.qa.ya/	ʃqa	'he was busy'

The glide-based approach would involve three rules. The first one in (110a) deletes the glide intervocalically. The two other rules (110b and c) involving vowels must be also provided, thus we will end up with three rules in this order:

(110) The glide-based approach

a. G ⟶ ϕ / V —— V

b. $V \rightarrow \phi$ / C ——— C

c. $V \rightarrow \phi$ / C ——— C

However, if the vowel-based analysis is applied, only one rule deleting vowels in three different environments is needed:

(111) The vowel-based approach

$$V \longrightarrow \phi \ \Big/ \ \begin{array}{l} C \ \text{———} \ C \\ V \ \text{———} \ V \\ C \ \text{———} \ V \end{array}$$

Benhallam (ibid) concludes that “a glide-based analysis” requires more rules than the “vowel-based analysis” (p.54), and that the interaction between glides and vowels give the right surface syllabic configurations.

In short, the disagreement among linguists about the nature of the interaction between high vowel and glides seems to have been solved by considering the difference between glides and vowels in terms of the syllable structure.

The two glides /y/ and /w/ exhibit a systematic alternation with the full vowels /i/ and /u/ respectively. As far as I am concerned, glide formation is used as a solution to resolve the so-called vowel hiatus. It is used to break the cluster of two vowels as could be seen in the examples below:

(112)

Singular	Plural		Gloss
	UR	SR	
a. sif	s**i**uf	s**y**uf	‘sword’
b. bir	b**i**ar	b**y**ar	‘well’
c. bit	b**i**ut	b**y**ut	‘room’
d. suq	s**u**aq	s**w**aq	‘market’
e. kura	k**u**ari	k**w**ari	

Generally, the process of glide formation can be easily summed up as follows:

(113) Glide formation

[+syllabic] ⟶ [-syllabic] / ——— [+syllabic]

As it has been stated above, /i/ turns into /y/, and /u/ turns into /w/. In other words, the high front non-round vowel /i/ becomes the high front non-round glide [y] before a vowel, as shown in 114a. Similarly, the high back round vowel /u/ becomes the high back round glide [w] before a vowel, as shown in 114b:

(114) Glide formation

a. i ⟶ y / ——— [+syllabic]

$$\begin{pmatrix} \text{+syllabic} \\ \text{+high} \\ \text{-back} \\ \text{-round} \end{pmatrix} \longrightarrow \begin{pmatrix} \text{-syllabic} \\ \text{+high} \\ \text{-back} \\ \text{-round} \end{pmatrix}$$

b. u ⟶ w / ——— [+syllabic]

$$\begin{pmatrix} \text{+syllabic} \\ \text{+high} \\ \text{+back} \\ \text{+round} \end{pmatrix} \longrightarrow \begin{pmatrix} \text{-syllabic} \\ \text{+high} \\ \text{+back} \\ \text{+round} \end{pmatrix}$$

III.4.Coda Restrictions

Unlike the onset, the coda is optional in CMA. Therefore, we may have words involving codaless syllables either word-medially or word-finally as illustrated below:

(115) Codaless Syllables:

a. Word-medially:

.CV.CV.CV bi.Da.wi ‘from Casa’

CV.CV.CV	ʕi.ni.na	‘our eyes’
CCV.CV.CV	zzi.tu.na	‘olive’
CV.CVC	ma.zal	‘he is still …’

b. Word-finally:

CV	xu	‘brother’
CvC.CV	Səm.Ta	‘belt’
CCV	bka	‘he cried’
CV	ʒa	‘he came’
CCV	DDu	‘light’

Here again there are exceptions to this generalization. A word whose nucleus is a schwa has to have an obligatory coda. The schwa cannot occur in open syllables (i.e. codaless syllables).

(116) Obligatory Coda

ktə**f**	‘shoulder’	dxə**l**	‘enter’
smə**n**	‘preserved butter’	DRə**b**	‘hit’
sdə**r**	‘chest’	ħlə**m**	‘dream’
kə**rʃ**	‘stomach’	Rkə**b**	‘ride’

In fact, underlying vowels may occur in open and closed syllables, whereas the schwa can occur only in closed syllables. Codas can be simple or complex in CMA either word-medially or word-finally.

(117) Simple codas:

a. Word-medially:

Sound	Distinctive Features	Word	Gloss
/r/	[+cons +son +cont -ant +cor +voi]	bə**r**.gəg	‘he spied on’

/l/	+cons +son + cont +ant +cor +lat	mə**l**.məl	'he shook sth'
/n/	+cons +son - cont +ant +cor +nas	ħə**n**.ZəZ	'he gazed at'
/s/	+cons -son + cont +ant +cor -voi	mə**s**.ləm	'Muslim'
/r/	+cons +son +cont -ant +cor +voi	ʃə**r**.ʒəm	'window'

b. Word-finally:

Sound	Distinctive features	Word	Gloss
/l/	+cons +son +cont +ant +cor +lat	rʒə**l**	'leg'
/d/	+cons -son - cont +ant +cor +voi	wtə**d**	'peg'
/z/	+cons -son +cont +ant +cor +voi	qfə**z**	'cage'
/n/	+cons +son - cont +ant +cor	wdə**n**	'ear'

	+nas		
/R/	+cons +son +cont -ant +cor +voi	qbə**R**	‘tomb’

More words that involve simple codas word-finally are the following:

(118)

a. Nouns	Gloss	b. Adjectives	Gloss
smə**n**	‘preserved butter’	ħwə**l**	‘cross-eyed’
STə**l**	‘bucket’	zRə**q**	‘blue’
sbə**ʕ**	‘lion’	kħə**l**	‘black’
qmə**R**	‘gambling’	Smə**k**	‘deaf’
ʕdə**s**	‘lentils’	ħrə**ʃ**	‘rough’

c. Verbs	Gloss
dxə**l**	‘enter’
ʃRə**b**	‘drink’
ħlə**m**	‘dream’
Rkə**b**	‘ride’
lħə**s**	‘lick’

Using the appropriate feature geometry terms, simple codas can be considered as simple segments. Simple segments consist of a root node characterized by at most one oral articulator feature. This can be illustrated as follows:

(119)

a. b, m,
place
|

b. n, l, s, R, ʃ, d, z
place
|

c. q, k, ʕ
place
|

[labial]

[coronal]

[dorsal]

(120) Complex Codas:

a. Word-medially:

Clusters	Sound (1)	Distinctive features	Sound (2)	Distinctive features	Word	Gloss
/nt/	/n/	+cons +son - cont +ant +cor +nas	/t/	+cons -son - cont +ant +cor -voi	bə**nt**.hum	'their daughter'
/ft/	/f/	+cons -son +cont +ant -cor -voi	/t/	+cons -son - cont +ant +cor -voi	ʃə**ft**.kum	'I saw you'
/ld/	/l/	+cons +son +cont +ant +cor +nas	/d/	+cons -son -cont +ant +cor +voi	wə**ld**.hum	'their son'
/ʕt/	/ʕ/	+cons -son -cont -ant -cor	/t/	+cons -son - cont +ant +cor	bə**ʕt**.hum	'I sold them'
/ħd/	/ħ/	+cons -son -cont -ant -cor -nasal	/d/	+cons -son - cont +ant +cor -voi	wa**ħd**-axər	'another one'

b. Word-finally:

In complex codas, the two consonants can be identical or different. When the coda consists of two different consonants, the sonority index[15] of the first consonant (S1) should be superior to that of the second one (S2) as could be seen below:

Words	Gloss	Sound (1)	Distinctive features	Sonority index	Sound (2)	Distinctive features	Sonority index
də**nb**	'sin'	/n/	+cons +son - cont +ant +cor +nas	6	/b/	+cons -son - cont +ant -cor +voi	2
ɣə**rs**	'plant'	/r/	+cons +son +cont -ant +cor +voi	7	/s/	+cons -son +cont +ant +cor -voi	3
ħə**Rb**	'war'	/R/	+cons +son +cont -ant +cor +voi	7	/b/	+cons -son - cont +ant -cor +voi	2
bə**nt**	'girl'	/n/	+cons +son - cont +ant +cor +nas	6	/t/	+cons -son - cont +ant +cor -voi	1
qə**lb**	'heart'	/l/	+cons +son +cont +ant +cor +lat	7	/b/	+cons -son - cont +ant -cor +voi	2

Words that involve two identical consonants (i.e. geminates) in the coda are:

(121) Geminates in the coda position

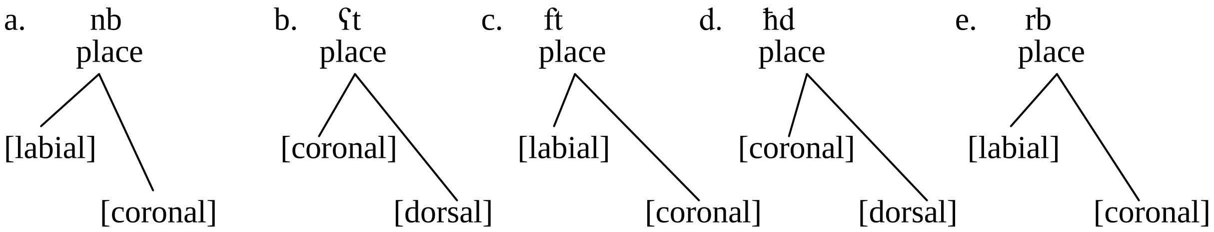
hə**zz**	'lift'	bə**qq**	'bugs'
də**qq**	'knock at'	mə**xx**	'brain'
mə**ss**	'touch'	fə**mm**	'mouth'

[15] The role of sonority in assigning syllable structure will be discussed in this chapter, section 5.

də**mm** ‘blood’ ʕə**DD** ‘bite’

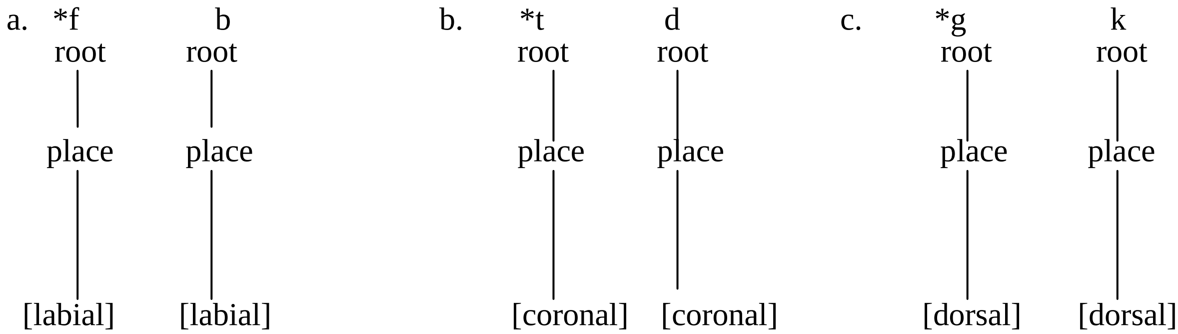
The above complex codas can be treated as complex segments. A complex segment is a root node characterized by at least two different oral articulator features, representing a segment with two or more simultaneous oral tract considerations. This can be illustrated as follows:

(122)



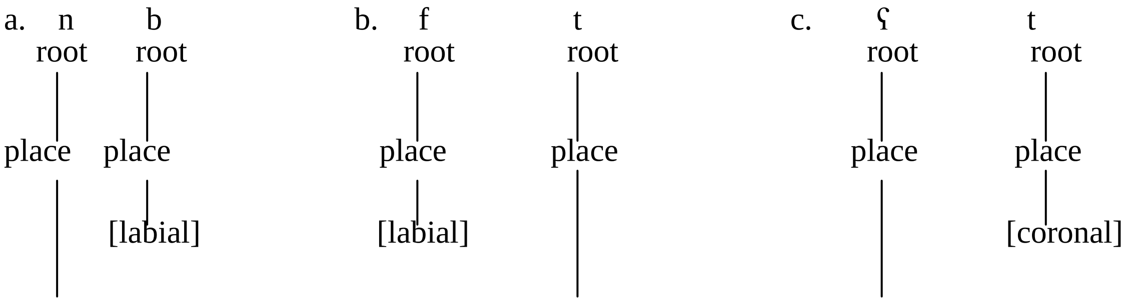
As far as the coda restrictions are concerned, the constraints on onsets presented in the second section may equally be used for codas (see section 2 above). The coda restrictions can be best accounted for by the OCP. It prevents two adjacent segments in the coda, as shown below:

(123)



The above complex codas in (120) obey the OCP, as illustrated below:

(124)



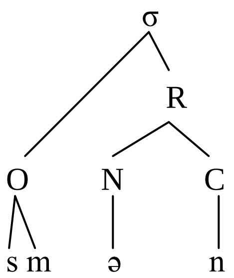
[coronal] [coronal] [dorsal]

In the last chapter of analysis, I will consider all the possible clusters that obey or violate the OCP in both the onset and coda. I will also shed light on the autosegmental representation of geminates, and will see how the OCP works in CMA.

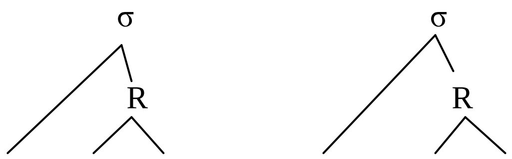
III.5.Syllabification and Sonority

Following Al Ghadi (1990), I will assume that the basic syllable type in CMA is CV. As it has been stated above[16], it is the All-Nuclei First Approach which will be adopted in the syllabification process. It is worth pointing out that the process (i.e. approach) can be applied to all the data, but I will provide the syllabification of some monosyllabic, disyllabic and trisyllabic words only. For the sake of illustration, let’s consider the following examples:

(125) a. Monosyllabic word: smən /CCvC/[17] ‘preserved buttter’

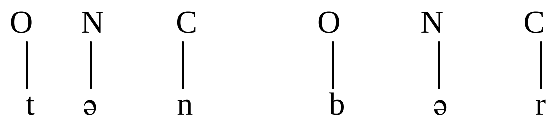


b. Disyllabic word: tən.bər /CvC.CvC./ ‘stamp’

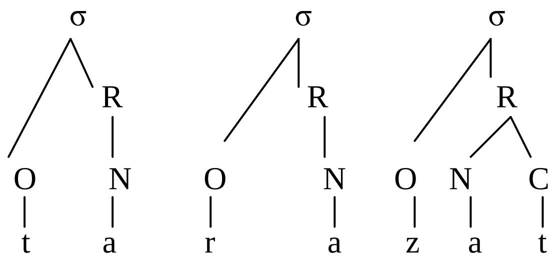


[16] See ch. II, section 1.4, p. 27

[17] I am using the small v to refer to the schwa, and V to refer to the full vowels [i, a, u]



c. Trisyllabic word: ta.ra.zat /CV. CV. CVC/ ‘turbans’



Besides CV, CMA has, on the surface level of representation, other syllabic patterns which are: CVC, CCV, C¡C¡V, C¡C¡CV, CCVC, C¡C¡VC, C¡C¡CVC, CVCC, CVC¡C¡, and CCVCC. These syllabic patterns are derived from the basic syllable type CV by syllabification rules.

Moreover, CMA syllables are of two types: open and closed. Open syllables are composed either of CV, CCV, C¡C¡V, or C¡C¡CV.

(126)

a. CV		b. CCV		c. C¡ C¡V	
ʒa	‘he came’	bna	‘to build’	bba	‘my father’
ma	‘water’	kma	‘to smoke’	mmi	‘my mother’
xu	‘brother’	bka	‘to kry’	DDu	‘light’

d. C¡C¡CV

ssma	‘the sky’
ddwa	‘medicine’

Closed syllables, on the other hand, may end in one consonant, two different consonants or geminates:

(127) a. CVC		b. CvCC		c. CvC¡C¡	
had	‘this’	fəRx	‘bird’	fəmm	‘mouth’

baʃ 'so that' ʃəmʃ 'sun' məxx 'brain'

baʕ 'to sell' dənb 'sin' sədd 'close'

ban 'to appear' DəRb 'hitting' ʕəDD 'bite'

Tab 'to become ripe' qəlb 'heart' mədd 'give'

d. C¡C¡CvC f. CCvC g. C¡C¡VC

ssbəʕ 'the lion' smən 'preserved butter' ddir 'you do'

nnmər 'the tiger' sdər 'chest' nnas 'people'

ʒʒməl 'the camel' STəl 'bucket' DDaR 'the house'

h. CCVCC

mSafr 'travelling'

Having considered the syllabification of some words, CMA has lexical items which obey the sonority hierarchy[18] such as / ktəf/ 'shoulder', /smən / 'preserved butter', / gləs/ 'sit down', and /DRəb/ 'hit'. Let's look at the following table:

(128)

Words	Sound (1)	Distinctive features	Sonority index	Sound (2)	Distinctive features	Sonority index
a. **kt**əf	/k/	+cons -son - cont -ant -cor -voi +high -low +back	1	/t/	+cons -son - cont +ant +cor -voi	1
b. **sm**ən	/s/	+cons -son +cont +ant +cor -voi	3	/m/	+cons +son - cont +ant -cor +nas	6
c. **gl**əs	/g/	+cons -son - cont	4	/l/	+cons +son +cont	7

[18] See the sonority hierarchy on page 30 ,ch. II ,section .1.3

		-ant -cor +voi +high -low +back			+ant +cor +lat	
d. **DR**əb	/D/	+cons -son - cont +ant +cor +voi	2	/R/	+cons +son +cont -ant +cor +voi	7

The sonority of consonants in onsets must increase from margin to peak as illustrated in the examples above. However, there are lexical items that violate the hierarchy principle such as /sdər/ 'chest', /bka/ 'cry', /sbəʕ/ 'lion', /mbəxRa/ 'censer', and /Rkəb/ 'ride'.

(129)

Words	Sound (1)	Distinctive features	Sonority index	Sound (2)	Distinctive features	Sonority index
a. **sd**ər	/s/	+cons -son +cont +ant +cor -voi	3	/d/	+cons -son - cont +ant +cor +voi	2
b. **bk**a	/b/	+cons -son - cont +ant -cor +voi	2	/k/	+cons -son - cont -ant -cor +voi +high -low +back	1
c. **sb**əʕ	/s/	+cons -son +cont +ant +cor -voi	3	/b/	+cons -son - cont +ant +cor +voi	2
d. **mb**əxRa	/m/	+cons +son - cont +ant -cor +nas	6	/b/	+cons -son - cont +ant +cor +voi	2
e. **Rk**əb	/r/	+cons +son +cont -ant	7	/k/	+cons -son - cont	1

		+cor +voi			-ant -cor +voi +high -low +back	

In chapter four (i.e. CMA phonotactics), I will list all the possible clusters that obey or violate the sonority hierarchy both in the onset and coda positions .By doing this, we can have a list of all the possible clusters that obey or violate the sonority hierarchy either word-initially or word-finally.

As far as the coda is concerned, the sonority of consonants in codas must decrease from peak to margin as could be illustrated by the following examples:

(130)

Words	Sound (1)	Distinctive features	Sonority index	Sound (2)	Distinctive features	Sonority index
a. qə**rd**	/r/	+cons +son +cont -ant +cor +voi	7	/d/	+cons -son - cont +ant +cor +voi	2
b. qə**lb**	/l/	+cons +son +cont +ant +cor +lat	7	/b/	+cons -son - cont +ant -cor +voi	2
c. də**nb**	/n/	+cons +son - cont +ant +cor +voi	6	/b/	+cons -son - cont +ant -cor +voi	2
d. fə**Rx**	/r/	+cons +son +cont -ant +cor +voi	7	/x/	+cons -son +cont -ant -cor +back +high -low	5
e. ɣə**rs**	/r/	+cons	7	/s/	+cons	3

		+son +cont -ant +cor +voi			-son +cont +ant +cor -voi	

There are some exceptions in which the sonority of consonants in the coda increases from peak to margin. These words are listed below:

(131)

a. ħəbs ‘jail’ b. kəbʃ ‘sheep’ c. gəbs ‘gypsum’

In brief, Boudlal (1993) states that nouns generally abide by the sonority principle while verbs and adjectives violate this principle.

III.6. Schwa Epenthesis

While underlying vowels are not subject to any restrictions on syllable structure, schwas are problematic in a number of respects. Unlike full vowels which can occur in both open and closed syllables, schwas never occur in open syllables. Schwas always get deleted when they occur in open syllables[19].

(132) a. Full vowels in open syllables b. Schwas in open syllables

a. Full vowels in open syllables			b. Schwas in open syllables		
CV	x**u**	‘brother	Cv. CCvC	* m**ə**.sləm	‘Muslim’
CCV	bk**a**	‘cry’	Cv. CCvC	* m**ə**.lməl	‘she shook sth’
CvC. CV	zəb.d**a**	‘butter’	Cv. CCVCV	*D**ə**. Rbatu	‘she hit it/him’
CV. CV. CV	t**a**.r**a**.z**a**	‘turban’	Cv. CCVC	* m**ə**.zyan	‘nice’

Following Benhallam (1990), I will assume that schwa epenthesis is dependent on syllabification. As it has been stated above, CMA has three underlying vowels which are [i, a, u] and an epenthetic schwa. The schwa is epenthesized to break up consonantal clusters that the language does not allow. This process is known in the linguistic literature as ***schwa epenthesis rule.*** The following consonantal clusters are prohibited by the language (i.e. CMA):

[19] It is proposed by Benhallam (1980: p.85) that the schwa has to be dropped in open syllables.

(133) *fRx 'bird' *fndəq 'hotel' *zbda 'butter' *Rmla 'sand'

*lʕb 'play' *Rkb 'ride' *gls 'sit down' *DRb 'hitting'

*kħl 'black' *SfR yellow' *ħmR 'red' *lbs 'wear'

The above data provides us with good evidence that the schwa is epenthetic in adjectives, nouns, verbs, etc. On the one hand, it is inserted to break up the impermissible triconsonantal clusters like the ones in (133). It is inserted in the peak slot of a peakless syllable (Benhallam: 1980, p.72). On the other hand, the schwa cannot be epenthesized to break up permissible triconsonantal clusters. Three consonants are allowed word-medially and word-finally. The words that involve three consonants w-medially are the following:

(134) Word-medially

a. sə**nsl**a 'zip' b. fə**rml**i 'nurse'

c. ʃə**rʒm**u 'his window' d. tə**nbr**i 'my stamp'

e. fə**yyq**u 'they woke up' f. xə**ddm**u 'they operated'

g. bə**rdʕ**a 'saddle-bag'

Benhallam's (1980: p.80) words:

h. kə**llm**ək 'he spoke to you' k. qa**llh**um 'he said to them'

(135) Word-finally

Benhallam's (ibid: p.76) words:

a. maSərfə**qtʃ** 'I didn't slap' b. madərdə**rtʃ** 'I didn't sprinkle'

c. maktə**btʃ** 'I didn't write'

In the above examples, the coda of the final syllable is of the form CCC where the second C (-t-) is the first person singular marker and the third C (-ʃ) is part of the negative particle (i.e. ma ….ʃ). Benhallam (1980: p.76) points out that "the schwa is never inserted prior to the negating ʃ ". He adds that the schwa can be inserted prior to the /ʃ/ when it meets the structural description of schwa epenthesis in triconsonantal verbs, such as /Trəʃ/ 'he slapped' and /ʕTəʃ/ 'he became thirsty'. In brief, the schwa cannot be epenthesized prior to the negating /-ʃ/.

The rule which epenthesizes the schwa has to refer to the syntactic category of the base. Thus, the way schwas behave in verbs and adjectives, for example, is different from the way they behave in nouns. While the schwas occurring in verbs and adjectives can be accounted for by a structure-building algorithm of syllabification, nominal schwa epenthesis is dependent on the sonority of consonants of the base.

Benhallam (1980, 1990a, 1991) assumes that all instances of schwas are epenthetic and thus inserted by syllabification rules. Al Ghadi (1990) maintains that schwa insertion and consequently nominal schwa syllabification is dependent on the sonority hierarchy of segments occupying the second and third position in trisegmental roots. According to him, schwa is inserted before the more sonorant of the two segments occupying the two positions. Let's look at the following examples:

(136)

Word	Gloss	Sound (1)	Sonority index	Sound (2)	Sonority index
1. k**təf**	'shoulder'	/t/	1	/f/	3
2. qə**rd**	'monkey'	/r/	7	/d/	2
3. qə**lb**	'heart'	/l/	7	/b/	2
4. kə**lb**	'dog'	/l/	7	/b/	2
5. ʒ**məl**	'camel'	/m/	6	/l/	7
6. w**dən**	'ear'	/d/	2	/n/	6
7. də**nb**	'sin'	/n/	6	/b/	2
8. bə**rd**	'wind'	/r/	7	/d/	2
9. fə**Rx**	'bird'	/R/	7	/x/	5
10. γə**rs**	'plant'	/r/	7	/s/	3
11. q**fəz**	'cage'	/f/	3	/z/	4
12. q**məR**	' gambling'	/m/	6	/R/	7
13. w**səx**	'dirt'	/s/	3	/x/	5
14. s**bəʕ**	' lion'	/b/	2	/ʕ/	5
15. q**bəR**	'tomb'	/b/	2	/R/	7
16. n**mər**	' tiger'	/m/	6	/r/	7
17. w**təd**	' peg'	/t/	1	/d/	2

18. S**T**ə**l**	' bucket'	/T/	1	/l/	7
19. r**ʒ**ə**l**	'leg'	/ʒ/	4	/l/	7
20. kə**rʃ**	'stomach'	/r/	7	/ʃ/	3
21. s**d**ə**r**	'chest'	/d/	2	/r/	7
22. bə**nt**	'girl'	/n/	6	/t/	1
23. ʕ**d**əs	'lentils'	/d/	2	/s/	3
24. nə**ħ**s	'bad luck'	/ħ/	5	/s/	3
25. lə**ʕb**	'game'	/ʕ/	5	/b/	2
26. Də**Rb**	'hitting'	/R/	7	/b/	2
27. ʃə**mʃ**	'sun'	/m/	6	/ʃ/	3
28. ħə**Rb**	'war'	/R/	7	/b/	2
29. D**b**ə**ʕ**	'hyena'	/b/	2	/ʕ/	5
30. ħ**T**ə**b**	'fire wood'	/T/	1	/b/	2
31. g**m**ə**l**	'lice'	/m/	6	/l/	7
32. ħ**b**ə**l**	'robe'	/b/	2	/l/	7
33. ʕ**s**ə**l**	'honey'	/s/	3	/l/	7
34. n**m**ə**l**	'ants'	/m/	6	/l/	7
35. b**ħ**ə**R**	'sea'	/ħ/	5	/R/	7
36. z**b**ə**l**	'rubbish'	/b/	2	/l/	7
37. bɣə**l**	'mule'	/ɣ/	4	/l/	7
38. s**q**ə**f**	'ceiling'	/q/	1	/f/	3
39. sə**rʒ**	'saddle'	/r/	7	/ʒ/	4
40. t**m**ə**R**	'dates'	/m/	6	/R/	7
41. b**S**ə**l**	'onions'	/S/	3	/l/	7
42. t**q**ə**b**	'pierce'	/q/	1	/b/	2
43. Də**ħk**	'laughter'	/ħ/	5	/k/	1
44. t**b**ə**n**	'straw'	/b/	2	/n/	6
45. S**b**ə**ʕ**	'finger'	/b/	2	/ʕ/	5
46. n**ħ**ə**l**	'bees'	/ħ/	5	/l/	7
47. n**x**ə**l**	'date palm'	/x/	5	/l/	7
48. ʃ**q**ə**f**	'shard'	/q/	1	/f/	3
49. ʃ**ʕ**ə**R**	'hair'	/ʕ/	5	/r/	7
50. ʃ**b**ə**r**	'one span'	/b/	2	/r/	7

51. ʃ**hə R**	'one month'	/h/	5	/r/	7
52. ʒ**də r**	'root'	/d/	2	/r/	7
53. D**fə R**	'fingernail'	/f/	3	/r/	7
54. D**hə R**	'back'	/h/	5	/r/	7
55. ʒ**bə n**	'cheese'	/b/	2	/n/	6
56. ʃ**ʒə R**	'trees'	/ʒ/	4	/r/	7
57. Z**hə R**	'luck'	/h/	5	/r/	7
58. k**fə n**	'shroud'	/f/	3	/n/	6
59. g**də m**	'heel'	/d/	2	/m/	6
60. ħ**ʒə R**	'rocks'	/ʒ/	4	/r/	7
61. ʕ**qə l**	'mind'	/q/	1	/l/	7
62. q**Tə n**	'cotton'	/T/	1	/n/	6
63. w**tə d**	'peg'	/T/	1	/d/	2
64.w**ʒə ʕ**	'pain'	/ʒ/	4	/ʕ/	5
65. lə**ft**	'turnip'	/f/	3	/t/	1
66. bə**nk**	'bank'	/n/	6	/k/	1
67. ʕə**rs**	'wedding'	/r/	7	/s/	3
68.ʒə**ld**	'skin'	/l/	7	/d/	2
69. Sə**Rf**	'change'	/r/	7	/f/	3
70. ʃə**Rq**	'east'	/r/	7	/q/	1
71. sə**lk**	'wire'	/l/	7	/k/	1
72. tə**lʒ**	'snow'	/l/	7	/ʒ/	4
73. lə**rD**	'ground'	/r/	7	/D/	2
74. Tə**Rz**	'embroidering'	/r/	7	/z/	4
75. wə**ld**	'boy'	/l/	7	/d/	2
76. ʃə**RT**	'condition'	/R/	7	/T/	1
77. Də**rs**	'lesson'	/r/	7	/S/	3
78. Tə**Rf**	'piece'	/R/	7	/f/	3
79. bə**ħt**	'research'	/ħ/	5	/t/	1
80. b**gə R**	'cows'	/g/	4	/R/	7
81. zə**ng**	'zinc'	/n/	6	/g/	4
82. mə**lħ**	'salt'	/l/	7	/ħ/	5
83. Tə**lq**	'credit'	/l/	7	/q/	1

84. bə**nʒ**	‘anesthetic’	/n/	6	/ʒ/	4
85. bə**Rʒ**	‘fort’	/R/	7	/ʒ/	4
86. Tə**lħ**	‘acasia’	/l/	7	/ħ/	5
87. fə**Rħ**	‘celebration’	/R/	7	/ħ/	5
88. ʒə**ħʃ**	‘young donkey’	/ħ/	5	/ʃ/	3
89. wə**ʕd**	‘promess’	/ʕ/	5	/d/	2
90. nə**ʕt**	‘description’	/ʕ/	5	/t/	1
91. ʒə**hd**	‘strength’	/h/	5	/d/	2
92. mə**lk**	‘property’	/l/	7	/k/	1
93. ħə**nk**	‘jaw’	/n/	6	/k/	1
94. ʕə**Rʃ**	‘branch/throne’	/R/	7	/ʃ/	3
95. mə**RD**	‘illness’	/R/	7	/D/	2
96. gə**rʃ**	‘coin’	/r/	7	/ʃ/	3
97. tə**xt**	‘dregs’	/x/	5	/t/	1
98. ʒə**Rħ**	‘a cut’	/R/	7	/ħ/	5
99. wə**rt**	‘inheritance’	/r/	7	/t/	1
100. γə**Rb**	‘west’	/R/	7	/b/	2

If the second and third segments have the same sonority index, the schwa is inserted before the third segment. For instance:

(137)

Words	Gloss	Sound (1)	Sonority index	Sound (2)	Sonority index
a. s**mən**	‘preserved butter’	/m/	6	/n/	6
b.γ**nəm**	‘sheep’	/n/	6	/m/	6
c. f**təq**	‘hernia’	/t/	1	/q/	1

The first word /smən/ is provided by Benhallam (1980), whereas the two last words (i.e. /γnəm/ and /ftəq/) are taken from the data I collected in Casablanca. As far as I am concerned, there are some exceptions to the above generalization. I have some nouns in the list of data

(66) in which the schwa is inserted before the second segment though they have the same sonority index. Examples of such nouns are the following:

(138)

a. /nəfs/ 'breathe' b. /wəqt/ 'time'

If I insert the schwa before the third segment, I will derive the following ill-formed structures:

(139)

a. *nfəs 'breathe' b. *wqət 'time'

One question arises here about the above exceptions: why is the schwa inserted before the second segment and not the third in the nouns above? This is not the only question that can be asked about the exceptions, but more questions will arise as we move on.

I listed 100 nouns that conform to the sonority hierarchy to show that schwa insertion depends on the sonority hierarchy in the majority of nouns. However, Benhallam (1980) provides us with some exceptional nouns that do not conform to the sonority hierarchy.

(140) a. /ʕməʃ/ 'discharge of the eye' c. /ħəbs/ 'jail'

b. /ħməd/ 'Ahmed' d. /ħnəʃ/ 'snake'

The data I collected from people involves six exceptional nouns that are not governed by the sonority principle. These words are the following:

(141)

a. /dhəb/ 'gold' b. /gəbs/ 'gypsum' c. /ʕnəb/ 'grapes d. /Rnəb/ 'hare'

e. / kəbʃ/ 'sheep' f. /ʃməʕ/ 'wax' g. /qSəb/ 'reeds'

The above examples can be represented as follows:

(142)

Words	Gloss	Sound (1)	Sonority index	Sound (2)	Sonority index
1. ʕ**məʃ**	'discharge of the eye'	/m/	6	/ʃ/	3

2. ħə**bs**	'jail'	/b/	2	/s/	3
3. ħ**mə****d**	'Ahmed'	/m/	6	/d/	2
4. ħ**nəʃ**	'snake'	/n/	6	/ʃ/	3
5. d**həb**	'gold'	/h/	5	/b/	2
6. gə**bS**	'gypsum'	/b/	2	/S/	3
7. kə**bʃ**	'sheep'	/b/	2	/ʃ/	3
8. ʕ**nəb**	'grapes'	/n/	6	/b/	2
9. ʃ**məʕ**	'wax'	/m/	6	/ʕ/	5
10. R**nəb**	'hare'	/n/	6	/b/	2
11. q**Səb**	'reeds'	/S/	3	/b/	2

If I epenthesize the schwa before the most sonorant segment occupying the two positions in the ten nouns above, I will derive the following ill-formed structures:

(143)

*ʕəmʃ	'discharge of the eye'	*ħbəs	'jail'
*ħəmd	'Ahmed'	*ħənʃ	'snake'
*dəhb	'gold'	*ʕənb	'grapes'
*kbəʃ	'sheep'	*ʃəmʕ	'wax'
*Rənb	'hare'	*gbəs	'gypsum'
*qəSb	'reeds'		

One legitimate question that arises here is: why do we have such exceptions? In other words, why don't the ten nouns conform to the sonority principle? A future research on this phenomenon can probably provide answers to this question.

This accounts for schwa insertion in a large number of trisegmental and quadrisegmental[20] nouns. However, they fail to account for verb and adjective schwa placement. Nominal schwa syllabification is argued to be dependent to a large extent on the sonority of the surrounding consonants (see Al Ghadi 1990, Boudlal 1993, 2001, to cite but a few) as it has been

[20] Trisegmental and quadrisegmental are Al Ghadi's (1990) terms.

presented above, while verb and adjective schwa syllabification is not governed by the sonority principle. Let's consider the following examples:

(144)

Verb	Gloss	Adjective	Gloss
x**r**ə**ʒ**	'leave'	ħ**w**ə**l**	'cross-eyed'
D**R**ə**b**	'hit'	S**m**ə**k**	'deaf'
l**ʕ**ə**b**	'play'	m**l**ə**s**	'soft'
g**l**ə**s**	'sit down'	ħ**R**ə**ʃ**	'rough'
n**ʕ**ə**s**	'sleep'	z**R**ə**q**	'blue'

In short, verb and adjective schwa syllabification is not governed by the sonority principle as is the case with the majority of nouns.

Other cases of schwa insertion can be seen in the following data:

(145)

a. 3rd person plural- perfect : /+u/

xəddəm	'he operated'	xəddmu	'they operated'
fəyyəq	'he woke up'	fəyyqu	'they woke up'
ʕaqəb	'he punished'	ʕaqbu	'they punished'

b. Imperfect prefix : /n+/

nəʒbər	'I find'	nʒəbru	'we find'
nədxul	'I enter'	ndəxlu	'we enter'

c. 2nd person sing. Object suffix: /+ək/

ʒbər	'he found'	ʒəbrək	'he found you'
qtəl	'he killed'	qətlək	'he killed you'

In (a), the schwa is deleted when immediately followed by a consonant which is immediately followed by a suffix beginning with a vowel:

(146) Schwa deletion

$$\text{ə} \longrightarrow \phi \ / \ CC \_\_ \ C + u$$

In (b), the schwa is apparently inserted when a prefix consisting of a single consonant immediately precedes a stem beginning with two consonants:

(147) Schwa epenthesis

$$\phi \longrightarrow \text{ə} \ / \ C \ \_\_ \ CC + u$$

In (c), these deletion and insertion rules combine to create what appears to be metathesis whenever a suffix beginning with a vowel is added to a stem of the shaped CVCC. These insertion and deletion processes are completely automatic and without exception throughout the inflectional morphology. They can be stated in linear notation as follows:

(148)

a. Schwa deletion

$$\overset{\text{ə}}{\begin{bmatrix} \text{-high} \\ \text{-low} \\ \text{+back} \\ \text{-round} \end{bmatrix}} \longrightarrow \phi \ / \ C \ \_\_ \ C + vC$$

b. Schwa epenthesis

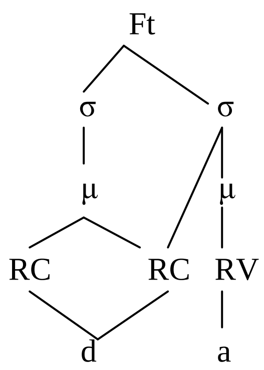
$$\phi \longrightarrow \overset{\text{ə}}{\begin{bmatrix} \text{-high} \\ \text{-low} \\ \text{+back} \\ \text{-round} \end{bmatrix}} \ / \ C \_\_ \ CC$$

III.7. The Treatment of Geminates:

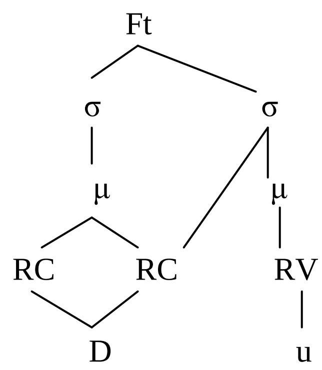
The central dilemma facing one when it comes to complex onsets and codas relates primarily to geminates. The first and probably the most difficult task in this regard is how geminates are represented. The relevant linguistic literature on geminates provides us with different views about the representation of geminates. The most striking view is Selkirk's Two-Root Theory of Length. According to this theory, geminates are represented with two root nodes that share stricture and place features. To put this discussion on a concrete footing, let's look at the following examples:

(149) (i) Initial Geminates

a. dda 'he took'

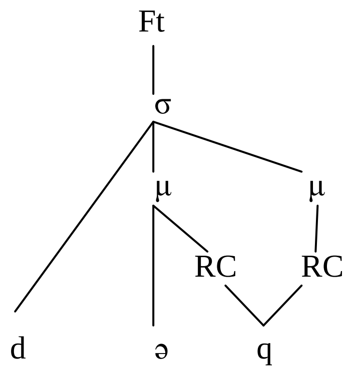


b. DDu 'light'

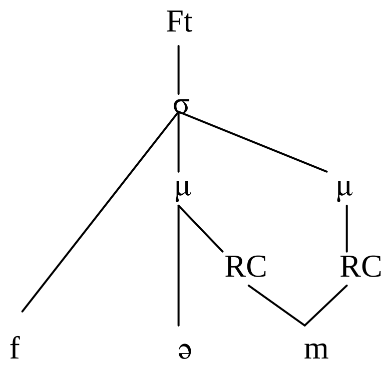


(150) (ii) Final Geminates

a. dəqq 'knock at'



b. fəmm 'mouth'



Keegan (1986) claims that geminate clusters do not occur word finally at the phonetic level, but there is clear evidence that they occur at the underlying level:

(151)

a. ʕəm 'uncle' ʕəmmi 'my uncle'

b. bəq 'bugs' bəqqa 'a bug'

c. fəm ‘mouth’ fəmmi ‘my mouth’

Keegan (ibid) points out that there exists an alternation between a single word-final consonant and geminate clusters which are word final. This is due to the fact that geminate clusters are pronounced as single consonants when in word final position. This can be formalized into the following rule.

