The Phonology of Ma'ani Arabic: Stratal or Parallel OT

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DEDICATION

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ABSTRACT

Accounting for the phonology of Ma’ani Arabic, a JA dialect that has never previously been studied, and supporting the superiority of Stratal Optimality Theory over other parallel Optimality Theory models, i.e. classic, Sympathy and Correspondence, are the main purposes of this dissertation. This dissertation is dedicated to the investigation of the phonology of Ma’ani Arabic. Special attention is given on stress assignment, vowel epenthesis, syncope, geminates and the interaction of these processes.

Authentic examples from Ma’ani Arabic and other Arabic dialects show that the interaction of phonology and morphology is inevitable. In chapter three, the transparent stress assignment rules is comprehensively investigated and accounted for.

Segment epenthesis is investigated in chapter four, where two types are identified, i.e. lexical and postlexical. Prosthetic /ʔi/, which is inserted before the imperative form, and the epenthetic vowel /i/, which breaks sequences of four medial consonant clusters, are lexical. The epenthetic /i/, which breaks medial three consonant clusters and final antisonority clusters, is postlexical.

The dissertation addresses syncope and vowel shortening in chapter five. It is argued that the high short vowel deletion is a lexical process that takes place at both the stem and word levels. Vowel shortening in open and closed syllables takes place at the stem level only.

An account is developed in chapter six to explain the nature of geminates in Ma’ani Arabic. It is argued that there are two types of geminates in Arabic, i.e. true and fake geminates. True geminates are underlyingly moraic, while fake geminates

are sequences of identical consonants which result form a constraint that prohibits high short vowels between identical consonants.

Ma'ani Arabic is compared to other Jordanian dialects and to other neighbouring dialects through out this dissertation. When certain phonological phenomena are active in Ma'ani and other Arabic dialects, this dissertation tries to uncover the underlying reasons especially when these phenomena behave differently in one of the dialects.

Finally, chapter seven summarises the main outcomes of the current dissertation and gives some recommendations for future research.

TABLE OF CONTENTS

List of Symbols and abbreviations

'	Stress
!	fatal constraint violation
∅	null element
✦	selector constraint
❁	sympathetic candidate
*	ungrammatical form or constraint violation
/ð̣/	emphatic voiced dental fricative
/ḍ/	emphatic voiced alveodental stop
/ġ/	voiced velar fricative
/ḥ/	voiceless pharyngeal fricative
/ṛ/	emphatic voiced alveolar flap
/ṣ/	emphatic voiceless alveolar fricative
/ṭ/	emphatic voiceless alveodental stop
|	stem boundary
☞	optimal candidate
ā	Long low vowel[♣]
AJ	Ajluuni Arabic
AM	Ammani Arabic
BHA	Bani Hasan Arabic
C	consonant
Con	constraint
dotted line or ,	non-ranking
ē	Long mid vowel[♣]
ERR	End Rule Right
Eval	evaluator
F	foot
f.	feminine
Gen	generator
H	heavy syllable

[♣] This symbol is only used in transliterations.

Ḥ	voiceless pharyngeal fricative♣
JA	Jordanian Arabic
KA	Karki Arabic
L	light syllable
LP	Lexical Phonology
m.	masculine
MA	Ma'ani Arabic
MSC	Morpheme Structure Constraint
MSD	Minimal Sonority Distance
NJA	Northern Jordanian Arabic
OCP	Obligatory Contour Principle
O-O	output-output relations
OT	Optimality theory
pl.	plural
PrWd	prosodic word
ROTB	Richness of the Base
S	syllable
s.	singular
SA	Standard Arabic
SCC	Strict Cyclicity Condition
solid line or >>	dominance relationship
SPE	Sound Pattern of English
SSP	Sonority Sequencing Principle
V	Vowel
X	Timing slot
μ	mora
σ	syllable

List of Constraints

***[ʔC**

Complex onset cannot begin with a glottal stop.

***3$_{\mu}$**

No trimoraic syllables.

***CC-**

Word initial consonant clusters are not allowed.

***CLASH**

Adjacent prominent syllables are prohibited.

***CODA**

Syllables must not have codas.

***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.

***FINAL-C-μ**

Word-final coda consonant is weightless.

***GRIDSTRUC**

Do not have grid marks.

***i$_{[CiCi]\text{MORPH}}$**

No high short vowel is allowed between two identical consonants in the same morpheme.

***i]σ**

High short unstressed vowels in open syllables are not allowed.

***LIGHT$_{\sigma}$**

Assign one violation mark for any sequence of more than three successive light syllables.

***MORA$_{[V]}$**

No mora is associated with a vowel.

***PrWd**

A prosodic word is minimally bimoraic.

***SHORTENING-$_{\text{V[LONG CLOSED]}}$ (*SHORT)**

No shortening is allowed in long closed syllables.

***VVC-**

Nonfinal long closed syllables or long open syllables which are followed by a moraic consonant are not allowed.

ALIGN (Hd-σ, Ft, L)
Align the head syllable with the left edge of the foot.

ALIGN (Hd-σ, Ft, R)
Align the head syllable with the right edge of the foot.

ALIGN (Stem, R; PrWd; R)
The right edge of the stem must coincide with the right edge of the PrWd.

ALIGN-APP Align (Applicative, Left; Light Syllable, Right)
The left edge of the applicative morpheme must coincide with the right edge of a light syllable.

ALIGN-L Align (Stem, L, PrWd, L)
The left edge of each stem coincides with the left edge of a PrWd.

CONTIGUITY-IO
The portion of S_1 standing in a correspondence forms a contiguous string as does the correspondent portion of S_2. (No medial epenthesis or deletion of segments)

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

FTBIN
Feet are bimoraic.

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

IDENT-STRESS
If α is stressed, then *f* (α) must be stressed. where *f* is the correspondence relation between input (lexical) and output (surface) strings of segments.

LICENSE-μ
A mora must be affiliated with a syllable.

LICENSE-$_C$
A segment must be licensed by a syllable or mora.

LINKFAITH
If the number of syllable positions linked to S_I = n, and S_I R S_O, then the number of syllable positions linked to S_O = n.

MAX-$_\mu$-IO
Every mora in S_1 has a correspondent in S_2. (no deletion of moras)

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

MAX-IO$_{[C\text{-}STEM]}$

Every consonant of the stem in the input has a correspondent in the output.

MAX-IO['V]

Stressed vowels of the input have correspondent in the output.

MAX-IO$_{V[LONG]}$

Assign one violation mark for every long vowel that undergoes shortening.

NONFINALITY

No head of PrWd is final in PrWd.

NOSHAREDMORA (*SHARED-$_{\mu}$)

Moras should be linked to single segments.

NUC

Syllables must have nuclei.

ONS

Syllable must have onsets.

PARSE$_{\sigma}$

All syllables must be parsed into feet.

PARSE-2

One of two adjacent stress units must be parsed by a foot.

PARSE-2-R

One of two adjacent stress units at the right edge of the word must be parsed by a foot.

RIGHT-ANCHORING-IO (RT-ANCHOR)

Any element at the designated periphery of S_1 has a correspondent at the designated periphery of S_2. (No epenthesis or deletion at the right edge)

RIGHTMOST

The right most foot of the word is the head.

SONORITY SEQUENCE (SONSEQ)

Coda clusters with rising sonority are not allowed.

WEIGHT-BY-POSITION (WBP)

Coda consonants are moraic.

WEIGHT-TO-STRESS-PRINCIPLE (WSP)

Heavy syllables are prominent both on the grid and foot structure.

ςς=σ

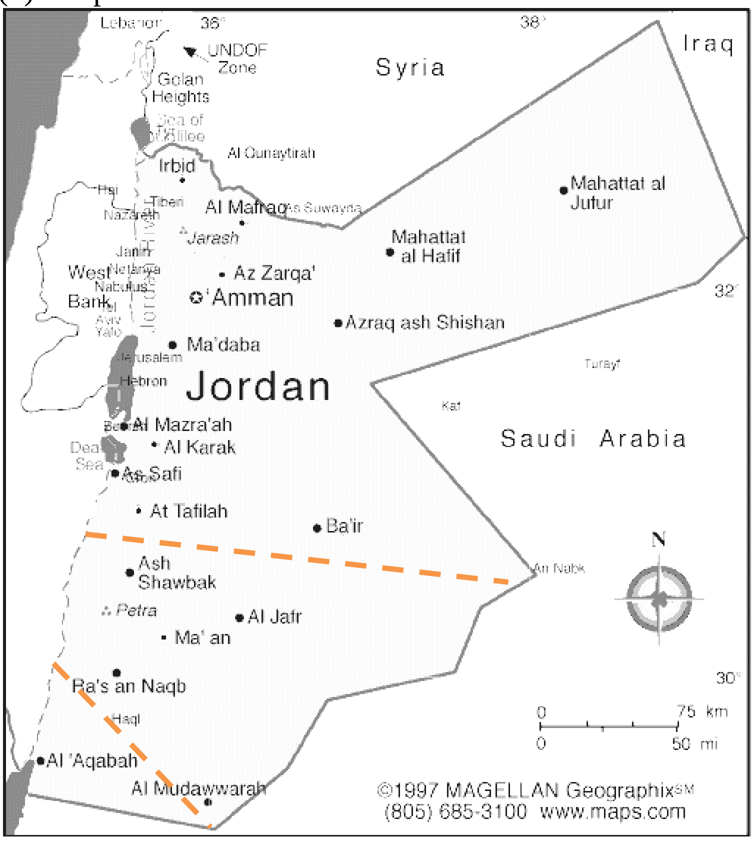
Two adjacent semisyllables must form a major syllable.

1 Introduction

1.1 Locality

The province of Ma'an is located about 216 km south of Amman, the capital of the Hashemite Kingdom of Jordan. The dotted lines on the map below roughly indicate the borders of the province of Ma'an. The eastern and southeastern borders of Ma'an form part of the borders between Jordan and Saudi Arabia, as can be seen in (1) below. The western border of Ma'an forms part of the western border with Palestine. The province of At-Tafilah and the province of El-Karak are located north of Ma'an, while the province of Al'Aqabah forms the southern and the southwestern borders.

(1) Map of Jordan



Ma'an has a long history, which is beyond the scope of this study. However, I will briefly point out some of the major historical events affecting the region. In the period between 200 BC and 1300 BC, the area which is known nowadays as Ma'an, Al'Aqabah and Wadi el-Ḥisa was called Sa'iir which was inhabited by the Edom. In the eighth century BC the Assyrians conquered Sa'iir until 580 BC. After the decline of the Assyrian civilization the Nabataeans took over until 106 AD. In the seventh century AD Muslims took over and since then it has been ruled by Muslims. During the time of the Ottoman Empire, Ma'an flourished as it became the most important town on the Pilgrimage Route to Mecca.

Burckhardt[1] (1784-1817), Wallin[2] (1811-1852) and Musil[3] (1868-1944) are three of the pioneer oriental scholars who visited Ma'an and recoded what they saw and heard about the area. Burckhardt, the most important traveller among them, went to Syria where he learned Arabic and then started his journey which led him to discover Petra, part of the province of Ma'an. He then visited Ma'an and mentioned that it was the only fully inhabited town on the Pilgrimage Route whose inhabitants were literate. He then described the city, saying that it was built on two hills which divide the people into two divisions.

The two hills, namely: Ma'ān al-Ḥijāziyyih and Ma'ān iš-Šāmiyyih are still recognised as such today. The people who live in Ma'ān al-Ḥijāziyyih are assumed to be originally from al-Ḥijāz, while those who live in Ma'ān iš-Šāmiyyih are assumed to be originally from Syria. However, other families who emigrated from Hebron and Gaza also settled in Ma'an because of its location on the Pilgrimage Route and also as many of them were merchants. Ma'an has a special relationship

[1] Johann Ludwig Burckhardt (1784-1817) was a Swiss who disguised himself as a Muslim. Some scholars think that his conversion to Islam is sincere. As a Muslim he named himself Sheikh Ibrahim Ibn Abdallah and then he visited Mecca.

[2] Georg August Wallin (1811-1852) was a Finnish explorer who visited Ma'an in his journey to the pilgrimage sites in 1846.

[3] Alois Musil (1868-1944) began his first journey to Jordan where he discovered Amra and Tuba, two Omayyad castles. He described Ma'an and said that the period between 1893 and 1915 is the golden era for Ma'an.

with Syria, especially after it was linked to Damascus by railway in 1904. This had a profound impact on the lives of people in Ma'an.[4]

The above information about the origins of the families who live in Ma'an helps the author establish why old people in the city of Ma'an say their fathers were able to tell if a certain person was from Maʻān al-Ḥijāziyyih or Maʻān iš-Šāmiyyih without being informed about the man's name or origin. Some of these old people say 'when a man speaks our fathers were able to tell where that man was from,' and then adding 'nowadays one cannot tell the difference'. As a phonologist, the author understands from this statement that there were phonological differences between people of Maʻān al-Ḥijāziyyih and people of Maʻān iš-Šāmiyyih which no longer exist. The author urges those old men to describe the way in which their fathers and grandfathers were able to tell the difference. Although answers were not always clear, it seems that people of Maʻān iš-Šāmiyyih allow coda consonant clusters while those of Maʻān al-Ḥijāziyyih do not. However, this observation cannot be taken for granted. Although the two hills are still inhabited the city is no longer separated and people no longer live according to where they are originally from. Nowadays in modern Ma'an, however, it is very difficult to spot any phonological differences between people of Ma'an as a city rather than a province. Finally, Ma'ani Arabic cannot be studied apart from other Jordanian dialects. Accordingly, references to other Jordanian dialects will be made where necessary throughout this thesis.

1.2 The Dialect under Investigation

Jordanian Arabic dialects, henceforth referred to as JA, belong to Levantine Arabic varieties spoken in what was known as Greater Syria. JA has three main dialects: the

[4] Most of the families who emigrated from Syria to Ma'an were there decades before the opening of the railway in 1904.

bedouin, the urban and the rural (Al-Sughayer, 1990 and Sakarna, 1999). Furthermore, each variety of JA has its own subset of dialects. According to Sakarna (1999) there are five different bedouin JA dialects that have been studied by scholars. Theses include the dialect of the Bani Hasan tribe (Irshied, 1984; Irshied and Kenstowicz, 1984), the dialect of the Bani Saxar tribe (Palva, 1980), the dialect of the Al-Ajarma tribe (Palva, 1976), the dialect of the Bduul tribe (Bani Yasin and Owens, 1984), and the Dialect of the Ḥwēṭāt tribe (Palva, 1986). In addition, the sixth bedouin dialect is the dialect of the Aabady tribe which has been studied by Sakarna (1999). Urban dialects, moreover, are those which are spoken by city-dwellers. Urban Jordanian dialects share some similarities with other urban Arabic dialects spoken in Syria and the Lebanon (Ibrahim, 1984). In Jordan, urban dialects are mainly spoken in Amman. Rural dialects, on the other hand, are spoken by farmers who live in the countryside in the north of the country. These dialects 'share a lot of similarity with the ḥawran dialect which is spoken in southern Syria' Al-Sughayer (1990). However, the literature on JA lacks clear classification of the dialects spoken in southern Jordan, such as Karaki Arabic, At-Tafilah Arabic, Al'Aqabah Arabic and Ma'ani Arabic. As far as I am aware, no studies have been conducted on these dialects, except on Karaki Arabic which has been phonologically addressed by Btoosh (2006). According to the classification of JA dialects, the author believes that the one under investigation here, namely, Ma'ani Arabic, henceforth MA, is best classified as one of the rural dialects which are spoken in southern Jordan, since the similarities that can be found between MA and other rural dialects are more than those between MA and bedouin and or urban dialects[5].

[5] Classification of JA dialects is beyond the scope of this dissertation.

To sum up, MA, which is spoken in the city of Ma'an, belongs to Levantine Arabic varieties and to rural JA dialects. However, MA distinguishes itself from other JA dialects in many aspects. These will be pointed out where necessary, over the course of this thesis.

1.3 Consonant Inventory in MA

MA has twenty-seven consonants which can be classified as seven Stops (/b, t, d, k, g, ʔ and the emphatic ṭ/), fourteen Fricatives (/f, θ, ð, s, z, , ʃ, x, ġ , ḥ, ʕ, h and the emphatics ð̣ and ṣ/), one Affricate (/dʒ/), two Nasals (/m and n/), one Lateral (/l/), one Flap (/r/) and two Glides (/w and j/). These phonemes are introduced in table (2) below where voiceless consonants are on the left side of each column and voiced ones are on the right side.

(2) Ma'ani Arabic Consonant Inventory

Place / Manner	Bilabial	Labiodental	Dental	Alveodental	Alveolar	Alveopalatal	Palatal	Velar	Pharyngeal	Glottal
Stops	b			t d				k g		ʔ
Emphatic Stops				ṭ						
Fricatives		f	θ ð		s z	ʃ		x ġ	ḥ ʕ	h
Emphatic Fricatives			ð̣		ṣ					
Affricates						dʒ				
Nasals	m				n					
Lateral					l					
Flap				r						
Glides	w						j			

MA consonant inventory differs from other consonant inventories in JA in many aspects. Consider the table in (2) below which compares some JA dialects to MA and standard Arabic (SA).

(2)

	SA	MA	ʕA	BHA	AJ
Stops	b, t, d, k, g, q, ʔ	b, t, d, k, g, ʔ	b, t, d, k, g, ʔ	b, t, d, k, g, ʔ	b, t, d, k, g, q, ʔ
Emphatic Stops	ṭ, ḍ	ṭ	ṭ	ṭ, ḍ	ṭ, ḍ
Fricatives	f, θ, ð, s, z, ʃ, x, ġ, ḥ, ʕ, h	f, θ, ð, s, z, ʃ, x, ġ, ḥ, ʕ, h	f, θ, ð, s, z, ʃ, x, ġ, ḥ, ʕ, h	f, θ, ð, s, z, ʃ, x, ġ, ḥ, ʕ, h	f, θ, ð, s, z, ʃ, x, ġ, ḥ, ʕ, h
Emphatic Fricatives	ð̣, ṣ	ð̣, ṣ	ð̣, ṣ	ð̣, ṣ	ð̣, ṣ
Affricates	dʒ	dʒ	tʃ, dʒ	tʃ, dʒ[6]	tʃ, dʒ
Nasals	m, n	m, n	m, n	m, n	m, n
Liquids	l, r	l, r	l, r	l, r	l, r
Emphatic liquids			ṛ	ṛ	ṛ
Glides	w, j	w, j	w, j	w, j	w, j

SA= Standard Arabic, MA= Ma'ani Arabic, ʕA= Abbady Arabic
BHA= Bani Hasan Arabic, AJ= Ajluuni Arabic

The table in (2) shows some differences between SA and other JA dialects. First of all, /ḍ/ the emphatic counterpart of the plain /d/ is one of the SA phonemes which is used by Bani Hasan Arabic (BHA). This is argued by Irshied (1984) and by speakers of Ajluuni Arabic (AJ) as indicated by AbuAbbas (2003). However, the emphatic consonant /ḍ/ is realized as /ð̣/ in MA as explained in the examples in (3) below where the pronunciation of MA is compared to that of SA:

[6] These phonemes were grouped with stops in Irshied (1984).

