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An Optimality Theoretic Account of the Phonology and Morphology of the Saoura Spoken Arabic

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Dedication

I dedicate this momentous event of my life to the memory of my father. I hope that, from the world that is his own now, he appreciates this humble gesture as proof of gratitude from a son who has always prayed for the salvation of his soul. May Allah, the Almighty, have him in his holy mercy! I also dedicate it to my beloved family, especially my mother, my wife, and my sons.

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Finally, I wish to thank all the members of my family for their encouragement, moral and emotional support while I was carrying out this work.

However, I am solely responsible for the omissions, shortcomings and weaknesses that this study can contain. This being the case, the remarks contained in this thesis incur only my own responsibility.

Abstract

The present study is an investigation of the phonology and morphology of one variety of Algerian Arabic. This is the variety spoken by inhabitants of Bechar and villages near this city and villages along the Saoura valley, henceforth referred to as the Saoura Spoken Arabic (SSA). The main goal of this thesis is the study of some aspects of the prosodic phonology and prosodic morphology of SSA, couched within the framework of Optimality Theory (OT) and Correspondence Theory (CT). The aspects of prosodic phonology considered are the syllable structure and the stress system. As to the aspect of prosodic morphology treated, is the morphology of the broken plural (BP) of triliteral forms. The basic principles of OT have been applied to the areas where prosody and morphology interact. Within the OT model of Prosodic Morphology, interaction takes the form of constraint domination, where prosodic well-formed constraints have priority over morphological requirements. In CT, faithfulness is conceived of as a set of constraints on correspondence relations between the input and the output. It is argued that prosodic aspects such as the syllable structure and the stress system and morphological aspects such as BP are better understood as cases involving interaction between two types of conflicting universal constraints, namely markedness constraints and faithfulness constraints. It is shown that a distinction must be made between two types of syllables: a minor syllable and a major syllable, i.e. a minor syllable with a moraic consonant, and a major syllable, whose nucleus includes either a schwa or one of the vowels of the language. The analytical framework herein conceptualized provides a thorough understanding to the stress system of SSA which shows trochaic feet. It is shown that the grammar based on correspondence relations makes it possible to report in a more interesting way the morphology of BP in SSA. It is also shown that the central axis of this morphology is based on the moraic correspondence of the syllables targeted as the prosodic domain, thus, establishing a hierarchy of constraints inscribed within the hierarchical prosodic grid, in the sense that the strictly prosodic constraints take priority over the purely segmental constraints. The ultimate objective in the present thesis is to exploit the basic tools available in the OT framework to adequately analyze the aforementioned aspects of SSA prosody and morphology. Attaining this objective means a significant move towards the establishment of an individual grammar of SSA based on the reranking of a set of violable universal constraints.

Keywords: Optimality Theory, Correspondence Theory, Moraic Correspondence, Syllable, Stress, Broken Plural, Saoura Spoken Arabic.

Résumé

La présente étude est une enquête sur la phonologie et la morphologie d'une variété d'arabe algérien. C'est la variété parlée par les habitants de Béchar et des villages proches de cette ville et des villages le long de la vallée de la Saoura, dorénavant appelée Parler Arabe de la Saoura (PAS). L'objectif principal de cette thèse est l'étude de certains aspects de la phonologie prosodique et de la morphologie prosodique de la PAS, dans le cadre de la théorie de l'optimalité (TO) et de la théorie de correspondance (TC). Les aspects de la phonologie prosodique considérés sont la structure des syllabes et le système de l'accent tonique. Quant à l'aspect de la morphologie prosodique traitée, est la morphologie du pluriel brisé (PB) des formes trilitères. Les principes de base de la TO ont été appliqués aux domaines où la prosodie et la morphologie interagissent. Dans le modèle de la TO de la morphologie prosodique, l'interaction prend la forme de la domination des contraintes, où les contraintes prosodiques bien formées ont priorité sur les exigences morphologiques. Dans la TC, la fidélité est conçue comme un ensemble de contraintes sur les relations de correspondance entre l'input et l'output. On fait valoir que les aspects prosodiques tels que la structure syllabique et le système de l'accent tonique et les aspects morphologiques tels que PB sont mieux compris comme des cas impliquant une interaction entre deux types de contraintes universelles conflictuelles, à savoir les contraintes de marquage et les contraintes de fidélité. On montre qu'il faut distinguer entre deux types de syllabes: une syllabe mineure et une syllabe majeure, c'est-à-dire une syllabe mineure avec une consonne moraïque, et une syllabe majeure, dont le noyau comprend soit un schwa, ou l'une des voyelles de la langue. Le cadre analytique ici conceptualisé fournit une compréhension approfondie sur le système de contraintes du PAS qui montre les pieds trochaïques. On montre que la grammaire basée sur les relations de correspondance permet de rendre compte de manière plus intéressante sur la morphologie de PB du PAS. On montre également que l'axe central de cette morphologie repose sur la correspondance moraïque des syllabes visées comme domaine prosodique, établissant ainsi une hiérarchie des contraintes inscrites dans la grille prosodique hiérarchique, au sens où les contraintes strictement prosodiques sont prioritaires sur les contraintes purement segmentales. L'objectif ultime de la présente thèse est d'exploiter les outils de base disponibles dans le cadre de la TO pour analyser de manière adéquate les aspects susmentionnés de la prosodie et de la morphologie du PAS. Atteindre cet objectif signifie un pas important vers l'établissement d'une grammaire individuelle du PAS basée sur le reclassement d'un ensemble de contraintes universelles violables.

Mots clés: Théorie de l'optimalité, Théorie de correspondance, Correspondance moraïque, Syllabe, l'Accent tonique, Pluriel brisé, Parler arabe de la Saoura.

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List of Symbols, Acronyms and Abbreviations

Symbols

ˈ	Stress
*	Ungrammatical form or constraint violation
!	Fatal constraint violation
☞	Optimal candidate
☜	Sub-optimal candidate
💣	Wrong optimal candidate
Ø	Null element or deletion
O	Insertion
>	More harmonic, superior or higher
<	Inferior or lower
>> or solid line	Dominance relationship (hierarchy, high order)
< >	Enclose underparsed material
Dotted/dashed line	Non-ranking
Blank cell	Constraint satisfaction
Shaded cell	Constraint Irrelevance
√	Root
μ	Mora
σ	Syllable
σμ	Mono-moraic syllable
σμμ	Bi-moraic syllable
σμμμ	Tri-moraic syllable
∀	Whatever
∃	There is
∈	Belong
≈	Correspond
=	Equal
¬	Anti

N	Nucleus
V	Vowel
X	Timing slot
LX	Lexical word

Acronyms and Abbreviations

C	Candidate or Consonant
CA	Classical Arabic
Cat	Category
SPE	Sound Pattern of English
OT	Optimality Theory
UG	Universal Grammar
ASP	Autosegmental Phonology
GEN	Generator
EVAL	Evaluator
Cand	Candidate
iff	if and only if
SSA	Saoura Spoken Arabic
CON	Constraint
OA	Old Arabic
AA	Algerian Arabic
BA	Bechar Arabic
BP	Broken Plural
ACT	Active
PTCP	Participle
M	Masculine
SG	Singular
IPFV	Imperfective
masc.	Masculine
pers.	Person
sing.	Singular
fem.	Feminine
PrWd	Prosodic word

SSP	Sonority Sequencing Principle
HV	High Vocoid
OO	Output-Output correspondence relation between the singular and broken plural

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General Introduction

General Introduction

1. Background of the Study

Morphology as an autonomous component in Generative Grammar has been established with Chomsky (1970) and Halle (1973). Since then, a number of theories dealing with word structure and the organization of the lexicon have emerged. Examples of such theories include the theory of Word Formation (Aronoff 1976), the theory of Level-Ordered Morphology (Siegle 1974, Allen 1978), the X-bar theory of word structure (Selkirk, 1982) and the theories dealing with the interaction between Morphology and Phonology such as the Lexical Morphology and Phonology (Kiparsky 1982 ; Mohanan 1986) and the theory of Prosodic Morphology (McCarthy 1979, 1981, 1982; McCarthy and Prince 1986 et al.).

In Phonology, since the standard theory of Chomsky and Halle (1968), parallel developments have been achieved. The traditional view that the input to phonological representations is matched to the output by a set of rewrite rules has been challenged by theories such as the theory of Constraints and Repair Strategies (Paradis, 1988a) and Government Phonology (Kaye et al. 1985, 1990). While the first theory accounts for phonological alternations by appealing to a set of surface-unviolated constraints complemented by repair strategies whose role is to solve any violation resulting from constraint conflicts; the second attempts to replace rules by a set of universal principles common to all linguistic systems along with a series of language-specific parameters.

The proposals concerning the role of constraints in grammar advanced in the aforementioned works and others gave rise to the emergence of a theory of constraints and constraint interaction, known as Optimality Theory (Prince and Smolensky 1991, 1992, 1993, McCarthy and Prince 1993a). It is a theory of grammar developed by Prince and Smolensky (1991, 1992, 1993) and McCarthy and Prince (1993a, 1993b, 1994, 1995), who have applied it to phonological facts from different languages. According to the theory, universal grammar provides a set of universal constraints and the grammars of individual languages consist of at least one ranking of these constraints, which interact to select, for each input form, the optimal surface structure from a set of candidates.

In Optimality Theory (henceforth OT), the central idea is that Universal Grammar consists of a set of ranked and violable constraints on output structures together with general means of resolving their conflicts. In order for OT to resolve conflicts, it has recourse to the means that rank constraints in a strict dominance hierarchy: higher-ranked constraints take priority over lower-ranked ones. The constraints themselves fall into two types: well-formedness constraints and faithfulness constraints. The former enforce segmental or prosodic markedness, while the latter fight against any changes between an input and its output.

The basic principles of OT have been applied to the areas where prosody and morphology interact. Later developments within the OT framework were very important to the emergence of Correspondence Theory (McCarthy and Prince 1995, 1999). In Correspondence Theory (henceforth CT), faithfulness is conceived of as a set of constraints on correspondence relations between the input and the output, the base and the reduplicant.

2. (Problem) Statement of the Intent

It is within the general framework of OT and CT that we attempt to analyze some aspects of the prosodic phonology and prosodic morphology of a variety of Algerian Arabic – the Saoura Spoken Arabic (henceforth SSA). The phonological aspects of SSA that we will consider are the syllable structure and the stress assignment. As to the morphological aspect that we will treat, is the broken plural of triliteral forms. The choice of the theoretical framework adopted in the study of the phonological and morphological aspects stems from the reason that both the theories and the classes of the SSA phonology and morphology have received no attention from researchers at all.

3. Research objectives

The primary goal of the present thesis is to exploit the basic tools available in the OT framework and see to what extent they can allow us to adequately analyze the previously mentioned aspects of SSA phonology and morphology. Achieving this objective means a significant move towards the establishment of an individual grammar of SSA based on the reranking of a set of violable universal constraints. Particularly, we investigate the syllable shape of SSA dialect and provide a comprehensive analysis of the syllable structure and its interaction with schwa epenthesis within the framework of OT (Prince and Smolensky 1993, 2004). Furthermore, we enrich the research on SSA stress both from an empirical side by doing a quantitative work and also from the theoretical side by applying the OT principles i.e., expressed in terms of competing constraints rather than rules to account for stress assignment. Moreover, we show that the grammar based on correspondence relations makes it possible to report, in a more interesting way, the morphology of Broken Plural (BP) in SSA**.**

4. Research Questions

Our study aims to answer the following questions:

a). Are prosodic structure assignment and schwa epenthesis governed by the step-by-step syllable structure building rules proposed within the derivational frameworks, or by universal constraints such as the constraint requiring the onset and the constraint prohibiting the coda?

b). Do the interaction of well-formedness constraints and faithfulness constraints and their relative ranking derive the recalcitrant problem of schwa occurrences?

c). How can the schwa epenthesis and consequently the SSA syllable structure be accounted for adequately within the OT and CT frameworks?

d). Is OT able to capture the intricacies of SSA stress without too many special stipulations?

e). Is SSA a quantity-sensitive system favouring trochaic feet?

f). Is SSA sensitive to syllable weight or syllable position or both?

g). Why words with the object clitics do not get stress in spite of their being heavy and in final position?

h). Do (the grammar based on) moraic correspondence relations of the syllables (targeted as the prosodic domain) make it possible to report the morphology of BP in SSA?

i). Do the strictly prosodic constraints take priority over the purely segmental constraints?

5. Research Hypotheses

In order to respond to the research questions, we propose the following hypotheses:

a)- From the interaction of constraints, pertaining to Universal Grammar, SSA derives syllabic well-formedness. That is the interaction and ranking of structural (markedness) constraints such as the constraints requiring syllables to have onsets and no codas, and faithfulness constraints regulating the relationship between the input and the output along with other constraints determine syllabic well-formedness in the SSA.

b)- SSA stress falls on the rightmost penultimate syllable.

c)- The hypothesis to defend (in chapter five) is that faithfulness to the prosodic structure, translated in terms of moraic correspondence, for example, takes precedence over faithfulness to auto-segmental associations between segments and prosodic units that cover them.

6. Outline of the Chapters

This study consists of five chapters. In chapter one, we introduce some methodological preliminaries which give details about the relevant phonology and morphology of the variety of SSA to be analyzed.

In chapter two, we present the theoretical preliminaries which allow an optimal understanding of the general principles that serve as a backdrop to our analysis.

In Chapter three, we offer a constraint-based account of SSA syllable structure and its interaction with schwa epenthesis. Therein, we argue that prosodic structure assignment and consequently schwa epenthesis are governed by universal constraints such as the constraint requiring the onset and the constraint prohibiting the coda. The issue of epenthetic schwa in CCC clusters will be shown to derive from the interaction and ranking of faithfulness constraints and well-formedness constraints.

In chapter four, we analyze the stress assignment of SSA. Therein, we set the background for an empirical study of stress whose objective is to quantify the results obtained from a perceptive test given to native speakers who were given a list of items and were asked to place stress relying on their intuitions. Within the OT model, it will be shown that the location of stress in isolated words leads to trochaic feet follows from the Selkirk (1978) prosodic hierarchy.

Finally, in chapter five, we study the repertoire of triliteral forms of the Broken Plural (BP) that build a template structure of the type [H], i.e. heavy. The assumption of the moraic correspondence between the output of the singular and that of the corresponding BP will emerge as the basic assumption of this analysis. The foot binarity on the moraic layer will emerge as a markedness constraint taking precedence over any other constraint on the segmental structure, as will be shown in the analysis of pure consonant forms, geminate consonant forms and root forms of High Vocoid (hence HV).

The OT offers a conceptual tool capable of integrating an extensive range of more elaborate linguistic phenomena than any other theory. The analyzed chapters will be concrete witnesses. On purely conceptual grounds, therefore, we should prefer the framework that uses only constraints. One of the main purposes of this study is to try to show that such a framework might be empirically superior as well.

CHAPTER ONE:

Methodological Preliminaries

1. Methodological Preliminaries

1.1 Introduction

The objective of this chapter is to present some methodological preliminaries allowing an optimal understanding of the general principles that serve as a backdrop to our analysis. The described variety is the one used in interpersonal communication by native speakers of the Saoura. Much of the data we have collected for linguistic description purposes is our own realization, corroborated by that of the people who are close to us or who we have come into contact with, and who are, overwhelmingly, native speakers of the Saoura Arabic. This is the variety of Algerian Arabic spoken by inhabitants of the city of Bechar, which is the centre of the province of the Saoura, and villages near this city, henceforth referred to as the Saoura Spoken Arabic (SSA). We took care, in choosing our informants, that they were all born and have always lived in Bechar, and that their parents were also born in this city or, at least, have spent a good part of their lives there. The phonology and morphology aspects that hold our attention most are those of the syllable structure, stress and the broken plural (henceforth BP).

This chapter is organized around eight axes. The first section contains the introduction. The second gives a brief review of the literature on Arabic dialects. The third is about the sociolinguistic situation of Algeria. The fourth presents a lot of information about SSA and the city of Bechar. The fifth is about the procedure followed in the collection of the data. The sixth gives a background knowledge about the phonology and morphology of the variety to be studied. Therein, we list the consonantal and vocalic inventories as well as the relevant morphological categories that we judge necessary to be explored. The seventh sets out the paradigm of the BP forms used in this analysis. A subsection will be devoted to the description of the triliteral forms. Finally, the eighth section summarizes the chapter.

1.2 Review of the Literature on Arabic Dialects

Some of the most salient differences among the Arabic language and its vernaculars have to do with syllable structure. There have been expanded studies within the OT framework. In general, there are two significant facts about the syllable in Arabic. First, onsets are obligatory, i.e. no syllable starts with a vowel. Several studies, for example Gadoua (2000), McCarthy (2005), and Haddad (2005), have all pointed out that syllables in Arabic have no initial vowel.

Yet, Haddad (2005) asserts that syllables in standard Arabic and Cairene Arabic cannot begin with a vowel.

Likewise, complex onsets are prohibited in Arabic. Several researchers, namely McCarthy (2005), Archibald (2003), Edzard (2000) and Haddad (2005), agree that complex onset is prohibited in many varieties of Arabic. Archibald (2003), in particular, asserts that Egyptian Arabic does not allow initial consonant clusters. Haddad (2005) also states that complex onset is not allowed in both Cairene and modern standard Arabic. In addition, Gafos (2003) argues that while geminates are allowed in Arabic, the onset does not consist of geminates and that no complex syllable onsets are permitted in Arabic. McCarthy (2005), however, argues that initial consonant clusters are possible due to syncope of certain perfective verbs of Arabic. The examples which McCarthy cited are found in classical Arabic and Moroccan Arabic.

Second, there are varieties of Arabic that allow geminates to occupy the onset. Boudlal (2004) points out several examples in Casablanca Moroccan Arabic. Moreover, Boudlal highlights that complex onsets exist in the onset without any process of syncope.

So, clearly, the syllable in most of the varieties of Arabic starts with an onset and does not start with a vowel. Based on the studies presented, the onset in most varieties of Arabic is not complex save for the case of Casablanca Moroccan Arabic. Geminates, on the other hand, exist in several varieties both word medially and word finally.

The Saoura Arabic retains many features of the varieties cited by previous studies, namely, no initial vowels, but complex onsets and geminates are allowed, e.g. [**ʔ**amr] ‘order’, [**sm**a] ‘sky’, [**ʃʃm**æʕ] ‘the candles’, [kə**tt**əl] ‘cause to kill’, [fu**mm**] ‘mouth’, ... etc.

1.3 Aspects of the Sociolinguistic Situation of Algeria

In his study of multilingual speech communities, Ferguson (1959) classifies languages according to the political or social status that qualifies them as being official, national, standard or vernacular, etc. For the Algerian sociolinguistic profile, Arabic is the national and the official language, and it usually appears in its two forms: Modern Standard Arabic (MSA) and dialectal Arabic. MSA is the language of most Arabic literature. It is the written variety of the language, common to all literate Arabic speakers in the world, used in the media, in literature, at school and for all literate activities, and almost exclusively used in its spoken form in the electronic media. It is a unified, codified pan-Arab variety of Arabic, the modern descendant of Classical Arabic (CA) (Holes, 1995).

The origin of CA and its split into various dialects is a complex one. In pre-Islamic times, Old Arabic (OA) was the prestigious, poetic language; it was the language of the Bedouin tribes, of pre-Islamic poetry, and eventually, the language of the revealed Book, the Quran. Present day CA, a continuation of this OA that was codified by the grammarians, is the literary and cultural language of the Arabo-Islamic world as it is today (cf. Versteegh, 2004). This OA began to transform alongside the expansion of Islam through the Islamic conquests, and, hence, the expansion of the Arabic language. Now, no more restricted to the register of poetry of pre-Islamic times, OA was exported to the conquered cities in attempts to facilitate communication with the indigenous population. This gave rise to a new form of Arabic, Neo-Arabic (to be contrasted with OA), a form of Arabic that has features traced back to pre-Islamic dialects, and that developed into the Arabic dialects as we know them nowadays. One among others, is Algerian Arabic (hence AA) which is, on the other hand, the dialectal Arabic or the spoken variety, and is used spontaneously by Algerians to express themselves.

The early inhabitants of Algeria were the Imazighen, who spoke varieties of Tamazight, a Hamito-Semitic variety, which came to be called Berber by the early invaders. Algeria was first invaded by the Phoenicians. It became a Roman Province in 46 BC and part of the Byzantine Empire in 395 AD. In the seventh century, Algeria, along with the whole of the North African Littoral was conquered by the Arabs. The Arab rule lasted almost nine centuries before the country came under the Ottoman supremacy in 1518 and was governed by an Ottoman " Dey " and his subordinates, the " Beys ". Algeria continued to be an outpost of the Ottoman Empire until 1830 when the French forces began to invade the country. By 1848 Algeria was declared a French territory. Right up until the twentieth century, Europeans, not only from France but also from Italy, Spain and Malta settled in the country. By 1960 the European population reached one million. Yet it was the European minority who took control of the rest of the population. The French ruled the country until 1962 when Algeria gained independence.

Before the Arab conquest, the Tamazight-speaking population resisted adopting the languages and religions of their invaders. Following the Arab conquest, however, the Algerians, along with the inhabitants of the other North African countries, adopted the Arabic language and embraced Islam. However, they managed to retain their language and customs. According to Camps (1987),

> La Berbérie devient musulmane en moins de deux siècles alors qu'elle n'est pas entièrement arabiseé, treize siècles après la première conquête arabe.
> (Berberia becomes Muslim in less than two centuries while it is not yet fully Arabized, thirteen centuries after the first Arab conquest).

In spite of the fact that Algeria came under the direct Ottoman influence for three centuries, Turkish does not seem to have left its mark on either Arabic or Tamazight, apart from a negligible number of terms. When the French forces finally took over the whole country in the nineteenth century, French became the only language of administration and instruction and was used exclusively on signposts and public posters.

After getting its independence, Algeria needed to regain its identity as an Arabic and Muslim country. The Algerian leaders, especially the Nationalists, soon adopted the following motto:

> « L'Islam est notre religion, l'Algérie est notre patrie, la langue arabe est notre langue »
> (Islam is our religion, Algeria is our mother country, Arabic is our language).

For Nationalists, Arabic was considered as the best successful means of communication without which Algeria would certainly lose identity and values. That is why, in 1968, president Houari Boumedienne (1927-1978) declared :

> « Sans la récupération de cet élément essential et important qui est la langue nationale, nos efforts resterons vains, notre personnalité incomplète et notre entité un corps sans âme ».
> (Without recovering that essential and important element which is the national language, our efforts will be vain, our personality incomplete and our entity a body without a soul).

When examining Algeria's sociolinguistic situation following the independence, we can say that it is more intricate than it seems. Measured by the yardstick of history, the French colonization which lasted a hundred and thirty-two years seems relatively short. Yet, the consequences of the French linguistic impact are very strong. The long and sustained spreading of the French language and culture had gradually succeeded in maintaining Algeria as a stronghold until independence. Thus, when Algeria became independent in 1962 in addition to

Algerian Arabic and Tamazight, the languages of indigenous inhabitants, French was commonly used. To this day and despite massive and intensive continuous policies and programs of Arabization, one can notice that the influence of the French presence did not cease with independence.

Consequently, there are three languages that are spoken and/or written in Algeria. The spoken languages include a variety of Arabic (Algerian Arabic), French and Berber such as Kabyle, Chawia, Mozabite, and Tamachek – the mother tongue of the Touaregs. The written languages include the Modern Standard Arabic (MSA) French and Tamazight.

To sum up, the linguistic situation in Algeria is very complex. It is diglossic, bilingual and multilingual. The Algerian people have several codes at their disposal, and can use any code at any time: Algerian Arabic, standard Arabic, Berber, French, and Arabic-French.

1.4 The Saoura Arabic (Southwestern Algeria)

The Wadi Saoura (Saoura River) is located in the southwestern region of Algerian Sahara: it crosses a part of the great Western Erg from Ksabi, passes through the oases of Kerzaz, Beni Abbes, Mazzer, Igli and leads to Abadla where it takes the name Wadi Guir (Guir River). The oases of Bechar and Kenadsa, although located on the river of Bechar, Lahmar, Mougheul and Boukais, are part of the natural and administrative area (wilaya) of the Saoura.

Geographically, the region of the Saoura itself covers all of western Algerian Sahara, from the eastern edge of the Western Grand Erg and the Tidikelt (Ain Salah region) to Tindouf, near the Western Sahara.

What is meant here by the "Saoura Arabic" covers a smaller restricted area: it is essentially the spoken Arabic of the oases of Bechar (including Lahmar, Mougheul, and Boukais), Kenadsa, Abadla, Igli, Mazzer, Beni Abbes, Elouata, Kerzaz and Ksabi, so the Arabic spoken in the region of Wadi Saoura. We will restrict our study to the City of Bechar which is the center of the province of the Saoura.

The variety of AA spoken in Bechar is characterized by certain particularities attributed to rural dialects. Despite the heterogeneity of the inhabitants of the City of Bechar, we can nonetheless, speak of a somewhat homogeneous variety where regional variations have been neutralized to yield the variety referred to as SSA.

1.4.1 Etymology

There are two names for the city of Bechar; each one has a story:

The first is Bashar, whose name is derived from the word "bashar" i.e. the “annunciation,” and that Abdul Malik Sultan of Turkey sent explorers from the north of the country to the desert to search for new sources of water; one of them arrived at the SAOURA and discovered the water springs; he returned to the Turkish Sultan with the annunciation. There has been a lot of talk about Bashar who returned with happy news; since then, this region has been known as "Bechar."

The second Colomb Bechar said that it was known by the name of the French Captain de Colomb, who entered the region in 1857 where he stationed his armies and added his name to the name of the city to become "Colomb Bechar." This name was given to the city throughout the French colonial period, and the original name of Bechar was restored with the beginning of independence.

1.4.2 Locality

The city of Bechar is bordered to the east by the Atlas Mountain range, which includes Mount Antar (The highest mountain peak in the province, which is 1953m high); it overlooks the city directly. The city is also bordered to the west by Kenadza. From the north and south, the city is bordered by the Wakda Oasis and the Hamada, respectively.

1.4.3 Early History

Bechar's history has undergone several stages that can be divided by population into:

a. The Discovery of Bechar

During the ninth century of the Hegira, the Turkish Sultan sent messengers to the Sahara, which he wanted to annex to his power and urged them to count everything that is important, especially water sources and promised who brought the better news, exemption from the tax and army service, in addition to an attractive amount of money that would make him safe from poverty. Most of the apostles did not return because their compatriots perished because of thirst or hunger, while some discovered rare stones and minerals, and some others discovered water springs. But the water was not fresh and only one of them who was lucky was asked to enter the Sultan's Council. And when he met him, he offered him a goatskin churn with pure water. The king was surprised by the important discovery and presented a great gift to the discoverer Prophet and called him the *Bashar* because of the annunciation that he came with and the name was also given to the area where he discovered the water.

b. Ouled Nusair Ksar

The Sultan chose the tribe of Ouled Nusair to build and live in this area. These new inhabitants soon became rich as a result of the good harvest of agriculture, which was added to hunting, and because the area was full of ostriches, deer and antelopes. Some of the sons of Nusair were mainly engaged in agriculture, while the rest worked in livestock raising in the surrounding pastures of Wadi Guir. This growth and prosperity brought to the region new residents who lived with Ouled Nusair.

1.4.4 Demography, Population and Language

The historical inhabitants of Bechar, i.e., the inhabitants of the ksar of Bechar (before the French colonization), are divided into four large families that are integrated with each other and with Berber tribes of Moughal, Ouakda, and Taghit. These families are:

- Ouled Al-Hirach
- Ouled Al-Ayad
- Ouled Addi
- Ouled Charif of Touat

After the French intervention in 1903, began the migration of the Jews of Tafilalt towards Bechar, where they formed a secluded community (they only get married among themselves) within their own section in the modern city that began to be formed and then inhabited by Spanish, French and Arab families. This community remained until the establishment of the state of Israel in 1948, where most of them went there, while some of them returned to Morocco and some remained until independence, and most of them went to France. We recall from the Jewish families who lived in the city: Bou Hsira, Abukrat, Asiraf, Azoulay, Benhammou, Dahan, Sabban (there is a neighborhood that bears the name today - Sabban -), Tarjuman, Zanu ...etc.

French forces imposed a narrowing on the movements of the nomads. Most of the nomads were forced to settle in order to form the largest population bloc. A large part of the population of Dwi Mnie settled in Bidon II and the rest in Abadla, while Ouled Jerir settled in Debdaba. The inhabitants of the ksars of the region who came to the city lived in the center of Bechar and Debdaba and most of them were from Kenadsa and Bani Abbas and Ain Sefra and El-Bayadh. After independence, Bechar became one of the largest cities in Algeria, being the center of the third military district. As a result, huge numbers of inhabitants, mostly military families and merchants, found Bechar to be a suitable place for their activity, justified by the rise of the population from about 45 thousand at independence to 171,724 in the year 2009.

Table 1: Demography (population growth)[1]

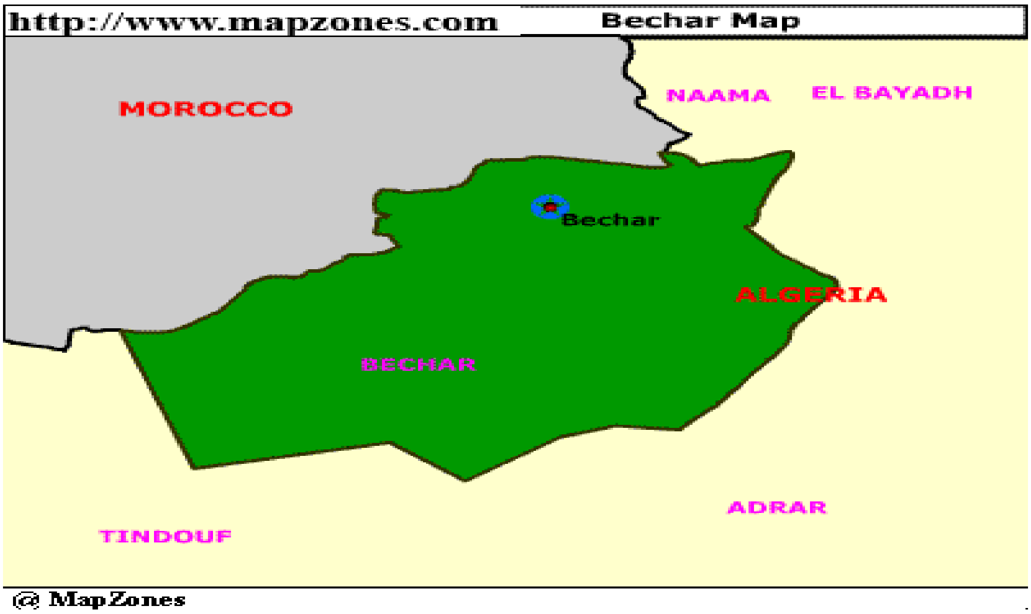
Year	1936	1954	1966	1977	1987	1998	2008	2009	2018
Population	5.100	43.300	46.500	56.600	107.300	134.500	165.627	171.724	274.866

Arabic is the most spoken language in commerce and with the city's administration because most of its inhabitants are Arabs, mostly from the nomadic tribes that inhabited the area (Dwi Mnie, Ouled Jrir, Ghnanma and Amour ...). Today, the local Arabic dialect includes several Berber, French, Spanish and other words.

After the compensation of the southern provinces of the French territories in the Sahara in 1957, Bechar became the center of the province of the Saoura. With the dawn of Algeria's independence, the region of the Saoura was composed of the circles of Bechar, Beni Abbas, Adrar, El-Abyed Sidi Cheikh, Timmoun and Tindouf, and this until 1974, where the new administrative division was issued , which divided the region into two provinces:

• The province (Wilaya) of Adrar, including Timimoun district.
• The province of Bechar, including the rest of the districts.

After the new administrative division of 1984, Tindouf and El-Bayadh were given the rank of province, and Bani Abbas and Ain Sefra remained districts until 2009, where they were included in the list of delegated States.


http://www.mapzones.com
Bechar Map
MOROCCO
NAAMA
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Bechar
ALGERIA
BECHAR
ADRAR
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Encyclopaedia Britannica (2008)

1.4.6 Dialectal Situation

As a consequence of the migration of rural speakers of the neighboring areas of Bechar, especially Berber-speaking areas, notably from Igli, Ouakda, Lahmar, Taghit, Mougheul, Boukais and Tabelbala as well as migrants from other regions of the country, SSA has become a mixing of different rural and urban dialects. Undoubtedly, contact between these varieties has taken place, causing dialect mixture and giving rise to new dialectal forms.

Besides varieties of AA, foreign languages, namely French and Spanish have established their presence in Bechar. Given the interaction of foreign languages as well as the different regional varieties of AA and Berber, the linguistic situation in Bechar seems quite difficult to define.

Despite the heterogeneous dialectal situation in Bechar, it is still possible to speak of one specific variety of SSA. The linguistic situation of Bechar shows that the presence of many languages in the city led to the emergence of an interdialect. As a matter of fact, it is this interdialect that later developed into what came to be known as SSA whose native speakers could be identified throughout the country. Of course this dialect shares most of the grammatical features of the other varieties of AA but concomitantly differs from them with respect to certain phonological and morphological aspects.

1.5 Methodology of the Research

The data set in the present analysis is provided by the author of this work who is a native speaker of the dialect under discussion. They were collected in Bechar among family members and friends, in particular. In collecting the data, certain variables have been taken into consideration. The informants we have chosen were all born in Bechar. Moreover, their parents have been living there for a long period. For the purpose of homogeneity, we have disregarded the data collected from informants whose parents were migrants from other regions of the country. We have also gathered extensive original data on SSA, including a corpus of natural speech transcribed from recorded conversations among some famous people such as singers, jokers and poets from the local radio and television stations. The corpus chosen is representative of the phonological and morphological aspects dealt with in SSA.

1.6 Basic Phonology and Morphology

This section sets the linguistic background of the variety of SSA being studied. It introduces the segmental inventory of phonemes as well as the phonological and morphological aspects that we judge necessary to understand the whole dissertation.

1.6.1 Consonantal Inventory

The consonantal system of AA has perhaps received little treatment. But nevertheless, we postulate that the number of consonant phonemes the dialect of the Saoura has is only 27 consonant phonemes. The consonantal inventory of SSA is displayed in the following chart:

Table2: Saoura Arabic Consonant Phonemes

Place of Articulation

Manner of Articulation		**Labial**		**Coronal**			**Dorsal**			
		Bilabial	**Labio-dental**	**Alveolar**	**Palato-alveolar**	**Palatal**	**Velar**	**Uvular**	**Pharyngeal**	**Glottal**
Stops	**V-**			**t ʈ**			**k**	**q**		**ʔ**
	V+	**b**		**d ɖ**			**g**			
Fricatives	**V-**		**f**	**s ʂ**	**ʃ**			**χ**	**ħ**	
	V+			**z**	**ʒ**			**ɣ**	**ʕ**	**h**
Nasals		**m**		**n**						
Lateral				**l**						
Trill				**r ɽ**						
Glide		**w**				**j**				

The chart represents the consonants of SSA as pronounced by the majority of speakers. Sketchily, the most important features of the Arabic spoken in the Saoura are the following: first, the phoneme /q/ is often phonetically realized as /g/ e.g. [guul] 'say', [ʕagrəb] 'scorpio', [gəmla] 'louse',[gənʈra] 'bridge', etc. But there are numerous examples where the realization of /q/ has been preserved, e.g. [qbəl] 'before/accept', [ʕaqəl] 'smart', [səqsi] 'ask', etc. However, some words have /g/ for instance [mnagəʃ] 'earrings', [dəgdəg] 'chop up', [drəg] 'disappear/hide', [gurʃaal] 'dirt', [gərɖa] 'a large piece/loaf', [guub] 'a kind of spots on the face', … etc. We also have an example of the shift of /q/ to /k/, e.g. [qtəl] is realized as [ktəl]. Second, the interdentals do not occur in SSA. Accordingly, /θ/ has shifted to /t/ in the city dialect but to /f/ in rural areas. Thus, CA [θamma] 'over there' commonly becomes [təmma] and/or [təm] and [fəmma] and/or [fəm] in neighboring areas; /ð/ becomes /d/, example CA [haða] 'this' is [hada], CA [kaðaba] 'he lied' becomes [kdəb], … etc. Third, the glottal stop /ʔ/ does not form part of the phonemic inventory of SSA; it is only prosthesized before vowel-initial words for onset purpose, e.g. [ʔataj] 'tea', [ʔarɖ] 'earth', and it is also realized as a vocalic length e.g. [raas] 'head', [faar] 'mouse' in SSA for [raʔs], [faʔr] in CA …etc. Fourth, the phonemes /r/ and /ɽ/ are distinct as shown by the minimal pairs such as [dərb] 'ghetto' and [ɖaɽb] 'hitting', [dær] 'he did' and [daaɽ] 'a house', [rbæħ] 'win' and [ɽbaʕ] 'a quarter', [ʒæri] 'liquid' and [ʒaɽi] 'my neighbour'; [jəbra] 'needle' and [jəbɽa]'he'll be healed'… etc.

1.6.2 Vocalic Inventory

Phonologically, SSA presents a vocalic system based on seven–vowels, three long or medium and three short or ultra-short and an epenthetic schwa. These vowels have, of course, several allophones according to their consonantic contours.

<u>Table 3: The Saoura Arabic Vowel Phonemes</u>

Short Vowels	Allophones	Long Vowels	Allophones
/a/ /ɪ/ /u/ /ə/	[æ] [e] [o] …	/aa/ /ii/ /uu/ …	… [ee] [oo] …

a. Long Vowels

We have the three long vowels of Classical Arabic /aa/, /ii/ and /uu/ as autonomous phonemes and two allophones /oo/ and /ee/ which present themselves as contracted realizations of the diphthongs /əw/ and /ej/ sometimes alternating freely with the latter: [ʈeen] → [ʈejn] ‘clay’, [ʂoot] → [ʂəwt] ‘sound’,

[aa]: [gaal] ‘he said’
[ii]: [fiil] ‘elephant’
[uu]: [muus] ‘knife’

These vowel phonemes also have variants/allophones conditioned by the consonantal environments/contours:
[ii] has the variant/allophone [ee] in contact with a velar, pharyngeal or laryngeal consonant:
[ʂɣeer]: ‘small’, [tqeel] ‘heavy’, [jʈeer] ‘he flies.’
[uu] has the variant/allophone [oo]: [door] ‘role’, [noor] ‘light.’

b. Short Vowels

We have the three short vowels of classical Arabic /a/, /ɪ /, /u/ and an epenthetic schwa /ə/:
[a]: [jdawwər] ‘he seeks’,
[ɪ] : it can have the variant/allophone [e] → [ʈeħa] ‘falling’,
[u]: [jħukk] ‘he itches’. It can have the variant/allophone [o] in contact with emphatic consonants: [ɽ], [h], [l], [ʈ] e.g. [johɽob] ‘he runs away’, [joʈlob] ‘he begs’, [joʃrob] ‘he drinks’, [ʈobʂɪ] ‘a plate’.
[ə]: [nəqqa], ‘he cleaned’, [nəgga] ‘he peeled off’.

The short vowels have in many cases been reduced to a schwa with various realizations depending on context : hence, [nsar] → [nsər] ‘eagle’, [marga] → [mərga] ‘stew’; [ʕurs] →

[ʕərs] ‘wedding’, [ɣurbaal] → [ɣərbaal] ‘a sieve’; [ʒɪnn] → [ʒənn] ‘ghost’, [waħɪd] → [waħəd] …etc. However, in some cases, almost always next to a velar or uvular , but occasionally near a bilabial, [u] is retained; thus, [ħugrɑ] ‘bullying’, [fumm] ‘mouth’, [burʒ] ‘tower’, [gult] ‘I said’. This alternation between the schwa and the short vowels can be viewed either as a process of schwa strengthening, i.e., a process whereby the schwa becomes a full vowel; or a process of vowel reduction. Whichever the case is, the alternation exists and reflects an intra-dialectal variation within the variety of SSA.

c. Diphthongs

The different diphthongs of SSA are [aj] → [mʃajʃ] ‘a kitten’, [bajɖ] ‘eggs’, [ɖajf] ‘guest’; [aw] → [ʕawd] ‘a horse’; [ij] → [twijqɑ] ‘a small window’, [fij] ‘terror; [əw] → [nəw] ‘rain’; and [ej] → [lejl] ‘night’, [χejl] ‘horses’, … etc. There is a sporadic contraction of the diphthongs [əw] and [ej] to [oo] (sometimes [u]) and [ee] respectively: [ʂəwt] → [ʂoot], [məwluud] → [muluud] ‘Prophet’s birth’, [ʕejn] → [ʕeen] ‘eye/source’, [ʈeen] ‘clay.’ But this contraction is not general, and there are the diphthongs [əw] and [ej] corresponding to the diphthongs [aw] and [aj] of classical Arabic: [ɖəw] ‘light’, [bejt] ‘room’, [zejt] ‘oil’,…etc.

There are conditioned variants [aw] and [aj] in contact with emphatic, laryngeal and pharyngeal consonants: ʕawd] ‘horse’, [ʕajn] ‘eye’, [ħaj] ‘city/alive’. We have to signal the authentic dialectal diphthongs [aw] and [aj]: [nsaw] ‘they forgot’, [ʕajla] ‘a family.’ One last point to mention about vowels is that in SSA, there are some vocalic alternations between long vowels and diphthongs which are mainly used by old people, e.g., [mʃiiʃ] → [mʃajʃ] ‘kitten’, [kliit] → [klajt] ‘I ate’, … etc.

d. The Syllable Structure of SSA

Arabic has two kinds of syllables: open syllables CV and CVV, and closed syllables CVC and CVCC. Each syllable begins with a consonant. In this work, we assume that SSA exhibits fourteen types of syllables. In terms of syllable complexity (Table 4), some syllables may include up to three consonants in onset position and two in the coda. Table 4 also shows that closed syllable types outnumber open ones (9 and 5 respectively):

Table 4: Types of Syllable Structures Classified in terms of Complexity

Simple Onset		Complex Onset			
CV	ka, ɣi, mi.na	CCV	mna.gəʃ	CCCV	ssma
CVV	faa.jəq	CCVV	mʃuu.mər	CCCVVC	sslaaħ
CVC	ʕar.bun	CCVC	msam.ħɪn	CCCVC	ʃʃmaʕ
CVCC	gult	CCVCC	ʃrəbt	CCCVCC	nnbag
CVVC	za.ʕiim	CCVVC	kliit	……………..	……………..

The general observation that we can make in the light of this investigation is that consonant clusters are more frequent in SSA as in most dialects of North Africa. This dialect exhibits syllables that comprise clusters of three consonants in syllable-initial position and have the highest frequency of occurrence of all types of complex syllables. These clusters are mainly present in onset position, which confirms earlier findings stating that clusters occur more frequently at onset than coda positions (Zerling, 2000) and (Molinu and Romano, 1999).

1.6.3 Morphology

In this subsection, we will deal with some aspects of the prosodic morphology of SSA. First, we will define the root-and-pattern morphology and second, we will illustrate with examples the morphological processes that we judge necessary to be explored.

a. Root-and-Pattern Morphology

The term root-and-pattern morphology refers to the complex set of nonconcatenative (or nonlinear) alternations that characterize word structure in the Semitic languages. Words in Semitic languages can be described in terms of roots, typically consisting of three consonants, which lend the basic meaning (e.g. k-t-b "write", q-b-r "bury", ʔ-m-r "order") and patterns which in some way modify the basic meaning, frequently situating the root in a particular grammatical context. The Semitic verbal system is an important key to understanding the genesis of the root and pattern morphology in the Semitic language (Bat-El, 2003). As other Semitic languages, SSA is built on the basic consonantal skeleton, the root. It occurs in patterns with different vowels to occupy specific meanings. For example, the root / χ r ʒ /, which has the meaning of — ‘going out’, includes the following patterns, among others. Consider table 5 for illustration:

Table 5: Roots and Patterns

Patterns	**Gloss**
[χ r ə ʒ]	he went out
[χ r u ʒ]	go out, imp.
[χ r uu ʒ]	going out
[χ a r ʒ a]	way out
[χ aa r ə ʒ]	abroad
[χ ə r r ə ʒ]	cause to go out

1.6.4 Morphological Processes

The central issue in the present work is to account, by means of constraints, for some aspects of the phonology and prosodic morphology of SSA. The phonological aspects that will be dealt with are mainly stress and syllable structure. As to morphology, the only aspect that will be dealt with is chiefly the broken plural. But nevertheless, some morphological aspects are judged necessary to be explored. These include the perfective and the imperfective, the imperative, the causative, the diminutive, the passive participle, and the nisba adjective.

a. The Perfective and Imperfective

Verbs in SSA have complex morphology. They follow derived-form patterns and each form is inflected into the perfect or imperfect tense. The two tenses share the grammatical categories of person, gender and number. The perfective is obtained by a set of suffixes attached to the verb stem. The imperfective is formed by a set of prefixes in the singular and by the same set of prefixes plus a set of suffixes in the plural. There is no dual or gender distinction in the plural form. The perfective is suffixal, whereas the imperfective is characterized by suffixes and prefixes. Table 6 and 7 illustrate the two paradigms for SSA.

In the verbal system of SSA, the use of a pre-verb has led to the development of two imperfect forms: '[ka -jəktəb]' and '[jəktəb]' (the oldest form). This grammaticalized pre-verb [ka-] '(be)', which is a mood marker, probably derives from the existential verb [kana] (Ferrando, 1996), or it is most probably a truncated form of this same verb. The bare form, i.e. without the pre-verb, is reduced to either syntactic dependency or modal values, whereas the new pre-verb form marks the 'real' imperfective. This includes the notions of habitual, repetitive, general truths or progressive (Caubet 1993, 1994). '[ka-jəktəb]' means 'he writes' or 'he is writing', according to the context, whereas '[jəktəb]' can only mean 'let him write', 'he'll write', 'he'd write' (hortative, vague future, eventual, etc.), or be used in concatenatives like:

[baɣi]	[jəktəb]
want (ACT. PTCP. M. SG.	write (IPFV. 3M. SG)

He wants to write.