(152) Final degemination

$$C_i\, C_i \longrightarrow C_i \;/\; \underline{\quad\quad}\;\#$$

The above data (151) involves two important processes. The first one is final degemination which has been formalized in (152). The second process is referred to in the relevant literature as gemination. The single consonants are geminated when they occur intervocalically i.e. when they occur between a schwa and a full vowel. This can be formalized as follows:

(153) Gemination

$$C_i \longrightarrow C_iC_i \;/\; \underset{\begin{bmatrix}\text{-high}\\ \text{-low}\\ \text{+back}\\ \text{-round}\end{bmatrix}}{ə}\;\underline{\quad\quad}\;V$$

The behaviour of geminate clusters with respect to some phonological rules has been accounted for in different ways in the literature (Benkaddour 1982, Benhallam 1980, Rguibi 1990, to cite but a few). As far as I am concerned, the behaviour of geminates can be best described within the theory of feature geometry. There has been a debate about the difference between true and apparent geminates in the relevant linguistic literature. Benhallam (1977b) states that true geminates refer to underlying or lexical geminates, they do not result from any phonological or morphological processes. Apparent or derived geminates are the result of any phonological or morphological processes, such as assimilation and affixation. To put this discussion on a concrete footing, let’s consider the following examples:

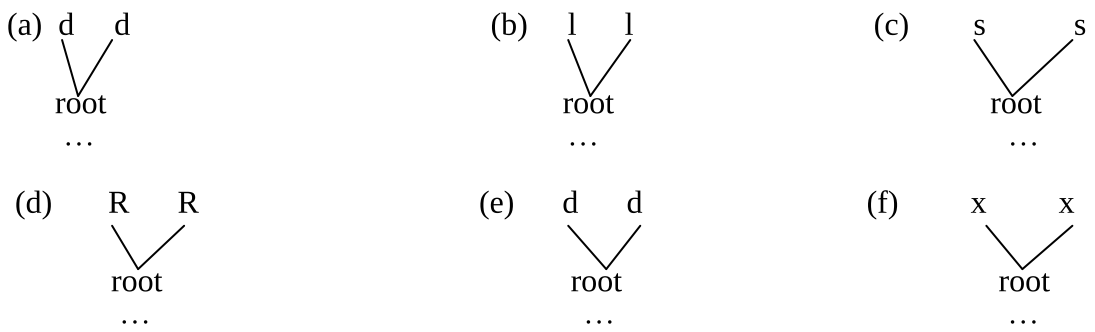
(154)

a. sədd	‘he closed’	d. ʒəRR	‘he pulled
b. ħəll	‘he opened’	e. xədd	‘ cheek’

c. məss ‘he touched’ f. məxx ‘ brain’

The above geminates are true since they have multilinked structures, as shown below:

(155)



In this case, the above geminates form the coda of the syllable and are never broken up. Therefore, epenthesis must not be expected to apply to the above forms. However, if epenthesis applies, we obtain the incorrect forms below:

(156)

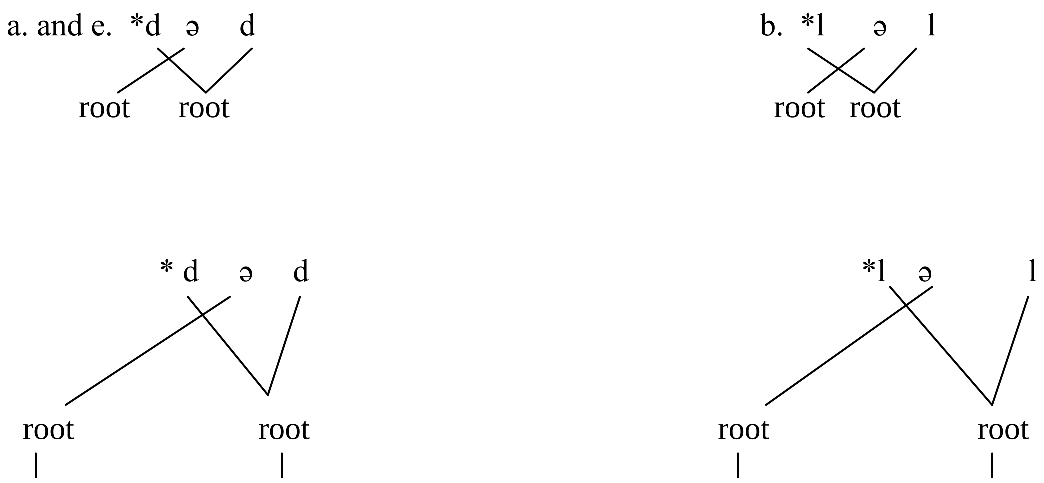
a. *sədəd d. *ʒəRəR

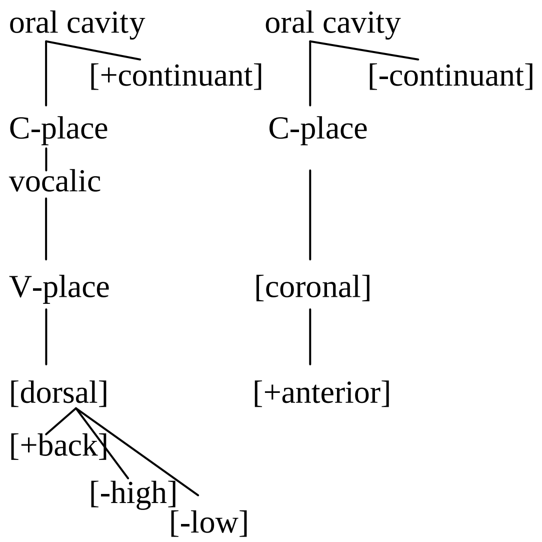
b. *ħələl e. *xədəd

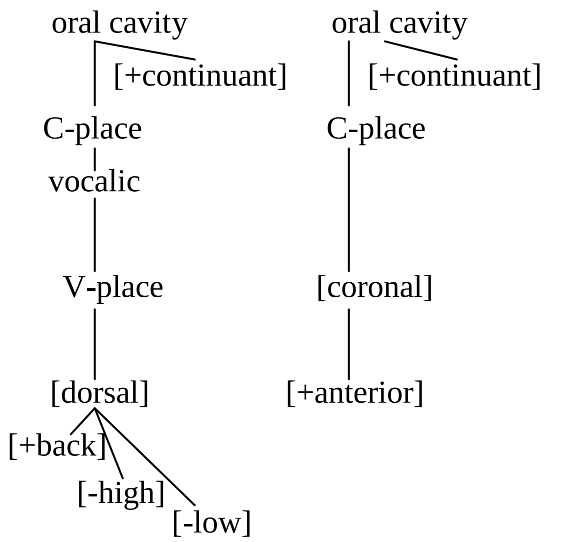
c. *məsəs f. *məxəx

The failure of epenthesis to apply in the geminates above can be explained by the fact that the insertion of an epenthetic vowel into the linked structure (155) would create a violation of the constraint against crossed association lines as shown in (157):

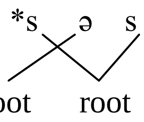
(157)



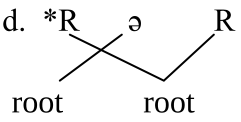

oral cavity
[+continuant]
C-place
vocalic
V-place
[dorsal]
[+back]
[-high]
[-low]
oral cavity
[-continuant]
C-place
[coronal]
[+anterior]

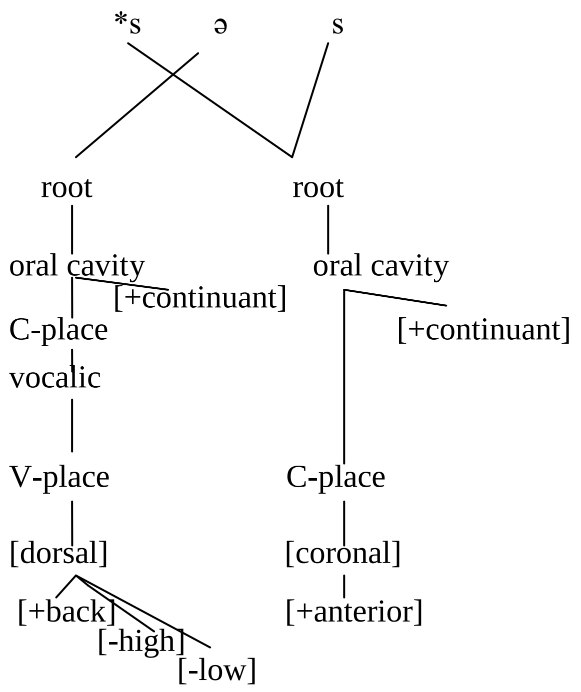

oral cavity
[+continuant]
C-place
vocalic
V-place
[dorsal]
[+back]
[-high]
[-low]
oral cavity
[+continuant]
C-place
[coronal]
[+anterior]

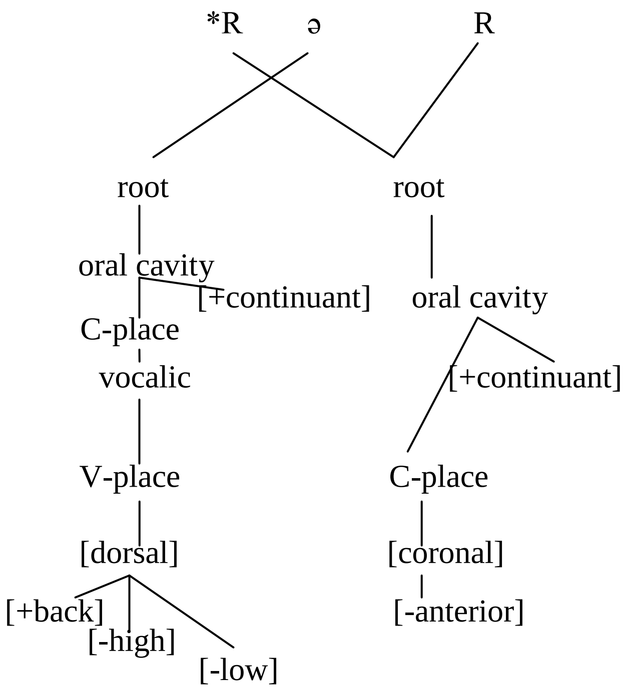
c.


*s
ə
s
root
root

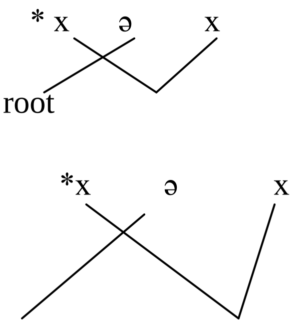
d.

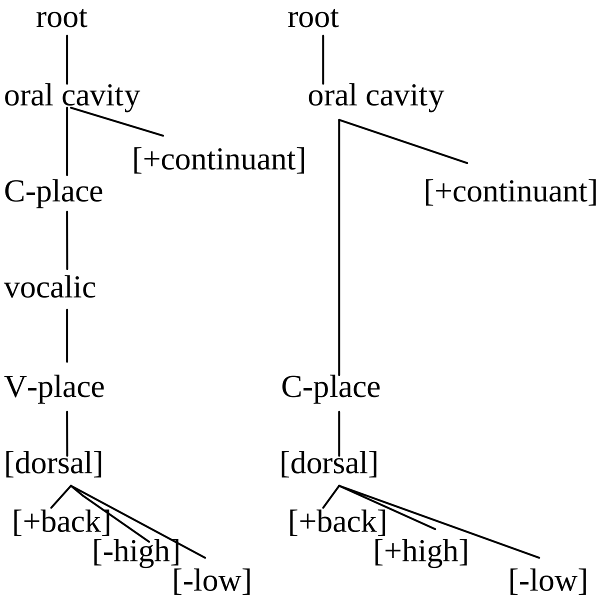

*R
ə
R
root
root


*s
ə
s
root
root
oral cavity
[+continuant]
C-place
vocalic
V-place
[dorsal]
[+back]
[-high]
[-low]
oral cavity
[+continuant]
C-place
[coronal]
[+anterior]


*R
ə
R
root
root
oral cavity
[+continuant]
C-place
vocalic
V-place
[dorsal]
[+back]
[-high]
[-low]
oral cavity
[+continuant]
C-place
[coronal]
[-anterior]

f.


* x
ə
x
root
*x
ə
x



The above true geminates cannot be split up by the schwa epenthesis, but can be broken up by morphological rules. The above geminates can be broken up by morphologically-inserted infixes as shown below:

(158) Nouns with broken plural

a. Singular	Gloss	b. Plural	Gloss
xədd	‘ cheek’	xduud	‘cheeks’
məxx	‘ brain’	mxaax	‘brains’

(159) Passive participle

a. Verb	Gloss	b. Passive participle	Gloss
sədd	‘he closed’	məsduud	‘closed’
ħəll	‘he opened’	məħluul	‘opened’
məss	‘he touched’	məmsuus	‘touched’
ʒəRR	‘he pulled’	məʒruur	‘pulled’

In the above examples, both the broken plurals and the passive participle are formed by inserting a long vowel between the last two identical consonants of the root. This can be formalized as follows:

(160) Vowel insertion

$$\phi \longrightarrow VV \quad / \; C_i \;\_\_\; C_i$$

Unlike true geminates, apparent or derived geminates can be split up by phonological rules, as illustrated below:

(161) a. məmdud ‘lying down’

b. məmluk ‘owned’

c. yəybəs ‘made dry’

The above geminates are broken up by epenthesis since they are formed by affixation i.e. they are morphological geminates. Therefore, they have separate root nodes as could be seen in (162):

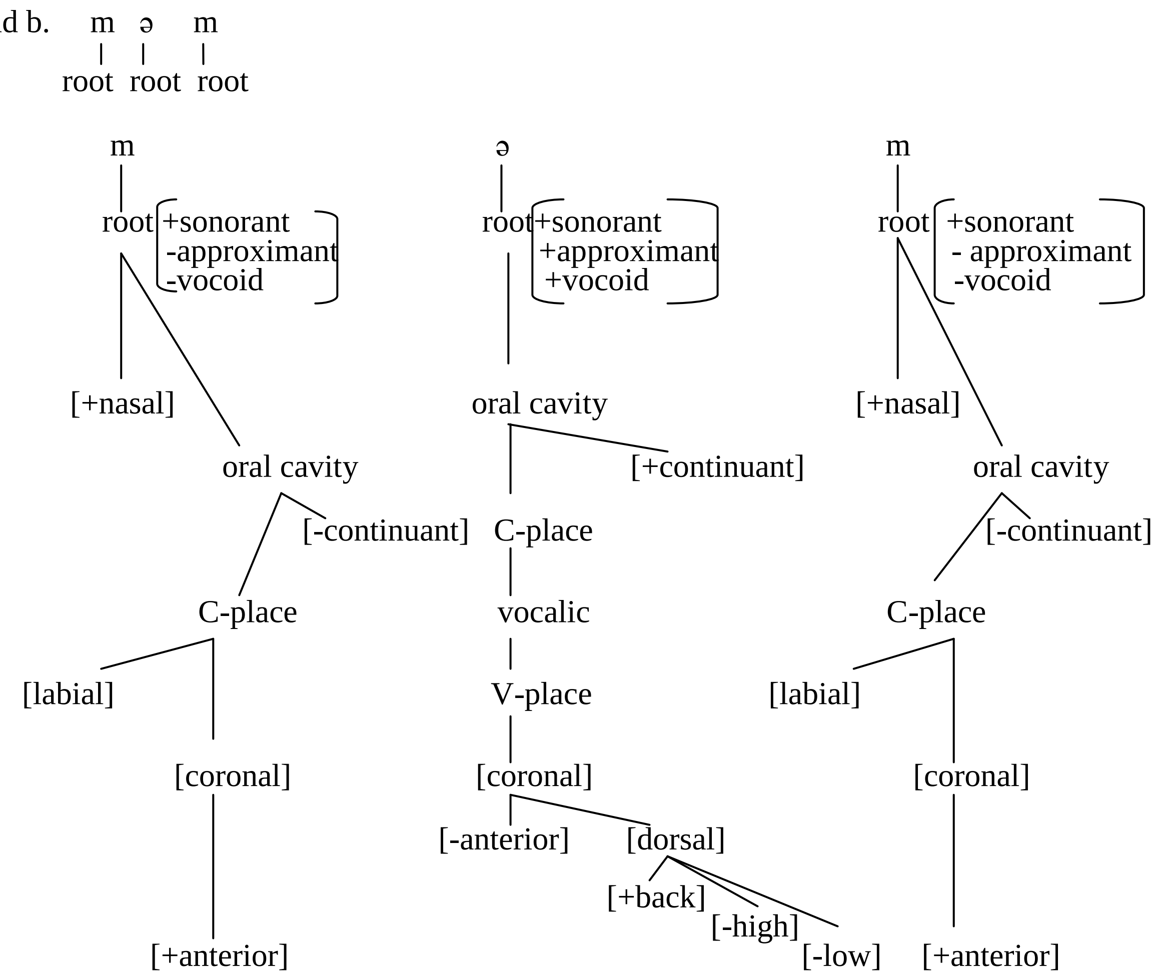
(162)

a. m m	b. m m	c. y y
| |	| |	| |
root root	root root	root root

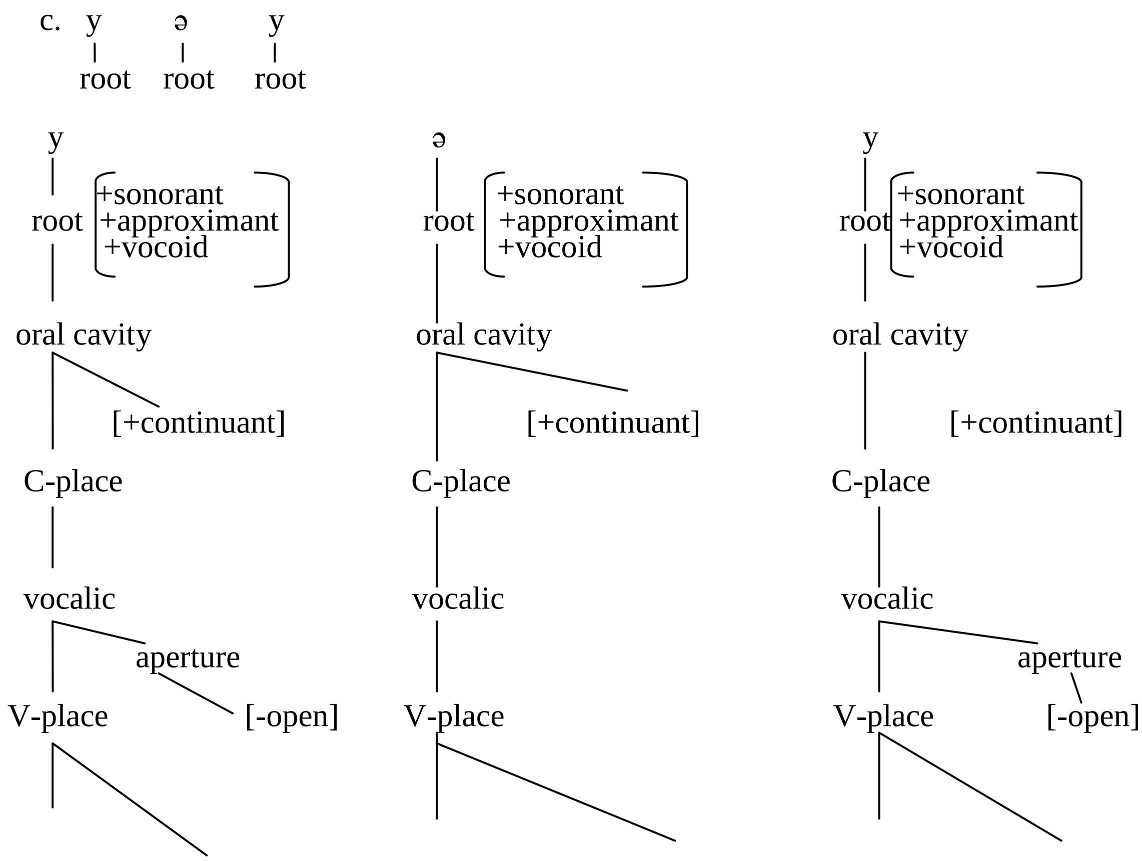
The insertion of an epenthetic vowel must be expected to apply to the above forms since it would not create a violation of the No-Crossing Constraint (NCC), which militates against the crossing of association lines:

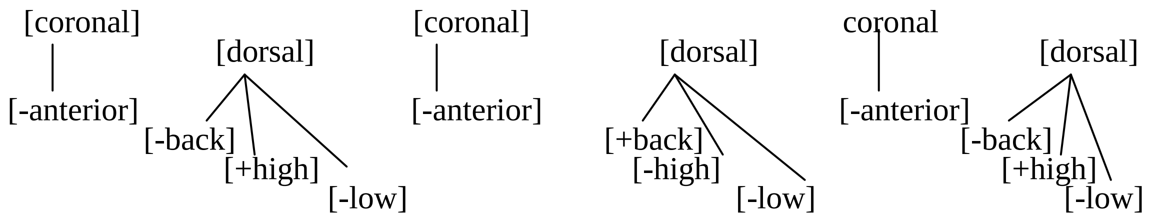
(163)

a. and b.


m ə m
root root root
m
root
+sonorant
-approximant
-vocoid
[+nasal]
oral cavity
[-continuant]
C-place
[labial]
[coronal]
[+anterior]
ə
root
+sonorant
+approximant
+vocoid
oral cavity
[+continuant]
C-place
vocalic
V-place
[coronal]
[-anterior]
[dorsal]
[+back]
[-high]
[-low]
m
root
+sonorant
- approximant
-vocoid
[+nasal]
oral cavity
[-continuant]
C-place
[labial]
[coronal]
[+anterior]

c.


y ə y
root root root
y
root
+sonorant
+approximant
+vocoid
oral cavity
[+continuant]
C-place
vocalic
aperture
V-place
[-open]
ə
root
+sonorant
+approximant
+vocoid
oral cavity
[+continuant]
C-place
vocalic
V-place
y
root
+sonorant
+approximant
+vocoid
oral cavity
[+continuant]
C-place
vocalic
aperture
V-place
[-open]



To summarize the above discussion, I can briefly say that true geminates cannot be split up by phonological rules, but can be broken up by morphological operations. Derived geminates can be split up by phonological rules. This is known in the relevant linguistic literature as ***the Geminate Law***:

(164) The Geminate Law

Geminate clusters can be split up by morphological (or morpholexical) rules but not by phonological rules.

The Geminate Law (henceforth GL) above does not tell us whether underlying or derived geminates[21] which are governed by it. For this reason, Benhallam (1980: p.145) revises the above GL and provides a new clear version which could be presented below:

(165) Benhallam's GL

Underlying geminate clusters can be split up by morphological, or phonolexical rules but not by phonological rules.
Derived geminate clusters can be split up by phonological rules.

The shortcoming of the new version (165) is that it does not tell us whether morphological and/or phonolexical rules do break up derived geminates or not. Following Benhallam (1980), I assume that the new version of the law will remain as it is until further data shows that derived geminates can be broken up by these rules or not. Another problem with the GL is that we find underlying geminates which are split up by the schwa epenthesis rule (Rguibi: 1990, p.156)[22]:

(166)

a. sləl	'baskets'	a.bərgəg	'to gossip'
c. qfəf	'baskets'	d. qəʃʃəʃ	'to furnish'

[21] Note that the terms apparent and derived, true and underlying are used interchangeably.
[22] The examples are taken from Benhallam (1987: p.20).

e. rzəz ‘turbans’

Having said this, some initial geminates are derived by phonological processes namely assimilation. They can be found in definite nouns where the definite article / l/- has assimilated to a following coronal sound as could be seen below:

(167)

a. / l+ ʒməl/ → ʒ+ ʒməl → [ʒʒməl] ‘the camel’

/ the+ camel/

b. /l+ DaR/ → D+DaR → [DDaR] ‘the house’

/the+ house/

c. /l + sma/ → s+sma → [ssma] ‘the sky’

/the+ sky/

d. /l+ nas/ → n+nas → [nnas] ‘the people’

/ the+ people/

Keegan (1986: p.23) formalizes this as follows:

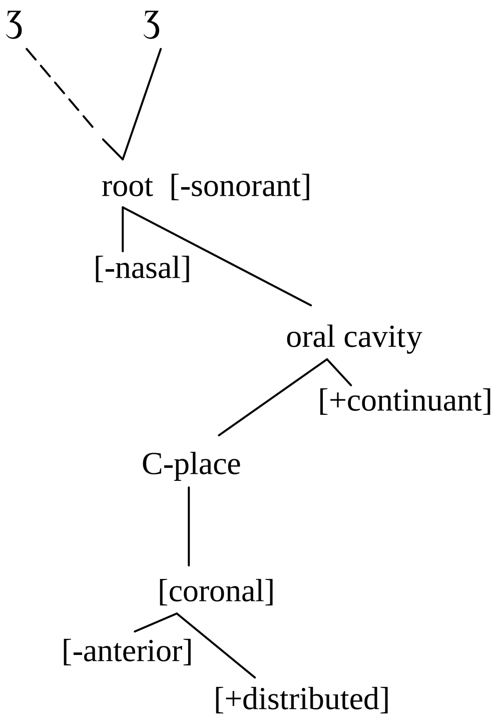
(168) Coronal assimilation

$$\underset{\text{(def. art.)}}{l} \longrightarrow C_i \;/\; \underline{\qquad\quad} \begin{bmatrix} C_i \\ +\text{coronal} \end{bmatrix}$$

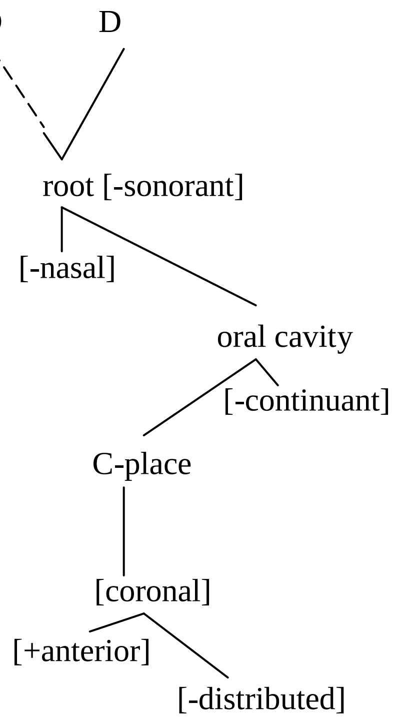
The above geminates are the result of total regressive coronal assimilation. Using feature geometry terms, this assimilation is total or complete since the affected segment acquires all the features of the trigger when the root node spreads. The spreading of the root node replaces the root node of the affected segment, which is deleted by convention. For example, the root node of [l] is replaced by the root node of the trigger [ʒ] in the word [ʒʒməl]. To put this discussion on a concrete footing, let’s consider the following representations:

(169)

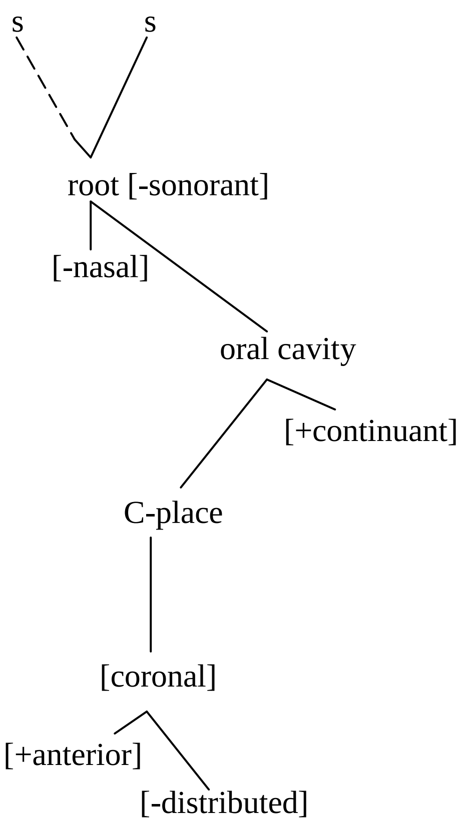
a. /l- ʒməl/ > [ʒʒməl]



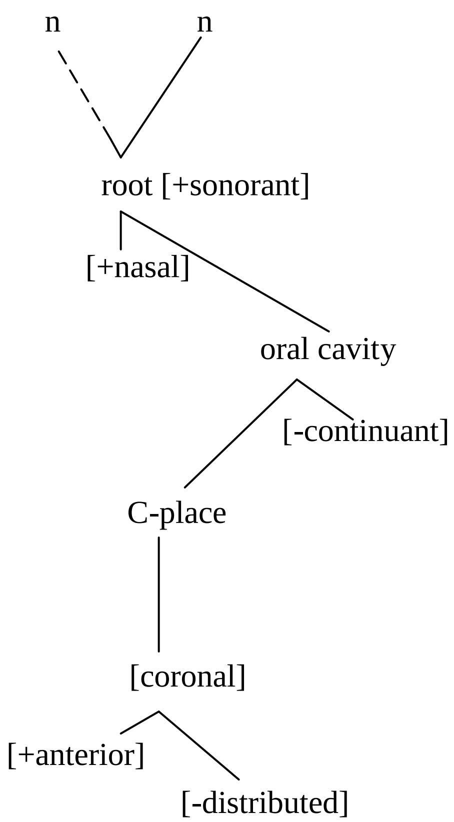
b. /l-DaR/ > [DDaR]



c. /l-sma/ > [ssma]



d. /l-nas/ > [nnas]



What is surprising in the above data is that the derived geminates in (163) cannot be broken up by phonological rules. The above geminates are derived by assimilation, but they cannot be split up by the schwa epenthesis rule. Following the geminate law, epenthesis ***must*** be expected to apply to the above forms. However, if epenthesis applies, we obtain the incorrect forms below:

(170) a. * [ʒəʒməl] c. * [səsma]

b. * [DəDaR] d. *[nənas]

These geminates behave like true geminates because if epenthesis applies, it would create a violation of the constraint against crossed association lines as shown in (171):

(171)

It seems to me that the above geminates are problematic to a great extent. On the one hand, schwa epenthesis, a phonological rule, fails to break up them though they are derived by assimilation. On the other hand, they cannot be considered as true geminates since they cannot be broken up by morphological rules. As far as I am concerned, another problem with the GL is that we find derived geminates which are not split up by phonological rules.

Last but not least, I would like to present some answers to one important question about medial geminates whether they are codas of the first syllable, or they are the coda of a syllable and the onset of the second syllable. According to Benhallam (1980: p.80), there are two factors that need to be considered; whether the geminate cluster is followed by a vowel or a consonant. If it is followed by a vowel, the tendency is to be partially a coda of a syllable and partly the onset of the following one to avoid onsetless syllables which the language prohibits. If it is followed by a consonant, it generally forms the coda of the preceding syllable.

Benhallam (ibid) did not name the process by which the language copes with the problem of onsetless syllables. As far as I can tell, the language resorts to the process of ***resyllabification*** to avoid VC syllables. Thanks to this process, the second member of the previous syllable coda becomes the onset of the following syllable. To put this discussion on a concrete footing, let's consider the following examples:

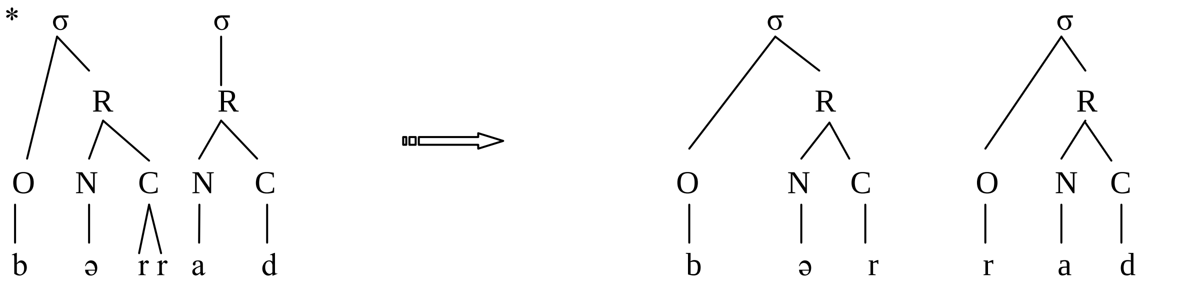
(172)

UR	SR	Gloss
a. bərr.**ad** CvCC.VC	bər.**rad** CvC.CVC	'teapot'
b. gəzz.**ar** CvCC.VC	gəz.**zar** CvC.CVC	'butcher'
c. Səbb.**aɣ** CvCC.VC	Səb.**baɣ** CvC.CVC	'painter'

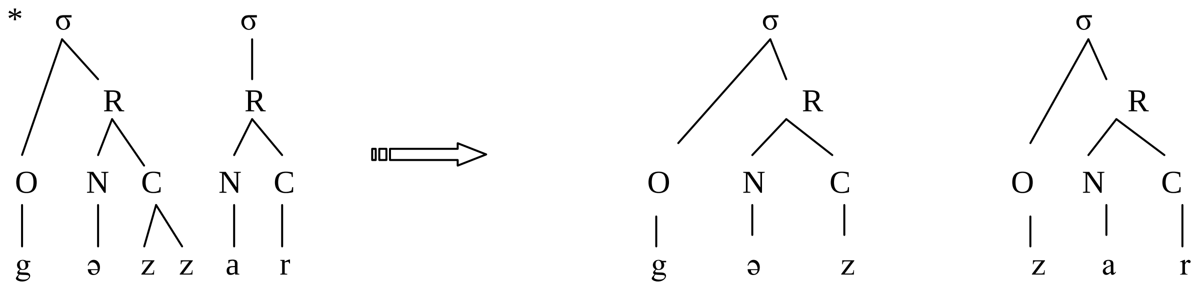
This can be represented as follows:

(173)

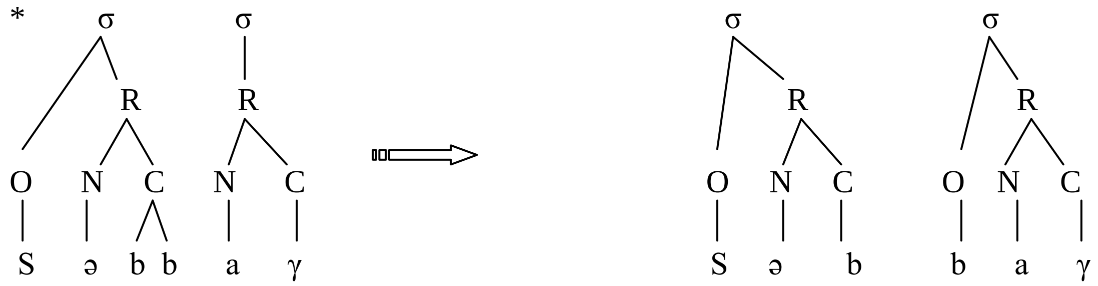
a. *bərr.ad   bər.rad



b. *gəzz.ar   gəz.zar



c. *Səbb.aɣ   Səb.baɣ



The underlying onsetless syllables /.ad/, /.ar/, and /.aγ/ surface with an onset by resyllabifying the second member of the previous syllable coda.

When a geminate cluster is followed by a consonant it generally forms the coda of the preceding syllable since there is no risk of creating a VC syllable, i.e. an onsetless syllable. For illustration, let's consider the following examples:

(174)

a. /kə**ll.m**ək/ 'he spoke to you' b. /fə**yy.q**u/ 'they woke up'

c. /xə**dd.m**u/ 'they operated'

Benhallam (1980) provides us with one exception to the tendency of geminates followed by consonants to form the coda of the preceding syllable. /qallhum/ 'he said to them' syllabifies as qal.lhum. In this regard, one legitimate question that arises here is about the exception above: why does /qallhum/ syllabify as qal.lhum and not qall.hum? As an answer to this question, Benhallam (1980: p.81) claims that the geminates under discussion are derived. The underlying representation of the item under discussion is /qal+l+hum/. Syllabification in this case helps disambiguate the status of some geminate clusters. No other items similar to the above one could be found to determine whether this is a general trend (Benhallam: ibid). In short, he adds that the only criteria available for the syllabification of the above item is pause, or infixing an item in the middle of the above word. Both the pause and the infixation occur exactly at the point where the syllable boundary is shown here, i.e. qal.lhum.

III.8. Conclusion:

In this chapter, I examined CMA syllable structure from a feature geometry perspective. In the second section, I presented the onset restrictions using the constriction-based model. I will extend the discussion of co-occurrence restrictions in the last chapter of analysis.

In the third section (i.e. the peak of CMA syllables), I dealt with the major syllable-related phonological processes namely vowel reduction, vowel strengthening, diphthongization, and glide formation. In the third section, I presented the coda restrictions together with the coda types (e.g. simple and complex coda word-medially and word-finally). I also gave the distinctive features of segments in both the onset and coda. I made use of the All-Nuclei First Approach in the syllabification process. In this section, I looked at the role of sonority in assigning syllable structure, and presented some possible clusters that obey or violate the sonority hierarchy in the onset and coda positions.

In the last two sections, I discussed the phenomenon of schwa epenthesis. We saw that noun schwa syllabification depends on the sonority hierarchy, whereas verb and adjective schwa syllabification is not governed by the sonority principle. I presented some nouns that do not conform to the sonority principle. Last but not least, I devoted a section to the treatment of geminates. In this section, I examined the behaviour of CMA geminate clusters with respect to some phonological rules, namely assimilation and epenthesis. I dealt with the two types of geminates (i.e. true vs. apparent), and looked at their representations. The difference between true and apparent geminates was made clear within the theory of feature geometry.

Chapter IV: Co-occurrence Restrictions in CMA

IV.0. Introduction

A core area of phonology is the study of *phonotactics*, or how sounds are linearly combined. Phonotactics refers to the sequential arrangements of phonological units that are possible in a language. The question that arises in this regard is whether words are concatenated in an intuitive post-hoc fashion i.e. consonants freely combine at random, or are the result of certain principles. Segments are said to be organized into well-formed sequences according to universal principles, namely Sonority Sequencing Principle (SSP)[23] and Obligatory Contour Principle (OCP).

The crucial role of sonority in defining possible and impossible onsets and codas is uncontroversial. Long standing phonological assumptions that put much weight on the explanatory adequacy of this principle, i.e. SSP. We will see if the SSP is a reliable phonological predictor for the sequencing of the consonant clusters in CMA onset and coda. The question that arises is: is the phonotactics of CMA complex onset and coda sonority-based?

Having said this, CMA complex margins may violate SSP in two manners. First, two segments in a margin may have the same sonority; these are known as sonority plateaus (Clements, 1990). Second, the more peripheral in the onset and coda may have higher sonority than a segment closer to the nucleus, such aberrant sonority profiles are known as reversals. Based on exhaustive data, the study aims to thoroughly and quantitatively answer the following questions:

(1) What are the onset and coda clusters that conform to the Sonority Sequencing Principle? What are their different patterns and subpatterns? How frequent is each?

(2) What are the onset and coda clusters that demonstrate sonority reversals? What are their different patterns and subpatterns? How frequent is each?

(3) What are the onset and coda clusters that exhibit sonority plateaus? What are their different patterns and subpatterns? How frequent is each?

(4) In view of the findings, is the Sonority Sequencing Principle a reliable phonological predictor for CMA complex onset and coda?

---

[23] SSP holds that sonority must increase towards the peak and decrease towards the margins.

The anwers of these questions will definitely bridge some gaps in the avalaible research. As far as I can tell, the available works on MA in general and CMA in particular provide no exhaustive and quantitative account of CMA onset and coda clusters that conform to SSP, or violate it in the manner of sonority reversals and plateaus. They neither identify the different patterns and subpatterns under each category nor do they provide their frequency of accurrence. This constitutes the rationale behind examining co-occurrence restrictions from a sonority-based perspective.

As far as the OCP is concerned, the autosegmental analysis accounts for the cooccurrence restrictions in CMA by application of the OCP. In this chapter, I will list all the possible clusters that obey or violate the OCP in both the onset and coda. We will see if the OCP is a reliable predictor for the sequencing of consonant clusters in CMA onset and coda. The answer to this question will be the number of clusters that conform or violate this principle.

Having said this, this chapter investigates the phonotactics of onset and coda consonant clusters in CMA from the perspectives of feature geometry, SSP and OCP. I will look at the co-occurrence restrictions of 25 consonants[24]. Based on more than one thousand lexical items, the study will list all the possible clusters in both the onset and coda. Also, the impossible clusters will be considered. I will list all the possible clusters that obey or violate the SSP. I will list all the possible clusters that violate or obey OCP in the onset and coda.

This chapter is structured as follows. The first section, i.e. word-initial consonant clusters, will deal with CMA onset clusters. The subsection, i.e. chart, will present the co-occurrence restrictions of twenty five consonants. The chart involves 25 consonants following this order: Labials, Alveolars, Alveo-palatals, Velars, Uvulars, Pharyngeal and Glottal (Boudlal: 2001)[25]. In the second subsection, I will also consider all the possible and impossible clusters using the constriction-based model of feature geometry. In the third and fourth subsections, I will examine and present all the possible clusters that obey or violate SSP and OCP.

The section section, i.e. word- final consonant clusters, is not different from the first one in terms of structure. In this section, I will present the co-occurrence restricttions of CMA consonants in the form of a chart. I will deal with all the possible and impossible clusters in the coda position from a constriction-based perspective. The last two subsections will

[24] The total number of possible and impossible clusters is 1250 clusters both in the onset and coda.
[25] See CMA consonant inventory on page 17.

consider all the possible clusters that obey or violate SSP and OCP. Having said this, the next section will deal with CMA onset clusters.

IV.1. Word-initial Consonant Clusters

In this section, I am going to list all the possible and impossible clusters in the onset. I will deal with the possible clusters that obey or vioalate the OCP. Finally, I will consider all the possible clusters that obey or violate SSP.