(3)

SA	MA	Gloss
a. ḍa.rab	ð̣a.rab	he hit
b. faa.ḍi	faa.ð̣i	empty
c. ra.kaḍ	ra.kað̣	he ran

The examples in table (3) above show that /ḍ/ is substituted by /ð̣/ in MA word-initially, word-medially and word-finally. Secondly, the realization of /q/, the voiceless uvular stop, in MA is /g/ in all positions while it is realized as /ʔ/ in many urban dialects of Jordan especially in urban dialects as in /ʔa.bil/ 'before' where /ʔ/ substitutes /q/[7]. The affricate /tʃ/ is not one of SA phonemes; however, it is considered a phoneme in ʕabadi Arabic (ʕA) according to Sakarna (1999), AJ and BHA. The affricate /tʃ/ is used instead of the stop consonant /k/ in certain phonological environments in these dialects as in /tʃeef/ 'how' where /tʃ/ is used to substitute /k/. Accordingly /tʃ/ is a phone rather than a phoneme in these dialects. Finally, dark /ḷ/ is considered an allophone in SA and other JA dialects including MA. Dark /ḷ/ in MA can only be found in one word /aḷḷaah/ 'God' and I assume this is the case in all JA dialects.

Furthermore, there are several other observations that could be made about the consonantal differences between the above dialects which cannot be inferred from table (2) above. One of the main differences between SA and JA in place of articulation is demonstrated by the consonants /x/ and /ġ/ which are uvulars in the

[7] This is true about MA except for certain words like /quraan/ 'Qur'an' since it is a religious word which people tend to pronounce using SA.

former while they are velars in the latter. The consonant /v/ is used in many borrowed words in urban JA dialects. However, /v/ in MA is pronounced word-initially but not word-medially where it is pronounced as /f/[8]. Consider the examples in (4) below.

(4)

a. /veela/ "villa"

b. / risiifer/ "receiver"

1.4 Vowel Inventory in MA

Unlike consonants, vowels in all JA dialects are the same. Thus, there is no point comparing them to MA. The vowel inventory of MA is discussed with reference to SA in this section instead. The vowel system in SA is made up of three underlying short vowels and their long counterparts (Watson 2002). In addition, SA has two diphthongs namely /ay/ and /aw/. MA, like all other JA dialects, has retained the same set of SA vowels, i.e. MA has three short vowels and three long counterparts, as can be seen in (5) below.

(5)

Short Vowels		Long Vowels	
i	u	ii	uu
a		aa	

However, the diphthongs /ay/ and /aw/ in SA are replaced in MA by long mid vowels /ee/ and /oo/ respectively, as can be seen in (6) below. I think that long mid vowels in MA are derived diachronically from SA through Monophthongization.

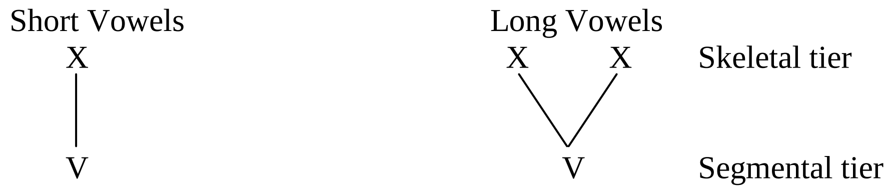
[8] I could not find any example in which /v/ occurs word-finally.

(6)

SA	MA	Gloss
a. /bayt/	/beet/	house
b. /ʃayx/	/ʃeex/	leader
c. /jawm/	/joom/	day
d. /lawn/	/loon/	colour

Long and short vowels in MA are the same in terms of their distinctive features. The only difference is that long vowels occupy two timing slots on the skeletal tier[9], while short ones occupy one slot as the representations in (7) show:

(7)



Accordingly, the inventory of MA vowels consists of three short vowels and five long ones, in which long and short vowels are contrastive. This is exemplified in (8).

(8)

Short V	Gloss	Long V	Gloss
a. ka.tab	he wrote	kaa.tab	he corresponded
b. ḥa.lim	he dreamed	ḥa.liim	tolerant (m.)
c. ḥas.saan	[proper name]	ḥas.suun	goldfinch

Vowel length is contrastive word-finally when long vowels belong to different morphemes since word-final monomorphemic long vowels are not allowed in MA as

[9] See section (2.4.2) for the explanation of the skeletal tier.

in /ra.ma/ ‘he threw’ when compared to /ra.maa/ ‘he threw it’ where the long vowel in the latter belongs to two morphemes[10]. However, there are some exceptions where monomorphemic final long vowels appear on the surface as in /ṣa.laa/ ‘a prayer’. This word and a few other similar ones are underlyingly derived from /...VVh/ where /h/ is deleted as argued by Brame (1971) and McCarthy (1979).

The last point to highlight here is that unstressed long vowels are shortened. The phenomenon of long vowel shortening is applicable even for long mid vowels in MA. When these long mid vowels are shortened, the word ends up by having a short mid vowel as can be seen in the following examples.

(9)

input	output	Gloss
a. beet-een	be.teen	two houses
b. loon-een	lo.neen	two colours

The short mid vowels in the above examples are not phonemic since they cannot be contrasted with other vowels. Accordingly, I believe that [e] and [o] are allophones of the vowel /i/ and /u/ respectively.

1.5 Data Sources

The data for MA comes from recorded interviews which have been carried out by the municipality of Ma’an and private interviews that have been conducted by the author with different speakers of MA. The last source of data is the author himself and his wife who are native speakers of MA.

[10] The author believes that the underlying form in SA is /CVCVyV/ in which the glide is deleted since glides cannot surface between two vowels. What proved that the final vowel in /ra.ma/ is long is that the shortened vowel retains its length when a consonant suffix is attached like in /ra.maa.na/. Shortening also applies to suffixes so a word like /ka.tab.ti/ is assumed to be derived from /katab-t-ii/ since /ka.tab.tii.ha/ is realized with a long vowel. However, the opposite argument has also been introduced in the literature. For further information see Brame (1971), McCarthy (1979), Haddad (1984) and Abu Mansour (1987).

The interviews conducted by the author were mostly spontaneous conversations. However, the author asked some informants to pronounce certain words and give the plural form(s) for others. Furthermore, when certain examples could not be found from these sources, the author and his wife provided those examples which the author then confirmed by consulting other native speakers. Finally, the data that has been phonetically transcribed is for individual words only. However, the author has transcribed some phrases and sentences to give examples for certain phonological processes[11].

The main informants were five females and seven males, excluding the author and his wife. In addition, there were about five other informants who were consulted by the author[12]. All informants are originally from Maʻān al-Ḥijāziyyih[13]. Finally, the age range for all informants was between nineteen years and forty five years. In the data collected from the municipality of Ma'an, the speech of people aged fifty or above was not considered[14].

1.6 Overview of the Dissertation

The rest of the dissertation is organised as follows. Chapter two briefly discusses different models of Optimality Theory, i.e. Classic, Sympathy, Correspondence and Stratal, where the reason for adopting the Stratal Optimality model over other models are justified. After that, an overview of Arabic morphology is given.

[11] The writer did not transcribe whole conversations since connected speech processes are not considered in this thesis.
[12] All of those five informants are relatives of the author.
[13] The author believes that there are no phonological differences between people who are originally from Maʻān al-Ḥijāziyyih and those who are originally from Maʻān iš-Šāmiyyih nowadays. However, this claim should not be taken for granted since phonological studies on Maʻān iš-Šāmyyih should be conducted first and then a comparison between the two groups can be established.
[14] I excluded the speech of the people whose age above fifty since those informants spent most of their lives in other Jordanian cities.

The prosodic features of MA are discussed in chapter three. In the aforementioned chapter issues such as the syllable, the foot and the transparent stress assignment rules are discussed. Chapter three argues for exhaustive parsing, left-to-right foot construction. Finally, the analysis that has been developed to account for the transparent stress assignment rules in MA is compared to other accounts where the former proves superior to the latter.

Chapter four investigates and accounts for segment insertion. Consonant insertion is employed to avoid initial consonant clusters and to satisfy the minimal word requirement at the lexical level. Vowel epenthesis, which is used to break up coda consonant clusters, is then accounted for where a distinction between lexical and postlexical epenthesis is made to explain stress opacity.

Vowel syncope and long vowel shortening are the main aspects addressed in chapter five. Vowel syncope usually results from the ban on unstressed high short vowels in open syllables, while long vowel shortening is employed to avoid stress clash. The relation between syncope and epenthesis, moreover, receives more comprehensive attention in this chapter.

Chapter six is devoted to understanding geminates in Arabic in general. An analysis is then established to account for geminates in MA. Finally, true and fake geminates are discussed, where fake geminates are considered and treated as sequences of identical consonants.

Finally, chapter seven summarises the main points discussed throughout the dissertation, whilst also offering suggestions for future research.

2 Theoretical Background

2.1 Introduction

In rule-based generative phonology (Chomsky and Halle's *Sound Pattern of English* (SPE) 1968), 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 derive an output, as in (1).

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

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

According to classic generative phonology, the mapping from underlying to surface representation is achieved by using a series of ordered rewrite rules. The rewrite rule is an expression A → B / C___D that changes any CAD sequence into a CBD sequence. Rules in SPE do not seek to attain universality or even to describe unmarkedness since they are just merely descriptive tools. In other words, rules are either highly language-specific or universal. Since rules describe *operations*, they are not well-suited to expressing restrictions on the ways segments may combine when no overt operation is involved. Accordingly, SPE supplemented rules with Morpheme Structure Constraints (MSCs) which define the possible morpheme shapes that are allowed by a language. This combination of rules and MSCs creates many problems that have been addressed in the literature. Postal (1968) argued that the phonological shapes which rules create, and those which MSCs enforce, often overlap which creates redundant elements in the grammar. 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. Kisseberth shows that Yawelmani Yokuts has conspiracy of rules where consonant deletion and vowel epenthesis processes are aiming at the same goal[1]. This is exemplified in (2)

(2) Yawelmani Yokuts “rule conspiracy” (Kisseberth, 1970)[2]

C → ∅ / C+___C	giti:n+hnil	→	giti:nnil	‘hold under the arm’
∅ → V / C___C {#, C}	di:yl+t	→	di:ylit	‘guard’
	ʔilk+hin	→	ʔilikhin	‘sing’

In addition to the rules in (2), Yawelmani has a rule that deletes a vowel in context VC___CV. Accordingly, Kisseberth assumed an output constraint *CC{C, #} which is violated by medial three consonant clusters or final two consonant clusters. Although these rules account for the phonological processes exhibited in Yawelmani Yokuts, they miss a very important generalization about the language since SPE has no concept of phonotactically well-formed surface strings because the phonotactics principles in SPE model are deducible from MSCs and the serially order rules.

These problems, amongst many others, foreshadowed the move towards theories where rules have a minimal role to play. This move began in the mid-1970s with the development of nonlinear phonology. In this, we can identify two major theories, Autosegmental Phonology[3] (Goldsmith, 1976) and Metrical Phonology (Liberman, 1975 and Liberman and Prince, 1977). The move toward highly articulated representations in nonlinear theories helped to limit the operation of rules. As representations became more elaborate, the role of the rule component was narrowed in favour of constraints on representations. However, “*the proposed*

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[1] These rules are conspiring to arrive at a maximally CV(C) syllable structure.

[2] ‘+’ stands for morphemes boundaries.

[3] In section (2.4) I will show how McCarthy (1979a, 1981) applies the principles of autosegmental phonology to Classical Arabic.

universal constraints did not hold in every language all of the time. That is why subsequent literature on autosegmental and metrical phonology, such as Pulleyblank (1986) and Hayes (1995), returned to language-particular rewrite rules as the central analytic mechanism." (McCarthy, 2008: 6)

By the end of the 1980s, phonologists recognized the importance of output constraints. Therefore, Paradis (1988) proposed a theory of Constraints and Repair Strategies. This explains phonological alternations by assuming a set of inviolable surface constraints accompanied by repair strategies whose role is to solve any violations resulting from constraint conflicts. 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-specific parameters.

Finally, the well-acknowledged role of output constraints was very important in the emergence of a theory of constraint interaction, known as Optimality Theory (Prince and Smolensky, 2004; McCarthy and Prince 1993). The central premise of Optimality theory (OT), as laid out in Prince and Smolensky (2004), is that Universal Grammar is composed of a set of constraints on representational well-formedness which construct individual grammars. These constraints on linguistic well-formedness are relative, not absolute.

The rest of the chapter is organised as follows: the first part discusses the general idea of Classic OT. In the subsequent sections, different models which have been developed within OT framework, such as Correspondence Theory, Sympathy Theory and Stratal OT, will be introduced as well as an exploration of why these developments are needed. The second part of this chapter gives an overview of Arabic morphology. The discussion will mainly focus on the Autosegmental approach to Arabic morphology (McCarthy 1979a, 1981).

2.2 Optimality Theory

OT does not invent constraints themselves, as they have been reported in the literature since the early 1970s as discussed above. OT, however, was developed because of a "*conceptual crisis at the center of phonological thought.*" Prince & Smolensky (1993: 1). This conceptual crisis was all about the role of output constraints. Aspects of the use of Output constraints in the pre-OT era were unclear. 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?"*(Zuraw, 2003: 820) have still not been answered since the emergence of OT in the early 1990s.

OT distinguishes itself form other phonological theories by disregarding the ideas that; the mapping of the input to the output is achieved serially via 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: Violability, Ranking, Inclusiveness, Parallelism, and Universality (Prince and Smolensky, 2004).

The theory states that linguistic constraints are ranked and violable. The ranking of constraints is essential when two or more of them are in conflict. Accordingly, the optimal output is the one which incurs minimal violations within a specific ranking.

OT is a mechanism of input-output relation in which each input has precisely one output. To accomplish this function, any grammar should consist of two main components. The GENERATOR (Gen), which generates an infinite number of possible outputs, and the EVALUATOR (Eval), which evaluates the outputs by a set of ranked constraints and then selects the optimal output among these competing candidates (Kager, 1999). The flowchart in (3) explains the relationship between the two components.

(3)

Input → $\boxed{\text{Gen}}$ → Candidates → $\boxed{\text{Eval}}$ → Output

Another component, which Eval uses to evaluate the candidates generated by Gen in order to choose the optimal output, is CONSTRAINT (Con). Constraint is a set of constraints that are universal, not language-specific. Differences in constraint rankings explain the differences between languages. All constraints may end up being violated in some language. The optimal candidate in a particular language does not have to satisfy all constraints. Rather, it is the one which is most harmonic with respect to the set of ranked constraints. In addition to Gen and Eval, the grammar contains a LEXICON that features all the forms which are inputs to Gen. The Richness of the Base Hypothesis states that there are no language-particular restrictions on inputs; therefore, all linguistically significant generalizations are expressed by the grammar, not by restrictions on the lexicon. This idea is known as Richness of the Base (ROTB).

(4)

Richness of the Base
No constraints hold at the level of underlying forms.

The basic idea of Richness of the Base was introduced by Prince and Smolensky (2004[1993]), who argued that the interaction between constraints is active at the output level, never at the input level. In pre-OT literature, the absence of certain segments in a language (e.g., front round vowels in English) was analyzed by imposing restrictions on the input. In OT, the absence of certain segments is accounted for by the interaction of constraints at the output level.

Constraints in OT are of two types: markedness constraints and faithfulness constraints. Markedness constraints evaluate outputs only, while faithfulness ones require identity in input-output mapping. In OT, markedness constraints make general statements about well-formedness; any structure that violates a markedness constraint is considered to be marked with respect to that constraint. Markedness constraints are constraints on the *output.* They may contradict each other, so that only their ranking with respect to each other and to faithfulness constraints determines which marked structures will be allowed in a language. Markedness constraints require output forms to avoid certain marked structures; or in other words, markedness constraints demand that outputs be structurally well formed. The targets of markedness constraints encompass segmental structures as well as syllabic or metrical structures. Examples of markedness constraints are given in (5) below:

(5)

- *V NASAL
  Vowels must not be nasal
- *VOICED-CODA
  Obstruents must not be voiced in coda position
- *[ŋ
  No word-initial velar nasal
- NO-CODA
  Syllables are open
- *CLASH
  No adjacent syllables are stressed
- ONSET
  Syllables must have onsets

The second type of constraints are faithfulness constraints which try to maintain a perfect correspondence between the input and the output. Faithfulness constraints are needed to ensure that lexical contrasts present in the underlying representation are present in the output (Kager, 1999: 5). Two classes of faithfulness constraints can be identified: MAX and DEP. The MAX constraint family demands that properties of the input correspond to properties of the output, while the DEP constraint family insists that the output correspond to the input[4].

The satisfaction of constraints in OT is achieved in a parallel way, i.e. there are no intermediate level(s) between the input and the optimal output. In other words, serial order is not allowed in classic OT. Constraints in OT, as mentioned above, are violable, and ranked in accordance with a language-specific hierarchy. The constraints interact and evaluate an infinite set of candidates through what is known as a TABLEAU. Constraints in the tableau are ranked descendingly from left to right, while candidates are arranged vertically in random order.

As can be seen in tableau (6) below, the asterisk (*) means that the relevant constraint is violated. A blank cell, by contrast, indicates that the relevant constraint is satisfied. Ruling out a certain candidate or, in other words, pointing out that a certain candidate has a fatal violation is represented by using an exclamation mark (!). The pointing finger (☞) indicates the optimal candidate which has the fewest and lowest violations, i.e. the most harmonic one. Finally, solid lines between the constraints indicate crucial rankings, while dashed or dotted lines mean that constraints on either side are not mutually ranked.

(6)

Input	Con 1	Con 2	Con 3
☞ Can 1			*
Can 2		*!	
Can 3	*!		

[4] MAX and DEP replaced PARSE and FILL in the original work of Prince and Smolensky (1993).

The well-known example in tableau (7) below is used to show how constraints and candidates interact with each other. In the tableau, we have two constraints A and B, and two possible candidates Can 1 and Can 2. Can 1 violates constraint B and satisfies constraint A while Can 2 violates constraint A and satisfies constraint B. Accordingly, Can 1 is the optimal candidate. What is inferred from this information is that a crucial ranking has been established between the two constraints, i.e. constraint A dominates constraint B.

(7)

	Con A	Con B
☞Can 1		*
Can 2	*!	

If on the other hand, Can 2 is the optimal candidate, then constraint B should dominate constraint A. This will give a new ranking with the two constraints as explained in tableau (8) below.

(8)

	Con B	Con A
Can 1	*!	
☞Can 2		*

2.2.1 Classic OT

After this brief introduction to OT, we are better placed to see how Classic OT employs its principles in dealing with some of the problematic issues in phonology. One of these is the conspiracy problem. Classic OT smoothly solved the Yawelmani Yokuts conspiracy, outlined in (2) above, by getting rid of rules entirely and replacing them with output constraints which interact with each other to optimise the desired output. In Yawelmani Yokuts, the sequence CCC is not allowed, therefore, it is repaired by vowel epenthesis that is inserted after the first consonant, i.e. C*v*CC but not CC*v*C. However, sequences like CvCC and CCvC do occur in the language. The second repair strategy to the prohibited sequence CCC is achieved by deleting a consonant that is not part of the stem or adjacent to a vowel, i.e. in a sequence like …VC+CCV… the second consonant is deleted. The aforementioned facts about Yawelmani Yokuts are captured elegantly in OT by proposing violable output constraints as can be seen in (9-10) [5] below.