<u>Table 6 : The Perfective Paradigm</u>

Person	Number	Gender	Affix	Verb+affix
1	Singular	M/F	-t	kdəb-t
2	Singular	M	-t	kdəb-t
2	Singular	F	-ti	kdəb-ti
3	Singular	M	Ø	kdəb
3	Singular	F	-ət	kədb-ət
1	Plural	M/F	-na	kdəb-na
2	Plural	M/F	-tu	kdəb-tu
3	Plural	M/F	-u	kədb-u

Table 7: The Imperfective Paradigm (bare form)

Person	Number	Gender	Affix	Affix + verb
1	Singular	M/F	n-	nə-kdəb
2	Singular	M	t-	tə-kdəb
2	Singular	F	t-……i	t-kədbi
3	Singular	M	j-	jə-kdəb
3	Singular	F	t-	tə-kdəb
1	Plural	M/F	n……u	n-kədbu
2	Plural	M/F	t……u	t-kədbu
3	Plural	M/F	j……u	j-kədbu

Table 8: The Imperfective Paradigm with the pre-verb [ka-]

Person	Number	Gender	Affix	Affix + verb
1	Singular	M/F	ka-n-	ka-nə-kdəb
2	Singular	M	ka-t-	ka-tə-kdəb
2	Singular	F	ka-t-……i	ka-t-kədbi
3	Singular	M	ka-j-	ka-jə-kdəb
3	Singular	F	ka-t-	ka-tə-kdəb
1	Plural	M/F	ka-n……u	ka-n-kədbu
2	Plural	M/F	ka-t……u	ka-t-kədbu
3	Plural	M/F	ka-j……u	ka-j-kədbu

b. The Imperative

The imperative is conjugated with the suffixes of the imperfective but without any prefixes or preverbs as shown in the examples below:

[ktəb] "write (2^{nd} pers. masc. sing.) "

[kətb-i] "write (2^{nd} pers. fem. sing.) "

[kətb-u] "write (2^{nd} pers. pl.)"

c. The Causative

We obtain the causative by doubling the second segment of the base. Consider Table 9 for illustration:

Table 9 : The Causative Paradigm

Nbr.	Base	Gloss	Causative	Gloss
a.	ɣrəq ktəl kwa ħfa	drown kill iron/coterize blunt	ɣərrəq kəttəl kuwwa ħəffa	cause to drown cause to kill cause to iron cause to blunt
b.	dub noɖ fɪq ţeħ	dissolve stand up wake up fall down	duwwəb nowwəɖ fɪjjəq ţejjəħ	cause to dissolve cause to stand up cause to wake up cause to fall down

The causative involves the gemination of the second segment of the base and operates at the left side of the minimal syllable as in table 9 (a) or at the right side as in (b). The items in table 9 also show that verb bases on the pattern CCV can be accounted for in the same way as bases on the pattern CCVC. For example, the causative form of a verb such as [ħ.fa] 'blunt' is [ħəf.fa] 'cause to blunt' where the syllable-initial segments in the derived word correspond to the syllable-initial segments in the base stem. The problematic cases are bases on the pattern CVC whose causative form is realized as CəG.GəC, where G stands for glide. Thus, in an example such as [noḍ] 'stand up!' whose causative form is [now.wəḍ] 'cause to stand up', the initial segment of the second syllable i.e., the glide [w] does not have a correspondent in the base [nuḍ]. It should be noted that the output of the causative is a disyllabic word which satisfies Foot Binarity (McCarthy and Prince 1993a and Prince and Smolensky 1993), and the reduplicant is always the second segment of the base.

d. The Diminutive

As can be seen in table10 below, noun diminutives are normally obtained by the infixation of the segment [-ɪ-] after the second segment of the base:

Table 10 : The Diminutive Paradigm

Nbr.	Base	Gloss	Diminutive
a.	kəlb ktaab fum bənt	dog book mouth girl	klɪjjəb/klib ktɪjjəb ffɪjjəm/ffim bnɪjja
b.	taqa huta kəbda	window fish liver	twɪqa/twijqa hwɪta/hwɪjta kbɪda/kbɪjda
c.	kursɪ xudmɪ ṭobṣɪ ṣɪnɪjja	chair knife plate tray	krɪsɪ xdɪmɪ ṭbɪṣɪ ṣwɪnɪyya

Three remarks have to be made about the items above. First, the output of the diminutive consists minimally of two syllables and maximally of three. Second, monosyllabic bases are augmented by the addition of [-jjə-] or the suffixation of [-a] as in (a). Third, the glide [w] is sometimes inserted before the diminutive segment [-ɪ-] as in (b) and (c).

e. The Passive Participle

As illustrated in table 11, the passive participle is formed by the prefixation of the segment [m-] and sometimes the infixation of the segment [-u-] to the verb stem.

Table 11 : The Passive Participle Paradigm

Nbr	Verb Stem	Gloss	Passive Participle	Gloss
a.	gsəm dfən qes	divide bury throw	məgsum mədfun məqjus	divided buried thrown
b.	dħɪ səlləħ fukər ħənnɪ	insert arm displease dye with henna	mədħi msəlləħ mfukər mħənni	inserted armed displeased dyed with henna

Two remarks need to be made about the items above. First, the items in (a) proceed to further infixation of the segment [-u-] before the final segment of the base. Second, the pre-final vowel appears in items (a) and not in items (b).

f. The Nisba Adjective

We form the nisba adjective by the suffixation of the morpheme [-ɪ] to the base. Consider Table 12 for illustration:

Table 12: The Nisba Adjective Paradigm

Nbr.	Base	Nisba	Gloss
a.	[bəʃʃar] [taɣɪt] [wahran]	[bəʃʃar- ɪ] [taɣɪt- ɪ] [wahran- ɪ]	from Bechar from Taghit from Wahran
b.	[wakda] [blɪda] [qnadsa]	[wakd- ɪ] [blɪd- ɪ] [qənds- ɪ]	from Wakda from Blida from Kenadsa
c.	[bʒaja] [ɪglɪ]/[glɪ] [bərbɪ]	[bʒaw- ɪ] [glaw- ɪ] [bərbaw- ɪ]	from Bejaia from Igli from Berrebi
d.	[bnɪ -ʕəbbas] [wlad-ʒrɪr] [dwi-mnɪʕ]	[ʕəbbas- ɪ] [ʒrɪr- ɪ] [mniʕ- ɪ]	from Beni-Abbes of Ouled Djerir of Doui-Mnie
e.	[tabəlbala] [laħmər]	[bəlbal- ɪ] [ħimr- ɪ]	from Tabelbala from Lahmar

As can be seen in (a), when the base ends up in a consonant, nothing special happens after the suffixation of the nisba morpheme [-ɪ]. However, when the base ends up in a vowel, two different phonological processes take place: truncation or glide epenthesis. If the final vowel of the base is the feminine suffix {-a}, it gets truncated after the suffixation of the morpheme [-ɪ] as in (b). But if this vowel forms part of the base, then the glide [w] is epenthesised to serve as an onset to the nisba suffix as in (c).

What is more interesting in the present study is the nisba adjectives derived from compound nouns and nouns with the prefix {ta}. Both cases involve deletion of some segments from the base. In (d), it is the left-hand member of the compound that is truncated; whereas in (e), the prefixes {ta-} and {la-} that are deleted.

g. The Plural System of SSA

We distinguish two different classes of plural inflection among nouns and adjectives in SSA : sound plurals and broken plurals. The sound plurals are formed in a concatenative mechanism by adding the suffixes [-in] , [-a] to the singular form to make the sound masculine plural; e.g., [χəjjaʈ] ‘a tailor’, pl. /χəjjaʈin/ ‘tailors’, /χəddam/ ‘a worker’, pl. /χəddama/ ‘workers’ and the suffixes [-t], [-at] to the singular form to make the sound feminine plural; e.g., [xana] ‘a beauty spot’, pl. [χanat] ‘beauty spots’, [zʈam] ‘a wallet’, pl. /zʈamat/ ‘wallets’.

Broken plurals are formed by a non-concatenative process. It involves an internal modification of the singular stem, e.g., [kəlb] ‘a dog’, pl. [klæb] ‘dogs’. Generally, the broken plural usually has the same consonants (root) as the singular but vowels are inserted between the consonants in accordance with a strict pattern or template (McCarthy & Prince, 1990a). For example, the singular CVC.CV word [kur.si] ‘a chair’ maps the plural [kra.sa] ‘chairs’; the plural template in this case being CCa.Ca. The most common broken plural templates, along with the singular templates to which they correspond, are listed as follows:

1. Plural Templates with the Infix [-a-]

A)- CCa**C** – This plural template corresponds to different triliteral singular patterns. These include the following singular templates:

➢ ***Singular Template CəCC, CuCC:***

Singular	*Broken Plural*	*Gloss*
[qənt]	[qnat]	corners
[kəlb]	[klab]	dogs

[muχχ]	[mχaχ]	brains
[kumm]	[kmam]	sleeves
[χurʂ]	[χraʂ]	earrings
[fumm]	[ffam]	mouths

➢ ***<u>Singular Template CCiC</u>*** ***:***

<u>Singular</u>	*<u>Broken Plural</u>*	*<u>Gloss</u>*
[mlıħ]	[mlæħ]	good
[nḍıf]	[nḍaf]	clean
[nsıb]	[nsæb]	fathers/brothers-in-law

➢ ***<u>Singular Templates CCəC, CCuC</u>:***

<u>Singular</u>	*<u>Broken Plural</u>*	*<u>Gloss</u>*
[ḍfər]	[ḍfar]	nails
[ʒbəl]	[ʒbæl]	mountains
[ʃɣul]	[ʃɣæl]	work

➢ ***<u>Singular Templates CəCCa, CuCCa</u>:***

<u>Singular</u>	*<u>Broken Plural</u>*	*<u>Gloss</u>*
[ʃəʕba]	[ʃʕæb]	divisions
[təfla]	[tfæl]	spit
[guffa]	[gfaf]	baskets

➢ The plural template CCaC derived from singulars which have less than three consonants usually involves the glide [j] or [w] as the second consonant of the plural pattern:

<u>Singular</u>	**<u>Broken Plural</u>**	**<u>Gloss</u>**
[dıb]	[djæb]	wolves
[næb]	[njæb]	fongs
[næga]	[njæg]	she-camels

[xæl]	[xwæl]	uncles
[ħæl]	[ħwæl]	weather/situation
[ʕæm]	[ʕwæm]	years
[ʃa]	[ʃjæh]	sheep
[ma]	[mijæh]	waters

B)- CCaCı – Most plurals of this template are derived from the singular templates CəCCa, CoCCa and CuCCa as shown below :

Singular	***Broken Plural***	***Gloss***
[qəhwa]	[qhawı]	coffee-parlours
[fərda]	[fradı]	single shoes
[nugʈa]	[ngaʈı]	drops
[ʕugda]	[ʕgadı]	knots

➢ **Other CCaCi plurals derived from other singular templates are as follows:**

Singular	***Broken Plural***	***Gloss***
[ʕəfsa]	[ʕfası] [ʕfajəs]	tricks
[taqa]	[twaqı]	windows
[dərri]	[drarı]	kids
[lila]	[ljælı]	nights
[tuqba]	[tqabı]	holes
[ħasi]	[ħwası]	wells

C)- CCaCa – This plural template is derived from the singular templates CəCCi and CuCCi. A few exceptions are [kurı] 'pigsty' pl. [kwara], [bıru] 'office' pl. [bbara], [ʃinwi] 'Chinese' pl. [ʃnawa], [nəʂrani] 'Christian' pl. [nʂara], [sufi] 'from Wad Suf' pl. [swafa]…etc.

Singular	***Broken Plural***	***Gloss***
[ħəwli]	[ħwala]	rams
[ʈəbʂi]	[ʈbaʂa]	plates
[kursi]	[krasa]	chairs
[χudmi]	[χdama]	knives

D)- CCaCəC/-iC – This template is typically the plural of quadriconsonantal words, regardless of whether the four consonants come from a quadriliteral or a triliteral root. The typical case is for the glides [w] and [j] to be added to the three consonants of the singular noun to fill out the four consonants of the plural template, although there are occasional exceptions where another segment is added to the triconsonantal root to form the plural pattern CCaCəC/-iC, e.g., [ɣəbra] 'dust' pl. [ɣbabər], [hbil] 'crazy' pl. [mhabil]. Here are some examples:

Singular	***Broken Plural***	***Gloss***
[mʂəlha]	[mʂæləh]	brooms
[ʂəndug]	[ʂnædəg]/[ʂnædig]	boxes/cases
[sərwæl]	[srawəl]/[srawil]	trousers
[məskin]	[msækin]	poors
[bərræd]	[brarid]	tea-pots
[qənbula]	[qnæbəl]	bombs
[ʃærəb]	[ʃwærəb]	lips
[χætəm]	[χwætəm]	rings
[kaɣəʈ]	[kwaɣəʈ]	papers
[giʈun]	[gwaʈin]/[gjaʈin]	tents
[kurda]	[kwarəd]	ropes
[bluza]	[blæjəz]	dresses
[blaʂa]	[blajəʂ]	places

➢ The plural template **CCaCəC** derived from singular nouns of biliteral roots where both glides [w] and [j] are added are rare and only a few examples can be found:

Singular	***Broken Plural***	***Gloss***
[ħæʒa]	[ħwæjəʒ]	things
[ʒiha]	[ʒwæjəh]	directions
[riħa]	[rwæjəħ]	perfume, odours
[sæʕa]	[swæjəʕ]	watches, hours

2. Plural Templates with the infix [-ɪ-]

A- CCiC – As illustrated below this plural pattern can be derived from singular nouns of triliteral roots:

Singular	***Broken Plural***	***Gloss***
[ʕəbd]	[ʕbid]	slaves
[ħmɑr]	[ħmir]	donkeys
[məʕza]	[mʕiz]	goats
[wgida]	[wgid]	dung/animal excreta

B- CCi – This plural pattern can be formed by changing the segment [a] of some singular nouns of bilateral roots to [i] as shown in the examples below :

Singular	***Broken Plural***	***Gloss***
[ʕʂa]	[ʕʂi]	sticks
[ksa]	[ksi]	blankets

C- CiCaC – This plural template corresponds exclusively to the singular template **CaC,** though there are a few cases of it corresponding to the singular templates **CiC** and **CuC.** Here are some examples :

Singular	***Broken Plural***	***Gloss***
[bæb]	[bibæn]	doors
[far]	[firæn]	mice
[ʒar]	[ʒiræn]	neighbours
[ɣar]	[ɣiræn]	cave, lair
[ras]	[risæn]	heads
[ħiʈ]	[ħiʈæn]	walls
[ʕud]	[ʕidæn]	sticks, lutes
[tur]	[tiræn]	bulls

3. Plural Templates with the infix [-u-]

A- CCuC – This template bears a close relation with the following one **CCuCa,** since a number of words form their plurals in both templates **CCuC/CCoC** and **CCuCa/ CCoCa** for example [gəlb] 'heart' pl. [glob] or [globa]. Here are other examples:

Singular	***Broken Plural***	***Gloss***
[muʃ]	[mʃuʃ]	cats
[xəd]	[xdud]	cheeks
[gərn]	[gron]	horns
[xəʈ]	[xʈoʈ]	lines
[qbəɽ]	[qboɽ]	tombs
[ktæb]	[ktub]	books
[ʃhaɽ]	[ʃhoɽ]	months

B- CCuCa :

Singular	***Broken Plural***	***Gloss***
[sbəʕ]	[sbuʕa]	lions
[ʒdəʕ]	[ʒduʕa]	calves
[ħnəʃ]	[ħnuʃa]	snakes
[bɣəl]	[bɣula]/[bɣæl]	mules
[kfən]	[kfuna]	shrouds
[mqəʂ]	[mquʂa]	scissors
[qfəl]	[qfula]	locks
[ʈbəg]	[ʈboga]	traditional bowl made of straw

➢ There are some singular nouns of biliteral roots which form their plurals by inserting the glide [j] after the first consonant as is shown below:

Singular	***Broken Plural***	***Gloss***
[ʃix]	[ʃjux]/[ʃjuxa]	old men
[xiʈ]	[xjuʈ]/[xjuʈa]	thread
[ʂef]	[ʂjuf]/[ʂjufa]	summer seasons

[sif]	[sjuf]/[sjufa]	swords
[dib]	[djæb][djuba]	wolves

C)- CoCCa :

Singular	***Broken Plural***	***Gloss***
[ʈæləb]	[ʈolba]	teachers of Quran
[ʈbib]	[ʈobba]	doctors

D)- CuCCaaC – As will be shown in the examples below, most nouns of this pattern refer to human beings and are almost exclusively limited to active participles :

Singular	***Broken Plural***	***Gloss***
[sæjəħ]	[sujjaaħ]	tourists
[kæfər]	[kuffaar]	atheists
[χaʈib]	[χuʈʈaab]	preachers
[ʃæb]	[ʃubbaan]	youths
[tæʒər]	[tuʒʒaar]	traders

E)- CuCuC:

Singular	***Broken Plural***	***Gloss***
[ɖərs]	[ɖurus]	lessons
[fərɖ]	[furuɖ]	obligations
[rəmz]	[rumuz]	symbols
[ʕilm]	[ʕulum]	science

F- CuCəC/CoCəC:

This plural template corresponds exclusively to adjectives which singular template is **CCəC** as shown below:

Singular	***Broken Plural***	***Gloss***
[bjəɖ]	[bojəɖ]	white
[kħəl]	[kuħəl]	black
[χɖər]	[χoɖər]	green
[qrəʕ]	[qorəʕ]	bald
[ʈrəʃ]	[ʈorəʃ]	deaf
[brəʂ]	[borəʂ]	leprous

4. Plural Templates with Schwa Insertion

A- CCəC – This plural pattern corresponds to the following singular patterns:

Singular	***Broken Plural***	***Gloss***
[gulla]	[gləl]	jars
[guffa]	[gfəf]	baskets
[gubba]	[gbəb]	domes
[səlla]	[sləl]	baskets
[gərba]	[grəb]	churns
[χima]	[χjəm]	tents
[ʈrig]	[ʈrəg]	roads
[ʃəmʕa]	[ʃməʕ]	candles
[kaʃʃa]	[kwəʃ]/[kjəʃ]	blankets
[kuʃa]	[kwəʃ]	bakeries

B)- CəCCæC – This plural template corresponds exclusively to the singular templates **CCuC, CCiC, CaCi, CCi,** and **CCu :**

Singular	***Broken Plural***	***Gloss***
[χruf]	[χərfæn]	lambs
[ʕris]	[ʕərsæn]	bride-grooms
[raʕi]	[rəʕjæn]	shepherds
[ʒdi]	[ʒədjæn]	kid-goats
[ʕdu]	[ʕədjæn]	enemies

5. Miscellany

Singular	***Broken Plural***	***Gloss***
[ʔustæd]	[ʔasatida]	professors
[dəmm]	[dmujæt]	blood
[ʒnæħ]	[ʒənħin]	wings
[mijjət]	[muta]	dead persons
[mra]	[nsa]/[mrajæt]	women
[mərd̢]	[ʔamræd̢]	illnesses
[bəntær]	[bnatrija]	painters
[wzir]	[wuzara]	ministers
[bʕɪr]	[baʕɪr]	camels
[χu]	[χut]/[χawa]	brothers
[χut]	[χwatæt]	sisters
[ʃa]	[ʃjæh]	sheep
[ma]	[mijjæh]/[mjuhæt]	waters

In sum, we can say that SSA has two forms of plural : sound linear plural and non-linear or broken plural. Sound linear plural is of two types : the sound feminine plural that is formed by attaching the suffixes [-t] and [-at] to the singular stem, and the sound masculine plural that is formed by attaching the suffixes [-in] and [-a] to the singular stem. The second form of the plural is what is called the non-linear or the irregular plural and is formed by a change in the vocalic melody of the singular stem. The above examples illustrate the nature of non-concatenative morphology. They demonstrate that the morphologically complex forms, in this case, these plurals, cannot be easily decomposed into their corresponding singular forms on the one hand, and some affix marking plural on the other. Rather the formation of the broken plurals in SSA involves changing the prosodic shape of the singular form, in addition to changing the quality of the vowels.

1.7 Description of data

1.7.1 Broken Plural Forms

The body of data that we will present in this section relates exclusively to the types we are going to deal with in this study, viz. BP of triliteral forms. Our choice fell on this category of BP, for the simple reason that we intend to study only the cases of correspondence internal to the root or its extension, the morphological word of micro-level.

a. Triliteral Forms

The data on which our study will focus are those BP patterns of triliteral roots corresponding to the canonical shape **CCVC.** Here is a corpus:

(1)

Singular	***Broken Plural***	***Gloss***
[gərn]	[gron]	horns
[ḍərs]	[ḍros]	teeth
[kənz]	[knuz]	treasures
[ʕəbd]	[ʕbid]/[ʕbɑd]	slaves/people
[qənt]	[qnɑt]	corners
[kəlb]	[klɑb]	dogs
[wəld]	[wlɑd]	boys
[kəbʃ]	[kbɑʃ]	rams

The above forms of the singular have a triliteral root, a schwa appears between the first and the second root consonants and the shapes of the corresponding BP show a full vowel whose tone is unpredictable.

Other types of forms may also be concerned by this type of BP formation, viz.

(2)

Singular	***Broken Plural***	***Gloss***
[məʕzɑ]	[mʕiz]/[mʕɑz]	goats
[kədbɑ]	[kdub]	lies
[nəʒmɑ]	[nʒum]	stars
[qərʕɑ]	[qroʕ]	bottles

These forms of the singular have a triliteral root, a feminine morpheme suffix appears in word final position, the tri-consonantal cluster is broken by epethesis of the schwa which always appears between the first and the second segments of the root, they are marked mainly by the disyllabic character and BP shapes infix the morphemic vowel between the second and third consonants.

The position of the schwa in the forms of the singular constitutes a third type of forms of this type of BP, viz.

(3)

Root	***Singular***	***Broken Plural***	***Gloss***
√bɣl	[bɣəl]	[bɣæl]	mules
√ʒml	[ʒməl]	[ʒmæl]	camels
√bħr	[bħər]	[bħor]	seas
√ʃdg	[ʃdəg]	[ʃdug]	cheeks

These data are characterized by having a triliteral root, the occurrence of the schwa between the second and the third segments for the forms of the singular, and the morphemic vowel of the BP appears in the same position as the schwa.

Forms of geminate consonants are also concerned by the formation of the BP in question, viz.

(4)

Root	***Singular***	***Broken Plural***	***Gloss***
√ʒd	[ʒədd]	[ʒdud]	grandfathers
√sd	[sədd]	[sdud]	dams
√sl	[səlla]	[sləl]	baskets
√rz	[rəzza]	[rzəz]	turbans (headdress)
√kf	[kəffa]	[kfəf]	plates of the balance

The following properties are unique to these data, viz. a rather biliteral root, the second root consonant consists of a geminate in the singular form, some forms know the suffixation of the feminine morpheme, the schwa appears therefore between the first and the second root consonants and the geminate is split in the BP form sometimes even by a schwa.

The alternation of corresponding gilde / high vowel acquires, for its part, its rightful place in this type of BP. Consider the following examples:

(5)

Root	***Singular***	***Broken Plural***	***Gloss***
√mr	[mir]	[mjær]/ [mjur]	mayors
√db	[dib]	[djæb]	wolves
√dr	[dur]	[dwær]	roles
√sq	[suq]	[swæq]	markets

The data of this corpus are distinguished by the following distribution, viz. BP forms have a triliteral root whose second segment is a HV; the HV is made as a high vowel in the singular forms, the forms of BP present exclusively the vowel a as a morpheme, and HV appears as glide in the forms of BP.

The alternating forms of glide / high vowel have, in addition, a feminine morpheme vowel. Here are some examples:

(6)

Root	***Singular***	***Broken Plural***	***Gloss***
√kʃ	[kuʃa]	[kwæʃ]/[kwəʃ]	bakeries
√ng	[næga]	[njæg]	she-camels
√tq	[tæqa]	[tjuq]	windows
√χm	[χima]	[χjæm]/[χjəm]	tents
√mʒ	[muʒa]	[mmaʒ]/[mwæʒ]	waves

The following features are exclusive to the forms mentioned above, i.e. BP forms have a triliteral root, the forms of the singular are strictly feminine, they have the feminine morpheme **a**, HV takes a nuclear position in singular and a marginal position in the BP where it appears to be a glide.

The alternation in question may exhibit an occurrence of two HV that will compete. The following examples reflect this situation.

(7)

Root	Singular	Broken Plural	Gloss
√ʃx	[ʃɪx]	[ʃʝux]/[ʃʝuxa]	old men
√χʈ	[xeʈ]	[xjoʈ]	thread
√ʂf	[ʂef]	[ʂjof]	summer seasons
√sf	[sɪf]	[sjuf]	swords
√sr	[sɪr]	[sjur]	laces
√mr	[mɪr]	[mjur]	mayors
√ħʈ	[ħeʈ]	[ħjoʈ]	walls

Here are data characteristics that make the particularity of these forms, viz. BP forms always have a triliteral root, HV which appears as a high vowel in the singular, the vowel chosen as morpheme of the HV is of the same tone as the root vowel which gives the place of the syllable nucleus to its morphemic competitor in the BP.

The resuscitation of the underlying glide (implicit) in BP forms characterizes another type of BP, viz.

(8)

	Root	Singular	Broken Plural	Gloss
a)	√dr	[dor]	[dwær]	roles
	√sq	[suq]	[swæq]	markets
	√nr	[nor]	[nwar]	blossoms/light
b)	√χl	[χæl]	[χwæl]	uncles
	√ħl	[ħæl]	[ħwæl]	states
	√ʕm	[ʕæm]	[ʕwæm]	years
c)	√rs	[ræs]	[rjus]	heads
	√dr	[dar]	[djur]/[djær]	houses

This type of form has some special features, i.e. BP forms always have a triliteral root, but which only exhibits two of its consonants in the phonetic form of the singular, the appearance of the vowel **u/a** in the phonetic form of the singular and the reappearance of the underlying root segment (HV) in the form of BP which is relegated to a marginal position.

The coincidence of the underlying glide and the morphemic one is characteristic of the forms in (c). This type of form has nearly the same characteristics as the previous type with little differences, viz. the underlying root HV has the same height characteristics as the morphemic one. However, it is the morphemic HV which plays the role of syllable nucleus in the forms of the BP.

Other types of forms are marked mainly by the bisyllabic character of the singular forms,

(9)

	Root	***Singular***	***Broken Plural***	***Gloss***
a)	√ɽʒl	[ɽaʒəl]	[ɽʒæl]	men
	√ʕml	[ʕæməl]	[ʕmæl]	works
	√ʃhd	[ʃæhəd]	[ʃhud]	witnesses
b)	√ʃʕb	[ʃəʕba]	[ʃʕæb]	divisions
	√tfl	[təfla]	[tfæl]	spit
	√mʕz	[məʕza]	[mʕɪz]	goats

The following characteristics are exclusive to the forms mentioned above, viz. BP forms always have a triliteral root, the singular morpheme vowel chooses its site between the first and second roots, an epenthetic schwa breaks the remaining consonants and thus builds a first/second syllable and the corresponding BP forms simply consist of one syllable.

Still other forms are advanced in comparison with bisyllabic ones. Consider these examples:

(10)

	Root	***Singular***	***Broken Plural***	***Gloss***
a)	√ɖfr	[ɖfər]	[ɖfar]	nails
	√ʒbl	[ʒbəl]	[ʒbæl]	mountains

	√ʒbl	[ʃɣul]	[ʃɣæl]	works
b)	√ktb	[ktæb]	[ktub]	books
	√lsn	[lsæn]	[lsun]	tongues
	√ħmɽ	[ħmaɽ]	[ħmiɽ]	donkeys

These data are characterized by the fact that BP forms have a triliteral root, the appearance of a schwa or a full vowel between the second and third root in the singular form, and the forms of BP have similar structure with a difference in the quality of the morphemic vowel.

1.8 Conclusion

Throughout this chapter, we have focused on presenting some methodological preliminaries necessary for a better understanding of the guidelines of our study. Thus we are attached to provide a panorama of the Saoura under its different facets: geographical, historical, economic, social and linguistic.

After a brief literature review of Arabic dialects, we have presented the syllable structure and the phoneme inventories of the variety under study. We have shown that while SSA shares common characteristics with other varieties of Arabic, it differs from them by the number of consonant phonemes it consists of.

In morphology, we have presented the root-and-pattern morphology, the plural system and we have listed some representative examples of the morphological categories which we judge necessary to be explored. These categories include the perfective and the imperfective, the imperative, the causative, the diminutive, the passive participle, and the nisba adjective.

We then went on to scrutinize the description of the data which will be the subject of our study in the following chapters. An organization of our data of BP was made and we have taken care to present them according to the problems they raise, relating to the quality of the segments that compose them, to their arrangement in the lexical units, to the relations of cooccurrence that they maintain and to the different types of structures that they build.

Chapter Notes

1. National Office of Statistics (2018).

Chapter Two:

Theoretical Framework

2. Theoretical Framework

2.1. Introduction

Previous works in phonology assume that the task of a phonological theory is to define the underlying form (input) and the surface form (output) of a linguistic object. The matching between the input and the output is achieved through phonological rules. In the conception of phonological processes proposed in Chomsky & Halle (1968), the phonology was believed to take a lexical item and then apply ordered rules to derive an output. That is, in rule-based generative phonology, Chomsky and Halle's *Sound Pattern of English* (*SPE*), the grammar of a language consists of an ordered list of rules that apply to an input form in a strict sequence in order to produce an output form, as in (1) below.

(1) **Rule-based phonology** (Pulleyblank 1997: 63)

Lexicon:	input (initial form)
Rule1 :	intermediate form$_1$
Rule2 :	intermediate form$_2$
………………..	
Last rule:	output (final form)

Traditional generative phonology also uses rules like A → B / C _ D to change an underlying string /CAD/ to the surface string *CBD*; this is known as a derivational approach. Rules in *SPE* do not seek to attain universality or even to describe unmarkedness since they are merely descriptive tools. In other words, rules are either highly language-specific or universal. Kisseberth (1970) points out that several rules are often needed for the same functions within a grammar i.e. rules conspire to achieve a common goal in the output. In later theories, sets of rules were grouped together forming "levels" (Kiparsky 1982, Mohanan 1982, 1986) . In the 1980s the need for phonological rules – operations on phonological forms – was questioned. Instead, phonological structures were permitted to generate freely providing that output forms did not violate any well-formedness statements, also called *constraints*. While constraints are requirements on the *output* form, the order of constraints within a level became irrelevant.[1]

By the end of the 1980s, phonologists admitted the importance of output constraints. As a result, Paradis (1988a, 1988b) put forward a theory of “Constraints and Repair Strategies”. In this theory, phonological alternations are explained by assuming a set of inviolable surface constraints accompanied by repair strategies whose role is to solve any violations resulting from constraint conflicts. Yet, “Government Phonology” (Kaye et al. 1985, 1990) aims to account for phonological processes by replacing rules with a restricted set of universal principles and a series of language-particular parameters.

Since Optimality Theory (McCarthy and Prince 1993a, 1993b; Prince and Smolensky 1993, 2004) is radically different from rule-based generative phonology, it can be seen as the culmination of trends in phonological theory. The central premise of Optimality Theory (henceforth, OT) is that Universal Grammar is composed of a set of constraints on representational well-formedness which constructs individual grammars. These constraints on linguistic well-formedness are relative, not absolute. An individual grammar consists of a ranking of these constraints, which resolves any conflict in favour of the higher-ranked constraint. The constraints provided by Universal Grammar are simple and general; inter-linguistic differences arise from the permutations of constraint-ranking. Because they are ranked, constraints are regularly violated in the grammatical forms of a language.

The theoretical framework we propose for the analysis of the phonological and morphological aspects of SSA combines the proposals of two separate but closely related theories, viz. Optimality Theory and Correspondence Theory. The remainder of the chapter is organized as follows: the second section discusses the Prosodic Morphology Theory which has led to the emergence of this Optimality Theory and Correspondence Theory. The third section attempts to present the founding principles of optimality theory. A first subsection is about the Architecture of Grammar in Optimality Theory. The fourth section presents one of the recent developments of this theory, viz. the theory of correspondence. Finally, section five summarizes the main outcomes of the current chapter.

2.2 Prosodic Morphology

McCarthy (1981) describes a portion of the morphology of Modern Standard Arabic within the framework of an extended version of Autosegmental Phonology (ASP). The theory has been developed recently in order to deal properly with certain types of prosodic features, especially tone. A discussion of some of the main points of ASP can be found in Goldsmith

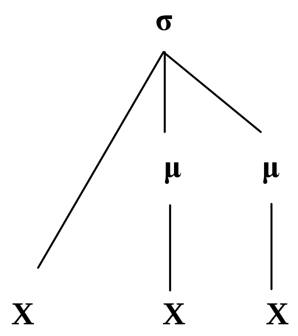
(1977). Yet, another version of this theory is laid out in Clements and Ford (1979). In this theory of Autosegmental Phonology (Goldsmith, 1976, 1979), the characterization of nonconcatenative morphology was made much easier than the boundary apparatus utilized in Chomsky and Halle (1968).

Autosegmental representations and processes also provide a means of representing nonconcatenative morphology, notably the complex interweaving of roots and patterns in Semitic languages. The adaptation of the principles of ASP to account for languages with nonconcatenative morphology gave rise to the emergence of the theory of Nonconcatenative Morphology (McCarthy 1979, 1981, 1982), which later develops into Prosodic Morphology (McCarthy and Prince 1986).

The outstanding trait of this theory is its assertion that the templates of non-concatenative morphology are defined in terms of the authentic units of prosody (rather than CV units): the mora, the syllable, the foot and the prosodic word. In other words, the Prosodic Morphology Hypothesis demands that the vocabulary of templates is the same as the vocabulary of prosody in general, including stress, syllabification, epenthesis, rhyme, poetic meter, compensatory lengthening, etc. (McCarthy and Prince, 1986).The prosodic constituents are arranged in a hierarchy of exhaustive domination (Selkirk, 1980). Thus, the prosodic word dominates the foot, and the foot dominates the syllable which, in turn dominates the mora. Each of these prosodic categories is defined in terms of the lower one in the hierarchy. The mora, being the lowest unit, serves to determine syllable weight. A light syllable consists of one mora [σμ], a heavy two moras [σμμ].

The syllable is the unit that bridges two levels; the moraic level and the foot level. The foot according to McCarthy and Prince (1986) is assumed to be governed by a constraint which requires that it be binary under syllabic or moraic analysis. Together the prosodic hierarchy and the foot binarity constraint derive the minimal word. The notion “minimal word” corresponds to “minimal foot” and is found to play a major role in prosodic morphology. For example, the minimal word in CA is an iambic foot; that is, a sequence of light-heavy syllables, or light-light syllables or simply a heavy syllable.

As the tree below depicts, the moraic model of the syllable, in which some elements (the nucleus and/or the coda) are moraic, whereas the onset is not, seems to be superior to the other syllable theories like onset/rhyme models (Pike and Pike, 1947; Fudge, 1969; Selkirk, 1982) as the mora offers a way to distinguish between light, heavy, and superheavy syllables.



2.3 Optimality Theory

Optimality Theory is one of the most important and powerful methodologies in the recent years after its introduction in 1993 by Prince and Smolensky. The constraint-based approach of this theory has a very strong impact on the linguistic studies in general. Not very long ago, there was a shift of focus in much of the studies on phonological theory, from rule-based system to sets of constraints on well-formedness principles making way to the formation of Optimality Theory (Paradis 1988a, 1988b; McCarthy & Prince 1993a, 1993b; Bird & Klein 1994; Prince & Smolensky 1997; McCarthy 2001, among others). This theory was developed as a response to a “conceptual crisis at the centre of phonological thought” (Prince & Smolensky 1993). This conceptual crisis was all about the role of output constraints.

Aspects of the use of output constraints before OT were unclear. According to Zuraw (2003) questions such as, “How should a constraint be designated to block or trigger a rule? What if output constraints conflicted? How could non-absolute preferences be expressed?” have remained unanswered since the emergence of OT in the early 1990s. Although it was originally applied to phonology, the relevance of OT to topics in morphology, syntax, sociolinguistics, psycholinguistics, and semantics has become increasingly apparent.[2]

OT distinguishes itself from earlier phonological theories by disregarding the idea that the mapping of the input to the output is achieved serially through phonological rules; the constraints on the output are phonotactically language-specific statements that cannot be violated. Therefore, in OT, we can identify five fundamental principles which underlie it (Prince & Smolensky, 2004). These are stated in (2) below:

(2)

a. Violability

b. Ranking

c. Inclusiveness

d. Parallelism

e. Universality

The first principle of OT *violability*, holds that constraints in OT are violable, but this violation should be minimal. According to McCarthy and Prince (1993), The notion of minimal violation (or best-satisfaction) is defined in terms of the *ranking* of constraints. In OT, the optimal form is selected by a set of well-formedness constraints ranked in a hierarchy of relevance, i.e. constraints are ranked on a language-particular basis, so that a lower-ranking constraint may be violated to secure a higher-ranking one. *Inclusiveness* means that the candidate analyses, which are evaluated by constraint hierarchy, are generated by very general considerations of structural well-formedness. No specific rules or repair strategies with specific structural descriptions or structural changes or with connections to specific constraints are admitted.

Parallelism means that the best-satisfaction of the constraint hierarchy is computed over the whole hierarchy and the whole candidate set; there is no serial derivation; all the possible candidate analyses produced are evaluated according to the constraint hierarchy. The candidate that passes the higher-ranking constraint is the output form. The final principle of OT *universality*, holds that constraints are essentially universal and of general formulation, with a great potential for disagreement among the well-formedness of analyses. According to Prince and Smolensky (1993), the determination of constraints on universal ground does not deny the role that individual grammars play in phonological analysis. They hold that the role of an individual grammar consists in the ranking of universal constraints.

2.3.1 Architecture of Grammar in OT

The central idea of OT is that an output form is optimal in the sense that it incurs the least serious violations of conflicting sets of constraints. The seriousness of a violation is defined in terms of hierarchies of constraints; the violations of higher-ranked constraints are most serious. For a given input, the grammar of a language generates and evaluates an infinite set of output candidates from which it chooses the most harmonic or optimal one. To do this, the grammar must have two functional components: one generates the possible outputs, the other assesses them. The organization of grammar is schematically represented as follows:

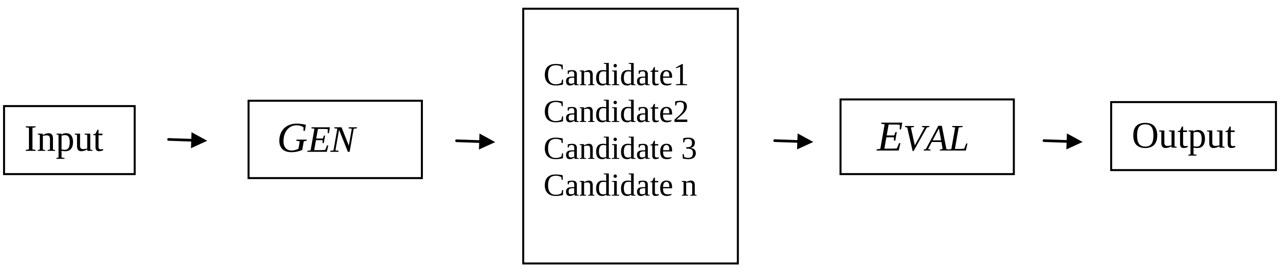
(3) **Grammar mechanism as input / output** (Prince & Smolensky, 1993)

$$\textbf{GEN}\ (\text{input}_i) \longrightarrow \{\ \text{Cand}_1, \text{Cand}_2, \text{cand}_3 \ldots \text{Cand}_n\ \}$$

$$\textbf{EVAL}\ \{\ \text{Cand}_1, \text{Cand}_2, \text{cand}_3 \ldots \text{Cand}_n\} \longrightarrow (\text{output}_i)$$

More elaborately, from an input, *GEN* (generator) produces a set of unique output candidates. Among these candidates at least one could be identical to the input and the rest are somewhat modified in their structure. Then, *EVAL* (evaluator) functions to choose the most harmonic or optimal candidate that best satisfies a set of specially ranked constraints depending on the violation (Kager, 1999) i.e., in OT the constraints are violable. The ranking process of the constraints is very crucial here, because it is the most important criterion that chooses the optimal candidate as output. *EVAL* opts for a set of candidates starting from two to an infinite number (n). The flowchart in (4) below explains the relationship between the two components and summarizes the core universal elements of the OT architecture.[3]

(4) **Graphic representation of OT/Basic OT architecture**



As shown in (4) above, candidates analyses are supplied by the component *GEN*. McCarthy and Prince (1993a) propose that the following three basic principles underlie the operation of *GEN*:

(5)

a. *Freedom of analysis (or Inclusivity)*: "Any amount of structure may be posited."
b. *Containment*: "Every element of the phonological input representation is contained in the output. No element may be literally removed from the input form. The input is thus contained in every candidate form."
c. *Consistency of Exponence*: "No changes in the exponence of a phonologically-specified morpheme are permitted." (McCarthy & Prince 1993a, 1993b, 1994).

The component *GEN* is universal, meaning that the candidate forms emitted by *GEN* for a given input are the same in every language. These candidates are also very diverse. This property of *GEN* has been called "*inclusivity or freedom of analysis*." *GEN* is free to generate any conceivable output for a given input, establishing the amount of its structure. That is, it can supply candidates with prosodic structure (mora, syllable, foot, prosodic word, etc.), morphological structure (root, word, affix, etc.), and with additional segmental material (vowel, consonant, etc.). No rules or strategies need to be posited.

Containment says that all of the phonological material in the underlying representation must be preserved ("contained") in every candidate output form. Under the containment model of faithfulness, a deleted segment like the final /ɡ/ of English *long* (cf. *longer*) is literally present in the output of the grammar but syllabically unparsed – [lɔŋ <ɡ>] (where < > enclose underparsed material), in their notation. The unsyllabified [ɡ] violates the constraint *PARSE*, as does any other segment that is not incorporated into syllable structure. Since remaining unincorporated into syllable structure is effectively the same as deletion in this theory, *PARSE* is the anti-deletion faithfulness constraint, even though it has the form of a markedness constraint, since it evaluates only the output and not the input–output relation.

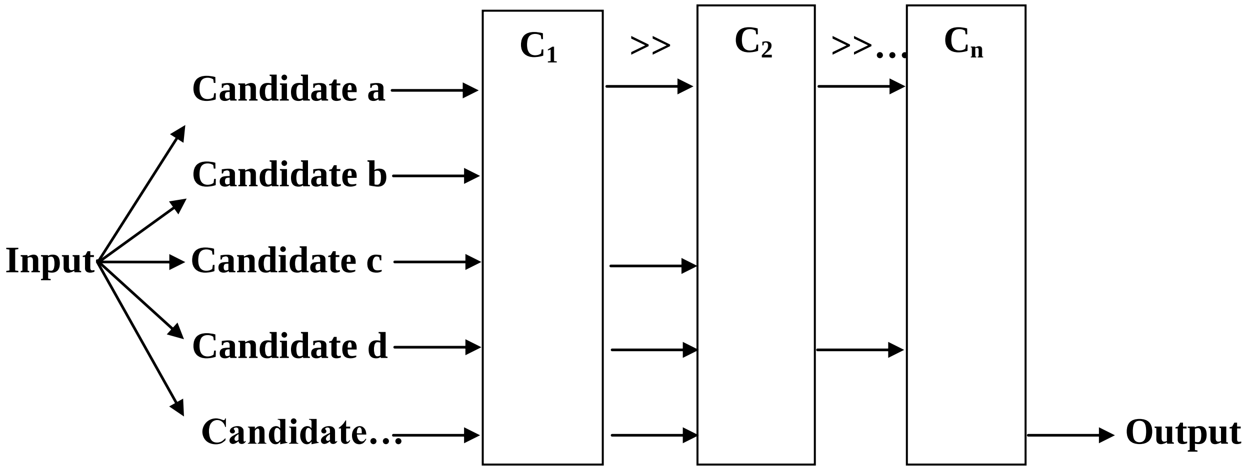
Consistency of Exponence was explained by McCarthy and Prince (1993a, 1994) in the following way:

> "[Consistency of Exponence] means that the lexical specifications of a morpheme (segments, prosody, or whatever) can never be affected by Gen. In particular, epenthetic elements posited by Gen will have no morphological affiliation, even when they lie within or between strings with morphemic identity. Similarly, underparsing of segments – failure to endow them with syllable structure – will not change the make-up of a morpheme, though it will surely change how that morpheme is realized phonetically. Thus, any given morpheme's phonological exponents must be identical in underlying and surface forms."

Underlying this is an important assumption on what *GEN* can do to morphology: it can only concatenate morphemes; it cannot change the morphemes themselves to something completely different. Phonologically, we are free; we can spread features from one morpheme to another, insert various types of material and decide not to pronounce other parts; but this will never affect the morphological status of the phonological material involved. If we decide not to pronounce the final *t* of *cat,* or if we insert a vowel at its end ([kætə]), this does not change the fact that the morpheme is {kæt}.

In OT, candidates are compared by applying a hierarchy of violable constraints. In other words, constraints are violable and are ranked in a hierarchy of relevance. Undoubtedly, the component *EVAL* is the central component of the grammar, in that it assumes the responsibility to account for all observable regularities in the output forms. Its initial role is to compare, evaluate and then decide on the harmony of the competing candidates, according to a set of hierarchically ranked constraints $\{C_1 >> C_2 >> \ldots C_n\}$, where the symbol ">>" stands for domination relation. The elimination stage in OT is represented in (6) below:

(6) **Mapping from input to output in OT grammar (Kager 1999)**



The assessment operates through a hierarchically ordered set of constraints, each of which eliminates any output candidate until there remains only one survivor. To put it differently, the function *EVAL* proceeds by evaluating all the possible candidates and then selects the most harmonic one with respect to the set of ranked constraints, i.e. the real output or optimal candidate.

The procedure for harmonic evaluation is represented in tableaux with lines and columns. While the lines represent potential candidates for harmonic evaluation, the columns represent the hierarchy of the constraints involved. The order of the columns from left to right is the order in the overall hierarchy. The optimal candidate is the one that incurs fewer violations. To best-exemplify the notion of constraint violability, consider the example of McCarthy and Prince (1993a). Assume that grammar L consists of two constraints: A and B. Assume further that *GEN* produces $Cand_1$ and $Cand_2$ from $Input_i$ (underlying form). If A and B disagree, we can say that there is a constraint conflict. This is represented in the Constraint Tableau in (7) below. Constraints are given in domination order from left to right, and the rows contain the different candidates, one of which is optimal. In the individual cells, the violations are indicated by an asterisk (*) and a fatal violation is marked by an exclamation mark (!); satisfaction is indicated by a blank cell; fixed ranking between the two constraints is shown by solid lines separating the two constraint columns; the optimal candidate is called out by a pointed hand (☞).