IV.1.1. Chart (1)[26]:

(175)

a.

	b	**f**	**m**	**w**	**t**	**T**	**d**	**D**	**S**	**S**	**z**	**n**	**l**
b	√bb	*bf	*bm	√bw	√bt	√bT	√bd	*bD	√bs	√bS	√bz	√bn	√bl
f	*fb	√ff	*fm	√fw	√ft	√fT	√fd	√fD	√fs	√fS	√fz	√fn	√fl
m	√mb	√mf	√mm	√mw	√mt	√mT	√md	√mD	√ms	√mS	√mz	√mn	√ml
w	*wb	√wf	*wm	*ww	√wt	√wT	√wd	√wD	√ws	√wS	√wz	√wn	√wl
t	√tb	√tf	√tm	√tw	√tt	*tT	*td	*tD	√ts	√tS	√tz	√tn	√tl
T	√Tb	√Tf	√Tm	√Tw	*Tt	√TT	*Td	*TD	*Ts	*TS	*Tz	√Tn	√Tl
d	√db	√df	√dm	√dw	*dt	*dT	√dd	*dD	√ds	*dS	*dz	√dn	√dl
D	√Db	√Df	√Dm	√Dw	*Dt	*DT	*Dd	√DD	*Ds	√DS	*Dz	√Dn	√Dl
s	√sb	√sf	√sm	√sw	√st	√sT	√sd	*sD	√ss	*sS	*sz	√sn	√sl
S	√Sb	√Sf	√Sm	√Sw	*St	√ST	*Sd	√SD	*Ss	√SS	*Sz	√Sn	√Sl
z	√zb	√zf	√zm	√zw	*zt	√zT	√zd	√zD	*zs	*zS	√zz	√zn	√zl
n	√nb	√nf	√nm	√nw	√nt	√nT	√nd	√nD	√ns	√nS	√nz	√nn	*nl
l	√lb	√lf	√lm	√lw	√lt	√lT	√ld	√lD	√ls	√lS	√lz	*ln	√ll
r	√rb	√rf	√rm	√rw	√rt	√rT	√rd	√rD	√rs	√rS	√rz	√rn	*rl
ʃ	√ʃb	√ʃf	√ʃm	√ʃw	√ʃt	√ʃT	√ʃd	√ʃD	*ʃs	*ʃS	*ʃz	√ʃn	√ʃl
ʒ	√ʒb	√ʒf	√ʒm	√ʒw	√ʒt	√ʒT	√ʒd	√ʒD	*ʒs	*ʒS	*ʒz	√ʒn	√ʒl
y	√yb	√yf	√ym	√yw	√yt	√yT	√yd	√yD	√ys	√yS	√yz	√yn	√yl
k	√kb	√kf	√km	√kw	√kt	*kT	√kd	*kD	√ks	*kS	*kz	√kn	√kl
g	√gb	√gf	√gm	√gw	*gt	√gT	√gd	*gD	*gs	√gS	√gz	√gn	√gl
q	√qb	√qf	√qm	√qw	√qt	√qT	√qd	√qD	√qs	√qS	√qz	√qn	√ql
x	√xb	√xf	√xm	√xw	√xt	√xT	√xd	√xD	√xs	√xS	√xz	√xn	√xl
ɣ	√ɣb	√ɣf	√ ɣm	√ɣw	√ɣt	√ɣT	√ɣd	√ɣD	√ɣs	√ɣS	√ɣz	√ɣn	√ɣl
ħ	√ħb	√ħf	√ħm	√ħw	√ħt	√ħT	√ħd	√ħD	√ħs	√ħS	√ħz	√ħn	√ħl
ʕ	√ʕb	√ʕf	√ʕm	√ʕw	√ʕt	√ʕT	√ʕd	√ʕD	√ʕs	√ʕS	√ʕz	√ʕn	√ʕl

[26] The symbol √ means that the cluster is possible.
The symbol * means that the cluster is impossible.

h	√hb	*hf	√hm	√hw	√ht	*hT	√hd	√hD	*hs	*hS	√hz	√hn	√hl

b.

	r	**ʃ**	**ʒ**	**y**	**k**	**g**	**q**	**x**	**ɣ**	**ħ**	**ʕ**	**h**
b	√br	√bʃ	√bʒ	√by	√bk	√bg	√bq	√bx	√bɣ	√bħ	√bʕ	√bh
f	√fr	√fʃ	√fʒ	√fy	√fk	√fg	√fq	√fx	*fɣ	√fħ	√fʕ	√fh
m	√mr	√mʃ	√mʒ	√my	√mk	√mg	√mq	√mx	√mɣ	√mħ	√mʕ	√mh
w	√wr	√wʃ	√wʒ	*wy	√wk	√wg	√wq	√wx	*wɣ	√wħ	√wʕ	√wh
t	√tr	√tʃ	√tʒ	√ty	√tk	√tg	√tq	√tx	√tɣ	√tħ	√tʕ	√th
T	√Tr	*Tʃ	*Tʒ	√Ty	*Tk	*Tg	*Tq	*Tx	√Tɣ	√Tħ	√Tʕ	√Th
d	√dr	√dʃ	√dʒ	√dy	√dk	√dg	√dq	√dx	√dɣ	√dħ	√dʕ	√dh
D	√Dr	*Dʃ	*Dʒ	√Dy	*Dk	*Dg	√Dq	*Dx	√Dɣ	√Dħ	√Dʕ	√Dh
s	√sr	*sʃ	√sʒ	√sy	√sk	√sg	√sq	√sx	*sɣ	√sħ	√sʕ	√sh
S	√Sr	*Sʃ	*Sʒ	√Sy	*Sk	√Sg	√Sq	√Sx	√Sɣ	√Sħ	√Sʕ	√Sh
z	√zr	*zʃ	*zʒ	√zy	√zk	√zg	√zq	*zx	√zɣ	√zħ	√zʕ	√zh
n	*nr	√nʃ	√nʒ	√ny	√nk	√ng	√nq	√nx	√nɣ	√nħ	√nʕ	√nh
l	*lr	* lʃ	√lʒ	√ly	√lk	√lg	√lq	√lx	√lɣ	√lħ	√lʕ	√lh
r	√rr	√rʃ	√rʒ	√ry	√rk	√rg	√rq	√rx	√rɣ	√rħ	√rʕ	√rh
ʃ	√ʃr	√ʃʃ	√ʃʒ	√ʃy	√ʃk	√ʃg	√ʃq	√ʃx	√ʃɣ	√ʃħ	√ʃʕ	√ʃh
ʒ	√ʒr	*ʒʃ	√ʒʒ	√ʒy	*ʒk	*ʒg	*ʒq	*ʒx	√ʒɣ	√ʒħ	√ʒʕ	√ʒh
y	√yr	√yʃ	√yʒ	√yy	√yk	√yg	√yq	√yx	√yɣ	√yħ	√yʕ	√yh
k	√kr	√kʃ	*kʒ	√ky	*kk	*kg	*kq	*kx	*kɣ	√kħ	√kʕ	*kh
g	√gr	√gʃ	*gʒ	√gy	*gk	*gg	*gq	*gx	*gɣ	*għ	√gʕ	√gh
q	√qr	√qʃ	√qʒ	√qy	*qk	*qg	*qq	*qx	*qɣ	√qħ	√qʕ	√qh
x	√xr	√xʃ	√xʒ	√xy	*xk	*xg	*xq	*xx	*xɣ	*xħ	*xʕ	*xh
ɣ	√ɣr	√ɣʃ	*ɣʒ	√ɣy	*ɣk	*ɣg	*ɣq	*ɣx	*ɣɣ	*ɣħ	*ɣʕ	*ɣh
ħ	√ħr	√ħʃ	√ħʒ	√ħy	√ħk	√ħg	√ħq	*ħx	*ħɣ	*ħħ	*ħʕ	*ħh
ʕ	√ʕr	√ʕʃ	√ʕʒ	√ʕy	√ʕk	√ʕg	√ʕq	*ʕx	*ʕɣ	*ʕħ	*ʕʕ	*ʕh
h	√hr	√hʃ	√hʒ	√hy	*hk	√hg	*hq	*hx	*hɣ	*hħ	*hʕ	*hh

IV.1.2. Feature Geometry of Possible Clusters

In this section, CMA possible onset clusters will be deat with. **485** clusters are possible in CMA. These possible clusters have been seen to be divided into nine logically possible combinations, namely:

(176)

(1) Labial-Labial

(2) Labial-Coronal

(3) Labial-Dorso-guttural

(4) Coronal-Labial

(5) Coronal-Coronal

(6) Coronal-Dorso-guttural

(7) Dorso-guttural-Labial

(8) Dorso-guttural-Coronal

(9) Dorso-guttural-Dorso-guttural

All the above possible combinations can be summed up as follows:

(177)

	Labial	Coronal	Dorso-guttural
Labial	9	50	30
Coronal	52	118	90
Dorso-guttural	31	91	14

Co-occurrence of consonants in CMA

Having said this, the first class of CC onset clusters will be looked into.

IV.1.2.1. Labial-Labial

In CMA, there are **nine** labial-labial combinations. In these combinations, both obstruents and sonorants are combined. Obstruents can be concatenated with obstruents in the form of geminate clusters, namely /bb/ and /ff/ as shown below:

(178) /bb/ bba 'my father'

/ff/ ffad 'viscera'

Sonorants can co-occur with obtruents, as shown below:

(179) /mb/ mbəxRa 'censer'

mbaRəD 'files'
mbaRək 'proper name'

/mf/ mfawət 'unequal'
mfəlləs 'crasy'

/wf/ wfa 'to be faithful to'

Obsturents in turn can co-occur with sonorants, as illustrated below:

(180) /bw/ bwaʒa 'cranes'
bwaT 'night club'

/fw/ fwaR 'steam'

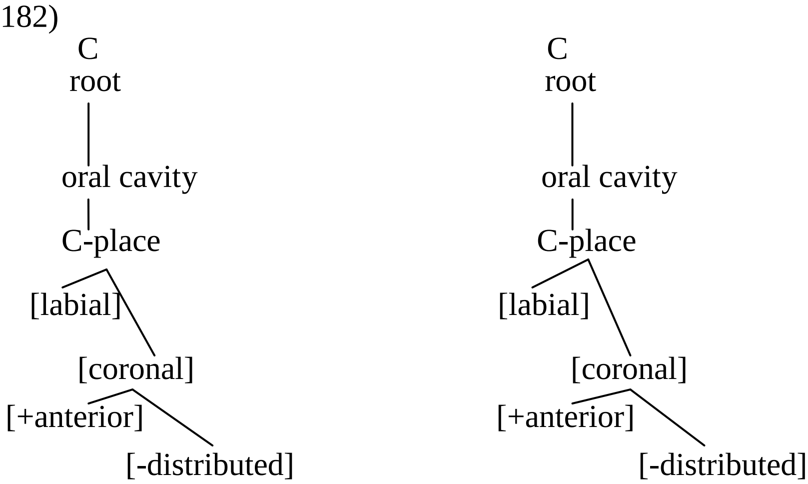
The last labial-labial combinations concern the sonorant-sonorant clusters, which will be listed below:

(181) /mm/ mmi 'my mother'

/mw/ mwəssəx 'dirty'
mwəlləf 'to be accustomed to'

To summarize the above labial-labial combinations, let's consider the following represention:

(182)



IV.1.2.2. Labial- Coronal

In this type of combinations, there are **fifty** clusters. Labial obstruents can co-occur with coronal obstruents, as can be seen in the following examples:

(183)

/bt/	btima	'a kind of herbs'	/ft/	ftəq	'hernia'
/bT/	bTaTa	'potatoes'	/fT/	fTəR	'to have breakfast'
/bd/	bda	'he began'	/fd/	fdadən	'fields'
/bs/	bsala	'dullness'	/fD/	fDəħ	'to reveal'
/fs/	fsəx	'to annul'	/fS/	fSəl	'to separate'
/bS/	bSəl	'onion'	/fz/	fzəg	'to get wet'
/bz/	bzim	'belt-buckle'	/fʃ/	fʃəl	'to fail'
/bʃ/	bʃaRa	'good news'	/fʒ/	fʒər	'dawn prayer'
/bʒ/	bʒəɣ	'to crush'			

Labial obstruents can co-occur with coronal sonorants, as illustrated below:

(184)

/bn/	bna	'to build'	/fn/	fnadəq	'hotels'
/bl/	blan	'plan'	/fl/	flus	'money'
/br/	brəd	'to get cold'	/fr/	fRəħ	'to be happy'
/by/	byəD	'white'	/fy/	fyaq	'wakefulness'

Labial sonorants can co-occur with coronal obstruents, as exemplified below:

(185)

/mt/	mtawya	'bargaining'	/wt/	wtəd	'peg'
/mT/	mTərqa	'hammer'	/wT/	wTaR	'guitar'
/md/	mdina	'city'	/wd/	wdən	'ear'
/mD/	mDəɣ	'to chew'	/wD/	wDu	'ablution'
/ms/	msəħ	'to erase'	/ws/	wsəx	'dirt'
/mS/	mSəlla	'a place for prayer'	/wS/	wSəl	'to arrive'
/mz/	mzaħ	'joking'	/wz/	wzən	'to weigh'
/mʃ/	mʃa	'to go'	/wʃ/	wʃəm	'to tattoo'
/mʒ/	mʒəR	'drawer'	/wʒ/	wʒəh	'face'

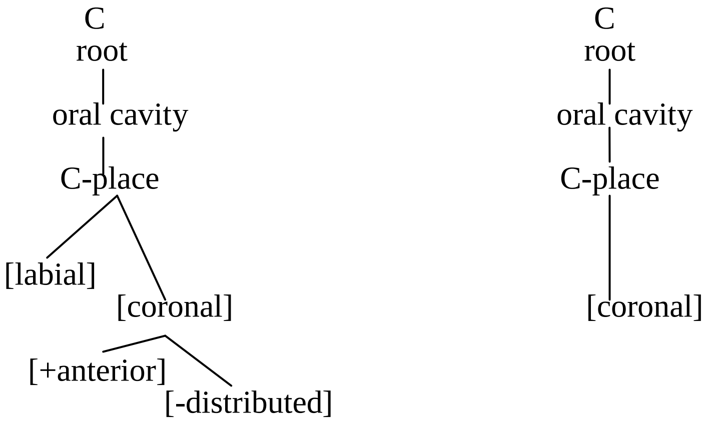
The last type of labial-coronal combinations is labial sonorant-coronal sonorant, as illustrated below:

(186)

/mn/	mnam	‘sleep’	/wn/	wnasa	‘companion/friend’
/ml/	mləs	‘soft’	/wl/	wləd	‘to give birth’
/mr/	mRəD	‘to get sick’	/wr/	wrət	‘to inherit’
/my/	myatayn	‘two hundred’			

The labial-coronal combinations can be summed up as follows:

(187)



IV.1.2.3. Labial-Dorsal-guttural

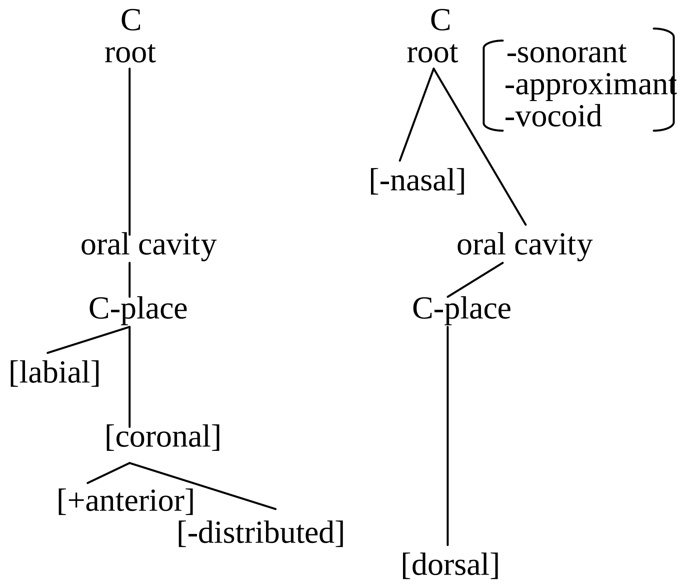
Thirty labial-dorso-guttural combinations are allowed in CMA. Both labial obstruents and labial sonorants can co-occur with the dorsal stops [k] and [g]:

(188)

/bk/	bka	‘cry’	/mk/	mkəħla	‘rifle’
/bg/	bgər	‘cows’	/mg/	mgadd	‘straight’
/fk/	fkaRən	‘turtles’	/wk/	wkəħ	‘to dry up’
/fg/	fgəs	‘to break’	/wg/	wgəf	‘to stand up’

This can be formalized as follows:

(189)



Labials can also co-occur with the gutturals [x, γ, q, ħ, ʕ, h], as shown below:

(190)

/bq/	bqa	'to remain'	/fq/	fqəd	'to lose'
/bx/	bxil	'stingy'	/fx/	fxaD	'thigh'
/bγ/	bγəl	'mule'	/fħ/	fħəS	'to test'
/bħ/	bħəR	'sea'	/fʕ/	fʕayəl	'doings/bahaviours'
/bʕ/	bʕid	'far'	/fh/	fhəm	'to understand'
/mh/	mhəl	'to give a respite to'	/bh/	bhima	'animal'
/mq/	mqəS	'scissor'	/wq/	wqid	'match'
/mx/	mxədda	'cushion'	/wx/	wxəR	'to delay'
/mγ/	mγərfa	'ladle'	/wħ/	wħəl	'to get stuck'
/mħ/	mħabəq	'flower pot'	/wʕ/	wʕar	'to become difficult'
/mʕ/	mʕək	'to kneed'	/wh/	whəm	'premonition'

IV.1.2.4. Coronal-Labial

There are **52** possible coronal-labial combinations in CMA. Coronal obstruents can co-occur with labial obstruents, as shown below:

(191)

/tb/	tbən	‘straw’	/sf/	sfina	‘ship’
/tf/	tfaRəq	‘to separate’	/Sb/	Sbəʕ	‘finger’
/Tb/	Tbib	‘doctor’	/Sf/	SfəR	‘yellow’
/Tf/	Tfa	‘to turn off’	/zb/	zbəl	‘rubbish’
/db/	dbal	‘to fade’	/zf/	zfəR	‘to stink’
/df/	dfən	‘to bury’	/ʃb/	ʃbər	‘one span’
/Db/	Dbəʕ	‘hyena’	/ʃf/	ʃfəR	‘to steal’
/Df/	DfəR	‘finger-nail’	/ʒb/	ʒbəl	‘mountain’
/sb/	sbəʕ	‘lion’	/ʒf/	ʒfən	‘region under the eye’

Coronal obstruents can co-occur with labial sonorants, as shown below:

(192)

/tm/	tməR	‘dates’	/sw/	swarət	‘keys’
/tw/	twam	‘twins’	/Sm/	Smək	‘deaf’
/Tm/	Tməʕ	‘to be greedy for’	/Sw/	Swab	‘good manners’
/Tw/	Twil	‘long’	/zm/	zman	‘ancient time’
/dm/	dmaɣ	‘brain’	/zw/	zwin	‘handsome’
/dw/	dwi	‘speak’	/ʃm/	ʃməʕ	‘wax’
/Dm/	DməS	‘to shuffle’	/ʃw/	ʃwa	‘steamed meat’
/Dw/	Dwa	‘to get light’	/ʒm/	ʒməl	‘camel’
/sm/	sməʕ	‘to listen’	/ʒw/	ʒwa	‘envelope’

Coronal sonorants can co-occur with labial obstruents, as shown below:

(193)

/nb/	nbəħ	‘to bark’	/rb/	Rbəħ	‘to win’
/nf/	nfəx	‘to pump up’	/rf/	rfəd	‘to pick up’
/lb/	lbəs	‘to wear’	/yb/	ybəs	‘to get dry’
/lf/	lfaʕi	‘snakes’	/yf/	yfəlli	‘to scrutinize’

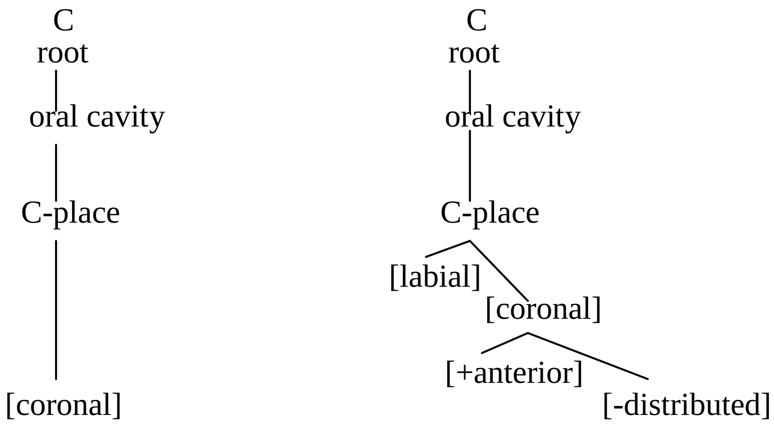
Coronal sonorants can co-occur with labial sonorants, as illustrated below:

(194)

/nm/	nməl	'ants'	/rm/	RmaD	'ashes'
/nw/	nwi	'intend'	/rw/	Rwaħ	'cold'
/lm/	lmaʕ	'it becomes shining'	/ym/	yməll	'to be fed up with'
/lw/	lwi	'to twist'	/yw/	ywəlli	'to become'

To summarize all the above coronal-labial combinations, let's consider the following representation:

(195)



IV.1.2.5.Coronal-Coronal

There are **118** coronal-coronal combinations in CMA. All the coronal-coronal combinations have been found to be devided into into four classes:

(196)

(1) Coronal obstruents-coronal obstruents (36 instances)

(2) Coronal obstruents-coronal sonorants (36)

(3) Coronal sonorants-coronal obstruents (35)

(4) Coronal sonorants-coronal sonorants (11)

Coronal obstruents can co-occur with coronal obstruents, as shown below:

(197)

/tt/	ttawa	‘to bargain’	/DS/	DSəR	‘to get out of hand’
/ts/	tsaləm	‘to greet each other’	/st/	stər	‘to hide’
/tS/	tSawəR	‘pictures’	/sT/	sTəl	‘bucket’
/tz/	tzad	‘to increase’	/sd/	sdər	‘chest’
/tʃ/	tʃaʃ	‘sparks’	/ss/	ssuq	‘the market’
/tʒ/	tʒi	‘to come’	/sʒ/	sʒəd	‘to prostrate onself’
/TT/	TTəRʒəm	‘to translate’	/ST/	STinaʕi	‘artificial’
/dd/	ddwa	‘the medicine’	/SD/	SDaʕ	‘noise’
/ds/	dsəm	‘grease’	/SS/	SSaka	‘tobacco store’
/dʃ/	dʃiʃa	‘wheat’	/ʃʃ/	ʃʃiTan	‘satan’
/dʒ/	dʒaʒ	‘chickens’	/ʃʒ/	ʃʒəR	‘trees’
/DD/	DDyaf	‘guests’	/ʒT/	ʒTək	‘your part’
/ʒt/	ʒtu	‘I brought it’	/zD/	zDəm	‘to step on’
/zT/	zTəm	‘to convince’	/zd/	zdəħ	‘to slam’

/zz/	zzənqa	‘the street’	/ʒd/	ʒdər	‘root’
/ʃt/	ʃtəf	‘to stamp on’	/ʒD/	ʒDaRtək	‘your origin’
/ʃT/	ʃTəħ	‘to dance’	/ʒʒ/	ʒʒaʒ	‘glass’
/ʃd/	ʃdəg	‘cheek’	/ʃD/	ʃDəq	‘talk’

The second class of coronal-coronal combinations is obstruent-sonorant clusters. The obstruent-sonorant combinations of CMA phonemes can be subdivided into three clusters: obstruent- nasal clusters, obstruent-liquid clusters and obstruent-glide clusters.

Obstruent-nasal onset clusters are common in CMA, as shown in (198) below:

(198)

/tn/	tnabər	‘stamps’	/Dn/	Dnit	‘I belived’
/Tn/	Tnəz	‘to joke’	/sn/	snan	‘teeth’

/dn/	dnub	‘sins’	/Sn/	Snəʕ	‘to make’
/zn/	znaqi	‘streets’	/ʃn/	ʃnəq	‘to hang’
/ʒn/	ʒnaħ	‘wings’			

Obstruents can be followed by liquids, as shown in (199):

(199)

/tl/	tləf	‘to get lost’	/Dl/	Dlam	‘to be dark’
/tr/	triya	‘chandelier’	/Dr/	DRəb	‘to hit’
/dl/	dlu	‘bucket’	/Tl/	Tləb	‘to request’
/dr/	drək	‘to obtain’	/Tr/	Trəʃ	‘to slap
/sl/	slaħ	‘weapons’	/sr/	sRəq	‘to steal’
/Sl/	Sləħ	‘to repair’	/ʃl/	ʃlaDa	‘salad’
/Sr/	Srəf	‘to spend’	/ʃr/	ʃRəb	‘to drink’
/ʒr/	ʒrəħ	‘to hurt’	/ʒl/	ʒla	‘to lose’
/zl/	zləq	‘to slide’	/zr/	zRəq	‘blue’

Obstruents can co-occur with the glide [y], as presented below:

(200)

/ty/	tyəssər	‘to be available’	/zy/	zyan	‘to become nice’
/Ty/	TyuR	‘birds’	/dy/	dyab	‘wolves’
/ʃy/	ʃyaT	‘odor of burning hair, etc.’	/Dy/	DyuR	‘houses’
/sy/	syuf	‘swords’	/Sy/	Syam	‘fasting’
/ʒy/	ʒyub	‘pockets’			

Apart from obstruent-obstruent clusters and obstruent-sonorant clusters, CMA also allows sonorant-obstruent clusters. The presence of sonorant-obstruent onsets suggests that the Sonority Sequencing Principle can be violated in CMA. The coronal sonorant-coronal obstruent combinations can be illustrated as follows:

(201)

/nt/	ntaqəl	‘to move’	/lt/	ltam	‘veil’
/nT/	nTəħ	‘to hit with the horns’	/lT/	lTəf	‘to be gentle toward’
/nd/	ndəm	‘to regret’	/ld/	ldid	‘delicious’
/nD/	nDaDəR	‘eyeglasses’	/lD/	lDəɣ	‘to sting’
/ns/	nsər	‘vulture’	/ls/	lsan	‘tongue’
/nS/	nSəħ	‘to advise’	/lS/	lSəq	‘to stick’
/nz/	nzəl	‘to fall’	/lz/	lzəm	‘to owe’
/nʃ/	nʃəR	‘to hang’	/lʒ/	lʒam	‘rein’
/nʒ/	nʒəħ	‘to succeed’	/rt/	rtila	‘spider’

/rT/	RTəb	‘soft’	/yT/	yTiʕ	‘to obey’
/rd/	rdəm	‘to bury with debris’	/yd/	yduz	‘to pass’
/rD/	rDəʕ	‘to suckle’	/yD/	yDəll	‘to stay’
/rs/	rsəm	‘to draw’	/ys/	ysədd	‘to close’
/rS/	RSa	‘to stop’	/yS/	ySəlli	‘to pray’
/rz/	rzəq	‘fortune’	/yz/	yzid	‘to add’
/rʃ/	rʃawi	‘bribes’	/yʃ/	yʃəmm	‘to smell’
/rʒ/	rʒəl	‘leg’	/yʒ/	yʒib	‘to bring’
			/yt/	ytim	‘orphan’

The firth and last class of coronal-coronal combinations is sononrant-sonorant clusters.

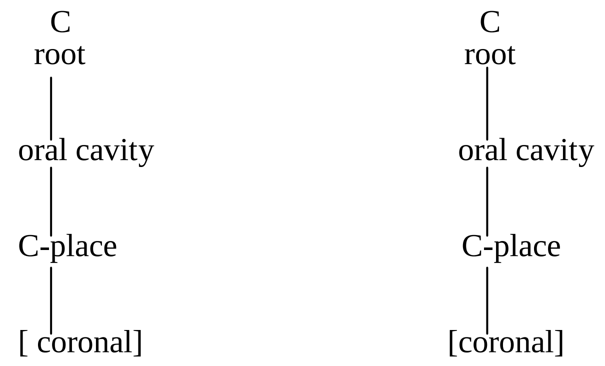
(202)

/nn/	nnas	‘people’	/rn/	Rnəb	‘hare’
/ny/	nyab	‘canines’	/rr/	RRaʒəl	‘the man’
/ll/	llun	‘the color’	/ry/	Ryus	‘heads’
/ly/	lyali	‘nights’	/yn/	ynuD	‘to wake up’

/yl/	yluħ	‘to throw’	/yr/	yrəDD	‘to turn back’
/yy/	yyəh	‘yes’			

All the coronal-coronal pairs can be formalized as follows:

(203)



IV.1.2.6. Coronal-Dorso-guttural:

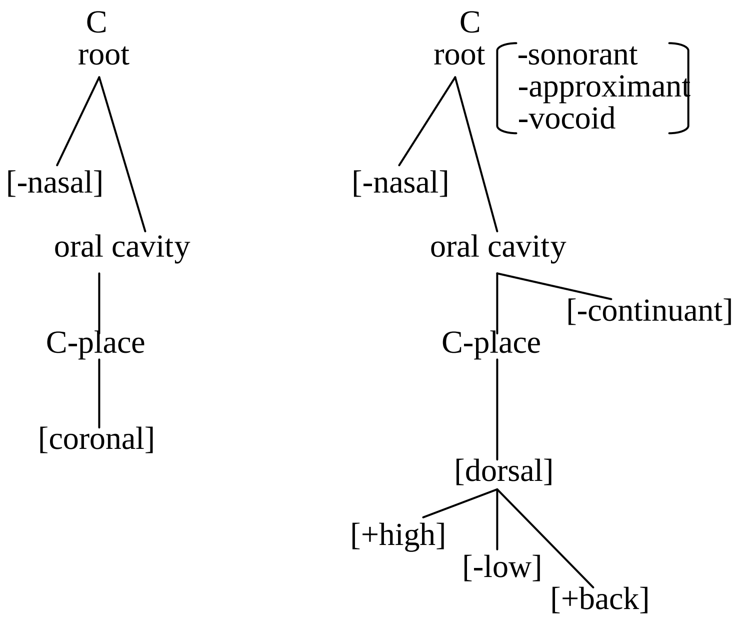
There are **84** coronal dorso-guttural combinations in CMA. Coronal obstruents can co-occur with the dorsals [k] and [g], as shown below:

(204)

/tk/	tkəlləm	‘to talk’	/Sg/	Sgəʕ	‘stubborn’
/tg/	tgərrəʕ	‘to belch’	/zk/	zka	‘to increase’
/dk/	dkər	‘to mention’	/zg/	zgəl	‘to miss’
/dg/	dgig	‘flour’	/ʃk/	ʃkəR	‘to thank’
/sk/	skən	‘to live’	/ʃg/	ʃgig	‘brother’
/sg/	sga	‘to water’			

This can be formalized as follows:

(205)



Coronal sonorants can co-occur with the dorsal stops [k] and [g]:

(206)

/nk/	nkəR	‘to deny’	/rk/	rkəl	‘to kick’
/ng/	ngab	‘veil’	/rg/	Rgiʕ	‘to botch everything’
/lk/	lkərsi	‘the chair’	/yk/	ykun	‘to be’
/lg/	lga	‘he found’	/yg/	ygul	‘to say’

Coronal obstruents can co-occur with the gutturals [q, x, γ, ħ, ʕ, h]:

(207)

/tq/	tqəb	‘to pierce’	/dγ/	dγəl	‘bad intention’
/tx/	txaSəm	‘to quarrel’	/dħ/	dħəs	‘to crush’
/tγ/	tγədda	‘to have lunch’	/dʕ/	dʕa	‘to prosecute’
/tħ/	tħasəb	‘to settle accounts’	/dh/	dhəb	‘gold’
/tʕ/	tʕadəl	‘to become equal’	/Dq/	Dqəq	‘to scrutinize’
/th/	thəm	‘he accused’	/Tγ/	Tγa	‘to trespass’
/Dħ/	Dħək	‘to laugh’	/Dγ/	DγəT	‘to make pressure’

/Tħ/	Tħən	'to grind'	/Dʕ/	Dʕif	'weak'
/Tʕ/	Tʕam	'food'	/Dh/	DhəR	'back'
/Th/	ThaRa	'circumcision'	/sq/	sqəT	'to fail'
/dq/	dqiqa	'minute'	/sx/	sxən	'to get hot'
/dx/	dxəl	'enter'			

/sħ/	sħəq	'to powder'	/zʕ/	zʕəf	'to get angry'
/sʕ/	sʕa	'to beg'	/zh/	zhəR	'luck'
/sh/	sha	'to get distracted'	/ʃq/	ʃqiqa	'migraine'
/Sq/	Sqəl	'to polish'	/ʃx/	ʃxəR	'to snore'
/Sx/	SxəT	'to disobey'	/ʃɣ/	ʃɣəl	'work'
/Sɣ/	SɣaR	'to get small'	/ʃħ/	ʃħiħ	'stingy'
/Sħ/	Sħiħ	'strong'	/ʃʕ/	ʃʕər	'hair'
/Sʕ/	Sʕib	'difficult'	/ʃh/	ʃhəR	'month'
/Sh/	Shəl	'to neigh'	/zq/	zqiqa	'a small thing'

/ʒɣ/	ʒɣəm	'to hang'	/ʒh/	ʒhəl	'to be unaware of'
/zɣ/	zɣəb	'hair'	/ʒħ/	ʒħuʃa	'young donkeys'
/zħ/	zħam	'crowd'	/ʒʕ/	ʒʕab	'tubes'

Coronal sonorants can co-occur with gutturals, as shown below:

(208)

/nq/	nqəd	'to save'	/lħ/	lħəs	'to lick'
/nx/	nxəl	'plam-tree'	/lʕ/	lʕəb	'to play'
/nɣ/	nɣəz	'to prick'	/lh/	lha	'to distract'
/nħ/	nħəl	'bees'	/rq/	Rqiq	'thin'
/nʕ/	nʕəs	'to sleep'	/rx/	Rxam	'marble'

/nh/	nhaR	‘day’	/rγ/	Rγawi	‘foams’
/lq/	lqa	‘he found’	/rħ/	Rħəl	‘to move’
/rʕ/	rʕəf	‘to bleed from the nose’	/lx/	lxənʃa	‘the bag’
/lγ/	lγa	‘to chat’	/rh/	Rhif	‘thin’
/yʕ/	yʕəss	‘to control’	/yx/	yxəlli	‘to leave’
/yγ/	yγəlli	‘to make sth expensive’	/yq/	yqum	‘to do’
/yħ/	yħənn	‘to be kind with’	/yh/	yhərr	‘to tickle’

IV.1.2.7. Dorso-guttural-Labial

There are **31** dorso-guttural-labial combinations in CMA. The dorsal stops [k] and [g] can co-occur with labial obstruents, as illustrated below:

(209)

/kb/	kbər	‘to become big’	/gb/	gbəD	‘to take’
/kf/	kfən	‘shroud’	/gf/	gfaf	‘baskets’

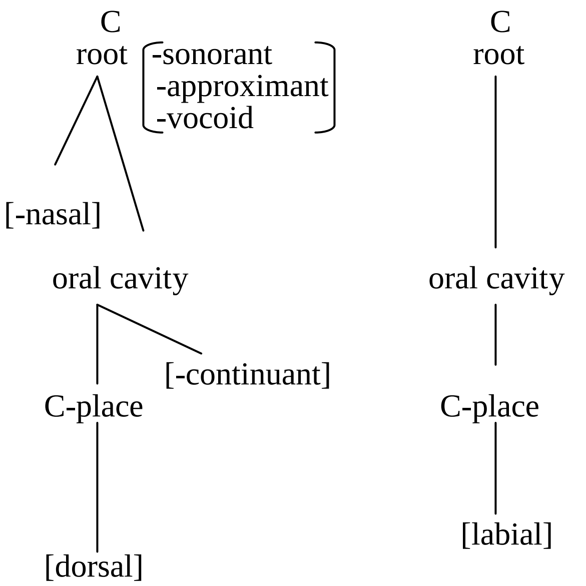
[k] and [g] can co-occur with labial sonorants:

(210)

/km/	kma	‘to smoke’	/gm/	gməl	‘lice’
/kw/	kwa	‘to solder’	/gw/	gwaməl	‘pans’

The dorsal-labial combinations can be formalized as follows:

(211)



Gutturals can co-occur with both labial obstruents and labial sonorants, as shown below:

(212)

/qb/	qbəR	'tomb'	/xb/	xbaR	'news'
/qf/	qfəz	'cage'	/xf/	xfaf	'to become light'
/qm/	qməR	'gambling'	/xm/	xməʒ	'to rote'
/qw/	qwas	'arches'	/xw/	xwən	'to steal'

/γb/	γbəR	'to disappear'	/ħb/	ħbəl	'rope'
/γf/	γfəR	'to forgive'	/ħf/	ħfəR	'to dig'
/γm/	γməz	'to wink at'	/ħm/	ħməR	'red'
/γw/	γwat	'shouting'	/ħw/	ħwəl	'cross-eyed'

/ʕb/	ʕbəR	'to weigh'	/hb/	hbəT	'to go down'
/ʕf/	ʕfən	'filthiness'	/hm/	hməl	'to neglect'
/ʕm/	ʕma	'blind'	/hw/	hwəd	'to go down'
/ʕw/	ʕwəR	'blind'			

IV.1.2.8. Dorso-guttural-Coronal

There are **91** dorso-guttural-coronal combinations in CMA. The dorsals [k] and [g] can co-occur with coronal obstruents:

(213)

/kt/	ktəf	'shoulder'
/kd/	kdəb	'to lie'
/gT/	gTaR	'hectatre'
/gd/	gdəm	'the heel'
/ks/	ksəR	'to break'
/gS/	gSəb	'reeds'

/gz/	gzəR	'to hit someone violently'
/kʃ/	kʃəf	'to fade'
/gʃ/	gʃuR	'barks'

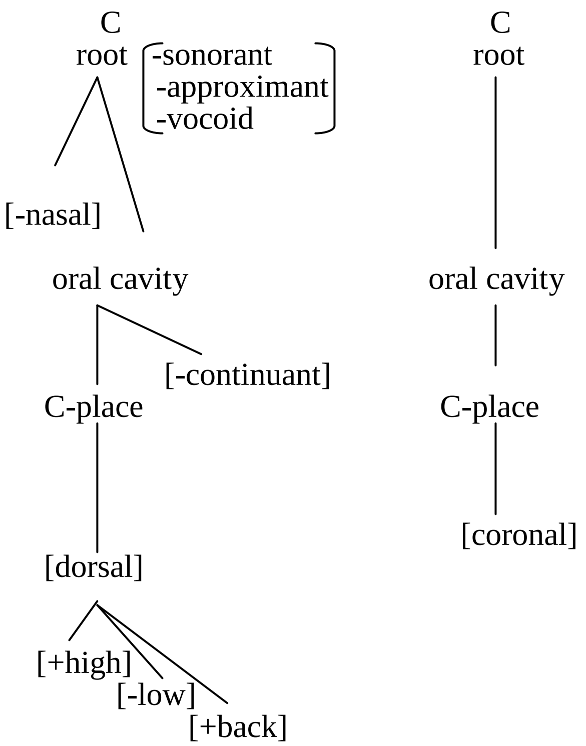
The dorsals [k] and [g] can co-occur with coronal sonorants, as illustrated below:

(214)

/kn/	knanəʃ	'notebooks'	/gn/	gnaza	'funeral'
/kl/	klab	'dogs'	/gl/	gləs	'to sit down'
/kr/	kra	'to rent'	/gr/	gRam	'gram'
/ky/	kyus	'pouch'	/gy/	gyud	'guides'

All the dorsal-coronal combinations can be formalized as follows:

(215)



As far as gutturals are concerned, they can co-occur with coronal obstruents:

(216)

/qt/	qtəl	'to kill'	/xt/	xtaRəʕ	'to invent'
/qT/	qTən	'cotton'	/xT/	xTəb	'to give a speech'
/qd/	qdam	'to get old'	/xd/	xdəm	'to work'

/qD/	qDa	'to accomplish'	/xD/	xDəR	'green'
/qs/	qsəm	'to swear'	/xs/	xsəR	'to lose'
/qS/	qSəm	'to divide'	/xS/	xSuma	'quarrel'
/qz/	qzadər	'tins'	/xz/	xzana	'tent'
/qʃ/	qʃuR	'barks'	/xʃ/	xʃəb	'wood'
/qʒ/	qʒəm	'to joke'	/xʒ/	xʒəl	'to be shy'

/γt/	γtəb	'to talk back'	/ħt/	ħtaRəm	'to respect'
/γT/	γTəs	'to immerse'	/ħT/	ħTəb	'fire wood'
/γd/	γdiR	'stream'	/ħd/	ħdid	'iron'
/γD/	γDəb	'to get angry'	/ħD/	ħDəR	'to show up'
/γs/	γsəl	'to wash'	/ħs/	ħsəb	'to count'
/γS/	γSəb	'to deprive'	/ħS/	ħSəD	'to harvest'
/γz/	γzal	'gazelle'	/ħz/	ħzəm	'to tie up'
/γʃ/	γʃim	'inexperienced'	/ħʃ/	ħʃiʃ	'grass'
/ʕʒ/	ʕʒəl	'calf'	/ħʒ/	ħʒəR	'stones'
/ʕt/	ʕtəq	'to save'	/ht/	htəm	'to take care'
/ʕT/	ʕTəʃ	'to get thirsty'	/hd/	hdiya	'gift'
/ʕd/	ʕdəs	'lentils'	/hD/	hDəR	'to talk'
/ʕD/	ʕDəm	'bone'	/hz/	hzəm	'to beat'
/ʕs/	ʕsəl	'honey'	/hʃ/	hʃiʃ	'tender'
/ʕS/	ʕSa	'stick'	/hʒ/	hʒəm	'to attack'
/ʕz/	ʕzəl	'to pick out'	/ʕʃ/	ʕʃub	'herbs'