(9)
C → ∅ / C+___C

giti:n+hnil	*COMPLEX	MAX-C_{stem}	MAX-C/___V	DEP-V	MAX-C
a. ☞gi.ti:n.nil					*
b. gi.t:n.hnil	*!				
c. gi.ti:h.nil		*!			*
d. gi.ti:n.hil			*!		*
e. gi.ti:n.hi.nil				*!	

(10.a)
∅ → V / C___C {#, C}

ʔilk+hin	*COMPLEX	MAX-C_{stem}	MAX-C/___V	DEP-V	MAX-C
a. ☞ʔi.lik.hin				*	
b. ʔil.khin	*!				
c. ʔil.hin		*!			*
d. ʔil.kin			*!		*

[5] The tableaux depend on lecture notes from Zuraw (2007).

(10.b)

di:yl+t	*COMPLEX	MAX-C_{stem}	MAX-C/___V	DEP-V	MAX-C
a. ☞di:y.lit				*	
b. di:ylt	*!			*	
c. di:.yilt	*!				**
d. di:y		*!			

Another advantage of OT is its ability to characterise typological variations among the world's languages by re-ranking a set of constraints. The interactions between markedness and faithfulness constraints, for example, accounts for the range of syllable inventories found in languages (cf. section 3.1.3). A sequence like CCVC might be syllabified in different ways depending on the ranking of the constraints as can be seen in tableau (11)[6].

(11)

CCVC	NUC	ONS	*CODA	MAX	DEP	*COMPLEX
a. /CCV.CV/					*	*
b. /CV.CV.CV/					**	
c. /CVC/			*	*		
d. /CV/				**		

In the above tableau there is no winning candidate, since no dominance relation is established between the constraints. Accordingly, it is possible for each of the candidates in (11) to surface as the optimal output in one language or another. Optimising one candidate over the others depends on the crucial ranking of the constraints which depends on the grammar of the targeted language.

[6] There are other syllabification patterns for such a string. However, I only included some of the most common ones.

The prediction of the emergence of the unmarked is another advantage of OT over other phonological theories. The basic idea of the emergence of the unmarked is the ability of one of the violated markedness constraints in a language to affect the outputs. In Timugon Murut, a Malaysian Austronesian language, ONS must be dominated because the language allows onsetless syllables. Onsetless syllables, in general, can be repaired by consonant insertion or by vowel deletion. This implies that in Timugon Murut the constraints DEP and MAX outrank ONS (McCarthy, 2008: 24). These facts are illustrated by considering the word [am.bi.lu.o] *'soul'* in tableau (12).

(12) The Emergence of the Unmarked (McCarthy, 2008: 24)[7]

	DEP	MAX	ONS
a. ☞am.bi.lu.o			**
b. ʔam.bi.lu.ʔo	**!		
c. bi.lu		***!	
d. am.bil.u.o			***!

The tableau shows that the markedness constraints ONS is dominated in this language. Thus, it still has the ability to specify the winner.

In sum, there are many other advantages of OT over other theories as explained above. However, it is beyond the scope of this thesis to discuss all of them. Although classic OT succeeds in addressing many problematic issues in phonology, it fails to address phonological *opacity*. Accordingly, new versions of OT have been developed to solve opaque cases and to establish the relationship between phonology and other components of grammar and in particular the interface between phonology

[7] McCarthy (2008) did not give the input for this example.

and morphology. Three of the new versions of OT have been used in addressing opacity and the interaction of phonology and morphology in Arabic, namely: Correspondence Theory, Sympathy Theory and Stratal Theory[8]. Before proceeding to the discussion of the different models of OT, I will first introduce opacity.

2.2.1.1 Opacity

In our previous discussion, we have seen that the mapping between the input and the output in Classic OT is achieved via constraint ranking in a strict parallel way. To this end, Classic OT can effortlessly deal with cases of *feeding* and *bleeding*. However, it cannot solve problems of *counterfeeding* or *counterbleeding*, since they require reference to intermediate steps between the input and the output. In order to understand the terms counterfeeding and counterbleeding, it is better to start by defining and exemplifying feeding and bleeding.

Feeding refers to the case when Rule 1 applies first and creates the environment for Rule 2 to apply. In this case, it is said that Rule 1 feeds Rule 2. In Classical Arabic, words cannot begin with consonant clusters. Accordingly, a prosthetic [ʔi] is inserted. In this case, /i/ is epenthesized to avoid the cluster which then facilitates the application of Rule 2, i.e. the insertion of /ʔ/ before the word-initial vowels. This derivation is explained in (13).

(13) Feeding Order in Classical Arabic (McCarthy, 2007:9)

Underlying	/ḍrib/	‘beat (m.s.)!’
Vowel epenthesis	iḍrib	
/ʔ/ epenthesis	ʔiḍrib	
Surface	[ʔiḍrib]	

We can account for these data in OT as can be seen in tableau (14).

[8] There are other versions of OT like Local Conjunction (Kirchner 1996; Smolensky, 1997; Ito and Mester, 2002), Comparative Markedness (McCarthy, 2002) and Candidate Chains (McCarthy, 2007).

(14)

ḍrib	*COMPLEX	ONS	DEP
☞ ʔiḍrib			**
ḍrib	*!		
iḍrib		*!	*

Bleeding, by contrast, is a process in which Rule 1 wipes out the condition for Rule 2 before it can apply. The plural morpheme /z/ in English is devoiced after a voiceless consonant at the end of a word, /kat-z/ → [kats]. However, this assimilation process is blocked when the plural morpheme /z/, which is a sibilant, is preceded by another sibilant. Assimilation is blocked by epenthesizing a vowel since the language does not allow two sibilants word-finally. In other words, vowel epenthesis between two sibilants word-finally (Rule 1) destroys the environment within which Rule 2 (voice assimilation) can take place.

(15) Bleeding order in English plural morpheme

Underlying	/feis-z/
Vowel epenthesis	feis-iz
Assimilation	*Blocked*
Surface	[feisiz]

Rules are said to be in counterfeeding order when Rule 1 feeds Rule 2, but they apply in the order Rule 1 precedes Rule 2. In Bedouin Arabic (McCarthy, 2007: 10-11), there are two phonological rules affecting short vowels: Rule 1 raises the low short vowel /a/ to a high short vowel in nonfinal open syllable and Rule 2 deletes high short vowels in the same environment. If Rule 1 feeds Rule 2, then all instances of high short vowels in nonfinal open syllables should be deleted. But, since these rules are in a counterfeeding order only, underlying high short vowels undergo deletion.

(15) Counterfeeding order in Bedouin Arabic (McCarthy, 2007:11)

Underlying	a. /dafaʕ/ 'he pushed'	b. /ʃarib-at/ 'she drank'
Vowel deletion	——	ʃarbat
/a/ raising	difaʕ	——
Surface	[difaʕ]	ʃarbat

Finally, when Rule 1 bleeds Rule 2 and they apply in the order Rule 1 precedes Rule 2, then these rules are in counterbleeding order. Tiberian Hebrew supplies an example of counterbleeding order (McCarthy, 1999). A vowel is epenthesized in Tiberian Hebrew to break up final clusters and the second process is deleting /ʔ/ when it is not in syllable onset.

(15) Counterbleeding order in Tiberian Hebrew

Underlying	a. /deʃʔ/ 'tender grass'	b. /qaraʔ/ 'he called'
Vowel epenthesis	deʃeʔ	——
/ʔ/ deletion	deʃe	qara
Surface	[deʃe]	[qara]

In the literature, feeding and bleeding are known as transparent rule interactions, while counterfeeding and counterbleeding are known as opaque rule interactions. Phonological opacity, according to Kiparsky (1973:79), stems from counterfeeding and counterbleeding interactions, as can be seen in (16).

(16) Opacity definition (Kiparsky, 1973: 79)

A phonological Rule P of the form $A \rightarrow B\ /C\_\_\_D$ is opaque if there are surface structures with any of the following characteristics:

a. instances of *A* in the environment $C\_\_\_D$,
b. instances of *B* derived by P that occur in environments other than $C\_\_\_D$.

According to this definition, counterfeeding interactions are opaque under statement (16.a), which is sometimes termed as *overapplication opacity*, while counterbleeding or *underapplication opacity* is opaque under clause (16.b)[9].

The inability of Classic OT to handle phonological opacity has been pointed out by several scholars (Idsardi, 1997, 2000; Kager, 1999; McCarthy, 1999 and Kiparsky 2000, 2003) amongst many others. McCarthy (1999: 332) states that '*As OT is currently understood, though, constraint ranking and violation cannot explain all instances of opacity. Unless further refinements are introduced, OT cannot contend successfully with any non-surface-apparent generalizations nor with a residue of non-surface-true generalizations*.'

Among the most important refinements that have been introduced to overcome opacity are Sympathy Theory, Correspondence Theory (output-output correspondence) and Stratal OT. These proposals will be discussed and evaluated in the next sections.

2.2.2 Correspondence Theory

Correspondence Theory allows OT to be a two-level theory in which input and output are considered separate strings, and faithfulness between the two is assessed through the correspondence relation provided by the candidate generator (Benua, 1997).

Correspondence Theory, as presented in McCarthy & Prince (1995), is considered to be the standard theory of faithfulness within OT. Faithfulness constraints in Correspondence Theory require two segments to stand in a relation with one another. This is known as the "correspondence relation". McCarthy & Prince (1995: 14) define Correspondence in (17) below:

[9] Overapplication opacity and underapplication opacity are sometimes called non-surface-apparent generalization and non-surface-true generalization respectively (Kager, 1999; McCarthy, 1999 and Idsardi, 2000).

(17) Correspondence

> 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 $\alpha R \beta$.

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), (Base, Reduplicant), 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 Input-Output (I-O), Base-Reduplicant (B-R), Input-Reduplicant (I-R), Tone to Tone-Bearer, and so on (McCarthy and Prince 1995: 122-123). In what follows, I will briefly introduce some of the faithfulness constraints in Correspondence Theory (McCarthy and Price 1995).

- **MAX**

  Every element of S_1 has a correspondent in S_2 .

  Domain(R) = S_1

The MAX constraint is responsible for prohibiting phonological deletion, demanding completeness of reduplicative copying, or requiring complete mapping in root-pattern morphology. The constraint MAX-IO, for example, is a reformulation for the constraint PARSE-segment in Prince & Smolensky (1993).

- **DEP**

  Every element of S_2 has a correspondent in S_1.

  Range(R) = S_2 .

The constraint FILL in Prince and Smolensky (1993) is almost replaced by the constraint DEP in Correspondence Theory. DEP is responsible for militating against epenthesis.

- **IDENT-[F]**

  Correspondent segments have identical values for the feature [F].

  If xRy and x is [γF], then y is [γF].

IDENT-[F] states that each correspondent segment be featurally identical to one another.

- **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 I-CONTIG rules out deletion of elements *internal* to the input string, while the constraint O-CONTIG rules out internal epenthesis.

- **{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 y=Edge(S_2 , R) then xRy.
  LEFT-ANCHOR. Likewise, *mutatis mutandis*.

ANCHOR constraint subsumes Generalize Alignment and captures the effects of Align in McCarthy & Prince (1993) Generalized Alignment.

- **LINEARITY**

  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 xR x′ and yR y′, then
  $x < y$ iff $\neg (y' < x')$.

LINEARITY constraint is responsible for excluding metathesis because it states that precedence relations in the input must be preserved in the output.

- **UNIFORMITY** — “No Coalescence”

  No element of S_2 has multiple correspondents in S_1.
  For x,y $\in$ S_1 and z $\in$ S_1 , if xRz and yRz, then x=y.

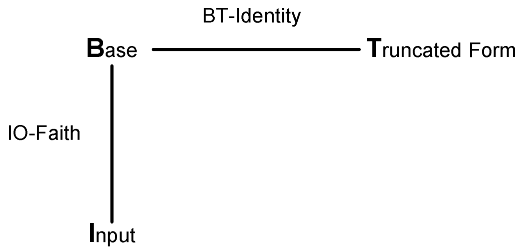
- **INTEGRITY** — “No Breaking”

  No element of S_2 has multiple correspondents in S_1.
  For x,y $\in$ S_1 and w,z $\in$ S_1 , if xRw and xRz, then w=z.

UNIFORMITY and INTEGRITY rule out two types of multiple correspondences -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.

Correspondence Theory has soon developed over the course of subsequent works, such as Benua (1995, 1997) and Kager (1999), to cover output-output relations (O-O correspondence). Benua (1995, 1997) proposes that a base is related to a derived surface form by correspondence. The derived form is influenced by the base so that both forms resemble each other on the surface. In her analysis of truncatory phenomena in certain American English dialects, Benua realised that truncation involves two correspondence relations. The first relation is between an input and the base (I-B correspondence) while the second is between the base and the truncated form (B-T correspondence). This can be seen in (18).

(18) Truncation (Benua, 1995:6)



Benua argues that the vowel in the truncated form *Lar* [lær] from *Larry* [læ.ri] does not respect the realization of the low vowel as [ɑ] before tautosyllabic /r/ as in *car* [kɑr]. In other words, the constraint against tautosyllabic /r/ (*ær]$_{\sigma}$) is not respected by truncated forms like [hær] and [lær]. This leads Benua to attribute the underapplication of [ɑ] in such cases to the identity effect between the base and the truncated form as shown in (19). Accordingly, we can account for this phenomenon in OT by ranking the BT-Identity constraint over *ær]$_{\sigma}$.

(19)

[læ.ri] —BT-Identity— [lær]

IO-Faith

/læ.ri/

O-O relations have been extended to cover other phenomena such as cyclic phenomena. Kager (1995, 1999) analysed the interactions between stress and syncope in Palestinian Arabic drawing on data from Brame (1974) who attributed these interactions to cyclic application of rules. In Palestinian Arabic, as described by Brame (1974), the unstressed high short vowel /i/ is syncopated in open nonfinal syllables. However, the high short vowel /i/ does not undergo syncopation in the same environments when attached to certain suffixes, i.e. subject suffixes. The deletion of unstressed /i/ in nonfinal open syllables indicates that stress applies before deletion. The examples in (20) show how attaching different suffixes to the stem /fihim/ 'to understand' affect /i/ deletion.

(20)

a. Verb plus subject suffix

1. /fihim-∅/	'fihim	he understood
2. /fihim-it/	'fihmit	she understood
3. /fihim-u/	'fihmu	they understood
4. /fihim-na/	'fhimna	we understood
5. /fihim-t/	'fhimt	I understood

b. Verb plus object suffix

1. /fihim-∅-na/	f**i**'himna	he understood us
2. /fihim-∅-kum/	f**i**'himkum	he understood you (pl.)
3. /fihim-∅-ha	f**i**'himha	he understood her

The examples in (20.a) show that the unstressed high short vowels are deleted when attached to subject suffixes. By contrast, the examples in (20.b) show that the boldface unstressed vowels resist syncopation when attached to object suffixes, although they occur in eligible environments for deletion. Bram used the cycle to account for these observations. There are two assumptions that should be taken into consideration when using the cycle: the first is that it requires rules to apply to inner constituents before they apply to outer ones and the second is that it cannot be applied to constituents that cannot stand alone as words, i.e. bound morphemes. Accordingly, Brame argues that the inner constituent /fihim/ in /fihim-na/ ‘we understood’ is a bound morpheme since it cannot stand alone, i.e. it is not a cyclic domain. By contrast the inner constituent /fihim-∅/ in /fihim-∅-na/ ‘he understood us’ is a cyclic domain because /fihim-∅/ is a free-standing word. The unstressed /i/ in [fi'himna] ‘he understood us’ escapes syncopation since in the first cycle it was stressed ['fihim] and in the second cycle the object suffix /na/ is added where the main stress is reassigned. This leaves the first syllable /fi/ with secondary stress, which prevents it from postcyclic syncopation. Finally, secondary stress is removed by a destressing postcyclic rule. This cyclic derivation is given in (21).

(21)

input		$[\text{fihim-na}]_{\text{Subj}}$	$[[\text{fihim-}\varnothing]_{\text{Subj}}\ \text{na}]_{\text{Obj}}$
Cycle 1			
	Stress	fi'him-na	'fihim-∅
Cycle 2			
	Stress	----	fi'him-∅-na
Postcyclic			
	i-Syncope	'fhim-na	blocked
	Destressing	n.a	fi'him-∅-na
Output		'fhimna	fi'himna

To return to the main point, Kager (1995, 1999) argues that the underapplication of /i/ syncope in the examples in (20) can be handled by reference to the base which he defined as ‘*a form that is compositionally related to the affixed* *word in a morphological and a semantic sense. (The meaning of the affixed form must contain all grammatical features of its base.) Moreover, the base is a free form, i.e. a word. This second criterion implies that a base is always an output itself.'* This definition of the base allows Kager to propose that /i/ is deleted in the examples in (20.a) because these forms are baseless since the stem /fihim/ 'to understand' does not fulfil the semantic compositionality criterion. The examples in (20.b), by contrast, preserve the unstressed /i/ since they have a base [fihim] 'he understood' which is morphologically and semantically related to them and can be an output itself. The following tableaux show how Kager (1995) employs O-O relation in accounting for /i/ syncopation.

(22) Kager (1995: 9)

Input:/fihim-na/ Base:['fihim]	HEAD-MAX(B/O)	NO [i]	MAX(I/O)
a. ☞[fi.'him.na]		*	
b. ['fhim.na]	*!		*

(23) Kager (1995: 9)

Input:/fihim-na/ Base: *none*	HEAD-MAX(B/O)	NO [i]	MAX(I/O)
a. [fi.'him.na]		*!	
b. ☞ ['fhim.na]			*

The HEAD-MAX(B/O) constraint requires every segment in the base prosodic head have a correspondent in the output. Therefore, the optimal output /fi.'him.na/ in tableau (22) wins over the other competitor by satisfying the B-O constraint since it preserves the stressed vowel in the base. Although the high short vowel /i/ is deleted in the optimal candidate /'fhim.na/ in tableau (23), it vacuously satisfies the HEAD-MAX(B/O) since this form is baseless.

The introduction of output-output relations into OT grammar has been criticised by many researchers who partially disagree with this approach (McCarthy, 1999) or totally refute it (Kiparsky, 2000, 2003)[10]. McCarthy (1999) argues that output-output faithfulness model cannot provide complete solution to the opacity problem. McCarthy (1999) argues that counterbleeding in Tiberian Hebrew (see 15.a above) is problematic since output-output faithfulness cannot work unless there is a form in the paradigm where the opaque process applies transparently. According to McCarthy (1999: 382) *'[T]he paradigms of words like /deʃʔ/ do not contain any form where epenthetic e and the ʔ are present together on the surface; indeed, no such form could exist, since epenthetic e is triggered by the need to syllabify coda ʔ, but ʔ never actually appears in coda position.'* To solve such problems, McCarthy proposed a new OT model which he called Sympathy Theory.