(7) Strict Dominance/Ranking

Constraint Tableau 2.1: A >> B

$[input_i]$	A	B
a. ☞ $Cand_1$		*
b. $Cand_2$	*!	

In (7), A is ranked above B. $Cand_1$ pointed (☞) satisfies A but violates B, whereas $Cand_2$ satisfies B but violates A. This is a fatal violation for this candidate because of the high ranking of A. (the shaded cells here emphasize the irrelevance of the constraint B to the evaluation process). Assuming that $Cand_1$ is the optimal output (surface form), the grammar requires that A takes precedence over or dominates B. This is written as (A >> B).

The violation of B by $Cand_1$ is irrelevant. This is one of the crucial aspects of Optimality Theory: a constraint violation is only fatal when other candidates satisfy the same constraint. No constraint violation in itself is ever fatal. Note that Optimality is not altered if both candidates violate B. Assume another underlying form ($input_j$) from grammar L produces the following candidate set:

(8)

Constraint Tableau 2.2: A >> B

$[input_j]$	A	B
a. ☞ $Cand_1$		*
b. $Cand_2$	*!	*

For $input_j$, $Cand_2$ fails A and both candidates fail B. The deciding constraint violation is still A since $Cand_1$ meets it and $Cand_2$ fails it. The violation of B by both candidates is irrelevant because the violation of A by $Cand_2$ is fatal and therefore $Cand_1$ is optimal.

Two candidates can tie with respect to satisfaction or violation of any given constraint. This is actually shown in (8) above, but it is irrelevant because satisfaction of A is decisive. Assume another underlying form ($input_k$) from grammar L generates the following candidate set:

(9)

Constraint Tableau 2.3: A >> B

[$input_k$]	A	B
a. $Cand_1$		*!
b. ☞ $Cand_2$		

$Input_k$ generates candidates that both meet A; hence A does not contribute to deciding optimality. As a result of this tie with respect to satisfying A, the next constraint in the ranking must be consulted. For $input_k$, $Cand_1$ fails B whereas $Cand_2$ meets it. Therefore, the violation of B by $Cand_1$ is fatal and $Cand_2$ is the optimal output. Looking at (9) another way, $Cand_2$ meets both A & B (i.e. all the constraints), so it would naturally be preferred to the other candidate regardless of constraint ranking. A situation similar to (9), where both candidates tie with respect to the higher ranking constraint, is a candidate set where both candidates fail A. Assume an another underlying from ($input_n$) from grammar L generates the following candidate set:

(10)

Constraint Tableau 2.4: A >> B

[$input_n$]	A	B
a. ☞ $Cand_1$	*	
b. $Cand_2$	*	*!

Both candidates fail A and so A makes no contribution to the matter of optimality. As in the tie of (9), the next constraint in the ranking must be consulted. In (10), $Cand_2$ fails B, which is a fatal violation, whereas $Cand_1$ meets it; hence $Cand_1$ is the preferred candidate.

The last type of tie to consider is when the same candidate incurs multiple violations of a constraint. For example, assume an ($input_m$) from grammar L emits the following candidate set:

(11)

Constraint Tableau 2.5: A >> B

$[input_m]$	A	B
a. $Cand_1$	**!	
b. ☞ $Cand_2$	*	

The multiple violations of A in $Cand_1$ is less harmonic than the single violation in $Cand_2$. Therefore, $Cand_2$ is the preferred candidate. It is important to note that constraint violations are not being counted. $Cand_1$ and $Cand_2$ are being compared for violations of A only. Both candidates fail A, so there is a tie, and so both candidates are compared with respect to A again. On the second pass, $Cand_1$ fails A but $Cand_2$ meets it. Constraint A is now decisive and its violation in $Cand_1$ is fatal.

In sum, the surface form of an underlying form is the preferred candidate from the candidate set generated by *GEN*. The preferred candidate is most harmonic or optimal, i.e., it has the highest success of constraint satisfaction when compared to other candidates. The evaluation of optimality proceeds as follows:

- All candidates are simultaneously evaluated with respect to the constraint hierarchy.
- Any candidate that violates a high-ranking constraint is non-optimal.
- The candidates that satisfy the constraint are evaluated with respect to the next highest constraint in the hierarchy. This is repeated until only one candidate survives.

Although surface violations of constraints are possible, these violations occur only under duress to satisfy higher ranking constraints. For example, the violation of B in L occurs in $[output_i]$ because the other candidate violates the higher ranking constraint A. In any other circumstances, the violation of B is fatal, e.g. $[input_k]$ and $[output_n]$, where there is a tie with respect to A. The fact that constraint conflict occurs only under duress minimizes constraint violation. Similarly, multiple violations of constraints are always less harmonic than single violations of a constraint. For example, consider $(input_p)$ from grammar L which produces the following candidate set:

(12)

Constraint Tableau 2.6: A >> B

[input$_p$]	A	B
a. Cand$_1$	*	**!
b. ☞ Cand$_2$	*	*

The candidates tie with respect to A, but the second violation of B is fatal for Cand$_1$; as a result, Cand$_2$, which minimally fails B, is preferred.

In OT, it is important to note that constraint interaction is defined by ranking. Two constraints can be ranked only when satisfaction of one in the optimal candidate leads to a violation of the other constraint in a nonoptimal candidate. This is the ranking configuration in (7) for constraint A and B in grammar L. Following this definition of constraint interaction, it is possible that two constraints are not ranked with respect to each other. This is indicated by dotted or dashed lines between columns in the constraint tableau (13). So, suppose grammar of language L has a constraint C that is ranked above B, but it is not ranked with respect to A.

(13)

Constraint Tableau 2.7: A, C >> B

[input$_q$]	A	C	B
a. Cand$_1$	*		*!
b. ☞ Cand$_2$		*	

Violations of A and C are treated as equal because these constraints are not ranked with respect to each other. Constraint B, therefore, is called upon to decide the preferred candidate. Cand$_2$ is the preferred candidate because it meets B and Cand$_1$ fails it.

2.4 Correspondence Theory

Departing from earlier work in OT (Prince & Smolensky 1993; McCarthy & Prince 1993a, b), we will adopt the Correspondence theory of faithfulness set out in McCarthy & Prince (1995). McCarthy & Prince (1995) note that a wide range of parallels exists between requirements on base-reduplicant identity in reduplicative morphology on the one hand, and requirements of input-output faithfulness in phonology on the other. Generalizing over the two domains, McCarthy & Prince propose that candidate sets come from *GEN* with a correspondence function expressing the dependency of the output on the input (or of the reduplicant on the base).

The OT grammar is defined as a set of violable constraints, common to all languages, but ranked on a language-particular basis. These universal constraints involve three broad categories: markedness constraints, faithfulness constraints, and alignment constraints. Markedness constraints assess the well-formedness of linguistic structure at a variety of levels, including featural, segmental and syllabic. Implicational relations which hold among more and less marked structure are encoded by means of markedness constraints and their relative rankings; structures which are more marked cross-linguistically are regulated by constraints which are higher-ranking than those which penalize relatively less marked elements.

Faithfulness constraints regulate the exactness of the correspondence between two strings (input and output, base and reduplicant, or output and output), penalizing deviations from the original string. The improvisational whims of *GEN* are reined in by the faithfulness constraints, which penalize a variety of changes including addition or deletion of features and segments, changes in the linear order of segments and fusion of segments.

(14) *Correspondence* (McCarthy & Prince 1995)

> Given two strings S_1 and S_2, correspondence is a relation R from the elements of S_1 to those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as *correspondents* of one another when $\alpha R \beta$.

Any two strings of words have a correspondence relation. Segments or features of one string relate to segments or features of the other string. The following sections outline the premises of two correspondence families adopted in the analysis of broken plurals. These are output-output correspondence and positional faithfulness.

All faithfulness constraints in Correspondence Theory refer to a pair of representations (S_1, S_2), standing in relation to each other as Input-Output (I-O), Base-Reduplicant (B-R), Input-Reduplicant (I-R), Output-Output (O-O), etc. The constraints also refer to a relation R, the correspondence relation defined for the representations being compared. Thus, each constraint is actually a constraint-family, with instantiations for I-O, B-R, I-R, Tone to Tone-Bearer, and so on. Some of the constraints families on correspondent elements provided by McCarthy & Prince (1995) are as follows:

(15) **The MAX Constraint Family (maximization)**

General Schema

Every segment of S_1 has a correspondent in S_2.

Domain (R) = S_1

Specific Instantiations

MAX-IO

Every segment of the input has a correspondent in the output.

(No phonological deletion)

The MAX constraint family reformulates PARSE-segment in Prince and Smolensky (1991, 1993) and other OT work, liberating it from its connection with syllabification and phonetic interpretation. It prohibits phonological deletion, demands completeness of reduplicative copying and requires complete mapping in root-and-pattern morphology.

(16) **The DEP Constraint Family (dependency)**

General Schema

Every element of S_2 has a correspondent in S_1

Range (R) = S_1

Specific Instantiations

DEP-IO
Every segment of the output has a correspondent in the input.
(Phonological epenthesis is not permitted)

The DEP constraint family also reformulates the function of FILL in Prince & Smolensky (1991, 1993) and other work of OT. It encompasses the anti-epenthesis effect of FILL without requiring that epenthetic segments be literally unfilled positions whose content are to be specified by phonetics. It also extends to reduplication and other relations.

(17) **The IDENT-F Constraint Family (identity)**

General Schema

Correspondent segments in S_1 and S_2 have identical values for feature [F]
If x *R* y and x is [γF], then y is [γF]
(Features may not be changed) or
(Correspondent segments are identical in feature F)

Specific Instantiations

IDENT-IO
Output correspondents of an input [γF] segment are also [γF].

The IDENT constraint family replaces PARSE-feature and FILL-feature-node in Prince and Smolensky (1993). It requires that correspondent segments be featurally identical to one another. Unless dominated, IDENT requires complete featural identity between correspondent elements. Crucial domination of one or more IDENT constraints leads to featural disparity, a phonological alternation.

(18)

The CONTIG Constraint Family (contiguity)

a. I-CONTIG (No Skipping)

The portion of S_1 standing in correspondence forms a contiguous string.

Domain (*R*) is a single contiguous string in S_1.

b. O-CONTIG (No Intrusion)

The portion of S_2 standing in correspondence forms a contiguous string.

Range (*R*) is a single contiguous string in S_2.

The constraint family CONTIG characterizes two types of contiguity (see also Kenstowicz 1994b): I-CONTIG and O-CONTIG. The constraint I-CONTIG rules out deletion of elements internal to the input string. Thus, the map *xyz* → *xz* violates I-CONTIG, because the Range of R is {x, z}, and *x, z* is not a contiguous string in the input. But the map *xyz* → *xy* does not violate I-CONTIG, because *xy* is a contiguous string in the input. The constraint O-CONTIG rules out internal epenthesis: the map *xz* → *xyz* violates O-CONTIG , but *xy* → *xyz* does not. The definition assumes that we are dealing with strings. When the structure S_k is more complex than a string, we need to define a way of plucking out a designated substructure that is a string, in order to apply the definitions to the structure.

(19) The ANCHOR Constraint Family

{RIGHT, LEFT}-ANCHOR (S_1, S_2)

Any element at the designated periphery of S_1 has a correspondent at the designated periphery of S_2.

Let *Edge* (X, {L, R}) = the element standing at the *Edge* = L, R of X.

RIGHT-ANCHOR. If x = Edge (S_1, R) and any y = Edge (S_2, R) then x R y.

LEFT-ANCHOR. Likewise, *mutatis mutandis.*

The ANCHOR constraint family subsumes Generalized Alignment (McCarthy & Prince 1993b) and captures the effect of the constraint ALIGN (GCat, Left/Right, PCat, Left/Right). It can be straightforwardly extended to (PCat, PCat) alignment if correspondence is assumed to be a reflexive relation. McCarthy and Prince (1999) cite the example of the foot (*bí.ta*) in which the left edge of the foot anchors with the left edge of the head syllable. In other words, the left edge of the foot and the head syllable align because *b* and its correspondent (reflexively, *b*) are initial in both.

(20) The LINEARITY Family – (No Metathesis)

S_1 is consistent with the precedence structure of S_2, and vice versa.

Let $x, y \in S_1$ and $x', y' \in S_2$.

If $x\ R\ x'$ and $y\ R\ y'$, then

$x < y$ iff $\neg (y' < x')$.

LINEARITY simply excludes metathesis, i.e. it preserves the linear order of elements in the input or the base. McCarthy (1995) cites the example of Rotuman (a language spoken on the island of Rotuma in Fiji**)** whereby the final two segments of the input /pure/ metathesize in the incomplete phrase [puer], thus causing violation of the constraint LINEARITY.

(21) The **UNIFORMITY** Family – (No Coalescence)

No element of S_2 has multiple correspondents in S_1.

For $x, y \in S_1$ and $z \in S_2$, if $x\ R\ z$ and $y\ R\ z$, then $x = y$.

(22) The INTEGRITY Family – (No Breaking)

No element of S_1 has multiple correspondents in S_2.

For $x \in S_1$ and $w, z \in S_2$, if $x\ R\ w$ and $x\ R\ z$, then $w = z$.

UNIFORMITY and INTEGRITY rule out two types of multiple correspondence — coalescence, where two elements of S_1 are fused in S_2, and diphthongization or phonological copying, where one element of S_1 is split or cloned in S_2. To put it differently, UNIFORMITY is violated when two elements of S_1 are fused in S_2 while INTEGRITY is violated when one element of S_1 is split or cloned in S_2. (On the prohibition against metathesis, see also Hume (1992)), (on coalescence, see Gnanadesikan (1995), Lamontagne & Rice (1995), McCarthy (1995), and Pater (1995)).

2.4.1. Output-Output Correspondence

The basic Correspondence Theory first comes from McCarthy and Prince (1995). The theory states that given two strings S1, S2, correspondence is a relation R from an element of S1 to those of S2. Benua (1997), who studied morphologically related words that are required to be phonologically identical through ranked and violable OT constraints, was the first to put forward the relation of output-output (O-O) correspondence between two surface forms. She explains O-O correspondence as a morphological derivation (affixation, truncation, etc ...) governed by a phonological faithfulness relation between the derived output and an output base. The related words are required to be identical by OO-correspondence constraints, and they are also required, by constraints on an IO-correspondence relation, to be faithful to their underlying forms. This relation, which is used to illustrate an output-output relation in SSA, is schematically represented in (23) below:

(23) Transderivational OO-correspondence

$$\begin{array}{ccccc} & [\text{kæt}] & \xrightarrow{\text{OO-correspondence}} & [\text{kæts}] & \\ \text{IO-correspondence} & \uparrow & & \uparrow & \text{IO-correspondence} \\ & /\text{kæt}/ & & /\text{kæt + s}/ & \end{array}$$

Each output word is linked to an input by an IO-correspondence relation, and the two words are related to each other by a transderivational OO-correspondence relation. Through these relations each word is evaluated for faithfulness to its input by Input-Output Faithfulness constraints (MAX-IO, DEP-IO, IDENT-IO [F], etc.) and the two outputs are compared by Output-Output Identity constraints (MAX-OO, DEP-OO, IDENT-OO [F], etc.). The two types of faithfulness requirements are distinct and separately rankable. Input-Output Faithfulness and Output-Output Identity constraints coexist in the hierarchy, and interact with one another and with a fixed ranking of markedness constraints.

O-O correspondence maintains the consonants' identity between the derived output and the base. In OT, this correspondence relation between two output forms is governed by identity constraints (MAX-OO, DEP-OO, IDENT-OO [F]):

(24) MAX-OO

For every segment in output1, there is a correspondent segment in output2.
Deletion of segments is banned.

(25) DEP-OO

For every segment in output 2, there is a corresponding segment in output 1. Epenthesis (addition) of segments is banned.

(26) IDENT-OO [F]

The feature of segments in output 2 must be identical to the corresponding segment in output 1.

Transderivational OO-correspondence relations are the phonological mirrored image of a morphological relation between two words. All types of morphological derivation are mirrored by a transderivational correspondence relation; affixation, truncation, reduplication, ablaut, consonant mutation, mapping to a template, compounding, or any other type of word formation requires an OO-correspondence relation between the derived word and an output base.

2.4.2 Generalized Alignment Theory

Alignment describes the tendency for certain linguistic features to coincide, such as the locus of primary stress in a word. As a constraint in OT, it was initially proposed by Prince and Smolensky (1993/2004) to explain infixation and further developed by McCarthy and Prince (1993).

a. Alignment constraints

Faithfulness constraints are essential to any theory of phonology, for without them, all inputs would converge on a single unmarked output. The final category of constraints, alignment constraints, requires the coincidence of edges of various phonological and/or morphological constituents (McCarthy & Prince 1993a). In other words, Alignment constraints require particular edges of categories or constituents to align with some edges of other categories or constituents. The constituents to be aligned may be drawn from the set of morphological or syntactic categories (affix, root, stem), prosodic categories (syllable, foot, prosodic word, etc.), or the set of distinctive features. For example, in the formation of broken plurals, they require that the right edge of syllables in the broken plural (prosodic constituent) coincide with a morphological constituent.

The general formalism of the alignment constraints is couched in Generalized Alignment Theory (McCarthy and Prince 1993b).

(27) Generalized Alignment

(28) Alignment (McCarthy & Prince 1993a)

General Schema

ALIGN (Cat_1, $Edge_1$, Cat_2, $Edge_2$) = def

$\forall Cat_1$ $\exists Cat_2$ such that $Edge_1$ of Cat_1 and $Edge_2$ of Cat_2 coincide.

Where: Cat_1, $Cat_2 \in PCat \approx GCat$ (prosodic and grammatical categories)

$Edge_1$, $Edge_2 \in$ {Right, Left}

The effects of alignment constraints proposed in the literature include the edgemost placement of affixes (prefix vs. suffix, infix, the placement of stress feet, iterative footing, McCarthy & Prince 1993a), directional syllabification (Mester & Padgett 1994) , and triggering of featural spreading processes, including vowel harmony (Kirchner 1996).

2.5 Conclusion

Throughout this chapter, we have focused on presenting some theoretical preliminaries necessary for a better understanding of the guidelines of our study. We have stated the basic principles of the theory of Prosodic Morphology, Optimality Theory and Correspondence Theory which constitute the theoretical framework that will be adopted for the analysis of the aspects of the phonology and morphology of SSA. We focused our presentation on the founding principles of the optimality theory. It is a model that predicts surface forms of words by measuring various competitors, or candidates, against a fixed hierarchy of formal constraints. In this chapter, we have described how such evaluations work, and introduced the kinds of constraints that appear in formal accounts.

A beginning premise is that every underlying representation has a unique output form. The basic machinery then works as follows: the function GEN (generator) creates a set of competing candidates, the size of which is potentially infinite. Each candidate is evaluated by the function EVAL (evaluator) against the same set of ranked constraints CON. Given the nature of constraints, no candidate can satisfy all of them, so better candidates are the ones that violate lower-ranked constraints or afflict fewer violations.

From the candidate set thus emerges the optimal form—the output—which is the one candidate that is bested by no other candidate. In other words, EVAL predicts the best possible output form for any given input representation, and does so with a consistent set of criteria in mind. Constraints measure *Markedness*, the well-formedness of output structure, and *Faithfulness*, the degree of likeness between inputs and outputs.

We then began a presentation of one of the recent developments of this theory, known as the Correspondence Theory. Two subsets of constraints have been presented, one of which is faithfulness to the segmental structure; the other the organization of this structure.

Chapter Notes

1. For further information on the nature of constraints see Chomsky & Lasnik (1977).

2. For further discussion on Optimality-theoretic syntax see Legendre, Grimshaw & Vikner (2001).

3. This graphic representation is indicative only. The actual output tableaux differ from this representation.

Chapter Three:

Syllabes and Syllable Structure in SSA

3. Syllabes and Syllable Structure in SSA

3.1 Introduction

Syllable structure is one of the prominent topics in the research activities in the OT framework. Not long ago, Féry & Van de Vijver (2003) presented a collection of studies in this topic that opens up new ways of further research on several issues of syllable structure.

In the present work, we postulate that the vocalic inventory of SSA consists of three underlying pairs of vowels and an epenthetic schwa. The schwa in SSA can be considered as epenthetic for many reasons. First, the main purpose of the vowel schwa is to break impermissible three-consonant clusters that the language does not allow, e.g. [χsər] 'to lose', [məlħ] 'salt', [mərfəg] 'elbow'. Second, unlike the other vowels of the language [a, aa, ɪ, ii, u, uu] which can occur in both open and closed syllables, the schwa never occurs in open syllables, e.g. [raħma] 'a pity', [ħæmaɖ] 'sour', [mʂəlħa] 'a broom', [sənsla] 'a zip/chain'. Third, closed syllables headed by a schwa tend to be unstressed in the presence of syllables headed by the other vowels, e.g. [mək'tuub] 'destiny', ['mæləħ] 'salty' … etc.

The distribution of the schwa is dictated by the morphological category of the base, and is largely governed by two different rules. The first is the sonority rule, which is active in nouns, inserts the schwa before the most sonorous consonant or between the second and third consonant if they have the same sonority index. While the second inserts the schwa between the last two consonants in verbs and adjectives. 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 chiefly dependent on the sonority of the consonants of the base (cf. Al Ghadi, 1990; Boudlal, 1993).

In this chapter, we will comprehensively discuss the syllable and the foot. Further in the sections, we will highlight issues like onsets, codas and geminates. We argue that the schwa problems cited previously, and consequently SSA syllable structure can be accounted for adequately within the OT framework as developed in Prince and Smolensky (1993, 2004) and extended in CT by McCarthy and Prince (1995, 1999). Particularly, we will demonstrate that structural constraints such as the constraints requiring syllables to have onsets, (i.e. a syllable must begin with an onset as all words in SSA begin with a consonant and none starts with a vowel), and no codas, (i.e. a syllable must not have a coda), and faithfulness constraints which regulate the relationship between the input and the output along with other constraints, are all what we need in order to account for SSA syllable structure. We will also demonstrate that it is the ranking of these constraints that determines syllabic well-formedness.

The chapter is organized into seven major sections. The first section contains the introduction. The second one introduces some theoretical background knowledge about the syllable along with the analytical framework of OT (cf. 3.2.1 & 3.2.2). In this section, the mora model will be explained, as an adopted syllable theory. The relation between the syllable and sonority hierarchy will then be demonstrated in (3.2.3). After giving some information about the syllable in general, the syllable types in modern Arabic dialects and SSA will be illustrated in detail (cf. 3.2.4 & 3.2.5). Section three discusses the syllable structure within OT as an analytical framework. Section four examines the mechanisms SSA resorts to in order to satisfy Foot Binarity and the nature of the Prosodic Word. The relation between the syllable and sonority hierarchy will be illustrated in section five. In section six, the representation of geminates is raised in relation to prosodic structure. We argue herein that prosodic minimality in non-derived words containing geminates is achieved in the same way as other words which lack geminates. Throughout this chapter, we argue that from the interaction of constraints, pertaining to Universal Grammar, SSA derives syllabic well-formedness. Finally, section seven summarizes the chapter.

3.2 The Syllable

In phonology, a syllable is a unit of pronunciation typically larger than a single sound and smaller than a word. We find the term 'syllable' in English being used starting from the time of Chaucer and it is used in linguistic descriptions very frequently. Actually, the notion of syllable is more intuitive than linguistic to native speakers. However, there are at least two levels of representation of the notion of syllable, viz., at phonetic and phonological level. We will focus on the phonological level here.

The recognition of the syllable as a significant unit in phonology started with the works of Hooper (1972) and Vennemann (1972). Since then, the theory of the syllable has gained more and more attention.

Evidence to support the importance of the syllable in phonological generalization (Hooper 1972; McCarthy 1979; Kahn 1980; Selkirk 1982; Clements and Keyser 1983; Blevins

1995) is threefold. First, it is only with reference to the syllable that phonotactic patterns of a language can be determined. Kahn (1976) argues that the hypothetical *atktin* is an impossible English word that cannot be ruled out without a direct reference to the syllable. The sequences *tk* and *kt* are not allowed word-initially or word-finally in English. However, they do occur word-medially as in *Atkins* and *Cactus* respectively. Accordingly, the word *atktin* is not permissible in English because the sequences *tk* and *kt* are not allowed syllable-initially and syllable-finally respectively. Second, many phonological rules, like rules of nasalization, vowel lengthening/shortening, or assimilation in general, require direct reference to the syllable. For instance, Broselow (1979) argues that pharyngealization in Cairene Arabic is best accounted for with reference to the syllable. Similarly, Kahn (1976) argues that syllable-initial obstruents are aspirated in English. Finally, the domain for suprasegmental phenomena like stress and tone is the syllable. The syllable as a stress-bearing unit is fully documented in the literature. According to their weight, two types of syllable are usually distinguished: heavy syllables (CVC, CVV) and light syllables (CV), where the former are more likely to attract stress.

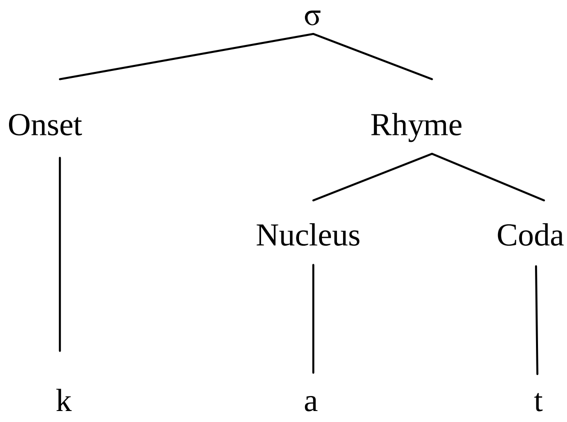
Blevins (1995) defines the syllable as *'... the phonological unit which organizes segmental melodies in terms of sonority.'* Angoujard (1990) states that the theory of the syllable contains the following principles and parameters:

a. 'Each syllable contains one sonority peak.
b. Each syllable contains n segmental slots.
c. The segmental slots have a predetermined hierarchy interrelation.'

These principles show that a syllable must have a peak which is usually a vowel or sometimes a syllabic consonant. They assume a maximal limit for the number of segments. Finally, the arrangement of segments is governed by a hierarchical relationship.

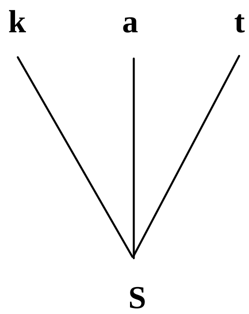
3.2.1 Types and Representations of the Syllable

The internal structure of the syllable has been the most contentious representational issue in autosegmental theory (Selkirk 1982; Clements & Keyser 1983; Hyman 1985; McCarthy & Prince 1986; Zec 1988; Hayes 1989, Hayes 1995). As a result, many models have been proposed. The most enduring model is known as the onset-rhyme model which is represented in the following way:



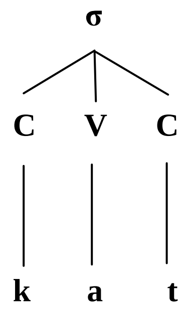
The basic aspects of this model were proposed by Pike & Pike (1947)[1]. Among its interesting characteristics is the division into onset, nucleus, and coda constituents, and the further grouping of the nucleus and coda into another constituent – the rhyme. In other words, the syllable has a binary branching structure. The syllable node is divided into onset and rhyme, as shown in the representation above. The onset consists of zero or more consonants, while the rhyme node branches into the obligatory nucleus node and the optional coda node. The nucleus node dominates the sonority peak, which is usually a vowel or sometimes a syllabic consonant, whereas the coda node consists of zero or more consonants.

Kahn (1976) proposed the first nonlinear representation of the syllable in generative grammar. In his proposal, segments are associated to the syllable node on a separate tier where no further constituents of the syllable can be defined. In this model, a word like *cat* is schematized as follows:



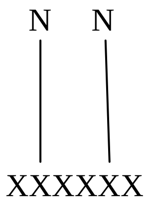
All subsequent proposals on the syllable structure adopt the core idea of Kahn's (1976) proposal, i.e. the hierarchically organized representation of the syllable.

McCarthy (1979a, 1981) proposed the CV theory, in which a skeletal level mediates between the syllable node and the segments. The segments in CV theory, as the representation below depicts, are linked to the skeletal tier and then to the syllable node:

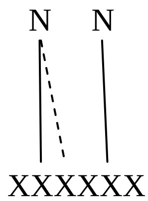


Kaye & Lowenstamm (1985); Levin (1985) proposed a closely related theory, the X-theory, where the skeletal tier is filled with Xs which represent timing slots. Replacing the CV skeleton by X skeleton is motivated by the fact that a skeletal position may associate with either a consonant or a vowel. An example to support such replacement comes from Arabic, where the distinction between consonantal and vocalic slots is crucial. In the templates for the forms *CVCCVC* and *CVVCVC* verbs, the vocalic slots are interpreted as X-slots pre-associated to a nucleus as shown below (Kenstowicz 1994; Watson 2002)

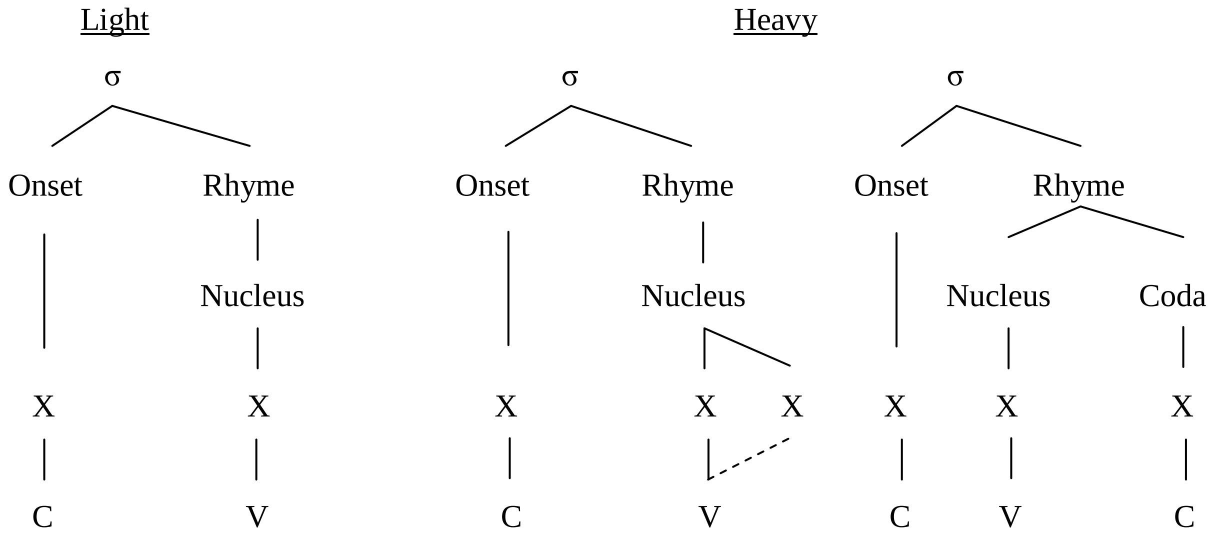
(a) CVCCVC



(b) CVVCVC



In X-theory, weight is defined by the number of skeletal positions in the rhyme of the syllable. In a light syllable, CV, the vocalic segment is associated with one skeletal position in the rhyme, whereas in heavy syllables, CVV or CVC, it is associated with two positions as schematized below:

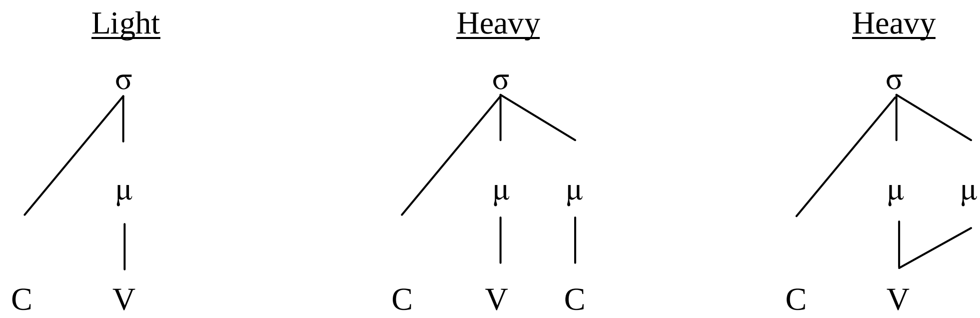


These representations show that each segment is linked directly to a timing slot, while long segments are linked to two timing slots in the skeletal tier. Linking segments to timing slots establishes the distinction between light and heavy syllables. However, under this model and since all segments are associated with X-slots, it is not possible to distinguish between CVC as a light syllable and CVC as a heavy syllable. This paves the way to a new prosodic conception in which the syllable does not consist of an onset and rhyme, but of two morae (from the Latin word meaning ‘a short period of time’ or ‘delay’).

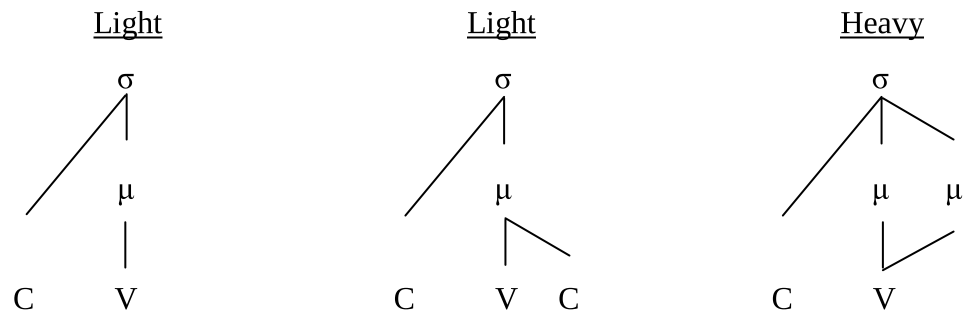
While the traditional model allows a number of phonological facts to be stated easily, it is far more complex than the moraic model. It is only mentioned as it is an essential part of one theory of syllable weight (Blevins 1995). The moraic model is the most important and influential syllable theory (Hyman 1985; McCarthy and Prince 1986, 1990; Hayes 1989). The mora, also called a beat or weight unit, is an old concept that has been recognized in almost every school of linguistics. The notion mora, in the moraic theory as proposed by Hyman (1985) and McCarthy and Prince (1986), has a dual role. First, it is a unit of phonological weight that measures syllables’ heaviness or lightness; a bimoraic syllable is heavy whereas a monomoraic syllable is light. The second role the mora plays is as a skeletal position which indicates the position of segments in the syllabic structure (Farwaneh 1995).

Under moraic theory (Hyman 1985; Hayes 1989, 1995), the X-slots in the nucleus are replaced by moras. X-slots in the coda are dispensed with moras in languages that recognize CVC as a heavy syllable otherwise the coda consonant is linked directly to the syllable node in languages where CVC is considered light. Cross-linguistically, CV syllables are treated as light or monomoraic (represented with one mora) and CVV syllables as heavy or bimoraic (represented with two moras). CVC syllables are treated as heavy in Arabic and English, while other languages treat it as light (Wilkinson 1988). A language-specific rule should state how a certain language treats different types of syllables. A rule called ‘weight-by-position’ proposed by Hayes (1989) overcomes this problem. As shown below, this rule allows the language to assign a mora to consonants in the coda. Accordingly, the rhyme in CVC may be assigned with one or two moras depending on the language rules:

a. In a language in which closed syllables and syllables with a long vowel are heavy, whereas other syllables are light (Hayes 1995:52).

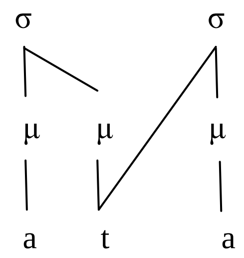


b. In a language in which only long vowels count as heavy (Hayes 1995:52).



As the above trees depict, consonants in the onset are not assigned moras in moraic theory because they have no effect on syllable weight. They are linked directly to the syllable node. The length of the segment can be represented in two ways: long vowels are assigned two moras, whereas geminate (long) consonants are attached to the coda of one syllable and the onset of the next one. To put it differently, they are linked to a mora and to the syllable node of the following syllable because geminate consonants serve as a coda for one syllable and an onset for the next one:

VCCV representation (Hayes 1995:52)



Most languages allow for only monomoraic or bimoraic syllables, syllables with only one or two moras. This means that long vowels could not be followed by geminates. A moraically-oriented approach counts for the number of beats or timing units or moras present within the syllable. This counting ability makes this model superior to previous ones as it has the power to scan and relate the elements immediately dominated by the moras. The advantages of the moraic model over the other syllable models are summarized below:

a)- The model expresses the weight-irrelevance of the onset;
b)- it offers a way of expressing light, heavy and superheavy syllables;
c)- it offers an account of short vs. long vowels;
d)- it offers an account of singletons vs. geminates;
e)- it expresses the variable nature of coda-weight;
f)- finally, moras are better integrated into the prosodic hierarchy.

Many other distinctions like Margin, Nucleus and Coda were introduced by other scholars (Cairns & Feinstein 1982, among others). Among these perhaps the most useful element for this study is the mora or syllable weight.

3.2.2 The syllable in OT

According to Prince and Smolensky (1993, 2004), a syllable structure in OT is generated in a way similar to any other grammatical feature. The function GEN generates a set of candidates for any unsyllabified input. The function EVAL opts for the optimal candidate which should comply with the constraints imposed by the universal grammar (UG) and ranked on a language-specific basis.

The syllable type CV is widely viewed as the basic syllable structure Jakobson (1962). Prince and Smolensky (2004) account for the basic syllable shapes and they state the two basic universal constraints that emerge as follows:

(15)

a. ONS ONSET
$^*[_\sigma V$
Syllables must have onsets.

b. *CODA NO-CODA
$^*C\,]_\sigma$

Syllables must not have codas/syllables are open.

Given an input of the shape /CVCV/, together ONS and *CODA, which are universally unmarked constraints, enable the function GEN to generate the following candidates, among others in the Tableau 3.1 below:

Tableau 3.1

[CVCV]	ONS	*CODA
☞ **a.** CV.CV		
b. CVC.V	*!	*

Tableau 3.1 shows two parses of which only (a) is optimal because it satisfies the two constraints ONS and *CODA. The parse in (b) is suboptimal in two ways: the first syllable is closed and as such violates the constraint *CODA while the second syllable violates the constraint ONS. As a result, it is eliminated by the fatal mark ‘‘*!’’.

Within the OT framework, the range of syllable inventories found in languages results from the interaction between “markedness” and “faithfulness” constraints. The markedness constraints include the constraint ‘NUC’, which states that each syllable must have a nucleus, and the constraints ‘ONS’ and ‘*CODA’. The main faithfulness constraints are represented in (16) below. MAX constraint prohibits deletion while DEP constraint prohibits epenthesis.[2]

(16) Faithfulness Constraints

a. MAX-IO

Every segment in the input has a correspondent in the output.

b. DEP-IO

Every segment in the output has a correspondent in the input.

Tableau 3.2 shows how these constraints work to derive the optimal output for an input of the shape /CVC/. The (V) stands for an epenthetic vowel.

Tableau 3.2

[CVC]	MAX-IO	DEP-IO	*CODA
a. CVC			*
b. CV	*		
c. CV.C(V)		*	

The optimal candidate cannot be determined from the structures in (3.2) because each of these structures violates one constraint. In (3.2a), the whole input is parsed as one syllable CVC, thus violating the *CODA constraint. In (3.2b) only the sequence CV is syllabified, satisfying the *CODA constraint but violating the MAX-IO constraint which prohibits deletion. In (3.2c), a final vowel has been epenthesised and as such satisfies both the constraints MAX-IO and *CODA but violates the constraint DEP-IO which prohibits epenthesis.

For Prince and Smolensky (1993), the optimal candidates are those that incur minimal violation of universal constraints. So, the optimal candidate can only be determined after the ranking of the constraints in (3.2). That is the candidate that violates the lower-ranked constraints is optimal while the one that violates the higher-ranked constraints is suboptimal.

It should be noted here that the ranking scale is very important since individual grammars rank universal constraints differently depending on the internal system of the language concerned. For instance, in a language that allows codas, the optimal candidate would be (3.2a) and as such the constraint *CODA would be ranked low in the ranking scale. Whereas, in a language where MAX-IO is ranked low, the optimal candidate would be the structure in (3.2b). Finally, in a language where DEP-IO is ranked low, the structure in (3.2c) would be the optimal candidate.

In sum, the constraints on syllable structure are of the two types: The markedness constraints ONSET and *CODA, and the faithfulness constraints MAX-IO and DEP-IO. Further, in section 3.3 below, we will see how the ranking of MAX-IO and DEP-IO and their interaction with other constraints can account for SSA syllable structure.

In order to account for complex margins, we should take into consideration the constraint *COMPLEX-MARGIN (Prince and Smolensky 1993). It can also be stated as *COMPLEX$_{ONS}$ and *COMPLEX$_{CODA}$.

(17)

*COMPLEX-MARGIN (henceforth *COMPLEX)
Codas and onsets must not branch.

Or

a. *COMPLEX$_{ONS}$
a syllable must not have more than one onset segment

b. *COMPLEX$_{CODA}$
a syllable must not have more than one coda segment

For instance, if language X optionally allows onsets, bans codas and allows complex onsets, then the ranking in (18)[3] is required:

(18)

NUC >> ONS >> *CODA >> MAX-IO >> DEO-IO >> *COMPLEX

In Tableau 3.3 below, we show how these constraints interact to derive the optimal output for the input [CCVC]:

Tableau 3.3

[CCVC]	NUC	ONS	*CODA	MAX-IO	DEP-IO	*COMPLEX
☞**a.** CCV.CV					*	*
b. CV.CV.CV					**!	
c. CVC			*!	*		
d. CV				**!		

This tableau shows that minimally violating the constraint DEP-IO is better than syllabifying the sequence with a coda. Therefore, candidate (3.3a) wins the competition. Violating the constraint MAX-IO, on the other hand, is intolerable due to its high status in the grammar of this language and cross-linguistically. Moreover, ranking the constraint *COMPLEX (*COMPLEX$_{ONS}$) over the constraint DEP-IO would optimize candidate (3.3b).

3.2.3 The Sonority Hierarchy and the Syllable

In the theory of syllable structure, segments in syllables are grouped according to their sonority hierarchy, or sonority scale. The most sonorous elements are assigned the highest value, and the least sonorous the lowest value. The centre of a syllable (the syllabic nucleus) is defined as the place where sonority is greatest (the sonority peak). Patterns of sonority sequence have been noted, leading to such observations as the sonority sequencing generalization: in any syllable, there is a segment constituting a sonority peak which is preceded and/or followed by a sequence of segments with progressively decreasing sonority values. In optimality theory, the term refers to a constraint which requires that syllable onsets increase in sonority and codas decrease in sonority.

Sonority is an acoustic property of sounds. Trask (1996: 327) defines it as the kind of prominence associated with a segment by virtue of its intrinsic articulation. Accordingly, vowels are more sonorous or higher in sonority than glides; glides are higher in sonority than liquids; liquids are higher in sonority than nasals; nasals are more sonorous than fricatives; fricatives are higher in sonority than stops.

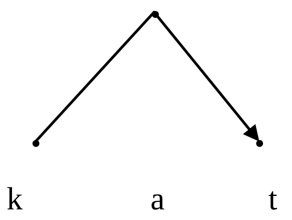
A universal sonority hierarchy has been proposed by different studies (Hooper 1976; Kiparsky 1979; Broselow 1979; Selkirk 1984; Clements 1990; Butt 1992). Almost all these scholars have agreed on one fixed universal sonority scale which refers only to the major natural classes and not to individual segments, which should be assigned by each language by means of sonority-independent parameters. This is represented in (19) below:

(19) Universal Sonority Scale

5 Vowels (Low, Mid, High)
4 Glides
3 Liquids
2 Nasals
1 Obstruents

In syllables, the peak of sonority is occupied by the segment highest in sonority which might be preceded and also be followed by marginal segments, i.e. onset and coda respectively. Sonority starts ascending from the onset towards the peak and then descending towards the coda, as shown in (20) below.

(20)

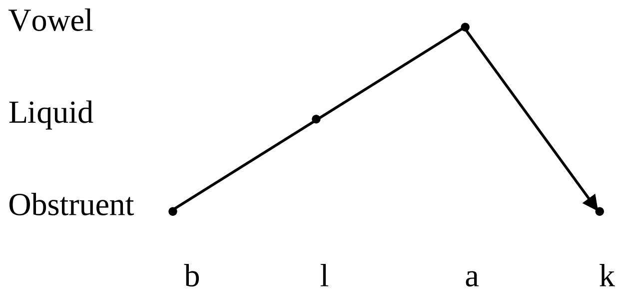


Many different studies (Hooper 1976; Kiparsky 1979; Steriade 1982; Clements 1990 among others) have proposed the Sonority Sequencing Principle (SSP), which states that the first consonant in complex onsets is lower in sonority than the second one, whereas in complex codas, the first consonant is higher in sonority than the second one.

(21) **Sonority Sequencing Principle (SSP)**
The sonority profile of the syllable must rise until it peaks, and then falls.

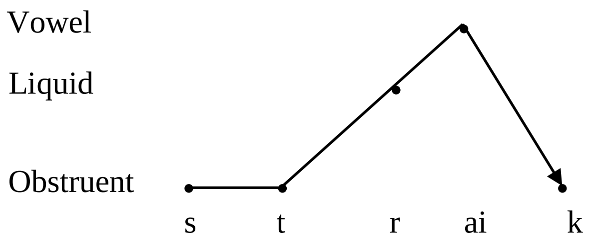
For example, the sonority sequence of the English complex onset of the word *black* is represented as follows:

(22)



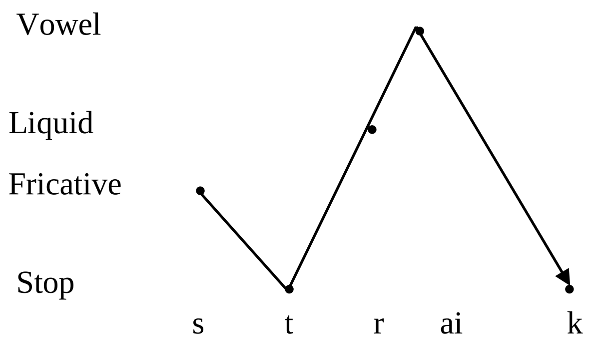
When we consider an onset with an s-initial cluster, this generalization about English can be violated, even though obstruents are equal in sonority since the claim is that the second consonant is higher in sonority than the first one. This point is illustrated in (23) below.