Gutturals can co-occur with coronal sonorants, as illustrated below:

(217)

/qn/	qnat	'corners'	/xn/	xnəz	'to stink'
/ql/	qləb	'to turn'	/xl/	xləʕ	'to scare'

/qr/	qRin	‘peer’	/xr/	xrəʒ	‘to leave’
/qy/	qyas	‘measurement’	/xy/	xyab	‘to become ugly’

/ɣn/	ɣnəm	‘sheep’	/ħn/	ħnaʃ	‘snakes’
/ɣl/	ɣliD	‘thick’	/ħl/	ħləm	‘to dream’
/ɣr/	ɣRəq	‘to sink’	/ħr/	ħrəʃ	‘rough’
/ɣy/	ɣyam	‘clouds’	/ħy/	ħyuT	‘walls’

/ʕn/	ʕnəb	‘grapes’	/hn/	hna	‘here’
/ʕl/	ʕla	‘on’	/hl/	hlək	‘to cause much harm to’
/ʕr/	ʕRəf	‘to know’	/hr/	hrəm	‘to get old’
/ʕy/	ʕya	‘to get old’	/hy/	hyuʃ	‘asses’

IV.1.2.9. Dorso-guttural-Dorso-guttural

There are **14** dorso-guttural-dorso-guttural combinations in CMA. Dorsals can co-occur with gutturals:

(218)

/kħ/	kħəl	‘black’
/kʕ/	kʕab	‘ankles’
/gʕ/	gʕəd	‘sit down’
/gh/	ghəm	‘to take away the appetite’

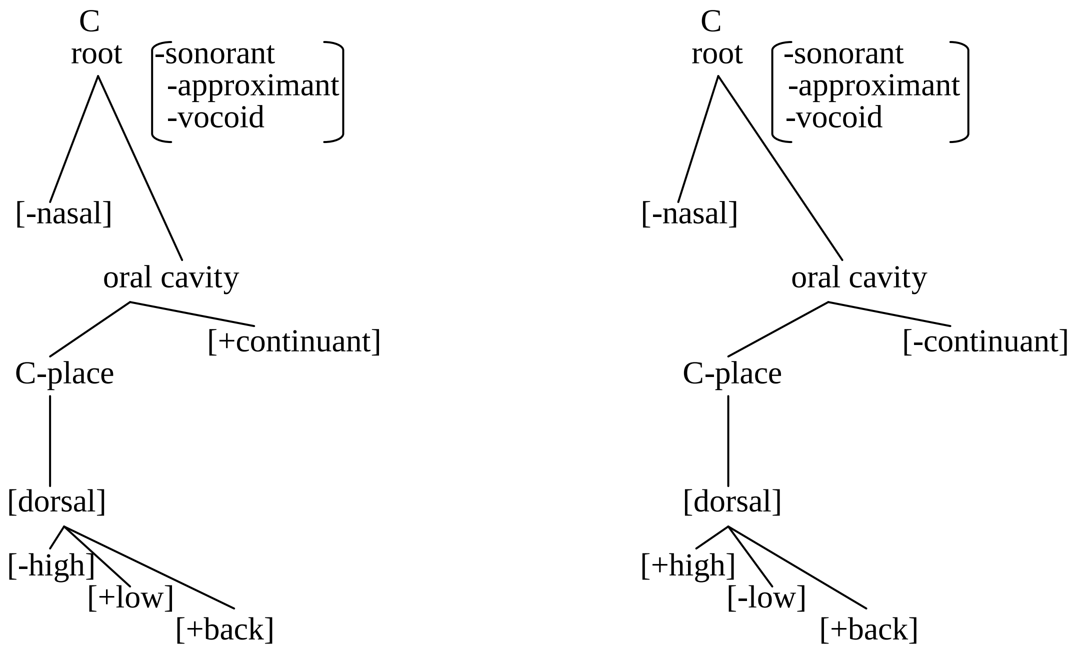
Gutturals in turn can co-occur with dorsals, as illustrated below:

(219)

/ħk/	ħkəm	‘to govern’	/ʕk/	ʕkəR	‘lipstick’
/ħg/	ħgəR	‘to humiliate’	/ʕg/	ʕgəz	‘to become lazy’
/hg/	hgiyya	‘hiccups’			

This can be formalized as follows:

(220)



Gutturals can occur with other gutturals, as shown below

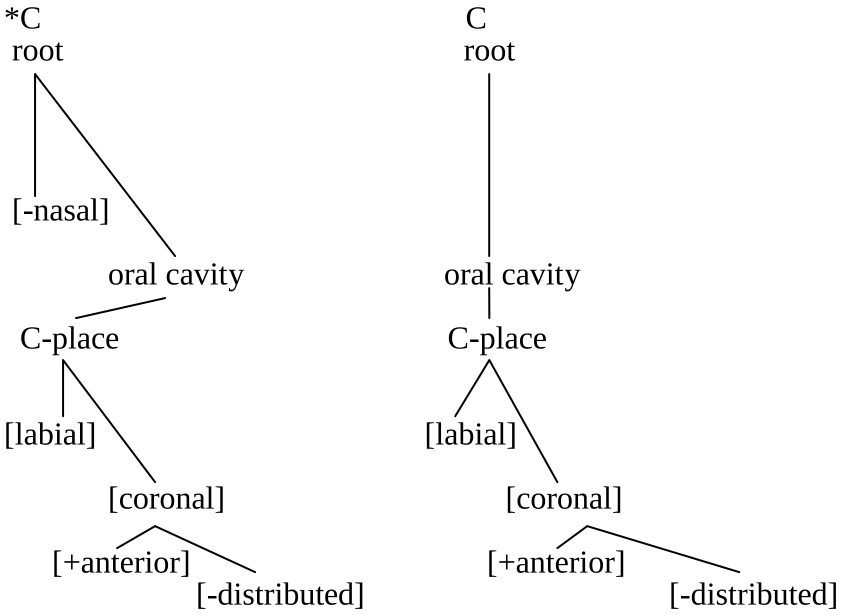
(221)

/qħ/	'….'		/ħq/	ħqəd	'to detest'
/qʕ/	qʕadi	'…..'	/ʕq/	ʕqəl	'mind'
/qh/	qhəR	'to beat'			

IV.1.3. Feature Geometry of Impossible Clusters

There are **140** clusters that are impossible in CMA. The first combinations that are not allowed are labial-labial combinations, namely /bf/, /bm/, /fb/ /fm/, /wb/, /wm/ and /ww/. These impossible combinations can be represented as follows:

(222)

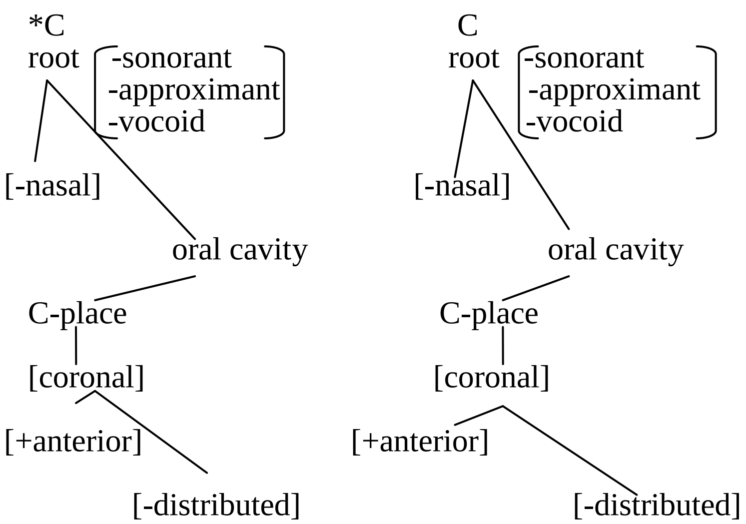


The clusters /wy/, /bD/, /fγ/ and /wγ/ are not possible in CMA.

Having said this, coronal-coronal onset clusters are allowed as I presented above. However, the clusters */Ts/ and */Tz/ are not possible. The OCP is responsible for the absence of the following clusters. It bans clusters of two adjacent coronals. Sequences of two coronals do not occur in CMA, namely:

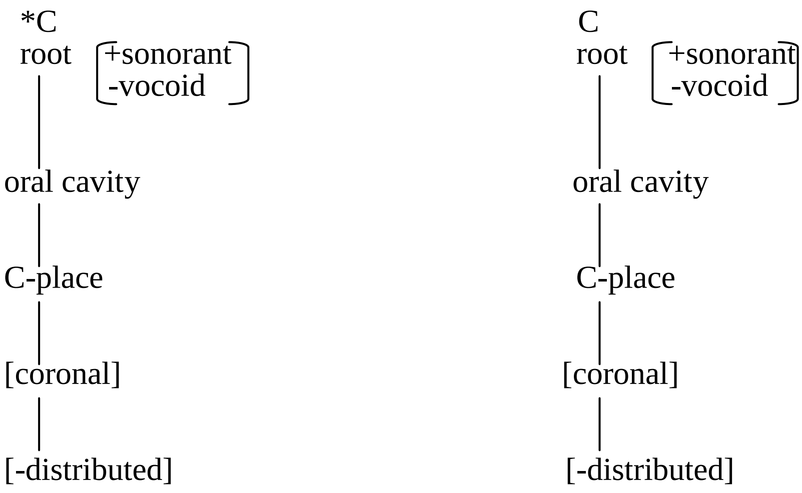
1. tT-, td-, tD-, Tt-, Td-, TD-, Ts-, TS-, Tz-, dt-, dT-, dD-, dS-, dz-, Dt-, DT-, Dd-, Ds-, Dz-, sD-, sS-, sz- , St-, Sd-, Ss-, Sz-, zs- , zS-, zt-.

(223)



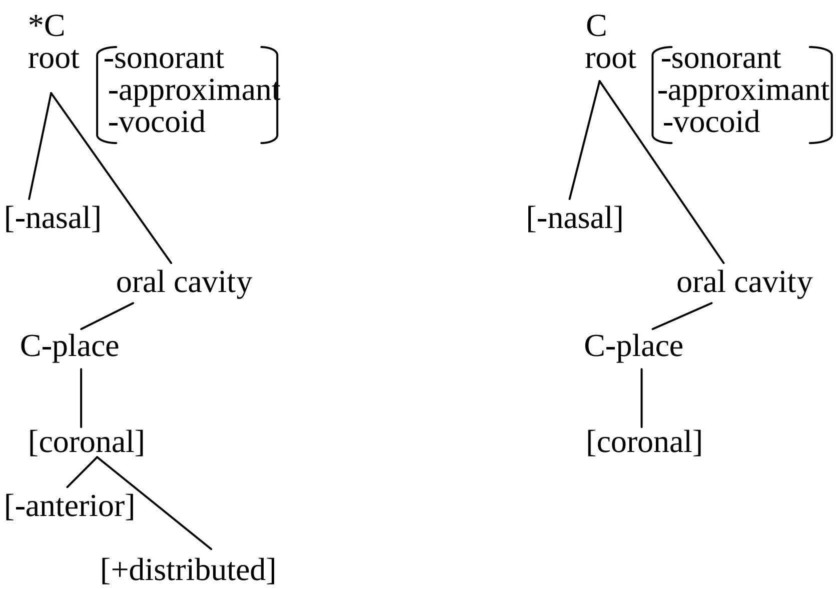
2. –ln, -nl, -rl, -nr, -lr

(224)



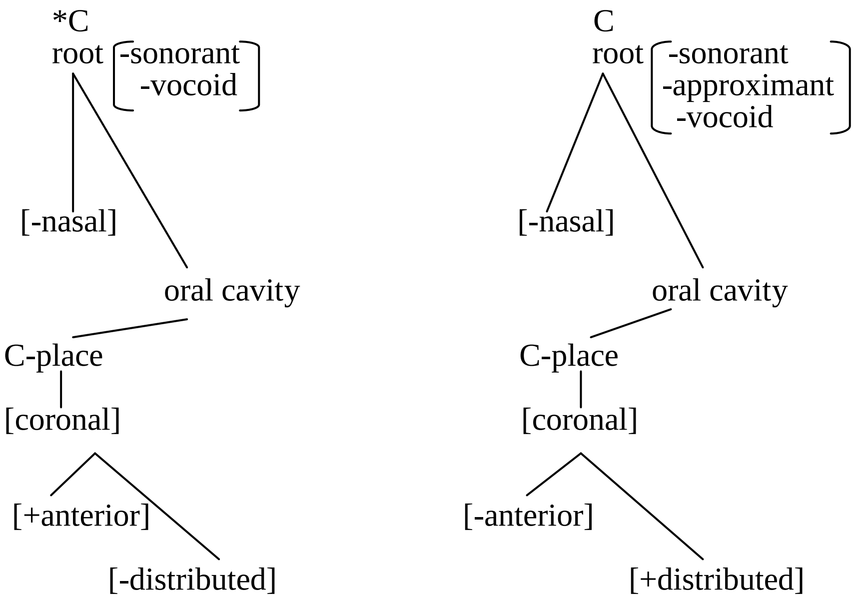
3. -ʃz, -ʒz,-ʒʃ, ʃs,ʃS, ʒs, ʒS.

(225)



4. - Tʃ, -Tʒ, sʃ, -zʃ, zʒ, Sʒ, Sʃ, Dʃ, Dʒ, lʃ.

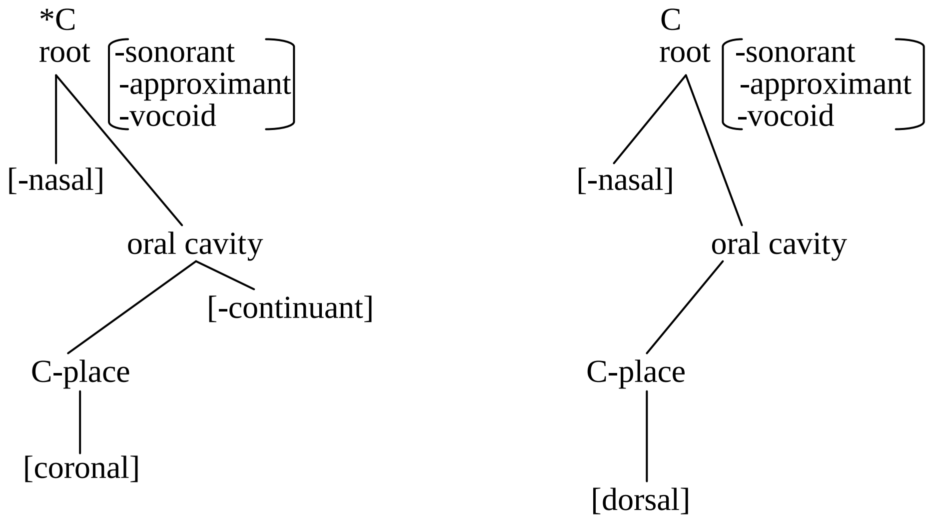
(226)



Coronals cannot co-occur with dorso-gutturals, as can be seen below:

Tk, Tg-, Tx-, Dk-, Dg-, Sk-, Tq-, Dx-, sγ-, zx-, ʒk-, ʒg-, ʒq-, ʒx-

(227)

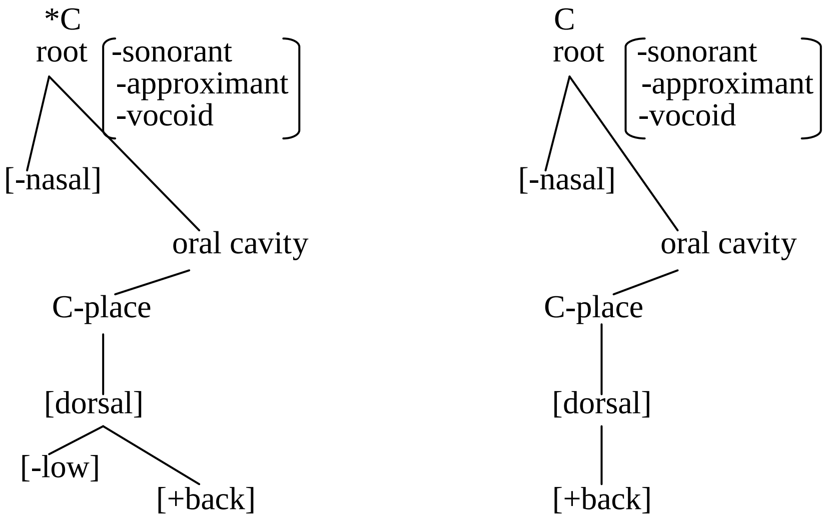


The language does not only accept some coronal-coronal combinations, but it also does not allow some dorso-guttural-coronal combinations, namely: *kT-, kD-, kS-, kz-, kʒ-, gt-, gD-, gs-, gʒ-, γʒ-, hT-, hs- and hS-.

Both dorsals and gutturals are incapable of geminating, for instance: */kk/, */gg/, */qq/, */xx/, */ʕʕ/, */ħħ/ and */hh/. All the impossible dorso-gutturals combinations can be presented as follows:

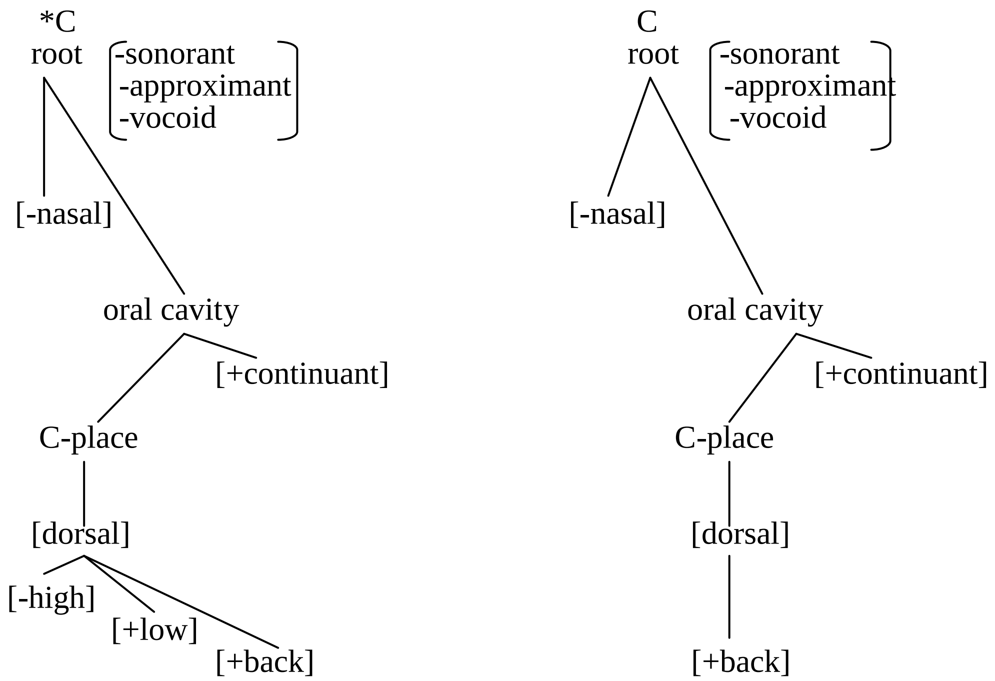
1. kk, –kg, -kq, -kx, -kγ, -gk, -gg, -gq, -gx, gγ, -qk, -qg, -qq, -qx, -qγ, -xk, -xg, -xq,-xx, -xγ, -xħ, -xʕ, -γk, -γg, -γq, -γx, -γγ, -γħ, -γʕ, għ.

(228)



2. -ħx, -ħγ,-ħħ, -ħʕ, -ʕx, -ʕγ, -ʕħ, -ʕʕ

(229)



The guttural /h/ can not co-occur with the labial /f/. It cannot also co-occur with other dorso-gutturals. The following combinations are impossible in CMA:

(230)

hf, xh, γh, ħh, ʕh, hq, hx, hγ, hħ, hʕ, hh, kh, hk.

IV.1.4.Obligatory Contour Principle

In this section, we will list all the possible clusters that obey or violate OCP. We will also provide a brief discussion of the autosegmental representation of geminates. There are **344** clusters that obey OCP and **141** clusters that violate it as can be exhibited in figure (1) below. Having said this, the next subsection will list all the possible clusters that obey OCP.

IV.1.4.1. Conformity to OCP

OCP disfavors combinations of homorganic consonants in proximity to each other. I will limit my discussion to the place node tiers, such as labial, coronal and dorsal. OCP applies to rule out sequences of consonants having identical occurrences of the features [coronal], [labial] and [dorsal]. It applies to nodes which are adjacent, and hence located on the same tier. There are **344** clusters that conform to OCP in CMA. It has been found that all these clusters can be divided into six classes:

(231)

(1) Labial-Coronal (50 instances)

(2) Labial-Dorso-guttural (30)

(3) Coronal-Labial (52)

(4) Coronal-Dorso-guttural (90)

(5) Dorso-guttural-Labial (31)

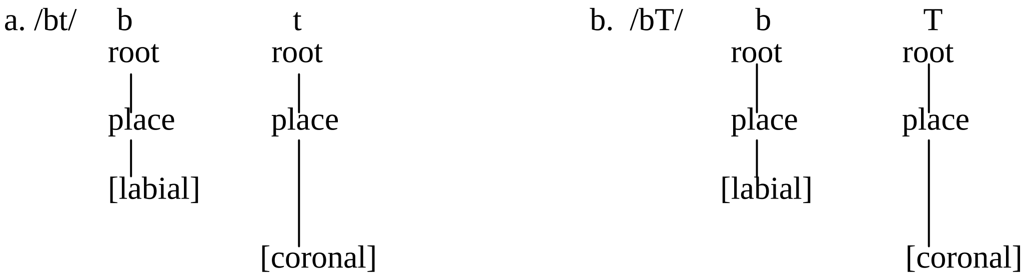
(6) Dorso-guttural-Coronal (91)

Having said this, the labial-coronal clusters will be listed.

a. Labial- Coronal

As I already stated, OCP applies at the root tier. The wellformedness of the representations below is due to the conformity to the OCP on the [labial] and [coronal] tiers.

(232)



Having seen this, I will next list all the possible clusters that confom to the OCP.

(233)

/bt/	/ft/	/mt/	/wt/
/bT/	/fT/	/mT/	/wT/
/bd/	/fd/	/md/	/wd/
/bs/	/fD/	/mD/	/wD/
/bS/	/fs/	/ms/	/wz/
/bz/	/fS/	/mS/	/ws/
/bn/	/fz/	/mz/	/wS/
/bl/	/fn/	/mn/	/wn/
/br/	/fl/	/ml/	/wl/
/bʃ/	/fr/	/mr/	/wr/
/bƷ/	/fʃ/	/mʃ/	/wʃ/
/by/	/fƷ/	/mƷ/	/wƷ/
	/fy/	/my/	

b. Labial-Dorso-guttural

(234)

/bk/	/fk/	/mk/	/wk/
/bg/	/fg/	/mg/	/wg/
/bq/	/fq/	/mq/	/wq/
/bx/	/fx/	/mx/	/wx/
/bγ/	/fħ/	/mγ/	/wħ/
/bħ/	/fʕ/	/mħ/	/wʕ/
/bʕ/	/fh/	/mʕ/	/wh/
/bh/		/mh/	

c. Coronal-Labial

(235)

/tb/	/Tb/	/db/	/Db/	/sb/	/Sb/	/zb/	/nb/
/tf/	/Tf/	/df/	/Df/	/sf/	/Sf/	/zf/	/nf/
/tm/	/Tm/	/dm/	/Dm/	/sm/	/Sm/	/zm/	/nm/
/tw/	/Tw/	/dw/	/Dw/	/sw/	/Sw/	/zw/	/nw/

/lb/	/rb/	/ʃb/	/Ʒb/	/yb/
/lf/	/rf/	/ʃf/	/Ʒf/	/yf/
/lm/	/rm/	/ʃm/	/Ʒm/	/ym/
/lw/	/rw/	/ʃw/	/Ʒw/	/yw/

d. Coronal-Dorso-guttural

(236)

/tk/	/lh/	/dk/	/Dq/	/sk/	/zk/	/nk/	/rh/
/tg/	/Tγ/	/dg/	/Dγ/	/sg/	/Sg/	/zg/	/ng/
/tq/	/Tħ/	/dq/	/Dħ/	/sq/	/Sq/	/zq/	/nq/
/tx/	/TƩ/	/dx/	/DƩ/	/sx/	/Sx/	/yh/	/nx/
/tγ/	/Th/	/dγ/	/Dh/	/sħ/	/Sħ/	/zħ/	/nγ/
/tħ/	/dħ/	/ʃk/	/zh/	/sƩ/	/Sh/	/zƩ/	/nƩ/
/SƩ/	/dƩ/	/sh/	/zγ/	/nħ/	/nh/	/Sγ/	/dh/
/tƩ/	/lk/	/th/	/rk/	/yk/	/lg/	/rg/	/ʃg/
/yg/	/lq/	/rq/	/ʃq/	/yq/	/lx/	/rx/	/ʃx/
/yx/	/lγ/	/rγ/	/ʃγ/	/Ʒγ/	/yγ/	/lħ/	/rħ/
/ʃħ/	/Ʒħ/	/yħ/	/lƩ/	/rƩ/	/ʃƩ/	/ƷƩ/	/yƩ/
/ʃh/	/Ʒh/						

e. Dorso-guttural-Labial

(237)

/kb/	/gb/	/qb/	/xb/	/γb/	/ħb/	/Ʃb/	/hb/
/kf/	/gf/	/qf/	/xf/	/γf/	/ħf/	/Ʃf/	/hm/
/km/	/gm/	/qm/	/xm/	/γm/	/ħm/	/Ʃm/	/hw/
/kw/	/gw/	/qw/	/xw/	/γw/	/ħw/	/Ʃw/	

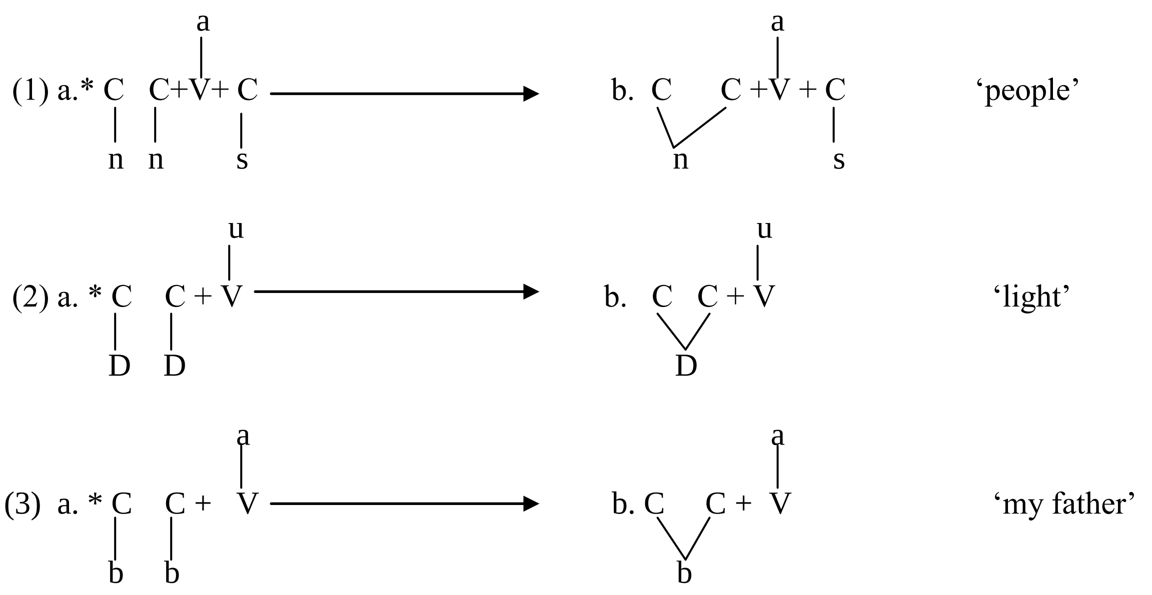
f. Dorso-guttural-Coronal

(238)

/kt/	/qt/	/xt/	/γt/	/ħt/	/ʕt/	/ht/	/gT/
/qT/	/xT/	/γT/	/ħT/	/ʕT/	/kd/	/gd/	/qd/
/xd/	/γd/	/ħd/	/ʕd/	/hd/	/qD/	/xD/	/γD/
/ħD/	/ʕD/	/hD/	/ks/	/qs/	/xs/	/γs/	/ħs/
/ʕs/	/gS/	/qS/	/xS/	/γS/	/ħS/	/gz/	/qz/
/xz/	/γz/	/ħz/	/ʕz/	/hz/	/kn/	/gn/	/qn/
/xn/	/γn/	/ħn/	/ʕn/	/hn/	/kl/	/gl/	/ql/
/xl/	/γl/	ħl/	/ʕl/	/hl/	/kr/	/gr/	/qr/
/xr/	/γr/	/ħr/	/ʕr/	/hr/	/kʃ/	/gʃ/	/qʃ/
/xʃ/	/γʃ/	/ħʃ/	/ʕʃ/	/hʃ/	/qʒ/	/xʒ/	/ħʒ/
/ʕʒ/	/hʒ/	/ky/	/gy/	/qy/	/xy/	/γy/	/ħy/
/ʕy/	/hy/	/ʕS/					

Having said this, to see how the OCP works in CMA, consider the following representations:

(239)

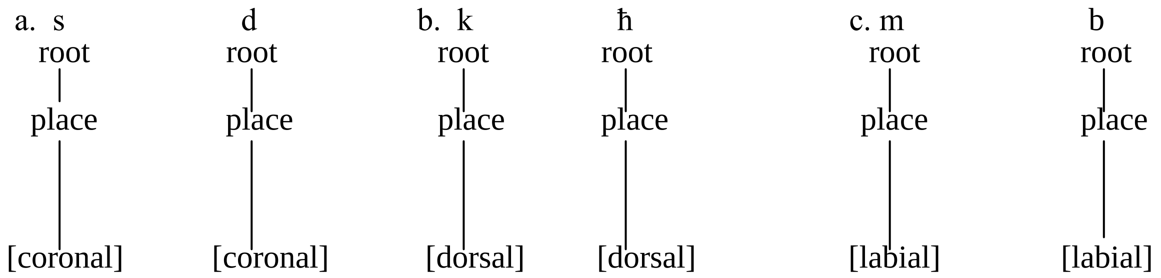


The representations of (b) are allowed while the ones in (a) are ruled out exactly as predicted by the OCP.

IV.1.4.2. OCP Violation

OCP prohibits two coronals, labials and dorso-gutturals to occur adjacently. The constraint against identical adjacent consonants applies at the root tier. Consider the following clusters:

(240)



The illformedness of the above representations is due to the violation of the OCP on the [coronal], [dorsal] and [labial] tiers. Having preseted some clusters that violate OCP, the next subsections will present the labial-labial combinations that violate this constraint.

I have been found that the clusters that violate the OCP can be classified into three major classes:

(241) (1) Labial-Labial (9 instances)

(2) Coronal-Coronal (118)

(3) Dorso-guttural-Dorso-guttural (14)

a. Labial-Labial

(242)

/bb/	/mb/
/bw/	/mf/
/ff/	/mm/
/fw/	/mw/
/wf/	

b. Coronal-Coronal

(243)

/tt/	/TT/	/dʃ/	/Dy/	/ST/	/nt/	/ny/	/lʒ/	/rr/	/ʃn/	/yD/	
/ts/	/Tn/	/dʒ/	/st/	/SD/	/zT/	/nT/	/lt/	/ly/	/rʃ/	/ʃl/	/ys/
/tS/	/Tl/	/dy/	/sT/	/SS/	/zd/	/nd/	/lT/	/rt/	/rʒ/	/ʃr/	/ʒn/
/tz/	/Tr/	/DD/	/sd/	/Sn/	/zD/	/nD/	/ld/	/rT/	/ry/	/ʃʃ/	/ʒl/
/tn/	/Ty/	/DS/	/ss/	/Sl/	/ns/	/lD/	/rd/	/ʃt/	/ʃʒ/	/ʒr/	/yn/
/tl/	/dd/	/Dn/	/sn/	/Sr/	/zz/	/nS/	/ls/	/rD/	/ʃT/	/ʃy/	/ʒʒ/
/tr/	/ds/	/Dl/	/sl/	/zn/	/nz/	/lS/	/rs/	/ʃd/	/ʒt/	/ʒy/	/yr/
/tʃ/	/dn/	/Dr/	/sr/	/zl/	/nn/	/lz/	/rS/	/ʃD/	/ʒT/	/yt/	/yʃ/

/tʒ/ /dl/ /sʒ/ /Sy/ /zr/ /nʃ/ /ll/ /rz/ /ʒd/ /yT/ /yʒ/ /yz/
/ty/ /dr/ /sy/ /zy/ /nʒ/ /rn/ /ʒD/ /yd/ /yy/ /yS/ /yl/

c. Dorso-guttural-Dorso-guttural

(244)

/gʕ/ /ħq/ /qh/ /hg/
/kħ/ /gh/ /ʕk/ /ʕg/
/kʕ/ /qħ/ /ħk/
/qʕ/ /ħg/ /ʕq/

As I already said, **344** possible clusters conform to the OCP and **141** violate it, as exhibited in the figure below:

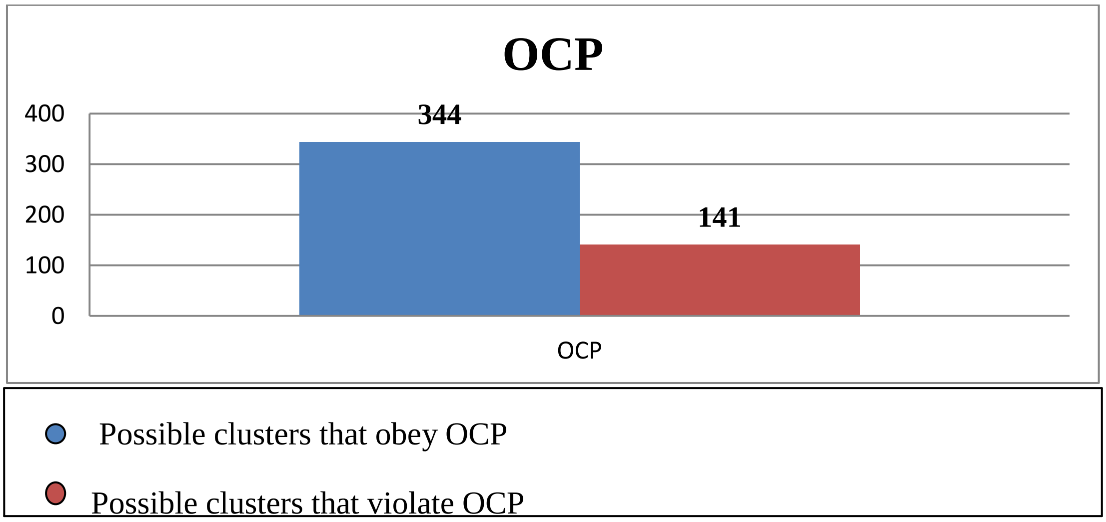


Figure 1: CMA onset and OCP

IV.1.5. Sonority Sequencing Principle

In the **485** lexical items, each onset cluster in each lexical item will be categorized where it fits under any of the three sonority possibilities: conformity, plateaus and reversals, and the patterns and subpatterns of each category will be identified. Obstruents will be broken down into fricatives and stops, and these, in turn, into voiced and voiceless. Conformity has been observed in **221** cases; sonority reversals in **226**; and sonority plateaus in **38** instances, as demonstrated in figure (2) below:

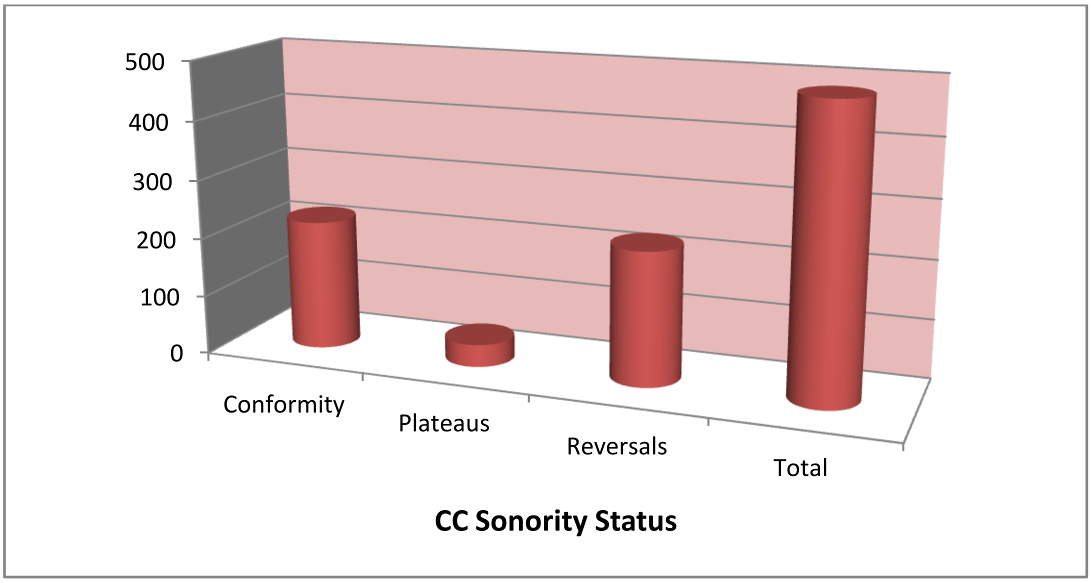


Figure 2: CMA onset and SSP.

IV.1.5.1. Conformity to Sonority Sequencing Principle

As stated above, **221** CC onset clusters appear to conform to SSP. These "core clusters" have been found to fall into 6 major patterns as exhibited in figure (3) below:

(245)

(1) Consonant +liquid

(2) Consonant +nasal

(3) Consonant +voiced fricative

(4) Consonant+ voiceless fricative

(5) Consonant + voiced stop

(6) Consonant + Glide

All the onset conformity patterns have been found to comprise a number of subpatterns, as specified below.