2.2.3 Sympathy Theory

The central idea behind Sympathy Theory was to show that, with some refinement, the general OT framework can handle phonological opacity in a parallel way as argued by McCarthy (1999) and Kager (1999). In other words, parallelism is preferred over serial derivation in which '*an underlying form passes through a number of intermediate representations on its way to the surface*', McCarthy (1999:331).

[10] Kiparsky's argument against O-O faithfulness will be introduced later in this chapter.

(24) Serial derivation (McCarthy, 1999: 331)

underlying representation = UR

↓

UR transformed by rule 1 = $output_1$

↓

$output_1$ transformed by rule 2 = $output_2$

↓

……

$output_{n-1}$ transformed by rule n = surface representation

In Sympathy Theory, a failed candidate, which is known as the sympathetic candidate and indicated by using the symbol, ❀ is selected by a special constraint known as the selector, which is annotated by the symbol✦. At the same time, the ❀-candidate should be faithful to the ❀-constraint. The ❀-candidate then serves as intermediate input to which other candidates are compared as shown in the representational tableau in (25).

(25)

Input	Con_1	❀ Con	✦ Con
a. ☞ opaque			*
b. ☜ transparent		*!	*
c. ❀ sympathetic	*!		
d. faithful	*!	*!	

In tableaux like the one in (25), all candidates are evaluated by the ❀-constraint which is chosen by the ✦-constraint. Accordingly, the transparent candidate in (25.b) loses by violating the ❀-constraint which is achieved by assuming that the ❀-candidate (25.c) is the intermediate input to which other candidates are compared. To this end, Sympathy Theory is considered an extension of Correspondence Theory since it increases the amount of correspondence mapping relations between the different components of an OT tableau, i.e. the selector.

It was suggested earlier that output-output model cannot handle the Tiberian Hebrew overapplication opacity (15.a), which involves vowel epenthesis in final clusters and [ʔ]-deletion in the coda. Accordingly, McCarthy (1999: 337) accounts for this phenomenon by using Sympathy Theory as shown in tableau (26).

(26)

deʃʔ	CODA-COND	*COMPLEX	❀ MAX-V	✦MAX-C	DEP-V
a. ☞ deʃe				*	*
b. ☜ deʃ			*!	*	
c. ❀ deʃeʔ	*!				*
d. deʃʔ	*!	*!	*!		

The optimal candidate (26.a) wins over the transparent candidate (26.b) by satisfying the sympathetic constraint ❀ MAX-V. ❀ MAX-V evaluates all candidates with reference to the sympathetic candidate (26.c) which serves as an intermediate input. Therefore, candidate (26.b) loses.

Sympathy theory met with various objections (Idsardi, 1997; Kiparsky, 2000; Ito and Mester 2002). In his argument against Sympathy Theory, Kiparsky (2000) analysed the opaque interaction of stress and vowel epenthesis in Palestinian Arabic using Sympathy Theory. In Palestinian Arabic, epenthetic vowels cannot bear stress.

(27) Epenthesis-stress interaction (Kiparsky, 2000: 355)

katab-t	*COMPLEX	❀ IDENT-STRESS	✦DEP-(I/O)-V
a. ☞ ka'tabit			*
b. 'katabit		*!	*
c. ❀ ka'tabt	*!		

However, accounting for vowel shortening in (28) '*require a separate sympathy constraint (referring to the same Selector constraint) to "borrow" the* *opaque shortening in /ʃaaf-t / ʃifit 'I saw' from the same failed candidate *ʃift.'*(Kiparsky, 2000: 356). This is because Sympathy Theory cannot capture the generalisation that '*epenthesis (like all postlexical processes) is invisible to all word phonology*'. This is depicted in tableau (29) below.

(28)

a. /ʃaaf-at/	ʃaaf-at	she saw	(transparent retention of length)
b. /ʃaaf-t/	ʃifit (*ʃaafit)	I saw	(opaque shortening)

(29) Vowel Shortening (Kiparsky, 2000: 356)

ʃaaf-t	*COMPLEX	❁ IDENT-LENGTH	✦DEP-(I/O)-V
a. ☞ʃifit			*
b. ʃaafit		*!	*
c. ❁ ʃift	*!		

Accordingly, this model of OT is totally inadequate since it will require a different sympathy constraint for each different opaque process which will lead to a proliferation of sympathy constraints.

2.2.4 Stratal OT

2.2.4.1 An Introduction to Lexical Phonology

Lexical Phonology (Kiparsky, 1982, 1985; Mohanan 1982) (LP) is a theory of rules and derivations which tries to show how phonology interacts with other components of grammar, in particular morphology and syntax. To this end, LP presents the first major departure from SPE, as it regards morphology and phonology as two separate components. According to Booij (1997: 262) Lexical Phonology has two core hypotheses:

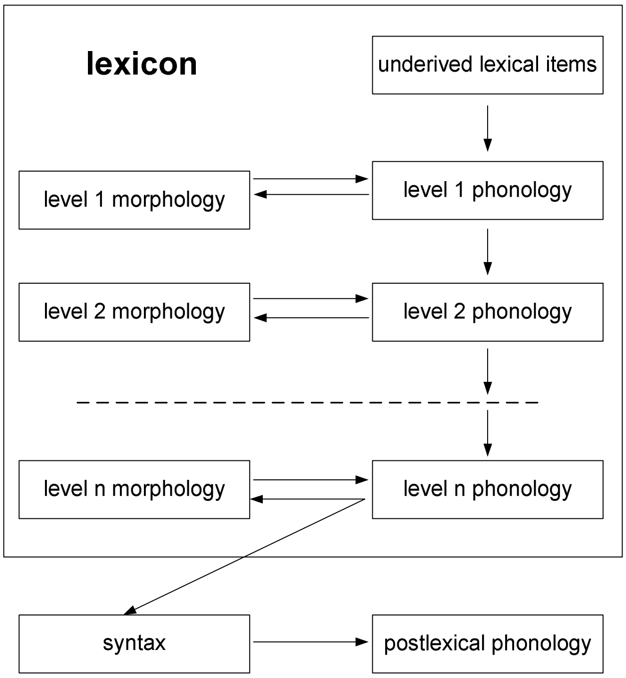
(30) Lexical Phonology core hypotheses (Booij, 1997: 262)

a. '*There is a systematic difference between lexical and postlexical phonology,*

b. *Morphology and phonology apply in tandem*'

Hypothesis (30.b) means that phonological and morphological rules apply cyclically. Morphological rules that apply to a given word create new domains for the application of phonological rules which in turn can serve as an input for another morphological operation. These processes of phonology-morphology feeding, i.e. cycles, are repeated until the lexical level is over. The output of the lexical level is used as the input for the postlexical level where rules of syntax apply before the application of postlexical phonological rules as shown in (31).

(31) LP representation (Kiparsky, 1982: 4)



LP assumes three levels of phonological representation: underlying, lexical and postlexical (phonetic). The figure in (31) shows that morphological and phonological rules are divided in ordered levels, or strata, within the lexicon. The rules in these ordered strata may apply cyclically either stratum-internally or across strata. Morphological rules, moreover, are paired with phonological rules on a particular level. The output of each stratum is then used as the input for the following one. In addition, the figure shows that there are two types of phonological rules: lexical and postlexical. Lexical rules are those rules which apply during morphological affixation. In LP, lexical rules are characterised as being *structure preserving*. Structure preservation proposes that lexical rules can only produce or refer to phonology that is present underlyingly in a language (Kenstowicz, 1994: 221). In English, for example, the rule of /l/ velarization is not a lexical rule, since it refers to a segment that is not part of the phonemic system of the language. Lexical rules, moreover, are prone to exception, are cyclic and sensitive to morphology. Postlexical rules, by contrast, are neither cyclic nor morphologically sensitive. Furthermore, they are exceptionless in that they apply everywhere as long as their environment is appropriate.

Different versions of LP posit different numbers of levels in the lexicon. Halle and Mohanan (1985) posit a four-levelled morphology; Kiparsky (1982) propose three lexical strata; Kiparsky (1985) and Booij & Rubach (1987) accept the need for two levels. The organisation of the strata in the lexicon, as assumed in most versions of LP, is largely affected by the level at which affixes are attached, i.e. affix-driven[11]. Stratum 1 in the two-level LP, for example, consists mostly of affixes which are more closely related to the stem than other affixes, has phonological effect, and they may also be from some historical leftover affixes, such as the affix *-th* in *depth* in English. Level 2 affixes, by contrast, are usually regular suffixes which has little phonological effect.

In order to constrain the application of cyclic rules, Kiparsky (1982) used the *Strict Cyclicity Condition* (SCC). SCC indicates that a phonological rule at a given

[11] Giegerich (1988) proposes that morphological strata are defined by morphological base categories like stems and words.

stratum affects strings of sounds that undergo a morphological rule at the same level. In English, for example, trisyllabic shortening is triggered by the suffix -*ity* which is a level 1 suffix. Consequently, trisyllabic shortening is not triggered by any level 2 suffixes[12].

After this brief and concise introduction to LP, the question that needs to be addressed is how to combine OT with LP. The answer to this question forms the core of the next section.

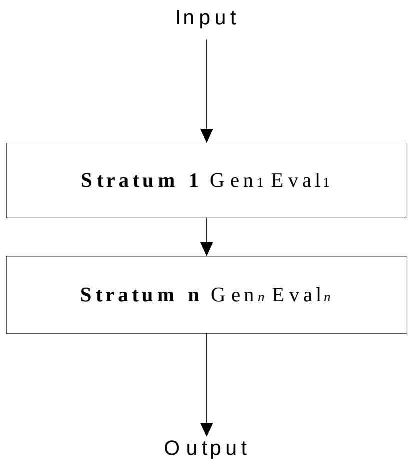
2.2.4.2 Stratal Optimality Theory

Stratal Optimality Theory is a hybrid model of OT in which the insights of Lexical Phonology and Morphology are broadly combined with parallel OT. This combination of OT with LP should by no means be understood as Stratal OT adopting LP theory wholescale. In the previous section, two key principles of LP were pointed out: Structure Preservation and Strict Cyclicity Condition. Both concepts are rejected in Stratal OT, since the former imposes restrictions on the underlying representation which violates the principle of Richness of the Base. Strict Cyclicity Condition, moreover, cannot be accepted within any OT framework since it is empirically incorrect.

In contrast to classic OT, Stratal OT consists of several serially ordered mappings from input to output. The figure in (32) shows how Stratal OT works:

[12] Kiparsky (1993) rejected the SCC on empirical grounds.

(32) Stratal OT (Kager, 1999: 382)



The figure in (32) shows that the output of each stratum serves as the input of the following one. When taking Arabic as an example, as discussed by Kiparsky (2000, 2003), then the output of the first stratum which represents the stem level becomes the input of the next stratum which represents the word level. The post-lexical level is then fed by the output of the last stratum which is the word level one.

Kiparsky (2003: 152) states the main features of Stratal OT as follows:

- *'Stems, words, and sentences are characterized by distinct constraint systems*[13]*.*
- *These constraint systems are serially related.*
- *Morphology and phonology are cyclically interleaved in each domain.*
- *I/O constraints are the only type of correspondence constraint.'*

Consider the following tableaux as an illustration of how stratal OT works at different levels.

[13] Kiparsky (1997) argues that only faithfulness constraints could be re-ranked in each stratum while markedness constraints have a fixed ranking at all levels. However, Kiparsky himself disregards this assumption in later works as in Kiparsky (2003). Accordingly, I think that markedness and faithfulness constraints can be freely re-ranked at each level. This will become clear when data from MA is analysed (cf. chapter 4-6).

(33) Stem Level

	CON$_1$	CON$_2$	CON$_3$
a. ☞Can$_1$			*
b. Can$_2$	*!		
c. Can$_3$		*!	

(34) Word Level

	CON$_3$	CON$_1$	CON$_2$
a. ☞Can$_1$			*
b. Can$_2$		*!	
c. Can$_3$	*!		

(35) Postlexical Level

	CON$_2$	CON$_1$	CON$_3$
a. ☞Can$_1$			*
b. Can$_2$		*!	
c. Can$_3$	*!		

This serial way of analysis using OT contradicts one of the proprieties of classic OT which states that outputs are evaluated in a parallel system. Accordingly, Stratal OT raises a serious question about the notion of parallelism. It has already been stated that a full strict parallel OT theory cannot handle cases of phonological opacity; therefore, classic OT has been refined many times. Each time, it was imperative for phonologists to recognise an intermediate level between the input and the output, so they departed from the full parallel theory and moved towards semiparallel theories i.e. Correspondence 'Output-Output' and Sympathy. However, as discussed earlier, the semiparallel OT theories fail to account for phonological opacity.

A very strong argument against these theories, and in favour of Stratal OT, has been introduced by Kiparsky (2000). In our discussion of Sympathy theory, we have seen that the theory fails to account for opaque shortening in words like /ʃaaf-t/ which surfaces as /ʃi.fit/ since, to derive the optimal output /ʃi.fit/, a separate sympathy constraint (referring to the *same* Selector constraint) is needed which then will cause chaos in the system. In the aforementioned work, Kiparsky argues that the output-output constraint 'HEAD-MAX(B/O)', which has been used by Kager (1995, 1999) to account for the cycle in Palestinian Arabic, can be replaced by a simple I/O constraint, i.e. MAX[V́]. Kiparsky (2000: 358) argues that '*the contrast between i-Deletion in fh´ım-na 'we understood' and the failure of i-Deletion in fih´ım-na 'he understood us' is connected with the fact that subject and object suffixes belong to different layers of morphology*'. Accordingly, Kiparsky assumes that subject suffixes are attached at the stem level, while object and possessive suffixes are attached at the word level as shown in (36).

(36) Kiparsky (2000:362)

Word Level	MAX[V́]	NO [i]	MAX(I/O)
['fihim]na			
a. ☞[fi.'him.na]		*	
b. ['fhim.na]	*!		*

[fi.'him.na]			
a. [fi.'him.na]		*!	
b. ☞ ['fhim.na]			*

In the light of current phonological theories, it seems that a full parallel theory, which is able to account for all cases of phonological opacity, is unattainable in the near future. Accordingly, adopting serialism, i.e. multistratal OT, is the best theory available on the market. Whilst I do not claim that it is perfect, it is still less problematic than others.

2.3 Which OT Model?

It is clear from this discussion about the different models of OT that the author is going to adopt the Stratal OT model, as developed by Kiparsky (2000, 2003, and Kiparsky to appear). In this model, different suffixes are attached at different strata. For example, subject suffixes are attached at the stem level while object pronouns are positioned at the word level. MA is in line with this assumption as it differentiates between two main levels, namely: the lexical level and the postlexical level. The lexical level, furthermore, is divided into two levels depending on the type of attached suffix. Therefore, the lexical level is composed of the stem level and the word level.

The levels at which suffixes are attached to stems are very crucial for the present study, as it is with many other studies adopting the Stratal OT framework. Accordingly, examples of different types of suffixes are given in (37-39) below.

(37) Subject suffixes

Suffix	Example	Gloss
∅	ʔakal	he ate
-at	ʔakal-**at**	she ate
-u	ʔakal-**u**	they ate
-t	ʔakal-**t**	I ate
-ti	ʔakal-**ti**	you (f. s.) ate
-na	ʔakal-**na**	we ate
-tu	ʔakal-**tu**	you (m. pl.) ate
-tin	ʔakal-**tin**	you (f. pl.) ate

(38) Object suffixes

Suffix	Example	Gloss
-u	ʃaaf-**u**	he saw him
-ha	ʃaaf-**ha**	he saw her
-hum	ʃaaf-**hum**	he saw them (m.)
-hin	ʃaaf-**hin**	he saw them (f.)
-ak	ʃaaf-**ak**	he saw you (m.s.)
-ki	ʃaaf-**ki**	he saw you (f.s.)
-ku	ʃaaf-**ku**	he saw you (m.pl.)
-kin	ʃaaf-**kin**	he saw you (f.pl.)
-ni / i	ʃaaf-**ni**	he saw me
-na	ʃaaf-**na**	he saw us

(39) Possessive suffixes

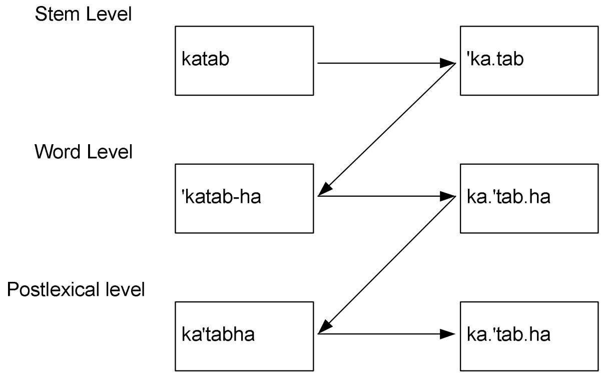
Suffix	Example	Gloss
-u	kalb-**u**	his dog
-ha	kalb-**ha**	her dog
-hum	kalb-**hum**	their (m.) dog
-hin	kalb-**hin**	their (f.) dog
-ak	kalb-**ak**	your (m.s.) dog
-ki	kalb-**ki**	your (f.s.) dog
-ku	kalb-**ku**	your (m.pl.) dog
-kin	kalb-**kin**	your (f.pl.) dog
- i	kalb-**i**	my dog
-na	kalb-**na**	our dog

Suffixes are also attached to stems in order, i.e. subject suffixes are attached at the stem level, while object and possessive suffixes are attached at the word level. Accordingly, a stem that is attached to two suffixes, like the subject suffix /t/ and the object suffix /ha/, should appear like /….-t-ha/ as in /samiʕ-t-ha/ ‘I heard her’.

In order to understand these levels, we might consider how a word like /ka.'tab.ha/ ‘he wrote it’ is achieved in the schematic representation in (40) below[14].

[14] This schematic representation is in line with Kiparsky (2003).

(40)



The figure in (40) shows that the unsuffixed stem is syllabified and received stress which then becomes the input for the next level. At the word level, the object morpheme /ha/ is attached where stress lodges at the heavy syllable. Finally, /ka.'tab.ha/ surfaces intact at the postlexical level, i.e. faithful to the input.

So far in our discussion, we have not addressed what motivates the distinction between lexical levels themselves and between lexical and postlexical levels in MA. First of all, the claim that affixes are attached at different levels is not unique with regard to Arabic, since it has been reported in many languages including English (Kiparsky, 1982), Slovak (Rubach, 1993), Dutch (Booij, 1997) and Russian (Rubach, 2008). In relation to Arabic, it has been discussed in many works, such as Kenstowicz (1983, 1986), Abu Mansour (1987, 1991), Ratcliffe (1990), Kiparsky (2000, 2003), Watson (2002) and Kabrah (2004). One piece of evidence to support this claim comes from the behaviour of the closed syllable shortening process. The long closed syllable is shortened *before* consonant-initial subject suffixes but *not* before object suffixes, as shown in (41) below.

(41) Closed syllable shortening

a. ʃaaf-**na**	ʃuf.na	we saw
b. ʃaaf-**na**	ʃaaf.na	he saw us
c. ʃaaf-**ki**	ʃaaf.ki	he saw you (f.s.)