(23)



Moreover, if we consider that fricatives are higher in sonority than stops, we deduce that sonority falls from the fricative /s/ and then starts to rise as can be seen in (24).

(24)



3.2.4 The Syllable in Arabic Dialects

Some of the most salient differences among the Arabic language and its vernaculars have to do with syllable structure. They have received extensive analyses within the OT framework. In general, there are three significant facts about the syllable in Arabic. First, Onsets are obligatory, i.e. no syllable starts with a vowel in Arabic. Several studies, e.g. Gadoua (2000), McCarthy (2005), and Haddad (2005), have all pointed out that syllables in Arabic do not start with an initial vowel. Haddad (2005) asserts that syllables in Cairene Arabic and standard Arabic have no initial vowels. In addition, Carter (2004) points out that Classical Arabic does not allow a syllable to start with a vowel.

Second, complex onsets are prohibited in Arabic. Several researchers, namely Edzard (2000), Archibald (2003), McCarthy (2005) and Haddad (2005), agree that complex onsets are prohibited in many dialects of Arabic. Archibald (2003), in particular, asserts that Egyptian Arabic does not allow initial consonant clusters. Haddad (2005) also states that complex onsets are not allowed in both Cairene and Modern standard Arabic. Furthermore, Gafos (2003) argues that while geminates are allowed in Arabic, the onset does not consist of geminates and that no complex syllable onsets are permitted in Arabic. McCarthy (2005), however, argues that initial consonant clusters are possible due to syncope of certain perfective verbs of Arabic. The examples which McCarthy cited are found in classical Arabic and Moroccan Arabic.

Third, codas and complex codas are allowed in many, if not all, Arabic varieties. The different syllable types in (25) illustrate the three criteria about the syllable in Standard Arabic.

(25) *The syllable Types in Modern Standard Arabic*

CV	:	/ka.ta.ba/	to write
CVV	:	/kaa.tib/	a writer
CVC	:	/kat.ta.ba/	to make write
CVCC	:	/katm/	secrecy, hiding
CVVC	:	/ki.taab/	a book

If we compare the syllable types of Standard Arabic with the other Arabic dialects, we will come up with the following details: First of all, onsetless syllables are prohibited in all Arabic dialects. Secondly, complex onsets are prohibited in some dialects like Cairene Arabic, and allowed in some others like Syrian Arabic, Palestinian Arabic, Jordanian Arabic, ... etc . Similarly, complex codas are allowed in some dialects like Syrian, Palestinian, … and prohibited in others like Mekkan, …Geminates, on the other hand, exist in several varieties of Arabic, and are allowed word medially and word finally. Therefore, all Arabic dialects retain the range of syllable types found in Standard Arabic in addition to other types to account for the fact that they allow complex onsets and complex codas.

The Saoura Spoken Arabic accommodates many features of the varieties cited by previous studies, namely, no initial vowels, but complex onsets, complex codas and geminates are allowed. Geminates are allowed word initially, word medially and word finally. Complex onsets in SSA can result from the deletion of the underlying unstressed high short vowels in open syllables as the following examples in (26) depict:

(26)

Input (CA)	Output (SSA)	Gloss
[kitaab]	[ktæb]	book
[silaaħ]	[slæħ]	weapon

3.2.5. Syllable Types in SSA

The syllable plays an important role in the phonology of Arabic and its varieties (Bird & Blackburn, 1990; Kay, 1987; McCarthy, 1981 among others). The analysis and description of the syllable in Arabic has been deeply rooted since old Arab grammarians studied it (ElSaaran, 1951). Classical as well as Colloquial Arabic have received an extensive amount of analyses Abdo, 1969; Al-Ani, 1970; Brame, 1970, 1973; McCarthy, 1979a, 1979b, 2007; Abdul-Karim, 1980; Benhallam, 1980, 1990a; Kenstowicz, 1981; Kenstowicz & Abdul-karim, 1980; Selkirk, 1981; Abu-Salim, 1982; Almozainy, 1982; McCarthy & Prince, 1986; Abu-Mansour, 1987; Angoujard, 1990; Al-Ghadi, 1990; Farwaneh, 1995; Kager, 1999; Molinu and Romano, 1999;

Kiparsky, 2003; Zerling, 2000; Watson, 2002, 2007) to mention but a few of the most prominent figures. They all agree that Modern Standard Arabic (MSA) has two kinds of syllables: open syllables CV and CVV, and closed syllables CVC, CVCC and CVVC. Each syllable begins with a consonant. As can be seen in (27), SSA exhibits fifteen types of syllables including the five types found in Standard Arabic.

(27) Types of Syllables Classified in terms of Complexity

Simple Onset

CV [wa] (and) [waa.lu] (nothing) [mʂəl.ħa] (broom)

CVV [baa.rəd] (cold) [ʃaa.rəf] (old/rough)

CVC [mər.bəʈ] (pigsty), [mər.fəg] (elbow)

CVCC [wəld] (boy), [səlk] (string), [sədd] (dam), [fəkk] (jaw)

[χurʂ] (earring), [qunn] (rabbit), [fənn] (art), [sər.fəkt] (to smack)

CVVC [waad] (river), [ʂaar.ħək] (he spoke frankly to you)

Complex Onset

CCV [kla] (eat), [χta.rəʕ] (invent)

CCVV [bɤaa.tni] (she wanted me)

CCVC [mʂal.ħa] (broom), [bʂal] (onions), [ddəm] (the blood)

CCVCC [nʒərr] (to be dragged), [nʃədd] (to be tightened), [nnəms] (the skunk)

CCVVC [klaam.hum] (their speech), [blaad.ku] (your country)

CCCV [stra] (cover), [stru] (he covered him)

CCCVV [sslaa.ʈa] (the salad), [nnʕaa.jəl] (the sandals), [ddfaa.jər] (the braids)

CCCVC [nnməl] (the ants), [nnħəl] (the bees), [ʃʃʈəb] (the timbers)

[ʃʃləg] (the sparks) [rrmad] (the ash)

CCCVCC [ssdadr] (the sofas)

CCCVVC [ʃʃraab] (the wine), [ʃʃduug] (the cheeks)

The syllable shapes in SSA fall into three categories: *light* CV, CCV, CVC (in final position) and CəC, *heavy* CVC (in non-final position) , CCVC, CCVV and CVCC, and *super-heavy* CVVC, CCVCC, CCVVC…

3.3 Universal Constraints on SSA Syllable Structure

(McCarthy & Prince 1993; Prince & Smolensky 1993, 2004) postulate that Universal Grammar has a set of violable universal constraints which encompass universal properties of languages. All universal constraints are available in every language in the world. However, each language has its particular ranking of these constraints, i.e., a certain hierarchy. Some languages may rank a certain constraint high in the hierarchy while others may rank the same constraints very low. This difference in constraint ranking explains the variation that arises between languages. In addition, OT adopts a tableau in which the candidate that optimally satisfies a given constraint ranking wins over all other candidates produced by GEN. The grammar decides on the winner through EVAL, which selects the best candidate that satisfies the high ranked constraints. Note that a given language may have high ranked but yet violable constraints. The most important issue is that the number of violations occurring to a given high constraint should be minimal.

OT offers an approach to linguistic theory that aims at combining universality and markedness. In terms of universality, Universal Grammar provides the theory with a set of constraints that are universal and universally present in all grammars. Whereas markedness aims at presenting a precise formal sense of what it means to be “unmarked.” In OT, forms are marked with respect to some constraint if they violate it. These forms are literally marked in that they incur violation marks for the constraint as part of their grammatical derivation. In other words, OT posits that both Constraint-unmarked-structure and the Constraint-marked-structure are present in the grammar of a language. Constraint ranking decides which of these structures surfaces in the language. Low ranked constraints are dominated by other high ranked constraints.

To account for SSA syllable structure, we will need to apply the four universal constraints, ONS, *CODA, MAX-IO, and DEP-IO mentioned in (15) and (16) above and we will show their ranking and interaction according to SSA rules. According to Prince and Smolensky (1993), ONS and *CODA are universally unmarked constraints. It is an established fact that the syllable in SSA, as in most of the varieties of Arabic, starts with an onset and does not start with a vowel. However, the constraint *CODA is frequently violated in SSA. Therefore, we assume that the constraint ONS is highly ranked. To illustrate, let us consider the input [ʃædɪ] 'monkey' and see how the constraints ONS and *CODA enable GEN to produce the following possible candidates shown in Tableau 3.4 below.

Tableau 3.4

[ʃædɪ]	ONS	*CODA
☞ **a.** ʃæ.dɪ		
b. ʃæd.ɪ	*!	*

Tableau 3.4 shows two parses of which only (a) is optimal because it satisfies the two constraints ONS and *CODA. The parse in (b) is suboptimal in two ways: the first syllable is closed and as such violates the constraint *CODA while the second syllable violates the constraint ONS. As a result, it is eliminated by the fatal mark ''*!''. Now, let us consider another example of the shape CVC. The constraint Tableau 3.5 below shows two candidate parses for the input [fɪq] 'wake up':

Tableau 3.5

[fɪq]	ONS	*CODA
a. fɪq		*
☞ **b.** fɪ.q		

Tableau 3.5 shows two possible parses of which only (3.5a) can be optimal. However, the choice (3.5b) is forced by the ranking ONS >> *CODA. Moreover, a candidate such as the one in (3.5b) is selected as optimal based on the hierarchy of constraints and the violations the candidates incur. Reasonably good questions to be asked here are: What forces the violation of *CODA? And is there a constraint ranked higher than *CODA and lower than ONS? And, most importantly, how can the candidate (3.5b) be eliminated and how can the candidate (3.5a) be chosen as optimal? According to Prince and Smolensky (1993), Candidate (3.5b) can be pronounced fatal by some dominating constraint labeled PARSE segment (hereinafter PARSE-seg) which Prince and Smolensky (1993) state as follows:

(28) PARSE segment (hereinafter PARSE-seg)

Every segment must belong to a syllable.

If we consider the constraint PARSE-seg and rank it over *CODA and lower than ONS, candidate (b) in the tableau 3.5 above will be ruled out. This can be restated in the following tableau:

Tableau 3.6

[fɪq]	ONS	PARSE-seg	*CODA
☞ **a.** fɪq			*
b. fɪ.q		*!	

Tableau 3.6 shows clearly that PARSE-seg dominates *CODA and, therefore, *CODA is better violated. Candidate (3.6b) is eliminated on the ground because it incurs a fatal violation of the constraint PARSE-seg. Candidate (3.6a) is chosen as optimal though it violates *CODA, a lower ranked constraint.

Since initial vowels are not allowed in SSA, a glottal stop or a glide is then epenthesized in order to avoid the surfacing of any onsetless syllable. Consider the examples in (29) for illustration:

(29)

	Input	**Output**	**Gloss**
a.	[ar.nəb]	[ʔar.nəb]	hare
	[am.rəd]	[ʔam.rəd]	grasshopper
	[ɪ.bɪl]	[ʔɪ.bɪl]	camels
	[ard]	[ʔard]	Earth
b.	[ʃɪn-ɪ]	[ʃɪn.wɪ]	Chinese
	[gla-ɪ]	[gla.wɪ]	from Igli
	[ʕasla-ɪ]	[ʕas.la.wɪ]	from ʕasla

In (29a) the epenthetic element is the glottal stop [ʔ]; in (29b), it is the glide [w] which is epenthesized between the suffix [i] and the stem final vowel. Both cases involve epenthesis and therefore violate DEP-IO. The deletion of segments violates the faithfulness constraint MAX-IO, represented in (30), which suggests that it outranks the other faithfulness constraint DEP-IO, stated in (31).

(30)

MAX-IO
Every segment of the input has a correspondent in the output (no deletion)

(31)

DEP-IO
Every segment of the output has a correspondent in the input (no epenthesis)

The output items in (29) contain an epenthetic glottal stop and an epenthetic glide to satisfy ONS and thus, it is evident that the constraint DEP-IO is violable and must be outranked by the constraint MAX-IO and ONS. Furthermore, according to Prince and Smolensky (1993) and McCarthy (2005), the constraint ONS is undominated in Arabic. Therefore, we can safely assume that ONS outranks both MAX-IO and DEP-IO in SSA. The tableau 3.7 illustrates the interactions between the constraint ONS and the faithfulness constraints MAX-IO and DEP-IO where MAX-IO >> DEP-IO since a glottal stop is inserted to overcome onstless syllables:

Tableau 3.7

[arnəb]	ONS	MAX-IO	DEP-IO	*CODA
a. ar.nəb	*!			*
b. ʔar.nəb			*!	*
💣 **c**. r.nəb		*		*

Tableau 3.7 shows that the candidate (a) is eliminated because it has an onsetless syllable. The candidate (b) is fatal because it has a segment in the output that does not have a correspondent in the input. (c), with the symbol (💣), is chosen as the wrong optimal candidate based on the hierarchy of the constraint violation shown above. Hence, MAX-IO must be ranked over PARSE-seg and DEP-IO and ONS must be ranked over both.

Now, let us see how the faithfulness constraints MAX-IO and DEP-IO interact with ONS, PARSE-seg and *CODA. The relevant possible candidates are illustrated in Tableau 3.8 for the input [arnəb]:

Tableau 3.8

[arnəb]	ONS	MAX-IO	PARSE-seg	DEP-IO	*CODA
a. ar.nəb	*!				*
☞**b.** ʔar.nəb				*	*
c. ʔar.nə		*!		*	*
d. ʔar.nə.b			*!	*	*

In Tableau 3.8, the candidate (a) is ruled out for an onsetless syllable – a very high-ranked constraint that is undominated. The candidate (b) is optimal with a minimal acceptable violation. In other words, since violation of lower-ranked constraints (DEP-IO) is allowed to secure higher-ranked constraints (MAX-IO and ONS), it follows that the optimal candidate is [ʔarnəb]. The candidate (c) is grounded by MAX-IO for not having a correspondent for the segment [b] in the output. Finally, (d) is eliminated because it has a segment that does not belong to a syllable.

Likewise, the cases of a glide epenthesis instead of the glottal stop could also be accounted for by the constraints above. The tableau below illustrates the candidate parses for the input [ʕasla-i]:

Tableau 3.9

[ʕasla-ɪ]	ONS	MAX-IO	DEP-IO	*CODA
a. ʕas.lɪ		*!		*
b. ʕas.la.ɪ	*!			*
☞ **c.** ʕas.la.wɪ			*	*

Candidate (3.9c) wins over the other two candidates since it only violates the lower ranked constraints DEP-IO and *CODA. Candidates (3.9a) and (3.9b) are ruled out because they violate the higher ranked constraints ONS and MAX-IO respectively.

So far, we have considered examples with simple onsets. Now consider the relevant candidate parses for the input [makla] 'food:'

Tableau 3.10

[makla]	ONS	MAX-IO	PARSE-seg	DEP-IO	*CODA
a. mak.la					*
☞**b.** ma.kla					
c. makl.a	*!				*

The tableau above demonstrates that the candidate in (3.10b) is optimal because it incurs no violation at all. (3.10a) is discarded since it violates the lower-ranked constraint *CODA. (3.10c) is ruled out for violating the higher-ranked constraint ONS. In order to ensure that EVAL selects (a) as optimal, we need to invoke the constraint *COMPLEX-MARGIN (Prince & Smolensky 1993) which requires that syllable margin consists of only a single consonant. The constraint is stated in (32) as follows:

(32) *COMPLEX-MARGIN (henceforth *COMPLEX)

Codas and onsets must not branch.

As can be seen from Tableau 3.10 above, a complex onset will pass MAX-IO. Thus, *COMPLEX must be ranked over MAX-IO and ONS must be ranked over both. Tableau 3.10 is reformulated in Tableau 3.11 with the constraint *COMPLEX:

Tableau 3.11

[makla]	ONS	*COMPLEX	MAX-IO	PARSE-seg	DEP-IO	*CODA
☞ **a.** mak.la						*
b. ma.kla		*!				
c. makl.a	*!					*

Candidate (3.11a) wins over the two other candidates since it only violates the lower-ranked constraint, namely *CODA. Candidate (3.11b) is discarded for violating *COMPLEX. Candidate (3.11c) is also discarded for violating ONS.

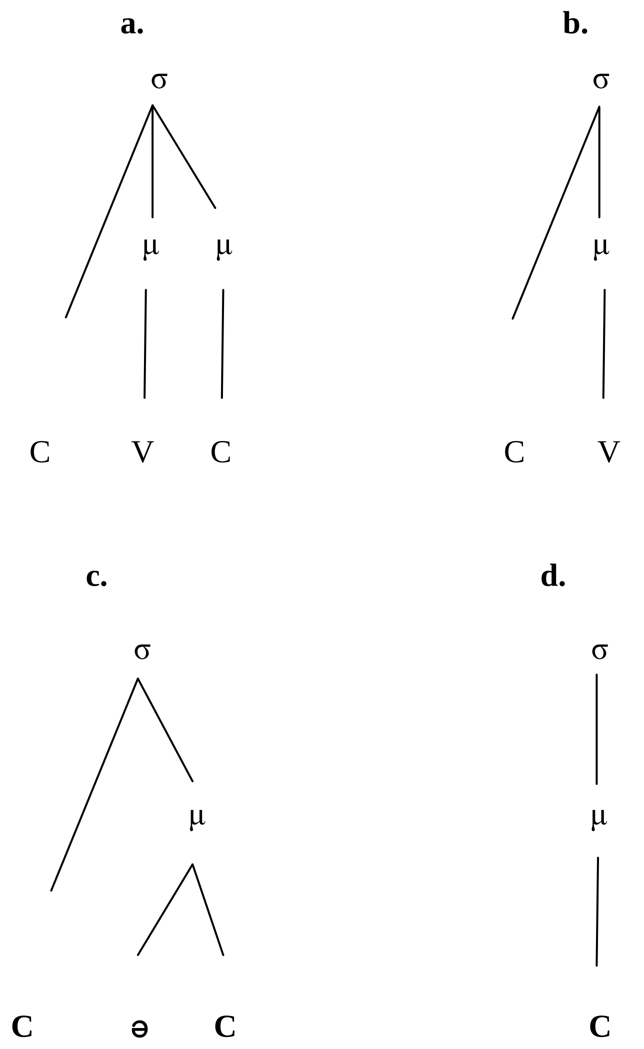
The constraints seen so far are of two types: (a) the undominated constraints, which are ONS , *COMPLEX, MAX-IO and PARSE-seg; and (b) the dominated ones which are DEP-IO and *CODA. That is ONS outranks *COMPLEX and MAX-IO; MAX-IO outranks both PARSE-seg and DEP-IO. *CODA is the lowest ranking constraint and is frequently violated. The hierarchy of constraints can be summarized in (33) as follows:

(33) ONS >> *COMPLEX >> MAX-IO >> PARSE-seg >>DEP-IO >>*CODA

3.4 Foot Binarity and the Prosodic Word in SSA

Feet are binary under syllabic or moraic analysis. More generally, the foot binarity constraint (henceforth FT-BIN) prohibits feet exceeding the two-mora limit. As shown below in (34) and according to Zec (1988), Hayes (1989), Alghadi (1994) and Boudlal (2004), under moraic theory, SSA distinguishes between bimoraic CVC heavy syllables, where V is different from the schwa (a); and monomoraic light syllables, which fall into three types : the first where the mora dominates one segment (b); the second where the mora dominates the schwa and the following consonant (c); and the third where the mora dominates a consonant belonging to a minor syllable known as a degenerate syllable. The degenerate syllable consists of a single consonant only. A representation of the degenerate syllable is shown in (d) below:

(34)



The fact that schwa appears in different positions shows that it is epenthetic. We must point out that this schwa is moraless on its own and that it acquires a moraic status only in combination with a following consonant in the syllable (Zec, 1988). In other words, that schwa in SSA never occurs in open syllables follows from the fact that it must head monomoraic syllables, consisting of a single branching mora that both schwa and the following coda consonant share as shown in (c) above. This assumption explains why schwa vowels are banned from occurring in open syllables.

The moraic representation in (34) above, which is also adopted for Moroccan Arabic, has led Alghadi (1994) to lay down the following equalities between syllables with a full vowel nucleus and syllables with a schwa nucleus :

(35)

a. CV = CəC

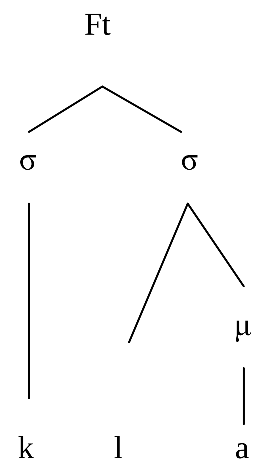
b. CVC = CəCC

c. CVCV = CəCCəC

d. CCV = CCəC

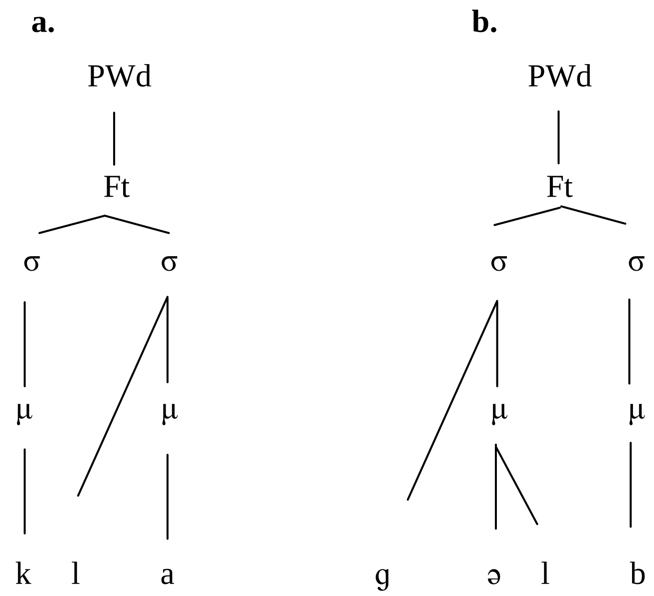
Both the templates in (b) and (c) meet the requirement of a PrWd and satisfy the constraint FT-BIN by virtue of their being bimoraic. But, the templates in (d) are monomoraic and therefore constitute a clear violation of FT-BIN. As we can see, both templates start with a consonant cluster (CCV and CCəC). To clarify, consider the following structure of the verb [kla]:

(36)



This structure shows that the lexical word [kla] does not meet the requirement of a PrWd. In other words, it does not satisfy FT-BIN, a constraint observed cross-linguistically. The question we ask here is that how is it possible to satisfy FT-BIN? The answer to this question is proposed by Alghadi (1994) who considers the first member of an initial consonant cluster or the second member of a final consonant cluster as part of a degenerate syllable, where the consonant is dominated by a mora. He also proposes that this mora be adjoined directly to the foot rather than projecting its own syllable. Following Alghadi, the lexical words [kla] ‘he ate’ and [gəlb] ‘heart’ will have the following structures:

(37)



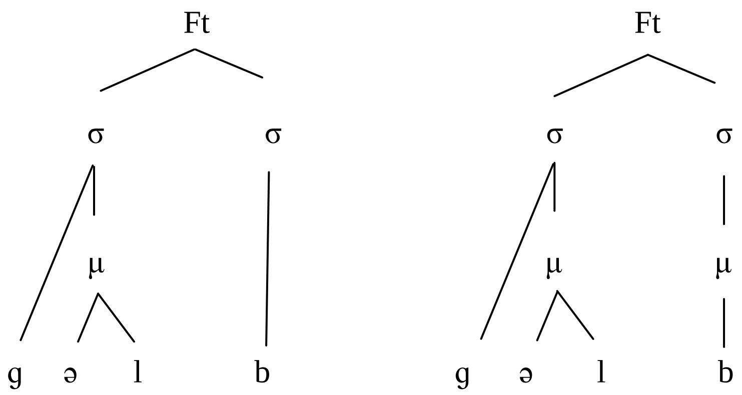
These structures show that the moraification of the consonants [k] and [b] is the result of the requirement that feet be binary. Thus, in forms such as [kla] and [gəlb], satisfying the constraint FT-BIN forces the consonants [k] and [b] to be moraic.

In sum, the behaviour of initial and final consonant clusters in tri-consonantal words points towards the fact that the only way to satisfy FT-BIN is by assigning a moraic status to a member of the cluster. Hence, satisfying foot binarity is very common and is found cross-linguistically**.**

Next, we consider items that end with a cluster of consonants, which present a special case that needs to be analyzed. The syllabification of the word [gəlb] ‘heart’ which ends with two consonants in the coda is reformulated in (38) below.

(38)

a. **b.**



Here we are concerned with the consequences of adopting either of the structures in our analysis. It should be pointed out that adjoining the consonant [b] in (38a) directly to the syllable node does not constitute a violation of the constraint PARSE-seg. In fact what is violated is Selkirk's (1980, 1981) Strict Layer Hypothesis (STRICT-LAYER) which requires that every prosodic constituent must be dominated by a constituent of the immediately superior type. That is to say, the mora is dominated by the syllable, and the syllable is dominated by the foot which is, in turn, dominated by the prosodic word. Moreover, according to Prince and Smolensky (1993), (38a) poses another problem related to the word minimality, any member of the morphological category corresponds to a prosodic word [Lexical word (LX) ≈ Prosodic word (PrWd)], which in turn corresponds to a foot. They argue that "the foot is subject to binarity which requires the prosodic word (PrWd) to be at least bimoraic if the language under study is quantity-sensitive or disyllabic if the language is quantity-insensitive." Obviously, then, the syllabification in (38a) incurs two violations: Strict Layer Hypothesis and Foot Binarity.

In this analysis, we need to adopt the syllabification in (38b) because neither Strict Layer Hypothesis nor Foot Binarity is violated. However, it should be noted that the representation in (38b) is not entirely without flaws. The morification of the consonants to satisfy Foot Binarity does incur a violation of Nuclear Harmony (henceforth NUC-H) (Prince & Smolensky 1993) and subsequently the constraint prohibiting Minor Syllable (henceforth *Min-σ) (A minor syllable consists of one consonant only, whereas a major syllable is one whose nucleus is a schwa or one of the full vowels). Accordingly, three constraints should be formulated as follows:

(39) Foot Binarity (henceforth FT-BIN)

Feet are binary under syllabic or moraic analysis.

(40) MINOR SYLLABLE (henceforth *Min-σ)

Minor syllables are prohibited.

(41) Nuclear Harmony (henceforth NUC-H)

A higher sonority nucleus is more harmonic than a lower sonority one.

(NUC-H considers C-nuclei to be less harmonic than V-nuclei).

The constraints developed so far will give the result in Tableau 3.12 for the input [gəlb]:

Tableau 3.12

[gəlb]	FT-BIN	*COMPLEX	DEP-IO	*Min-σ	NUC-H	*CODA
a. gəlb		*!				*
b. gəl$_{\mu}$.b	*!			*		*
☞ **c.** gəl$_{\mu}$.b$_{\mu}$				*	*	*

As indicated in Tableau 3.12, candidate (a) is ruled out for having a complex coda. Candidate (b) incurs a fatal violation of FT-BIN for having a minor syllable with a moraless consonant. It should be stated that if the constraint *Min-σ is not hypothesized, then, we assume that [b] is an unparsed segment violating PARSE-seg which involves that the latter must be dominated by FT-BIN. In other words, if we use a syllabification such as [gəl.b] without marking *Min-σ with an asterisk, then it is assumed to be an unparsed segment not belonging to any syllable or having a minor syllable of its own. In such a case, it is to be handled and taken care of by PARSE-seg. Candidate (c) is chosen as optimal since it only incurs one minimal acceptable violation of *Min-σ, NUC-H and *CODA. It should also be stated here that the only way to pass *COMPLEX is to have a minor syllable, and the only way to satisfy FT-BIN is to assign a mora to the consonant which, in turn, violates NUC-H.

Obviously, from what has been said and from the constraints developed thus far, the moraification of consonants is the result of the requirement that feet be binary. Thus, in a form such as [gəl$_{\mu}$.b$_{\mu}$], satisfying the constraint FT-BIN forces the consonant [b] to be moraic, thus violating the constraint NUC-H. So, clearly, FT-BIN must dominate both *Min-σ and NUC-H. Note also that DEP-IO must outrank *Min-σ and NUC-H and any form that incurs a violation of *Min-σ automatically violates NUC-H. Now let us see how all the constraints developed so far interact with each other. The relevant candidate parses for the input [gəlb] are illustrated in Tableau 3.13 as follows:

Tableau 3.13

[gəlb]	FT-BIN	ONS	*COMPLEX	MAX-IO	PARSE-seg	DEP-IO	*Min-σ	NUC-H	*CODA
a. gəlb			*!						*
b. gəl$_{\mu}$.b	*!						*		*
☞ **c.** gəl$_{\mu}$.b$_{\mu}$							*	*	*
d. lgəl$_{\mu}$.b$_{\mu}$			*!			*	*	*	*
e. al.gəl$_{\mu}$.b$_{\mu}$		*!				**	*	*	*
f. ʔal.gəl$_{\mu}$.b$_{\mu}$						***!	*	*	*
g. l.gəl$_{\mu}$.b$_{\mu}$					*!	*	*	*	*
h. l$_{\mu}$.gəl$_{\mu}$.b$_{\mu}$	*					*	**	*	*

Candidate (3.13a) is eliminated for having a complex coda. Candidate (3.13b) is ruled out for violating FT-BIN by having a moraless minor syllable. Candidate (3.13d) is punished for violating a very high-ranked constraint, namely *COMPLEX. Similarly, (3.13e) starts with (a vowel) an onsetless syllable; therefore, it is grounded for violating a very high-ranked constraint, namely ONS. Whereas candidate (3.13f) is punished based on the hierarchy of the constraints and on the number of violations it incurs – it violates DEP-IO three times in addition to violating the last three constraints. Thus, in terms of quantity, candidate (3.13c) is much better than the one in (3.13f).[1]Candidate (3.13g) is punished for having an unparsed segment that does not belong to a syllable nor does it have a minor syllable of its own. It should be noted that the first [l] does not violate Ft-BIN; it is assumed here to be just a floating segment. However, candidate

(3.13h) passes the high-ranked undominated constraints by having two minor syllables with moraic consonants.

To recapitulate what has been developed so far, it has been stated that the dominated constraints DEP-IO, *Min-σ, NUC-H and *CODA are highly violable constraints in SSA dialect, as can be seen in Tableau 3.13 above. While the undominated constraints FT-BIN, ONS, *COMPLEX, MAX-IO and PARSE-seg, are very high-ranked constraints. Hence, the constraints at our disposal up to now are ranked in (42) as follows:

(42)

FT-BIN >> ONS >> *COMPLEX >> MAX-IO >> PARSE-seg >>

DEP-IO >> *Min-σ >> NUC-H >> *CODA

When considering the position of the epenthetic vowel, we find that the constraints which have so far been developed are insufficient. Therefore, an alignment constraint is needed to ensure that the epenthetic vowel is inserted in the desired position. In other words, a CCC sequence could either surface as [C.CəC] or [CəC.C]. The distribution of the schwa is dictated by the morphological category of the base, and is largely governed by two different rules. The first is the sonority rule, which is active in nouns, inserts the schwa before the most sonorous consonant or between the second and third consonant if they have the same sonority index. While the second inserts the schwa between the last two consonants in verbs and adjectives. The rule responsible for schwa epenthesis in nouns may be formalized in (43) as follows:

(43)

$O \longrightarrow ə$: **a.** $C_1 \_\_\_ C_2C_3$ if $C_2 > C_3$

b. $C_1C_2 \_\_\_ C_3$ if $C_3 > C_2$

or $C_2 = C_3$

Or $C_1C_2C_3$ / C_2 / ≥ / C_3 /

These rules say that the insertion of schwa is sensitive to the sonority of the last two consonants of tri-consonantal roots. Schwa is epenthesised before the most sonorous consonant in the string or between the last two consonants with the same sonority index in nouns. For example:

(44) NOUNS

A)-

Root	Stem	Gloss
√sʈħ	[sʈəħ]	roof
√ʒml	[ʒməl]	camel
√ɣnm	[ɣnəm]	sheep
√lħm	[lħəm]	meat
√qbr	[qbər]	tomb

B)-

Root	Stem	Gloss
√sdd	[sədd]	dam
√fnn	[fənn]	art
√kbʃ	[kəbʃ]	ram
√knz	[kənz]	treasure
√gmħ	[gəmħ]	wheat
√brd	[bərd]	cold
√wsʈ	[wəsʈ]	middle

The rule responsible for schwa insertion in verbs and adjectives may be formalized in the following way:

(45)

O ⟶ ə / CC ___C] Stem Right Edge (V/Adj.)

This rule which should refer to the categories VERB and ADJECTIVE and which McCarthy & Prince (1993b) call Generalized Alignment, aligns the last full syllable with the stem at the right edge. For example:

(46)

VERBS

A)-

Root	**Stem**	**Gloss**
√ɖrb	[ɖrəb]	hit
√χsr	[χsər]	fail
√krh	[krəh]	hate
√ʈlb	[ʈləb]	ask
√nbħ	[nbəħ]	bark
√lbs	[lbəs]	wear

B)-

Root	**Stem**	**Gloss**
√frr	[fərr]	fly
√ħll	[ħəll]	open
√hzz	[həzz]	lift
√ʃdd	[ʃədd]	hold

ADJECTIVE

Root	**Stem**	**Gloss**
√ħrʃ	[ħrəʃ]	rough
√brʂ	[brəʂ]	leprous
√fħl	[fħəl]	brave
√ʈrʃ	[ʈrəʃ]	deaf
√qrʕ	[qrəʕ]	bald
√ħwl	[ħwəl]	cross-eyed

Accordingly, the constraint we need, to insure that the right edge of the root must coincide with the right edge of the syllable, is formulated in (47) as follows:

(47) ALIGN (stem, R, σ, R) (henceforth ALIGN-R)
The right edge of the root must be aligned with the right edge of the syllable.

To account for the difference between [C.CəC] and [CəC.C], we assume that no domination relationship exists between *COMPLEX and ALIGN-R and that both constraints must dominate DEP-IO. The input $[\text{ḍrb}]_{v}$ 'hit' and the relevant possible candidates are illustrated in the constraint Tableau 3.14 below:

Tableau 3.14

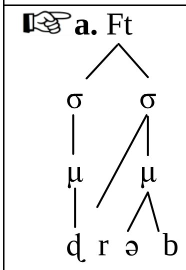
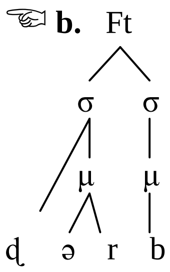
$[\text{ḍrb}]_{v}$	FT-BIN	*COMPLEX	ALIGN-R	DEP-IO	*CODA
				*	*
				*	*

Tableau 3.14 shows that both candidates satisfy ALIGN-R: (3.14 a) satisfies it because the right edge of the stem coincides with the right edge of the syllable; (3.14b) satisfies ALIGN-R although the right edge of the stem coincides with a minor syllable. In order to establish candidate (3.14 a) as optimal, another alignment constraint must be formulated, requiring that the right edge of the stem be aligned with a major syllable (Maj-σ) as stated in (48) below:

(48)

ALIGN-R-Maj-σ

The right edge of the stem must align with the right edge of a major syllable.

This constraint will have to dominate the general version of ALIGN-R. Thus, the syllabification [CəC_{μ}.C_{μ}] is eliminated on the ground because the right edge of the stem does not align with a major syllable. According to Boudlal (2004: 71),

> 'the problem with this constraint is that it seems to weaken the Alignment Theory by allowing it to look at the internal structure of the prosodic entity being aligned, i.e. it has to see whether it is a major or a minor syllable. For this reason, we are led to abandon the constraint ALIGN-R-Maj-σ in search for another constraint that has an explanatory power.' He suggests that 'epenthesizing a schwa before the third consonant of the root instead of the second follows from the general requirement that the stem be iambic.' 'He added that within the Alignment Theory, iambicity could be expressed by positing a constraint requiring that the right edge of the stem be aligned with the right edge of a prominent syllable in a foot.'

The constraint is stated in (49). The notation σ′ refers to the prominent syllable:

(49)

ALIGN-R (Stem, σ′) (ALIGN-R-σ′)

The right edge of the stem must be aligned with the right edge of the prominent syllable.

The syllabification [C_{μ}.CəC_{μ}] with the first consonant being dominated by a minor syllable satisfies ALIGN-R-σ′ since the right edge of the stem corresponds to the right edge of the prominent syllable of the foot, i.e. the syllable which bears the main stress of the word. While a minor syllable, which is dominated by a moraic consonant, can never be the prominent syllable. The constraint ensuring the non-prominence of a minor syllable is given in (50) below:

(50)

PROMINENT MINOR SYLLABLE (hereinafter *Min-σ′)

Prominent minor syllables are prohibited.

We assume that no domination relationship exists between *COMPLEX and *Min-σ′ and that both constraints must dominate ALIGN-R-σ′ and DEP-IO as the constraint Tableau 3.15 shows. Prominence is indicated by a small bar (ˈ) after a vowel if the syllable in question is a major syllable, and after a consonant if the syllable in question is a minor syllable.

Tableau 3.15

[ɖrb]$_v$	*COMPLEX	*Min-σ′	ALIGN-R-σ′	DEP-IO	*CODA
a. ɖ əˈr. b			*!	*	*
☞**b.** ɖ. r əˈ b				*	*
c. ɖ ə r. bˈ		*!		*	*

(3.15a) is fatal for violating ALIGN-R-σ′ by epenthesizing a schwa before the second consonant of the stem. (3.15c) is also fatal since it violates *Min-σ′ though it tries to satisfy ALIGN-R-σ′ by assigning prominence to a minor syllable. (3.15b) is chosen as optimal because it satisfies both ALIGN-R-σ′ and *Min-σ′ by right-aligning a major syllable.

However, the tables (44B) and (46B) give examples illustrating the argument against stem-prominent syllable right-alignment. These examples include verbs with final geminates and a subset of nouns with final geminates and others with a cluster of two consonants. In other words, they are syllabified as [CəC_{μ}.C_{μ}] with the prominent syllable on the left rather than the right edge of the foot, and as such they incur a clear violation of ALIGN-R-σ′. So, in order to derive forms on the pattern CəCC, ALIGN-R-σ′ must be outranked by some other constraints as will be shown in the coming sections.

3.5 Sonority and Syllabification

As the items in (44) above depict, the distribution of schwa is chiefly dependent on the sonority of input consonants. This schwa vowel is epenthesized before the most sonorous consonant in a string. In order to express this sonority-based insertion, we make use of Clements' (1988) sonority hierarchy from most to least sonorous which is defined as follows: vowels, glides, liquids, nasals, fricatives and stops. The class of glides comprises, in addition to [w] and [j], the pharyngeals [ħ] and [ʕ].This schwa is epenthesized before the most sonorous consonant in the string. It is epenthesized before the second consonant of the root if its sonority is greater than that of the third consonant. If the sonority of the third consonant is greater than that of the second consonant, the schwa is epenthesized before the third consonant. Likewise, the schwa is epenthesized before the third consonant if its sonority equals that of the second consonant.

It should be noted that there is an exceptional class of nouns that do not conform to the sonority hierarchy. Examples of such nouns include items like [ħəbs] ‘prison’, [ħnəʃ] ‘snake’, [ʕməʃ] ‘blear' … etc. Surprisingly enough, these items include a pharyngeal as one of their elements. On the whole, we believe that a large number of nouns abides by the sonority principle whereas others, such as [dhəb] ‘gold’,[gʂəb] ‘reeds’, [ʕləg] ‘leeches’, [kəbʃ] ‘ram’, [mədħ] ‘eulogy’,[ləħn] ‘melody’, do not.

Right-to-left directionality of schwa syllabification -- stem-prominent syllable right-alignment -- is also observed in nouns on the pattern C.CəC through satisfying the constraint ALIGN-R-σ′ which requires that the right edge of the stem coincides with the right edge of a prominent syllable. The only cases where ALIGN-R-σ′ is violated is when the sonority of consonants is at stake. This draws attention to the fact that sonority must outrank ALIGN-R-σ′. So, how is it possible to express the relative sonority of consonants in an optimality theoretical framework?

The answer to this question lies in the fact that it is the coda which determines the epenthesis of the schwa. That is to say, all schwa syllables have codas and that this schwa is moraless on its own and that it acquires a moraic status only in combination with a following consonant in the same syllable as the tree in (34c) above shows. Such an assumption excludes the possibility of having schwas in open syllables in SSA. Such behaviour of the schwa which Clements (1988) calls the Dispersion Principle is stated in (51) as follows:

(51) The Dispersion Principle

a. The preferred initial demi-syllable maximizes sonority dispersion.

b. The preferred final demi-syllable minimizes sonority dispersion.

According to Clements, demi-syllables are overlapping divisions of a syllable sharing the peak. For example, CV is an initial demi-syllable while VC is a final demi-syllable; V is both an initial and final demi-syllable. Syllables on this pattern are also called one-member demi-syllables. Clements ranks final demi-syllables as in (52) below:

(52)

Final demi-syllables

V >> VG >> VL >> VN >> VF >> VS

(V = vowel, G = glide, L = liquid, N = nasal, F = fricative and S = stop)

This ranking means that codaless syllables rank high, and that the closer the sonority of the coda is to that of the nucleus the better. Hence, SSA items on the pattern C.CəC and CəC.C abide by Clements' ranking save for the case of final demi-syllables of the type V if V is a schwa because the language does not allow open syllables with schwas. Accordingly, following Clements' ranking, the constraints on SSA final schwa demi-syllables can be formulated in (53) as follows:

(53)

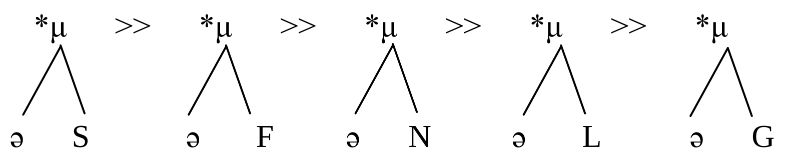
SSA Final Schwa Demi-syllables

əG >> əL >> əN >> əF >> əS

We must point out that a syllable headed by a schwa is moraless on its own and that it acquires a moraic status only in combination with a following consonant in the syllable (Zec, 1988). We must also point out that the schwa is placed before the most harmonic coda in terms of sonority. If this is the case, the hierarchy in (53) could well be expressed in terms of negative constraints on SSA schwa-demi-syllables. The ranking of these negative sonority constraints is given in (54) below:

(54)

Sonority in Nouns (hereafter SONORITY_N)



(*μ/əS >> *μ/əF >> *μ/əN >> *μ/əL >> *μ/əG)

These constraints are interpreted as follows:

Wherever the schwa is inserted before a stop consonant, the constraint *μ/əS is violated.

〃 〃 〃 〃 〃 〃 a fricative, the constraint *μ/əF is violated.

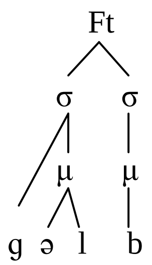
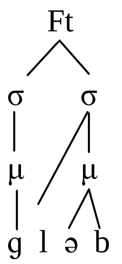
〃 〃 〃 〃 〃 〃 a nasal, 〃 〃 *μ/əN 〃 〃 .

〃 〃 〃 〃 〃 〃 a liquid, 〃 〃 *μ/əL 〃 〃 .

〃 〃 〃 〃 〃 〃 a glide, 〃 〃 *μ/əG 〃 〃 .

The sonority constraints in (54) reflect the idea that the optimal coda of schwa syllables is one with a higher sonority value. As stated earlier, nouns on the pattern CəC.C incur a clear violation of the constraint ALIGN-R-σ′ because the right edge of the stem corresponds to a minor syllable which cannot be prominent. This implies that the sonority constraints must outrank ALIGN-R-σ′. The Tableau 3.16 shows how these constraints interact to produce the optimal output for the input $[glb]_n$ where the schwa is epenthesized between the first and the second consonants of the root and where the sonority of the second consonant is greater than that of the third one, i.e. (**$C_1əC_2C_3$** if **C_2 > C_3** in sonority):

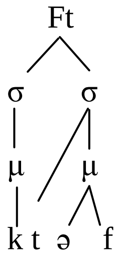
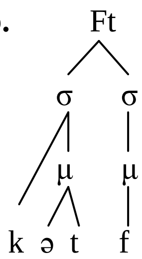
Tableau 3.16: (C_1**ə**C_2C_3 if $C_2 > C_3$ in sonority)

$[glb]_n$	*μ/əS	*μ/əL	ALIGN-R-σ′
☞ **a.** 		*	*
b. 	*!		

(3.16 b) is pronounced dead for violating *μ/əS whereas (3.16 a) is chosen as optimal because it incurs only a minimal acceptable violations.

Now let us consider another case where the schwa is inserted between the second and third consonants of the root and where the sonority of the third consonant is greater than that of the second, i.e. ($C_1C_2əC_3$ if $C_3 > C_2$ in sonority). In the Tableau 3.17 below, we show the candidate parses for the input noun $[ktf]_n$ ‘shoulder’:

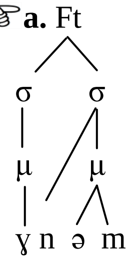
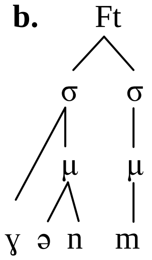
Tableau 3.17: ($C_1C_2əC_3$ if $C_3 > C_2$ in sonority)

$[ktf]_n$	*μ/əS	*μ/əF	ALIGN-R-σ′
☞ **a.** 		*	
b. 	*!		*

(3.17 a) is optimal for satisfying the constraints *μ/əS and ALIGN-R-σ′ while (3.17b) is eliminated for violating both constraints.