IV.1.5.1.1 Consonant + Liquid

Fourty CC onset instances out of **221** were found to follow the pattern consonant+ liquid, where the first consonant can be nasal (2 instances), voiced fricative (8), voiceless fricative (14), voiceless stop (8), and voiced stop (8), as shown below:

a. Nasal+ liquid

(246)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ml/	mləs	'soft'	/m/	6	/l/	7
/mr/	mRəD	'to get sick'	/m/	6	/r/	7

b. Voiced-fricative+liquid

(247)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(1)	Sonority index
/zl/	zlafa	'bowl'	/z/	4	/l/	7
/zr/	zRəq	'blue'	/z/	4	/r/	7
/ʒl/	ʒla	'to lose'	/ʒ/	4	/l/	7
/ʒr/	ʒrəħ	'to hurt'	/ʒ/	4	/r/	7
/ʕl/	ʕla	'on'	/ʕ/	5	/l/	7
/ʕr/	ʕRəf	'to know'	/ʕ/	5	/r/	7
/γl/	γliD	'thick'	/γ/	4	/l/	7
/γr/	γRəq	'to sink'	/γ/	4	/r/	7

c. Voiceless-fricative+ liquid

(248)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/fl/	fluka	'boat'	/f/	3	/l/	7
/fr/	fRəħ	'to be happy'	/f/	3	/l/	7
/sl/	sləq	'to boil'	/s/	3	/l/	7
/sr/	sRəq	'to steal'	/s/	3	/r/	7
/Sl/	Sləħ	'to repair'	/S/	3	/l/	7
/Sr/	Srəf	'to spend'	/S/	3	/r/	7
/ʃl/	ʃlaDa	'salad'	/ʃ/	3	/l/	7
/ʃr/	ʃRəb	'to drink'	/ʃ/	3	/r/	7
/xl/	xləʕ	'to scare'	/x/	5	/l/	7
/xr/	xrəʒ	'to leave'	/x/	5	/r/	7
/ħl/	ħləm	'to dream'	/ħ/	5	/l/	7
/ħr/	ħrəʃ	'rough'	/ħ/	5	/r/	7
/hl/	hlək	'to cause much harm to'	/h/	5	/l/	7
/hr/	hRəb	'to run away'	/h/	5	/r/	7

d. Voiceless-stop+liquid

(249)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/tl/	tləf	'to get lost'	/t/	1	/l/	7
/tr/	triya	'chandelier'	/t/	1	/r/	7
/Tl/	Tləb	'to request'	/T/	1	/l/	7
/Tr/	Trəʃ	'to slap'	/T/	1	/r/	7
/kl/	klab	'dogs'	/k/	1	/l/	7
/kr/	kra	'to rent'	/k/	1	/r/	7
/ql/	qləb	'to turn'	/q/	1	/l/	7
/qr/	qRin	'peer'	/q/	1	/r/	7

e. Voiced-stop+liquid

(250)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bl/	blan	'plan'	/b/	2	/l/	7
/br/	brəd	'to get cold'	/b/	2	/r/	7
/dl/	dlu	'bucket'	/d/	2	/l/	7
/dr/	drari	'children'	/d/	2	/r/	7
/Dl/	Dlam	'to get dark'	/D/	2	/l/	7
/Dr/	DRəb	'to hit'	/D/	2	/r/	7
/gl/	gləs	'to sit down'	/g/	4	/l/	7
/gr/	gRam	'gram'	/g/	4	/r/	7

IV.1.5.1.2. Consonant+Nasal

The consonant+nasal onset pattern has been seen in **36** instances out of **221** distributed into four basic subpatterns: 1) voiced fricative+ nasal (8 instances), 2) voiceless fricative+ nasal (13), 3) voiced stop + nasal (7), and 4) voiceless stop+ nasal (8), as illustrated below:

a. Voiced-fricative+ nasal

(251)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/zm/	zman	'ancient time'	/z/	4	/m/	6
/zn/	znaqi	'streets'	/z/	4	/n/	6
/ʒm/	ʒməl	'camel'	/ʒ/	4	/m/	6
/ʒn/	ʒnaħ	'wings'	/ʒ/	4	/n/	6
/ʕm/	ʕma	'blind'	/ʕ/	5	/m/	6

/ʕn/	ʕnəb	‘grapes’	/ʕ/	5	/n/	6
/ɣm/	ɣməz	‘to wink at’	/ɣ/	4	/m/	6
/ɣn/	ɣnəm	‘sheep’	/ɣ/	4	/n/	6

b. Voiceless-fricative+nasal

(252)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/fn/	fnadəq	‘hotels’	/f/	3	/n/	6
/sm/	sməʕ	‘to listen’	/s/	3	/m/	6
/sn/	snan	‘teeth’	/s/	3	/n/	6
/Sm/	Smək	‘deaf’	/S/	3	/m/	6
/Sn/	Snəʕ	‘to make’	/S/	3	/n/	6
/ʃm/	ʃməʕ	‘wax’	/ʃ/	3	/m/	6
/ʃn/	ʃnəq	‘to hang’	/ʃ/	3	/n/	6
/xm/	xməʒ	‘to rote’	/x/	5	/m/	6
/xn/	xnəz	‘to stink’	/x/	5	/n/	6
/ħm/	ħməR	‘red’	/ħ/	5	/m/	6
/ħn/	ħnin	‘kind’	/ħ/	5	/n/	6
/hm/	hməl	‘to neglect’	/h/	5	/m/	6
/hn/	hnud	‘Indians’	/h/	5	/n/	6

c. Voiced-stop+nasal

(253)

Clusters	Words	Gloss	Sound (1)	Sonority index	Sound(2)	Sonority index
/bn/	bnadəm	‘human being’	/b/	2	/n/	6
/dm/	dmaɣ	‘brain’	/d/	2	/m/	6
/dn/	dnub	‘sins’	/d/	2	/n/	6
/Dm/	Dmən	‘to guarantee’	/D/	2	/m/	6
/Dn/	Dnit	‘I believed’	/D/	2	/n/	6
/gm/	gməl	‘lice’	/g/	4	/m/	6
/gn/	gnaza	‘funeral’	/g/	4	/n/	6

d. Voiceless-stop+nasal

(254)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/qm/	qməR	‘gambling’	/q/	1	/m/	6
/qn/	qnat	‘corners’	/q/	1	/n/	6
/km/	kma	‘to smoke’	/k/	1	/m/	6
/kn/	knanəʃ	‘notebooks’	/k/	1	/n/	6

/Tm/	Tməʕ	'to be greedy for'	/T/	1	/m/	6
/Tn/	Tnəz	'to joke'	/T/	1	/n/	6
/tm/	tməR	'dates'	/t/	1	/m/	6
/tn/	tnabər	'stamps'	/t/	1	/n/	6

IV.1.5.1.3. Consonant+ Voiced fricative

The consonant onset pattern has been observed in **32** cases that spread out in four subpatterns: 1) voiced stop+ voiced fricative (10 instances), 2) voiceless stop+ voiced fricative (10), 3) voiceless fricative+ voiced fricative (10 instances), and 4) voiced fricative +voiced fricative (2), as demonstrated below:

a. Voiced-stop+ Voiced fricative

(255)

Clusters	Words	Gloss	Sound (1)	Sonority index	Sound(2)	Sonority index
/bz/	bzim	'belt-buckle'	/b/	2	/z/	4
/bʒ/	bʒəγ	'to crush'	/b/	2	/ʒ/	4
/dʒ/	dʒaʒ	'chickens'	/d/	2	/ʒ/	4
/gʕ/	gʕəd	'to sit down'	/g/	4	/ʕ/	5
/dγ/	dγəl	'bad intention'	/d/	2	/γ/	4
/dʕ/	dʕa	'to prosecute'	/d/	2	/ʕ/	5
/Dγ/	DγəT	'to make pressure'	/D/	2	/γ/	4
/Dʕ/	Dʕif	'weak'	/D/	2	/ʕ/	5
/bʕ/	bʕid	'far'	/b/	2	/ʕ/	5
/bγ/	bγəl	'mule'	/b/	2	/γ/	4

b. Voiceless-stop+ voiced-fricative

(256)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/tz/	tzad	'to increase'	/t/	1	/z/	4
/tʒ/	tʒi	'to come'	/t/	1	/ʒ/	4
/tʕ/	tʕadəl	'to become equal'	/t/	1	/ʕ/	5
/tγ/	tγədda	'to have lunch'	/t/	1	/γ/	4
/Tʕ/	Tʕam	'food'	/T/	1	/ʕ/	5
/Tγ/	Tγa	'to trespass'	/T/	1	/γ/	4
/kʕ/	kʕa	'to get	/k/	1	/ʕ/	5

		angry’				
/qʒ/	qʒəm	‘to joke’	/q/	1	/ʒ/	4
/qʕ/	qʕadi		/q/	1	/ʕ/	5
/qz/	qzadər	‘tins’	/q/	1	/z/	4

c. Voiceless-fricative+ Voiced fricative

(257)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound (2)	Sonority index
/fz/	fzəg	‘to get wet’	/f/	3	/z/	4
/fʒ/	fʒər	‘dawn prayer’	/f/	3	/ʒ/	4
/fʕ/	fʕayəl	‘doings’	/f/	3	/ʕ/	5
/sʒ/	‘to prostrate oneself’		/s/	3	/ʒ/	4
/ʃʒ/	ʃʒəR	‘trees’	/ʃ/	3	/ʒ/	4
/sʕ/	sʕa	‘to beg’	/s/	3	/ʕ/	5
/Sγ/	SγaR	‘to become small’	/S/	3	/γ/	4
/Sʕ/	Sʕib	‘difficult’	/S/	3	/ʕ/	5
/ʃγ/	ʃγəl	‘work’	/ʃ/	3	/γ/	4
/ʃʕ/	ʃʕər	‘hair’	/ʃ/	3	/ʕ/	5

d. Voiced-fricative+Voiced –fricative

(258)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/zʕ/	zʕəf	‘to get angry’	/z/	4	/ʕ/	5
/ʒʕ/	ʒʕab	‘tubes’	/ʒ/	4	/ʕ/	5

IV.1.5.1.4. Consonant + Voiceless fricative

The consonant+ voiceless fricative onset pattern has been seen in **53** cases unfolding in four subpatterns: 1) voiceless stop+voiceless fricative (20 instances), 2) voiced stop+voiceless fricative (17), 3) voiceless fricative+ voiceless fricative (12), and 4) voiced fricative + voiceless fricative (4), as shown below:

a. Voiceless-stop+ voiceless fricative

(259)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ts/	tsala	‘finished’	/t/	1	/s/	3
/Tf/	Tfa	‘to turn off’	/T/	1	/f/	3
/tf/	tfəRgəʕ	‘explode’	/t/	1	/f/	3
/tS/	tSawəR	‘pictures’	/t/	1	/S/	3
/tʃ/	tʃaʃ	‘sparks’	/t/	1	/ʃ/	3
/tx/	txaSəm	‘to quarrel’	/t/	1	/x/	5
/tħ/	tħasəb	‘to settle accounts’	/t/	1	/ħ/	5
/th/	thəm	‘he accused’	/t/	1	/h/	5
/Tħ/	Tħən	‘to grind’	/T/	1	/ħ/	5
/Th/	ThaRa	‘circumcision’	/T/	1	/h/	5
/qf/	qfəz	‘cage’	/q/	1	/f/	3
/ks/	ksəR	‘to break’	/k/	1	/s/	3
/kʃ/	kʃəf	‘to fade’	/k/	1	/ʃ/	3
/qs/	qsəm	‘to swear’	/q/	1	/s/	3
/qS/	qSəR	‘castle’	/q/	1	/S/	3
/qʃ/	qʃuR	‘barks’	/q/	1	/ʃ/	3
/kħ/	kħəl	‘black’	/k/	1	/ħ/	5
/qħ/			/q/	1	/ħ/	5
/qh/	qhəR	‘to beat’	/q/	1	/h/	5
/kf/	kfən	‘shroud’	/k/	1	/f/	3

b. Voiced-stop+ voiceless fricative

(260)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bs/	bsal	‘to become tastless’	/b/	2	/s/	3
/bS/	bSəl	‘onions’	/b/	2	/S/	3
/bʃ/	bʃaRa	‘good news’	/b/	2	/ʃ/	3
/bx/	bxil	‘stingy’	/b/	2	/x/	5
/bħ/	bħəR	‘sea’	/b/	2	/ħ/	5
/bh/	bhad	‘with’	/b/	2	/h/	5
/df/	dfən	‘to bury’	/d/	2	/f/	3
/Df/	DfəR	‘finger-nail’	/D/	2	/f/	3
/ds/	dsəm	‘grease’	/d/	2	/s/	3
/dʃ/	dʃiʃa	‘wheat partly ground’	/d/	2	/ʃ/	3
/DS/	DSəR	‘to get out of hand’	/D/	2	/S/	3
/dx/	dxəl	‘enter’	/d/	2	/x/	5
/dħ/	dħa	‘to push’	/d/	2	/ħ/	5

/dh/	dhəb	‘gold’	/d/	2	/h/	5
/Dħ/	Dħək	‘to laugh’	/D/	2	/ħ/	5
/Dh/	DhəR	‘back’	/D/	2	/h/	5
/gh/	ghəm	‘to take away the appetite’	/g/	4	/h/	5

c. Voiceless-fricative+ voiceless fricative

(261)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/fx/	fxaD	‘thigh’	/f/	3	/x/	5
/fħ/	fħuliya	‘virility’	/f/	3	/ħ/	5
/fh/	fhəm	‘to understand’	/f/	3	/h/	5
/sx/	sxən	‘to get hot’	/s/	3	/x/	5
/sħ/	sħab	‘clouds’	/s/	3	/ħ/	5
/sh/	sha	‘to get distracted’	/s/	3	/h/	5
/Sx/	SxəR	‘rock’	/S/	3	/x/	5
/Sħ/	Sħab	‘friends’	/S/	3	/ħ/	5
/Sh/	Shəl	‘to neigh’	/S/	3	/h/	5
/ʃx/	ʃxəR	‘to snore’	/ʃ/	3	/x/	5
/ʃħ/	ʃħəT	‘to strike’	/ʃ/	3	/ħ/	5
/ʃh/	ʃhəR	‘month’	/ʃ/	3	/h/	5

d. Voiced-fricative+ voiceless fricative

(262)

Clusters	**Words**	**Gloss**	**Sound (1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/zħ/	zħam	‘crowd’	/z/	4	/ħ/	5
/zh/	zhəR	‘luck’	/z/	4	/h/	5
/ʒħ/	ʒħuʃa	‘young donkeys’	/ʒ/	4	/ħ/	5
/ʒh/	ʒhəl	‘to get angry’	/ʒ/	4	/h/	5

IV.1.5.1.5. Consonant + Voiced stop

The consonant+voiced stop onset pattern has been observed in **14** cases out of **221** unfolding in three subpatterns: 1) voiceless stop+voiced stop (8 instances), and 2) voiced stop+ voiced stop (2), and 3) voiceless fricative+ voiced stop (4), as presented below:

a. Voiceless-stop+ voiced stop

(263)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/tb/	tbən	‘straw’	/t/	1	/b/	2
/Tb/	Tbəx	‘to cook’	/T/	1	/b/	2
/tg/	tgərrəʕ	‘to beltch’	/t/	1	/g/	4
/kb/	kbər	‘to get big’	/k/	1	/b/	2
/qb/	qbəR	‘tomb’	/q/	1	/b/	2
/kd/	kdəb	‘to lie’	/k/	1	/d/	2
/qd/	qdam	‘to get old’	/q/	1	/d/	2
/qD/	qDa	‘to accomplish’	/q/	1	/D/	2

b. Voiced-stop+voiced stop

(264)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bg/	bgər	‘cows’	/b/	2	/g/	4
/dg/	dgig	‘flour’	/d/	2	/g/	4

c. Voiceless fricative+ voiced stop

(265)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound (2)	Sonority index
/fg/	fgəs	‘to break’	/f/	3	/g/	4
/sg/	sga	‘to water’	/s/	3	/g/	4
/Sg/	Sgəʕ	‘stubborn’	/S/	3	/g/	4
/ʃg/	ʃgig	‘brother’	/ʃ/	3	/g/	4

IV.1.5.1.6. Consonant+ Glide

The consonant-glide onset pattern has been seen in **46** instances out of **221** distributed into six basic subpatterns: 1) voiced-stop+glide (8 instances), 2) voiceless-stop+glide (8), 3) voiced-fricative+glide (8) , 4) voiceless-fricative+ glide (14), 5) nasal+glide (4), and 6) liquid+glide (4), as illustrated below:

a. Voiced-stop+Glide

(266)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bw/	bwaʒa	‘cranes’	/b/	2	/w/	9
/by/	byəD	‘white’	/b/	2	/y/	9
/dw/	dwi	‘to speak’	/d/	2	/w/	9
/dy/	dyab	‘wolves’	/d/	2	/y/	9
/Dw/	Dwa	‘to get light’	/D/	2	/w/	9
/Dy/	Dyaq	‘to become narrow’	/D/	2	/y/	9
/gw/	gwaməl	‘pans’	/g/	4	/w/	9
/gy/	gyud	‘guides’	/g/	4	/y/	9

b. Voiceless-stop+ Glide

(267)

Clusters	Words	Gloss	Sound (1)	Sonority index	Sound(2)	Sonority index
/tw/	twam	‘twins’	/t/	1	/w/	9
/ty/	tyəssər	‘to be obtainable’	/t/	1	/y/	9
/Tw/	Twil	‘long’	/T/	1	/w/	9
/Ty/	TyuR	‘birds’	/T/	1	/y/	9
/kw/	kwira	‘ball’	/k/	1	/w/	9
/ky/	kyus	‘pouch’	/k/	1	/y/	9
/qw/	qwi	‘strong’	/q/	1	/w/	9
/qy/	qyas	‘measurement’	/q/	1	/y/	9

c. Voiced-fricative+ Glide

(268)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sobority index
/zw/	zwin	‘handsome’	/z/	4	/w/	9
/zy/	zyan	‘to become nice’	/z/	4	/y/	9
/ʒw/	ʒwa	‘envelope’	/ʒ/	4	/w/	9
/ʒy/	ʒyub	‘pockets’	/ʒ/	4	/y/	9
/ɣw/	ɣwat	‘shouting’	/ɣ/	4	/w/	9
/ɣy/	ɣyam	‘clouds’	/ɣ/	4	/y/	9
/ʕw/	ʕwəR	‘blind’	/ʕ/	5	/w/	9
/ʕy/	ʕyad	‘feasts’	/ʕ/	5	/y/	9

d. Voiceless-fricative+ glide

(169)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/fw/	fwaR	‘steam’	/f/	3	/w/	9
/fy/	fyaq	‘wakefulness’	/f/	3	/y/	9
/sw/	swarət	‘keys’	/s/	3	/w/	9
/sy/	syuf	‘swords’	/s/	3	/y/	9
/Sw/	Swab	‘good manners’	/S/	3	/w/	9
/Sy/	Syam	‘fasting’	/S/	3	/y/	9
/ʃw/	ʃwa	‘steamed meat’	/ʃ/	3	/w/	9
/ʃy/	ʃyaT	‘odor of burning hair’	/ʃ/	3	/y/	9
/ħw/	ħwəl	‘cross-eyed’	/ħ/	5	/w/	9
/ħy/	ħyuT	‘walls’	/ħ/	5	/y/	9
/hw/	hwəd	‘to go down’	/h/	5	/w/	9
/hy/	hyuʃ	‘asses’	/h/	5	/y/	9
/xw/	xwən	‘to steal’	/x/	5	/w/	9
/xy/	xyab	‘to become ugly’	/x/	5	/y/	9

e. Nasal+glide

(170)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/mw/	mwəssəx	‘dirty’	/m/	6	/w/	9
/my/	myəSSəl	‘original’	/m/	6	/y/	9
/nw/	nwi	‘intend’	/n/	6	/w/	9
/ny/	nyab	‘canines’	/n/	6	/w/	9

f. Liquid+ Glide

(271)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/lw/	lwi	‘twist’	/l/	7	/w/	9
/ly/	lyum	‘today’	/l/	7	/y/	9
/rw/	Rwaħ	‘cold’	/r/	7	/w/	9
/ry/	ryal	‘coin’	/r/	7	/y/	9

As I already mentioned, the conformity patterns are six. They can be represented as follows:

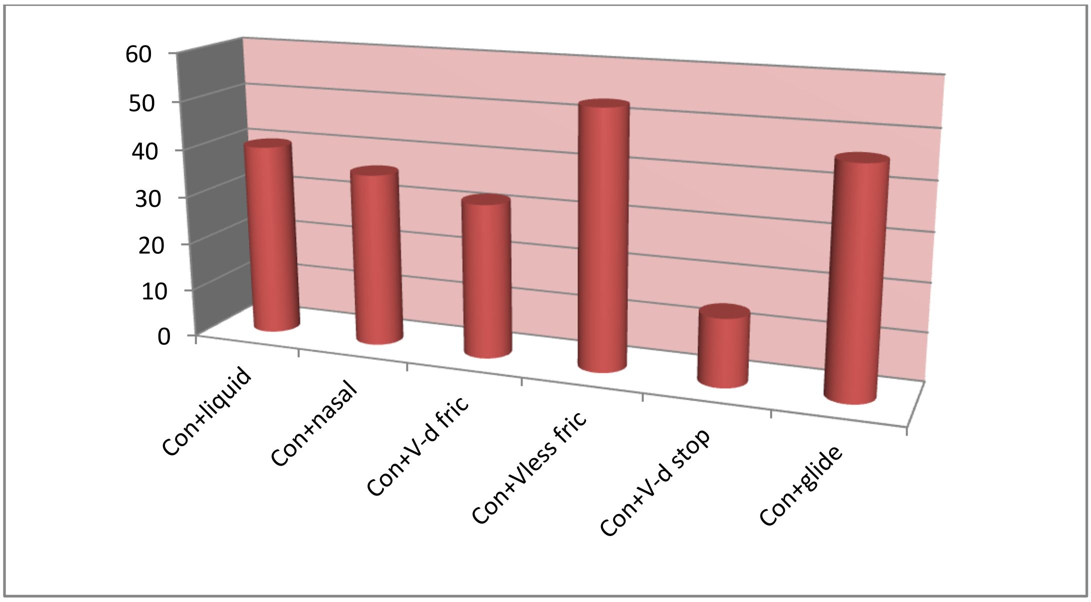


Figure 3: Conformity Patterns

Having identified the different CC patterns and subpatterns that conform to SSP, and shown that this conformity can only appear in **221** clusters out of **485** clusters. I can conclude that CMA onset is partially conditioned by this principle, and this provides an answer to one of the questions asked in the introduction above.

Having said this, legitimate CC onsets that violate SSP in the manner of sonority plateaus and reversals are discussed below.

IV.1.5.2. Violation of Sonority Sequencing Principle

In this section, I am going to deal with all the possible clusters that violate SSP.

IV.1.5.2.1. Sonority Plateaus

Sonority plateaus unfold in **38** instances that can be categorized into nine patterns: 1) nasal+nasal (4 instances), 2) voiced fricative+ voiced fricative (5), 3) voiceless fricative+ voiceless fricative (10), 4) voiced stop+voiced stop (6), 5) voiceless stop+voiceless stop (7), 6) liquid+liquid (2), 7) glide+glide (2), 8) voiced fricative+voiced stop (1), and 9) voiced stop+voiced fricative (1), as identified and exemplified below:

a. **Nasal+nasal**

(272)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/mm/	mmi	‘my mother’	/m/	6	/m/	6
/mn/	mnam	‘sleep’	/m/	6	/n/	6
/nm/	nməl	‘ants’	/n/	6	/m/	6
/nn/	nnas	‘people’	/n/	6	/n/	6

b. Voiced-fricative+ voiced-fricative

(273)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/zz/	zzənqa	‘the street’	/z/	4	/z/	4
/ʒʒ/	ʒʒru	‘the dog’	/ʒ/	4	/ʒ/	4
/zγ/	zγəb	‘hair’	/z/	4	/γ/	4
/ʒγ/	ʒγəm	‘to hang’	/ʒ/	4	/γ/	4
/γz/	γzal	‘gazelle’	/γ/	4	/z/	4

c. Voiceless-fricative+ voiceless fricative

(274)

Clusters	Words	Gloss	Sound (1)	Sonority index	Sound(2)	Sonority index
/ff/	ffad	‘viscera’	/f/	3	/f/	3
/fs/	fsəx	‘to annul’	/f/	3	/s/	3
/fS/	fSəl	‘to separate’	/f/	3	/S/	3
/fʃ/	fʃəl	‘to fail’	/f/	3	/ʃ/	3
/sf/	sfina	‘ship’	/s/	3	/f/	3
/Sf/	SfəR	‘yellow’	/S/	3	/f/	3
/ʃf/	ʃfəR	‘to steal’	/ʃ/	3	/f/	3
/ss/	ssuq	‘the market’	/s/	3	/s/	3
/SS/	SSaka	‘tobacco store’	/S/	3	/S/	3
/ʃʃ/	ʃʃiTan	‘the satan’	/ʃ/	3	/ʃ/	3

d. Voiced-stop+ voiced-stop

(275)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound (2)	Sonority index
/bb/	bba	‘my father’	/b/	2	/b/	2
/bd/	bda	‘he began’	/b/	2	/d/	2
/db/	dbal	‘to fade’	/d/	2	/b/	2

/Db/	Dbəʕ	‘hyena’	/D/	2	/b/	2
/dd/	dda	‘he took’	/d/	2	/d/	2
/DD/	DDyaf	‘guests’	/D/	2	/D/	2

e. Voiceless-stop+voiceless-stop

(276)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/tt/	ttasəl	‘to call’	/t/	1	/t/	1
/TT/	TTəRʒəm	‘to translate’	/T/	1	/T/	1
/tk/	tkəlləm	‘to talk’	/t/	1	/k/	1
/tq/	tqəb	‘to pierce’	/t/	1	/q/	1
/kt/	ktəf	‘shoulder’	/k/	1	/t/	1
/qt/	qtəl	‘to kill’	/q/	1	/t/	1
/qT/	qTən	‘cotton’	/q/	1	/T/	1

f. Liquid+liquid

(277)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ll/	llun	‘the color’	/l/	7	/l/	7
/rr/	RRaʒəl	‘the man’	/r/	7	/r/	7

g. Glide-glide

(278)

Clusters	Words	Gloss	Sound (1)	Sonority index	Sound(2)	Sonority index
/yy/	yyəh	‘yes’	/y/	9	/y/	9
/yw/	ywəlli	‘to become’	/y/	9	/w/	9

h. Voiced-fricative+ voiced-stop

(279)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/zg/	zgəl	‘to miss’	/z/	4	/g/	4

j. Voiced-stop+ voiced-fricative

(280)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/gz/	gzəR	'to hit someone violently'	/g/	4	/z/	4

This can be presented as follows:

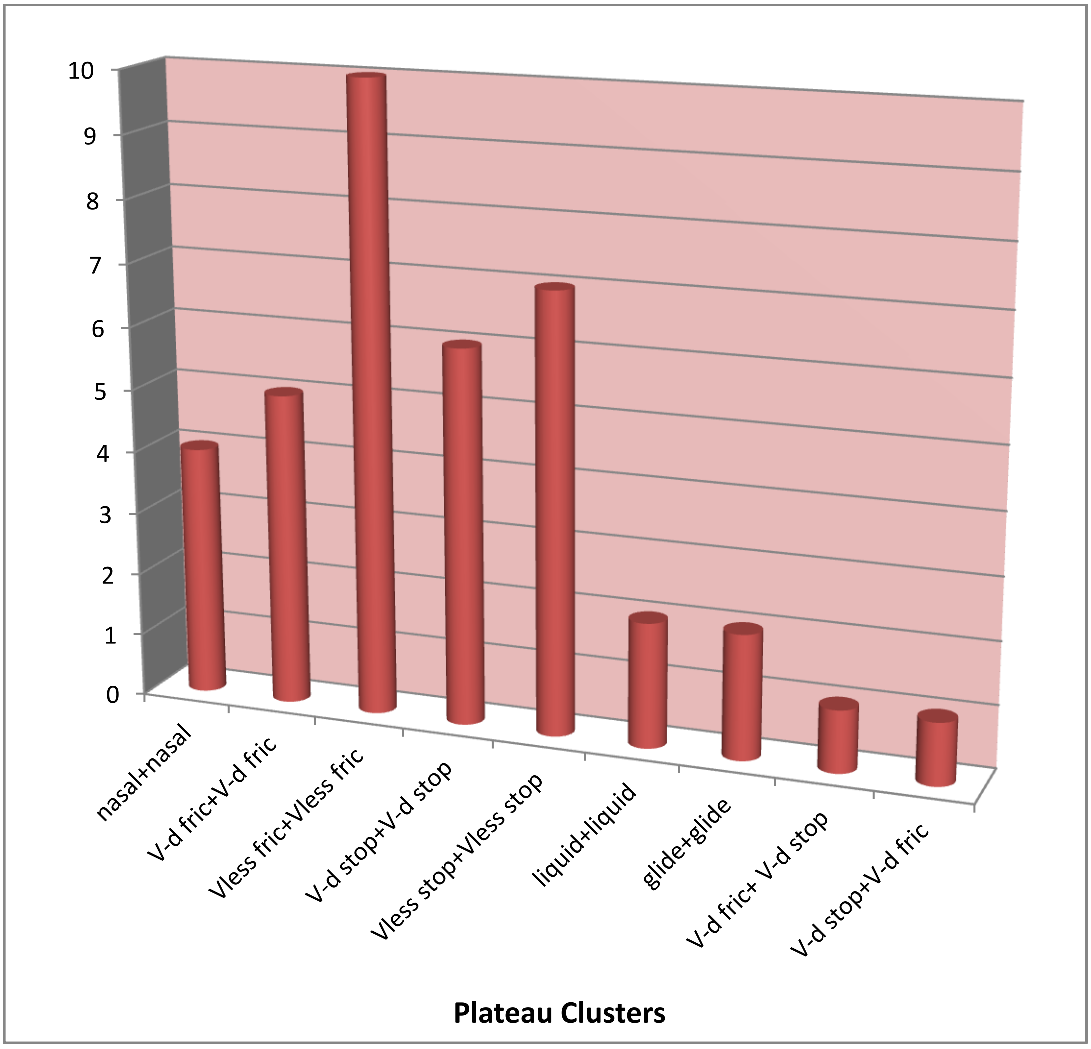


Figure 4: Plateau Patterns

As can be observed in the above figure, the pattern of voiceless fricative+ voiceless fricative is the largest amongst the sonority plateau patterns and this can be attributed to the existence of seven voiceless fricative consonants in CMA phonemic inventory, in contrast with less members in all other natural classes.

The presentation above provides us with an exhaustive answer to one of the questions related to sonority plateaus in CMA onset. The occurrence of only **38** clusters of plateaus in the onset shows that sonority plateaus are less frequent.

IV.1.5.2.2. Sonority Reversals

Almost half of the CC clusters in the data can be regarded as sonority reversals: **226** cases of **485**. This category has been found to include the following 6 patterns, which are the reverse of the conforming patterns:

(281)

(1) Liquid+ consonant (40 instances)

(2) Nasal+consonant (38)

(3) Voiced fricative+ consonant (36)

(4) Voiceless fricative+ consonant (55)

(5) Voiced stop+ consonant (13)

(6) Glide+ consonant (43)

This can be exhibited in the following figure:

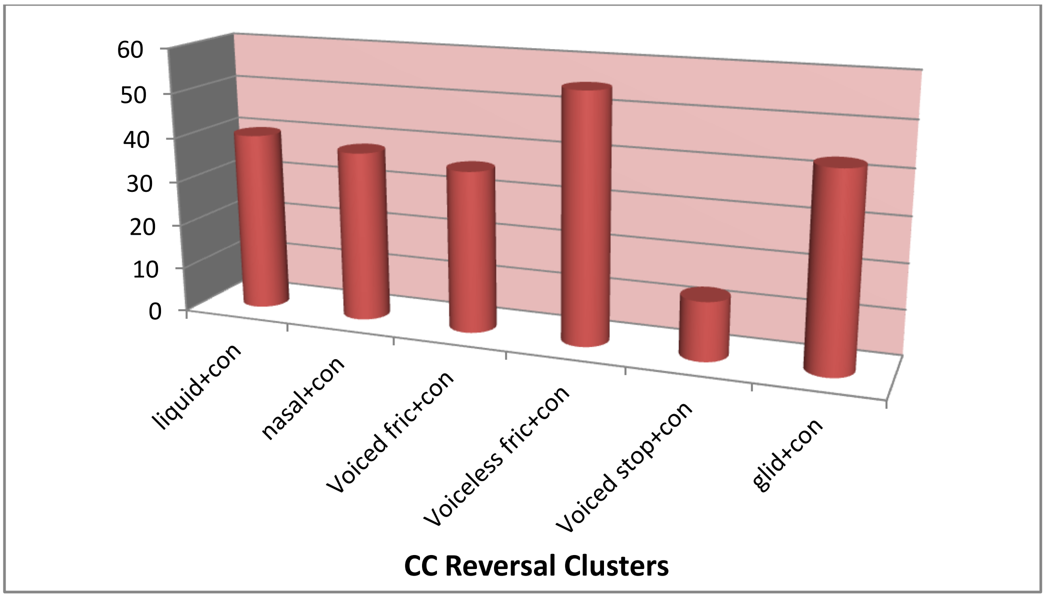


Figure 5: Reversal Patterns

IV.1.5.2.2.1. Liquid+ consonant

40 CC onset instances out of **226** were found to follow the pattern liquid+consonant, where the second consonant can be nasal (3 instances), voiced fricative (8), voiceless fricative (13), voiceless stop (8), and voiced stop (8), as exhibited below:

a. Liquid+nasal

(282)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/lm/	lmaʕ	‘it becomes shining	/l/	7	/m/	6
/rm/	RmaD	‘ashes’	/r/	7	/m/	6
/rn/	Rnəb	‘hare’	/r/	7	/n/	6

b. Liquid+ voiced fricative

(283)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/lz/	lzəm	‘to owe’	/l/	7	/z/	4
/lʒ/	lʒam	‘rein’	/l/	7	/ʒ/	4
/rz/	rzəq	‘fortune’	/r/	7	/z/	4
/rʒ/	rʒəl	‘leg’	/r/	7	/ʒ/	4
/lγ/	lγa	‘to chat’	/l/	7	/γ/	4
/lʕ/	lʕəb	‘to play’	/l/	7	/ʕ/	5
/rγ/	Rγawi	‘foams’	/r/	7	/γ/	4
/rʕ/	rʕəf	‘to bleed from the nose’	/r/	7	/ʕ/	5

c. Liquid+ voiceless fricative

(284)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/lf/	lfaʕi	‘snakes’	/l/	7	/f/	3
/rf/	rfəd	‘to pick up’	/r/	7	/f/	3
/ls/	lsan	‘tongue’	/l/	7	/s/	3
/lS/	lSəq	‘to stick’	/l/	7	/S/	3
/rs/	rsəm	‘to draw’	/r/	7	/s/	3
/rS/	RSa	‘to stop’	/r/	7	/S/	3
/rʃ/	rʃawi	‘bribes’	/r/	7	/ʃ/	3
/lx/	lxənʃa	‘the sack’	/l/	7	/x/	5

/lħ/	lħəs	‘to lick’	/l/	7	/ħ/	5
/lh/	lhət	‘to pant, to gasp’	/l/	7	/h/	5
/rx/	RxiS	‘cheap’	/r/	7	/x/	5
/rħ/	Rħəl	‘to move’	/r/	7	/ħ/	5
/rh/	Rhif	‘thin’	/r/	7	/h/	5

d. Liquid+ voiceless stop

(285)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/lt/	ltam	‘veil’	/l/	7	/t/	1
/lT/	lTəf	‘to be gentle toward’	/l/	7	/T/	1
/rt/	rtaħ	‘to rest’	/r/	7	/t/	1
/rT/	RTəb	‘soft’	/r/	7	/T/	1
/lk/	lkərsi	‘the chair’	/l/	7	/k/	1
/lq/	lqa	‘he found’	/l/	7	/q/	1
/rk/	Rkəb	‘to mount’	/r/	7	/k/	1
/rq/	Rqiq	‘thin’	/r/	7	/q/	1

e. Liquid+voiced stop

(286)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/lb/	lbəs	‘to wear’	/l/	7	/b/	2
/rb/	Rbəħ	‘to win’	/r/	7	/b/	2
/ld/	ldid	‘delicious’	/l/	7	/d/	2
/lD/	lDəγ	‘to sting’	/l/	7	/D/	2
/rd/	rdəm	‘to bury with debris’	/r/	7	/d/	2
/rD/	rDəʕ	‘to suckle’	/r/	7	/D/	2
/lg/	lga	‘he found’	/l/	7	/g/	4
/rg/	rgəd	‘to sleep’	/r/	7	/g/	4

IV.1.5.2.2.2. Nasal + Consonant

The nasal+ consonant onset pattern has been seen in **38** instances out of **226** distributed into four basic subpatterns: 1) nasal+ voiced fricative (8 instances), 2) nasal+ voiceless fricative (14), 3) nasal+ voiced stop (8), and 4) nasal +voiceless stop (8), as illustrated below:

a. Nasal+voiced-fricative

(287)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/mz/	mzaħ	‘joking’	/m/	6	/z/	4
/mʒ/	mʒəR	‘drawer’	/m/	6	/ʒ/	4
/mγ/	mγərfa	‘ladle’	/m/	6	/γ/	4
/mʕ/	mʕəlqa	‘spoon’	/m/	6	/ʕ/	5
/nz/	nzəl	‘to fall’	/n/	6	/z/	4
/nʒ/	nʒəħ	‘to succeed’	/n/	6	/ʒ/	4
/nγ/	nγəz	‘to prick’	/n/	6	/γ/	4
/nʕ/	nʕəs	‘to sleep’	/n/	6	/ʕ/	5

b. Nasal+ voiceless-fricative

(288)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/mf/	mfəlləs	‘crasy’	/m/	6	/f/	3
/ms/	msəlmin	‘Muslims’	/m/	6	/s/	3
/mS/	mSəTTi	‘crasy’	/m/	6	/S/	3
/mʃ/	mʃa	‘to go’	/m/	6	/ʃ/	3
/mx/	mxədda	‘cushion’	/m/	6	/x/	5
/mħ/	mħənʃa	‘a kind of cake’	/m/	6	/ħ/	5
/mh/	mhəl	‘to give a respite to’	/m/	6	/h/	5
/nf/	nfəx	‘to pump up’	/n/	6	/f/	3
/ns/	nsər	‘vulture’	/n/	6	/s/	3
/nS/	nSəħ	‘to advise’	/n/	6	/S/	3
/nʃ/	nʃəR	‘to hang’	/n/	6	/ʃ/	3
/nx/	nxəl	‘palm-tree’	/n/	6	/x/	5
/nħ/	nħəl	‘bees’	/n/	6	/ħ/	5
/nh/	nhaR	‘day’	/n/	6	/h/	5

c. Nasal+ voiced stop

(289)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/mb/	mbəxRa	‘censer’	/m/	6	/b/	2
/md/	mdina	‘city’	/m/	6	/d/	2
/mD/	mDəγ	‘to chew’	/m/	6	/D/	2
/mg/	mgadd	‘straight’	/m/	6	/g/	4

/nb/	nbəħ	‘to bark’	/n/	6	/b/	2
/nd/	ndəm	‘to regret’	/n/	6	/d/	2
/nD/	nDif	‘clean’	/n/	6	/D/	2
/ng/	ngab	‘veil’	/n/	6	/g/	4

d. Nasal+ voiceless stop

(290)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/mt/	mtawya	‘bargaining’	/m/	6	/t/	1
/mT/	mTərqa	‘hammer’	/m/	6	/T/	1
/mk/	mkəħla	‘rifle’	/m/	6	/k/	1
/mq/	mqəS	‘scissor’	/m/	6	/q/	1
/nt/	ntaqəm	‘to take revenge for’	/n/	6	/t/	1
/nT/	nTəħ	‘to hit with the horns’	/n/	6	/T/	1
/nk/	nkəR	‘to deny’	/n/	6	/k/	1
/nq/	nqəd	‘to save’	/n/	6	/q/	1

IV.1.5.2.2.3. Voiced fricative+ consonant

The voiced fricative+consonant onset pattern has been observed in **36** cases that spread out in four subpatterns: 1) voiced fricative +voiced stop (13 instances), 2) voiced fricative+ voiceless stop (11), 3) voiced fricative+ voiceless fricative (10 instances), and 4) voiced fricative +voiced fricative (2), as demonstrated below:

a. Voiced-fricative+ voiced stop

(291)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/zb/	zbəl	‘rubbish’	/z/	4	/b/	2
/ʒb/	ʒbəl	‘mountain’	/ʒ/	4	/b/	2
/zd/	zdəħ	‘to slam’	/z/	4	/d/	2
/zD/	zDəm	‘to step on’	/z/	4	/D/	2
/ʒd/	ʒdər	‘root’	/ʒ/	4	/d/	2
/ʒD/	ʒDaRtək	‘your origin’	/ʒ/	4	/D/	2
/γb/	γbəR	‘to disappear’	/γ/	4	/b/	2
/ʕb/	ʕbəR	‘to weigh’	/ʕ/	5	/b/	2
/γd/	γdiR	‘stream’	/γ/	4	/d/	2
/γD/	γDəb	‘to get angry’	/γ/	4	/D/	2
/ʕd/	ʕdəs	‘lentils’	/ʕ/	5	/d/	2
/ʕD/	ʕDəm	‘bone’	/ʕ/	5	/D/	2

/ʕg/	ʕgəz	‘to become lazy’	/ʕ/	5	/g/	4

b. Voiced-fricative+ voiceless stop

(292)

Clusters	Words	Gloss	Sound (1)	Sonority index	Sound (2)	Sonority index
/zT/	zTəm	‘to convince’	/z/	4	/T/	1
/ʒt/	ʒtu	‘I brought it’	/ʒ/	4	/t/	1
/ʒT/	ʒTək	‘your part’	/ʒ/	4	/T/	1
/zk/	zka	‘to increase’	/z/	4	/k/	1
/zq/	zqiqa	‘small/tiny thing’	/z/	4	/q/	1
/γt/	γtəb	‘to talk back’	/γ/	4	/t/	1
/γT/	γTəS	‘to immerse’	/γ/	4	/T/	1
/ʕt/	ʕtəq	‘to save’	/ʕ/	5	/t/	1
/ʕT/	ʕTəʃ	‘to become thirsty’	/ʕ/	5	/T/	1
/ʕk/	ʕkəR	‘lipstick’	/ʕ/	5	/k/	1
/ʕq/	ʕqəl	‘mind’	/ʕ/	5	/q/	1

c. Voiced-fricative+ voiceless fricative

(293)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound (2)	Sonority index
/zf/	zfəR	‘to stink’	/z/	4	/f/	3
/ʒf/	ʒfən	‘region under the eye’	/ʒ/	4	/f/	3
/γf/	γfəR	‘to forgive’	/γ/	4	/f/	3
/ʕf/	ʕfən	‘filthiness’	/ʕ/	5	/f/	3
/γs/	γsəl	‘to wash’	/γ/	4	/s/	3
/γS/	γSəb	‘to deprive’	/γ/	4	/S/	3
/γʃ/	γʃim	‘inexperienced’	/γ/	4	/ʃ/	3
/ʕs/	ʕsəl	‘honey’	/ʕ/	5	/s/	3
/ʕS/	ʕSa	‘stick’	/ʕ/	5	/S/	3
/ʕʃ/	ʕʃub	‘herbs’	/ʕ/	5	/ʃ/	3

d. Voiced-fricative+ voiced fricative

(294)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ʕz/	ʕzəl	‘to separate’	**/ʕ/**	**5**	**/z/**	**4**
/ʕʒ/	ʕʒəl	‘calf’	**/ʕ**	**5**	**/ʒ/**	**4**