Stress-epenthesis interaction provides another piece of evidence that can establish the distinction between lexical and postlexical levels. Stress in MA falls on one of the last three syllables in the PrWd. In the presence of one or more heavy syllables, the rightmost heavy syllable is stressed; in the absence of heavy syllables the first light syllable is stressed, as long as it does not exceed the antepenult[15]. Epenthetic vowels are invisible to stress in MA. However, they can be stressed under certain circumstances, as exemplified in (42) below.

(42) Stress-epenthesis interaction

a.	katab	/'ka.tab/		wrote
b.	katab-u	/'ka.ta.bu/		they wrote
c.	katab-t-ha	/ka.'ta.b***i***t.ha/	*/ka.ta.'b***i***t.ha/	I wrote it
d.	katab-t-l-ha	/ka.tab.'til.ha/	*/ka.'tab.t***i***l.ha/	I wrote for her

In (42.a-b), stress is assigned transparently to the light syllables. In (42.c), one expects stress to fall on the penultimate syllable since it is a heavy syllable. Conversely, stress opaquely appears on the antepenultimate syllable. By analogy, we expect stress in (42.d) to fall on the antepenultimate syllable since in (42.c) the heavy syllable /…b***i***t…/, which contains an epenthetic, vowel does not receive stress. However, the heavy syllable /…t***i***l…/ in (42.d) receives stress even though it contains an epenthetic vowel.

Accounting for the opaque interaction of stress and epenthesis in (42) requires us to distinguish between two types of vowel epenthesis: one that can bear stress and the other which cannot. This distinction can be illuminated by assuming that epenthetic vowels that can bear stress are epenthesized lexically, while those which cannot are epenthesized postlexically[16].

---

[15] Final CVC syllables are light in MA. See section (3.1.5.1) for more details.
[16] A full account of stress-epenthesis interaction is given in chapter four.

There are much more evidence concerning the motivation and necessity of distinguishing between different levels and this will be considered throughout the remainder of this thesis. In general, the distinction between lexical and postlexical phonological processes depends mainly on their sensitivity to lexical and morphological information, i.e. postlexical processes '*do not require access to morphological information*' and are '*purely phonologically conditioned*' (Watson 2002: 226).

To sum up, this thesis assumes that affixes are attached at different levels. In addition, Stratal OT is adopted here to account for the different phonological processes that take place at different levels.

2.4 Overview of Arabic Morphology

2.4.1 Introduction

A well-known fact about morphology is the distinction between *concatenative* morphology and *nonconcatenative* morphology. Concatenative morphology involves affixation at the right or the left edge of the base i.e. morphemes are arranged linearly at one or both edges of the base. Nonconcatenative morphology, by contrast, requires complicated morphological operations, such as infixation and reduplication, which make it more difficult to split morphemes from the base. Noncocatenative morphology, however, is typical in Arabic as well as in other Semitic languages (McCarthy 1981).

In his description of the traditional view of Semitic morphology, Schramm (1991: 1402) states that '*all verbs and most nouns are to be derived by a process of interdigitating discontinuous consonantal root morphemes, expressing lexical content and vocalic pattern morphemes which express grammatical content*'. This is exactly how early Arab grammarians viewed Arabic morphology. The discontinuous-morpheme hypothesis is closely associated with the work of stucturalist linguists, such as Cantineau and Harris (Khabir 1997). In other words, Arabic morphology is organized around a set of basic nominal and verbal representations from which all other Arabic words are derived. The consonantal root or the basic form is singled out as the fundamental lexical unit around which the properties of words are said to cluster (McCarthy 1981). Vowels, on the other hand, bear the grammatical function of the word. For instance, a word like *katab* contains the root /k-t-b/, which carries the broad meaning of ‘writing’ and the pattern /CaCaC/, where the vowels /a-a/ carry the syntactic meaning ‘perfective, active’.

In general, the basic nominal and verbal forms may have two, three, four or five consonants. Inflectional and derivational processes apply to the basic nominal and verbal forms. The plural *kutub*, for instance, is derived from the singular *kitaab*. *kaataba* is another example that illustrates the affixation process by inserting the vowel *a* in the basic form *kataba*.

2.4.2 The Generative-Transformational Approach

Deriving surface representations from underlying representations in the traditional generative-transformational approach requires a larger number of transformational rules, such as addition, deletion and metathesis to account for nonconcatenative morphology (Travis 1979). McCarthy (1981: 415-16) gives the derivational rules of Chomsky (1951) to derive the stem *kattab*, which has the remote representation ktb+a—:a as follows:

(43) Derivational rule (McCarthy, 1981: 415)

$$C_1C_2C_3\left\{\quad\right\} + Q_1\text{—}(:)Q_2\left[\quad\right] \longrightarrow$$

$$C_1Q_1C_2(:)Q_2C_3\left\{\quad\right\}\left[\quad\right] \text{ and } \longrightarrow$$

where $Q_i = V_i$ or ϕ [i = , 2]

As stated by McCarthy (1981: 415), the paraphrasing of this rule is '[t]*he consonants of a root and the vowels of a pattern are indexed by subscript integers from left to right. In concatenation, the first vowel (Q_1) is placed after the first consonant (C_1). If the second vowel is preceded by a colon, then the colon is placed after C_2, indicating gemination of the second root consonant. The colon is itself followed by the second vowel (Q_2) and then by the third root consonant (C_3). Curly brackets and square brackets both are identical in effect to the curly brackets of Chomsky and Halle (1968), except that the former are expanded before the latter. The result of these notations in* [43], *along with the reduction of "::", is that length of either C_3 or Q_2 or both in the input is realized by length of C_3 in the output*'.

In the aforementioned work, McCarthy argues that this analysis is inadequate since '*vocalism can be changed independently of gemination of medial consonant*' in Arabic, i.e. *katab* versus *kattab* and *kutib* versus *kuttib*.

2.4.3 The Autosegmental Approach

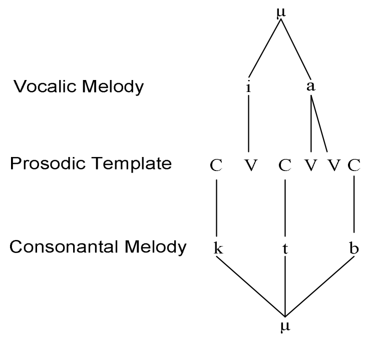
Goldsmith's autosegmental theory (1976) on tone in African Languages proposes that the underlying phonological representation is multi-tiered rather than a linear string of segments. The multi-tiered representation consists of segments and autosegments that are associated with a set of universal conventions[17].

[17] For a comprehensive description of autosegmental approaches, see Goldsmith (1976, 1990).

McCarthy (1979a, 1981) applies the principles of autosegmental phonology to Classical Arabic to formalize a theory which he termed the *Prosodic Theory of Nonconcatenative Morphology*.

The theory stipulates that the consonants and vowels of Arabic words belong to separate morphologically defined tiers. The consonant tier and the vowel tier form the melodic tiers. The skeletal tier is made up of CV elements linked to the melodic tier through universal and language-specific associations of segments. This is shown in (44) below in relation to the word *kitaab* 'book'. The segments in the skeletal tier are specified for the feature [syllabic]; Cs are [-syllabic] while the Vs are [+syllabic].

(44) McCarthy's (1979a) internal structure of a word in Classical Arabic



The three universal conventions (Goldsmith 1976; McCarthy 1982; Pulleyblank 1986) as stated in McCarthy (1981: 382) are:

a. '*If there are several unassociated melodic elements and several unassociated melody-bearing elements, the former are associated one-to-one from left to right with the latter.*

b. *If, after application of the first convention, there remains one unassociated melodic element and one or more unassociated melody-bearing elements, the former is associated with all of the latter.*

c. *If all melodic elements are associated and if there are one or more unassociated melody-bearing elements, all the latter are assigned the melody* *associated with the melody-bearing element on their immediate left if possible*'.

In his discussion of the morphology of Arabic, McCarthy gives the chart in (45) below, which features the fifteen derivational categories (i.e. binyanim) of the triliteral root *ktb* 'write' and the four derivational categories of the quadriliteral root *đħrj* 'roll'. The forms in the chart below are all citation forms. In other words, they do not show mood, agreement, case, gender, or number marking.

(45) Binyanim of triliteral and quadriliteral roots in Arabic (McCarthy 1981: 385)[18]

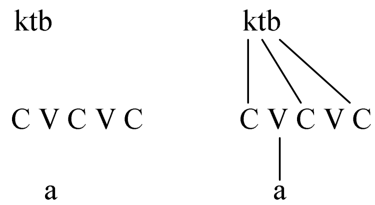
	Perfective		Imperfective		Participle	
	Active	Passive	Active	Passive	Active	Passive
Triliteral Roots						
I.	katab	kutib	aktub	uktab	kaatib	maktuub
II.	kattab	kuttib	ukattib	ukattab	mukattib	mukattab
III.	kaatab	kuutib	ukaatib	ukaatab	mukaatib	mukaatab
IV.	ʔaktab	ʔuktib	yuktib	yuktab	muktib	muktab
V.	takattab	tukuttib	atakattab	utakattab	mutakattib	mutakattab
VI.	takaatab	tukuutib	atakaatab	utakaatab	mutakaatib	mutakaatab
VII.	nkatab	nkutib	ankatib	unkatab	munkatib	munkatab
VIII.	ktatab	ktutib	aktatib	uktatab	muktatib	muktatab
IX.	ktabab		aktabib		muktabib	
X.	staktab	stuktib	astaktib	ustaktab	mustaktib	mustaktab
XI.	ktaabab		aktaabib		muktaabib	
XII.	ktawtab		aktawtib		muktawtib	
XIII.	ktawwab		aktawwib		muktawwib	
XIV.	ktanbab		aktanbib		muktanbib	
XV.	ktanbay		aktanbiy		mukanbiy	
Quadriliteral Roots						
QI.	daḥradʒ	duḥridʒ	udaḥridʒ	udaḥradʒ	mudaḥridʒ	mudaḥradʒ
QII.	tadaḥradʒ	tuduḥridʒ	atadaḥradʒ	utadaḥradʒ	mutadaḥridʒ	mutadaḥradʒ
QII	dḥanradʒ	dḥunridʒ	adḥanridʒ	udḥanradʒ	mudḥanridʒ	mudḥanradʒ
QIV	dḥardʒadʒ	dḥurdʒidʒ	adḥardʒidʒ	udḥardʒadʒ	mudḥardʒidʒ	mudḥardʒadʒ

[18] The imperfective and participle in form IV are corrected. For further information see Bauer (2003: 217).

It is convenient now to see how McCarthy's prosodic theory of nonconcatenative morphology accounts for some of the binyanim in Arabic. To get a correct analysis of the different binyanim, we should bear in mind that the three universal conventions, mentioned above, interact with language-specific rules such as flopping and erasure.

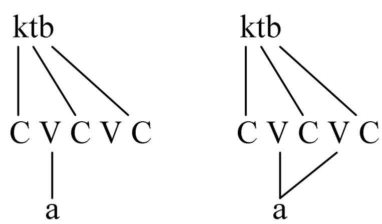
By applying the first convention rule on form I perfective-active which has the prosodic template tier CVCVC in which the perfective active vowel *a* represents the vowel tier and the consonants ktb represent the root consonantal tier, the vowel /a/ is associated with the leftmost /V/, and the root consonants /ktb/ are associated with the Cs on a one-to-one basis from left to right as can be seen in (46) below:

(46)



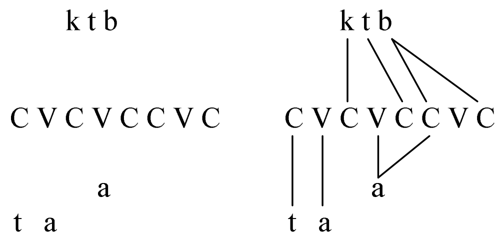
As can be noted from the representation in (46), the second vowel in the template is not associated with the vowel tier. Therefore, another rule is required. In this case, we need the third convention rule which assigns the melody of the vowel to the immediate left. As a result, we get the representation in (47):

(47)



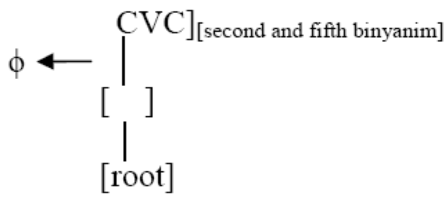
The analysis of the other binyanim is not as straightforward as it is for form I, the perfective active. Form V perfective active, which has the prosodic template tier CVCVCCVC, will give us the representation in (48) once we have applied the three convention rules.

(48)



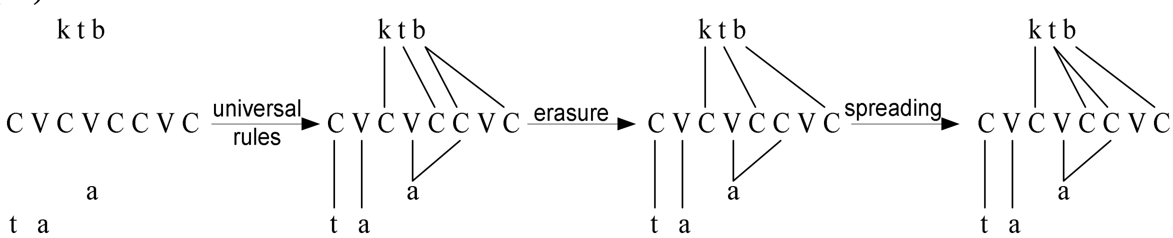
The application of the convention rules produce /takatbab/, which does not match the correct surface form of form V perfective active /takattab/. To solve the problem, McCarthy (1981:392) forms a language-specific rule termed *erasure*, which applies to the second and fifth binyanim only as follow:

(49) Second and Fifth Binyanim Erasure (McCarthy, 1981: 392)



The function of the erasure rule is to erase the association line of the next-to-last C in the root. The empty slot is then associated with the consonant slot on its left through the third convention rule, i.e. spreading. Ultimately, the medial consonant in the root is geminated, as shown in the schematic representations in (50).

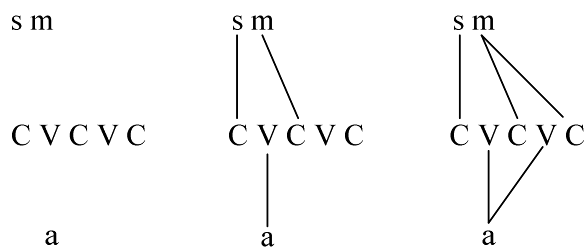
(50)



The rest of the binyanim, whether of triliteral or quadriliteralroots roots, are derived in the same way, i.e. the three universal convention rules interact with the language-specific rules to achieve the required results.

It is worth mentioning that McCarthy (1981:384) proposes a revised version of the Obligatory Contour Principle (OCP). OCP was originally proposed by Leben (1973) to prevent tonal melodies from containing adjacent identical elements. McCarthy's proposal states that: *'a grammar is less highly valued to the extent that it contains representations in which there are adjacent identical elements on any autosegmental tier'*. McCarthy proposes the OCP to account for some cases in Arabic morphology like that of the biliteral root. The biliteral root is realized on the surface with gemination of the second consonant, as in /smm/. The gemination of the second consonant resulted from the application of the universal left-to-right association convention as shown in (51) below. Left-to-right association, moreover, prohibits shapes like *ssm, or *ddrj, where the first two consonants are identical. The function of the OCP is to prevent the consonantal root from having two adjacent identical consonants, i.e. *smm. This fact is motivated by the lack of initial adjacent identical elements such as *ssm.

(51)



Assuming that biliteral verbs share the same underlying template as triliteral verbs in Standard Arabic stems from the fact that biliteral verbs map onto the triliteral verbs template when adding a consonant-initial suffix. This is exemplified in (52) below.

(52)

ʃadd-na	ʃadadna	we fastened
samm-tu	samamtu	I poisoned

However, this cannot be justified for most Arabic dialects, since words like *ʃadd* ‘he fastend’, *zatt* ‘he threw’ and *madd* ‘he extended’ never surface as *ʃadad, *zatat and *madad respectively.

(53)

ʃadd-na	ʃaddiina	we fastened
ʃadd-t	ʃaddiit	I fastened

Accordingly, I follow Watson (2002: 147) in assuming that ‘*a distinct prosodic template now exists for the doubled verb*’ in Arabic dialects.

2.5 Chapter Conclusion

In this chapter, different models of OT have been presented where we show that these models deviate from the strict parallel theory represented by classic OT to semiparallel ones exemplified by the Correspondence and the Sympathy models which recognise an intermediate level between the input and the output. In order to be in line with the general theory of strict parallel OT, Correspondence and Sympathy models establish new relations between the base and the output ‘BO’ and between special constraints ‘selector’ and special suboptimal candidate ‘sympathetic’ respectively. The failure of these models invoke the integration of some of the main principles of the theory of Lexical Phonology with OT, i.e. the integration of serialism with parallelism, which produce what is known nowadays as Stratal OT. Finally, an overview of the morphology of Arabic has then been introduced where we show that the basic verb form in Arabic is form I perfective-active which has the canonical shape /CVCVC/.

3 Prosodic Features

In the initial stages of this chapter, the syllable and the foot will be comprehensively discussed. In the sections that deal with the syllable, issues like onsets and codas in Arabic will be highlighted. A comparison between the syllable types in different JA dialects and MA will be offered, before discussing foot types. Finally, an account will be given for the transparent stress rules in MA.

3.1 The Syllable

With the exception of Fudge 1969, phonologists in the 1960's and early 1970's paid very little attention to syllables. In SPE, for example, the existence of the syllable as a distinct phonological constituent was denied. The recognition of the syllable as a significant unit in phonology started with the works of Vennemann (1972) and Hooper (1972). Since that time, the theory of the syllable has gained more and more attention.

Evidence to support the importance of the syllable in phonological generalization (Vennemann 1972; Hooper 1972; Kahn 1976; Selkirk 1982; Clements and Keyser 1983; McCarthy 1979; 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 nasalisation, vowel lengthening, 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 (1995:207) defines the syllable as '*…the phonological unit which organizes segmental melodies in terms of sonority*.' Angoujard (1990:26-29) states that the theory of the syllable contains the principles and parameters in (1):

(1) Principles and parameters of the syllable

a. 'Each syllable contains one and only one sonority peak.

b. Each syllable contains n segmental slots.

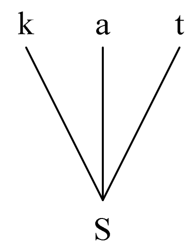
c. *The segmental slots have a predetermined hierarchic interrelation*'.

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 hierarchic relationship.

3.1.1 Types and Representations of the Syllable

There have been four main theories in the literature regarding the internal structure of the syllable. 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 flat model, a word like *cat* is represented as in (2) below:

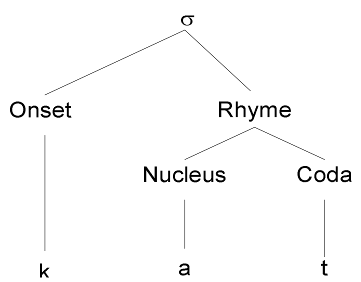
(2)



All subsequent proposals on the syllable structure adopt the core idea of Kahn's (1976) proposal (Farwaneh 1995), i.e. the hierarchically organized representation of the syllable.