The last case of tri-consonantal (CCC) nouns we will consider is one where the sonority of the second consonant equals that of the third, i.e. ($C_1C_2əC_3$ if $C_3 = C_2$ in sonority). Here the schwa is inserted between the two consonants and it is the constraint ALIGN-R-σ′ which is decisive. Consider the candidate parses of the input $[ɣnm]_n$ given in Tableau 3.18 below:

Tableau 3.18: ($C_1C_2əC_3$ if $C_3 = C_2$ in sonority)

[ɣnm]$_n$	*μ/əN	ALIGN-R-σ′
☞ **a.** 	*	
b. 	*	*!

(3.18b) is fatal for violating both constraints. (3.18a) is optimal. It should be stated that although ALIGN-R-σ′ is dominated, it is still active in the language in that it enables us to determine the appropriate position of the epenthetic schwa in triliteral (CCC) nouns whose second and third consonants are equal in sonority.

As it has been stated earlier in this chapter, SSA distinguishes between two modes of schwa syllabification: nominal schwa syllabification, which is dependent on the sonority of the consonants constituting the stem, and verb and adjective schwa syllabification. In OT terms, to account for the difference in syllabic pattern between verbs and adjectives, on the one hand, and nouns, on the other, we resort to an alignment constraint which requires that the right edge of the verb and adjective stem be aligned with a prominent syllable. This verb-/adjective-specific constraint is formulated in (55) below:

(55)

ALIGN-R (verb/adjective, σ′) (hereinafter ALIGN-R (V/Adj, σ′)

The right edge of the verb/adjective stem must be aligned with the right edge of the prominent syllable.

Now, let us assume that the constraint ALIGN-R (V/Adj, σ′) outranks the constraint ALIGN-R-σ′. This ranking implies that any triconsonantal verb stem or adjective epenthesizing a schwa between the last two consonants satisfies both ALIGN-R (V/Adj, σ′) and ALIGN-R-σ′. However, this ranking is problematic with words with final geminates which epenthesize a schwa between geminate consonants. Tableau 3.19 illustrates this situation for the input $[\text{ħll}]_V$ 'open':

Tableau 3.19: (**C_1əC_2C_3** if **C_2 > C_3** or **C_2C_3** is a geminate)

$[\text{ ħll }]_V$	ALIGN-R(V/Adj, σ′)	ALIGN-R-σ′	DEP-IO	*CODA
a. ħəl.l	*!		*	*
💣 b. ħ.ləl			*	*

As indicated in the Tableau 3.19, the correct output cannot be derived by the alignment constraints alone. They wrongly choose the candidate (3.19b) [ħləl] instead of [ħəll] as the optimal candidate. This fact calls for the need of a higher-ranked additional constraint that would block epenthesis in the case of geminates. In the next section, we consider this constraint and see how the prosodic word minimality requirement, i.e. bimoraic like [səmm] 'poison' and [mma] 'mother'and [dəzz] 'push', is achieved in geminate words.

3.6 Geminates and Syllable Structure

A wide range of material can be found on the nature and representation of geminates (Delattre, 1971; Kenstowicz & Pyle, 1973; McCarthy, 1979; Steriade, 1986; Hayes, 1989), among others. Generally, these authors' works fall into two broad categories with regard to the representation of geminates. The first category represents geminates as a mono-segmental unit whereas the second one regards them as a bi-segmental unit. The representation of geminate consonants remains a controversial topic in phonological theory. This discrepancy of phonologists on the nature of geminates results from the ambiguous behaviour of geminate consonants cross-linguistically. While advocates of skeletal theory represent geminates as a single root node multiply-linked to two skeletal positions (Leben, 1980; Clements & Keyser, 1983; Levin, 1985), proponents of moraic theory claim that geminates are intrinsically moraic (Hyman 1985; Hayes 1989, 1995; Davis 1994, 1999). In other words, the prosodic length analysis of geminates whereby a geminate is underlyingly a single consonant phoneme linked to two C-slots, and the moraic weight representation where a geminate is underlyingly a single consonant linked to a mora.

Thus, in autosegmental terms, geminate consonants are represented as one root node that is linked to two timing slots, as can be seen in (56): (56a) shows the representation of a geminate, and (56b) that of a singleton consonant.

(56)

a. *geminate* **b.** *singleton*

However, the skeleton and syllable structure were soon superseded by moraic representations. A fundamental tenet of moraic theory is that geminates are inherently moraic, i.e. they have weight. Thus, in moraic theory geminates are represented as shown in (57a).

(57)

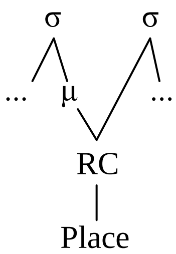
a. *geminate* **b.** *singleton*

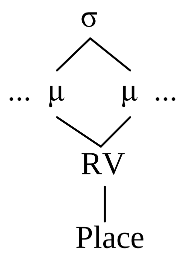
This representation shows that a geminate consonant has its own mora and is ambisyllabic, since it is linked to both syllable σ_1 and syllable σ_2.

More explicitly, there are two different theories in regard the analysis and representation of geminates. The first one is the One-Root Theory of Length proposed by McCarthy and Prince (1986) and Hayes (1989). The authors of this theory claim that geminates are linked to a single root node as shown in (58) below:

(58) The One-Root Theory of Length
(geminates as a single root node)

a. *Geminate Consonant* b. *Geminate Vowel*



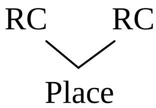


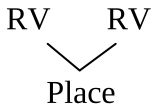
The second theory, which will be adopted in regard to the analysis of geminates, is the Two-Root Theory of Selkirk (1990, 1991). This theory views geminates as a representation of two root nodes that share stricture and place features as shown in (59) below:

(59)

The Two-Root Theory of Length
(geminates as two root nodes)

a. Geminate consonant **b.** Geminate vowel

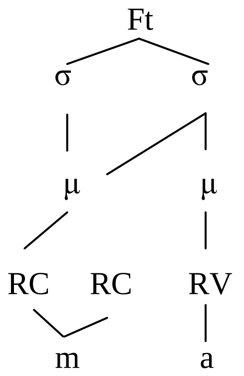




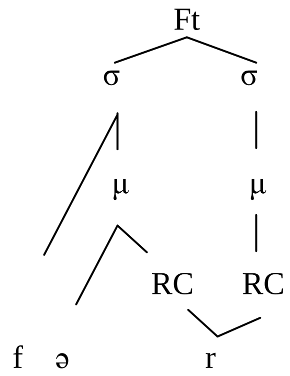
According to Selkirk, the advantage of the representations above is that they allow for a clear distinction between full and partial geminates. Full geminates involve full feature sharing, whereas partial geminates are structures where specifications for laryngeal features or nasality may differ in halves. What concern us here are the full geminates. Selkirk's representation of full geminates is demonstrated in (60) below. The examples we consider are [mmɑ] 'mother' and [fərr] 'fly'.

(60) Full Geminates

a. *Initial Geminate*



b. *Final Geminate*



However, it should be pointed out that the Two-Root Theory does not specify the moraic structure of geminates. This is a property that should be supplied from the language under discussion. In SSA, and as it has already been stated, the initial segment of the word in (60a) is associated to two root nodes, thus producing initial geminate, the first of which is associated to a mora to satisfy FT-BIN. Likewise, the final consonant of the word in (60b) is associated to a morphemic tier that is represented here as two root nodes, hence producing a final geminate, both of which is associated to a mora to satisfy FT-BIN. In other words, the Two-Root Theory treats geminates as a consonantal cluster. Note that the representation in (60) somewhat resembles the syllable representation presented earlier in (37) save for the fact that the RC nodes are adjoined together in (60). Therefore, the same constraints that handle consonant cluster can take care of the geminates.

The analysis we propose in this section will cover final and initial underlying geminates.

3.6.1 Analysis of Final Geminates

Geminates in SSA are found in triliteral verbs, nouns and adjectives in which the last consonant is a geminate, as shown in (61) below:

(61) A/- VERBS

Root	Stem	Gloss
√grr	[gərr]	confess
√ħll	[ħəll]	open
√hzz	[həzz]	lift
√ʕɖɖ	[ʕaɖɖ]	bite
√kʃʃ	[kəʃʃ]	catch

B/- NOUNS

Root	Stem	Gloss
√sdd	[sədd]	dam
√fnn	[fənn]	art
√ħrr	[ħərr]	heat
√hll	[həll]	relatives
√χrr	[χərr]	nonsense
√χnn	[χənn]	twang

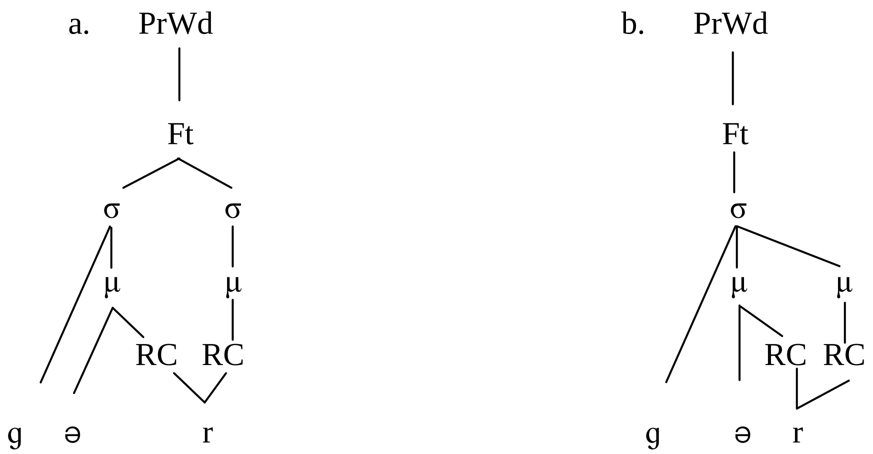
C/- ADJECTIVES

Root	Stem	Gloss
√mrr	[murr]/[mərr]	bitter
√ħrr	[ħurr]	free

Geminates are employed to satisfy the "Minimal Word requirement," i.e. bimoraic or bisyllabic. The notion "Minimal Word" is derived from The Prosodic Hierarchy and Foot Binarity (Prince, 1980; Broselow, 1982; McCarthy and Prince, 1986, 1990a, 1991a, 19991b). According to the Prosodic Hierarchy, any instance of the category Prosodic Word must contain at least one Foot. By Foot Binarity, every Foot must be bimoraic or disyllabic. By transitivity, then, a Prosodic Word must contain at least two moras or two syllables.

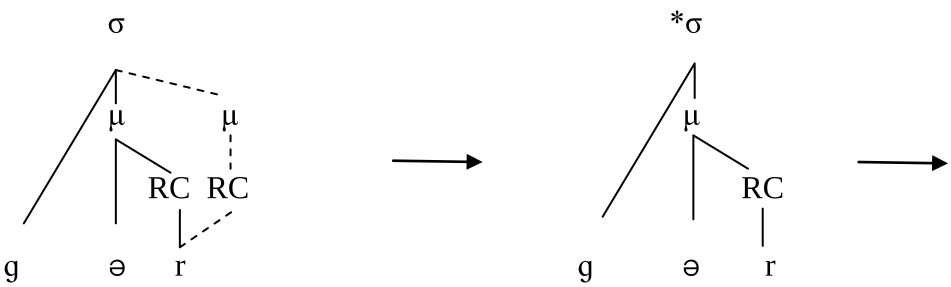
In a quantity-sensitive prosody, the “Minimal Word” is simply bimoraic, a pair of light syllables or a single heavy one. Observed word minimality restrictions therefore follow from the grammatical requirement that a certain morphological unit, often Stem or Lexical Word, must correspond to a Prosodic Word. Following this prosodic organization, a word such as [gərr] could have either of the two representations shown in (62) below:

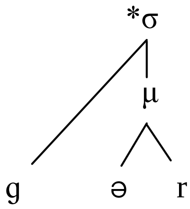
(62)



The representation in (62a) shows that the word [gərr] is made up of two syllables, with the second one being a minor syllable associated with the second part of the geminate. While the representation in (62b) shows that the word is monosyllabic, consisting of a heavy syllable. So, both representations meet the requirement of a prosodic word and satisfy the constraint FT-BIN by virtue of their being bimoraic. It is worth noting here that The Two-Root Theory treats the final geminate as a final consonantal cluster. Accordingly, (62b) should be eliminated for having a complex coda, i.e. violating the constraint *COMPLEX. However, we can spare the violation of *COMPLEX by deleting a root consonant of the input, thus resulting in a form such as [gər]. This is illustrated in (63) below:

(63)





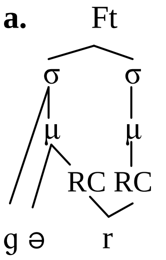
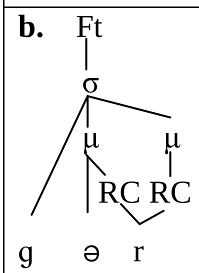
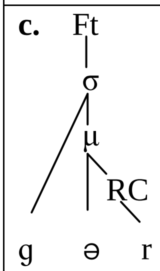
To prevent this deletion, Boudlal (2004), among others, posits a constraint of the MAX family in regard to the geminates, namely MAX-RC, which states that consonants of the root must be preserved as shown in (64) below:

(64) MAX-RC

All root consonants of the input must be preserved in the output

Now consider the constraints interaction and the relevant candidates for the underlying input $[grr]_V$ given in Tableau 3.20 below:

Tableau 3.20

$[grr]_V$	FT-BIN	*COMPLEX	MAX-RC	DEP-IO	*Min-σ′
a. 		*!		*	*
b. 		*!		*	
c. 	*!		*!	*	

From Tableau 3.20 above, none of the candidates is optimal. Candidate (3.20a) is ruled out for violating the constraint *COMPLEX by allowing the two root consonants of the geminate to occupy the coda. Candidates (3.20b) and (3.20c) are excluded for violating higher-ranked constraints.

To account for the difference between *[g. rər] and [gər. r] (3.20a), it should be pointed out that although [gər.r] incurs a clear violation of the constraint *Min-σ′, i.e. stem-prominent syllable right alignment, it should be considered as optimal. While *[g. rər] is excluded for splitting up geminates by schwa epenthesis, a well-known fact that geminates consonants cannot be split up by epenthesis (Kenstowicz and Pyle, 1973; Guerssel, 1976; Hayes, 1986; Sherer, 1994; MacBride, 1996, among others). This points out to the fact that a new constraint ought to be incorporated in order to derive the correct output. This is stated in (65) as follows:

(65)

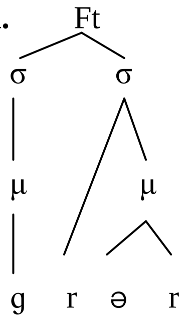
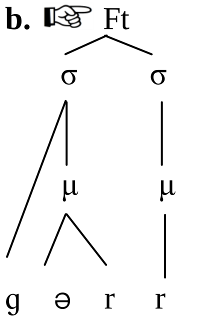
NO-SPLITTING (NO-SPLIT)
Geminates must not split (epenthesis cannot apply to geminates)

Or

GEMINATE-INTEGRITY (GEM-INTEG)
Geminates are inseparable (a vowel cannot be inserted into a geminate)

We assume that the function of the constraint NO-SPLIT is to ensure not only that the geminates do not split but also that no vowel is inserted between them. This constraint must outrank the constraint ALIGN-R (V/Adj, σ′) and ALIGN-R-σ′ in order to produce the optimal candidate [gər. r]. Now, consider Tableau 3.21 for illustration:

Tableau 3.21

$[grr]_{V}$	FT-BIN	NO-SPLIT	ALIGN-R (V/Adj, σ′)	ALIGN-R-σ′	DEP-IO
a. 		*!			*
b. ☞ 			*	*	*

Candidate (3.21 a) is ruled out for violating the higher-ranked constraint NO-SPLIT, the effect of which is to block schwa epenthesis from splitting up final geminates. Candidate (3.21b) is chosen as the optimal candidate because it indicates that it is more highly valued to incur a violation of the alignment constraints than epenthesize a schwa between the two segments of the geminate.

Triconsonantal nouns such as the ones in (61) could be accounted for in the same way as trisegmental verbs and adjectives, save for the fact that only the constraint ALIGN-R-σ′ which is active as shown in the Tableau 3.22 for the noun [fənn]:

Tableau 3.22

$[fnn]_{n}$	FT-BIN	NO-SPLIT	ALIGN-R (V/Adj, σ′)	ALIGN-R-σ′	DEP-IO
a. f^{μ}. $nən^{\mu}$		*!			*
b. ☞ $fən^{\mu}$. n^{μ}			*	*	*

Candidate (3.22a) is ruled out for violating the higher-ranked constraint NO-SPLIT. Candidate (3.22b) is chosen as the optimal candidate because it incurs only minimal acceptable violations. The shaded column is meant to show the irrelevance of the concerned constraint since the target is a noun.

To summarize, it has been shown that the adoption of the Two-Root Theory of Length allows for a better representation of geminates in that it treats them as final consonant clusters that share common features. It has also been shown that the fact that final geminates in tri-consonantal verbs are never split up by schwa epenthesis results from the ranking of the constraint NO-SPLIT over the constraint ALIGN-R (V/Adj, σ′).

3.6.2 Analysis of Initial Geminates

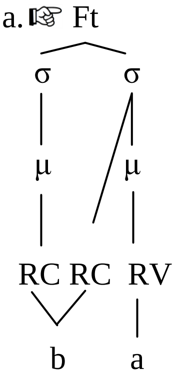
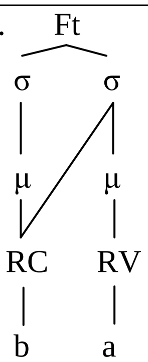
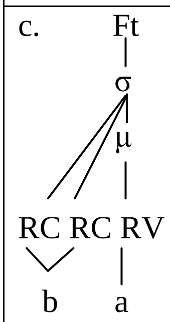
The next items we will consider in this subsection are cases of biliteral nouns and verbs whose initial segment is geminated. These are given in (66) below:

(66)

	Root	**Stem**	**Gloss**
A/- NOUNS	√bb	[bba]	my father
	√mm	[mma]	my mother
	√ss	[ssɪ]	Mister
	√nn	[nnu]	the rain
B/- VERBS			
	√dd	[dda]	take
	√ʃʃ	[ʃʃa]	stop to a donkey
	√rr	[rra]	go to a donkey

The items in (66) represent cases of tautomorphemic geminates that occur in SSA. In order to account for words with initial geminates and to decide about the optimal candidate, we need the constraints FT-BIN, *COMPLEX, MAX-RC, DEP-IO and *Min-σ. The candidates for the underlying input $[bbɑ]_n$ are presented in Tableau 3.23 below:

Tableau 3.23

$[bba]_n$	FT-BIN	*COMPLEX	MAX-RC	DEP-IO	*Min-σ
a. ☞ 					*
b. 			*!	*	*
c. 	*!	*!			

The candidate (3.23 a) is optimal since it only violates *Min-σ to satisfy FT-BIN. The candidate (3.23b) satisfies FT-BIN but is excluded because it incurs a fatal violation of MAX-RC by deleting a root consonant node of the input. Finally, the candidate (3.23c) associates both root consonants to the syllable node and therefore is eliminated because it violates both FT-BIN and *COMPLEX.

To sum up, it has been shown that The Two-Root Theory of Length treats initial geminates in the same way as initial consonantal clusters (CCəC or CCV). The first part of the geminate is always associated with a minor syllable to satisfy both *COMPLEX and FT-BIN.

Finally, in this section we have looked at geminates word finally and word initially. Regarding the structure of geminates, we adopt Selkirk's Two-Root Theory of Length. It is concluded that initial and final geminates are treated in the same way as final consonant clusters. The constraints necessary to account for SSA syllable structure are stated in (67) below:

(67)

1. <u>Undominated constraints</u>:

FT-BIN, *COMPLEX, MAX-IO, PARSE-seg, ONS, SONORITY$_N$, *Min-σ' and ALIGN-R (Vb/Adj, σ') and NO-SPLIT/GEM-INTEG.

2. <u>Dominated constraints</u>:

DEP-IO, *CODA, NUC-H, *Min-σ, ALIGN-R, ALIGN-R-σ'

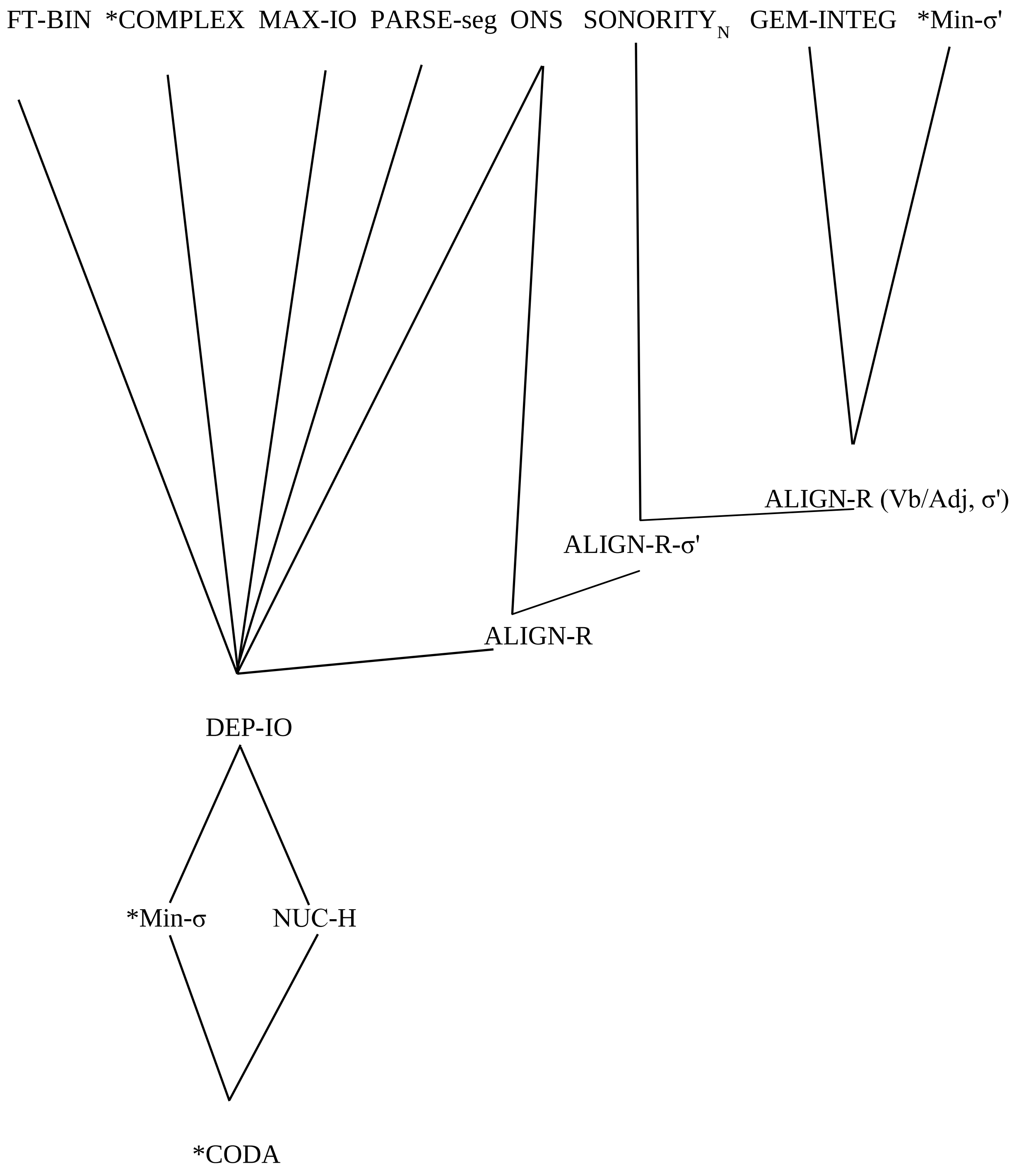
The domination relation among these constraints is stated in (68):

(68)

1. ONS >> MAX-IO >> PARSE-seg >> DEP-IO >> *CODA
2. FT-BIN >> *COMPLEX >> DEP-IO >> *Min-σ >> NUC-H >> *CODA
3. *Min-σ' >> ALIGN-R (Vb/Adj, σ') >> ALIGN-R-σ' >> ALIGN-R >> DEP-IO
4. NO-SPLIT/GEM-INTEG >> ALIGN-R (Vb/Adj, σ') >> ALIGN-R-σ'
5. ALIGN-R (Vb/Adj, σ'), SONORITY$_N$ >> ALIGN-R-σ'

The grammar or ranking of constraints to account for SSA syllable structure is summarized below in (69) in the form of a lattice:

(69)


FT-BIN
*COMPLEX
MAX-IO
PARSE-seg
ONS
SONORITY$_N$
GEM-INTEG
*Min-σ'
ALIGN-R (Vb/Adj, σ')
ALIGN-R-σ'
ALIGN-R
DEP-IO
*Min-σ
NUC-H
*CODA

3.7 Conclusion

This chapter has shed light on the importance of the syllable in the overall theory of grammar, the internal structure of the syllable, the syllable in OT, the syllable and sonority hierarchy, the syllable in Arabic, and the syllable in SSA. The chapter has also explained the mora model as an adopted syllable theory. The analysis offered in this chapter has shown that prosodic structure assignment in SSA is not governed by rules but by constraints such as the ones listed in (68).

This chapter has discussed the syllable structure of the Saoura Spoken Arabic couched within the OT constraint-based framework (Prince and Smolensky 1993, 2004). It has been demonstrated that syllable inventories can be attributed to the interaction of faithfulness constraints and markedness constraints in OT. The markedness constraints including ONS, *CODA, PARSE-seg and *COMPLEX (*COMPLEX$_{ONS}$ and *COMPLEX$_{CODA}$) are universal as well as MAX and DEP as faithfulness constraints. The ranking of these constraints is language-specific (i.e. different from one language to another). For instance, ONS is ranked as the highest constraint in languages where onsetless syllables are not allowed. Also, the constraint *COMPLEX (*COMPLEX$_{ONS}$) is ranked as one of the highest constraints in languages where complex onsets are prohibited. However, ONS is not ranked as the highest constraint in languages that tolerate onsetless syllables. The constraint *COMPLEX (*COMPLEX$_{CODA}$) is ranked as one of the highest constraints in languages where complex codas are not permitted. The constraint *CODA is low-ranked in languages where syllables have codas.

It has been shown that nominal schwa epenthesis is dependent on syllable structure as well as on the sonority of the consonants of the base. A constraint-based analysis offers a straightforward analysis to the problems of syllabification and the representation of geminates and their contribution to the achievement of prosodic word minimality requirement. Syllabification has been shown to derive from alignment constraints such as ALIGN-R (Vb/Adj, σ'), ALIGN-R-σ′ or else from ALIGN-R.

It has been shown that a large number of triliteral items epenthesizes a schwa between the second and third consonant of the root and this follows from the constraint requiring that the stem be iambic. It has also been shown that the disparity in schwa syllabification between verbs and adjectives, on the one hand and nouns schwa syllabification on the other, could be accounted for by ranking the verb-/adjective stem-prominent syllable alignment above the general stem-prominent syllable right alignment. It has been shown that, in either case, the constraint *Min-σ' prohibits a minor syllable to be in prominent position.

Chapter Notes

1. Also see Hockett (1947), Fudge (1969), Levin (1985), McCarthy (1979), Kiparsky (1980), Halle & Vergnaud (1980), Fudge (1987), Blevins (1995).

2. In the original work of Prince and Smolensky (1993) MAX and DEP replaced PARSE and FILL.

3. This is a very basic ranking established to illustrate the point discussed.

Chapter Four:

The Stress System in SSA

4. The Stress System in SSA

4.1. Introduction

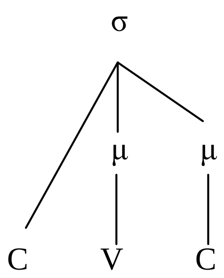
Stress is generally taken to involve the force or intensity with which a syllable is uttered. Stress is also detectable from the many effects it has on segments, since it appears so often in the environment of segmental rules. The aim of this chapter is to analyze the facts of stress of the Saoura Spoken Arabic within a framework which is metrical i.e., satisfying foot binarity, empirical by doing a quantitative work and theoretical by applying the OT principles i.e., expressed in terms of competing constraints rather than rules.

In our analysis of SSA stress, we distinguish between schwa syllables and syllables with underlying vowels. This distinction is crucial because it helps characterize syllable weight which is a decisive factor in a number of stress systems. Thus, we maintain that, in SSA, a light syllable of the type CV (where V is a short vowel) is equivalent to CəC, which should also be considered as light. If this is so, it follows that the weight distinction needed to account for SSA stress is one between the heavy CVC, CVV, CVVC (where VV is a long vowel), CəCC and CVCC syllables and the light CV and CəC syllables. Support for this claim is given further in this chapter.

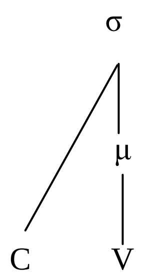
As shown below and according to Zec (1988), Hayes (1989) and Alghadi (1994), under moraic theory, SSA distinguishes between bimoraic CVC heavy syllables, where V is different from the schwa (a); and monomoraic light syllables, which fall into three types : the first where the mora dominates one segment (b); the second where the mora dominates the schwa and the following consonant (c); and the third where the mora dominates a consonant belonging to a minor syllable known as a degenerate syllable. The degenerate syllable consists of a single consonant only. A representation of the degenerate syllable is shown in (d) below:

(1)

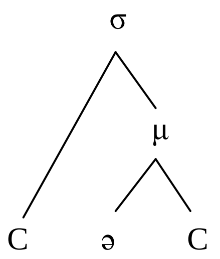
a.



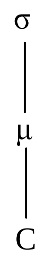
b.



c.



d.



The fact that schwa appears in different positions shows that it is epenthetic. We must point out that this schwa is moraless on its own and that it acquires a moraic status only in combination with a following consonant in the syllable (Zec, 1988). In other words, that schwa in SSA never occurs in open syllables follows from the fact that it must head monomoraic syllables, consisting of a single branching mora that both schwa and the following coda consonant share as shown in (c) above. This assumption explains why schwa vowels are banned from occurring in open syllables. The moraic representation in (1) above which is also adopted for Moroccan Arabic by Alghadi (1994), has led to lay down the following equalities between syllables with a full vowel nucleus and syllables with a schwa nucleus :

(2)

a. CV = CəC

b. CVC = CəCC

c. CVCV = CəCCəC

d. CCV = CCəC

In this chapter, we will analyze the stress patterns of words that occur in isolation. The depicted stress from these isolated words shows that SSA is a quantity sensitive system which favours trochaic feet. We will also endeavour to demonstrate that the fact that stress dwells on one of the final two syllables of a word follows from the constraint requiring the alignment of the right edge of the foot containing the stressed syllable with the right edge of the prosodic word.

The chapter is structured as follows: section one contains the introduction. Section two presents a review of the literature on Arabic dialects stress. Section three sets up a practical basis for stress in SSA. The aim of this section is to quantify the native speakers' intuition about the placement of stress. Section four is about the general stress patterns obtained from the quantitative test. Section five offers an Optimality-theoretic analysis of stress in SSA. Finally, section six presents the concluding remarks.

4.2. Review of the Literature on Arabic Dialects Stress

Arabic, with its variation in stress across dialects, has been very visible in the literature on stress. In particular, the Cairene variety has been subject to much discussion. Mitchell (1960), McCarthy (1979), Hayes (1981), Halle & Vergnaud (1987), Hayes (1995), amongst others provide analyses which elegantly predict the stress pattern of Cairene. The analyses can be summarized as follows:

A. Cairene Arabic

There are only three short vowels in Arabic /ɪ, u, a/ and their long counterparts /ii, uu, aa/.

I. Stress the Final Superheavy:

a. /ka.'tabt/ 'I/you wrote'
b. /sa.ka.'kɪːn/ 'knives'

II. Stress the Heavy Penult:

a. /'bii.tɪ/ 'my house'
b. /mu.'dar.rɪs/ 'teacher'
c. /haa. 'ðaa.nɪ/ 'these'

III. Stress the Light Penult or Antepenult:

a. /'sa.mak/ 'fish'
b. /'bu.χa.la/ 'misers
c. /ka.ta.'bɪ.tu/ 'she wrote it'
d. /ʃa.ʤa.'ra.tu.hu/ 'his tree'
e. /mar.'ta.ba/ 'mattress'
f. /ʔɪn.'ka.sa.ra/ 'it got broken'

g. /ʔad.wɪ.ja.'tu.hu/ ‘his drugs’

h. /ʔad.wɪ.ja.'tu.hu.ma/ ‘their *dual* drugs’

B. Urban Hijazi Arabic, Al-Mohanna (1998)

I. Stress the Final Superheavy:

a. /ka.'tabt/ ‘I/ you wrote’

b. /muf.'taah/ ‘key’

II. Stress on a Heavy Penult:

a. /'dar.sɪ/ ‘my lesson’

b. /'taa.ʤɪr/ ‘merchant’

c. /faa.'tuu.rah/ ‘receipt’

III. Stress on a Heavy Antepenult:

a. /'mak.ta.bah/ ‘library’

b. /ʔas. 'haː.ba.na/ ‘our friends’

IV. Stress on a Light Penult or Antepenult:

a. /'sa.ma/ ‘sky’

b. /'fa.ʤur/ ‘dawn’

c. /'ka.ta.bu/ ‘they wrote’

d. /'ba.sa.lah/ ‘an onion’

e. /ba.ga. 'ra.tɪ/ ‘my cow’

f. /da.ra. 'ba.tak/ ‘she hit you’

g. /ʃa.ʤa. 'ra.tu.hu/ ‘his tree’

h. /mak. 'ta.ba.tɪ/ ‘my library’

i. /daħ.ra.ʤa. 'tu.hu/ ‘his rolling’

Al-Mozainy (1982) has accounted for the Bedouin Hijazi Arabic (BHA) stress patterns within a rule-based framework; he describes and analyses BHA stress system as follows: Stress falls on one of the last three syllables. Stress is placed on the final syllable if it is superheavy (CVVC or CVCC)(S: superheavy, H: heavy, L: light syllable).

C. Bedouin Hijazi Arabic

I.	a- H'S	/mak.'tuub/	written
	b- L'S	/da.'rabt/	I hit

If the final syllable is not superheavy and the penultimate is heavy (CVV or CVC), the penultimate receives stress.

II.	a- H'HH	/mak.'tuu.fah/	tied
	b- H'HL	/gaa.'bɪl.na/	meet us

If the final syllable is not superheavy and the penultimate is not heavy, stress falls on the antepenultimate.

III.	a- 'HLL	/'maa.la.na/	our property
	b- 'HLH	/'jaʃ.rɪ.bɪn/	they drink

Disyllabic words receive penultimate stress if the final syllable is not superheavy.

IV.	a- 'LH	/'kɪ.tab/	he wrote
	b)- 'LL	/'ra.za/	he raided

Antepenultimate stress is expected in words with non-superheavy ultimate and non-heavy penult.

V.	'LLL	/'ʔa.lu.xu/	the brother
		/'ʔa.lɪ.bu/	the father

Monosyllabic words receive stress on their vowel.

VI	a- 'H	/m'aʔ/	water
	b- 'L	/l'ɪ/	for me

D. Palestinian

Abu Salim (1982), Kenstowicz and Abdul-Karim (1980), Kenstowicz (1981), (1983), Hayes (1995), and others:

I. Stress on a Final Superheavy:

a. /da.ˈrast/ ‘I studied’

b. /duk.ˈkaan/ ‘shop’

II. Stress on a Heavy Penult:

a. /ˈjɪr.ʃi/ ‘he bribes’

b. /ˈbaa.rak/ ‘he blessed’

c. /mak.ˈtab.na/ ‘our office’

III. Stress on a Heavy Antepenult:

a. /ˈʕal.la.mat/ ‘she taught’

b. /ˈʔɪd.fa.ʕu/ ‘(you *pl.*) pay’

IV. Stress on a Light Penult, Antepenult, or Preantepenult:

a. /ˈʔa.na/ ‘I’

b. /ˈka.tab/ ‘he wrote’

c. /ˈka.ta.bu/ ‘they wrote’

d. /ˈʃa.ʤa.ra.tun/ ‘a tree

e. /ʃa.ʤa.ˈra.tu.hu/ ‘his tree’

f. /ʕal.ˈla.ma.tu/ ‘she taught him’

E. Ma’ani Arabic

Stress in Ma’ani Arabic (MA), a Jordanian Arabic dialect (Aburakhieh, 2009), falls on one of the three syllables in the prosodic word (PrWd). Heavy syllables attract stress. In the presence of more than one heavy syllable, the rightmost heavy one is stressed, bearing in mind that it must fall within the three-syllable window. By contrast, in the absence of a heavy syllable, the first light syllable is stressed as long as it does not exceed the antepenult. MA is a count system that counts moras and its foot inventory includes (L'L) and ('H), i.e. moraic trochee. Syllables are footed from left-to-right and are left headed, i.e. trochaic. Extrametricality applies to the final consonant in final CVC, final unfooted light syllable and to the final foot. Examples of the different word patterns that occur in MA are as follows:

Monosyllabic words can only be of the shape (H) in order to satisfy the minimal word condition that requires the PrWd to be minimally bimoraic. When referring to canonical shapes, monosyllabic words surface as:

a)-	/CVV/	/'fii/	there is
b)-	/CVCC/	/'kalb/	dog
c)-	/CVVC/	/'ʤaar/	neighbor
d)-	/CVVCC/	/'maadd/	he strengthened

Disyllabic words include four possible patterns viz. ('LL), (L'H), ('HL) and (H'H). These patterns are exemplified as follows:

a)-	('LL)	/'ðɑ.hɑb/	gold
b)-	L('H)	/ʈɑ.'wɪ:l/	tall
c)-	('H)L	/'χaa.tɪm/	ring
d)-	(H)('H)	/muf.'taah/	key

As can be seen, heavy syllables attract stress and in the presence of two heavy syllables stress falls on the rightmost one. In the absence of heavy syllables, stress falls on the penultimate syllable in disyllabic words.

In trisyllabic words, stress falls on the rightmost heavy syllable; the antepenult is stressed in the absence of heavy syllables.

a)-	('LL)L	/'ʃa.ʤa.ra/	tree
b)-	(LL)('H)	/ba.ga.'raat/	cows
c)-	L('H)L	/sa.'fii.na/	ship
d)-	L(H)(H')	/ma.ʤarr.'tiin/	two galaxies
e)-	('H)LL	/'muħ.ta.ram/	respectable
f)-	(H)L('H)	/mus.ta.'ʃaar/	consultant
g)-	(H)('H)L	/mɪs.'taʕ.ʤɪl/	in a hurry
h)-	(H)(H)('H)	/mɪʤ.tam.'ʕiin/	are gathered

The rules that govern stress assignment for trisyllabic words are almost the same rules that govern stress assignment for quadrisyllabic and more without forgetting that stress cannot exceed the antepenult.

a)-	(LL)('H)L	/ʃa.ʤa.'raat.ha/	her trees
b)-	L(H)('H)L	/ʂa.far.'ʤal.ha/	her quince
c)-	(H)('LL)L	/muh.'ta.ra.mɪ/	respectable
d)-	(H)(LL)('H)	/mam.la.ka.'tiin/	two kingdoms
e)-	(H)L('H)L	/stɪg.ba.'laat.hɪn/	their receptions
f)-	(H)L(H)('H)	/mɪs.ta.ʕɪʤ.'liin/	are in a hurry
g)-	(H)('H)LL	/tɪt.'kal.la.mɪn/	you talk
h)-	(H)(H)L('H)	/tɪl.fɪz.ju.'niin/	two televisions
i)-	(H)(H)('H)L	/tɪs.tag.'bɪl.hɪn/	she received them

Not all possible quadrisyllabic word patterns could be attested as they do not surface due to syncopation processes and resyllabification.

F. Casablanca Moroccan Arabic

Boudlal (2004) has carried out a quantitative and an instrumental test which have allowed him to find out about the location of stress in Casablanca Moroccan Arabic (CMA). Both words in isolation and words in context have been analyzed. The experiment on words in isolation has generally confirmed the major results obtained from the quantitative test, namely that stress is triggered by two factors: syllable weight and syllable position. It has been shown that a final heavy syllable gets stress. In the absence of a final heavy syllable, stress falls on the penultimate syllable. It has also been shown that the clitics [kum] and [hum] should be considered as light and are therefore not stressed in final position. The stress patterns of CMA obtained from test items in isolation are represented by the following items:

a. Ultimate stress

/law.'yɪn/	wilted
/lɪ.'mun/	oranges
/məl.'yun/	a million
/man.ɖa.'ɽɪn/	clementine

/mər.məd.ˈnak/	we trailed you (in dust)
/ban.ya.ha.ˈlɪh/	she is building it for him

b. Penultimate stress

/ˈkal.kum/	he ate you
/ˈbab.ha/	her/its door
/ˈməl.məl/	he shook (sth.)
/ˈma.yəl/	bent
/ˈɽəm.la/	sand
/law.ˈyɪn.hum/	they are twisting them
/mqul.ˈbɪ.nək/	they are deceiving you
/wəl.ˈda.tnɪ/	she gave birth to me
/lɪ.ˈmu.na/	an orange
/dɪ.rɪ.hɑ.ˈlɪ.ha/	do it for her

Examining the lists of forms above reveals a number of similarities and differences. Firstly, the dialects agree on stressing a final superheavy syllable, and they also agree on stressing a heavy penult if the ultima is either light or heavy. In addition, Palestinian and Hijazi stress a heavy antepenult when followed by two light syllables. Add to that the fact that a light syllable is appointed as a potential stress-docking-site depending on the number of light syllables preceding it. Nonetheless, stress may not go beyond the antepenult for Hijazi and Cairene and the preantepenult for Palestinian. These facts may be formalised as follows:

Stress in quantity-sensitive languages is governed by two main factors: syllable weight and syllable position, i.e. the distance of the stressed syllable from the left or right edge of the prosodic word (Hyman 1985, Prince and Smolensky 2004). Levantine Arabic, for example, is governed by these two constraints. The right edge of the PrWd is designated for stress and heavy syllables are targeted for stress. A light syllable is stressed in the absence of a heavy syllable.

Stress in Jordanian Arabic (AbuAbbas, 2003), Syrian Arabic (Adra, 1999) and Egyptian Arabic (McCarthy 1979b) is in the line with the principle of the three-syllable window, where stress does not fall on any syllable beyond the antepenult. Stress in Palestinian Arabic, on the other hand, can surface on the pre-antepenultimate syllable as reported by Brame (1973, 1974) and Hayes (1995).

4.3 Practical Basis for Stress in SSA

Before we start, perhaps it is worth pointing out that Brame (1974) amongst others has mentioned the fact that non-phonemic stress in Arabic has three degrees: primary, secondary and weak stress. Versteegh (2004) explains that a stress is non-phonemic in a language “if there are no two words that are distinguished solely by a difference in stress.” For the purpose of this study, primary stress is the focus of our investigation assuming the non-existence of secondary stress in SSA.

4.3.1 The Quantitative Test

The objective of setting a quantitative analysis is to try to quantify data on the intuitions of the native speakers of SSA about the location of stress. The corpus is chosen in such a way that both full vowel sounds [a, aa, u, uu, ɪ, ii] and the schwa [ə] would be tested in all possible environments. The items selected are disyllabic, trisyllabic and polysyllabic. The informants, who are all teachers of English (university, middle and secondary school teachers), are given a list of items and are asked to mark stress on the appropriate syllable, relying on their intuition and on their prior knowledge of English word stress.

4.3.2 The Hypothesis

Following previous works on Arabic dialects stress, we will assume that the working hypothesis for SSA is that stress falls on the rightmost penultimate syllable. Thus, our objective in the present work will be to consider why words with final or antepenultimate stress, if there are any, do not receive penultimate stress.

4.3.3 The Questionnaire

The questionnaire consists of two parts. The first part includes general information about the participants, while the second includes the list of the test items. The first part is prepared in such a way that the informants first proceed by giving personal information about themselves and then about activities related to their field of interest, i.e. linguistics. While we think that the participants’ names and their gender are not determinant factors in the activity undertaken, we strongly believe that information about the place of birth, i.e. whether or not the informant is a native speaker of the dialect under study plays a key role in the research undertaken. Also, to ensure a high degree of homogeneity, the chosen subjects are all born in Bechar. In the first part, the participants are asked to fill in a form (cf. Appendix B)

4.3.4 The Corpus

The second part of the questionnaire is the list of test items. They are provided by the author who is a native speaker of the dialect under study. They include both simple and affixed forms. In choosing these items, we try to include all syllable types, i.e. CVC, CVVC, CVV, CVCC, CvCC, CV, and CvC (where short v stands for the schwa) in all possible environments to see whether stress is sensitive to syllable weight and/or syllable position as claimed by Hyman (1985) and Prince and Smolensky (2004), and whether affixation plays any major role in stress assignment. The following is the list of test items which includes disyllabic, trisyllabic and polysyllabic words and is listed the way it has been presented to the participants:

(3)

a. Disyllabic Words

Templates	Items	Gloss
CVC.CVC	ʕar.bun	under payment
CCvC.CVC	ktəl.hum	he killed them
CVC.CvC	ʂar.ħək	he told you the truth
CVC.CV	ɖar.ba	hit
CV.CVC	sa.rut	key
CvC.CvC	dəf.fəg	he spilled
CvC.CvC	mər.fəg	elbow
CV.CvC	χa.təm	ring
CvC.CV	gəm.la	louse
CV.CV	mɪ.na	bomb
CVC.CV:C	naʕ.sɪ:n	asleep (pl.)
CV:C.CVC	ʃaaf.kum	he saw you
CvC.CV:C	fək.ru:n	tortoise

CV.CV:C	za.ʕɪ:m	boss
CCV.CV:C	msa.kɪ:n	poors
CCV.CvC	mna.gəʃ	earrings
CCV.CV	ʃka.ra	sack
CV:.CvC	faa.jəq	awake
CCV.CvC	χwa.təm	rings
CCV.CCV	snɪ.tra	guitar
CvC.CvC	mər.fəg	elbow
CV.CVCC	ka.faħt	I struggled
CvC.CvCC	ʃər.rəgt	I tore
CvC.CV:C	bəʃ.kɪ:r	a large towel
CvC.CvC	fər.fər	fly

b. Trisyllabic Words

Templates	Items	Gloss
CVC.CVC.CVC	gal.bɪn.hum	they reversed them
CCVC.CVC.CVC	msam.ħin.kum	we forgive you
CVC.CV.CVC	ʃuf.na.hum	we saw them
CCV.CV.CVC	klɪ.na.hum	we ate them
CvC.CV.CVC	kər.da.hum	he bought them on credit
CvC.CvC.CVC	sər.qət.hum	she stole them
CvC.CVC.CV	səb.gat.nɪ	she outran me
CVC.CV.CV	gul.na.ha	we said it
CCV.CV.CV	ʕʈɪ.na.hu	we gave them
CvC.CV.CV	χən.bu.ʃa	beetle
CVC.CV.CV	sar.dɪ.na	sardine
CvC.CvC.CV	jər.fəd.ha	he takes it
CvC.CV.CV	jəb.ɣɪ.na	he loves us
CvC.CCV.CV	χər.bʃu.hɑ	they put it into disorder
CV.CV.CV	fa.rɪ.na	flour
CvC.CV.CvC	səʕ.da.tək	lucky you
CCV.CvC.CV	tta.ʂəl.na	we called
CvC.CvC.CV	məʂ.ʂəl.ħa	a broom

CvC.CV:CvC	rəb.baa.təh	she brought him up
CVC.CV.CVC	bar.ku.kas	a kind of kouskous
CvC.CV.CVC	ləm.nɑ.gɪʃ	the earrings

c. Polysyllabic Words

Templates	Items	Gloss
CV.CvC.CvC.CV	bu.fər.ţəţ.ţu	butterfly
CvC.CvC.CV.CVC	fər.rəħ.na.hum	we pleased them
CvC.CV.CV.CV:C	məd.da.rɪ.jaat	eye glasses
CvC.CvC.CvC.CV	nət.wəs.səd.ha	we use it as a cushion
CV.CvC.CvC.CvC.CV	ka.nət.wəs.səd.ha	I use it as a cushion

4.3.5 The Informants

We have initially distributed seventy five (75) copies of test items, but only thirty of the informants have responded. They were all teachers of English. Seven (07) of them were university teachers at the Department of Arts & English at the University of Mohammed Tahri, Bechar, eleven (11) were secondary school teachers and twelve (12) were middle school teachers. They were thirteen (13) females and seventeen (17) males. The subjects have had many years of linguistics studies. All the subjects were given the list of test items listed in the subsection above and were asked to repeat the words several times and use their intuition and their prior knowledge about English word stress and mark stress on the syllable they judge most prominent.