IV.1.5.2.2.4. Voiceless fricative + consonant

The voiceless fricative +consonant onset pattern has been seen in **55** cases unfolding in four subpatterns: 1) voiceless fricative +voiceless stop (22 instances), 2) voiceless fricative+ voiced stop (18), 3) voiceless fricative+ voiceless fricative (9), and 4) voiceless fricative + voiced fricative (6), as shown below:

a. Voiceless-fricative+ voiceless stop

(295)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ʃk/	ʃkəR	‘to thank’	/ʃ/	3	/k/	1
/ʃq/	ʃqiqa	‘migraine’	/ʃ/	3	/q/	1
/xt/	xtaRəʕ	‘to invent’	/x/	5	/t/	1
/xT/	xTəb	‘to give a speech’	/x/	5	/T/	1
/ħt/	ħtaRəm	‘to respect’	/ħ/	5	/t/	1
/ħT/	ħTəb	‘fire wood’	/ħ/	5	/T/	1
/ht/	htəm	‘to take care of’	/ħ/	5	/t/	1
/ħk/	ħkəm	‘to govern’	/ħ/	5	/k/	
/ħq/	ħqəd	‘to detest’	/ħ/	5	/q/	1
/hg/	hgiyya	‘hiccups’	/h/	5	/g/	4
/ft/	ftəq	‘hernia’	/f/		/t/	1
/fT/	fTəR	‘to have breakfast’	/f/	3	/T/	1
/fk/	fkaRən	‘turtles’	/f/	3	/k/	1
/fq/	fqih	‘Imam’	/f/	3	/q/	1
/st/	stər	‘to hide’	/s/	3	/t/	1
/sT/	sTəl	‘bucket’	/s/	3	/T/	1
/ST/	STinaʕi	‘artificial’	/S/	3	/T/	1
/ʃt/	ʃta	‘rain’	/ʃ/	3	/t/	1
/ʃT/	ʃTəħ	‘to dance’	/ʃ/	3	/T/	1
/sk/	skən	‘to live’	/s/	3	/k/	1
/sq/	sqəf	‘ceiling ’	/s/	3	/q/	1
/Sq/	Sqəl	‘to polish’	/S/	3	/q/	1

b. Voiceless fricative+ voiced stop

(296)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/fd/	fdadən	‘fields’	/f/	3	/d/	2
/fD/	fDəħ	‘to reveal’	/f/	3	/D/	2
/sb/	sbəʕ	‘lion’	/s/	3	/b/	2
/Sb/	Sbəʕ	‘finger’	/S/	3	/b/	2
/ʃb/	ʃbər	‘one span’	/ʃ/	3	/b/	2

/sd/	sdər	‘chest’	/s/	3	/d/	2
/SD/	SDaf	‘noise’	/S/	3	/D/	2
/ʃd/	ʃdəg	‘cheek’	/ʃ/	3	/d/	2
/xb/	xbaR	‘news’	/x/	5	/b/	2
/ħb/	ħbəs	‘to imprison’	/ħ/	5	/b/	2
/hb/	hbəT	‘to go down’	/h/	5	/b/	2
/xd/	xdəm	‘to work’	/x/	5	/d/	2
/xD/	xDəR	‘green’	/x/	5	/D/	2
/ħd/	ħdid	‘iron’	/ħ/	5	/d/	2
/ħD/	ħDəR	‘to show up’	/ħ/	5	/D/	2
/hd/	hdiya	‘present’	/h/	5	/d/	2
/hD/	hDəR	‘to talk’	/h/	5	/D/	2
/ħg/	ħgəR	‘to humiliate’	/ħ/	5	/g/	4

c. Voiceless fricative+ voiceless fricative

(297)

Clusters	words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/xf/	xfaf	‘to become light’	/x/	5	/f/	3
/ħf/	ħfəR	‘to dig’	/ħ/	5	/f/	3
/xs/	xsəR	‘to lose’	/x/	5	/s/	3
/xS/	xSuma	‘quarrel’	/x/	5	/S/	3
/xʃ/	xʃəb	‘wood’	/x/	5	/ʃ/	3
/ħs/	ħsəb	‘to count’	/ħ/	5	/s/	3
/ħS/	ħSira	‘mat’	/ħ/	5	/S/	3
/ħʃ/	ħʃiʃ	‘grass’	/ħ/	5	/ʃ/	3
/hʃ/	hʃiʃ	‘tender’	/h/	5	/ʃ/	3

d. Voiceless fricative+ Voiced fricative

(298)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/xz/	xzən	‘to store’	/x/	5	/z/	4
/xƷ/	xƷəl	‘to be shy’	/x/	5	/Ʒ/	4
/ħz/	ħzəm	‘to tie up’	/ħ/	5	/z/	4
/ħƷ/	ħƷəR	‘stones’	/ħ/	5	/Ʒ/	4
/hz/	hzəm	‘to beat’	/h/	5	/z/	4
/hƷ/	hƷəm	‘to attack’	/h/	5	/Ʒ/	4

IV.1.5.2.2.5. Voiced stop+consonant

The voiced stop+ consonant onset pattern has been observed in **13** cases out of **226** unfolding in three subpatterns: 1) voiced stop +voiceless stop (8 instances), and 2) voiced stop+ voiced stop (2), and 3) voiced stop +voiceless fricative (3), as presented below:

a. Voiced-stop+ voiceless stop

(299)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bt/	btima	'a kind of herbs'	/b/	2	/t/	1
/bT/	bTaTa	'potatoes'	/b/	2	/T/	1
/bk/	bka	'cry'	/b/	2	/k/	1
/bq/	bqa	'to remain'	/b/	2	/q/	1
/dk/	dkər	'to mention'	/d/	2	/k/	1
/dq/	dqiqa	'minute'	/d/	2	/q/	1
/Dq/	Dqəq	'to scrutinize'	/D/	2	/q/	1
/gT/	gTaR	'hectare'	/g/	4	/T/	1

b. Voiced-stop+ voiced stop

(300)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/gb/	gbəD	'to take'	/g/	4	/b/	2
/gd/	gdəm	'the heel'	/g/	4	/d/	2

c. Voiced-stop+ voiceless fricative

(301)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/gf/	gfaf	'baskets'	/g/	4	/f/	3
/gS/	gSəb	'reeds'	/g/	4	/S/	3
/gʃ/	gʃuR	'barks'	/g/	4	/ʃ/	3

IV.1.5.2.2.6. Glide+consonant

The glide +consonant onset pattern has been seen in **43** instances out of **226** distributed into six basic subpatterns: 1) glide +voiced-stop (7 instances), 2) glide +voiceless-stop (8), 3) glide+ voiced-fricative (7) , 4) glide+ voiceless-fricative (14), 5) glide+ nasal (3), and 6) glide + liquid (4), as illustrated below

a. Glide+ voiced-stop

(302)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wd/	wdən	'ear'	/w/	9	/d/	2
/wD/	wDu	'ablution'	/w/	9	/D/	2
/wg/	wgəf	'to stand up	/w/	9	/g/	4
/yb/	ybəs	'to get dry'	/y/	9	/b/	2
/yd/	ydux	'to get dizzy'	/y/	9	/d/	2
/yD/	yDuq	'to taste'	/y/	9	/D/	2
/yg/	ygul	'to say'	/y/	9	/g/	4

b. Glide+ voiceless-stop

(303)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wt/	wtəd	'peg'	/w/	9	/t/	1
/wT/	wTaR	'guitar'	/w/	9	/T/	1
/wk/	wkəħ	'to dry up'	/w/	9	/k/	1
/wq/	wqəf	'to stand up'	/w/	9	/q/	1
/yt/	ytim	'orphan'	/y/	9	/t/	1
/yT/	yTiʕ	'to obey'	/y/	9	/T/	1
/yk/	ykun	'to be'	/y/	9	/k/	1
/yq/	yqum	'to do'	/y/	9	/q/	1

c. Glide+voiced-fricative

(304)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wz/	wzən	'to weigh'	/w/	9	/z/	4
/wʒ/	wʒəʕ	'pain'	/w/	9	/ʒ/	4
/wʕ/	wʕar	'to become difficult'	/w/	9	/ʕ/	5
/yz/	yzid	'to add'	/y/	9	/z/	4
/yʒ/	yʒib	'to bring'	/y/	9	/ʒ/	4
/yγ/	yγəlli	'to make sth expensive'	/y/	9	/γ/	4
/yʕ/	yʕəss	'to control'	/y/	9	/ʕ/	5

d. Glide+voiceless-fricative

(305)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wf/	wfa	‘to be faithful to’	/w/	9	/f/	3
/ws/	wsəx	‘dirt’	/w/	9	/s/	3
/wS/	wSəl	‘to arrive’	/w/	9	/S/	3
/wʃ/	wʃəm	‘to tattoo’	/w/	9	/ʃ/	3
/wx/	wxəR	‘to delay’	/w/	9	/x/	5
/wħ/	wħəl	‘to get stuck’	/w/	9	/ħ/	5
/wh/	whəm	‘premonition’	/w/	9	/h/	5
/yf/	yfəʃʃ	‘to deflate’	/y/	9	/f/	3
/ys/	ysədd	‘to close’	/y/	9	/s/	3
/yS/	ySəlli	‘to pray’	/y/	9	/S/	3
/yʃ/	yʃədd	‘to take’	/y/	9	/ʃ/	3
/yx/	yxəlli	‘to leave’	/y/	9	/x/	5
/yħ/	yħənn	‘to be kind with’	/y/	9	/ħ/	5
/yh/	yhərr	‘to tickle’	/y/	9	/h/	5

e. Glide+nasal

(306)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wn/	wnasa	‘companion/friends’	/w/	9	/m/	6
/ym/	yməll	‘to be fed up with’	/y/	9	/m/	6
/yn/	ynuD	‘to wake up’	/y/	9	/n/	6

f. Glide+liquid

(307)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wl/	wləd	‘to give birh’	/w/	9	/l/	7
/wr/	wrət	‘to inherit’	/w/	9	/r/	7
/yl/	yluħ	‘to throw’	/y/	9	/l/	7
/yr/	yrib	‘to fall down’	/y/	9	/r/	7

Having identified the different CC patterns and subpatterns that exhibit sonority reversals, and shown that **226** clusters violate SSP. I can confirm the previous conclusion that SSP is not a reliable phonological predictor for the CMA CC onset.

Based on the above exhaustive quantitative evidence, the study provides us with a thorough account of the different CMA CC onset patterns and subpatterns that either show conformity to the SSP or violate it in the manner of sonority reversals and plateaus. Contrary to what is taken for granted in the literature that MA or CMA CC onset normally complies with SSP, the study reveals compliance in **221** clusters out of **485** and, consequently, **264** clusters violate the SSP, distributed between the sonority plateaus (**38**) and sonority reversals (**226**)

IV.2. Word-final Consonant Clusters

In this section, I will list all the possible and impossible clusters in the coda. I will deal with the possible clusters that obey or violate both the OCP and SSP.

IV.2.1.Chart (2)

(308)

a.

	b	**f**	**m**	**w**	**t**	**T**	**d**	**D**	**s**	**S**	**z**	**n**	**l**
b	√bb	*bf	*bm	√bw	√bt	√bT	√bd	√bD	√bs	√bS	√bz	√bn	√bl
f	*fb	√ff	*fm	√fw	√ft	√fT	√fd	√fD	√fs	√fS	√fz	√fn	√fl
m	*mb	*mf	√mm	√mw	√mt	√mT	√md	√mD	√ms	√mS	√mz	√mn	√ml
w	√wb	√wf	√wm	*ww	√wt	√wT	√wd	√wD	√ws	√wS	√wz	√wn	√wl
t	√tb	√tf	√tm	√tw	√tt	*tT	*td	*tD	√ts	*tS	√tz	√tn	√tl
T	√Tb	√Tf	√Tm	√Tw	*Tt	√TT	*Td	*TD	*Ts	*TS	*Tz	√Tn	√Tl
d	√db	√df	√dm	√dw	*dt	*dT	√dd	*dD	√ds	*dS	*dz	√dn	√dl
D	√Db	√Df	√Dm	√Dw	*Dt	*DT	*Dd	√DD	*Ds	√DS	*Dz	√Dn	√Dl
s	√sb	√sf	√sm	√sw	√st	√sT	√sd	*sD	√ss	*sS	*sz	√sn	√sl
S	√Sb	√Sf	√Sm	√Sw	√St	√ST	*Sd	√SD	*Ss	√SS	*Sz	√Sn	√Sl
z	√zb	√zf	√zm	√zw	√zt	√zT	√zd	√zD	*zs	*zS	√zz	√zn	√zl
n	√nb	√nf	√nm	√nw	√nt	√nT	√nd	√nD	√ns	√nS	√nz	√nn	*nl
l	√lb	√lf	√lm	√lw	√lt	√lT	√ld	√lD	√ls	√lS	√lz	*ln	√ll
r	√rb	√rf	√rm	√rw	√rt	√rT	√rd	√rD	√rs	√rS	√rz	√rn	*rl
ʃ	√ʃb	√ʃf	√ʃm	√ʃw	√ʃt	√ʃT	√ʃd	√ʃD	*ʃs	*ʃS	*ʃz	√ʃn	√ʃl
ʒ	√ʒb	√ʒf	√ʒm	√ʒw	√ʒt	√ʒT	√ʒd	√ʒD	*ʒs	*ʒS	*ʒz	√ʒn	√ʒl
y	√yb	√yf	√ym	√yw	√yt	√yT	√yd	√yD	√ys	√yS	√yz	√yn	√yl
k	√kb	√kf	√km	√kw	√kt	*kT	√kd	*kD	√ks	*kS	*kz	√kn	√kl
g	√gb	√gf	√gm	√gw	√gt	√gT	√gd	*gD	*gs	√gS	√gz	√gn	√gl
q	√qb	√qf	√qm	√qw	√qt	√qT	√qd	√qD	√qs	√qS	√qz	√qn	√ql
x	√xb	√xf	√xm	√xw	√xt	√xT	√xd	√xD	√xs	√xS	√xz	√xn	√xl
ɣ	√ɣb	√ɣf	√ɣm	√ɣw	√ɣt	√ɣT	√ɣd	√ɣD	√ɣs	√ɣS	√ɣz	√ɣn	√ɣl
ħ	√ħb	√ħf	√ħm	√ħw	√ħt	√ħT	√ħd	√ħD	√ħs	√ħS	√ħz	√ħn	√ħl
ʕ	√ʕb	√ʕf	√ʕm	√ʕw	√ʕt	√ʕT	√ʕd	√ʕD	√ʕs	√ʕS	√ʕz	√ʕn	√ʕl
h	√hb	√hf	√hm	√hw	√ht	√hT	√hd	√hD	*hs	*hS	√hz	√hn	√hl

b.

	r	**ʃ**	**ʒ**	**y**	**k**	**g**	**q**	**x**	**γ**	**ħ**	**ʕ**	**h**
b	√br	√bʃ	√bʒ	√by	√bk	√bg	√bq	√bx	√bγ	√bħ	√bʕ	√bh
f	√fr	√fʃ	√fʒ	√fy	√fk	√fg	√fq	√fx	*fγ	√fħ	√fʕ	√fh
m	√mr	√mʃ	√mʒ	√my	√mk	√mg	√mq	√mx	√mγ	√mħ	√mʕ	√mh
w	√wr	√wʃ	√wʒ	*wy	√wk	√wg	√wq	√wx	*wγ	√wħ	√wʕ	√wh
t	√tr	√tʃ	√tʒ	√ty	√tk	√tg	√tq	√tx	√tγ	√tħ	√tʕ	√th
T	√Tr	*Tʃ	*Tʒ	√Ty	*Tk	*Tg	√Tq	*Tx	*Tγ	√Tħ	√Tʕ	*Th
d	√dr	√dʃ	*dʒ	√dy	√dk	√dg	√dq	√dx	√dγ	√dħ	√dʕ	√dh
D	√Dr	√Dʃ	√Dʒ	√Dy	*Dk	*Dg	√Dq	√Dx	√Dγ	√Dħ	√Dʕ	√Dh
s	√sr	*sʃ	*sʒ	√sy	√sk	√sg	√sq	√sx	√sγ	√sħ	√sʕ	√sh
S	√Sr	*Sʃ	*Sʒ	√Sy	* Sk	√Sg	√Sq	√Sx	√Sγ	√Sħ	√Sʕ	√Sh
z	√zr	*zʃ	*zʒ	√zy	√zk	√zg	√zq	√zx	√zγ	√zħ	√zʕ	√zh
n	*nr	√nʃ	√nʒ	√ny	√nk	√ng	√nq	√nx	√nγ	√nħ	√nʕ	√nh
l	*lr	√lʃ	√lʒ	√ly	√lk	√lg	√lq	√lx	√lγ	√lħ	√lʕ	√lh
r	√rr	√rʃ	√rʒ	√ry	√rk	√rg	√rq	√rx	√rγ	√rħ	√rʕ	√rh
ʃ	√ʃr	√ʃʃ	√ʃʒ	√ʃy	√ʃk	√ʃg	√ʃq	√ʃx	√ʃγ	√ʃħ	√ʃʕ	√ʃh
ʒ	√ʒr	*ʒʃ	√ʒʒ	√ʒy	√ʒk	√ʒg	√ʒq	√ʒx	√ʒγ	√ʒħ	√ʒʕ	√ʒh
y	√yr	√yʃ	√yʒ	√yy	√yk	√yg	√yq	√yx	√yγ	√yħ	√yʕ	√yh
k	√kr	√kʃ	*kʒ	√ky	√kk	*kg	*kq	*kx	*kγ	√kħ	√kʕ	*kh
g	√gr	√gʃ	*gʒ	√gy	*gk	√gg	*gq	*gx	*gγ	*għ	√gʕ	√gh
q	√qr	√qʃ	√qʒ	√qy	*qk	*qg	√qq	*qx	*qγ	√qħ	√qʕ	√qh
x	√xr	√xʃ	√xʒ	√xy	*xk	*xg	*xq	√xx	*xγ	*xħ	*xʕ	*xh
γ	√γr	√γʃ	*γʒ	√γy	*γk	*γg	*γq	*γx	*γγ	*γħ	*γʕ	*γh
ħ	√ħr	√ħʃ	√ħʒ	√ħy	√ħk	√ħg	√ħq	*ħx	*ħγ	√ħħ	*ħʕ	*ħh
ʕ	√ʕr	√ʕʃ	√ʕʒ	√ʕy	√ʕk	√ʕg	√ʕq	*ʕx	*ʕγ	*ʕħ	*ʕʕ	*ʕh
h	√hr	√hʃ	√hʒ	√hy	*hk	√hg	*hq	*hx	*hγ	*hħ	*hʕ	*hh

IV.2.2. Feature Geometry of Possible Clusters

In this section, CMA possible coda clusters will be deat with. **502** clusters are possible in CMA. These possible clusters have been seen to be divided into nine logically possible combinations, namely:

(309)

(1) Labial-Labial

(2) Labial-Coronal

(3) Labial-Dorso-guttural

(4) Coronal-Labial

(5) Coronal-Coronal

(6) Coronal-Dorso-guttural

(7) Dorso-guttural-Labial

(8) Dorso-guttural-Coronal

(9) Dorso-guttural-Dorso-guttural

Having said this, the first class of CC coda clusters will be looked into.

IV.2.2.1. Labial-Labial

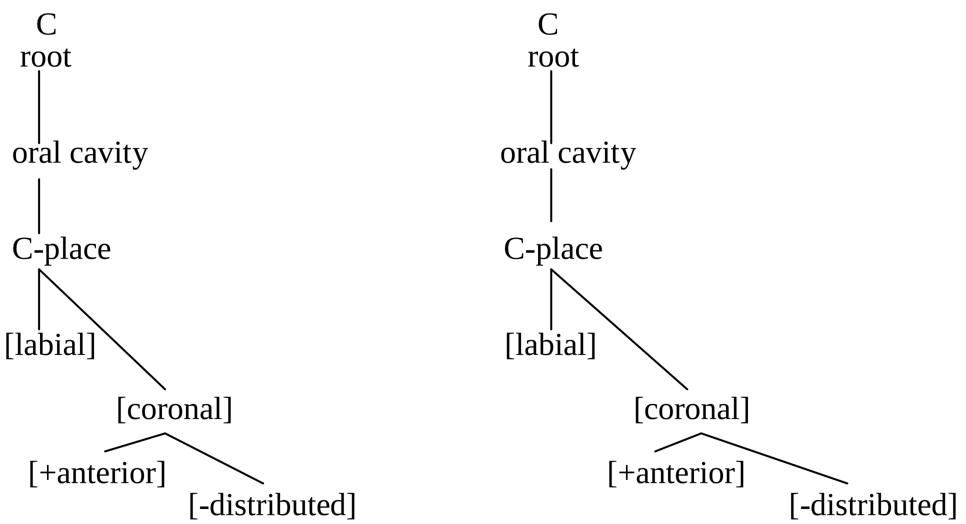
Labials can co-occur with other labials in the coda position, as shown below:

(310)

/bb/	kəbb	'to pour'
	səbb	'to insult'
/ff/	dəff	'a kind of tambourine without jingles'
	Səff	'row'
/fw/	ʕafw	'to give a pardon to'
/mm/	dəmm	'blood'
	fəmm	'mouth'
/wb/	ʒawb	'to answer'
/wm/	qawm	'to resist' '

To formalize the above combinations, let's consider the following representation:

(311)



IV.2.2.2. Labial-Coronal

Labial obstruents can co-occur with both coronal obstruents and coronal sonorants:

(312)

/bt/	səbt kəbt	'Saturday' 'suppression'	/bz/	xəbz dəbz	'bread' 'brawl'
/bT/	DəbT qəbT	'preciseness' 'constipation'	/fT/	nəfT	'oil'
/bd/	ʕəbd	'slave'	/fd/	wəfd	'delegation'
/bʃ/	kəbʃ	'sheep'	/bs/	ħəbs	'jail'
/ft/	ləft zəft	'turnip' 'asphalt'	/fs/	nəfs	'breath/pride'
/fD/	ħifD	'learning by heart'	/bS/	gəbS	'plaster'
/fS/	krafS	'celery'	/bl/	dubl	'double'
/fl/	gufl	'he inflated'			

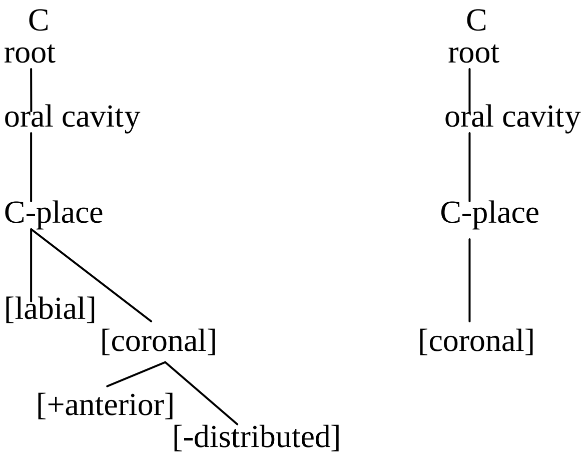
Labial sonorants can co-occur with both coronal obstruents and coronal sonorants:

(313)

/mt/	fhəmt Səmt zəmt	'I understood' 'silence' 'to be muggy'	/wd/	ʕawd	'horse'
/md/	ħamd	'praise'	/ws/	qəws	'arch'
/mD/	ħamD	'lemon'			
/ms/	nəms xəms	'ferret' 'five'	/wz/	ħəwz	'region near Marrakech'
/mz/	Rəmz	'symbol'	/wn/	kəwn ʕawn	'universe' 'assistance/ help'
/mr/	ʔamR ʕumR	'matter/order' 'lifetime	/wl/	ħawl	'to try'
/mʃ/	ʃəmʃ	'sun'	/wr/	DawR	'turn/role'
/wt/	Səwt	'silence'	/wD/	ʕawD	'instead of'

All the labial-coronal combinations can be represented as follows:

(314)



IV.2.2.3. Labial-Dorso-guttural

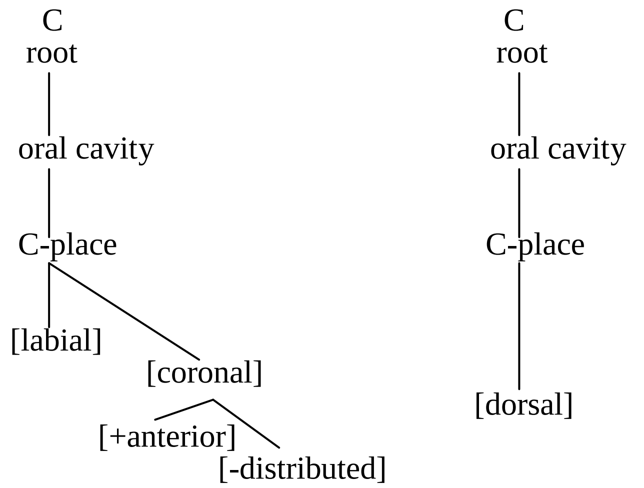
Both labial obstruents and labial sonorants co-occur with gutturals:

(315)

/bx/	Təbx	‘cooking’
/bʕ/	səbʕ	‘seven’
	rubʕ	‘quarter’
/bħ/	Subħ	‘first daily prayer’
/mk/	məkumk	‘he has the sense of humour’
/mq/	γamq	‘dark colored’
/mħ/	gəmħ	‘wheat’
/mʕ/	səmʕ	‘hearing’
	ʒəmʕ	‘assembly’
/mx/	səmx	‘ink’

The labial-dorsal combinations can be formalized as follows:

(316)



IV.2.2.4. Coronal-Labial

Both coronal obstruents and coronal sonorants can co-occur with labials:

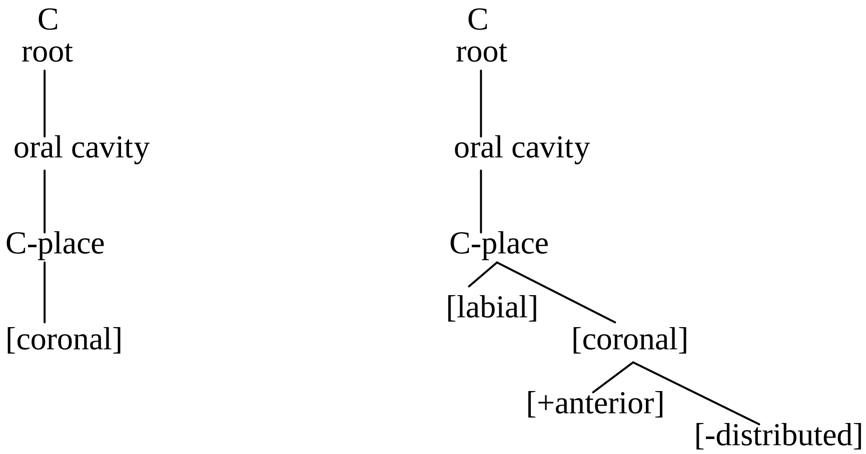
(317)

/Tb/	quTb	'pole'
/Tf/	luTf	'gentleness'
	ʕaTf	'sympathetic kindness'
/sm/	qism	'class'
/Sf/	wəSf	'description'
/zm/	ʕazm	'desire'
/nb/	dənb	'sin'
	ʒənb	'side'
/nf/	Sənf	'type'
/lb/	qəlb	'heart'
/lf/	wəlf	'attachment'
/lm/	Dulm	'injustice'
	film	'movie'
	ʕilm	'knowledge'
/rb/	DəRb	'hitting'
	ħəRb	'war'
	γəRb	'west'
	dərb	'alley'
/rf/	SəRf	'change
	ʒəRf	'cliff'
	TəRf	'piece'
	ħəRf	'letter'

/ʃf/	naʃf	‘dry’
/yb/	ʕayb xayb	‘defect’ ‘bad/uggly’

All the possible coronal-labial combinations can be formalized as follows:

(318)



IV.2.2.5. Coronal-Coronal

In coronal-coronal combinations, we distinguish four types of CC-codas in CMA, namely the obstruent-obstruent type, the obstruent-sonorant type, the sonorant-obstruent type and the sonorant-sonorant type. The CC-codas that start with a sonorant obey the Sonority Sequencing Principle as we will see in the next section. In this sub-section the four types will be investigated. The first class of CC coda clusters is the obstruent-obstruent combination. Coronal obstruents can co-occur with coronal obstruents:

(319)

/tʃ/	matʃ	‘game’	/SS/	DəSS məSS	‘pavement’ ‘to suck’
/TT/	ħəTT qəTT	‘to put down’ ‘tomcat’	/zt/	ddabəzt taxərrazt	‘I fighted’ ‘shoe making’
/dd/	nədd mədd sədd yədd	‘a kind of incense’ ‘to give’ ‘close’ ‘hand’	/zz/	həzz wəzz xəzz ʕəzz	‘to pick up’ ‘goose’ ‘moss’ ‘glory’
/ds/	quds	‘Jerusalem’	/ʃt/	ʕəʃt	‘I lived’
/DD/	DəDD rəDD ʕəDD	‘oppositeness’ ‘vomit’ ‘bite’	/ʃd/	ruʃd	‘maturity’

	ħəDD	'luck'			
/ss/	məss	'touch'	/ʃʃ/	ɣəʃʃ	'to deceive'
	ħəss	'sound/noise'		fəʃʃ	'to deflate'
				məʃʃ	'cat'
/st/	hərrəst	'I broke'	/ʒt/	xrəʒt	'I went out'
/ST/	wəST	'middle'	/ʒd/	məʒd	'glory'
	bəST	'joke'			
/SD/	qəSD	'purpose'	/ʒʒ/	qəʒʒ	'to strangle'
				ħəʒʒ	'pilgrimage'

The second class of CC coda clusters is the obstruent-sonorant clusters. These clusters violate the Sonority Sequencing Principle as we will see in the next section. Coronal obstruents can co-occur with coronal sonorants:

(320)

/dl/	ʕadl	'justice'
/dr/	ʕudR	'execuse'
/Dl/	biDl	'to pedal'
/Dr/	l-qaDR	'the 27th night of Ramadan'
/sr/	Dasr	'naughty, badly behaved'
/Sr/	naSR	'victory'
	miSr	'Egypt'
/zn/	ħuzn	'sadness'

The third type of CC coda clusters is the sonorant-obstruent combination. These clusters obey the Sonority Sequencing Principle: obstruents, the consonants that occur in the edge position of the syllable, are less sonorous than sonorants. Coronal sonorants can co-occur with coronal obstruents. The liquids /l/ and /r/ can be followed by any obstruent as shown in (321). Similarly, for the nasal /n/ this is the case. Every n-obstruent combination is a legal coda cluster as presented (322):

(321)

/lD/	γəlD	‘thickness’	/ls/	fəls	‘penny’
/lT/	zəlT	‘penury’	/ld/	ʒəld	‘skin’
				wəld	‘boy’
/rt/	wərt	‘inheritance’	/lʒ/	təlʒ	‘snow’
	ħəRt	‘cultivation’		məlʒ	‘leg of lamb’
/lt/	təlt	‘three’	rd/	qərd	‘monkey’
	kmalt	‘completion		bərd	‘cold
/rT/	ʃəRT	‘condition’	/rD/	ləRD	‘ground’
	gəRT	‘hay’		fəRD	‘obligation’
				məRD	‘illness’
/rs/	ʕərs	‘wedding’		wəRD	‘flowers’
	hərs	‘breaking’		ʕəRD	‘width’
	γərs	‘plant’			
/rS/	bəRS	‘white blotches on the skin’	/rʃ/	kərʃ	‘stomach’
	gəRS	‘pinching’		gərʃ	‘coin’
/rz/	Tərz	‘embroidering’	/rʒ/	bəRʒ	‘fort’
	ħərz	‘amulet’		sərʒ	‘saddle’
	fərz	‘difference’			

(322)

nt/	qənt	‘corner’	/nT/	qənT	‘getting bored’
	bənt	‘girl’			
/nd/	ʕənd	‘to/near/by’	/ns/	gəns	‘race’
	hənd	‘steel’			
/nz/	kənz	‘treasure’	/nʃ/	ħənʃ	‘snake’
	Tənz	‘joke’			
	xənz	‘offensive odor’			
/nʒ/	bənʒ	‘anesthetic’			
	ʃfənʒ	‘doughnut’			

The glide /y/ can co-occur with obstruents, as can be seen in the following examples:

(323)

/yT/	xəyT	'the thread'	/ys/	ɣəys	'mud'
	ħayT	'wall'			
/yz/	məyz	'discrimination'	/yʃ/	ʒayʃ	'army'

The last class of CC codas consists of sonorant-sonorant clusters.Coronal sonorants co-occur with coronal sonorants:

(324)

/nn/	Dənn	'to believe'	/yn/	kayn	'there is'
	fənn	'art'		ʔalfayn	'two hundred'
				yumayn	'two days'
/ll/	bəll	'to wet'			
	Dəll	'shadow'			
	ħəll	'solution'			
/rn/	gərn	'horn'	/yl/	xəyl	'horses'
	qəRn	'century'			
/rr/	hərr	'to tickle'	/yy/	ħəyy	'alive'
	mərr	'sour'		Rəyy	'opinion'
	gərr	'to confess'			
	sərr	'secret'			
	ʃəRR	'evil'			

All the coronal-coronal combinations can be formalized as follows:

(325)

```
   C                  C
  root               root
   |                  |
 oral cavity        oral cavity
   |                  |
 C-place            C-place
   |                  |
[coronal]          [coronal]
```

IV.2.2.6. Coronal-Dorso-guttural

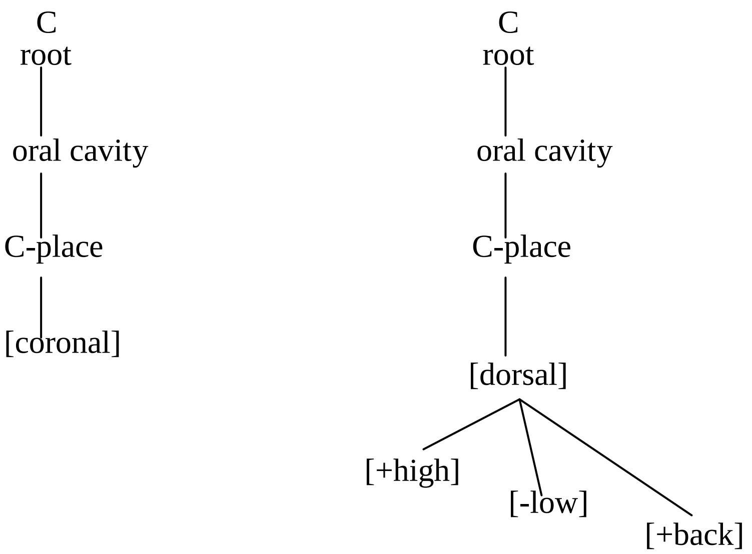
Both coronal obstruents and coronal sonorants co-occur with the dorsals [k] and [g]:

(326)

/dg/	ħadg	'skillful'
/sk/	məsk	'musk'

	disk	‘CD/track’
/zg/	fazg	‘wet’
/nk/	bənk	‘bank’
	ħənk	‘jaw’
	fRank	‘franc’
/ng/	gəng	‘blow with the head’
	Təng	‘tank’
	zəng	‘zinc’
	ʕəng	‘neck’
/lk/	səlk	‘wire’
	məlk	‘property’
	ʕəlk	‘resin’
/rk/	dəRk	‘pressure’
	wərk	‘hip’
/rg/	fərg	‘flock’ (birds)

All the coronal-dorsal combinations can be represented as follows:
(327)



Both coronal obstruents and coronal sonorants co-occur with gutturals:

(328)

/Tq/	nuTq	‘pronunciation’	/lq/	Təlq	‘credit’
				xəlq	‘people’
				ħəlq	‘throat’
/dħ/	mədħ	‘praising’	/lħ/	məlħ	‘salt’
				ʃəlħ	‘Berber’
				Təlħ	‘acasia’
				Sulħ	‘reconciliation’
/lʕ/	Səlʕ	‘squash’			

/Dq/	siDq	'honesty'	/rq/	ʃəRq ʕəRq məRq bəRq	'east' 'nerve' 'benefit' 'lightening'
/Dħ/	waDħ	'clear'	/Dʕ/	waDʕ	'situation'
/sx/	fəsx	'annulment'	/rx/	fəRx	'bird'
/sq/	fisq	'debauchery'			
/Sħ/	qaSħ	'solid'	/sʕ/	wasʕ	'large'
/Sʕ/	naSʕ	'bright'			
/nʕ/	mənʕ	'prohibition'	/rħ/	fəRħ ʃəRħ ʒəRħ TəRħ	'celebration' 'explanation' 'a cut' 'game'
/rʕ/	fəRʕ	'branch'	/rh/	kuRh	'dislike'
/yx/	dayx	'dizzy'	/yq/	fayq	'awake'

IV.2.2.7. Dorso-guttural-Labial

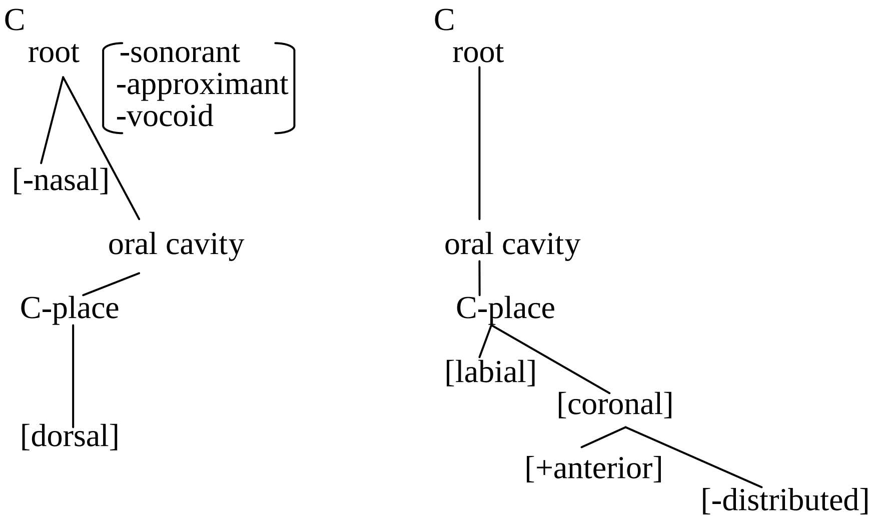
Both dorsals and gutturals co-occur with labials**:**

(329)

/km/	ħukm	'verdict'
/ɣm/	luɣm	'mine'
/ħb/	Saħb	'boyfriend'
/ħw/	nəħw	'grammar'
/ʕb/	ləʕb kəʕb	'game' 'ankle'
/ʕf/	Duʕf	'weakness'
/ʕm/	dəʕm	'support'

The dorsal-labial combinations can be summed up as follows:

(330)



IV.2.2.8. Dorso-guttural-Coronal

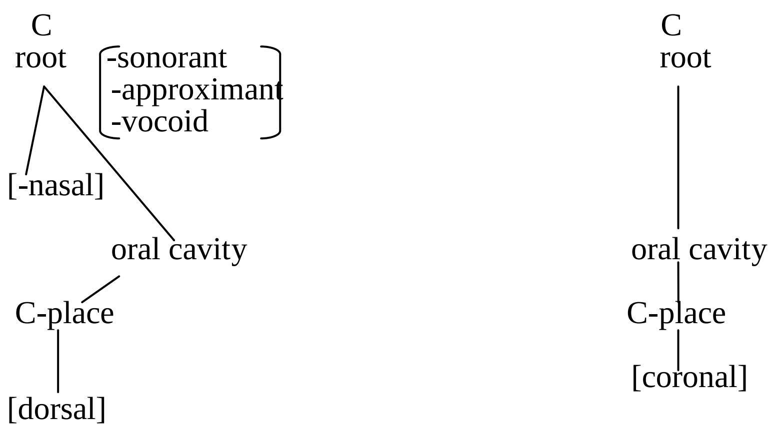
The dorsals [k] and [g] can co-occur with coronal obstruents and coronal sonorants:

(331)

/kt/	dirikt sakt	‘direct’ ‘silent’
/ks/	ʕəks/ʕaks fiks	‘oppositeness’ ‘fix’
/kn/	Rukn	‘a basic principle’
/kr/	fikr	‘ideas/knowledge’
/gt/	ʃərrəgt	‘I pulled’
/gl/	rigl	‘he fixed sth’

The dorsal-coronal combinations can be formalized as follows:

(332)



Both dorsals and gutturals co-occur with coronals:

(333)

/qt/	wəqt	'time'	/γr/	SəγR	'smallness'
/qS/	nəqS	'inferiority complex'	/ħt/	bəħt	'research'
/qd/	ʕaqd	'contract'	/ħT/	qəħT	'drought'
/qr/	fəqR/faqR	'poverty'	/ħs/	nəħs	'bad luck'
/qʃ/	nəqʃ	'sculpture'	/ħn/	laħn	'tune'
/xt/	təxt	'dregs'	/ħʃ/	wəħʃ	'homesickness'
/xT/	səxT	'disobedience'	/ʕt/	nəʕt	'description'
/xS/	RəxS	'cheapness'	/ʕd/	bəʕd	'after'
/xl/	buxl	'laziness'	/ʕD/	bəʕD	'some'
/ʕr/	waʕr	'difficult'	/γt/	Sbəγt	'I painted'
/ʕl/	fiʕl	'behaviour'	/γT/	DəγT	'pressure'
/γD/	buγD	'hatred'	/hd/	ʒəhd	'strength'
/γz/	luγz	'puzzle'	/hD/	SəhD	'heat'
/hl/	ʒahl	'ignorance'	/hr/	ʒahr	'loundness'
/hT/	rəhT	'undesirable person'			

IV.2.2.9. Dorso-guttural-Dorso-guttural

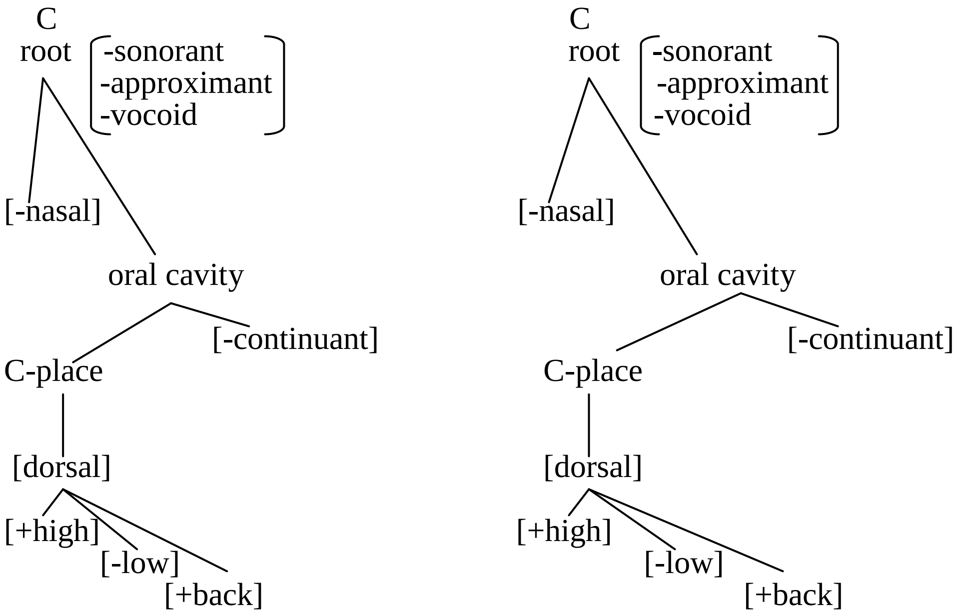
The dorsals [k] and [g] can co-occur as can be seen below:

(334)

/kk/	fəkk	'jaw'
	ʃəkk	'suspicion'
/gg/	dəgg	'to crush'

This can be formalized as follows:

(335)



Gutturals can co-occur with other gutturals, as illustrated below:

(336)

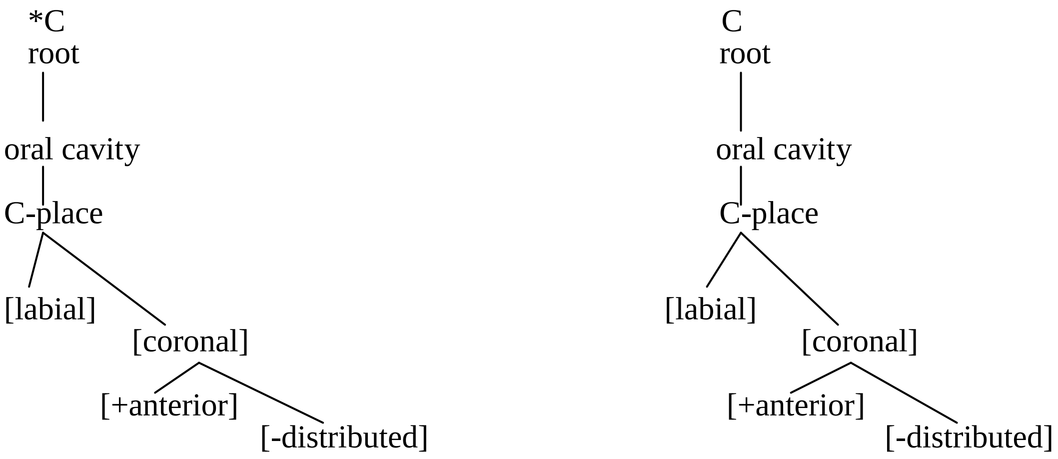
/qq/	bəqq	'bugs'
	dəqq	'to knock at'
/qh/	fiqh	'Muslim law'
/xx/	fəxx	'trick'
	məxx	'brain'
/ħk/	Dəħk	'laughter'
/ħq/	staħq	'to deserve'
/ħħ/	kəħħ	'to cough'
	məħħ	'eggyolk'
	Səħħ	'truth'

IV.2.3. Feature Geometry of Impossible Clusters

There are **123** impossible clusters in the coda position. The distribution of labial-labial clusters in the chart above shows that not all possible labial-labial combinations are present in CMA.