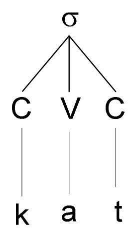
The second theory is known as the onset-rhyme theory (Fudge 1969, 1987; Kiparsky 1980; Blevins 1995 among others). In this theory, the syllable has a binary branching structure. The syllable node is divided into onset and rhyme, as the representation in (3) shows. The onset consists of zero or more consonants, while the rhyme node branches into the obligatory nucleus node and the optional coda node. The nucleus node dominates the sonority peak, which is a vowel or sometimes a syllabic consonant, whereas the coda node consists of zero or more consonants.

(3)



McCarthy (1979a, 1981) established the CV theory, in which a skeletal level mediates between the syllable node and the segments. The segments in CV theory, as the representation in (4) shows, are linked to the skeletal tier and then to the syllable node.

(4)



A closely related theory is the X theory (Kaye and Lowenstamm 1984; Levin 1985) 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, as in the case of the definite article in Tiberian Hebrew. The definite article geminates a following consonant, as in *ham-melek* 'the king', but not if the consonant is guttural where the preceding vowel is lengthened *haa-ʕiir* 'the city'. Assuming that the definite article ends in an empty X-slot allows it to link freely to any segment. Another example to support such replacement comes from Arabic, where the distinction between consonantal and vocalic slots is crucial. In the templates for form II *CVCCVC* and III *CVVCVC* verbs the vocalic slots are interpreted as X-slots pre-associated to a nucleus as shown below (Kenstowicz 1994: 431; Watson 2002: 51-2).

(5)

(a) CVCCVC

N N

XXXXXX

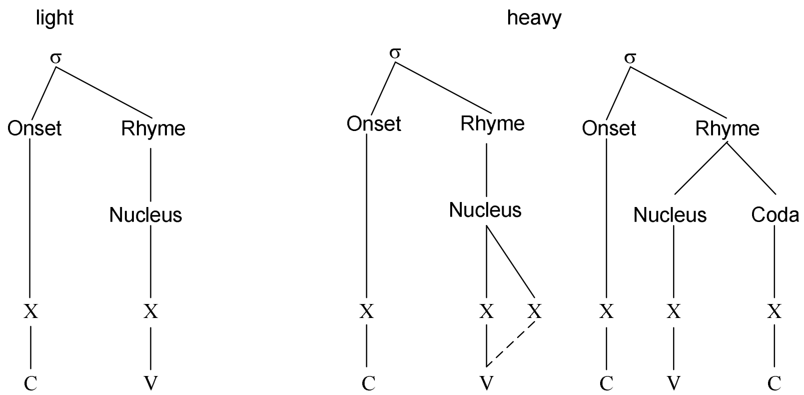
(b) CVVCVC

N N

XXXXXX

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, while in heavy syllables, CVV or CVC, it is associated with two positions as shown in (6)

(6)



The representations in (6) 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 X theory it is not possible to distinguish between CVC as a light syllable and CVC as a heavy syllable since all segments are associated with X-slots. This paves the way for a new prosodic conception of the skeletal level to develop, i.e. the mora.

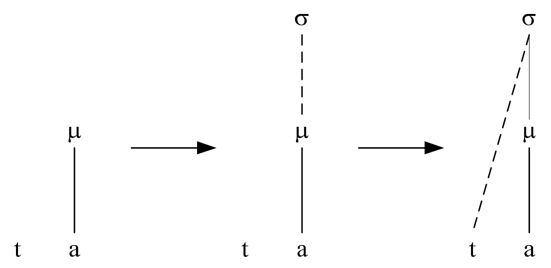
Finally, the most important and most influential syllable theory is the mora model (Hyman 1985; McCarthy and Prince 1986, 1990; Hayes 1989; Broselow 1995). The notion mora, or weight unit, is an old concept that has been recognised in almost every school of linguistics (Broselow 1995: 188). The mora, in the moraic theory as proposed by Hyman (1985) and McCarthy and Prince (1986), has a dual role. First, it is a unit of syllable weight that represents the contrast between light and heavy syllables in which the former is monomoraic and the latter bimoraic. The second role the mora plays is as a skeletal position which indicates the position of segments in the syllabic structure (Farwaneh 1995: 5).

Under moraic theory (Hyman 1985; Hayes 1989, 1995; Broselow 1995) the X-slots in the nucleus are replaced by moras. X-slots in the coda are dispensed with moras in languages that recognise CVC as a heavy syllable otherwise the coda consonant is linked directly to the syllable node in languages where CVC syllable is considered light. All languages treat CV syllables as light (represented with one mora) and CVV syllables as heavy (represented with two moras). CVC is treated in Arabic and English for example as a heavy syllable, while other languages, such as Lardil, treat it as light (Wilkinson 1988). A language-specific rule should state how a certain language treats different types of syllables. A rule to overcome this problem was proposed by Hayes (1989) who called it weight-by-position. This rule allows the language in question to assign a mora to consonants in the coda. Accordingly, the rime in CVC may be assigned with one or two moras depending on the language rules.

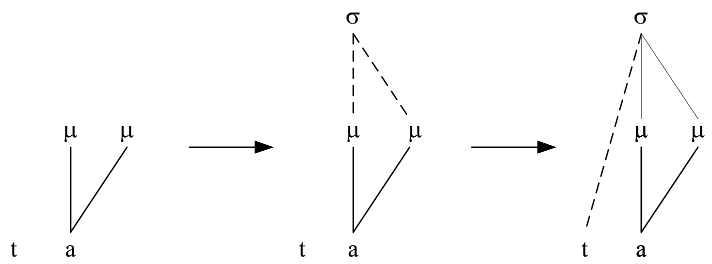
The onset is not assigned a mora in moraic theory since they have no effect on syllable weight. Consonants in the onset are linked directly to the syllable node. Although some phonologists tend to link the consonants on the onset with the mora, which is associated with the vowel assuming that they have some effect on the syllable weight, it is more common to link the onset with the syllable node directly.

The length of the segment is represented in two ways: long vowels are assigned two moras, while geminate consonants 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 following one.

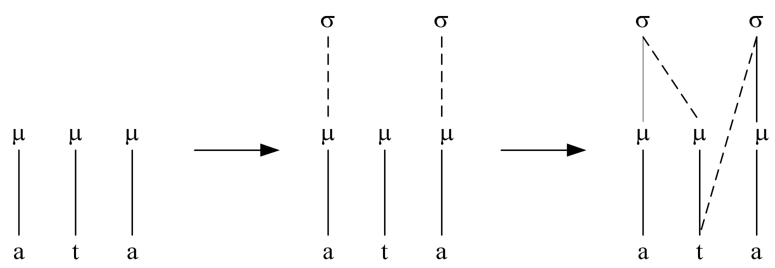
(7) CV representation (Hayes 1995: 52)



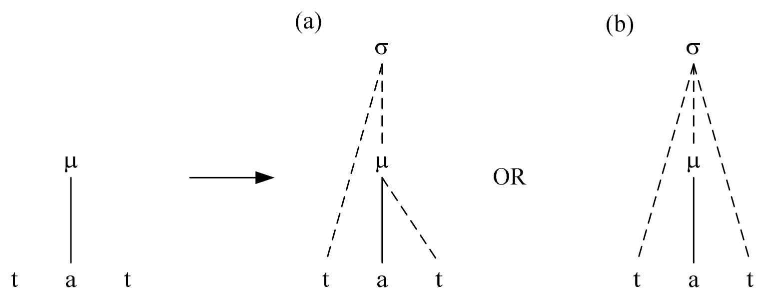
(8) CVV representation (Hayes 1995: 52)



(9) VCCV representation (Hayes 1995: 52)

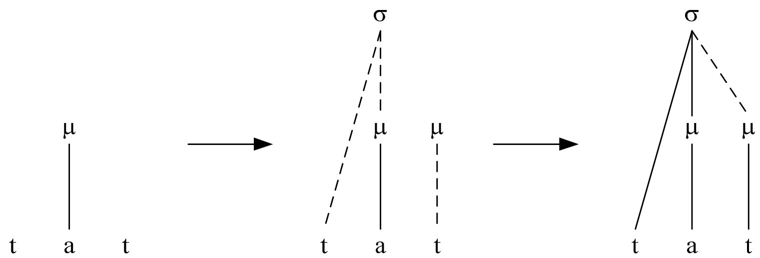


(10) CVC "light" representation (Hayes 1995: 52)



The difference between the two representations in (10) stems from the fact that, in (10.a), the language allows mora sharing, while in (10.b) coda consonants are considered weightless. Such a difference should be stated in the grammar of the language in question.

(11) CVC "heavy" representation "languages which apply the weight-by-position rule"



The advantages of the moraic model over other syllable models is summarised in (12) below[1].

(12)

(a) Moras are better integrated into the prosodic hierarchy;

(b) The model expresses the weight-irrelevance of the onset;

(c) It expresses the variable nature of coda-weight;

(d) It offers an account of short vs. long vowels and singletons vs. geminates;

(e) It offers a way of expressing light, heavy and superheavy syllables.

3.1.2 Syllable Typology

The claim about languages in general is that they allow consonant-initial syllables which are obligatory in some languages and optional in others[2]. Consonants syllable-

[1] For further details about the advantages of moraic theory over other theories see Hyman (1985) and Hulst & Ritter (1999) among others.
[2] It has been reported by Sommer (1969, 1970, 1981) that Kunjen, an Australian Aboriginal language, allows only vowel-initial syllables (Blevins 1995: 230).

finally, on the other hand, are allowed in some languages and prohibited in others. Eventually, onsets and codas are optional constituents while nuclei are obligatory.

Complex margins are allowed in many languages all over the world which increase the number of syllable types a particular language may have. Zec (2006), in her review of the typology of the syllable structure gives the table in (13) to show the typology of the syllable shapes, including those with complex onsets and/or complex codas.

(13)

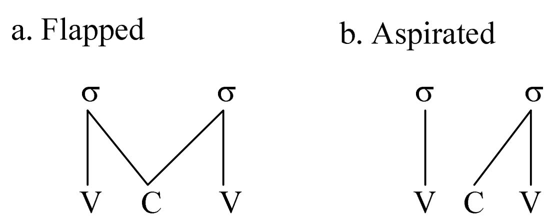
Onset	Coda	Onset Cluster	Coda Cluster	Inventory	Language
R	O	O	O	(C) C V (C) (C)	Totonak
			X	(C) C V (C)	Dakota
		X	O	C V (C) (C)	Klamath
			X	C V (C)	Temiar
R	X	O	-	(C) C V	Arabela
		X	-	C V	Senufo
O	O	O	O	(C) (C) V (C) (C)	English
			X	(C) (C) V (C)	Spanish
		X	O	(C) V (C) (C)	Finnish
			X	(C) V (C)	Turkish
O	X	O	-	(C) (C) V	Pirahã
		X	X	(C) V	Fijian

R= required, O= optional, X= banned

The languages in the table allow onsets, whether by requiring them or by not banning them. On the other hand, codas are optional or banned in these languages, i.e. no language requires codas as an essential component of its grammar. Furthermore, complex onset and complex codas behave in the same way cross-linguistically: they are not required by the grammar of a certain language, but they might be allowed or prohibited. Stevens and Keyser (1989) and McCarthy and Prince (1986) argue that, as long as complex margins are allowed in a given language, there is no limit on their number, i.e. the language will not impose a maximum of two, three or more consonants. However, limits are set by co-occurrence restriction on adjacent segments (Zec 2006).

Finally, the final point to mention in this section is a phenomenon known in the literature as onset maximization or Maximal Onset Principle (MOP). This was proposed by Pulgram (1970) and Kahn (1976) to refer to the syllabification of consonants between vowels as an onset for the second vowel in a sequence like /…VCV…/. Steriade (1982: 77) and Clements and Keyser (1983: 37) assume the sequence /VCV/ is cross-linguistically syllabified as /V.CV/ rather than /VC.V/. This view has been challenged by languages which allow vowel-initial syllables only (Blevins 1995: 230). To support MOP, Kahn (1976) argues that ambisyllabicity (consonants that are affiliated with more than one syllable) can account for the distribution of consonantal allophones in English. According to Kahn (1976), voiceless stops are aspirated syllable-initially in English while they are flapped when they are ambisyllabaic, as shown below.

(14)



Borowsky (1986) argues against ambisyllabicity by proposing that flapping, among other phonological processes in English, is the result of a stress-condition resyllabification rule which changes the /V.CV/ into /VC.V/ (Blevins 1995: 232).

3.1.3 The Syllable in OT

In OT, the range of syllable inventories found in languages results from the interactions between markedness and faithfulness constraints. The markedness constraints in (15) (Prince and Smolensky, 2004) account for the basic syllable shapes.

(15) Markedness Constraints

a. NUC
Syllables must have nuclei.

b. ONS
Syllable must have onsets.

c. *CODA
Syllables must not have codas.

The constraints in (15) state that each syllable must have a nucleus. An onsetless syllable will violate the constraint ONS and a syllable with a coda violates the constraint *CODA. As a result, the CV syllable is the least marked syllable form that satisfies all the constraints in (15).

Faithfulness constraints interact with markedness constraints to produce the desired syllable form. The main faithfulness constraints are represented in (16) below. MAX constraint prohibits deletion while DEP prohibits epenthesis.

(16) Faithfulness Constraints

a. MAX
An input segment has a correspondent segment in the output.

b. DEP
An output segment has a correspondent segment in the input.

In order to account for complex margins, two other markedness constraints should be taken into consideration: *COMPLEX$_{ONS}$ and *COMPLEX$_{CODA}$.

(17)

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.

The different rankings of the constraints in (15), (16), and (17) account for the syllable inventories found in languages. For example, 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 >> DEP >> *COMPLEX$_{ONS}$

The tableau in (19) shows how these constraints interact to derive the optimal output for a /CCVC/ syllable.

(19)

CCVC	NUC	ONS	*CODA	MAX	DEP	*COMPLEX$_{ONS}$
e. ☞/CCV.CV/					*	*
f. /CV.CV.CV/					**!	
g. /CVC/			*!	*		
h. /CV/				*!*		

The table shows that minimally violating the constraint DEP is better than syllabifying the sequence with a coda. Accordingly, candidate (19.a) wins the competition. Violating the MAX constraint, on the other hand, is intolerable in this language due to its high status in the grammar. Furthermore, ranking the constraint *COMPLEX$_{ONS}$ over the constraint DEP would optimise candidate (19.b).

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

3.1.4 The Sonority Hierarchy and the Syllable

A well known fact in the theory of syllable structure is that segments in syllables are grouped according to their hierarchic interrelations. In literature, the hierarchic interrelation is known as the *SONORITY HIERARCHY* or the *SONORITY SCALE.*

Sonority, in general, is an acoustic property of sounds. Trask (1996: 327) defines sonority as the 'sort of prominence associated with a segment by virtue of the way in which that segment is intrinsically articulated'. Accordingly, stops are lower in sonority than fricatives; fricatives are lower in sonority than nasals and so on.

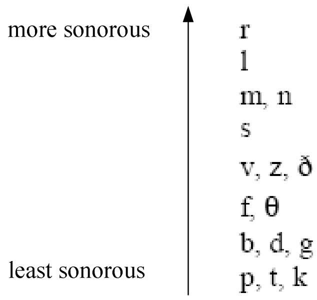
Many different studies (Hooper 1976; Kiparsky 1979; Broselow 1979; Selkirk 1984; Clements 1990; Butt 1992) have been proposed in the literature to derive a universal sonority hierarchy. After carefully examining these studies, a representation for a universal sonority scale would look like the one in (20) below, in which vowels are the most sonorous and obstruents are the least sonorous.

(20) Universal Sonority Scale

5	Vowels	
		Low vowels
		Mid vowels
		High vowels
4	Glides	
3	Liquids	
2	Nasals	
1	Obstruents	

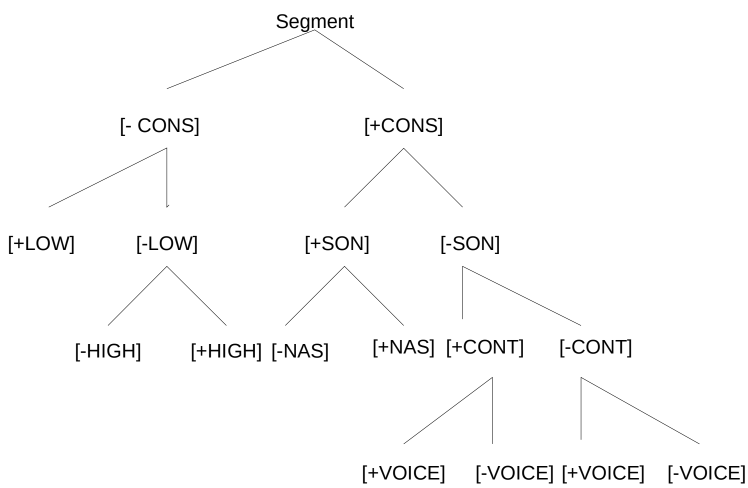
Fricatives and stops, according to Clements (1990), constitute a single class in relation to the sonority scale. Butt (1992), on the other hand, argues that voiceless obstruents are less sonorous than voiced ones. A further distinction among consonants is assumed by Selkirk (1984), who argues that voiceless stops are less sonorous than voiced ones. She goes on to distinguish between other consonants, shuch as between stops and fricatives as can be seen in (21) below:

(21)



To distinguish between segments according to their sonority, Blevins (1995: 211) gives the representation in (22). For each node, the left branch is more sonorous than the right one. Sonority relations for a given feature are defined with respect to segments with the feature specification of the mother node.

(22)

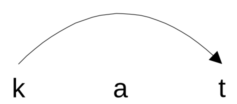


Blevins' sonority scale offers a finer degree of distinction among segments, although it does not account for the fact that the high back vowel [u] is more sonorous than the high front vowel [i], as discussed by Ladefoged (1971).

Almost all scholars who discuss sonority agree that a fixed universal sonority scale 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.

In syllables, the peak of sonority is occupied by the most sonorous segment 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, resulting in a mountain-like curve similar to the one in (23).

(23)



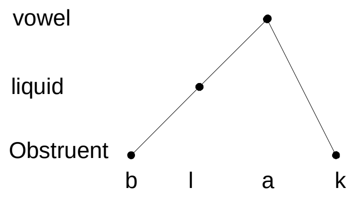
According to the *SONORITY SEQUENCING PRINCIPLE* (Hooper 1976; Kiparsky 1979; Steriade 1982; Selkirk 1982; Clements 1990), the first consonant in Complex onsets should be less sonorous than the second one, whilst in complex codas, the first consonant should be more sonorous than the second one.

(24) Sonority Sequencing Principle (SSP)

The sonority profile of the syllable must rise until it peaks, and then fall.