4.3.6 Data Analysis and Results

First, let us proceed by giving the numbers that will be used as the basis for the interpretation of the results. The total number in (a) below corresponds to the maximum possible number of answers which is obtained by multiplying the total number of subjects (30) and the total number of test items (50). The number in (b) corresponds to the total number of abstainers (45), that is, the subjects who for one reason or another, chose not to respond or were unable to place stress on one of the syllables. The number in (c) corresponds to the total number of responses obtained by subtracting the total number of abstainers from the maximum possible number of answers.

(4)

a)- Maximum possible number of answers: 30 x 50 = 1500

b)-Total number of abstainers: 75 – 30 = 45

c)- Total number of responses: (a) – (b) = (c) ⇒ 1500 – 45 = 1455

Since the working hypothesis in this study is that stress for SSA is ‘penultimate’, it is necessary to give the total number of times stress falls on penultimate syllables in the test items. Consider the score of the informants in disyllabic words:

(5)

a. Disyllabic Words

Nbr	Items	Ultimate Stress	Penultimate Stress
01	ʕar.bun	14	16
02	ktəl.hum	09	21
03	ʂar.ħək	08	22
04	ɖar.ba	10	20
05	sa.rut	19	11
06	dəf.fəg	17	13
07	χa.təm	08	22
08	gəm.la	11	19
09	mɪ.na	9	21
10	naʕ.siin	22	08
11	ʃaaf.kum	26	04
12	fək.ruun	23	07
13	za.ʕiim	23	07
14	msa.kiin	18	12
15	mna.gəʃ	07	23
16	ʃka.ra	05	25
17	faa.jəq	18	12
18	χwa.təm	09	21
19	snɪ.tra	10	20
20	mər.fəg	06	24
21	ka.faħt	23	07
22	ʃər.rəgt	19	11
23	bəʃ.kiir	20	10
24	fər.fər	07	23
Total number of times		341	379

The tableau above shows that stress is penultimate if the word consists of a sequence of two open syllables of the type CVCV. Thus words such as ['mina] 'a bomb', ['kuʃa] 'an oven' and ['dara] 'a circle' take penultimate stress. Such is also the case with words which consist of a sequence of a closed syllable of the type CəC and an open syllable of the type CV, e.g. ['gəmla] 'a louse' and ['nəħla] 'a bee', or a sequence of a CV syllable and a CvC syllable, e.g. ['χatəm] 'a ring' and ['raʒəl] 'a man'. This points out to the fact that CəC behaves like CV, a fact that is phonetically justified by Alghadi (1994).

Words on the pattern CvCCvC show a variation between penultimate and ultimate stress. Ultimate in geminated words such as [dəf'fəg] 'pour', and penultimate in reduplicated words as ['fərfər] 'fly' and the other sequences as ['mərfəg] 'elbow.' Stress is ultimate in words with closed heavy and superheavy syllables (cf. [sa.'rut] 'key' and [za.'ʕiim] 'boss'). This points out to the fact that heavy and superheavy syllables attract stress. That is stress in SSA is sensitive to syllable weight.

The generalization that we can draw at considering the tableau above and the discussion that follows is that stress falls on the ultimate syllable if it is heavy or superheavy; otherwise, it is placed on the penultimate.

Now let us consider the results obtained from trisyllabic words and see whether they go along the generalization stated about disyllabic words or form special patterns of stress.

b. Trisyllabic Words

Trisyllabic words seem to confirm, to a large extent, the generalization drawn about disyllabic words, namely that stress falls on the penultimate syllable if the final is not heavy or superheavy. Consider the results of the informants listed out in the table below:

(6)

Nbr.	Items	Ultimate Stress	Penultimate Stress	Antepenultimate Stress
01	gal.bɪn.hum	01	24	05
02	msam.ħin.kum	02	19	09
03	ʃuf.na.hum	02	23	05
04	kli.na.hum	01	21	08
05	kər.da.hum	01	25	04
06	sər.qət.hum	00	29	01
07	səb.gat.nɪ	00	28	02
08	gul.na.ha	00	20	08
09	ʕʈɪ.na.hu	00	13	17
10	χən.bu.ʃɑ	01	21	08
11	sar.dɪ.na	04	13	13
12	jər.fəd.ha	00	27	03
13	jəb.ɣɪ.na	00	26	04
14	χər.bʃu.ha	00	23	07
15	fa.rɪ.na	00	16	14
16	səʕ.da.tək	04	19	07
17	tta.ʂəl.na	00	11	19
18	məʂ.ʂəl.ħa	00	22	08
19	rəb.baa.təh	01	27	02
20	bar.ku.kas	16	10	04
21	ləm.na. gɪʃ	14	14	02
Total number of times		47	431	150

This tableau shows that 18 out of 21 items are stressed on the penultimate syllable which confirms previous generalization stated about disyllabic words. The exceptional cases are given below in (7):

(7)

9. 'ʕʈɪ.na.hu
11. 'sar.dɪ.na
17. 'tta.ʂəl.na
20. bar.ku.'kas

It should be noted that the items (9, 11, 17) show antepenultimate stress. It could be argued that the failure of subjects to score high in penultimate position may be attributed to the fact that the syllable in item (11) is closed and contains a full vowel as opposed to the penultimate syllables which are light (recall that CəC is equivalent to CV). In items 9 and 17, one possible way of explaining why stress falls on the antepenultimate syllable instead of the penultimate is that in words such as these stress usually remains on the root syllable ('ʕʈa, 'tta.ʂəl). Finally, item (20) contains a final heavy syllable.

c. Polysyllabic Words

These include four- to five-syllable words. The scores obtained from the test are listed out in the table below:

(8)

Nbr.	**Items**	**1st Syllable**	**2nd Syllable**	**3rd Syllable**	**4th Syllable**	**5th syllable**
01	bu.fər.ʈəʈ.ʈu	07	00	*18*	05	…
02	fər.rəħ.na.hum	02	11	*16*	01	…
03	məd.da.rɪ.jaat	00	09	*02*	19	…
04	nət.wəs.səd.ha	01	08	*21*	00	…
05	ka.nət.wəs.səd.ha	00	01	07	*22*	00
Total number of times		10	29	64	37	00

Total number of penultimate stress = 79

This tableau shows penultimate stress except item 3 which stresses a final heavy syllable and thus conforms to the general tendency.

In (10) below, we give the number of items totaling the maximum number of stresses on penultimate syllable:

(9)

a. Disyllabic words: 16/24

b. Trisyllabic words: 20/21

c. Polysyllabic words: 4/5

In disyllabic words, 16 out of 24 receive penultimate stress, i.e. about 66.66%. In trisyllabic words 20 out of 21 receive penultimate stress, i.e. about 95%. Finally, in polysyllabic words, 4 out of 5 receive penultimate stress, i.e. about 80 %.

In (10) below, we give the total number of times penultimate syllables in the test items above receive stress.

(10)

a. Disyllabic words: 379
b. Trisyllabic words: 431
c. Polysyllabic words: 79

The total number of penultimate stresses is 889, a number which exceeds half of the number of the total responses. The percentage of responses totaled by penultimate stress is given in (11) below:

(11)

$$\frac{889 \times 100}{1455} = 61.09\ \%$$

In sum, the tendencies that seem to account for stress in the 50 items chosen in this quantitative test could be stated as follows:

a. Stress falls on the penultimate syllable if the final syllable is not heavy or superheavy.
b. Object clitics such as [-kum] and [-hum] do not bear stress as they can be shortened to [-ku] → [ʃuf.na.ku] and to [-hu] →[ʃuf.na.hu] and thus considered as light.

4.4 General Stress Patterns in SSA

The data above show that SSA makes recourse to syllable weight and syllable position in the assignment of stress. In terms of syllable weight, it has been shown in section 4.1 that SSA distinguishes between bimoraic heavy syllables (CVC) and monomoraic light syllables, which fall into two types: one where the mora dominates one segment (CV); the other where the mora dominates the schwa and another consonant (CəC). The test items also show that the domain of stress is restricted to one of the last two syllables of the PrWd. Thus a word receives ultimate stress if it ends up in a heavy or superheavy syllable, e.g. [ʃər.'rəgt], [sa.'rut], [msa.'kiin], etc. If the final syllable is light, stress falls on the heavy antepenultimate and or the penultimate syllable, be it light or heavy, e.g. ['bar.ku.kəs], ['gəm.la], [bu.fər.'ʈəʈ.ʈu], etc.

Words that end up in the object clitics [-kum] and [-hum] which have the shape CVC and yet do not receive stress in spite of their being in final position. As has already been pointed out, these words have their penultimate syllable stressed instead of their ultimate. This shows that the clitics [-kum] and [-hum] could behave as if they were light syllables. They could appear as [-ku] and [-hu], i.e. light syllables and thus unstressed.

After having established a basis for stress assignment in SSA through a quantitative test, let us now turn, in the following section, to see how the variation in stress could be accounted for within the OT framework.

4.5 An OT Account of Stress in SSA

According to Prince and Smolensky (1993), in Optimality Theory, ordered rules are replaced by ranked constraints. There is a limited number of constraint rankings for stress patterns, and each language chooses one constraint ranking, which determines the normal stress pattern for that language.

According to Hyman (1986) and Prince and Smolensky (2004) stress in quantity sensitive languages is governed by two main factors: syllable weight and the distance of the stressed syllable from the left or right edge of the prosodic word. SSA is governed by these two constraints. The right edge of the prosodic word is designated for stress and heavy syllables are targeted for stress. Light syllables are stressed in the absence of heavy ones. The results obtained from the quantitative test show that SSA is quantity sensitive which prefers trochaic feet (head-initial).

As stated by Prince and Smolensky (1993) and McCarthy and Prince (1993a), feet are subject to the constraint FT-BIN which demands that they be binary under syllabic analysis if the language in question is quantity-insensitive, or moraic if it is quantity-sensitive. The constraint is given in (12) below:

(12)

Foot Binarity (FT-BIN)
Feet are binary under moraic or syllabic analysis (μ, σ).
(Prince & Smolensky 1993/2002)

This constraint says that the internal structure of feet is maximally and minimally binary. Therefore, a legitimate foot can only be disyllabic or bimoraic, though never monomoraic or trisyllabic. Yet, this raises the question of how to impose such a condition on foot structure throughout a given sequence of syllables. The constraint FT-BIN does not say anything about parsing syllables into feet, hence the inevitability of the constraint PARSE-SYL:

(13)

PARSE-SYL
Syllables must be parsed into feet.
(McCarthy & Prince 1993b)

According to McCarthy & Prince (1993b), in languages where foot binarity is required, dominance of FT-BIN over PARSE-SYL is certain, to the extent that they suggested including FT-BIN in GEN. This will eventually guarantee blocking degenerate feet. That is, the conflict between PARSE-SYL and FT-BIN arises only when the word concerned contains an odd number of syllables. This conflict can be resolved when FT-BIN outranks PARSE-SYL as demonstrated by the foot structure of the word [kli.'na.hum] in the following tableaux, where the two constraints interact, the parentheses (…) indicate foot constituency:

Tableau 4.1

[klɪ.'na.hum]	FT-BIN	PARSE-SYL
a)- (klɪ.)('na.hum)	*!	
☞ b)- klɪ. ('na.hum)		*

Because of the non-foot status of a light syllable of the type CV or CəC, the parse in (4.1a) is ruled out exactly because the first syllable of the word, which happens to be light, cannot form a foot on its own, and in this way it incurs a fatal violation of the constraint FT-BIN.

Tableau 4.2

[bu.fər.ˈṭəṭ.ṭu]	FT-BIN	PARSE-SYL
☞ a)- (bu.fər)(ˈṭəṭ.ṭu)		
b)- (bu.fər.ˈṭəṭ.ṭu)	*!	

This tableau indicates that in inputs with an even number of syllables, a candidate with the quadrisyllabic foot (4.2b) is avoided because it incurs a fatal violation of the higher-ranked constraint FT-BIN.

Tableau 4.3

[ka.nət.wəs.ˈsəd.ha]	FT-BIN	PARSE-SYL
a)- (ka.nət)(wəs.ˈsəd)(ha)	*!	
☞ b)- (ka.nət)(wəs.ˈsəd).ha		*
c)- (ka.nət.wəs.ˈsəd.ha)	*!	

Likewise, in odd-numbered sequences, exhaustive parsing of syllables into feet (4.3a, c) is diminished by the higher priority of binary. Therefore, the interaction of these two constraints will help evaluate and eventually optimize binary parsing of syllables.

As far as headedness is concerned, feet are basically of two types: left-headed or right-headed. According to the results obtained from the quantitative test, SSA stress falls on one of the last two syllables of a word. This means that the foot which contains the stressed syllable must be at the right edge of the prosodic word. Also, the directionality of footing is from right to left. Within the OT framework, directionality is attained by making recourse to McCarthy and Prince's (1993b) Generalized Alignment Theory. The constraint they proposed is a member of the Alignment family. This constraint, which we will be using, is the one requiring alignment of the right edge of every foot with the right edge of the prosodic word:

(14)

ALIGN-R (Ft, PrWd)
The right edge of every foot must be aligned with the right edge of the prosodic word.
(McCarthy & Prince 1993b)

What this constraint is saying is that the right edge of each and every foot, in a particular prosodic word, must be aligned with the same edge of that prosodic word. Nevertheless, this will only be perfectly satisfied by a candidate containing a single foot aligned to the nominated edge, but this is not always the case. Ranking FT-BIN over PARSE-SYL and having them dominate this alignment constraint to achieve binary bounded footing will inevitably incur violations of ALIGN-FOOT. This is not something adverse in OT. Candidates can violate some constraints and are still chosen to be optimal if the violation is kept to its minimum. So, in our particular case, the lower the number of violations of ALIGN-FOOT a certain candidate incurs, the higher its potentiality of being designated as the optimal true output, as shown in tableau (4.4) by the parsing of the word [ka.nət.wəs.'səd.ha] which receives penultimate stress:

Tableau 4.4

[ka.nət.wəs.'səd.ha] $_{PrWd}$	FT-BIN	PARSE-SYL	ALIGN-R (Ft, PrWd)
a. (ka)(nət.wəs)('səd.ha)	*!		******
☞b. ka (nət.wəs)('səd.ha)		*	**
c. ka.nət.wəs.('səd.ha)		*!**	

(4.4a) is excluded because it violates FT-BIN by parsing a monomoraic syllable into a foot. Although the parse in (4.4c) observes ALIGN-R (Ft, PrWd), it is not optimal because three of the syllables are left unparsed. The parse in (4.4b) is optimal because it incurs least violations.

The universal inventory of feet (Hayes 1985, 1987, 1995; McCarthy & Prince 1986) contains three basic types, two of which are *trochaic* (head-initial)/(left-headed), that is the stressed syllable is located at the left periphery of the foot, and one *iambic* (head-final)/(right-headed), that is the stressed syllable is situated at the right flank of the foot. These types are distinguished in terms of headedness. The quantity-sensitive *moraic trochee* has two light syllables, or a single heavy syllable. The quantity-insensitive *syllabic trochee* requires two syllables of indiscriminate weight, i.e. the foot counts only syllables regardless of their internal structure. Finally, the quantity-sensitive *iamb* has three forms: two light syllables, a single heavy, or a light syllable plus a heavy syllable. The universal foot types are given in (15) below. Headedness is marked with an acute accent (') before the designated element.

(15)

The Universal Foot Types

a. Syllabic Trochee : 'σ σ

b. Moraic Trochee : 'L L or 'H

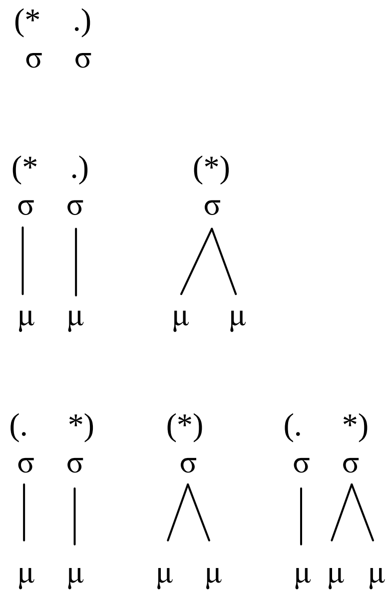
c. Iamb : L'L , 'H or L'H

Or

a. Syllabic trochee

b. Moraic trochee

c. Iamb



The stress patterns of SSA obtained from test items in isolation show that feet must be trochaic, and therefore the system is quantity sensitive since it is the heavy syllable of the word which receives stress. In the absence of a heavy syllable, it is the penultimate syllable of the foot which gets stress. This could be observed in terms of a constraint labeled TROCHAIC, which requires that the head syllable be aligned with the left edge of the foot. This constraint is stated as follows:

(16)

TROCHAIC
Feet are left-headed (i.e., align the head-syllable with its foot, on the left edge).

In order to account for the stress system of SSA, we assume that the basic stress pattern of the language is trochaic and that iambic feet arise under certain conditions. Under moraic analysis, in disyllabic words such as [mi.na], where both syllables are light, initial stress is determined by the constraint TROCHAIC. Trochaic feet are basic and can be obtained by ranking TROCHAIC over IAMBIC. The effect could be seen in the tableau below for the parses of the input [mɪ.na]:

Tableau 4.5

[mɪna]	TROCHAIC	IAMBIC
a. (mɪ.'na)	*!	
☞ b. ('mɪ.na)		*

(4.5a) is ruled out because it violates the top-ranked constraint TROCHAIC.

The final syllable receives stress iff (if and only if) it is heavy or superheavy. This shows that the foot must be iambic. The relevant constraint is given in (17) below**:**

(17)

IAMBIC
Feet are right-headed (i.e., align the head-syllable with its foot on the right edge).

Thus a sequence of a light syllable and a heavy syllable will have to be footed as (L'H) and not as L('H) where stress falls on the syllable on the right. This can be obtained by ranking the constraint IAMBIC above TROCHAIC as the tableau below shows:

Tableau 4.6

[gɪʈun]	IAMBIC	TROCHAIC
a. (ˈgɪ.ʈun)	*!	
☞ b. (gɪ.ˈʈun)		*

(4.6a) is ruled out because it violates the higher-ranked constraint IAMBIC.

According to Prosodic Structure Theory, sentences are organized into a structure whose categories are defined by Selkirk (1978) as follows:

(18)

The Prosodic Hierarchy

Utt Utterance
IP Intonational Phrase
PPh Phonological Phrase
PrWd Prosodic Word
Ft Foot
σ Syllable

This hierarchy of prosodic categories forms the essence of the theory of phonological constraints on prosodic structure. Selkirk (1995a) states the constraints on prosodic domination as follows:

(19)

Prosodic Domination

(i) Layeredness: No σ dominates a Ft.
(ii) Headedness: A PrWd must dominate a Ft.
(iii) Exhaustivity: No PrWd immediately dominates a σ.
(iv) Nonrecursivity: No Ft dominates a Ft.

It is the constraints on prosodic domination along with the prosodic hierarchy and their interaction with other constraints on the prosodic hierarchy that will allow us to derive both iambic and trochaic feet. In the SSA case, the parse in (15b) ('mi.na) is possible only when the word is in isolation; or to put it in Selkirk's (1978) terms, when the word is at the end of a PPh. Thus a word such as [mɪna] will have the following structure:

(20)

In isolation/phrase final:

$_{PPh}${['mɪ.na]$_{PrWd}$}$_{PPh}$

To keep stress off word-final syllables, Prince and Smolensky (1993) posit the constraint NON-FINALITY which refers to main-stress at the level of the PrWd. They formulate it as follows:

(21)

NON-FINALITY (σ', PrWd)

The prosodic head of the word does not fall on the word-final syllable.

(σ' stands for the prominent syllable, i.e. the syllable that carries the main stress)

This constraint says that the main-stressed syllable of a word is not in final position of the prosodic word. It will have to dominate both TROCHAIC and IAMBIC to be able to derive penultimate stress. The tableau 4.7 shows how stress is assigned to the word [mɪna]:

Tableau 4.7

[mɪna] $_{PrWd}$	NON-FINALITY (σ', PrWd)	TROCHAIC	IAMBIC
☞ a. [('mɪ.na)]$_{PrWd}$			*
b. [(mɪ.'na)]$_{PrWd}$	*!	*	

The candidate in (4.7b) is excluded because it incurs a fatal violation of the constraint NON-FINALTY (σ', PrWd) which requires the main-stressed syllable to be non-final within a PrWd.

Candidate (4.7a) is optimal since stress falls on the penultimate syllable which happens to be non-final within the PrWd.

A non-negligible number of disyllabic words with a final heavy syllable nevertheless have an iambic pattern. These words consist of a sequence of the type CVCVC, i.e. a light syllable followed by a heavy syllable. These words may be footed either as (CVCVC) or CV(CVC). In the former (CVCVC) both syllables are parsed into a single iambic foot; while in the latter CV(CVC) only the second syllable is parsed into a foot, a fact which constitutes a violation of PARSE-SYL; the remaining syllable is adjoined directly to the PrWd. The unparsed syllable cannot form a foot on its own because this would constitute a violation of FT-BIN.

Given these two parses, we have to determine which one is the most optimal. By ranking PARSE-SYL over TROCHAIC and below IAMBIC, we ensure that all syllables are parsed. In the following tableau, we show how a disyllabic word such as [gɪ.ʈun] would be stressed:

Tableau 4.8

[gɪʈun] $_{PrWd}$	NON-FINALITY (σ', PrWd)	IAMBIC	PARSE-SYL	TROCHAIC
a. [(gɪ.'ʈun)] $_{PrWd}$	*!			*
b. [gɪ('ʈun)] $_{PrWd}$	*!		*	
💣 c.[('gɪ.ʈun)] $_{PrWd}$		*		

Candidates (4.8a) and (4.8b) are ruled out because they incur a fatal violation of the top-ranked constraint NON-FINALITY (σ', PrWd). Candidate (4.8c), though satisfying the top-ranked constraint NON-FINALITY (σ', PrWd), PARSE-SYL and TROCHAIC, is considered as the wrong optimal candidate with stress on the light syllable rather than the heavy. This means that we need another constraint to be able to get the optimal output. The needed constraint is Weight-to-Stress Principle (henceforth WSP) which is formulated in Prince and Smolensky (1993) as follows:

(22)

WSP

Heavy syllables are stressed /A heavy syllable is stressed in foot structure.

This constraint is basically an OT mechanism to capture the tendency that some syllables, due to their internal constituent structure, are more likely to receive stress than others. What this constraint does is relate the weight of the syllable, compared with the other syllables in the word (e.g. light, heavy, superheavy), to its prominence. WSP can then be violated iff (if and only if) it turns out that a heavy syllable receives no stress.

In other words, and as reported by Boudlal (2004), WSP applies only at the foot level in order to exclude such patterns as (CVC)('CV.CVC) or (CVC.'CV)(CVC), in which the light rather than the heavy syllable of the foot that is stressed. If a foot contains syllables with equal weight as in (CV.CV) (LL), for example, either one could be stressed without there being violation of WSP. By WSP, a bad trochee of the type 'LH represented by the candidate *['giʈun] will be avoided in favour of a parse that gives priority to an iambic foot. To do so, the constraint WSP must be ranked over the constraint NON-FINALITY (σ', PrWd) to make sure that it is the final heavy syllable that gets main stress. The tableau below shows how the optimal parse is obtained from the input [gɪʈun]:

Tableau 4.9

[gɪʈun] $_{PrWd}$	WSP	NON-FINALITY (σ', PrWd)	IAMBIC	PARSE-SYL	TROCHAIC
☞ a.[(gɪ.'ʈun)] $_{PrWd}$		*			*
b. [gɪ('ʈun)] $_{PrWd}$		*		*!	*
c.[('gɪ.ʈun)] $_{PrWd}$	*!		*		

Candidate (4.9b) is excluded on the ground because it incurs a violation of NON-FINALITY (σ', PrWd), TROCHAIC and a fatal violation of PARSE-SYL. Candidate (4.9c) is also ruled out because it violates a higher-ranked constraint, namely WSP. Candidate (4.9a) is optimal although it violates NON-FINALITY (σ', PrWd) and TROCHAIC, a constraint ranked low in the ranking scale.

Likewise, in trisyllabic words on the pattern (CVC.CV.CVC) such as [bar.ku.'kas] it is the final heavy syllable which is stressed. In the following tableau (4.10), we show the possible parses of the input [barkukas]:

Tableau 4.10

[barkukas] $_{PrWd}$	WSP	NON-FINALITY (σ', PrWd)	IAMBIC	PARSE-SYL	TROCHAIC
a.[(bar)('ku.kas)]$_{PrWd}$	*!		*		
☞ b.[(bar)(ku.'kas)]$_{PrWd}$		*			*
c.[(bar)ku('kas)]$_{PrWd}$		*		*!	*

What Tableau (4.10) shows is that the constraint WSP is invisible to the first heavy syllable in all the candidates since it is the only syllable of the foot. Candidate (4.10a) is ruled out because it incurs a fatal violation of the top-ranked constraint WSP by assigning stress to the light rather than the heavy syllable of the foot. Both candidates (4.10b) and (4.10c) violate the constraints NON-FINALITY (σ', PrWd) and TROCHAIC. (4.10c), on the other hand, fails to parse the light syllable of the word, thus incurring a fatal violation of PARSE-SYL. Candidate (4.10b) is optimal because it incurs fewer violations, namely NON-FINALITY (σ', PrWd) and TROCHAIC, a constraint ranked low in the ranking scale.

As mentioned earlier in 4.4, one distinguishing feature about SSA stress is that the right edge of the prosodic word is designated for stress, i.e. only one of the last two syllables is targeted for stress. In OT terms, this means that the prominent foot which contains the main-stressed syllable has to be right-aligned with the prosodic word. The constraint responsible for this is formulated within McCarthy and Prince’s (1993b) Generalized Alignment Theory as shown in 23 below:

(23)

ALIGN-R (Ft', PrWd) (McCarthy and Prince, 1993b)
The right edge of the prominent foot must be aligned with the right edge of the PrWd.
(Ft' stands for the prominent foot, i.e. the foot that contains the main-stressed syllable)

The constraint ALIGN-R (Ft', PrWd) has to be ranked above the constraint WSP in order to exclude forms as [('bar)(ku.kas)] where stress falls on the antepenultimate heavy syllable instead of the penultimate syllable. Consider the input [barkukas] with the two possible output candidates in Tableau 4.11 below:

Tableau 4.11

[barkukas] $_{PrWd}$	ALIGN-R (Ft', PrWd)	WSP
a. ('bar)(ku.kas)	*!	
☞ b. (bar)('ku.kas)		*

Candidate (4.11a) is ruled out because it incurs a fatal violation of the higher-ranked constraint ALIGN-R (Ft', PrWd) by stressing the heavy syllable of the word which belongs to a foot other than the final.

Because the constraint ALIGN-R (Ft', PrWd) dominates the constraint WSP which, in turn, dominates the constraint NON-FINALTY (σ', PrWd), it follows that the constraint ALIGN-R (Ft', PrWd) must dominate the constraint NON-FINALTY (σ', PrWd). To illustrate this domination relation, consider the sequence CVCVCV which is footed as CV(CV.CV) with stress placed on either the penultimate or on the final syllable as can be seen in the Tableau 4.12 for the different parses of the input word [farına]:

Tableau 4.12

[farına] $_{PrWd}$	ALIGN-R (Ft', PrWd)	NON-FINALITY (σ', PrWd)	IAMBIC	TROCHAIC
a.[(fa.'rı)na]$_{PrWd}$	*!			*
b.[fa(rı.'na)]$_{PrWd}$		*!		*
☞c.[fa ('rı.na)]$_{PrWd}$			*	

This tableau indicates that both candidates (4.12a) and (4.12b) are ruled out: they both violate the constraint TROCHAIC. Candidate (4.12a) incurs a fatal violation of the top-ranked constraint ALIGN-R (Ft', PrWd) which requires the alignment of the prominent foot and the PrWd and because it fails to parse the rightmost syllable. Candidate (4.12b) also incurs a fatal violation of the constraint NON-FINALITY (σ', PrWd) by assigning stress to the final syllable.

Next, consider another trisyllabic word on the pattern (CəC.CV.CVC), i.e. it consists of a sequence of two light syllables followed by a final heavy syllable. Consider the Tableau 4.13 for the different candidate parses for the input word [ləmnagɪʃ]:

Tableau 4.13

[ləmnagɪʃ] $_{PrWd}$	ALIGN-R(Ft', PrWd)	WSP	NON-FINALITY (σ', PrWd)	IAMBIC	TROCHAIC	PARSE-SYL
a. [(ləm.'na)(gɪʃ)]$_{PrWd}$	*!	*			*	
b. [ləm(na.'gɪʃ)] $_{PrWd}$			*		*	*!
c. [ləm('na.gɪʃ)] $_{PrWd}$		*!		*		*!
☞d.[(ləm.na)('gɪʃ)]$_{PrWd}$			*		*	

Candidate (4.13 a) is ruled out because the right-hand foot does not contain the main-stressed syllable. Both candidates (4.13b) and (4.13d) assign stress to the final heavy syllable, thus violating NON-FINALITY (σ', PrWd) and TROCHAIC. Candidate (4.13b), on the other hand, incurs a fatal violation of PARSE-SYL. But because candidate (4.13d) has parsed all of its syllables into feet, it is the optimal candidate. Finally, (4.13c) is excluded because it stresses the light instead of the heavy syllable of the foot and it fatally violates PARSE-SYL.

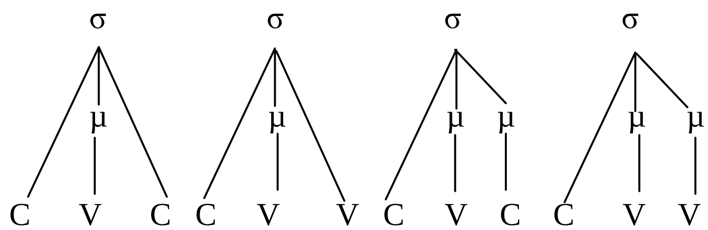
The final cases of words that deserve special attention are words that include superheavy syllables such as CVVC, and CVCC in different environments. SSA is a quantity-sensitive language which is based on syllable weight to assign stress loci. Heavy syllables assign two moras to (CVC) and (CVV) in non-final position whereas superheavy syllables assign two moras in word-finally and non-finally positions. Accordingly, the quantity of the syllables can be summarized by tree diagrams as follows:

(24)

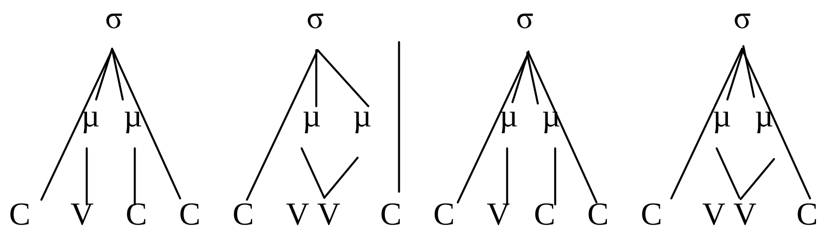
Extrametricality in Final and Non-Final Positions of Light, Heavy and Superheavy Syllables

a)- Final Position **Non-Final Position**

b)- Final Position **Non-Final Position**

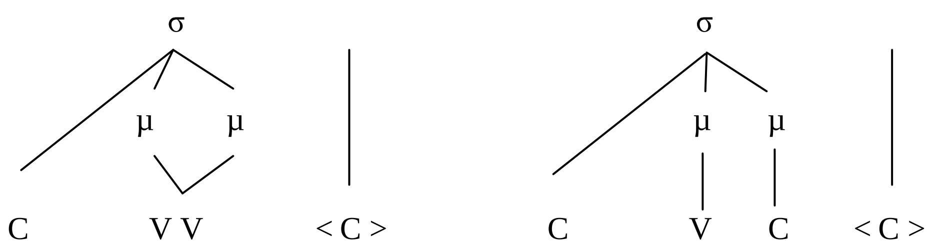


c)- Final Position **Non-Final Position**



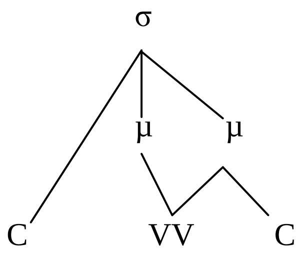
By applying the metrical rules of stress according to Hayes (1995), the last consonant in a superheavy syllable must be regarded as extrametrical at the level of syllabification as the following trees depict. Extrametricality is symbolized by (< >) notation.

(25) The Metrical Structure and Extrametricality



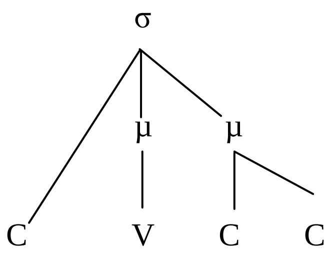
Yet, Broselow (1992) and Watson (2007) assume that the final C in the CVVC syllable shares its mora with the previous vowel. As a result, this syllable conforms to the ban on trimoraic structures which are not allowed in the dialect under study as shown in (26) below:

(26)



However, McCarthy (2007) agrees that the final consonants in the CVCC syllable can be linked to one mora via mora sharing if they obey sonority sequencing as shown in (27):

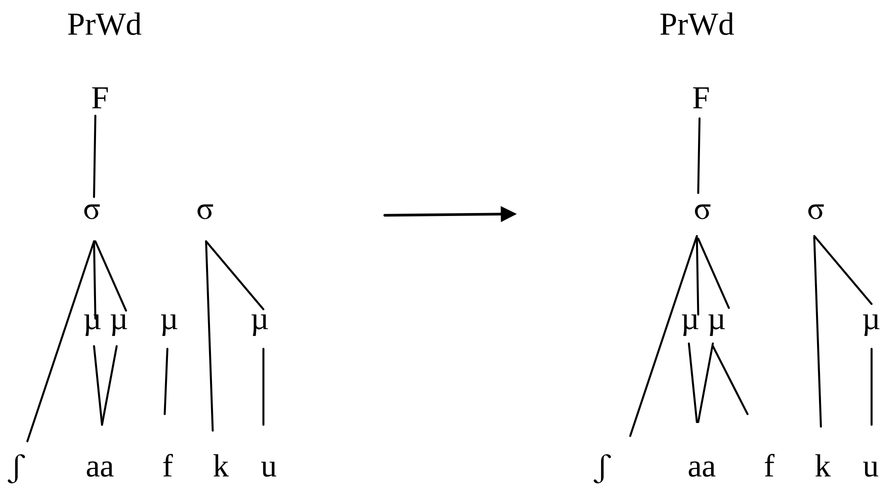
(27)



According to the different approaches to superheavy rhymes CVVC and CVCC, in SSA, mora sharing is utilized to affiliate the last consonant in the non-final CVVC syllable to the syllable node in order to avoid a semisyllable; i.e., the last consonant shares a mora with the second member of a long vowel in a CVVC syllable. Mora sharing is also used when dealing with a CVCC syllable where the last consonant cluster is assigned as a geminate; hence, the members of a geminate are directly linked to one mora.

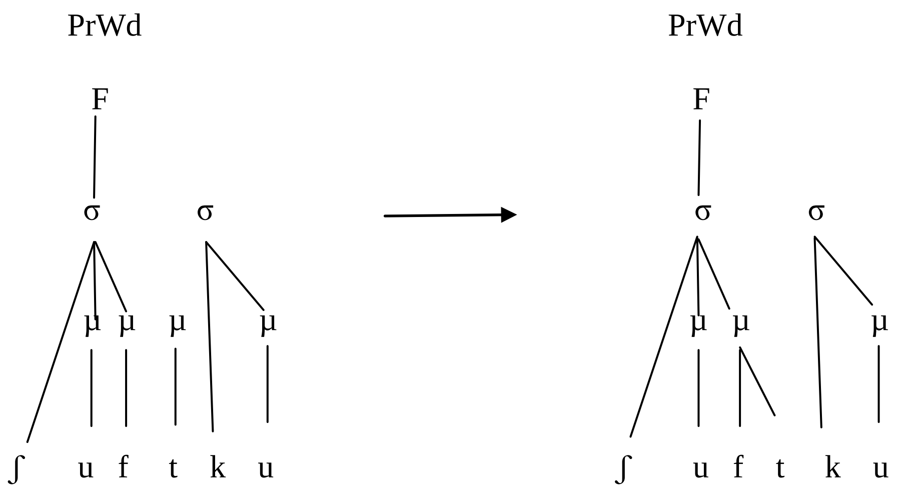
Now, let us consider disyllabic words on the patterns (CVVCCV) and (CVCCCV). These words end up in or have the shape (HL), i.e. words that consist of a heavy syllable followed by a light one:

(28)



The representation of the word /ʃaa.f$_{\mu}$.ku/ ‘he saw you’ in (28) above shows that a semisyllable is affiliated to a syllable node by sharing its mora with the second vowel.

(29)



The representation of the word [ʃuf.t$_{\mu}$.ku] ‘I saw you’ above, shows that a tri-moraic syllable is avoided by sharing the mora of a semisyllable [t] with the mora of a preceding segment [f]; i.e., a semisyllable does not exist due to mora sharing. Therefore, [f] and [t] belong to one mora instead of having different moras which consequently results in a tri-moraic syllable. This process, which is known as mora sharing, is introduced by Broselow (1992) and Watson (2007).

Prince and Smolensky (1993), McCarthy and Prince (1993a), Hayes (1995) show that the sequence HL is known to be marked or even absent from trochaic systems and as such feet of the type HL are banned on the basis of rhythmic structure which favours heavy syllables at the end of constituents. To rule out HL foot types, Prince and Smolensky (1993) propose the constraint RHYTHMIC-HARMONY (RH-HARM) that disfavours ('HL).

(30)

RHYTHMIC-HARMONY (RH-HARM). (Prince and Smolensky 1993)

Feet of the type HL are banned on the basis of rhythmic structure.

For SSA, we maintain that trochaic feet of the type (HL) do arise. To secure the undominated constraint ALIGN-R (Ft', PrWd), we need to incorporate the final light syllable into foot structure and at the same time avoid stressing this syllable in order not to violate WSP and NON-FINALTY (σ', PrWd) in cases such as [ʃaafku] and [ʃuftku]. Let us consider how the word gets penultimate stress when it is a PrWd. In order not to leave the final light syllable unparsed, the constraint RH-HARM has to be ranked below ALIGN-R (Ft', PrWd) and above WSP as the three competing parses for the input [ʃaafku] show:

Tableau 4.14

$[ʃaafku]_{PrWd}$	ALIGN-R(Ft',PrWd)	RH-HARM	WSP	TROCHAIC	IAMBIC
a. $[('ʃaaf)ku]_{PrWd}$	*!				*
☞b. $[('ʃaaf.ku)]_{PrWd}$		*			*
c. $[(ʃaaf.'ku)]_{PrWd}$		*	*!	*	

Candidate (4.14a) satisfies RH-HARM by unparsing the final light syllable, but causes a fatal violation of right alignment of the prominent foot and the PrWd. Candidate (4.14c) is ruled out because it violates RH-HARM and TROCHAIC and incurs a fatal violation of WSP. Candidate (4.14b) is optimal though it violates RH-HARM and IAMBIC which are lower-ranked.

In the Tableau (4.15), we will validate this constraint hierarchy by examining other data that contain heavy syllables only (HH). Consider the word /qur.ʔaan/ 'Qur'an':

Tableau 4.15

$[\text{qur.ʔaan}]_{PrWd}$	ALIGN-R(Ft',PrWd)	RHHARM	WSP	TROCHAIC	IAMBIC
☞a.$[(\text{qur}).(\text{'ʔaan})]_{PrWd}$				*	
b.$[(\text{'qur}).(\text{ʔaan})]_{PrWd}$	*		*!		*
c. $[(\text{'qur.ʔaan})]_{PrWd}$	*		*!		*

Both candidates (4.15b) and (4.15c) are ruled out because they violate the higher-ranked constraint ALIGN-R (Ft', PrWd) and incur a fatal violation of the constraint WSP. Candidate (4.15a) surfaces as optimal though it violates the lower-ranked constraint TROCHAIC.

Next, consider trisyllabic words on the patterns (CəC.CVC.CV) and or (CV.CVC.CV). The foot structure of such words could take one of the following parses:

(31)

a. $[\text{CəC('CVC.CV)}]_{PrWd}$ and or $[\text{CV('CVC.CV)}]_{PrWd}$

b. $[\text{CəC('CVC)CV}]_{PrWd}$ and or $[\text{CV('CVC)CV}]_{PrWd}$

c. $[\text{(CəC. 'CVC)CV}]_{PrWd}$ and or $[\text{(CV. 'CVC)CV}]_{PrWd}$

The sequence in the parse (31a) forms an even HL trochaic foot which we have shown to arise in SSA only when the right alignment of the prominent foot and PrWd is at stake. The parse (31b) tries to satisfy RH-HARM by unparsing the final light syllable while at the same time leaving the initial syllable unparsed, thus giving rise to a moraic trochee of the type H. The remaining candidate satisfies RH-HARM by unparsing the final light syllable while grouping the remaining sequence of light and heavy syllables into an iambic foot of the type LH. The constraint Tableau (4.16) shows the result for the different parses of the word [səb.gat.ni]:

Tableau 4.16

[səb.gat.nɪ]$_{\text{PrWd}}$	ALIGN-R (Ft', PrWd)	RH-HARM	WSP	NON-FINALITY (σ', PrWd)	TROCHAIC	IAMBIC
☞ a.[səb.('gat.nɪ)]$_{\text{PrWd}}$		*				*
b. [səb.(gat.'nɪ)]$_{\text{PrWd}}$		*	*!	*		
c. [(səb.'gat).nɪ]$_{\text{PrWd}}$	*!					

Even though it violates RH-HARM and IAMBIC, Candidate (4.16a) surfaces as optimal because priority is given to the parse that would lead to the right alignment of the prominent foot and the PrWd. Candidate (4.16b) is ruled out on the ground since it violates WSP by assigning stress to the light syllable rather than the heavy one. Candidate (4.16c) is also ruled out because the final light syllable cannot be integrated into foot structure.

To sum up, the following constraint hierarchy is put forward to account for stress assignment in SSA:

(32) Constraint hierarchy for SSA stress patterns:

ALIGN-R (Ft', PrWd)

RH-HARM

WSP

NON-FINALTY (σ', PrWd)

FT-BIN

PARSE-SYL

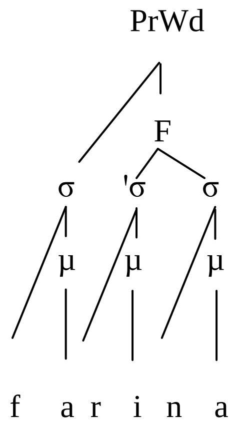
ALIGN-R (Ft, PrWd) TROCHAIC IAMBIC

The analysis of stress within the OT framework offered in this section has allowed us to account for the different stress patterns and determine the possible foot types in SSA. When words are assigned stress in isolation, we have shown that the foot types that arise are the universal trochaic 'LL and 'H and the anti-iambic foot 'HL we were forced to recognize. The three foot types can be illustrated by the words [fa('ri.na)], [(ʕar).('bun)] and [('ɖar).ba]/[('ʂɑr).ħək] in the following tree representations:

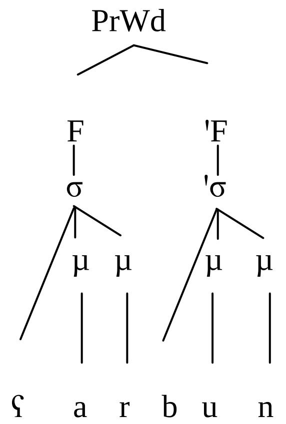
(33)

SSA Trochaic feet

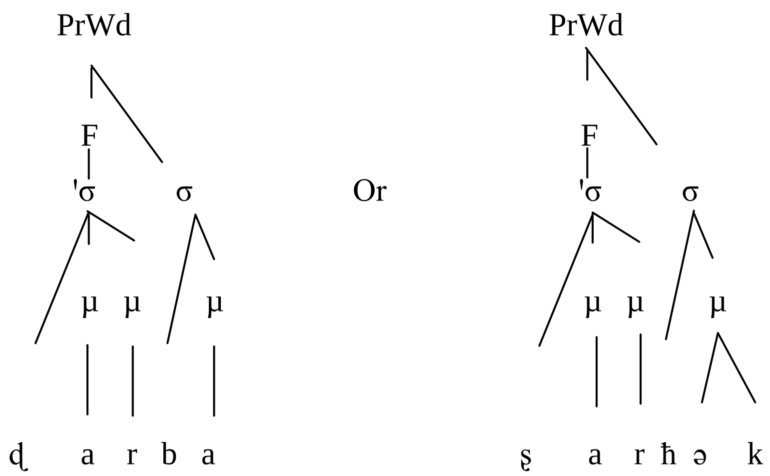
a.



b.



c.