-bf,-bm,-fb,-fm,-mb,-mf, , -ww

(337)

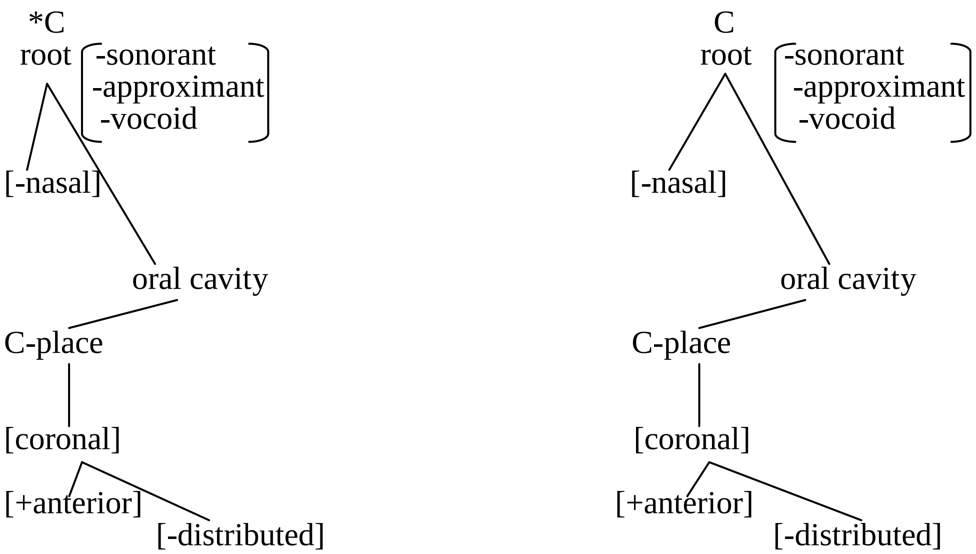


The clusters /wy/, /fγ/ and /wγ/ are not possible in CMA.

Having said this, coronal-coronal onset clusters are allowed as I presented above. However, the clusters */Ts/ and */Tz/ are not possible. The OCP is responsible for the absence of the following clusters. It bans clusters of two adjacent coronals. Sequences of two coronals do not occur in CMA, namely:

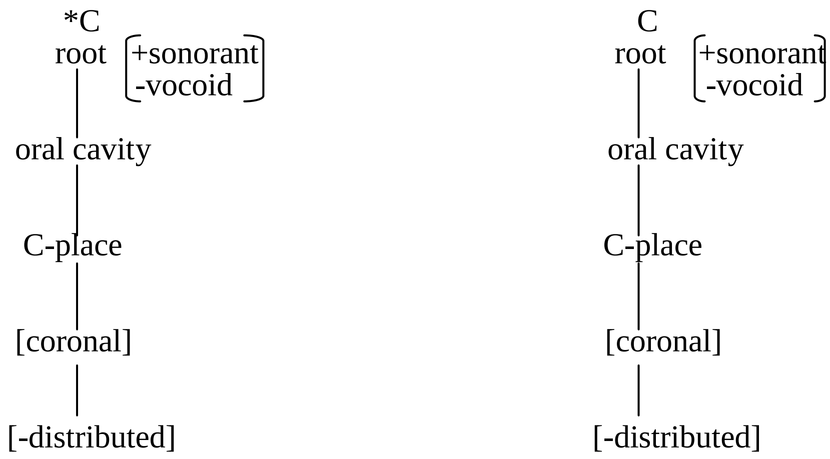
1. **–tT, -td, -tD, -tS, -Tt, -Td, -TD, -Ts, -TS, -Tz, -dt, -dT, -dD, -dS, -dz, -Dt, -DT, -Dd, -Ds, -Dz, -sD,-sz,-Sd, -zs, zS, sS, Ss, Sz,**

(338)



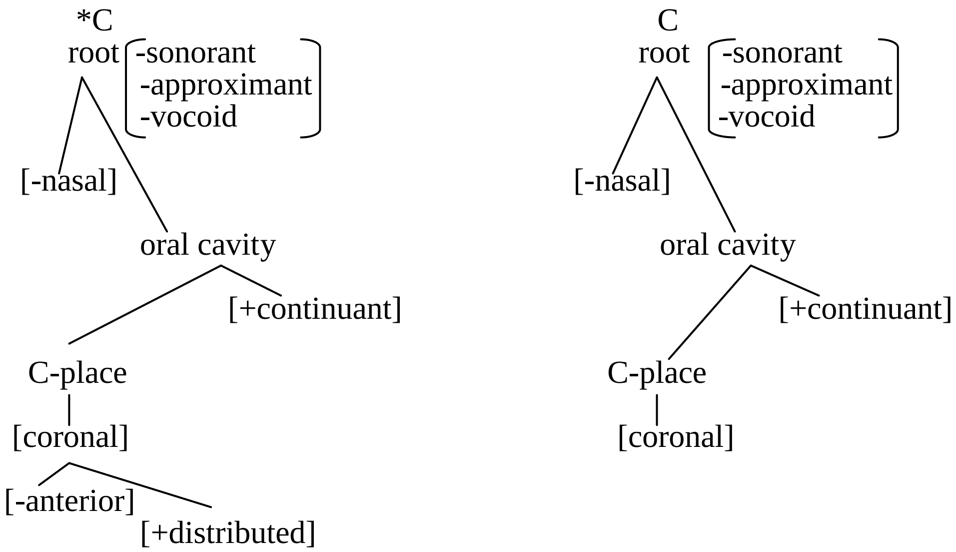
2. **–ln, -nl, -rl, -nr, -lr**

(339)



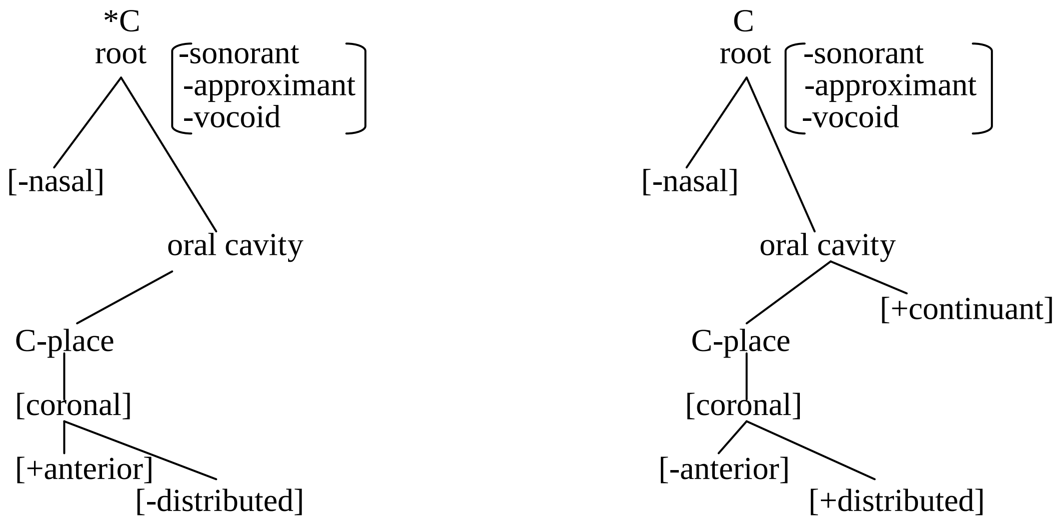
3**. -ʃz, -ʒz,-ʒʃ, ʃs, ʃS, ʒs, ʒS,**

(340)



4. - Tʃ, -Tʒ, -dʒ, sʃ, -sʒ,-zʃ, zʒ, Sʃ, Sʒ

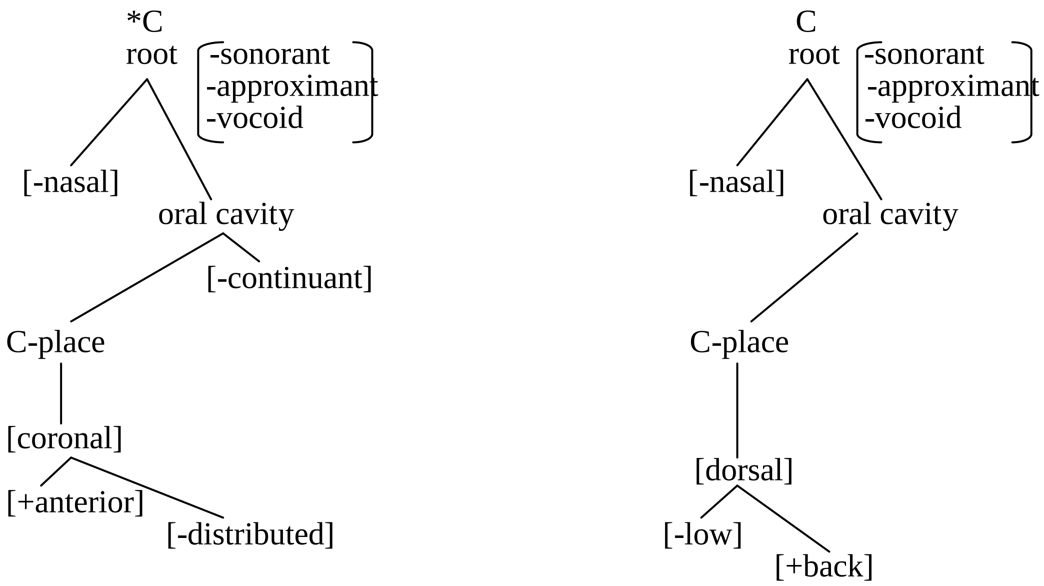
(341)



Coronals cannot co-occur with dorsals, as can be seen below:

-Tk, -Tg, -Tx, -Tγ, -Dk, -Dg, Sk,

(342)

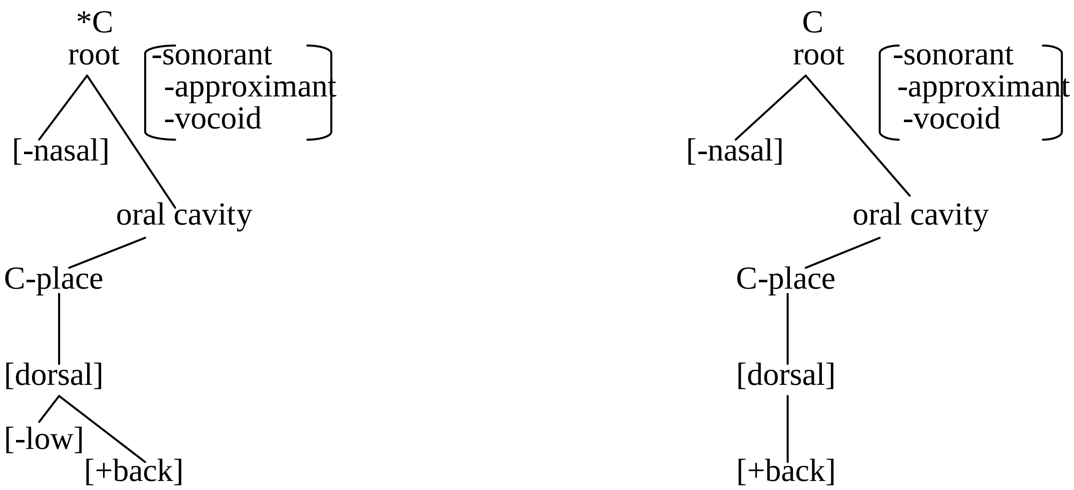


The coronal /T/ cannot co-occur with /h/. The language does not only accept some coronal-dorsal combinations, but it also does not allow some dorso-guttural-coronal combinations, namely: *kT, kD, kS, kz, kʒ, gD, gs, gʒ, γʒ, hs and hS.

The majority of dorso-guttural-dorso-guttural combinations are not allowed in CMA. These clusters can be summed up as follows:

1. –kg, -kq, -kx, -kγ, -gk, -gq, -gx, gγ, -qk, -qg, -qx, -qγ, -xk, -xg, -xq, -xγ, -xħ, -xʕ, -γk, -γg, -γq, -γx, -γγ, -γħ, -γʕ, -għ

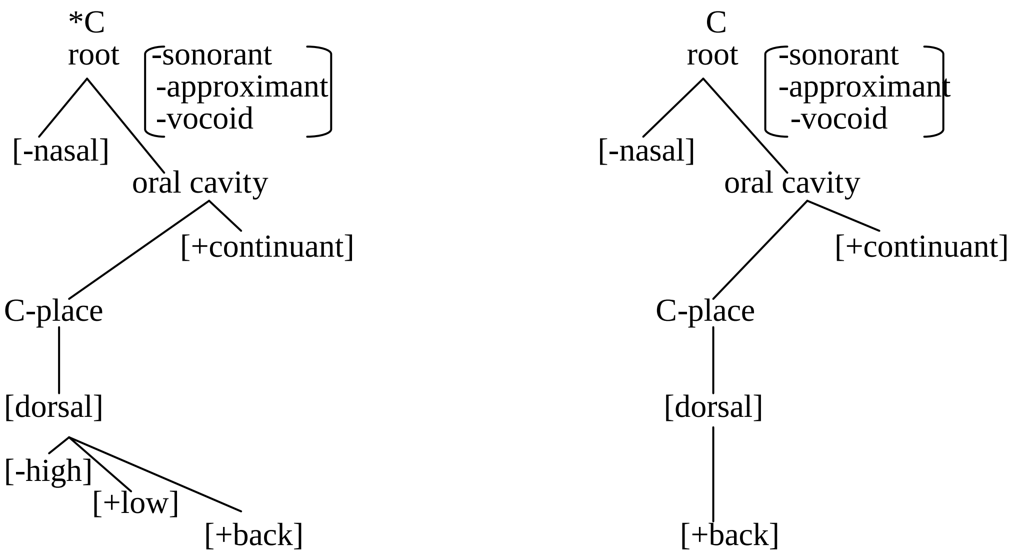
(343)



2.

(344)

a. -ħx, -ħγ, -ħʕ, -ʕx, -ʕγ, -ʕħ, -ʕʕ



b. xh, γh, ħh, ʕh, hq, hx, hγ, hħ, hʕ, hh, kh, hk

IV.2.4. Obligatory Contour Principle

In this section, I will list all the possible clusters that obey or violate OCP. I will also provide a brief discussion of the autosegmental representation of geminates. There are **354** clusters that obey OCP and **148** clusters that violate it as can be exhibited in figure (6) below. Having said this, the next subsection will list all the possible clusters that obey OCP.

IV.2.4.1. Conformity to OCP

There are **354** clusters that conform to OCP in CMA. It has been found that all these clusters can be divided into six classes:

(345)

(1) Labial-Coronal (51 instances)

(2) Labial-Dorso-guttural (30)

(3) Coronal-Labial (52)

(4) Coronal-Dorso-guttural (96)

(5) Dorso-guttural-Labial (32)

(6) Dorso-guttural-Coronal (93)

Having said this, the labial-coronal clusters will be listed.

a. Labial-Coronal

(346)

/bt/	/ft/	/mt/	/wt/
/bT/	/fT/	/mT/	/wT/
/bd/	/fd/	/md/	/wd/
/bD/	/fD/	/mD/	/wD/
/bs/	/fs/	/ms/	/ws/
/bS/	/fS/	/mS/	/wS/
/bz/	/fz/	/mz/	/wz/
/bn/	/fn/	/mn/	/wn/
/bl/	/fl/	/ml/	/wl/
/br/	/fr/	/mr/	/wr/
/bʃ/	/fʃ/	/mʃ/	/wʃ/
/bʒ/	/fʒ/	/mʒ/	/wʒ/
/by/	/fy/	/my/	

b. Labial-Dorso-guttural

(347)

/bk/	/fk/	/mk/	/wk/
/bg/	/fg/	/mg/	/wg/
/bq/	/fq/	/mq/	/wq/
/bx/	/fx/	/mx/	/wx/
/bγ/	/fħ/	/mγ/	/wħ/
/bħ/	/fʕ/	/mħ/	/wʕ/
/bʕ/	/fh/	/mʕ/	/wh/
/bh/		/mh/	

c. Coronal-Labial

(348)

/tb/	/Tb/	/db/	/Db/	/sb/	/Sb/	/zb/	/nb/
/tf/	/Tf/	/df/	/Df/	/sf/	/Sf/	/zf/	/nf/
/tm/	/Tm/	/dm/	/Dm/	/sm/	/Sm/	/zm/	/nm/
/tw/	/Tw/	/dw/	/Dw/	/sw/	/Sw/	/zw/	/nw/

/lb/	/rb/	/ʃb/	/ʒb/	/yb/
/lf/	/rf/	/ʃf/	/ʒf/	/yf/
/lm/	/rm/	/ʃm/	/ʒm/	/ym/
/lw/	/rw/	/ʃw/	/ʒw/	/yw/

d. Coronal-Dorso-guttural

(349)

/tk/	/dk/	/Dq/	/sk/	/Tʕ/	/zk/	/nk/
/tg/	/dg/	/Dx/	/sg/	/Sg/	/zg/	/ng/
/tq/	/dq/	/Dγ/	/sq/	/Sq/	/zq/	/nq/
/tx/	/dx/	/Dħ/	/sx/	/Sx/	/zx/	/nx/
/tγ/	/dγ/	/Dʕ/	/sγ/	/Sγ/	/zγ/	/nγ/
/tħ/	/dħ/	/Dh/	/sħ/	/Sħ/	/zħ/	/nħ/
/tʕ/	/dʕ/	/Tq/	/sʕ/	/Sʕ/	/zʕ/	/nʕ/
/th/	/dh/	/Tħ/	/sh/	/Sh/	/zh/	/nh/

/lk/	/rk/	/ʃk/	/ʒk/	/yk/
/lg/	/rg/	/ʃg/	/ʒg/	/yg/
/lq/	/rq/	/ʃq/	/ʒq/	/yq/

/lx/	/rx/	/ʃx/	/ʒx/	/yx/
/lγ/	/rγ/	/ʃγ/	/ʒγ/	/yγ/
/lħ/	/rħ/	/ʃħ/	/ʒħ/	/yħ/
/lʕ/	/rʕ/	/ʃʕ/	/ʒʕ/	/yʕ/
/lh/	/rh/	/ʃh/	/ʒh/	/yh/

e. Dorso-guttural-Labial

(350)

/kb/	/gb/	/qb/	/xb/	/γb/	/ħb/	/ʕb/	/hb/
/kf/	/gf/	/qf/	/xf/	/γf/	/ħf/	/ʕf/	/hf/
/km/	/gm/	/qm/	/xm/	/γm/	/ħm/	/ʕm/	/hm/
/kw/	/gw/	/qw/	/xw/	/γw/	/ħw/	/ʕw/	/hw/

f. Dorso-guttural-Coronal

(351)

/kt/	/qt/	/xt/	/γt/	/ħt/	/ʕt/	/ht/
/gd/	/gT/	/qT/	/xT/	/γT/	/ħT/	/ʕT/
/kd/	/qd/	/xd/	/γd/	/ħd/	/ʕd/	/hd/
/gt/	/qD/	/xD/	/γD/	/ħD/	/ʕD/	/hD/
/ks/	/qs/	/xs/	/γs/	/ħs/	/ʕs/	/hT/
/gS/	/gn/	/qS/	/xS/	/γS/	/ħS/	/ʕS/
/gz/	/qz/	/xz/	/γz/	/ħz/	/ʕz/	/hz/
/kn/	/qn/	/xn/	/γn/	/ħn/	/ʕn/	/hn/
/kl/	/ql/	/xl/	/γl/	/ħl/	/ʕl/	/hl/
/kr/	/qr/	/xr/	/γr/	/ħr/	/ʕr/	/hr/
/kʃ/	/qʃ/	/xʃ/	/γʃ/	/ħʃ/	/ʕʃ/	/hʃ/
/ky/	/qʒ/	/xʒ/	/gʃ/	/ħʒ/	/ʕʒ/	/hʒ/
/gy/	/qy/	/xy/	/γy/	/ħy/	/ʕy/	/hy/
/gl/						

/gr/

IV.2.4.2. OCP Violation

There are **148** coda clusters that violate the OCP. I have been found that these clusters can be classified into three major classes:

(352) (1) Labial-Labial (7 instances)

(2) Coronal-Coronal (124)

(3) Dorso-guttural-Dorso-guttural (17)

a. Labial-Labial

(353)

/bb/	
/bw/	/wf/
/ff/	/mm/
/fw/	/mw/

b. Coronal-Coronal

(354)

/tt/	/TT/	/dʃ/	/Dy/	/ST/	/zt/	/nt/	/ny/	/lʒ/	/rr/	/ʃn/	/yD/	/yS/	
/ts/	/Tn/	/st/	/SD/	/zT/	/nT/	/lt/	/ly/	/rʃ/	/ʃl/	/ys/	/yz/		
/St/	/Tl/	/dy/	/sT/	/SS/	/zd/	/nd/	/lT/	/rt/	/rʒ/	/ʃr/	/ʒn/		
/tz/	/Tr/	/DD/	/sd/	/Sn/	/zD/	/nD/	/ld/	/rT/	/ry/	/ʃʃ/	/ʒl/		
/tn/	/Ty/	/DS/	/ss/	/Sl/	/ns/	/lD/	/rd/	/ʃt/	/ʃʒ/	/ʒr/	/yn/		
/tl/	/dd/	/Dn/	/sn/	/Sr/	/zz/	/nS/	/ls/	/rD/	/ʃT/	/ʃy/	/ʒʒ/		
/tr/	/ds/	/Dl/	/sl/	/Sy/	/zn/	/nz/	/lS/	/rs/	/ʃd/	/ʒt/	/ʒy/		
/tʃ/	/dn/	/Dr/	/sr/	/zl/	/nn/	/lz/	/rS/	/ʃD/	/ʒT/	/yt/	/yʃ/		
/tʒ/	/dl/	/Dʃ/	/sy/	/zr/	/nʃ/	/ll/	/rz/	/ʒd/	/yT/	/yʒ/	/yr/		
/ty/	/dr/	/Dʒ/	/zt/	/zy/	/nʒ/	/lʃ/	/rn/	/ʒD/	/yd/	/yy/	/yl/		

c. Dorso-guttural-Dorso-guttural

(355)

/kk/	/gʕ/	/ħħ/	/ħq/
/kħ/	/gh/	/ʕk/	/hg/
/kʕ/	/qħ/	/ħk/	/ʕg/
/qʕ/	/ħg/	/ʕq/	/qq/
/xx/			

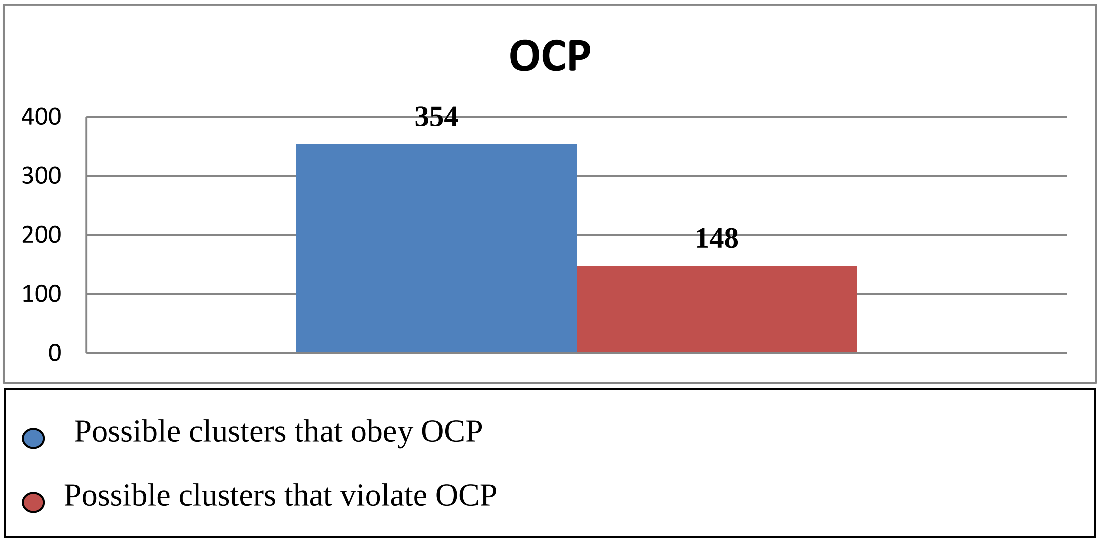
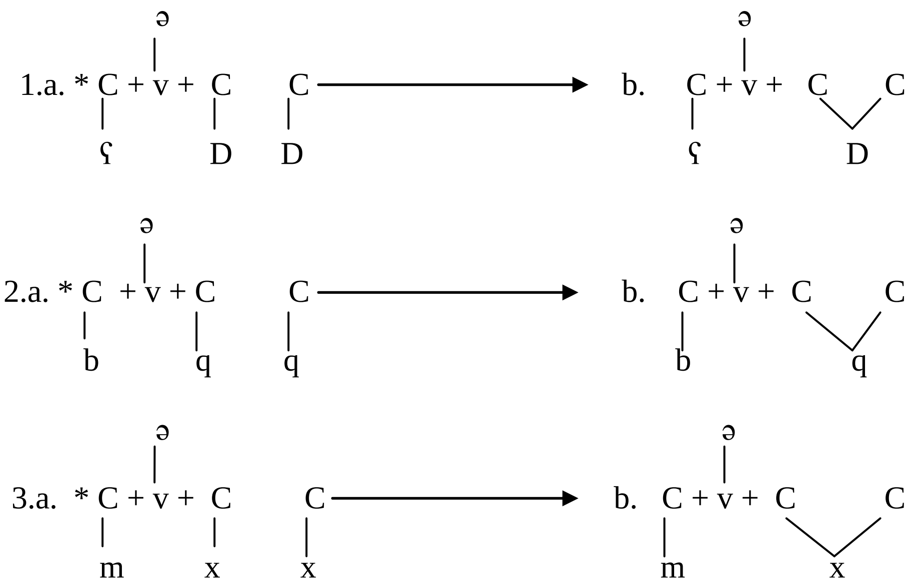


Figure 6: CMACoda and OCP

I can conclude by pointing out that OCP is a reliable phonological predictor. OCP is responsible for the sequencing of consonants.

To see how the OCP works in CMA, consider the following representations:

(356)



As can be seen above, the representations of (b) are allowed while the ones in (a) are ruled out exactly as predicted by the OCP.

IV.2.5. Sonority Sequencing Principle

Each coda cluster in each lexical item will be categorized where it fits under any of the three sonority possibilities: conformity, plateaus and reversals, and the patterns and subpatterns of each category will be identified. Conformity has been observed in **226** cases; sonority reversals in **229**; and sonority plateaus in **47** instances, as demonstrated in figure (7) below.

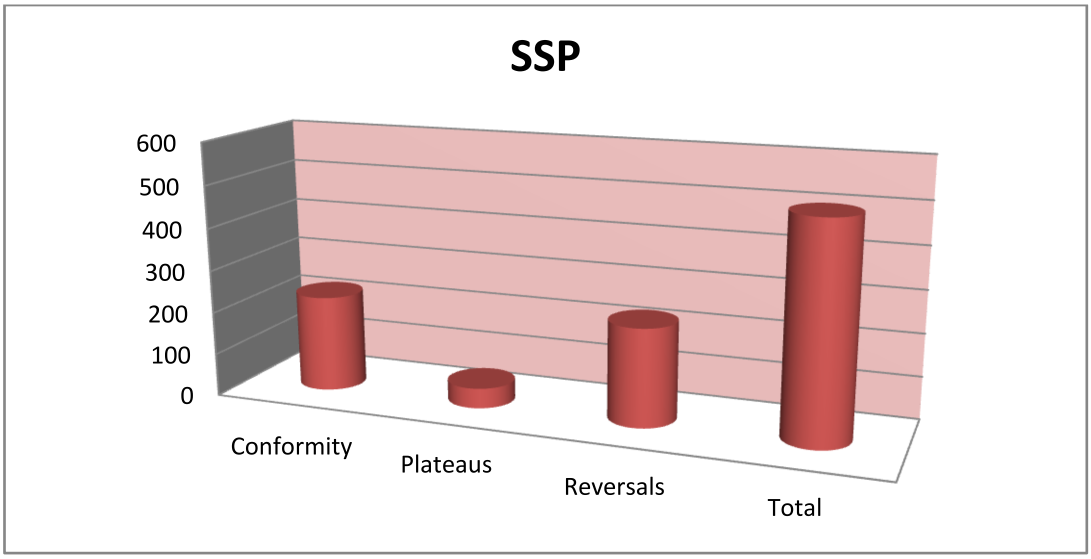


Figure 7: CMA coda and SSP.

IV.2.5.1. Conformity to Sonority Sequencing Principle

226 coda clusters appear to conform to SSP. These core clusters have been found to fall into six major patterns:

(357)

(1) Liquid+consonant

(2) Nasal+consonant

(3) Voiced fricative+ consonant

(4) Voiceless fricative+ consonant

(5) Voiced stop+ consonant

(6) Glide+ consonant

IV.2.5.1.1. Liquid+ Consonant

41 CC coda instances out of **226** were found to follow the pattern liquid+consonant, where the second consonant can be nasal (3 instances), voiced fricative (8), voiceless fricative (14), voiceless stop (8), and voiced stop (8), as exhibited below:

a. Liquid+nasal[27]

(358)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/lm/	Dulm	‘injustice’	/l/	7	/m/	6
/rn/	gərn	‘horn’	/r/	7	/n/	6

b. Liquid+voiced-fricative[28]

(359)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/lʒ/	təlʒ	‘snow’	/l/	7	/ʒ/	4
/rz/	Tərz	‘embroidering’	/r/	7	/z/	4
/rʒ/	bəRʒ	‘fort’	/r/	7	/ʒ/	4
/lʕ/	Səlʕ	‘baldness’	/l/	7	/ʕ/	5
/rʕ/	fəRʕ	‘branch’	/r/	7	/ʕ/	5

c. Liquid+Voiceless fricative[29]

(360)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/rf/	SəRf	‘change’	/r/	7	/f/	3
/lf/	wəlf	‘attachment’	/l/	7	/f/	3
/ls/	fəls	‘penny’	/l/	7	/s/	3
/rs/	ɣərs	‘plant’	/r/	7	/s/	3
/rS/	gəRS	‘pinching’	/r/	7	/S/	3
/rʃ/	kərʃ	‘stomach’	/r/	7	/ʃ/	3
/lħ/	məlħ	‘salt’	/l/	7	/ħ/	5
/rx/	fəRx	‘bird’	/r/	7	/x/	5
/rħ/	fəRħ	‘celebration’	/r/	7	/ħ/	5
/rh/	kuRh	‘dislike’	/r/	7	/h/	5

27 /rm/ is a legal liquid-nasal cluster that obeys SSP.
28 /lz/, /lɣ/ and /rɣ/ are possible liquid-voiced fricative clusters that obey SSP.
29 /lS/, /lʃ/, /lx/ and /lh/ are possible liquid-voiceless fricative clusters that obey SSP.

d. Liquid+ voiceless stop

(361)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/lt/	təlt	‘three’	/l/	7	/t/	1
/lT/	zəlT	‘penury’	/l/	7	/T/	1
/rt/	wərt	‘inheritance’	/r/	7	/t/	1
/rT/	ʃəRT	‘condition’	/r/	7	/T/	1
/lk/	məlk	‘property’	/l/	7	/k/	1
/rk/	dəRk	‘pressure’	/r/	7	/k/	1
/rq/	ʃəRq	‘east’	/r/	7	/q/	1
/lq/	Təlq	‘credit’	/l/	7	/q/	1

e. Liquid+ voiced stop[30]

(362)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/lb/	qəlb	‘heart’	/l/	7	/b/	2
/rb/	DəRb	‘hitting’	/r/	7	/b/	2
/ld/	ʒəld	‘skin’	/l/	7	/d/	2
/rd/	qərd	‘monkey’	/r/	7	/d/	2
/lD/	ɣəlD	‘thickness’	/l/	7	/D/	2
/rD/	məRD	‘illness’	/r/	7	/D/	2
/rg/	fərg	‘flock(birds)	/r/	7	/g/	4

IV.2.5.1.2. Nasal+ Consonant

The nasal+ consonant onset pattern has been seen in **36** instances out of **226** distributed into four basic subpatterns: 1) nasal+ voiced fricative (8 instances), 2) nasal+ voiceless fricative (13), 3) nasal+ voiced stop (7), and 4) nasal +voiceless stop (8), as illustrated below:

a. Nasal+ voiced fricative[31]

(363)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/mz/	Rəmz	‘symbol’	/m/	6	/z/	4
/mʕ/	səmʕ	‘hearing’	/m/	6	/ʕ/	5
/nz/	kənz	‘treasure’	/n/	6	/z/	4
/nʒ/	bəʒ	‘anesthetic’	/n/	6	/ʒ/	4

[30] /lg/ is a possible liquid-voiced stop cluster that obeys SSP.
[31] /mʒ/, /mɣ/ and /nɣ/ are possible nasal-voiced fricative clusters that obey SSP.

/nʕ/	mənʕ	‘prohibition’	/n/	6	/ʕ/	5

b. Nasal+ voicelss fricative[32]

(364)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ms/	nəms	‘ferret’	/m/	6	/s/	3
/mʃ/	ʃəmʃ	‘sun’	/m/	6	/ʃ/	3
/mx/	səmx	‘ink’	/m/	6	/x/	5
/mħ/	gəmħ	‘wheat’	/m/	6	/ħ/	5
/nf/	ʕunf	‘violence’	/n/	6	/f/	3
/ns/	gəns	‘race’	/n/	6	/s/	3
/nʃ/	ħənʃ	‘snake’	/n/	6	/ʃ/	3

c. Nasal+ voiced stop[33]

(365)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/md/	ħamd	‘praise’	/m/	6	/d/	2
/mD/	ħamD	‘lemon’	/m/	6	/D/	2
/nb/	dənb	‘sin’	/n/	6	/b/	2
/nd/	hənd	‘steel’	/n/	6	/d/	2
/ng/	zəng	‘zinc’	/n/	6	/g/	4

d. Nasal+ voiceless stop[34]

(366)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/mt/	zəmt	‘to be muggy’	/m/	6	/t/	1
/mk/	məkumk	‘he has the sense of humour’	/m/	6	/k/	1
/nk/	bənk	‘bank’	/n/	6	/k/	1
/mq/	ɣamq	‘dark colored’	/m/	6	/q/	1
/nt/	bənt	‘girl’	/n/	6	/t/	1
/nT/	qənT	‘getting bored’	/n/	6	/T/	1

32 /mS/, /mh/, /nS/, /nx/, /nħ/ and /nh/ are possible nasal-voiceless fricative clusters that obey SSP.
33 /mg/ and /nD/ are possible nasal-voiced stop clusters that obey SSP.
34 /mk/ and /nq/ are possible nasal-voiceless stop clusters that obey SSP.