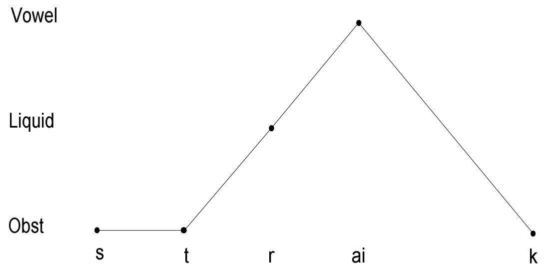
In English, for example, a complex onset cluster could be an obstruent followed by a liquid or a glide. Consider the sonority representation for the word *black* in (25):

(25)



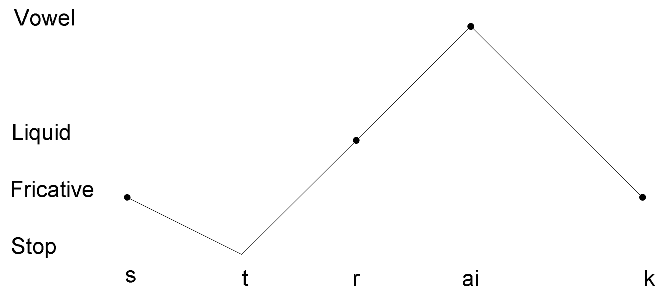
This generalisation about English is violated when we consider s-initial onset clusters, even if we believe that obstruents are equal in sonority since the claim is that the second consonant should be more sonorous than the first. The word *strike* in (26) illustrates this point:

(26)



Furthermore, if we acknowledge that fricatives are more sonorous than stops, we can easily detect that sonority falls from the fricative /s/ and then starts rising as (27) shows.

(27)



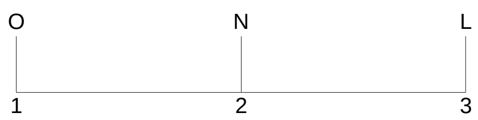
Sequences like [pn] and [ps] are not allowed in English, for instance. However, in many other languages these sequences are tolerated. In Greek, for example, words like *psycholgia* ‘psychology’ and *pnefmonia* ‘pneumonia’ are pronounceable (Roca and Johnson, 1999).

In order to account for these facts, Selkirk (1984) and Clements (1990), among others, propose the *MINIMAL SONORITY DISTANCE* principle:

(28)
Minimal Sonority Distance (MSD)
The member of a cluster must be *d* distance apart on the sonority scale.

In Spanish, for instance, sequences like [pr] and [pl], as in *preso* [preso] ‘prisoner’ and *plano* [plano] ‘flat’, are possible onsets but [pn] and [ml] are not. The scale in (27) shows that [p] is separated from [r] by two intervals, while [p] is separated from [n] and [m] from [l] by only one interval. So, to form a complex onset in Spanish, the first consonant should be two intervals apart from the second one:

(29)



The range of values for MSD, based on the scale in (29), is given in (30): 0-MSD value is given for flat sonority sequences, 1-MSD value for higher sonority sequences and 2-MSD for the highest sequences (Zec 2006).

(30) MSD Range of Values

MSD 0	OO, NN, LL
MSD 1	ON, NL
MSD 2	OL

3.1.5 The Syllable in Arabic

In general, three considerations about the syllable in SA should be taken into account. First, Onsets are obligatory, i.e. no syllable can begin with a vowel. Second, although onsets are required, complex onsets are prohibited. Finally, codas and complex codas up to two consonants are allowed. The examples in (31) show five different syllable types that satisfy the three criteria about the syllable in SA. In addition to these syllable types, SA has another syllable type, viz. /CVVCC/, in which the last two consonants are a geminate. The sequence /CVVCC/ takes place in a prepause absolute final position.

(31) SA Syllable Types

CV	/ka.ta.ba/	he write
CVC	/sal.la.ma/	he submitted
CVCC	/kalb/	dog
CVV	/kaa.tib/	writer
CVVC	/ʕaam/	public

Comparing these details about SA to Arabic dialects reveals the following. First of all, every Arabic dialect, to my knowledge, prohibits onsetless syllables and permits codas. Complex onsets are allowed in some Arabic dialects like Jordanian, Palestinian, and Syrian, to mention but three, and prohibited in some other dialects like Cairene Arabic and Al-Ahasa Arabic (Aljumah, 2008). Complex codas are similar to complex onsets, i.e. they are allowed in some Arabic dialects like Syrian and Palestinian and prohibited in other dialects like Makkan and AJ Arabic. Accordingly, Arabic dialects, in general, accommodate the range of syllable types found in SA and add other types to account for the fact that they allow complex onsets.

Complex onsets result from the deletion of the underlying unstressed high short vowel in open syllables. Consider the examples from Jordanian Arabic in (32) below.

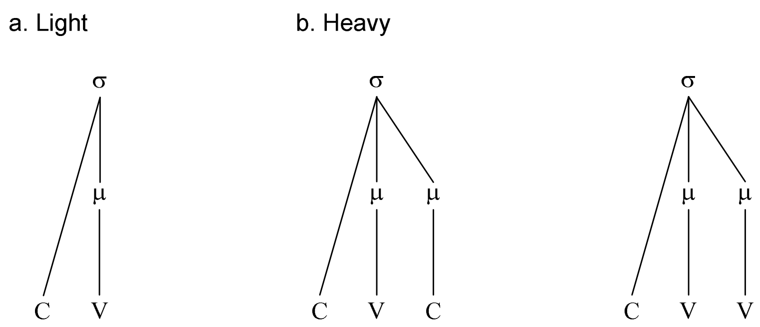
(32)

Input	Output	Glossary
/ki.taab/	/ktaab/	book
/si.laaḥ/	/slaaḥ/	weapon

3.1.5.1 Syllable weight and Consonant Extrametricality in Arabic

Arabic is a quantity sensitive language that distinguishes between two types of syllables, i.e. light versus heavy syllables. CV syllables are light since they are monomoraic while CVC and CVV are heavy because they are assigned two moras.

(33)



The position of the CVC syllable in a given word, as proposed by McCarthy (1979b), determines its weight. In other words, the CVC syllable in final position is light, while in all other positions it is heavy. This stems from the fact that the final C in CVC in ultimate final position is considered *extrametrical*. Thus, it is not assigned a mora. Heavy syllables in quantity sensitive languages, however, attract stress and the failure of a CVC syllable to attract stress when it occurs word-finally is explained by the fact that the final C, as shown in (34) below, is weightless.

(34)

/'ḍa.rab/	'he hit'	/ḍa.'rab.na/	he hit us
/'ḥa.mal/	'he carry'	/ḥa.'mal.na/	he carry us

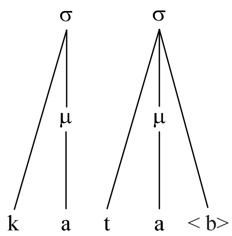
The notion of extrametricality was first proposed in metrical theory by Liberman and Prince (1977) and Hayes (1979). The idea of extrametricality was then developed in subsequent works of Hayes (1981, 1995), Ito (1986) and Roca (1992), among many others. Extrametricality '*designates a particular prosodic constituent as invisible for purposes of rule application*' (Hayes 1995: 57). In order to control extrametricality, Hayes (1981, 1995) proposed the following restrictions:

(35) restrictions on extrametricality (Hayes 1995: 57-8)

a. Constituency	Only constituents (segment, syllable, foot, phonological word, affix) may be marked as extrametrical.
b. Peripherality	A constituent may be extrametrical only if it is at a designated edge (left or right) of its domain.
c. Edge Markedness	The unmarked edge for extrametricality is the right edge.
d. Nonexhaustivity	An extrametricality rule is blocked if it would render the entire domain of the stress rules extrametrical

An extrametrical element is usually marked by placing it between angled brackets 〈 〉. The final consonant in *katab* 'he wrote' is extrametrical as illustrated in (36).

(36)



Consonant extrametricality is supposed to take place before the assignment of the mora through weight-by-position, since syllabification is achieved according to the algorithm in (37) (Clements 1990: 299; Watson 2002: 63):

a. Consonant extrametricality: C > ⟨C⟩ /___]word.

b. Associate moraic segments to a syllable node.

c. Given P (an unsyllabified segment) preceding Q (a syllabified segment), adjoin P to the syllable containing Q iff P has a lower sonority rank than Q (iterative).

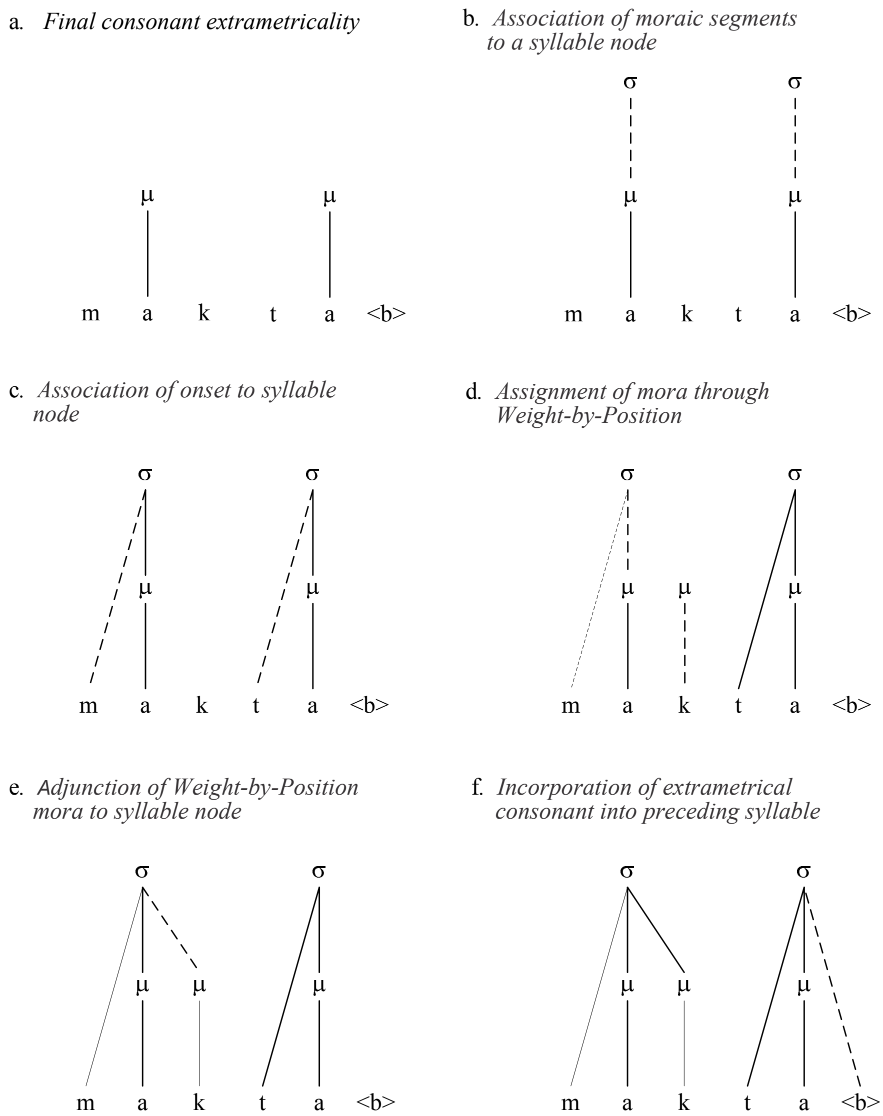
d. Given Q (a syllabified segment) followed by R (an unsyllabified segment), assign a mora to R (Weight-by-Position) [iff R has a lower sonority rank than Q (iterative)].

e. Adjoin moraic R to the syllable containing Q (iterative).

This algorithm can be exemplified in the syllabification of the word *maktab* ‘office’ in MA as shown in (38)[4].

[4] The syllabification in (38) depends on Watson (2002: 63).

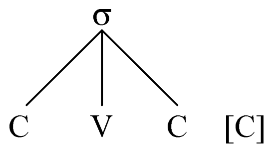
(38)



It has already been explained that heavy syllables are those which have two moras, i.e. bimoraic, while light ones are those which are monomoraic. However, in the studies that have been conducted on some Arabic dialects, the term superheavy syllable was used to refer to syllables of the canonical shapes /CVCC/ and /CVVC/. The appearance of such syllables word-finally and word-internally induced scholars to propose different approaches to account for them since they violate the ban on trimoraic syllables. In their analyses, Hayes (1995: 106–7), Kager (1995b: 376) and

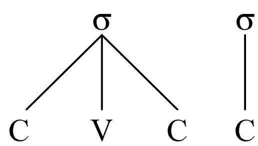
Kenstowicz (1994: 274) describe the final C in superheavy syllables as *extrasyllabic*, i.e. it falls outside the domain of the syllable.

(39)[5]



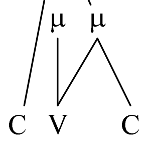
An extrasyllabic consonant is linked directly to a degenerate syllable (Aoun 1979; Selkirk 1981 among others), as shown in (40)

(40)



In another proposal, the final consonant in CVVC syllables is assumed to share a mora with the previous vowel (Broselow 1992, 1997; Watson 2007), i.e. keeping the bimoricity of the syllable. It has been argued, in the aforementioned works, that a consonant may share a mora with a preceding vowel but it is unlikely that two consonants will share a mora since mora sharing is linked to sonority profiles.

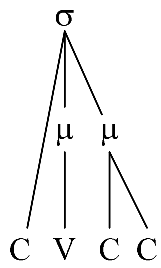
(41)



[5] I enclosed the extrasyllabic consonant between bracket squares to differentiate it from extrametrical consonants.

However, Farwaneh (1995: 66-70) and McCarthy (2007: 147-8) argue that the final consonants in CVCC syllable can share one mora, as shown in (42)[6].

(42)



As indicated above, the motive behind these proposals is the fact that the superheavy syllables violate the ban on trimoraic syllables. A full account of these syllables will be given when vowel epenthesis is discussed in chapter four.

3.1.6 Syllable Types in Jordanian Arabic Dialects

An extensive amount of studies have been conducted on Arabic dialects (Abdo, 1969; Al-Ani, 1970; Brame, 1970, 1973; Broselow, 1976; McCarthy, 1979a, 1979b, 2007; Abdul-Karim, 1980; Benhallam, 1980; Kenstowicz, 1981; Kenstowicz and Abdul-Karim, 1980; Selkirk, 1981; Abu-Salim, 1982; Al-Mozainy, 1982; McCarthy and Prince, 1986; Abu-Mansour, 1987; Angoujard 1990; Farwaneh, 1995; Kager, 1999; Kiparsky, 2000, 2003; Watson 2002, 2007) to mention but a few of the most prominent figures. However, fewer studies have addressed Jordanian Arabic (Palva 1976, 1980; Bani Yasin and Owen, 1984; Alghazo, 1987; Al-Sughayer, 1990; Sakarna, 1999; AbuAbbas, 2003; Btoosh, 2006; Al-Shboul, 2007). In this section, the syllable types that have been discussed by four of the above studies will be considered and compared to the syllable types exhibited by MA speakers. Al-Sughayer (1990)

[6] A mora can be shared by two consonant according to Farwaneh (1995) if they comply with the sonority scale of the language in question.

studied what he called Jordanian Arabic, in which he refers to the form of Arabic that is spoken in northern Jordan (henceforth NJA). Sakarna (1999) investigated the dialect of a Jordanian tribe living in the middle of Jordan next to the capital Amman. The tribe name is Abbaadi /ʕab.baa.di/ (henceforth ʕA). AbuAbbas (2003) analyzed data from Alghazo (1987) which came from a city called Ajlūn located to the north of Jordan (henceforth AJ). Finally, Btoosh (2006) handled the dialect of El-Karak, which is located to the south of Amman. I will refer to this dialect as KA. In MA, as can be seen in (43) below, eleven different syllable types are licensed. There are five of these syllable types, namely: CV, CVC, CVV, CVVC and CVCC. These are found in SA.

(43)

CV	/ða.hab/	Gold
CVC	/maḥ.ka.mi/	Court
CVV	/ʃaa.riʕ/	Street
CCV	/xta.raʕ.ha/	he invented it
CCVC	/stam.lak/	Own
CCVV	/xjaar/	Cucumber
CVVC	/maal/	Money
CVCC	/sadd/ /kalb/	Dam Dog
CCVVC	/klaab/	Dogs
CVVCC	/maadd/	Stretch
CCVCC	/nʃadd/	Tightened

The syllable shapes in JA can be divided into three groups: light, heavy and superheavy *'extraheavy'* syllables. CV, CCV and CVC (in final position) are considered light; CVC (in non-final position), CCVC, CCVV and CCVV are heavy syllables. Finally, CVCC, CVVC, CCVCC, CCVVC and CVVCC are termed superheavy[7]. In the literature, the syllable shape CVVCC is sometimes termed

[7] All syllables with complex onsets in JA are allowed word-initially only.

Ultraheavy[8]. For clarification purposes, I will discuss the differences and similarities between the syllable shapes in JA under two sub-headings: Onset in JA and Coda in JA.

Before carefully examining these syllable types, I will introduce the syllable types that are used by the speakers of other Jordanian dialects. The table in (44) below contains and compares the syllable types of MA to NJA, ʕA, AJ and KA. According to Sakarna (1999), ʕA does not allow consonant clusters in coda position. The dialect overcomes that by epenthesizing the short high vowel /i/ or the short low vowel /a/ depending on the phonetic context. In his words, /i/ is epenthesized in every context in coda consonant clusters except in two cases. The first is when the initial consonant in a cluster is a glide which changes into a vowel forming a long vowel. Second case is, when the first consonant in a cluster is a guttural then /a/ is epenthesized. Consider the examples in (45).

(45) Data from Sakarna (1999)[9]

Input	Output	Gloss
a. /ḥarq/	/ ḥa.rig/	Burn
b. /bayʕ/	/beeʕ/	Selling
b. /laḥm/	/la.ḥm/	Meat

However, Sakarna did not mention anything about how ʕA would deal with consonant clusters in coda position when it belongs to a geminate as in the examples in (46) below

(46)

/ḥadd/	Border
/sadd/	Dam
/zatt/	Throw

[8] Interested readers can see McCarthy (1979a) McCarthy and Prince (1990) and Angoujard (1990). It should not be understood that I am suggesting that superheavy syllables are trimoraic.

[9] Sakarna (1999) believes that the outputs for his dialect are derived from Classical Arabic inputs, i.e. he assumes /q/ as the input for /g/ and /ay/ as the input for /ee/. However, I believe that this claim is untrue since there is no evidence to support it.