4.6 Conclusion

The general outcome of this chapter was that stress assignment in SSA can be covered by a limited set of universal constraints. In other words, the stress system of SSA can be accounted for by the ranking of a limited set of universal constraints. The quantitative test we have carried out has allowed us to find out about the location of stress in SSA. The major results obtained have shown that stress is triggered by two factors, viz. syllable weight and syllable position. It has been shown that a final heavy syllable bears stress. In the absence of a final heavy syllable, stress falls on the penultimate syllable. It has also been shown that the object clitics [-kum] and [-hum] should be considered as light and therefore do not get stress.

The analysis offered in this chapter shows that the location of stress and consequently the foot types depend on the nature of the organization of prosodic words. In a single word phrase, it has been shown that stress falls on the final syllable if it is heavy; otherwise, on the penultimate. This conclusion has been reached after carrying out a quantitative test whose objective was to reflect the native speakers' intuitions about stress. The results obtained show that SSA is a quantity-sensitive system which favours trochaic feet. The OT analysis has also shown that restricting stress to the last two syllables of a word is a result of the constraint ALIGN-R (F', PrWd). It has also been shown that stressing the final heavy syllable of a word is the result of the constraint WSP which is observed in all words.

The arguments presented show that trochaic feet take priority over iambic ones and that this follows from ranking TROCHAIC over IAMBIC. The analysis has also shown that SSA favours exhaustive parsing of syllables into feet if this parsing does not lead to the violation of higher-ranked constraints. Thus, because the constraint ALIGN-R (Ft', PrWd) is undominated in SSA, we were led to recognize a trochaic foot of the type ('HL) that violates RH-HARM.

Chapter Five:

Morphology of the Broken Plural

5. Morphology of the Broken Plural

5.1 Introduction

Broken plural (henceforth BP) is an interesting yet complex phenomenon in Arabic. It has been studied extensively in Classical Arabic and Modern Standard Arabic. Arabic is a non-concatenative language that applies a masculine and feminine plural suffix, a dual, and a “broken plural” to mark number. The broken plural involves vowel changes internal to the noun stem and is defined by many distinct patterns. Much of the previous research focuses on Modern Standard Arabic while ignoring colloquial dialects of Arabic.

McCarthy and Prince (1990a) devise a theory deriving the BP from roots mapped on an iambic template of (LH). This study presents a proposal that derives BP stems from singular stems through moraic correspondence and root consonantal identity. Every mora in the singular stem has a corresponding mora in the BP stem. Root consonants in the BP stem are identical to root consonants in the singular stem. McCarthy (2000) is the first to apply output-output moraic correspondence to the BP of Classical Arabic. Moraic correspondence allows the BP stem to have equal moras with its singular stem. The focus of this study is the Saoura Spoken Arabic based on data collected by the author who is a native speaker of the dialect. Data analysis of this study follows the Optimality Theory posited by Prince and Smolensky (1993).

5.2 Statement of the Intent

The issue that we will tackle in this chapter relates to the existing trans-derivational relationship between the words in the lexicon of a language, notably the relations of "Output-Output Faithfullness" as recommended in Optimality Theory. We adopt the family of faithfulness constraints couched in Correspondence Theory (McCarthy and Prince 1995). This is Output-Output Correspondence (Benua 1995; 1997 & McCarthy 2000) which demands identity between related independent words.

We focus our interest on the relationship of correspondence between the output form of the singular, in parallel with the output form of the broken plural, to emphasize faithfulness to moraic constituance under moraic binarity in the strict sense. We try to show that faithfullness to the possible least marked prosodic structures takes precedence over faithfullness to the morphological structures, notably segmental structure.

In this study, we will endeavour to show that the morphology of the BP does not need to be burdened by the pre-established " Template Satisfaction Condition " (cf. McCarthy & Prince, 1986), and that the architecture of the pattern or template can be built via the independently motivated interaction of faithfulness and markedness constraints, i.e. operational across the grammar of the language under study and perhaps even in UG (Imouzaz, 2002). The Generalized Template Theory (GTT) provides a suitable framework for the implementation of this assumption (cf. McCarthy & Prince 1994, 1995, 1999; Gafos 1996; Spaelti 1997; McCarthy 2001b among others), in which it explains the interface prosody / morphology via the interaction of constraints and their hierarchy.

We will see that it is generally the less marked hierarchical prosodic structures in accordance with foot binarity that emerge as optimal structures and hierarchies.

5.2.1 Basic Assumptions

Some basic assumptions allow optimal understanding of the guidelines of our analysis. Moraic structures have the following characteristics:

▪ The correspondence relation between the singular and the plural counts the moras. To a minimally monomoraic syllable of the singular corresponds a monomoraic syllable of the plural, and to a maximally bimoraic syllable of the singular corresponds a bimoraic syllable of the plural.

▪ The initial syllable is chosen as the preferred area for the formation of BP in SSA; this is the position where the infixed morphemic vowels of the plural indulge in.

▪ BP formation rules morphologically neutralize gender distinction, in that the vowel of the feminine is not taken into consideration.

▪ Whole paradigm studied in this chapter is built on the pattern CVCC. It consists of a single bimoraic syllable, i.e. heavy. This situation puts in the forefront the notion of foot binarity observed on the moraic level.

As for the syllabic structures, they have the following characteristics:

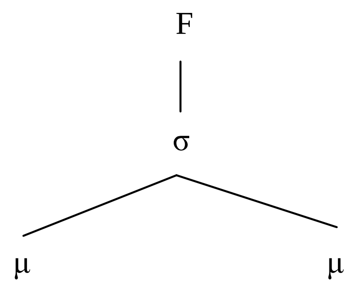
▪ Schwa syllables in SSA are considered monomoraic, i.e. light syllables, an assumption that allows us to make important predictions in the phonology of the language. We show that the derivation of the BP provides a strong argument in favour of that assumption.

▪ Syllables in SSA are monomoraic (σμ) or light, bimoraic (σμμ) or heavy but not trimoraic (σμμμ) or superheavy, which are universally condemned.

▪ The foot type built by the segmental structure of BP of triliteral forms is moraically binary:

(1) BIMORAICITY

(Foot Binarity)



The remainder of the chapter is mapped out as follows:

Section 5.3 will focus on the analysis of the simplest forms, consideration given on their segmental structure. We show in the first sub-section 5.3.1 that the faithfullness of moraic constituance of the monosyllable takes precedence over the segmental arrangements in the syllabic structure, translated in terms of constraints on prosodic anchors. In the second sub-section 5.3.2, we will endeavour to show that the major requirement of this type of morphology is the targeting of the first syllable as an entity mapped to the single (unique) syllable of BP.

Shapes (forms) of suffixed feminine morpheme {-a} will be analyzed in order to further highlight the monosyllabic but bimoraic appearance of forms of BP. In the third sub-section 5.3.3, we focus our interest on the syllabic correspondence to highlight the emergence of monosyllabic structure but bimoraic in the morphology of BP. The fourth sub-section 5.3.4, presents cases of geminate roots. We will be discussing the issue of priority of constraints on moraic correspondence on constraints that manage the integrity of geminates. These will be split as to meet the requirement of moraic structure of monosyllable.

Section 5.4 will focus on the issue of vowel alternation between high and corresponding glide. We will see, in the first sub-section 5.4.1, that the question of intrinsic sonority mainly concerns the structure of the segments. It yields, in its turn, to the requirement of bimoraicity. In the second sub-section 5.4.2, we arise the problem of the equivalence of sonority between a root segment and another affixed one of equal sonority. The third sub-section 5.4.3 studies the problem of the disappearance of some segments, namely in the occurrence of the glides in the singular forms, and their resuscitation in the forms of BP. This will arise a serious problem in the relationship Output-Output Correspondence. We will see that the reference to the form of the input is necessary if we want to account for this situation.

Section 5.5, meanwhile, will crown the study undertaken in this chapter by establishing a hierarchy between binary feet on the moraic level and the syllabic level. We will see that the foot binarity on the moraic level overrides the foot binarity on the syllabic level.
Finally, section 5.6 will sum up the chapter.

5.3 Segmental Structure

In this section, we will focus on the issue of segmental structure in relation to the requirements of the moraic correspondence. The monosyllabic but bimoraic structure of this type of BP forms requires certain behaviour. Structures that are involved in this correspondence relation are those exhibiting the following characteristics:

- An ordinary triliteral structure, i.e. a sequence of true consonants broken by schwa.

- A structure with the vowel /a/, a feminine morpheme, which requires an analysis of the singular form in two syllables.

- A structure of bisyllabic organization, whose interest is to bring out the monosyllabic but bimoraic character of prosodic structure of this type of BP.

- A structure of geminate consonants.

We adopt as a base theory that morphemic vowels of the Singular and BP maintain exclusion relations, insofar as they are in complementary distribution, they, therefore, cannot appear in the same form. This situation is dependent on the undomination of a "distributional" constraint of top-level of "morphemic exclusion".

5.3.1. Syllable Margins (BP initial CC cluster)

In this sub-section, we consider a BP form from the singular pattern CəCC. The existence of the schwa will have an impact on the process of syllabification which will operate in different ways in the plural structure, following the full vowel quality attaching to the morphemic vowel. Let's consider the following corpus which represents the typical (canonical) shapes of broken plurals in SSA:

(2)

Singular	BP	Gloss
[kənz]	[knuz]	treasures
[gəns]	[gnus]	race
[səʕd]	[sʕud]	luck
[gəlb]	[glub]	heart
[kərʃ]	[kruʃ]	belly
[qənt]	[qnæt]	corner
[kəlb]	[klæb]	dog
[bənt]	[bnæt]	girl
[kərʈ]	[kraʈ]	stone
[ʕurs]/[ʕərs]	[ʕræs]	wedding
[burʒ]	[braʒ]/[bruʒ]	tower
[murd]	[mrad]	big stone

Three general observations obtained by examining the shapes in (2) are reported below:

- Both BP and singular forms have a triliteral stem.
- A schwa/**u** vowel occurs between first and second root consonants.
- Forms of BP display an unpredictable full vowel.

The prototype (first model) kənz / knuz can stop on a case of conflict between moraic dependence constraints and prosodic anchor constraints. These are the statements of constraints on the correspondent entities:

(3) DEP-μ-OO

"Every mora in S2 must have a correspondent in S1"

Or

"For every **μ** in output 2, there is a correspondent **μ** in output 1"

This constraint is violated when the broken plural surfaces with an extra mora compared with the singular form. In other words, it marks with a star every form which adds any additional mora compared to the reference form, i.e. the output singular form. Any positive change in the moraic proponent is condemned.

(4) MAX-μ-OO

"Every mora in S1 must have a correspondent in S2"

Or

"For every **μ** in output 1, there is a correspondent **μ** in output 2"

This constraint is violated when the broken plural surfaces with fewer moras than its singular form.

(5) *μμμ]σ (*3μ)

Trimoraic syllables are prohibited (McCarthy & Prince 1990a, 1990b)

This constraint militates against the production of a trimoraic structure (*σμμμ), a highly marked structure cross-linguistically.

Following McCarthy (2000), we use the constraint that maintains the preservation of prosodic anchors in the correspondence relationship that can be established between morphologically and / or phonologically related entities. The hypothesis to defend is that faithfulness to the prosodic structure, translated in terms of moraic correspondence, for example, takes precedence over faithfulness to auto-segmental associations between segments and prosodic units that cover them.

Here is the statement of the constraints on prosodic anchors.

(6) ANCHOR (Cat1, Cat2, P) where P is [initial, final, head] (McCarthy (2000)

If x1 ∈ S1

x2 ∈ S2

x1 *R* x2 and

x1 is at position P of Cat1

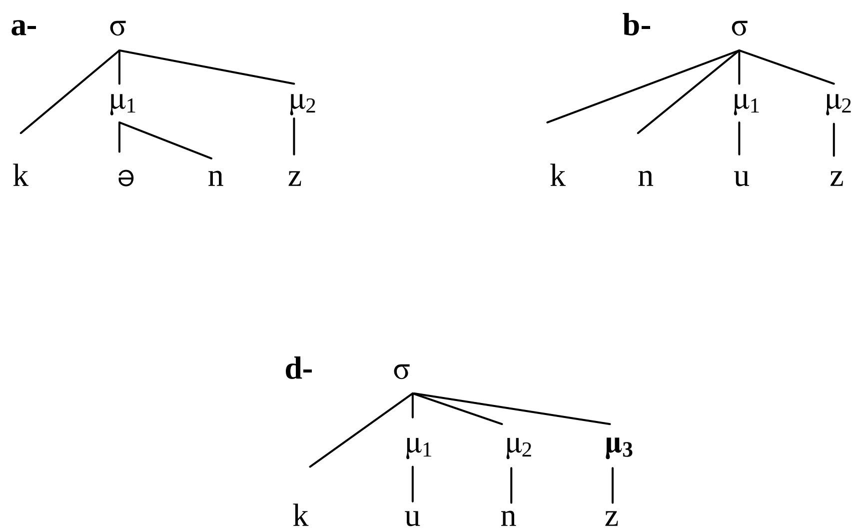
Then x2 occupies the position P of Cat2

This constraint militates against changing associations of corresponding segments to exclusive prosodic positions that shelter them. McCarthy (2000) argues that the anchor constraints are implemented to the theory of generalized alignment; they can possibly go beyond aligning edges to embrace other phenomena, such as prosodic constituency (circumscription).

All final prosodic positions are then affected (concerned) by the constraint in question. The **ANCHOR** family, as recently shown, meets in one of its possible instances, the predictions made by its counterpart **"Syllabic Role"** (McCarthy & Prince 1993).

Let us examine the properties of this type of form in the following appropriate representations:

(7)



The strictly prosodic constraints DEP-μ-OO (against epenthesis of μ**)**, MAX-μ-**OO** (against deletion of μ) and *μμμ]σ (three units of weight) referring to the prosodic structure, outrank the constraint of interface prosody / morphology ANCHOR-OO, referring to the association relationship between root-nodes and prosodic structures that cover them.

Now, in the following Tableau 1, we show the domination relationship and the interaction of the constraints:

Tableau1 [kənz] → [knuz]

[kə$n_{\mu1}z_{\mu2}$] / u $_{\textbf{plur}}$	DEP-μ-OO	MAX-μ-**OO**	*μμμ]σ	ANCHOR-OO
a. ☞ σ μ_1 μ_2 k n u z				*n
b. σ μ_1 μ_2 **μ_3** k u n z	*μ_3!		*3μ	*n*z

Tableau1 shows that candidate **(a)** is selected as optimal for the simple reason that it respects the constitution on the syllabic bimoraicity. Candidate **(b)** is excluded because it violates the requirement of moraic correspondence by developing an additional mora than the two existing moras, viz. the one associated with the coda. Such behaviour of the candidate **(b)** makes the syllable superheavy (*3μ), which goes against the syllabification algorithm of SSA, i.e. prohibited.

5.3.2 Shapes with Schwa and Feminine Gender

In this sub-section, we focus our attention on cases that include a schwa in their singular structure, and exhibit a mark of feminine, as shown by the following corpus:

(8)

Singular	BP	Gloss
[ʃəʕba]	[ʃʕæb]	divisions
[nəʒma]	[nʒum]/[nʒəm]	stars/wild plants
[təfla]	[tfæl]	spit
[zərda]	[zrud]/[zrəd]	feasts
[məʕza]	[mʕaz]/[mʕiz]	goats
[qərʕa]	[qroʕ]	bottles
[ʒəmra]	[ʒmar]	embers
[bəs̻la]	[bs̻al]	onions
[ʒəlda]	[ʒlud]	pieces of leather

These forms have the following characteristics:

▪ Singular forms are disyllabic.

▪ The feminine morpheme [**a**] is stem final.

▪ The triconsonantal cluster is broken up by schwa epenthesis which always appears between first and second root consonants.

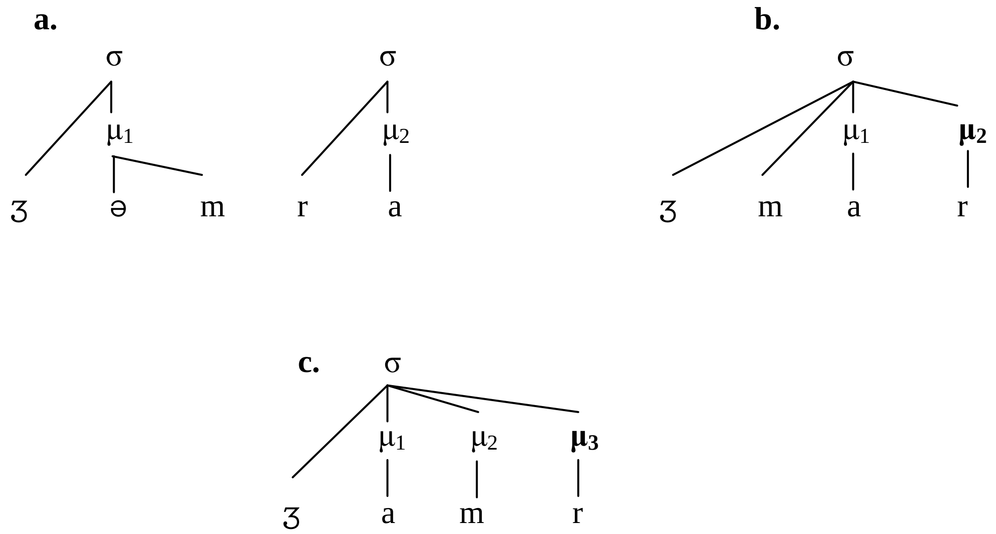
▪ BP forms are triconsonantal.

▪ Forms of BP infix a morphemic vowel between second and third root consonants.

The prototype [ʒəmra] → [ʒmar] argues generalization stating that the mark of the feminine gender is not taken into account by the rules of formation of BP. This distinction now falls into the lexical rules, where the feminine gender becomes an inherent lexical BP line (Imouzaz, 2002).

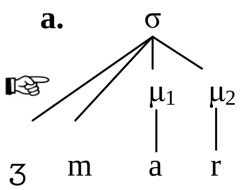
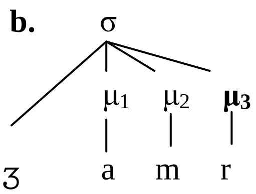
Here are the representations to visualize the representational structure of the candidates in the final phase of the harmonic assessment.

(9)



These representations show that the singular form, which serves as the starting point for this analysis, admits a bisyllabic representation, following the addition of the feminine morpheme {**-a**}, with a proper mora at its own lexical entry. This mora disappears in the plural form. In such a case, the correspondence relationship holds only for the remaining leftmost root syllables, i.e. first syllables of disyllabic words. In the following Tableau 2, we examine the implications arising from this assumption:

Tableau 2: [ʒəmra] → [ʒmar]

[ʒəm $_{\mu 1}$.ra$_{\mu 2}$] / a $_{plur}$	DEP-μ-OO	MAX-μ-**OO**	*μμμ]σ	ANCHOR-OO
☞ **a.** 	*μ2			*m
b. 	*μ2*μ3!		*3μ	*m

In the light of the hierarchy we have established so far, correspondence holds between the first syllable of disyllabic form of the singular and the output forms, which are monosyllabic. The morpheme {-a} of the feminine, being with its own mora in its lexical entry, is excluded from this correspondence relationship.

As Tableau 2 indicates, the optimal candidate (a) has a minimum violation vis-à-vis the first order constraint DEPμ-OO, as it adds a second mora **μ2** to mark out the consonant **r** added to the syllable after the loss of the morphemic vowel [**a**]. We notice that even the dominant constraints can be violated under certain conditions, but the violation must be minimal as postulated in the OT framework. In accordance with this concept, the optimal output [ʒmar] incurs one single violation mark in regard to the high-ranked constraint DEPμ-OO, while its competitor [ʒamr] totalizes three violations.

We can also notice at the close of this analysis that the form of the BP builds a binary structure on the moraic level, as opposed to the singular form, which is built on the syllabic level. This is one of the salient features of the BP of tri-consonantal forms obtained by infixion. This triliteral behaviour is an option of structure optimization, since according to the algorithm of syllabification of the language under study, the monosyllabic but bimoraic form is chosen as the optimal structure

5.3.3 Shapes with Triliteral Root

The cases that we consider in this sub-section are BP from singular forms on the pattern CCəC, i.e. they present the particularity of having a phonetic schwa between the second and third root consonants. The occurrence of this schwa will surely affect the morpho-prosodic anchoring translated in terms of correspondence relation. The following body of evidence demonstrates this situation:

(10)

Singular	BP	Gloss
[ɖfər]	[ɖfar]	nails
[ʒbəl]	[ʒbæl]	mountains
[ktəf]	[ktæf]	shoulders
[bɣəl]	[bɣæl]	mules

[wtəd]	[wtæd]	pegs
[ʃdəg]	[ʃdug]	cheeks
[nsər]	[nsur]	eagles
[gʂər]	[gʂor]	castles

These forms are characterized by the following properties:

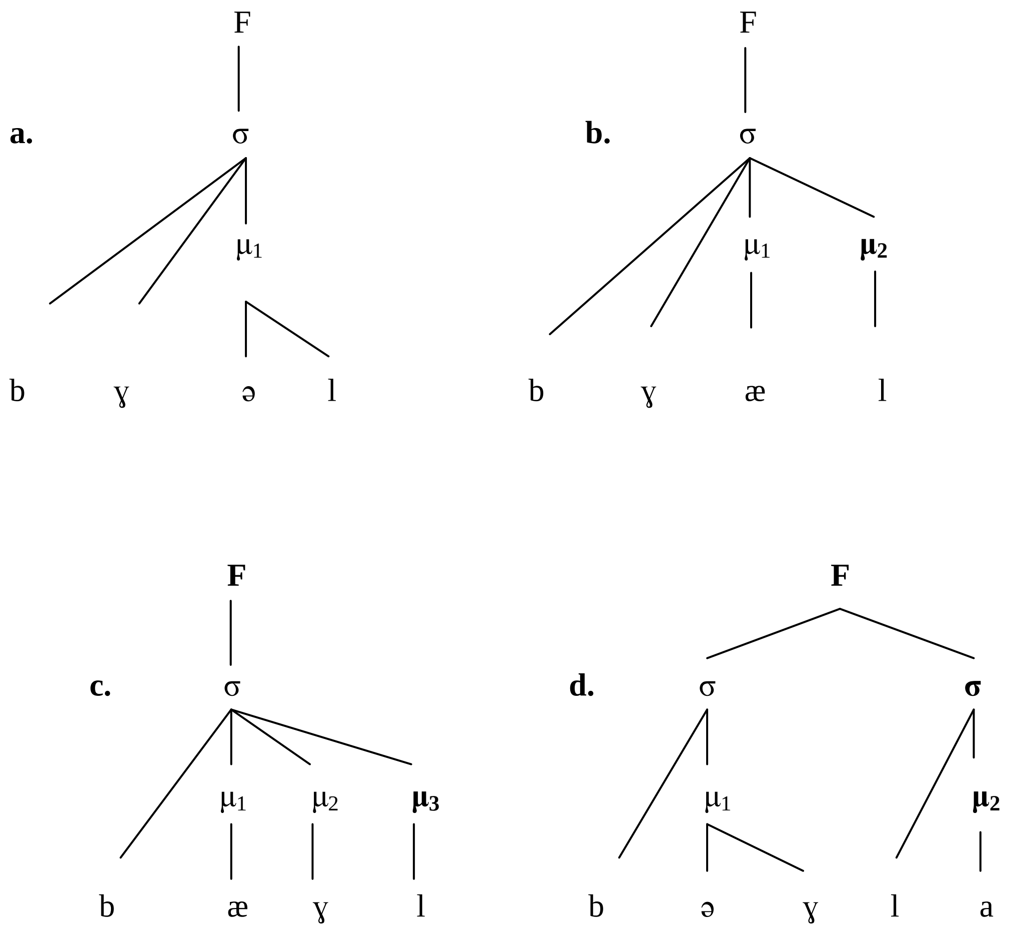
▪ Both singular and BP forms have a triliteral root.

▪ Schwa occurs between second and third root consonants in singular forms.

▪ BP morphemic vowel appears in the same position as the schwa.

Now, let’s examine the syllabic representations of the following candidates to consider what features they have in regard to syllabification algorithm:

(11)



If we have a succinct look at these representations, we will quickly realize that the candidates are ranked in the order established by the Theory of Markedness, i.e. counting the syllabic constituents, viz.

(12) **a.** bɣəl (σ + μ) = 2 items (sing.)

b. bɣæl (σ + μμ) = 3 items

c. bæɣl (σ + μμμ) = 4 items

d. bəɣ.la (σσ + μμ) = 4 items

This account can be fruitful, especially in the evaluation of forms. So, faced with this new situation, a constraint that manages the syllabic correspondence, one of the instances of the DEP family, is indispensable in this respect. Here is the formulation:

(13) **DEP-σ-OO.**

"Every syllable in output 2 must have a correspondent in output 1."

This constraint militates against the addition of syllables compared to the basic form, i.e. the singular form. Consider Tableau 3 for more detailed questions:

Tableau 3 : [bɣəl] → [bɣæl]

[bɣəl $_{\mu1}$] / a $_{plur}$	DEP-σ - OO	DEP-μ - OO	ANCHOR – OO
a. ☞ σ μ_1 $\boldsymbol{\mu_2}$ b ɣ **æ** l		*μ2	*l
b. σ μ_1 μ_2 $\boldsymbol{\mu_3}$ b **æ** ɣ l		*μ2 *μ3!	*ɣ *l
c. σ **σ** μ_1 $\boldsymbol{\mu_2}$ b ə ɣ **l** **a**	*lɑ!		*ɣ

Candidate (c) represents a disyllabic form with a nuclear syllable ("core syllable") built by the morphemic vowel [**-a**] and the final consonant **l** of the root; another syllable was made up by the remaining two root consonants supported by an epenthetic schwa. Thus, adding a syllable to the singular base syllable constitutes a violation of the constraint of a higher rank, viz. DEP-σ-OO. The constraint DEP-μ- OO, meanwhile, is respected for the reason that the circumscribed syllable has no additional mora (μ1 *R* μ1). Violation of ANCHOR - OO can be explained by the fact that μ1 is associated with the consonant **ɣ** (equally, the same mora is associated with **l** in the singular form).

Accordingly, as Tableau 3 indicates, to a monosyllabic singular form, which does not fulfill the condition of foot binarity, corresponds a disyllabic form of BP to highlight the need for syllabic dependence under the type of foot binarity considered here, i.e. binarity on the moraic level.

The resulting hierarchy is then as follows:

(14)

DEPσ – OO >> DEPμ - OO, MAXμ-**OO,** *μμμ]σ >> ANCHOR – OO.

DEPσ – OO

DEPμ - OO, MAXμ-**OO,** *μμμ]σ

ANCHOR – OO

One possible reading of this hierarchy is that the grammar of the language under study does not tolerate *the addition* of a mora, nor does it allow *the addition of* a larger unit, i.e. a syllable. The monomoraic character of the unit incorporated as a target is a prerequisite condition for the formation of this type of BP.

The generalization that can therefore lead to the study of these two cases is as follows:

(15)

Sing.		**BP**		
σ + μ	→	σμμ , i.e. 1syllable	→	*2syllables
σσ + μμ	→	σμμ , i.e. 1syllable	→	*2syllables (Imouzaz, 2002)

The moraic binarity, then, is the *sine qua non* of the morphology of BP.

5.3.4. Shapes with Geminates

The analysis developed in this sub-section will revolve around the interaction of the constraints related to the structure and prosodic anchor and those governing the behaviour of geminate consonants. The focus will be on the integrity of geminates in monosyllables (final geminates) and disyllables (medial geminates) with regard to the requirements of the appearance and the position of the vocalic melody of the plural morpheme.

Consider the following sample of data to demonstrate this situation:

(16)

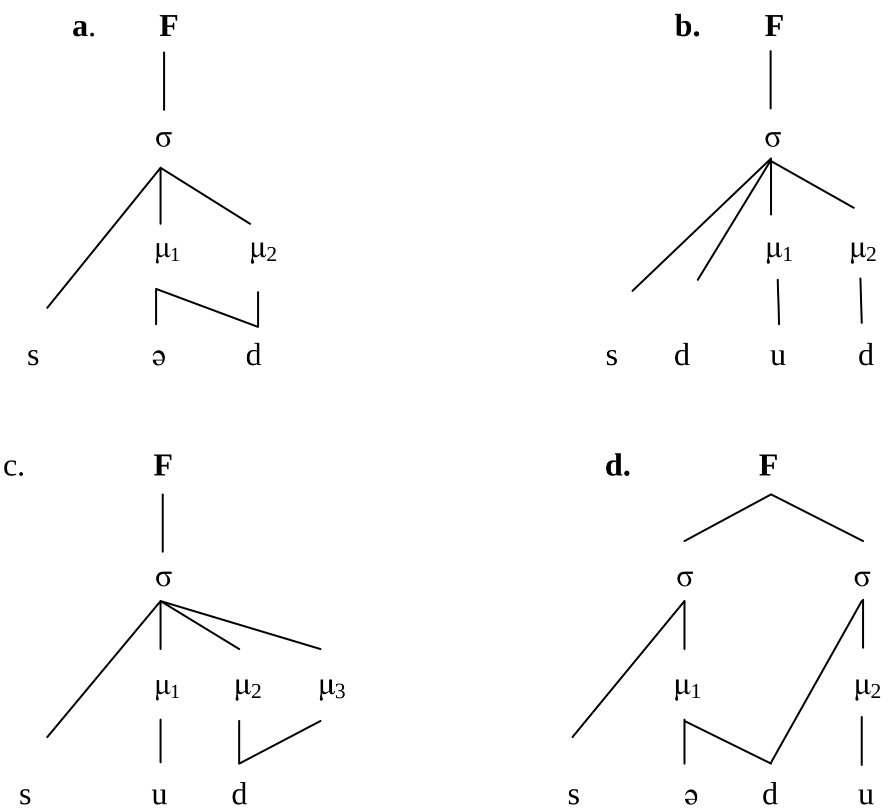
	Singular	**BP**	**Gloss**
a)	[sədd]	[sdud]	dams
	[χədd]	[χdud]	cheeks
	[muʃʃ]	[mʃuʃ]	cats
	[kumm]	[kmæm]	sleeves
	[ʕəmm]	[ʕmum]/[ʕmæm]	uncles
	[sənn]	[snan]	teeth
b)	[rəzza]	[rzəz]	turbans
	[kəffa]	[kfəf]	plates of balance
	[guffa]	[gfəf]	shopping bags

The following properties are peculiar to these data, viz.

- Geminates in (16a) are tautosyllabic.
- Singular forms in (16a) have final geminates.
- The second root consists of a geminate in singular form.
- Singular forms in (16b) are biliteral.
- The schwa/full vowel appears therefore between the first and second root consonants.
- Singular forms in (16b) have medial geminates with the first half of the geminates belonging to the first syllable of the singular and the second half filling the onset position of the second syllable.
- Forms of BP infix a morphemic vowel to split geminate consonants.
- In particular, the geminates in the broken plurals are split either by the vowel /a/ or /u/.
- The broken plurals consist of a consonantal root, which they share with their singular counterparts, plus schwa that splits their geminates.

The conspicuous feature of correspondence of the type [sədd]/[sdud] relates to the occurrence of a geminate in the base form, which is seen split in the derived form by prosodic considerations. Therefore, the segmental quality of the geminate should be preserved at the expense of its integrity, as schematized in the prosodic representations of the following candidates:

(17)



Kenstovicz and Pyle (1973) and Guerssel (1978) established a well-known generalization that geminate structures cannot be split by epenthesis and that they allow one half of the cluster to undergo a rule that the other half does not undergo. That is, geminates cannot be separated by inserting a vowel between them.

The integrity constraint which sponsors the geminate consonants tangibly is formulated as follows:

(18)

GEMINATE INTEGRITY (henceforth GEM - INTEG) (Kenstovicz and Pyle, 1973)
Geminates are inseparable (a vowel cannot be inserted into a geminate)

"Suppose x and y are segments, and S1, S2 are phonological representations.

S1 ***R*** S2, where

x1 ***R*** x2

y1 ***R*** y2

If x1 is identical to y1 in S1 and that

x1 is adjacent to y1 in S1,

Then x2 is identical to y2 in S2 and

x2 is adjacent to y2 in S2 "

The constraint GEM - INTEG, a segmental level constraint, concerns the representation of root knots. It is dominated by the constraint ANCHOR - OO. If we consider these last two constraints of the hierarchy, especially for the candidates [sədd]/[sdud], we find that their domination order, i.e. ANCHOR- OO >> GEM - INTEGR can make good predictions as shown in the following Tableau 4:

Tableau 4: [sədd] → [sdud] ANCHOR- OO >> GEM – INTEGR

$[\text{sə}d_{\mu 1}d_{\mu 2}]$ / u $_{plur}$	ANCHOR**- OO**	**GEM -** INTEG
a. ☞ σ μ_1 μ_2 s d u d	*d	*
b. σ μ_1 μ_2 μ_3 s u d	*d*d !	

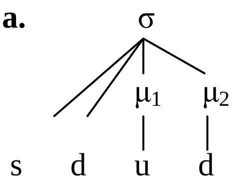
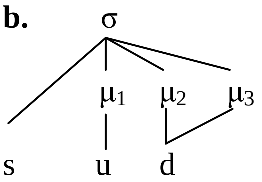
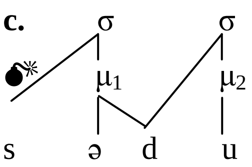
The reverse domination order, viz. GEM - INTEG >> ANCHOR - OO makes incorrect predictions as Tableau 5 shows clearly:

Tableau 5: [sədd] → [sdud] GEM - INTEG >> ANCHOR – OO

$[\text{sə}d_{\mu 1}d_{\mu 2}]$ / u $_{plur}$	**GEM -** INTEG	ANCHOR**- OO**
a. σ μ_1 μ_2 s d u d	*	*d
b. 💣 σ μ_1 μ_2 μ_3 s u d		*d*d

Likewise, if we add the third candidate [səd.du], the least harmonious reference made to the overall hierarchy, we see that it will win; the sponsoring constraint being the GEM **-** INTEG, as shown in the following Tableau 6:

Tableau 6: [sədd] → [sdud] GEM **-** INTEG >> ANCHOR – **OO**

[səd$_{\mu 1}$d$_{\mu 2}$] / u $_{plur}$	**GEM -** INTEG	ANCHOR**- OO**
a. 	*	*d
b. 		*d*d
c. 		*d

It should be noted that segmental level constraints do not allow us to choose the optimal form present in the grammar of the language; hence, the need for support by the constraints of a higher level, viz. prosodic constraints. Consider Tableau 7 for the overall hierarchy:

Tableau 7: [sədd] → [sdud]

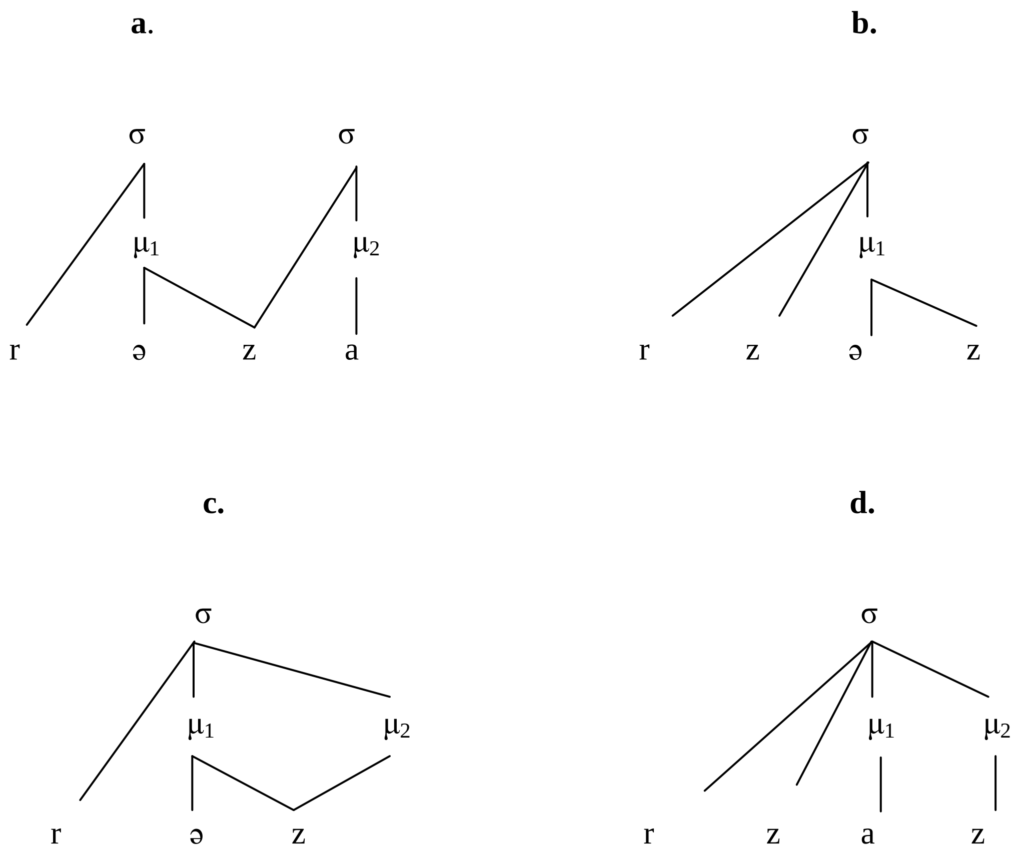
[$səd_{\mu 1}d_{\mu 2}$] + u $_{plur}$	DEP-σ - OO	DEP-μ - OO	*μμμ]σ	ANCHOR - OO	**GEM -** INTEG
a. ☞ σ μ_1 μ_2 s d u d				*d	*
b. σ μ_1 μ_2 μ_3 s u d		*μ_3!	*	*d*d	
c. σ σ μ_1 μ_2 s ə d u	*du!			*d	

Regarding Tableau 7 of the overall hierarchy, we find that the grammar of SSA sacrifices the integrity of geminate consonants in favour of more stringent conditions relating to the Prosody / Morphology interface requirements. Something that translates, perhaps in a more elegant way, the assumptions already encountered in the morpho-phonology of SSA, in general, stating that geminate consonants can be split up by morphological rules rather than by phonological rules (Guerssel, 1978).

With a minimal acceptable violation, candidate (a) [sdud] is chosen as optimal, for it respects, mainly, the constraint DEP-μ-OO in the sense that the first mora **(μ_1)** is recovered by the morphemic vowel [**u**], relegating the first portion of the geminate to the role of onset syllable. The second mora, meanwhile, remains in its original position, i.e. the position labeled **(μ_2)** of the base form. Thus, the maximum moraic quantity of the base is preserved. Candidate (b) [sudd], in its turn, develops an additional mora **(*μ_3)** in comparison with the base form, which constitutes a violation of the constraints DEP-μ - OO and *μμμ]σ. Candidate (c) [səd.du], incurs a fatal violation of the constraint placed high in the hierarchy, viz. DEP-σ-OO.

However, consider the inquisitively noteworthy instance of [rəzza]/[rzəz], schematically represented as follows:

(19)



These candidates and the overall hierarchy are shown in Tableau 8 below:

Tableau 8: [rəzza] → [rzəz]

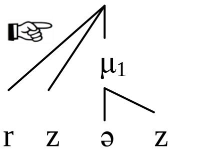
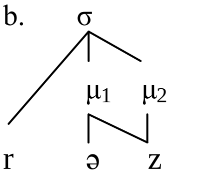
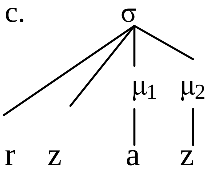
[rəz$_{\mu 1}$] za ø$_{plur}$	DEP-σ - OO	DEP-μ - OO	ANCHOR - OO	GEM - INTEG
a. ☞ 			*z1	*
b. 		*μ_2!	*z2	
c. 		*μ_2!	*z1*z2	*

Tableau 8 indicates that candidate (a) is optimal because it respects the highly-ranked constraints DEP-σ-OO and DEP-μ-OO. It only violates minimally the dominated constraints in this hierarchy, viz. ANCHOR-OO and GEM - INTEG. Candidate (b) preserves its prosodic anchors, mainly regarding the circumscribed domain (limited area) represented by the initial syllable - enclosed by square brackets in the singular - at the expense of moraic dependency constraint DEP-μ-OO. This violation is found to be fatal; the geminate cannot still be connected entirely to a mora which also contains the schwa.

Moreover, what seems to be remarkable and unusual, considering this analysis, is that the candidate of "top level", chosen by the harmonic evaluation procedure EVAL as the optimal candidate, i.e. [rzəz] presents a geminate split up by the epenthetic vowel schwa. It has been postulated in the literature that phonological geminate consonants can be broken by morphemic vowels rather than epenthetic vowels. In this regard, Guerssel (1978), in his ("Adjacency Identity Constraint"), stipulates that geminate consonants constitute a block in terms of phonological rules. For his part, Benhallam (1991), in his ("Rule of Geminates"), argues that the geminate consonants cannot be divided by vowel epenthesis. The case under analysis, i.e. **[rzəz]** is more harmonious, under optimality, than [rəzz], which preserves the integrity of the geminates, since the schwa is allowed to position itself between identical and adjacent consonants, for rather morpho-prosodic considerations. Thus, we argue that the analysis we have presented here provides a strong argument in favour of the prosodic morphology thought within the OT framework.

5.4 Shapes with Default Glides

In SSA there is a group of broken plurals which exhibits an additional consonant, specifically an extra glide in their surface forms. This glide does not exist in the singular forms from which these broken plurals are derived. In this section, we will focus on the behaviour of the glides and their correspondent high vocoids (HV), under the syllabification algorithm recommended by the prosodic constraints in the grammar of SSA.

These segments, equipped with a high sonority index (see Selkirk, 1984), can pretend to the prominent position of the syllable nucleus. Their special nature in the segmental inventory of the language is that they sometimes behave like "ordinary" from the rest of the segments, but other times they engage in conduct that is strictly their own. We will stop in the following sub-sections on all of these behaviours, based on the study of forms of BP considered in this chapter.

5.4.1 Glide / High Vocoid Alternation

The issue discussed in this subsection refers to the discrimination between the glide and its correspondent high vocoid and the roles they play within the syllabic structure, as evidenced by the following items:

(20)

	Sing.	BP	Gloss
a)	[ɣul]	[ɣwæl]	ghoul (mythical demon)
	[ħuʃ]	[ħwæʃ]	yard

b)	[ʒɪl]	[ʒjæl]	generation
	[sɪd]	[sjæd]	gentleman
	[mɪr]	[mjær]	mayor
	[kɪs]	[kjæs]	bag
	[χɪʈ]	[χjoʈ]	thread
	[rɪg]	[rjug]	dribble

The data in this corpus are distinguished by the following distribution:

- BP forms have a triliteral root, whose second segment is a glide.
- Forms of BP have only the vowel /**a**/ and /**u**/ as morphemes.
- The HV appears as a glide in the forms of BP.
- The HV is made (realized) as high vowel in the singular forms.

Besides the problems already discussed in this analysis, on the ranking of constraints implemented and their interaction to optimize outputs generated by the function GEN, the forms considered in this sub-section posit the problem of distinguishing between the high vocoid and its correspondent glide. Realization as glide or high vocoid is supported by the ranking of the constraints DEP-OO-Glide and SON-HV in the overall hierarchy in accordance with the basic assumptions of the OT.

(21)

DEP-OO-Glide

Every glide in output2 has a correspondent in output1.

This constraint is a faithfulness constraint which ensures that the glides in the output of the broken plural have correspondents in the output of the singular forms. This constraint is violated when the output of the broken plural surfaces with an extra glide.

The statement of the constraint of intrinsic sonority of HV which regulates their position in the syllabification algorithm is formulated as follows:

(22)

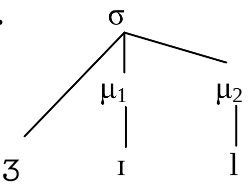
SONORITY OF HIGH VOCOIDS (SON-HV) (cf. Imouzaz, 1991)

"A HV whose index is equal to 7 on the sonority scale is better interpreted as a vowel."

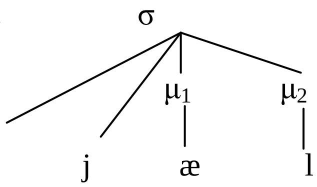
As reported by Imouzaz (2002), any superficial interpretation of HV as glide is considered as a mark of violation vis-à-vis this constraint. Now that the terms of the constraints are explicit, consider the representational structure of the candidates for optimal evaluation:

(23)

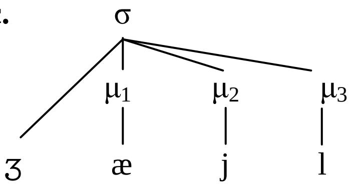
a.



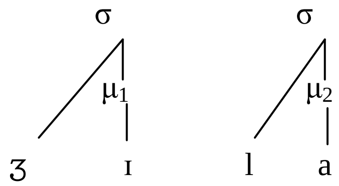
b.



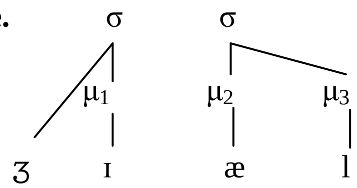
c.



d.



e.