IV.2.5.1.3. Voiced-fricative+ Consonant

The voiced fricative+consonant onset pattern has been observed in **30** cases that spread out in four subpatterns: 1) voiced fricative +voiced stop (13 instances), 2) voiced fricative+ voiceless stop (5), 3) voiced fricative+ voiceless fricative (10 instances), and 4) voiced fricative +voiced fricative (2), as demonstrated below:

a. Voiced-fricative+ voiced stop[35]

(367)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ʒd/	məʒd	'glory'	/ʒ/	4	/d/	2
/ʕb/	ləʕb	'game'	/ʕ/	5	/b/	2
/γD/	buγD	'hatred'	/γ/	4	/D/	2
/ʕd/	bəʕd	'after'	/ʕ/	5	/d/	2
/ʕD/	bəʕD	'some'	/ʕ/	5	/D/	2

b. voiced-fricative+ voiceless stop

(368)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/zt/	ddabəzt	'I fighted'	/z/	4	/t/	1
/ʒt/	xrəʒt	'I went out'	/ʒ/	4	/t/	1
/γt/	Sbəγt	'I painted'	/γ/	4	/t/	1
/γt/	Dəγt	'pressure'	/γ/	4	/t/	1
/ʕt/	nəʕt	'description'	/ʕ/	5	/t/	1

c. Voiced-fricative+ voiceless fricative[36]

d. Voiced-fricative+ voiced fricative [37]

IV.2.5.1.4. Voiceless-fricative+ Consonant

The voiceless fricative +consonant onset pattern has been seen in **60** cases unfolding in four subpatterns: 1) voiceless fricative +voiceless stop (24 instances), 2) voiceless fricative+ voiced stop (20), 3) voiceless fricative+ voiceless fricative (10), and 4) voiceless fricative + voiced fricative (6), as shown below:

[35] /zb/, /ʒb/, /zd/, /zD/, /ʒD/, /γb/, /γd/ and /ʕg/ are possible voiced fricative-voiced stop clusters that obey SSP.
[36] /zf/, /ʒf/, /γf/, /ʕf/, /γs/, /γS/, /γʃ/, /ʕs/, /ʕS/ and /ʕʃ/ are possible voiced fricative-voiceless fricative clusters that obey SSP.
[37] /ʕz/ and /ʕʒ/ are possible voiced fricative-voiced fricative clusters that obey SSP.

a. Voiceless-fricative+ voiceless-stop[38]

(369)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ħq/	staħq	‘to deserve’	/ħ/	5	/q/	1
/ħk/	Dəħk	‘laughter’	/ħ/	5	/k/	1
/hT/	rəhT	‘undesirable person’	/h/	5	/T/	1
/ħT/	qəħT	‘drought’	/ħ/	5	/T/	1
/ħt/	bəħt	‘research’	/ħ/	5	/t/	1
/xT/	səxT	‘disobedience’	/x/	5	/T/	1
/xt/	təxt	‘dregs’	/x/	5	/t/	1
/ʃt/	ʕəʃt	‘I lived’	/ʃ/	3	/t/	1
/ST/	bəST	‘joke’	/S/	3	/T/	1
/St/	xəlləSt	‘I paid’	/S/	3	/t/	1
/st/	hərrəst	‘I broke’	/s/	3	/t/	1
/sk/	məsk	‘musk’	/s/	3	/k/	1
/sq/	fisq	‘debauchery’	/s/	3	/q/	1
/ft/	ləft	‘turnip’	/f/	3	/t/	1
/fT/	nəfT	‘oil’	/f/	3	/T/	1

b. Voiceless-fricative+ voiced stop[39]

(370)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/hD/	SəhD	‘heat’	/h/	5	/D/	2
/hd/	ʒəhd	‘strength’	/h/	5	/d/	2
/ʃd/	ruʃd	‘maturity’	/ʃ/	3	/d/	2
/SD/	qaSD	‘purpose’	/S/	3	/D/	2
/fd/	wəfd	‘delegation’	/f/	3	/d/	2
/fD	ħifD	‘learning by heart’	/f/	3	/D/	2

[38] /fk/ , /fq/, /ʃT/, /sT/, /Sq/, /ʃk/, /ʃq/, /ht/ and /hk/ are possible voiceless fricative- voiceless stop clusters that obey SSP.

[39] /sb/, /sd/, /Sb/, /ʃb/, /ʃD/, /xb/, /xd/, /xD/, /ħb/, /ħd/, /ħD/, /ħg/, /hb/ and /hg/ are possible voiceless fricative- voiced stop clusters that obey SSP.

c. **Voiceless-fricative+ voiceless fricative**[40]

(371)

Clusters	words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ħʃ/	ʒəħʃ	'young ass or donkey'	/ħ/	5	/ʃ/	3
/ħs/	nəħs	'bad luck'	/ħ/	5	/s/	3
/xS/	RəxS	'cheapness'	/x/	5	/S/	3

d. Voiceless-fricative+ voiced-fricative[41]

IV.2.5.1.5. Voiced-stop+ Consonant

The voiced stop+ consonant onset pattern has been observed in **14** cases out of **226** unfolding in three subpatterns: 1) voiced stop +voiceless stop (9 instances), and 2) voiced stop+ voiced stop (2), and 3) voiced stop +voiceless fricative (3), as presented below:

a. Voiced stop+ voiceless stop[42]

(372)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bt/	səbt	'Saturday'	/b/	2	/t/	1
/bT/	qəbT	'constipation'	/b/	2	/T/	1
/Dq/	siDq	'honesty'	/D/	2	/q/	1
/gt/	ʃərrəgt	'I pulled'	/g/	4	/t/	1

b. Voiced stop+ voiced stop[43]

c. Voiced stop+ voiceless fricative [44]

IV.2.5.1.6. Glide+ Consonant

The glide +consonant onset pattern has been seen in **45** instances out of **226** distributed into six basic subpatterns: 1) glide +voiced-stop (8 instances), 2) glide +voiceless-stop (8), 3)

[40] /xf/, /xs/, /xʃ/, /ħf/, /ħS/ , /hf/, /hʃ/ are possible voiceless fricative-voiceless fricative clusters that obey SSP.
[41] /xz/, /xʒ/, /ħz/, /ħʒ/, /hz/ and /hʒ/ are possible voiceless fricative-voiced fricative clusters that obey SSP.
[42] /bk/, /bq/, /dk/, /dq/ and /gT/ are possible voiced stop-voiceless stop clusters that obey SSP.
[43] /gb/ and /gd/ are possible voiced stop-voiced stop clusters that obey SSP.
[44] /gf/, /gS/ and /gʃ/ are possible voiced stop-voiceless fricative clusters that obey SSP.

glide+ voiced-fricative (7) , 4) glide+ voiceless-fricative (14), 5) glide+ nasal (4), and 6) glide + liquid (4), as illustrated below:

a. Glide+ voiced stop[45]

(373)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/wb/	ʒawb	'to answer'	/w/	9	/b/	2
/yb/	xayb ʕayb	'ugly' 'defect'	/y/	9	/b/	2
/wd/	ʕəwd	'horse'	/w/	9	/d/	2
/wD/	ʕawD	'instead of'	/w/	9	/D/	2

b. Glide+ voiceless stop[46]

(374)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/wt/	Səwt	'voice'	/w/	9	/t/	1
/yT/	ħayT	'wall'	/y/	9	/T/	1
/yq/	fayq	'awake'	/y/	9	/q/	1

c. Glide+ voiced fricative[47]

(375)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wz/	**ħəwz**	**'region near Marrakech'**	**/w/**	**9**	**/z/**	**4**
/yz/	**məyz**	**'discrimination'**	**/y/**	**9**	**/z/**	**4**

d. Glide+ voiceless fricative[48]

(376)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ws/	**qəws**	**'arch'**	**/w/**	**9**	**/s/**	**3**
/ys/	**ɣəys**	**'mud'**	**/y/**	**9**	**/s/**	**3**

[45] /wg/, /yd/, /yD/ and yg/ are possible glide -voiced stop clusters that obey SSP.
[46] /wT/, /wk/, /wq/, /ɣt/ and /ɣk/ are possible glide-voiceless stop clusters that obey SSP.
[47] /wʒ/, /wʕ/, /yʒ/, /yɣ/ and /yʕ/ are possible glide-voiced fricative clusters that obey SSP.
[48] /wf/, /wS/, /wʃ/, /wx/, /wħ/, /wh/, /yf/, /yS/, /yħ/, and /yh/ are possible glide-voiceless fricative clusters that obey SSP.

/yʃ/	**ʒayʃ**	**'army'**	**/y/**	**9**	**/ʃ/**	**3**
/yx/	**dayx**	**'dizzy'**	**/y/**	**9**	**/x/**	**5**

e. Glide+ nasal[49]

(377)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wn/	ʕawn	'help'	/w/	9	/n/	6
/yn/	yumayn	'two days'	/y/	9	/n/	6
/wm/	qawm	'to resist'	/w/	9	/m/	6

f. Glide+ liquid[50]

(378)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/wl/	ħawl	'to try'	/w/	9	/l/	7
/wr/	DawR	'turn/role'	/w/	9	/r/	7
/yl/	xəyl	'horses'	/y/	9	/l/	7

The conforming patterns of SSP in the coda position can be exhibited in the following figure:

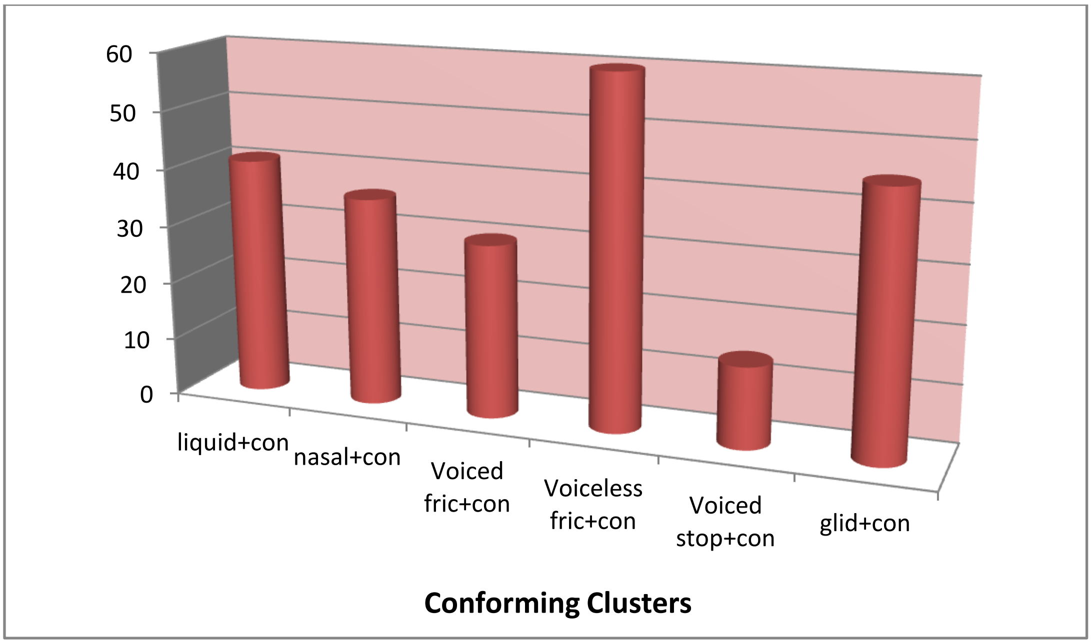


Figure 8: Conforming Patterns

[49] /ym/ is a possible glide-nasal cluster that obeys SSP.
[50] /yr/ is a possible glide-liquid cluster that obeys SSP.

Having identified the different coda patterns and subpatterns that conform to SSP, and shown that this conformity can only appear in **226** clusters as exhibited in the above figure. I can conclude this subsection, i.e. Conformity to sonority, by saying that CMA CC coda is only partially conditioned by the SSP. CMA possible codas that violate SSP in the manner of sonority plateaus and reversals are discussed below:

IV.2.5.2. Violation of Sonority Sequencing Principle

A brief introduction

IV.2.5.2.1. Sonority Plateaus

Sonority plateaus unfold in **47** instances that can be categorized into nine patterns: 1) nasal+nasal (4 instances), 2) voiced fricative+ voiced fricative (5), 3) voiceless fricative+ voiceless fricative (12), 4) voiced stop+voiced stop (8), 5) voiceless stop+voiceless stop (10), 6) liquid+liquid (2), 7) glide+glide (3), 8) voiced fricative+voiced stop (2), and 9) voiced stop+voiced fricative (1), as identified and exemplified in (n) below:

a. Nasal+nasal[51]

(379)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/mm/	dəmm	‘blood’	/m/	6	/m/	6
/nn/	Dənn	‘to believe’	/n/	6	/n/	6

b. Voiced fricative+ voiced fricative[52]

(380)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/zz/	xəzz	‘moss’	/z/	4	/z/	4
/ʒʒ/	qəʒʒ	‘to strangle’	/ʒ/	4	/ʒ/	4
/γz/	luγz	‘puzzle’	/γ/	4	/z/	4

[51] /mn/ and /nm/ are possible nasal-nasal clusters that violate SSP in the manner of sonority plateaus.
[52] /zγ/ and /ʒγ/ are possible voiced fricative-voiced fricative clusters that violate SSP.

c. Voiceless fricative+ voiceless fricative[53]

(381)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ff/	Səff	'row'	/f/	3	/f/	3
/fs/	nəfs	'breath/pride'	/f/	3	/s/	3
/fS/	krafS	'celery'	/f/	3	/S/	3
/Sf/	wəSf	'description'	/S/	3	/f/	3
/ʃf/	naʃf	'dry'	/ʃ/	3	/f/	3
/ss/	məss	'touch'	/s/	3	/s/	3
/SS/	məSS	'to suck'	/S/	3	/S/	3
/ʃʃ/	ɣəʃʃ	'to deceive'	/ʃ/	3	/ʃ/	3
/xx/	məxx	'brain'	/x/	5	/x/	5
/ħħ/	məħħ	'eggyolk'	/ħ/	5	/ħ/	5

d. Voiced stop+ voiced stop[54]

(382)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bb/	kəbb	'to pour'	/b/	2	/b/	2
/bd/	ʕəbd	'slave'	/b/	2	/d/	2
/bD/	nəbD	'pulse'	/b/	2	/D/	2
/dd/	mədd	'to give'	/d/	2	/d/	2
/DD/	ʕəDD	'bite'	/D/	2	/D/	2
/gg/	dəgg	'to crush'	/g/	4	/g/	4

e. Voiceless stop+ voiceless stop[55]

(383)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/TT/	ħəTT	'to put down'	/T/	1	/T/	1
/kk/	fəkk	'jaw'	/k/	1	/k/	1
/qq/	bəqq	'bugs'	/q/	1	/q/	1
/Tq/	nuTq	'pronunciation'	/T/	1	/q/	1
/kt/	sakt	'silent'	/k/	1	/t/	1
/qt/	wəqt	'time'	/q/	1	/t/	1

[53] /fʃ/ and /sf/ are possible voiceless fricative-vioceless fricative clusters that violate SSP.
[54] /db/ and /Db/ are possible voiced stop-voiced stop clusters that violate SSP.
[55] /tt/, /tk/, /tq/ and /qT/ are possible voiveless stop-voiceless stop clusters that violate SSP.

f. Liquid+liquid

(384)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ll/	Dəll	‘shadow’	/l/	7	/l/	7
/rr/	hərr	‘to tickle’	/r/	7	/r/	7

g. Glide+glide[56]

(385)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/yy/	ħəyy	‘alive’	/y/	9	/y/	9

h. Voiced fricative+ voiced stop[57]

(386)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/zg/	fazg	‘wet’	/z/	4	/g/	4

j. Voiced stop+ voiced fricative[58]

The patterns that consist sonority plateaus can be represented as flows:

[56] /wy/ and /yw/ are possible glide-glide clusters that violate SSP.
[57] /ʒg/ is a possible voiced fricative-voiced stop cluster that obeys SSP.
[58] /gz/ is a possible voiced stop-voiced fricative cluster that violates SSP.

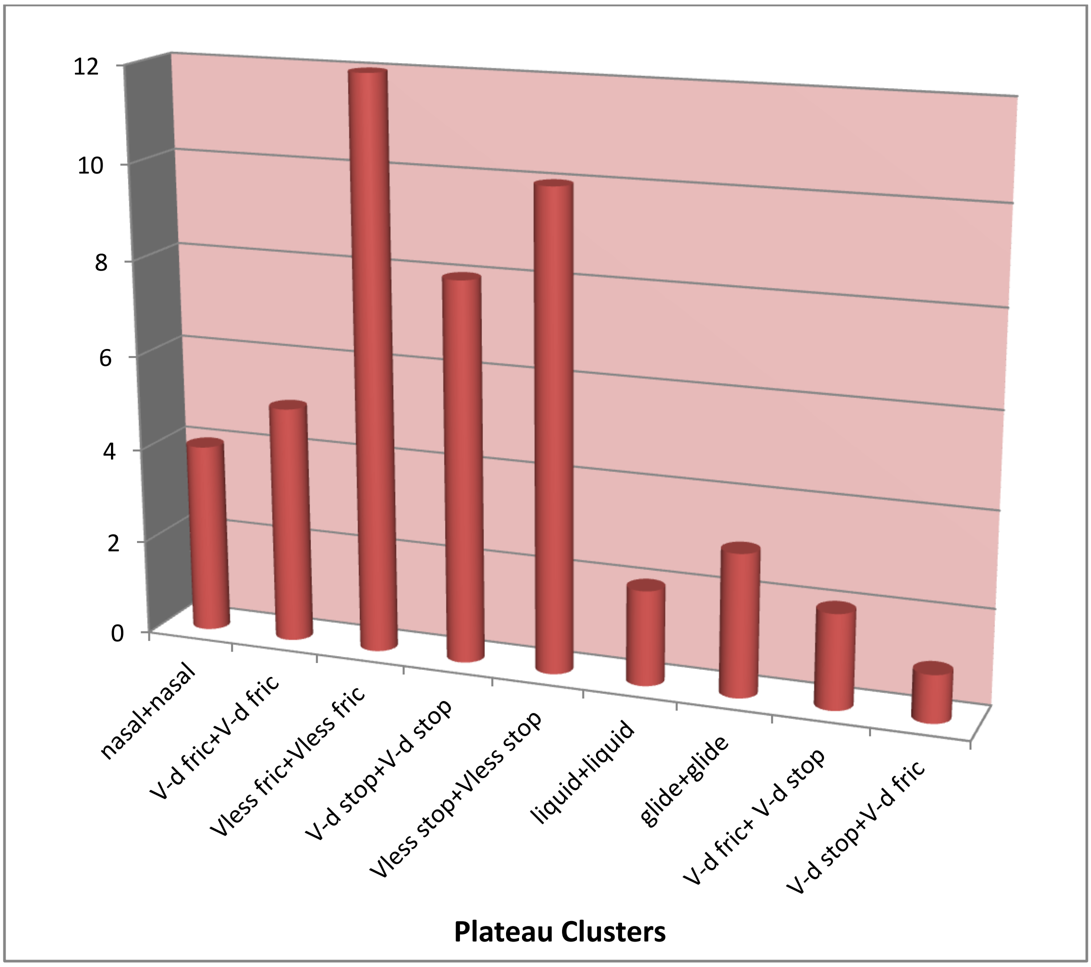


Figure 9: Plateau Patterns

As can be observed in the above figure, the pattern of voiceless fricative + voiceless fricative is the largest amongst the sonority plateau patterns and this can be attributed to the existence of seven voiceless fricative consonants in CMA phonemic inventory.

IV.2.5.2.2. Sonority Reversals

As stated above, **229** CC onset clusters appear to conform to SSP. These “core clusters” have been found to fall into 6 major patterns as exhibited in figure (10):

(387)

(1) Consonant+liquid

(2) Consonant+nasal

(3) Consonant+voiced fricative

(4) Consonant+ voiceless fricative

(5) Consonant + voiced stop

(6) Consonant + Glide

IV.2.5.2.2.1. Consonant+ liquid

Fourty CC onset instances out of **229** were found to follow the pattern consonant+ liquid, where the first consonant can be nasal (4instances), voiced fricative (5), voiceless fricative (10), voiceless stop (7), and voiced stop, as shown below:

a. Nasal + liquid[59]

(388)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/mr/	ʔamR	'order'	/m/	6	/r/	7

b. Voiced fricative+ Liquid[60]

(389)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/γr/	SəγR	'smallness'	/γ/	4	/r/	7
/ʕr/	waʕr	'difficult'	/ʕ/	5	/r/	7
/ʕl/	fiʕl	'doing/behaviour'	/ʕ/	5	/l/	7

c. Voiceless fricative+ Liquid[61]

(390)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/fl/	gufl	'he inflated'	/f/	3	/l/	7
/sr/	Dasr	'naughty, badly behaved'	/s/	3	/r/	7
/Sr/	naSr	'victory'	/S/	3	/r/	7
/xl/	buxl	'laziness'	/x/	5	/l/	7
/hl/	ʒahl	'ignorance'	/h/	5	/l/	7
/hr/	ʒahR	'loudness'	/h/	5	/r/	7

[59] /ml/ is a possible nasal-liquid cluster that violates SSP.
[60] /zl/, /zr/, /ʒl/, /ʒr/ and /γl/ are possible voiced fricative-liquid clusters that violate SSP.
[61] /fr/, /sl/, /Sl/, /ʃl/, /ʃr/, /xr/, /ħl/ and /ħr/ are possible voiceless fricative-liquid clusters that violate SSP.

d. Voiceless stop+ Liquid[62]

(391)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/kr/	fikr	'ideas/knowledge'	/k/	1	/r/	7
/qr/	faqR	'poverty'	/q/	1	/r/	7

e. Voiced stop+ Liquid [63]

(392)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bl/	dubl	'double'	/b/	2	/l/	7
/dl/	ʕadl	'justice'	/d/	2	/l/	7
/dr/	ʕudR	'excuse'	/d/	2	/r/	7
/Dl/	biDl	'to pedal'	/D/	2	/l/	7
/Dr/	ʕtaDr	'to apologize	/D/	2	/r/	7
/gl/	rigl	'he fixed sth'	/g/	4	/l/	7

IV.2.5.2.2.2. Consonant +nasal

The consonant+nasal onset pattern has been seen in **36** instances out of **229** distributed into four basic subpatterns: 1) voiced fricative+ nasal (8 instances), 2) voiceless fricative+ nasal (13), 3) voiced stop + nasal (7), and 4) voiceless stop+ nasal (8), as illustrated below:

a. Voiced fricative+ nasal[64]

(393)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/zm/	ʕazm	'desire'	/z/	4	/m/	6
/zn/	ħuzn	'sadness'	/z/	4	/n/	6
/ɣm/	luɣm	'mine'	/ɣ/	4	/m/	6
/ʕm/	dəʕm	'support'	/ʕ/	5	/m/	6

[62] /tl/, /tr/, /Tl/, /Tr/, /kl/ and /ql/ are possible voiceless stop-liquid clusters that violate SSP.
[63] /br/ and /gr/ are possible voiced stop-voiced stop clusters that violate SSP.
[64] /ʒm/, /ʒn/, /ɣn/ and /ʕn/ are possible voiced fricative-nasal clusters that violate SSP.

b. Voiceless fricative+ nasal[65]

(394)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/sm/	qism	'class'	/s/	3	/m/	6
/hm/	səhm	'the state of deserving sth bad'	/h/	5	/m/	6
/ħn/	laħn	'tune'	/ħ/	5	/n/	6

c. Voiced stop+ nasal[66]

d. Voiceless stop+ nasal [67]

(395)

Clusers	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/km/	ħukm	'verdict'	/k/	1	/m/	6
/kn/	Rukn	'a basic principle'	/k/	1	/n/	6

IV.2.5.2.2.3. Consonant+ voiced fricative

The consonant onset pattern has been observed in **32** cases that spread out in four subpatterns: 1) voiced stop+ voiced fricative (11 instances), 2) voiceless stop+ voiced fricative (9), 3) voiceless fricative+ voiced fricative (10 instances), and 4) voiced fricative +voiced fricative (2), as demonstrated below:

a. Voiced stop+ voiced fricative[68]

(396)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/bz/	xəbz dəbz	'bread' 'brawl'	/b/	2	/z/	4
/bʕ/	rubʕ	'quarter'	/b/	2	/ʕ/	5
/Dʕ/	waDʕ	'situation'	/D/	2	/ʕ/	5

65 /fn/, /Sm/, /Sn/, /ʃm/, /ʃn/, /sn/, /xm/, /xn/, /ħm/ and /hn/ are possible voiceless fricative-nasal clusters that violate SSP.
66 /bn/, /dm/, /Dm/, /dn/, /Dn/, /gm/ and /gn/ are possible voiced stop-nasal clusters that violate SSP.
67 /tm/, /Tm/, /tn/, /Tn/, /qm/ and /qn are possible voiceless stop-nasal clusters that violate SSP.
68 /bʒ/, /bγ/, /dʒ/, /Dʒ/, /dγ/, /dʕ/, /Dγ/ and /gʕ/ are possible voiced stop-voiced fricative clusters that violate SSP.

b. Voiceless stop+ voiced fricative[69]

c. Voiceless fricative+ voiced fricative[70]

(397)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/sʕ/	wasʕ	‘spacious’	/s/	3	/ʕ/	5
/Sʕ/	naSʕ	‘bright’	/S/	3	/ʕ/	5

d. Voiced fricative+ voiced fricative[71]

IV.2.5.2.2.4. Consonant+ voiceless fricative

The consonant+ voiceless fricative onset pattern has been seen in **55** cases unfolding in four subpatterns: 1) voiceless stop+voiceless fricative (19 instances), 2) voiced stop+voiceless fricative (18), 3) voiceless fricative+ voiceless fricative (12), and 4) voiced fricative + voiceless fricative (6), as shown below:

a. Voiceless stop+ voiceless fricative[72]

(398)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/Tf/	luTf ʕaTf	‘gentleness’ ‘sympathetic kindness’	/T/	1	/f/	3
/tʃ/	matʃ	‘the game’	/t/	1	/ʃ/	3
/qʃ/	nəqʃ	‘sculpture’	/q/	1	/ʃ/	3
/ks/	ʕəks	‘oppositeness’	/k/	1	/s/	3
/qS/	nəqS	‘inferiority complex’	/q/	1	/S/	3
/qh/	fiqh	‘Muslim law’	/q/	1	/h/	5

69 /tz/, /tʒ/, /tɣ/, /tʕ/, /Tʕ/, /qz/, /qʒ/, /qʕ/ and /kʕ/ are possible voiceless stop-voiced fricative clusters that violate SSP.

70 /fz/, /fʒ/, /fʕ/, /ʃʒ/, /sɣ/, /Sɣ/, /ʃɣ/ and /ʃʕ/are possible voiceless fricative-voiced fricative clusters that violate SSP.

71 /zʕ/ and /ʒʕ/ are possible voiced fricative-voiced fricative clusters that violate SSP.

72 /tf/, /ts/, /tx/, /tħ/,/th/, /Tħ/, /kf/, /qf/, /kʃ/, /qs/, /kħ/, /kh/ and /qħ/ are possible voiceless stop-voiceless fricative clusters that violate SSP.

b. Voiced stop+ voiceless fricative[73]

(399)

Clusters	Words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/ds/	quds	‘Jerusalem’	/d/	2	/s/	3
/dħ/	mədħ	‘praising’	/d/	2	/ħ/	5
/bs/	ħəbs	‘jail’	/b/	2	/s/	3
/bS/	gəbS	‘plaster’	/b/	2	/S/	3
/bħ/	Subħ	‘first daily prayer’	/b/	2	/ħ/	5
/bʃ/	kəbʃ	‘sheep’	/b/	2	/ʃ/	3
/Dħ/	waDħ	‘clear’	/D/	2	/ħ/	5
/bx/	Təbx	‘cooking’	/b/	2	/x/	5

c. Voiceless fricative+ voiceless fricative[74]

(400)

Clusters	words	Gloss	Sound(1)	Sonority index	Sound(2)	Sonority index
/sx/	fasx	‘annulment’	/s/	3	/x/	5
/Sħ/	qaSħ	‘solid’	/S/	3	/ħ/	5

d. Voiced fricative+ voiceless fricative [75]

IV.2.5.2.2.5. Consonant+ voiced stop

The consonant+voiced stop onset pattern has been observed in **14** cases out of **229** unfolding in three subpatterns: 1) voiceless stop+voiced stop (8 instances), and 2) voiced stop+ voiced stop (2), and 3) voiceless fricative+ voiced stop (4), as presented below:

[73] /df/, /dʃ/, /DS/, /Dʃ/, /dx/, /dh/, /Dx/, /Dh/, /gh/ and /bh/ are possible voiced stop-voiceless fricative clusters that violate SSP.

[74] /sħ/, /sh/, /Sx/, /Sh/, /ʃx/, /ʃħ/, /ʃh/, /fh/, /fħ/ and /fx/ are possible voiceless fricative-voiceless fricative clusters that violate SSP.

[75] /zx/, /zħ/, /zh/, /ʒx/, /ʒħ/ and /ʒh/ are possible voiced fricative-voiceless fricative clusters that violate SSP.

a. Voiceless stop+ voiced stop[76]

(401)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/Tb/	quTb	‘pole’	/T/	1	/b/	2
/qd/	ʕaqd	‘contract’	/q/	1	/d/	2

b. Voiced stop+ voiced stop[77]

(402)

Clusters	**Words**	**Gloss**	**Sound(1)**	**Sonority index**	**Sound(2)**	**Sonority index**
/dg/	ħadg	‘skillful’	/d/	2	/g/	5

c. Voiceless fricative+ voiced stop[78]

IV.2.5.2.2.6. Consonant+ Glide

The consonant-glide onset pattern has been seen in **46** instances out of **229** distributed into six basic subpatterns: 1) voiced-stop+glide (5 instances), 2) voiceless-stop+glide (4), 3) voiced-fricative+glide (4) , 4) voiceless-fricative+ glide (5), 5) nasal+glide (4), and 6) liquid+glide (4), as illustrated below:

a. Voiced stop+ glide

(403)

/bw/ /Dw/ /dy/ /gw/

/by/ /dw/ /Dy/ /gy/

b. Voiceless stop+glide

(404)

/tw/ /Tw/ /kw/ /qw/

/ty/ /Ty/ /ky/ /qy/

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[76] /tb/, /tg/, /kb/, /qb/, /kd/and /qD/ are possible voiceless stop-voiced stop clusters that violate SSP.
[77] /bg/ is a possible voiced stop-voiced stop cluster that violates SSP.
[78] /fg/, /sg/, /Sg/ and /ʃg/ are possible voiceless fricative-voiced stop that violate SSP.

c. Voiced fricative+glide

(405)

/zw/ /ʒw/ /ɣw/ /ʕw/

/zy/ /ʒy/ /ɣy/ /ʕy/

d. Voiceless fricative+ glide

(406)

/fw/ /sw/ /Sw/ /ʃw/ /xw/ /ħw/ /hw/

/fy/ /sy/ /Sy/ /ʃy/ /xy/ /ħy/ /hy/

e. Nasal+ glide

(407)

/mw/ /nw/

/my/ /ny/

f. Liquid+ glide

(408)

/lw/ /rw/

/ly/ /ry/

The above patterns can be exhibited in the following figure:

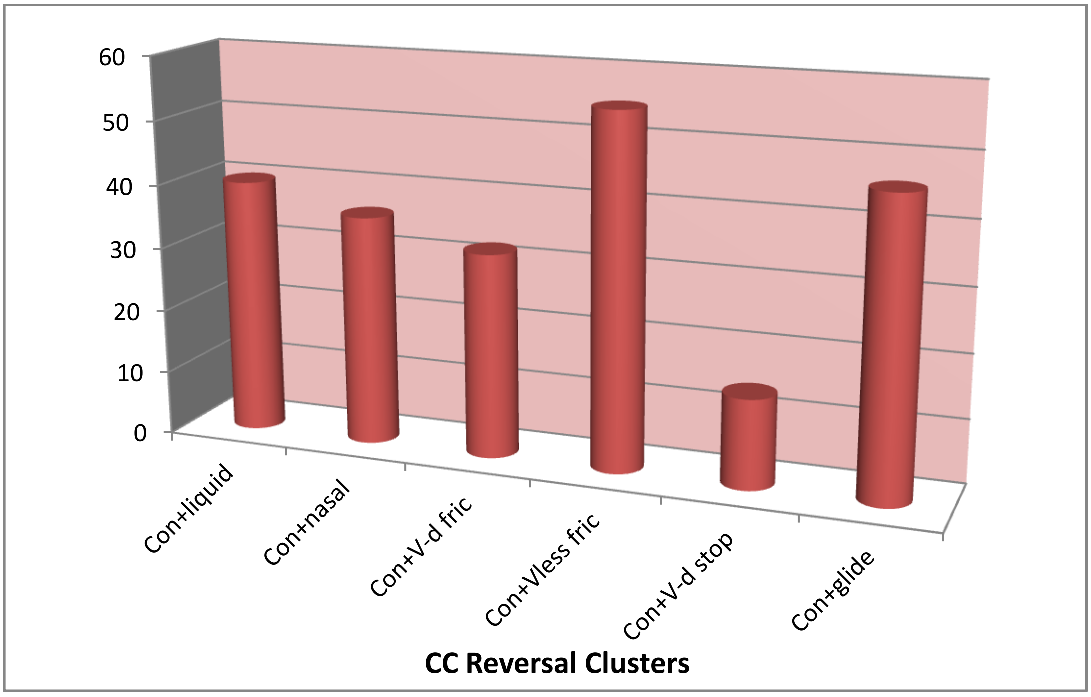

Figure 10: Reversal Patterns

Having identified the different patterns and subpatterns that exhibit sonority reversals, and shown this violation occurs in **229** clusters, I can confirm my previous conclusion that SSP is not a reliable phonological predictor for the sequencing of the consonant clusters in CMA onset and coda..

IV.3. Conclusion

In this chapter, I presented all the possible and impossible clusters in the onset and coda from a constriction-based model. I listed all the possible clusters that obey or violate the OCP. I found that OCP is a reliable phonological predictor for the sequencing of the consonant clusters in CMA onset and coda. This can be seen in the number of clusters conforming to the OCP. There are **344** clusters that conform to the OCP and **141** violate it in the onset. **354** clusters conform to the OCP and **148** clusters violate it in the coda.

Based on exhaustive quantitative evidence, the study provides us with a thorough account of the different CMA onset and coda patterns and subpatterns either show conformity to the SSP or violate it in the manner of sonority plateaus and reversals. Contrary to what is taken for granted that CMA onset and coda normally comply with SSP, the study reveals compliance in only **221** clusters in the onset and **226** in the coda, and **264** clusters in the onset and **276** clusters in the coda violate the SSP. CMA CC onset and coda are thus almost divided between compliance and insurgence, with some inclination toward the latter status. This state of affairs poses challenge to SSP which has been assumed for long to govern complex onsets and codas in syllables. Accordingly, reconsidering a more relevant theoretical model outside the scope of the sonority theory is called for.

To sum up, I found that there are **485** possible clusters and **140** impossible clusters in the onset, and there are **502** possible clusters and **123** impossible clusters in the coda. The main finding is that we can rely on the OCP, but we cannot rely on SSP.

General Conclusion

In this thesis, I briefly sketched the geographical and dialectal situation of Casablanca, and presented the methodology. A brief description of CMA derivation and inflection was given. The purpose of this chapter was to introduce the consonantal and vocalic system of CMA with a brief discussion of the status of the schwa. Also, a distinction between derivation and inflection was established, and the CMA morphological processes were exemplified.

The second chapter aimed to present the theoretical outlooks within which the phenomenon of CMA consonant phonotactics was studied. The first section on syllable structure presented the definition of the syllable and the different theoretical views of it. I discussed the syllable types and constituents with examples. This section presented the different ways of assigning syllable structure and the role of sonority in doing so. The phenomena of extrasyllabicity and licensing were dealt with. Finally, I devoted a sub-section to the treatment of geminates with examples from CMA. The second section on autosegmental phonology highlighted the tools with which CMA co-occurrence restrictions was examined. Also, I tackled the major phenomena in the theory, namely association convention, NCC, and compensatory lengthening, etc. The focus was on the OCP which was exemplified. The third section on feature geometry was an attempt to provide a general overview of the theory. The different feature classes were presented along with the evidence in support of feature organization. Also, the distinction between an articulator-based- model and a constriction based model was established, but the focus was more on the constriction-based model since it is the one that was adopted in the study.

In the third chapter, I examined CMA syllable structure from a feature geometry perspective. In the second section, I presented the onset restrictions using the constriction-based model. The discussion of co-occurrence restrictions was extended in the last chapter of analysis. In the third section (i.e. the peak of CMA syllables), I dealt with the major syllable-related phonological processes namely vowel reduction, vowel strengthening, diphthongization, and glide formation. In the third section, I presented the coda restrictions together with the coda types (e.g. simple and complex coda word-medially and word-finally). I also gave the distinctive features of segments in both the onset and coda. I made use of the All-Nuclei First Approach in the syllabification process. In this section, I looked at the role of sonority in assigning syllable structure, and presented some possible clusters that obey or violate the sonority hierarchy in the onset and coda positions. In the last two sections, I discussed the phenomenon of schwa epenthesis. We saw that noun schwa syllabification depends on the sonority hierarchy, whereas verb and adjective schwa syllabification is not governed by the sonority principle. I presented some nouns that do not conform to the sonority principle. Last but not least, I devoted a section to the treatment of geminates. In this section, I examined the behaviour of CMA geminate clusters with respect to some phonological rules, namely assimilation and epenthesis. I dealt with the two types of geminates (i.e. true vs. apparent), and looked at their representations. The difference between true and apparent geminates was made clear within the theory of feature geometry.

In the fourth and last chapter of analysis, I presented all the possible and impossible clusters in the onset and coda from a constriction-based model. I listed all the possible clusters that obey or violate the OCP. I found that OCP is a reliable phonological predictor for the sequencing of the consonant clusters in CMA onset and coda. This can be seen in the number of clusters conforming to the OCP. There are **344** clusters that conform to the OCP and **141** violate it in the onset. **354** clusters conform to the OCP and **148** clusters violate it in the coda. I also found that there are **485** possible clusters and **140** impossible clusters in the onset, and **502** possible clusters and **123** impossible clusters in the coda.

Based on exhaustive quantitative evidence, the study provided us with a thorough account of the different CMA onset and coda patterns and subpatterns either show conformity to the SSP or violate it in the manner of sonority plateaus and reversals. Contrary to what is taken for granted that CMA onset and coda normally comply with SSP, the study reveals compliance in only **221** clusters in the onset and **226** in the coda, and **264** clusters in the onset and **276** clusters in the coda violate the SSP. CMA CC onset and coda are thus almost divided between compliance and insurgence, with some inclination toward the latter status. This state of affairs poses challenge to SSP which has been assumed for long to govern complex onsets and codas in syllables. Accordingly, reconsidering a more relevant theoretical model outside the scope of the sonority theory is called for.

Appendices

Appendix I : Monosyllabic nouns

wtəd	‘ peg’	qbəR	‘tomb’
sbəʕ	‘ lion’	nmər	‘ tiger’
qfəz	‘cage’	wsəx	‘dirt’
qməR	‘ gambling’	ʒməl	‘camel’
ʕnəb	‘grapes’	ʃərT	‘condition’
ʕdəs	‘lentils’	dhəb	‘gold’
sqəf	‘ceiling’	gəbs	‘gypsum’
ma	‘water’	xu	‘brother’
bnat	‘girls’	bγəl	‘mule’
Dlam	‘darkness’	zbəl	‘rubbish’
Dbəʕ	‘hyena’	ʃʃi	‘the thing’
gməl	‘lice’	ħnəʃ	‘snake’
ħbəl	‘robe’	ħTəb	‘fire wood’
wTar	‘guitar’	sərʒ	‘saddle’
ʕsəl	‘honey’	nməl	‘ants’
bħəR	‘sea’	ħTəb	‘firewood’
γnəm	‘sheep’	tməR	‘dates’
ftəq	‘hernia’	qSəb	‘reeds
nəfs	‘breathe’	wəqt	‘time’
bəħt	‘research’	bgəR	‘cows’
bəRS	‘white blotches on the skin’	bir	‘well’

Appendix II: Monosyllabic Verbs

thəm	'accuse'	kma	'smoke'
xda	'take'	kbər	'to become big'
ħləm	'dream'	ħləf	'swear'
ħsəb	'count'	ʕrəD	'invite'
wħəl	'to get stuck'	rxaS	'it became cheap'
γlaD	'he/it became fat'	rqaq	'he/it became slim'
qdam	'he/it became old'	baʕ	'to sell'
bda	'to start'	brək	'to sit down'
dbəħ	'to slaughter'	dhən	'to grease'
dəkk	'to stamp down'	dlək	'to rub'
drəs	'to thresh'	Dləm	to be unjust to
DəRR	to harm	gadd	to be able to

Appendix III: Monosyllabic Adjectives

mRiD	'sick'	bSiR	'blind
ħsən	'better'	bSiT	'simple'
bləq	'very white'	bxil	'mean'
bnin	'delicious'	ʒdid	'new'
fSiħ	'eloquent	qbiħ	'bad'

Appendix IV: Disyllabic nouns

baRba	'beet'	bubRiS	'small lizard'
baʃa	'type of town mayor'	buglib	'cholera'
baʃaR	'human being'	dSaRa	'impertinence'

bTaTa	'potatoes'	DfiRa	'plait'
bazaR	'shop of native handicraft'		
bəɣrir	'a kind of pancake'		
blaSa	'place'		
bniqa	'jail'		
bəsbas	'fennel'		

Appendix V : Disyllabic Adjectives

basəl	'tasteless'	məskin	'poor'
bəhlul	'stupid'	mufid	'useful'
braber	'berbers'	məzyan	'good'
RbaTi	'from Rabat'	ħaməD	'sour'
ʕali	'high'		

Appendix VI : Trisyllabic nouns

baliza	'suitcase'
baxiRa	'fishing boat'
qaDiya	'matter'
bidaya	'beginning'
biTaRi	'veterinarian'
bnadəm	'human being'

Appendix VII: Medial geminates

baddaz	'kind of couscous made from corn meal'		
bəddəl	'to change'	bəxxuʃ	'a bug'
bənnəʒ	'to drug'	dəbbaɣ	'a tanner'

bəqqal	'a grocer'	dəbbəR	'to find'
bərrəħ	'announce'	dəllaħ	'watermelon'
bərraka	'barracks'	dərrəs	'to teach'
bəRRani	'stranger'	dəʃʃən	'to inaugurate'
bərraħ	'a town crier'	dəwwəx	'to make dizzy'
dəwwəb	'to melt'	dəxxən	'to smoke'
Dəyyəq	'to narrow'	DəRRəg	'to hide'
Dəħħa	'to sacrifice	fəDDa	'silver'
fəqqaS	'small biscuit'	fəRRəq	'to distribute'
gaRRu	'cigaret'	gəbbaS	'plasterer'
gərrab	'a one who buys water'	γədda	'tomorrow'
γəDDaR	'unfaithful'	γəmməD	'to close the eyes'
γənna	'to sing'	həbbəT	'to lower'
rəmməʃ	'to blink'	səbba	'reason'
səbbəb	'to cause'	səbbəq	'to advance'

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