After this representational development, it is time to tackle the harmonic evaluation procedure shown in the following Tableau 9:

Tableau 9: [ʒɪl] → [ʒjæl]

[ʒɪ$_{\mu 1}$l$_{\mu 2}$] + æ $_{plur}$	DEP-σ-OO	DEP-μ-OO	DEP-OO-Glide	SON-HV
a. ☞ σ μ_1 μ_2 ʒ j æ l			*	*j
b. σ μ_1 μ_2 μ_3 ʒ æ j l		*μ_3!	*	*j
c. σ σ μ_1 μ_2 ʒ ɪ l a	*la!			
d. σ σ μ_1 μ_2 μ_3 ʒ ɪ æ l	*æl!	*μ_3!		

As demonstrated in Tableau 9, the analysis through SON-HV has made the same predictions as the prosodic anchoring. Although SON-HV is a constraint of interface segment / prosody in nature, it is seen overshadowed by the strictly dominant prosodic constraints, viz. DEP-σ-OO, DEP-μ-OO and DEP-OO-Glide.

To this level of our analysis, the issue of discrimination between the glide and its correspondent high vocoid is logically inferable, because we observe an alternation between these two segments when the singular and the BP are made parallel. The primary concern of this type of correspondence is to optimize the prosodic structure, to the detriment of the segmental structure.

Indeed, and in virtue of its quality of plural morpheme, the vowel **ɑ** is granted the nuclear position of the syllable, and thus relegates the vocoid **ɪ**, which is rather given a marginal position in the BP where it appears as a glide, to onset role. As reported by Imouzaz (2002), this situation is expressed in the OT by a family of constraints of which SON-HV is a particular instance, defending the idea that a segment with a high sonority is better analyzed as a nucleus (N) rather than as a margin (M) (equivalent to N / **a** >> N / **ɪ**, **u** ... or vice versa ... M / **ɪ**, **u** >> M / **a** in a system based on syllable constituents) (cf. Prince & Smolensky, 1993).

5.4.2 Equal Sonority Index

The case we consider at this stage of our analysis presents a conflict between vowels of equal sonority indices. We try to demonstrate that the analysis in the light of the OT reflects this state of affairs in a more convincing way. Here is a sample of data that shows these properties:

(24)

Sing.	BP	Gloss
[nɪf]	[njuf]	nose
[rɪg]	[rjug]	dribble
[ʃɪχ]	[ʃjuχ]	old man
[χɪʈ]	[χjoʈ]	thread
[ʂɪf]	[ʂjof]	summer
[sɪf]	[sjuf]	sword

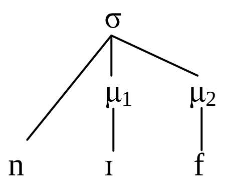
The following characteristics are the prerogative of the forms mentioned above.

- Singular is biliteral whereas BP is triliteral.
- HV root is given a nuclear position in singular.
- HV root is rather given a marginal position in the BP where it appears as a glide.

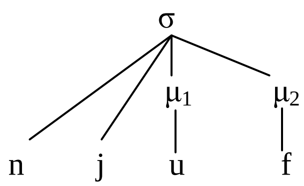
One of the striking properties of these data relates to the occurrence of a HV of a coronal **ɪ** which is granted a nuclear position in the singular forms, and which is challenged by a HV labial **u** in the forms of BP. This competition between the HV candidates in harmonic evaluation is outlined as follows:

(25)

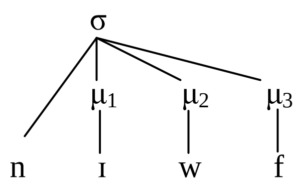
a.



b.

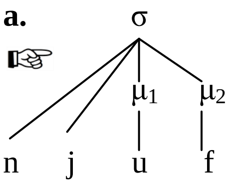
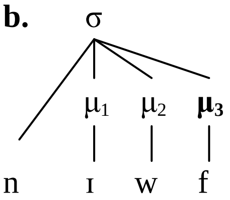


c.



Now, consider the following Tableau 10 in order to decide between the candidates:

Tableau 10: [nɪf] → [njuf]

[nɪ $_{\mu1}$f$_{\mu2}$] + u $_{plur}$	DEP-μ-OO	*μμμ]σ	SON-HV
a. ☞ 			*j
b. 	*μ3!	*	* w

We note, considering the input of this tableau, that the constraint **ANCHOR-OO** alone is not enough to make good predictions**,** for the simple reason that the root HV **[ɪ]** and the morphemic vowel **[u]** have the same sonority index; they are, therefore, both potential segments for the nuclear position.

Similar situations are commonplace in the phonological literature as part of the multidimensional theory of the syllable (cf. Selkirk (1984). Generally, they are solved by resorting to the directionality of the syllabification which can, in some cases, prove to be refractory, which forces us to adopt an opposite directionality strategy (cf. Imouzaz, 1991).

The vocoid **[ɪ]** is privileged by the nucleus position of the syllable in the output form of the plural according to the faithfulness requirements relation which binds (links) it to the singular form, where it occupies the nuclear position. The current candidate [nɪ**w**f] is thus likely to emerge as optimal.

However, the assumption of the monomoraic correspondence, translated in terms of constraint interactions, e.g. DEP-μ-OO and *μμμ]σ to choose the optimal candidate [njuf], makes the expected predictions, and thus solves the classic problem of right-left or left-right directionality.

5.4.3 Segmental Dependency

The type of examples we will analyze in this sub-section raises the problem of the reappearance of the glide in the form of BP, e.g. [ʕ**j**æd], [s**w**æq], while it has been elided in the form of the singular [ʕɪd], [sʊq]. The following examples bear witness of this situation:

(26)

	Singular	Boken Plural	Gloss
a.	[ḍɪf]	[ḍjaf]/[ḍjof]	guests
	[ṭer]	[ṭjor]	birds
	[mɪr]	[mjær]/[mjur]	mayors
	[ḍaṛ]	[ḍjaṛ]/[ḍjoṛ]	houses
b.	[qom]	[qwæm]	people
	[χæl]	[χwæl]	uncles
	[ħæl]	[ħwæl]	states
	[ʕæm]	[ʕwæm]	years

This type of forms has some special features:

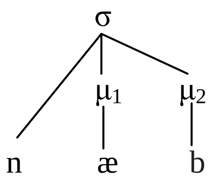
• BP forms have a triliteral root, but which only exhibits two of its consonants in the phonetic form of the singular.
• Reappearance of the underlying root segment (HV) in the BP form;
• HV is relegated to a second position.

We need to determine the nature of function of the glide deletion process. Two analyses compete to see which of the two candidates will be optimal, viz. [ħ**w**æl] or [ħæ**w**l], [ṭ**j**or] or [ṭo**j**r].

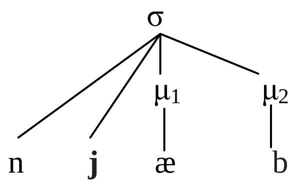
For the moment, let us examine the representational structure of the candidates:

(27)

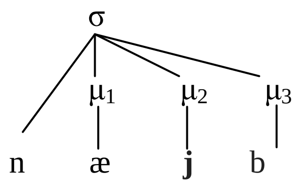
a.



b.



c.



Considering the correspondence relation connecting, for example, the singular [ħæl] and the plural [ħwæl], one of the instances of the DEP family must be entitled in this analysis, namely the constraint DEP-seg-OO. Referring to the hierarchy at the beginning of this presentation, which establishes a marriage between the constraints on the corresponding entities, precisely the constraints on the structural quantity MAX and DEP, on the one hand, and the entities of the hierarchical prosodic grid, on the other hand, we are entitled to order DEP-μ-OO on a plan higher than that of DEP-seg-OO. The latter constraint, which militates against the addition of segments compared to the basic form, i.e. the singular form, is stated as follows:

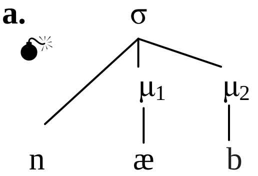
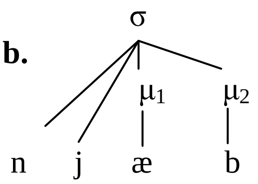
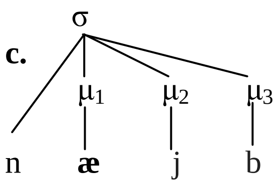
(28)

DEP-seg-OO

"Every segment in output 2 must have a correspondent in output 1"

Consider the tableau below for more detailed questions:

Tableau 11: [næb] → [njæb]

[næ$_{\mu 1}$b$_{\mu 2}$] / æ $_{plur}$	DEP-µ-OO	*µµµ]σ	DEP-seg-OO	SON-HV
a. 				
b. 			*!	*j
c. 	*!	*	*	*j

The constraints in Tableau 11 wrongly predict that the optimal candidate is (11a), i.e. the candidate that is successfully analyzed, as it is most faithful to the base form of this correspondence relationship. The implication that stems from this situation is simply that the glide, once deleted in the form of the singular, should also be deleted in the form of the corresponding plural.

The grammar of SSA will have to incorporate a higher-ranked additional constraint. It must rank higher than the constraints DEP-µ-OO and DEP-seg-OO. This constraint is stated as follows:

(29)

MAX-seg-IO (McCarthy & Prince (1995, 1999)).

Every segment of the input must have a correspondent in the output.

This constraint, which concerns the Input / Output Faithfulness of the "Complete Model" of the theory of correspondence, stipulates that, in a large majority of cases of derivational morphology, the root consonants of the lexical entry of an item are maximized in almost every word derived from this item. Consider the following items for illustration:

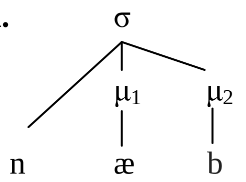
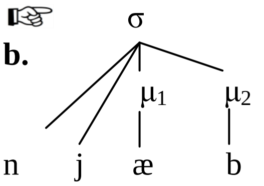
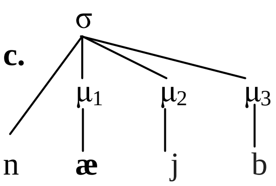
(30)

Items	**Gloss**
ktəb	write
ktæb	book
ktuub	books
maktab	desk
maktaba	library
maktuub	written/destiny
kəttəb	cause to write
ktijjəb	booklet
kətba	writing
tkatəb	he agreed in writing

etc.

The tableau 12 shows the optimal candidate according to the constraint ranking given:

Tableau 12 [næb]→ [njæb]

√njb [n $æ_{\mu 1} b_{\mu 2}$] /æ $_{plur}$	MAX-seg-IO	DEP-μ-OO	*μμμ]σ	DEP-seg-OO	**SON-HV**
a. 	*!				
☞ **b.** 				*	*j
c. 		*!	*	*	*j

The optimal candidate (12b) satisfies the higher-ranked constraint MAX-seg-IO, while the candidate (12a) fatally violates it, because one of its root consonants has disappeared. Candidate (12b) also satisfies the subsequent constraint DEP-μ-OO according to the heavy character of the singular syllable, whereas the candidate (12c) violates it, since its syllable is superheavy. We can thus conclude that candidate (12b) wins the faithfulness competition because it holds both the root structure of the input and the prosodic structure of the output.

To conclude this subsection, we have to clarify some points about the dependence constraint between the input and the corresponding outputs. According to McCarthy & Prince (1993a, 1995, 1999), the DEP family consists of a set of constraints that predict the prohibition of epenthesis. Now, the case of [njæb], herein discussed, refers to the reappearance of the glide. This glide, being a root segment endowed with a morphological affiliation, its reappearance cannot be taken for an epenthesis. Indeed, the explanation that we can offer to this phenomenon consists in saying that the existence of a so-called "surface form" endowed with a sort of "active memory" which reinterprets the underlying structures even after deletion/elision process. This is in a way the case of what is current in the most recent developments of the OT.

5.5 Moraic Binarity

In this section, we will try to shed light on one of the most salient aspects of our analysis relating to the requirement of foot binarity. It is a matter of seeing to what extent and in what way this major requirement of the prosody of the language is satisfied in singular bisyllabic forms, whose bisyllabicity emanates from the root and not from the addition of a suffix, such as was the case for the forms discussed in the previous section. Other types of forms will also be considered for comparison. Consider the following corpus:

(31)

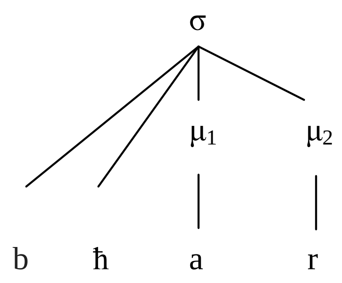
	Singular	**Boken Plural**	**Gloss**
a.	[ʃhar]	[ʃhor]	months
	[bħar]	[bħur]	seas
	[ħmar]	[ħmir]	donkeys
	[ɖarʂ]	[ɖroʂ]	teeth
	[lħæf]	[lħuf]	sheets
	[ʃɣul]	[ʃɣæl]	works
	[ʕurs]	[ʕræs]	weddings
	[χurʂ]	[χraʂ]	earrings
	[muχχ]	[mχaχ]	brains
	[kumm]	[kmam]	sleeves
b.	[læqəb]	[lqæb]	nicknames
	[ɽaʒəl]	[ɽʒæl]	men
	[ʂaħəb]	[ʂħæb]	friends
	[ʃæhəd]	[ʃhud]	witnesses
	[ʕæməl]	[ʕmæl]	works
c.	[ɽəmla]	[ɽmal]/[ɽməl]	sand
	[kəlma]	[klæm]	words

	[kədba]	[kdub]	lies
	[təfla]	[tfæl]	spit
	[ʃəʕba]	[ʃʕæb]	divisions
d.	[nəχla]	[nχəl]	palm-trees
	[nəħla]	[nħəl]	bees
	[ʕəlga]	[ʕləg]	leeches
e.	[ʕgiga]	[ʕgig]	beeds
	[wgida]	[wgid]	excrements

The data in (31a) are characterized by the occurrence of a full vowel that appears between the first and second or second and third roots in the form of the singular, the BP forms have a similar structure, with the difference in the quality of the morphemic vowel, and both singular and plural forms have triliteral roots. While in data (31b), the singular morphemic vowel chooses its site between the first and second roots, an epenthetic schwa breaks up the remaining consonants and thus builds a second syllable, and BP forms have a triliteral root.

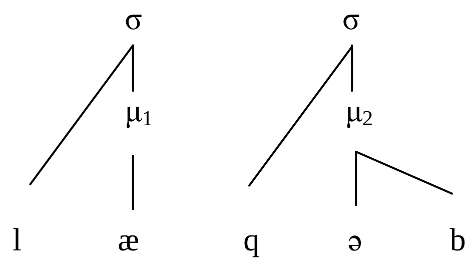
The data in (31a) have a rather heavy syllable, i.e. bimoraic, the singular vowel appears between the second and third roots. The latter is attached to the moraic coda of the syllable as shown in the following representation:

(32)



The data presented in (31b), meanwhile, report a singular bisyllabic form. That is, the vowel of the singular comes to grant itself a position between the first and the second root consonants, thus building a nuclear syllable [læ] for the prototype [læqəb]. The two remaining root consonants provide the ideal context for the insertion of the schwa, viz. [qəb]. Consider the following representation for explanation:

(33)

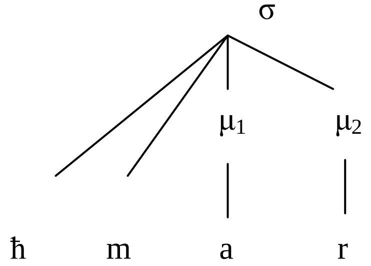


Two comparisons between the type of forms [bħar] and [læqəb] can be made, one external and the other internal. The former clearly shows that two options are chosen by the rules of word formation in SSA, for the generation of these forms. The first option concerns the singular where the vowel is **a** and/or **u** for all these forms. The second concerns the plural where we find that the majority of forms, even if they are minimal, choose an infix **a** to mark their BP. The difference lies in the choice of the position of the vowel and the number of syllables. We will see, a little further in this analysis, that this difference is only apparent under prosodic considerations. The latter comparison is that the singular [læqəb] proceeds by inserting the schwa, whereas the plural opts rather for the heaviness of the syllable. As for the [bħar]→[bħur], [ħmar]→[ħmir], …etc. correspondence, the opposition is marked by the quality of the vowel, an option that remains, in our view, mandatory [a]→[u, i].

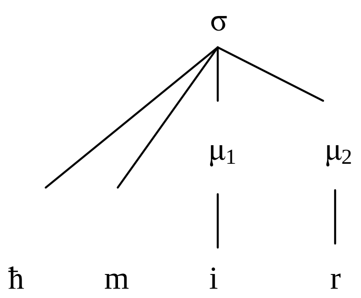
The following representations allow a better visualization of the optimal forms of the singular and the corresponding BP:

(34)

a.

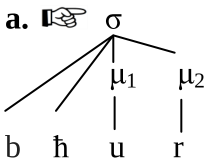
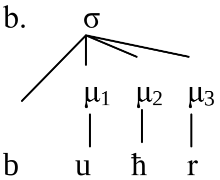
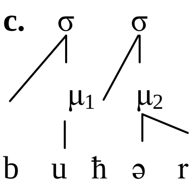


b.



The following tableau represents the hierarchy of constraints for the mapping [bħar] → [bħur]:

Tableau 13: [bħar] → [bħur]

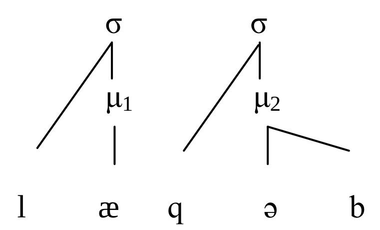
[bħa$_{\mu1}$r$_{\mu2}$] / u$_{plur}$	DEP-σ-OO	DEP-μ-OO	*μμμ]σ	DEP-seg-OO	ANCHOR-OO
a. ☞ 					
b. 		*!μ3	*		*** bħr
c. 	*!σ2			*ə	*** bħr

In examining this tableau, we find that the optimal candidate (13a) for BP's output is in perfect harmony with the singular form that serves as input, for it respects the monosyllabic structural character, the bimoraic character of the syllable, the quantity and segmental structure, and finally accounts for the prosodic anchoring. The other candidates meanwhile present violations of different natures. Candidate (13b) incurs a fatal violation of the constraint DEP-μ-OO because it develops an additional mora to house the second occurrence of a complex coda, i.e. (*μ_3 / DEP-μ-OO), resulting in fluctuations in prosodic anchors, i.e. (*b*ħ*r /ANCHOR- OO). Candidate (13c) fatally violates the constraint DEP-σ-OO by developing a whole syllable, i.e. (*σ2 / -DEP-σ-OO), following the insertion of the schwa, i.e. (*ə / DEP-seg- OO), which also generates a revision of the prosodic anchoring, all confused syllables, i.e. (*b*ħ*r / (ANCHOR-OO).

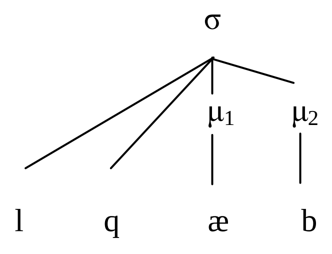
To sum up this analysis, we state exactly that the perfect correspondence between the bimoraic syllable of the singular and the bimoraic syllable of BP is, undoubtedly, preserved. In order to shed light on this notion of foot binarity, let us examine the representations of the pair [l**æ**qəb] → [lqæb].

(35)

a.



b.



Out of these two representations, we notice that the perfect harmony cannot be achieved, since the singular is bisyllabic whereas the BP is rather monosyllabic.

A constraint of the MAX family militates against the disappearance of constituents, i.e. responsible for prohibiting phonological deletion, requiring complete mapping in root-and-pattern morphology. It also militates against the simplification of the number of syllables.

This constraint is formulated as follows:

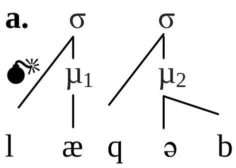
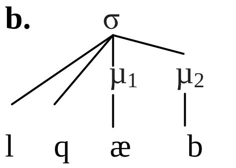
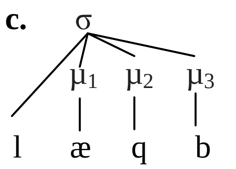
(36)

MAX-σ- OO

"Each syllable of the first output of a correspondence relation must have a correspondent in the second output."

In the following tableau, we consider the hierarchy underlying the [l**æ**qəb] → [lqæb] correspondence, reflecting the conflict of constraints discussed so far.

Tableau 14: [l**æ**qəb] → [lq**æ**b]

[$læ_{\mu1}qəb_{\mu2}$] /æ plur	MAX-σ-OO	DEP-μ-OO	*μμμ]σ	MAX-seg-OO	ANCHOR-OO
a. 					
b. 	*! σ2			*ə	*** lqb
c. 	*! σ2	*μ3	*	*ə	*** lqb

The hierarchy of constraints defended during this analysis, falling within the prosodic hierarchy, as represented in the UG, brings out the candidate (14a) as optimal, i.e. the candidate that is successfully analyzed, because it is extraordinarily faithful to the singular structure of this correspondence relation. The other candidates (14b) and (14c) have fatal violations of the constraint MAX-σ-OO (i.e. σ2 = 0 / MAX-σ-OO) because they reduce the number of their syllables.

One remark that can be made about the study of this tableau relates to the constraints of the MAX family, which ban deletion in structures put into correspondence relation, namely, the constraints MAX-σ-OO and MAX-seg-OO. The relation between the singular and the corresponding BP shows the disappearance of a syllable.

Indeed, we find that the hierarchy that we have defended so far is inadequate in the face of a relationship like the one we have at hand. It is, therefore, important to have recourse to a particular constraint governing the subject under study.

To this end, we make use of the "foot binarity" constraint developed in Prince & Smolensky (1993) and stated as follows:

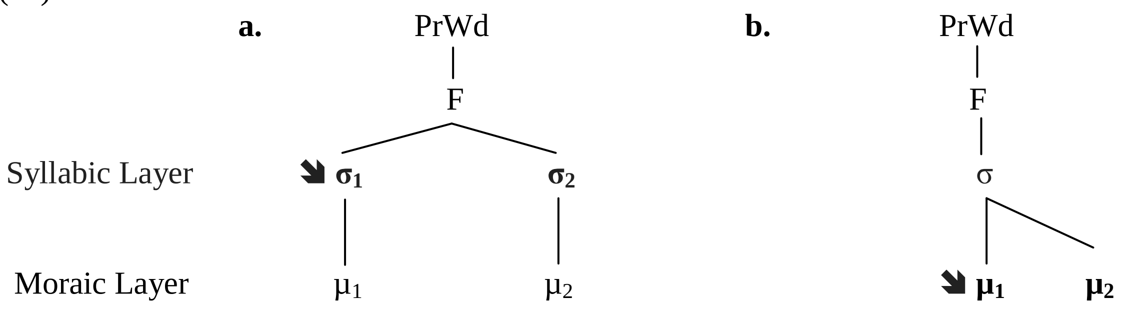
(37)

FOOT BINARITY (henceforth FT-BIN)
Feet are binary under syllabic or moraic analysis

The concept of Foot Binarity states that the prosodic feet must be binary on one of the two levels, viz. the syllabic or the moraic level, with the aim of underpinning the notion of "Minimal Word" (for details on the Bimoraic Minimality requirement in colloquial varieties of Arabic, see McCarthy and Prince 1990). According to the prosodic hierarchy, any instance of the "Prosodic Word" category must contain at least one foot. In other words, and by virtue of the principle of Binarity (Prince and Smolensky (1993)), each foot must be bimoraic or bisyllabic, and then each Prosodic Word is made up of at least two moras or two syllables.

The foot, and hence the Prosodic Word, is minimally bimoraic in quantity-sensitive languages, and minimally bisyllabic in quantity-insensitive languages. We suggest that FOOT-BINARITY be interpreted here under a moraic analysis, which basically means that a metrical foot consists of exactly two moras (μμ). As a result, a single heavy syllable (σμμ) constitutes a foot of its own, and two successive light syllables (σμσμ) pair up together to make one foot. Consider the following representations for explanation:

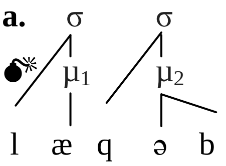
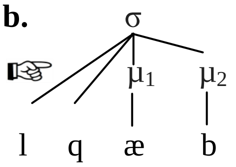
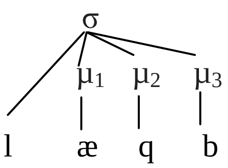
(38)



The feet represented by these trees are called rhythmic and binary. The former is of the type "Light-Light" **(σμσμ)**, i.e. [LL], while the latter is of the type "heavy" **(σμμ)**, i.e. [H].

The following tableau illustrates the interaction between the constraints related to binarity, viz. FT-BIN-μ which refers to the binary character of the syllable under moraic consideration, and FT-BIN-σ which refers to the binary character of the syllable under syllabic consideration.

Tableau 15: [læqəb] → [lqæb]

[$læ_{μ1}qəb_{μ2}$] / æ plur	FT-BIN-μ	FT-BIN-σ
a. 		
b. ☞ 		*
c. 	*!	*

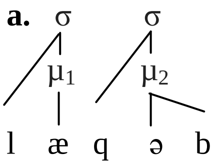
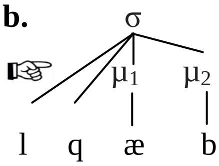
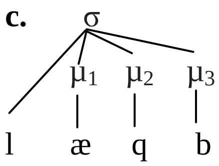
Even though Candidate (15a) is successfully analyzed, i.e. most faithful to the base form of this correspondence relationship, it cannot be chosen as optimal because, and following McCarthy & Prince (1993a), we postulate the existence of a dominance relation within the typology of iambic feet, in which a "heavy" [H] foot is more harmonious and more optimal than the "light-light" [LL] one. Hence, candidate (15b) succeeds to survive as the optimal form. This distinction is formulated as follows:

(39)

"heavy"	>	"light-light"
[H]	>	[LL]

Now, let's take an overview of the global hierarchy elucidated in the following tableaux:

Tableau 16: [læqəb] → [lqæb]

[læ$_{\mu1}$qəb$_{\mu2}$]/ æ $_{plur}$	FT-BIN-μ **[H]**	FT-BIN-σ **[LL]**	MAX-σ-OO	DEP-μ-OO	MAX-seg-OO	ANCHOR-OO
a. 	*!					
b. ☞ 		*σ2	*σ2		*ə	*** lqb
c. 	*!	*σ2	*σ2	*μ3	*ə	*** lqb

Candidates (16a) and (16c) are eliminated on the ground because they incur fatal violations of the highly-ranked constraint, namely, the constraint (FT-BIN-μ-[H]). In addition that the latter is separated by the decisive constraint (DEP-μ-OO), in the sense that it develops one additional mora to its structure, as opposed to the optimal candidate.

Tableau 17: [qərʕa] → [quruʕ]

[qər$_{\mu 1}$ʕa$_{\mu 2}$]/u $_{plur}$	FT-BIN-μ **[H]**	FT-BIN-σ **[LL]**	MAX-σ-OO	DEP-μ-OO	MAX-seg-OO	ANCHOR-OO
a. σ σ μ$_1$ μ$_2$ q ə r ʕ a	*!					
b. ☞ σ μ$_1$ μ$_2$ q r u ʕ		*σ2	*σ2		*ə	*** qrʕ
c. σ μ$_1$ μ$_2$ μ$_3$ q ə r ʕ	*!	*σ2	*σ2	*μ3	*ə	*** qrʕ

Candidates (17a) and (17c) incur fatal violations of the highly-ranked constraint, namely, the constraint (FT-BIN-μ-[H]) and as such they are eliminated on the ground . In addition that the latter is separated by the decisive constraint (DEP-μ-OO), in the sense that it develops one additional mora to its structure, as opposed to the optimal candidate.

5.6 Conclusion

Throughout this chapter, we have established the main objective of showing that the grammar based on correspondence relations makes it possible to report, in a more interesting way, the morphology of BP in SSA. We have shown that the central axis of this morphology is based on the moraic correspondence of the syllables targeted as the prosodic domain. Thus, we have established a hierarchy of constraints inscribed within the hierarchical prosodic grid, in the way that the strictly prosodic constraints take priority over the purely segmental constraints.

The global hierarchy was thus conceived as an instance of the EUM insofar as the constraints on the corresponding segments of the structure of the input-root are located at the highest level of the hierarchy, thus demanding a maximum faithfulness to the structure, e.g. MAX-seg-OO. The organization of the output structure, at least for this type of BP, is the perquisite of the constraints on the prosodic organization at different levels of the universal prosodic hierarchy, viz. feet (FT-BIN-μ, FT-BIN-σ), syllables (DEP-σ-OO, MAX-σ-OO), moras (DEP-μ-OO) and segments (SON-HV, GEM-INTEGR,).

In short, the hierarchy represented at the end of this study is as follows:

(40)

IO - FAITHFULNESS (MAX-seg-IO) >> PROSODIC CONSTRAINTS (FT-BIN-μ, FT-BIN-σ, MAX-σ-OO, DEP-σ-OO, DEP-μ-OO, **MAX-μ-**O-O,) >> OO - FAITHFULNESS (DEP-μ-OO, **MAX**μ-O-O, *μμμ]σ, DEP-seg-OO, DEP-OO-Glide, MAX-seg-OO, ANCHOR-OO)

In the following lattice, we summarize the grammar or ranking of the constraints adopted to offer an integrated analysis to the diverse shapes of broken plural in the Saoura Spoken Arabic:

(41)

MAX-seg-IO

FT-BIN-μ

FT-BIN-σ

MAX-σ-OO , DEP-σ-OO

DEP-μ-OO, MAX-μ-OO, *μμμ]σ

DEP-seg-OO , DEP-OO-Glide , MAX-seg-OO , ANCHOR-OO

SON-HV , NO-SPLIT/GEM-INTEGR

GENERAL CONCLUSION

CONCLUSION

SSA is one of the varieties of Algerian Arabic that has never been studied before. Therefore, this dissertation has been dedicated to the investigation of the phonology and morphology of SSA. Special attention has been given to the syllable structure, stress assignment and the morphology of the broken plural. The proposed analysis of these aspects has been couched within the framework of Optimality Theory, making use of a number of independently motivated constraints. We therefore set ourselves the general objective of studying the interaction of these constraints within the OT framework.

We began, first, by describing the dialect and giving historical, economic, social and linguistic information about the Saoura region. Once the linguistic situation and the basic phonology and morphology were determined, we moved to the presentation of the data of the corpus on which our analysis would be based. A classification was adopted, dictated, on the one hand, by the nature of the lexicon studied and, on the other hand, by that of the problems raised. Thus, we divided our corpus according to the chosen morphology, viz. the morphology of the BP of triliteral forms. They raised the problem of prosodic organization difference.

Chapter two was devoted to the presentation of the theoretical framework that served as a backdrop to our analysis, viz. the framework of the Optimality Theory. We have made a presentation of its founding principles, relating to the enhancement of the role of constraints and their interaction in general linguistic theory. Different theoretical modules have been in the spotlight: Prosodic Morphology and Correspondence Theory.

In chapter three we have dealt with SSA syllable structure, and therein we have distinguished a minor syllable from a major syllable, i.e. a minor syllable with a moraic consonant, and a major syllable, whose nucleus includes either a schwa or one of the other vowels of the language. Minor syllables appear to eschew fatal violations of the constraint *COMPLEX, prohibiting branching codas and onsets. The moraification of a minor syllable allows for the satisfaction of the constraint FT-BIN, particularly triliteral words with the patterns CCV, CCəC and CəCC, in which the first consonant of the initial cluster in CCV, CCəC and the second consonant of the final cluster in CəCC are associated to a minor syllable.

Furthermore, the current analysis has allowed us to explain the cases of schwa epenthesis maintaining that this schwa insertion in triliteral nouns is largely dependent on the sonority of the neighbouring consonants. Particulary, it has been shown that the placement of the schwa between the last two consonants in triconsonantal verbs and adjectives, i.e. in CCəC, derives from the constraint ALIGN-R (Vb/Adj, σ'), requiring stem-prominent syllable right-alignment, thus producing an iambic foot type. This verb- and adjective-specific alignment constraint must outrank the general stem-prominent syllable right-alignment constraint ALIGN-R-σ', needed to account for iambicity in nouns, verbs and adjectives. In both cases, a minor syllable can never occur in a prominent position because of the undominated constraint *Min-σ'.

We have shown that in order to account for nominal schwa syllabification, reference has to be made to a set of markedness constraints favouring schwa syllables with a higher sonority coda. Since these markedness constraints are noun-specific, they must outrank the general stem-prominent syllable right-alignment constraint in order to account for nominal cases which have the pattern CəCC, in which the schwa is inserted before the second consonant, thus leading to a noun whose right syllable is minor.

In chapter four, stress assignment rules in SSA were comprehensively investigated. We have provided a clear and principled account of the stress system of SSA by undertaking a quantitative study which has enabled us to quantify the results of the native speakers' intuitions about the position of stress. The results obtained from the quantitative test about words in isolation confirm to a large extent that the language is quantity-sensitive with stress placed on the ultimate syllable, if it is heavy, otherwise on the penultimate. We have provided an OT account based on the idea that trochaic feet take precedence over iambic ones, and this by ranking the constraint TROCHAIC higher than IAMBIC. We have shown that the location of stress and consequently the foot types depend on the nature of the organization of the prosodic words.

Within a single prosodic word, the foot type that surfaces as optimal is trochaic with stress placed on the ultimate or penultimate syllable. Penultimate stress is derived by positing the constraint NON-FINALTY (σ', PrWd), requiring that the prominent syllable be non-final within a prosodic word. It has also been shown that restricting stress to the last two syllables of a word results from the undominated constraint ALIGN-R (Ft', PrWd), requiring right-alignment of the PrWd and the prominent foot. Since this constraint is undominated, we have been led to recognize a trochaic foot of the type (HL) which violates RH-HARM and an iambic foot of the type (L) which violates FT-BIN; both types occur word-finally.

Chapter five devoted itself to the analysis of the morphology of BP. The triliteral root forms were the first to hold our attention. We have focused on the Mora Correspondence as a guideline to our analysis. The culminating point of our argument was to defend the hypothesis that the mora constituency of the target syllable of BP is tributary, except under more restrictive conditions, that of the form of the corresponding singular. We thus raise our hierarchy gradually to reach a higher level in the prosodic hierarchy, viz. the syllable. The question integrity of geminate consonants also emerged as a salient aspect to our study. It has been established that the condition of geminates integrity can be violated to satisfy more striking constraints of the prosody-morphology interface. Other constraints on the segmental structure have also been relegated to the rank of constraints dominated by the prosodic constraints, which is the constraint related to the intrinsic sonority of segments. The top of the prosodic hierarchy was reached by the implementation of foot binarity on the moraic level as a top-level constraint in the hierarchy.

Throughout this dissertation, we have tried to show that the analysis couched within the framework of OT and CT is able to elegantly capture the intricacies of SSA syllable structure, stress assignment and the broken plural without too many special stipulations, i.e. the most appropriate for the treatment of syllable structure and stress as cases related to SSA prosodic phonology, and the treatment of broken plural as cases related to SSA prosodic morphology. It has been argued that this framework allows for a better understanding of these cases in terms of the interaction of constraints pertaining to Universal Grammar and ranked on a language-specific basis. Constraint interaction takes the form of conflict. It has been shown that lower-ranked constraints are allowed to be violated for the sole purpose of securing higher order constraints which determine the optimal shape of the output.

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APPENDICES

Appendix A

The Constraints Listed in the Dissertation

The constraints needed to account for the prosodic phonological and morphological aspects of the Saoura Spoken Arabic dealt with in this dissertation are listed below:

ALIGN-R
The right edge of the root must be aligned with the right edge of the syllable

ALIGN-R-Maj-σ
The right edge of the stem must align with the right edge of a major syllable

ALIGN-R (Ft, PrWd)
The right edge of every foot must be aligned with the right edge of the prosodic word

ALIGN-R (Ft', PrWd)
The right edge of the prominent foot must be aligned with the right edge of the PrWd.

ALIGN-R-σ′
The right edge of the stem must be aligned with the right edge of the prominent syllable

ALIGN-R (V/Adj, σ′)
The right edge of the verb/adjective stem must be aligned with the right edge of the prominent syllable.

ANCHOR-OO [initial, final, head]
Where two strings S1 and S2 are in an O-O correspondence relation and S1 is the base and S2 the affiliate of that correspondence relation, a syllable-initial/final/head segment belonging to S2 must correspond to a syllable-initial/final/head segment belonging to S1.

***CODA - NO-CODA - *C]σ**
Syllables must not have codas/syllables are open

***COMPLEX-MARGIN (*COMPLEX)**
Codas and onsets must not branch

***COMPLEX$_{\text{CODA}}$**
A syllable must not have more than one coda segment

***COMPLEX$_{\text{ONS}}$**
A syllable must not have more than one onset segment

DEP-IO
Every segment in the output has a correspondent in the input

DEPμ-OO.
Every mora in S2 must have a correspondent in S1

DEPσ-OO.
Every syllable in Output 2 must have a correspondent in Output 1

FT-BIN
Feet are binary under syllabic or moraic analysis

FT-BIN-μ
Feet are binary under moraic analysis

FT-BIN-σ
Feet are binary under syllabic analysis

GEM-INTEG
Geminates are inseparable (a vowel cannot be inserted into a geminate)/
Identical segments in the input remain identical in the output

IAMBIC
Feet are right-headed (i.e., align the head-syllable with its foot on the right edge)

MAX-IO
Every segment in the input has a correspondent in the output

MAX-RC
All root consonants of the input must be preserved in the output

MAX-seg-IO
Every segment of the input must have a correspondent in the output

MAX-σ- OO
Each syllable of the first output of a correspondence relation must have a correspondent in the second output

***Min-σ**
Minor syllables are prohibited

***Min-σ′**
Prominent minor syllables are prohibited

NON-FINALITY (σ', PrWd)
The prosodic head of the word does not fall on the word-final syllable.

NO-SPLIT
Geminates must not split (epenthesis cannot apply to geminates)

NUC
Each syllable must have a nucleus

NUC-H
A higher sonority nucleus is more harmonic than a lower sonority one

ONS - ONSET - $^*[_\sigma$ V
Syllables must have onsets

PARSE-seg
Every segment must belong to a syllable

PARSE-SYL
Syllables must be parsed into feet

SON-HV
A HV whose index is equal to 7 on the sonority scale is better interpreted as a vowel

TROCHAIC
Feet are left-headed (i.e., align the head-syllable with its foot, on the left edge)

RH-HARM
Feet of the type HL are banned on the basis of rhythmic structure

WSP
Heavy syllables are stressed /A heavy syllable is stressed in foot structure.

Appendix B

The Quantitative Test

The Questionnaire

This questionnaire is undertaken in the framework of a research study whose objective is to determine the placement of stress in the Saoura Spoken Arabic. Please answer the questions below. Thank you for your contribution.

A)- Phonetic Transcription and Transliteration Symbols used in this Study

1- Voiced Dental Emphatic Stop	/ ḑ /	→	[ḑalma]	→	darkness
2- Voiceless Dental Emphatic Stop	/ ţ /	→	[ţbiib]	→	doctor
3- Voiced Uvular Stop	/ q /	→	[qunn]	→	rabbit
4- Voiced Laryngeal Stop	/ ʔ /	→	[ʔamr]	→	order
5- Voiceless Alveolar Emphatic Fricative	/ **ş** /	→	[şabr]	→	patience
6- Voiceless Uvular Fricative	/ χ /	→	[χatəm]	→	ring
7- Voiced Uvular Fricative	/ ɣ /	→	[bɣəl]	→	mule
8- Voiceless Pharyngeal Fricative	/ ħ /	→	[ħabs]	→	prison
9- Voiced Pharyngeal Fricative	/ ʕ /	→	[ʕaḑḑ]	→	bite
10- Voiced Alveolar Emphatic Fricative	/ ʐ /	→	[ʐrag]	→	blue

11- Short vowels / **ɪ**, **u**, **a, ə /**

12- Long vowels / **ii** , **uu** , **aa** /

B)- Fill in the form

FIRST NAME:

LAST NAME:

GENDER: Male □ Female □

DATE OF BIRTH:

PLACE OF BIRTH:

OCCUPATION:

HAVE YOU TAKEN ANY LINGUISTICS COURSES?

Yes □ No □

IF YES, FOR HOW LONG?

C)- Place **stress** (ˈ) on the syllable you perceive as prominent in the following items. Syllable boundaries are marked by a period.

Disyllabic Words		Trisyllabic Words		Polysyllabic Words	
Items	Gloss	Items	Gloss	Items	Gloss
ʕar.bun	*under payment*	**gal.bɪn.hum**	*they reversed them*	**bu.fər.ʈəʈ.ʈu**	*butterfly*
ktəl.hum	*he killed them*	**msam.ħɪn.kum**	*we forgive you*	**fər.rəħ.na.hm**	*we pleased them*
ʂar.ħək	**he told you the truth**	**ʃuf.na.hum**	we saw them	**məd.dɑ.ri.jaat**	eye glasses
ɖar.ba	*hit*	**klɪ.na.hum**	*we ate them*	**nət.wəs.səd.ha**	*we use it as a cushion*
sa.rut	*key*	**kər.da.hum**	*he bought them on credit*	**ka.nət.wəs.səd.ha**	*I use it as a cushion*
dəf.fəg	*he spilled*	**sər.qət.hum**	*she stole them*	………………….	………………
χæ.təm	*ring*	**səb.gat.nɪ**	*she outran me*	………………….	………………
gəm.la	*louse*	**gul.na.ha**	*we said it*	………………….	………………
mi.na	*bomb*	**ʕʈɪ.na.hu**	*we gave them*	………………….	………………
naʕ.sɪːn	*asleep (pl.)*	**χən.bu.ʃa**	*beetle*	………………….	………………
ʃaaf.kum	*he saw you*	**sar.dɪ.na**	*sardine*	………………….	………………
fək.ruun	*tortoise*	**jər.fəd.ha**	*he takes it*	………………….	………………
za.ʕiim	*boss*	**jəb.ɣɪ.na**	*he loves us*	………………….	………………
msɑ.kiin	*poors*	**χər.bʃu.ha**	*they put it into disorder*	………………….	………………
mnæ.gəʃ	*earrings*	**fa.rɪ.na**	*flour*	………………….	………………

ʃka.ra	*sack*	**səʕ.da.tək**	*lucky you*	………………….	………………
fa:.jəq	*awake*	**tta.ʂəl.na**	*we called*	………………….	………………
χwæ.təm	*rings*	**məʂ.ʂəl.ħa**	*a broom*	………………….	………………
sni.tra	*guitar*	**rəb.baa.təh**	*she brought him up*	………………….	………………
mər.fəg	*elbow*	**bar.ku.kəs**	*a kind of kouskous*	………………….	………………
ka.faħt	*I struggled*	**ləm.næ.gıʃ**	*earrings*	…………………….	………………
ʃər.rəgt	*I tore*	…………………….	…………………….	…………………….	………………
bəʃ.kı:r	*A large towel*	…………………….	…………………….	…………………….	………………
fər.fər	*fly*	…………………….	…………………….	…………………….	………………

"حساب نظري أمثل لعلم الأصوات والتشكيلات اللغوية للغة العربية المنطوقة في الساورة"

ملخص

الدراسة الحالية عبارة عن تحقيق في علم الأصوات والتشكيل لمجموعة متنوعة من العربية الجزائرية. هذا هو التنوع الذي يتحدث به سكان بشار والقرى القريبة من هذه المدينة والقرى الواقعة على طول وادي الساورة ، والتي يشار إليها من الآن فصاعداً باسم العربية المنطوقة في الساورة Saoura Spoken Arabic (SSA). الهدف الرئيسي من هذه الأطروحة هو دراسة بعض جوانب علم الأصوات والتشكيل الإيقاعي لـ SSA ، والتي تمت صياغتها في إطار نظرية المثلى (OT) ونظرية المراسلة (CT). جوانب علم الأصوات الصوتية المدروسة هي بنية المقطع ونظام الإجهاد. أما بالنسبة لجانب التشكل البروزوديي الذي تم معالجته ، فهو مورفولوجيا جمع التكسير (BP) للأشكال الثلاثية. تم تطبيق المبادئ الأساسية لـ OT على المناطق التي يتفاعل فيها علم التشكل والعروض. ضمن نموذج OT لمورفولوجيا Prosodic ، يأخذ التفاعل شكل هيمنة القيد ، حيث يكون للقيود المشكّلة جيداً الأولوية على المتطلبات المورفولوجية. في CT ، يُنظر إلى الإخلاص على أنه مجموعة من القيود على علاقات المراسلات بين المدخلات والمخرجات. يُقال أن الجوانب العرضية مثل بنية المقطع ونظام الإجهاد والجوانب المورفولوجية مثل جمع التكسير (BP) يتم فهمها بشكل أفضل على أنها حالات تنطوي على تفاعل بين نوعين من القيود العالمية المتضاربة ، وهي قيود التمييز وقيود الإخلاص. يتضح أنه يجب التمييز بين نوعين من المقاطع: مقطع لفظي ثانوي ومقطع لفظي رئيسي ، أي مقطع لفظي صغير بحرف ساكن موراكي ، ومقطع رئيسي ، تشتمل نواته إما على schwa أو أحد أحرف العلة في لغة. يوفر الإطار التحليلي الذي تم تصوره هنا فهمًا شاملاً لنظام الإجهاد في SSA والذي يظهر أقدام trochaic. يتضح أن القواعد المبنية على علاقات المراسلات تجعل من الممكن الإبلاغ بطريقة أكثر تشويقًا عن مورفولوجيا BP في SSA. يتضح أيضًا أن المحور المركزي لهذا التشكل يعتمد على المراسلات الموروثة للمقاطع المستهدفة كمجال عرضي ، وبالتالي ، إنشاء تسلسل هرمي للقيود المدرجة داخل الشبكة العرضية الهرمية ، بمعنى أن القيود العرضية الصارمة تأخذ الأولوية على القيود القطاعية البحتة. الهدف النهائي في الأطروحة الحالية هو استغلال الأدوات الأساسية المتاحة في إطار عمل التكنولوجيا التشغيلية لتحليل الجوانب المذكورة أعلاه من علم التشكل والعروض بشكل مناسب. يعني تحقيق هذا الهدف تحركًا مهمًا نحو إنشاء قواعد نحوية فردية لـ SSA بناءً على إعادة ترتيب مجموعة من القيود العالمية القابلة للانتهاك.

الكلمات المفتاحية: نظرية المثلى ، نظرية المراسلات ، مراسلات مورايك ، مقطع لفظي ، الضغط ، الجمع المكسور ، العربية المنطوقة في الساورة.