(44) Syllable Types of Five Jordanian Dialects

Syllable shape	MA		NJA		ʕA		AJ		KA	
CV	/ða.hab/	gold	/wa/	and	/ka.tab/	he wrote	/sa.ʔa.lu/	he asked	/la.ban/	yoghurt
CVC	/maḥ.ka.mi/	court	/ða.hab/	gold	/ka.sar/	he broke	/ʕum.ri/	my age	/maθ.wa/	destiny
CVV	/ʃaa.riʕ/	street	/laa/	no	/haa.dʒam/	he attacked	/ʕaa.li/	high	/mu.raa.sil/	correspondence
CCV	/xta.raʕ.ha/	he invented it	/xta.laf/	to differ	/kta.sab/	he gained	--------	---------	------------	------------
CCVC	/stam.lak/	he owned	---------	--------	/staʕ.mal	he uses	/msik.tu/	I grabbed him	/msam.mam/	poisoned
CCVV	/xjaa.ri/	my cucumber	/tsaa.wa/	become equal	/ktaa.bu/	his book	----------	----------	--------------	--------------
CVVC	/maal/	money	/dʒaar/	neighbour	/dʒaab.lak/	he bring to you	/dʒaab/	he brought	/sa.laam/	peace
CVCC	/sadd/ /kalb/	dam dog	/darb/	road	--------------	----------	/madd/	he stretched	/fann/	art
CCVVC	/klaab/	dogs	----------	---------	/dʒbaal.na/	our mountains	/ktaab/	book	/blaad.na/	our countries
CVVCC	/maadd/	he stretched	/dʒaarr/	he drag	---------------	----------	/dʒaadd/	serious	/ʕaamm/	general
CCVCC	/nfakk/	to be loosened	/nʃadd/	to be tightened	-------------	---------	-----------	---------	-------------	---------------

3.1.6.1 The Onset in JA

The table in (44) shows that all Jordanian dialects require an onset, i.e. the onset is obligatory. As long as onsetless syllables are not allowed in JA then the universal constraint ONS, mentioned earlier, repeated in (47) for convenience, is highly ranked in the grammar of JA

(47)
ONS (Prince and Smolensky 2004)
Syllables must have onsets.

Complex onsets are also permissible in JA, though they are not allowed in SA. All JA dialects allow up to two consonants in the onset position. In OT terms, the constraint that accounts for complex onset is stated negatively as mentioned (48).

(48)
$*COMPLEX_{ONS}$
Syllables must not have more than one onset segment.

Complex onsets in JA result from two different phonological processes. The first is the deletion of the unstressed high short vowel in open syllables. This fact is represented in OT by the constraint in (49)

(49)
*i]σ (Kenstowicz 1995)
High short unstressed vowels in open syllables are not allowed.

By now we can say that the constraint ONS is undominated in JA, therefore, it should outrank the constraint *i]σ. The constraint *i]σ should outrank the constraint $*COMPLEX_{ONS}$ to allow the surfacing of onset clusters. These interactions are depicted in tableau (50) below, where the word /sil.aaḥ/ 'weapon', which is the underlying from of the surface word /slaaḥ/ in JA, is examined.

(50)

/silaaḥ/	ONS	*i]σ	*COMPLEX$_{ONS}$
a. ☞ /slaaḥ/			*
b. /si.laaḥ/		*!	
c. /i.laaḥ/	*!	*	

Candidate (50.a) wins over candidates (50.b) and (50.c) because it only violates the low ranked constraint *COMPLEX$_{ONS}$ and satisfies the other highly ranked constraints. Candidate (50.b) loses because it incurs a fatal violation of the constraint *i]σ. Candidate (50.c) loses since it incurs a fatal violation of the highly ranked constraint ONS.

The second reason for the surfacing of onset clusters in JA is the deletion of the unstressed low short vowel /a/ in open syllables. This should not be understood in terms of the language deleting low short vowels in open syllables, since the deletion of unstressed high short vowels takes place everywhere except word finally. Similarly, the environment for the deletion of the unstressed low short vowel is totally different and is exhibited by certain dialects in JA. This process is common in many Bedouin dialects and not specific to Jordanian Bedouin dialects. In JA, it was reported by Sakarna (1999) as a feature of ʕA and by Irshied (1984) as a feature of the dialect of Bani Hasan. In the literature, this process is known by different names, the most common being '*Trisyllabic Elision*' Irshied (1984) and Sakarna (1999). Trisyllabic elision is a process that deletes a short low vowel in an open syllable when it is followed by a non-final short open syllable. It is triggered by adding a vowel initial suffix to words with a canonical shape /CaCaC/. Accordingly, it changes the sequence /CaCaC-VC/ into /CCaC-VC/ (Sakarna 1999: 47).

Vowel deletion violates the faithfulness constraint MAX-IO, stated in (51), which suggests that it outranks the constraint DEP-IO, represented in (52). Since the constraint ONS is never violated in JA, a sequence like /VCCVC/ would surface as [CVC.CVC] or [CCVC], depending on how the faithfulness constraints MAX-IO and DEP-IO, which have been mentioned earlier and repeated in (51) and (52) respectively for convenience, are ranked with respect to each other.

(51)
MAX-IO
Every segment of the input has a correspondent in the output (no deletion)

(52)
DEP-IO
Every segment of the output has a correspondent in the input (no epenthesis)

In Arabic, the underlying structure of measure I imperative verb has the canonical shape /CCVC/ as shown in (53)[10].

(53) Measure I Imperative verbs

a. /zraʕ/	plant! (m.s.)
b. /ftaḥ/	open! (m.s.)
c. /ʃrab/	drink! (m.s.)

The forms in (53) surface in JA as *CV*CCVC where a vowel is inserted and a glottal stop is then epenthesized in order to avoid the surfacing of any onsetless syllables. Consider the examples in (54).

(54)

	Input	Output	Gloss
a.	zraʕ	ʔi z.raʕ	plant! (m.s.)
b.	ftaḥ	ʔif.taḥ	open! (m.s.)
c.	ʃrab	ʔiʃ.rab	drink! (m.s.)

[10] The structure of the imperative is discussed in Section (4.2.1.1) .

The tableau in (55) 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 remedy the onsetless syllable.

(55)

ftaḥ	ONS	MAX-IO	DEP-IO
a. ☞ ʔif.taḥ			**
b. taḥ		*!	
c. if.taḥ	*!		*

Candidate (55.a) wins over the other two candidates since it only violates the lower ranked DEP-IO constraint. Candidates (55.b) and (55.c) are ruled out since they violate the higher ranked constraints MAX-IO and ONS respectively. The faithful candidate /ftaḥ/, which is not included in the above tableau, never surfaces in JA since it does not satisfy the minimal word requirement.

To sum up, all JA dialects allow complex onsets because of the requirement of the constraint *i]σ which is ranked high in the grammar of all JA dialects. Furthermore, complex onsets result in some other Bedouin JA dialects, not only because of the deletion of the unstressed high short vowels in open syllables but also because of the requirement of the trisyllabic elision which deletes the short low vowel in open syllables when followed by a nonfinal short low open syllable.

3.1.6.2 Coda in JA

Codas are permitted in Arabic. In SA, simple and complex codas are allowed. In all Arabic dialects, simple codas are allowed which means that Arabic and, in particular, JA violate the universal markedness constraint that requires syllables to be open. This constraint is repeated in (56) below.

(56)
*CODA (Prince and Smolensky 2004)
Syllables must not have codas

Complex codas, on the other hand, are permitted in some Arabic dialects. In JA, complex codas are allowed in some dialects and prohibited in others. The dialect under investigation, moreover, does not prohibit complex codas unless they violate sonority sequencing principles. The table in (57) gives examples from MA to illustrate the fact that simple codas, complex codas and geminates are allowed.

(57)

	Input	Output	Gloss
a.	ʕabd	ʕabid	salve
b.	xubz	xubiz	bread
c.	tibn	tibin	Hey
d.	bikr	bikir	First baby
e.	gabl	gabil	Before
f.	gism	gisim	Section
g.	ḥafr	ḥafir	Digging
h.	mahr	mahir	Dowry
i.	ḥiml	ḥimil	Load
j.	farm	farim	Mincing
k.	taxt	taxit	Bed
l.	ʕuʃb	ʕiʃib	Grass
m.	xabṭ	xa.biṭ	Hitting
n.	ʕirs	ʕiris ~ ʕirs[11]	wedding
o.	ʃarg	ʃarg	East
p.	kalb	kalb	dog
q.	bint	bint	Girl
r.	rimʃ	rimʃ	Eye lash
s.	ḥurr	ḥurr	free person
t.	xadd	xadd	Cheek

[11] Words like *kils*, *ʕiris*, and *girʃ* were pronounced differently by the same speaker and by other speakers as well. They were pronounced with and without epenthetic vowel. It seems that the nature of the preceding consonants /l, r/ or the following consonants /s, ʃ/ urge such discrepancies in the pronunciation. This issue is not going to be discussed anymore and will leave for future research.

Accounting for the words in (57) using OT constraints is simple. The constraint *COMPLEX$_{CODA}$ in (58) should be ranked over the constraints MAX-IO and DEP-IO. The tableau in (59) shows how these constraints interact to produce the optimal output for the word /xubz/.

(58)
*COMPLEX$_{CODA}$
Syllables must not have more than one coda segment.

(59)

xubz	*COMPLEX$_{CODA}$	MAX-IO	DEP-IO
a. ☞ xubiz			*
b. xubz	*!		
c. xub		*!	

Candidate (59.a) wins over candidate (59.b) and (59.c) since it only violates the lower ranked constraint DEP-IO, while (59.b) and (59.c) fatally violate the constraint *COMPLEX$_{CODA}$ and the constraint MAX-IO respectively.

When considering the position of the epenthetic vowel, we find that the constraints which have so far been introduced are not sufficient. An alignment constraint is needed to insure that the epenthetic vowel is inserted in the desired position. In other words, a sequence like /CVCC/ could surface as /CV.C**V**C/ or */CVC.C**V**/. To make sure that we get the right syllabification, we introduce the alignment constraint in (60).

(60)
ALIGN (Stem, R; PrWd; R)
The right edge of the stem must coincide with the right edge of the PrWd.

The desired output, as can be seen in tableau (62), is achieved by integrating the constraint ALIGN (Stem, R; PrWd; R) with the already established ranking. Obviously, MAX-IO should outrank ALIGN (Stem, R; PrWd; R), which in its turn should outrank DEP-IO. Accordingly the ranking in (61) is established.

(61)
*COMPLEX$_{CODA}$ >> MAX-IO >> ALIGN >> DEP-IO

(62)

xubz	*COMPLEX$_{CODA}$	MAX-IO	ALIGN	DEP-IO
a. ☞ xubiz				*
b. xubz	*!			
c. xub		*!		
d. xub.zi			*!	*

Candidate (62.a) surfaces as the optimal output because it incurs a violation of the lower ranked constraint DEP-IO. Candidates (62.b) and (62.c) lose because they fatally violate the constraints *COMPLEX$_{CODA}$ and MAX-IO respectively. Candidate (62.d) loses as well since they fatally violates the constraint ALIGN.

The above argument can account for AJ and ʕA. However, it cannot account for MA, NJA and KA, since they allow final coda clusters. These dialects allow coda clusters when they are in line with the sonority hierarchy. In general, complex codas are allowed when the first consonant is a sonorant and followed by obstruents, i.e. falling sonority. This problem is solved by introducing a sonority constraint that prohibits coda clusters with raising sonority. This constraint is introduced in (63).

(63)
SONORITY SEQUENCE (SONSEQ) (Rice 2005: 198)[12]
Coda clusters with rising sonority are not allowed.

The constraint SONSEQ, obviously, should outrank the constraint *COMPLEX$_{CODA}$. The constraint *COMPLEX$_{CODA}$ should be demoted in MA and other similar dialects. As a result, it should be ranked below the constraint ALIGN and DEP-IO. The tableau in (64) shows how the optimal output /bint/ is achieved in these dialects.

(64)

bint	SONSEQ	MAX-IO	ALIGN	DEP-IO	*COMPLEX$_{CODA}$
a. ☞ bint					*
b. bi.nit				*!	
c. bin.ti			*!	*	
d. bin		*!			

The same hierarchy can also account for the surfacing of a word like /ʕa.dil/ ‘justice’, with an epenthetic vowel, since the sequence /dl/ violates sonority as shown in tableau (65).

[12] This is a markedness constraint originally stated by Clements (1990).

(65)

ʕadl	SONSEQ	MAX-IO	ALIGN	DEP-IO	*COMPLEX$_{CODA}$
a. ☞ ʕa.dil				*	
b. ʕadl	*!				*
c. ʕad.li			*!	*	
d. ʕad		*!			

The faithful candidate (65.b) loses because it fatally violates the obligation of the sonority constraint.

To summarize, it becomes clear that there are some similarities between the different JA dialects. However, there are some differences among them that should also be acknowledged. MA allows complex onsets word-initially regardless of their sonority because of the obligation of the constraint *i]σ. Coda clusters, moreover, are allowed word-finally if the cluster is falling in sonority, i.e. the first consonant is sonorant and the second is obstruent. Finally, nonfinal complex onsets and nonfinal complex codas are prohibited (cf. Section 4.2).

3.2 The Foot

The word foot is traditionally used in versification, but the meaning most suitable for our purposes is that which refers to a process of grouping syllables together wherein one of the syllables is the head. *Trochaic* and *Iambic* feet are the most familiar binary foot types. In a trochaic foot, the first syllable is accented while in an iambic one the second syllable is prominent. Regarding foot size, feet in the literature are either bounded or unbounded. Bounded feet have a fixed size in terms of syllables or moras while, by contrast, unbounded feet are of indeterminate size. This explanation implies that bounded feet, 'bounded-stress' languages have binary feet. Stress in binary feet systems is closer to the edges of the word, i.e. left or right.

To account for the different foot types in bounded feet languages, Hayes (1995) proposes three main types, as can be seen in (66) below. These are namely the syllabic trochee, the moraic trochee and the iamb.

(66) Hayes's (1995) foot types

A.	Syllabic Trochee	('σ σ)	('L L)
			('H L)
			('H H)
B.	Moraic Trochee	('μ μ)	('L L)
			('H)
C.	Iamb	(σ 'σ)	(L 'L)
			(L 'H)
		Or ('σ)	('H)

The syllabic trochee consists of two syllables in which the first is accented and the syllable structure is: two successive light (L) syllables, two successive heavy syllables, or a heavy syllable followed by a light one. The foot in the moraic trochee should have two moras, in which the first is the head. Accordingly, it might have one of the following two syllable structures: two light syllables or a heavy syllable. Finally, the iambic foot consists of two syllables in which the second is the head, or it consists of one syllable. In the two-syllable structure, two successive light syllables, or a light syllable followed by a heavy one, are allowed. In the one-syllable structure, the syllable must be heavy.

3.2.1 The Foot in MA

The foot in JA and in MA is moraic trochee, left headed, binary, and the direction of footing is from left-to-right. Accordingly, ('H) and ('LL) form the foot inventory in JA and MA. A word with two heavy syllables in MA is footed as /(H)('H)/, where the rightmost heavy syllable is stressed. Consider the word /muf.taá́h/ “key” which is stressed on the second syllable. This word can only be footed as /(muf)('taah)/ but not */(muf.'taaḥ)/, since it violates the principles of the foot binarity, i.e. moraic binarity. Under no circumstances can the trochaic foot as a constraint, be violated in MA or in any other JA dialects. In other words, degenerate feet are absolutely forbidden.

Grouping syllables into moraic trochees requires each foot to consist of two moras. In an even number of light syllables, the grouping is achieved without raising any problem. However, grouping an odd number of light syllables raises two questions: the direction of grouping, i.e. left-to-right or right-to-left and how to deal with the monomoraic syllable which is leftover after the grouping?

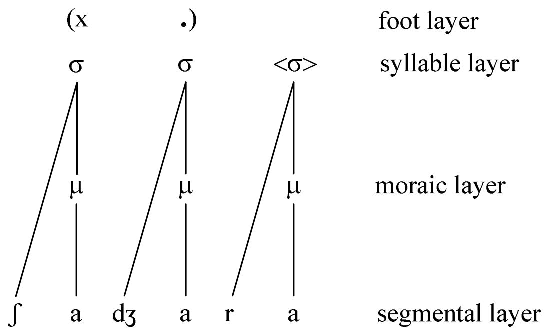
The directionality of footing would affect the assignment of stress. In a three-light-syllable word, stress falls on the antepenultimate syllable when the direction is from left-to-right and on the penultimate syllable when the direction is from right-to-left.

(67)

a. Left-to-right	b. Right-to-left
⟶	⟵
('LL)L	L('LL)

In MA, the penultimate is stressed in (67). However, there is no clear cut evidence for the direction of footing since the final syllable is deemed extrametrical, as shown in (68). Furthermore, the language does not allow a sequence of more than three light syllables that can be tested.

(68)



Languages differ in their treatment of degenerate feet, i.e. allowed in some languages and prohibited in others (Hayes, 1995). Hayes (1995: 87) proposes three different levels of prohibition on degenerate feet: strong, weak and non-prohibition, as shown in (69).

(69) Prohibition on Degenerate Feet (Hayes, 1995: 87)

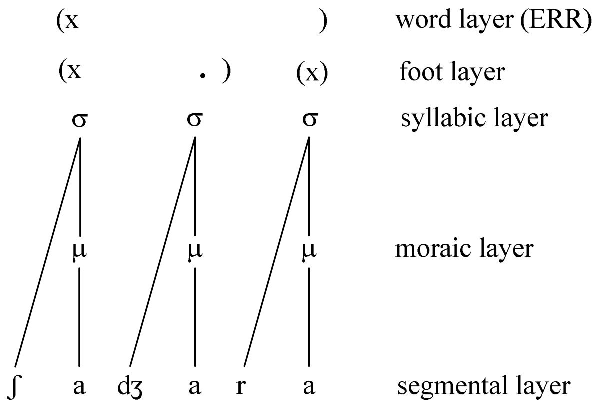
a. **strong prohibition**	absolutely disallowed
b. **weak prohibition**	allowed only in strong position, i.e. when dominated by another grid mark.
c. **non-prohibition**	Degenerate feet are freely allowed[13].

MA strongly prohibits degenerate feet for two reasons. First, it has been pointed out by Hayes that there is a strong correlation between the size of the minimal word and the treatment of degenerate feet, i.e. if the language does not allow minimal words smaller than its proper foot then it is highly unlikely it will permit degenerate feet. In MA, all content words should be minimally bimoraic. Supporting this claim about MA stems from the fact that underlying sub-minimal content words like *ʔab* 'father' surface as *ʔabb* where the final consonant is geminated to satisfy the minimal

[13] The evidence to support this type is weak as argued by Hayes (1995: 87).

word requirement[14]. Moreover, loan words that do not satisfy word minimality are lengthened as *baar* ‘bar’[15]. The second reason to disallow degenerate feet absolutely in MA is supported by the *End Rule Right* (ERR) which assigns stress to the rightmost foot in a given word. Accordingly, if degenerate feet are allowed then the ultimate syllable incorrectly receives stress in a word like *ʃadʒara* ‘tree’, as shown in (70) below.

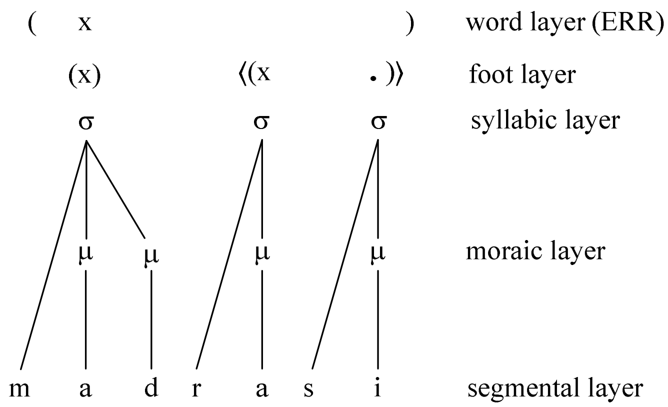
(70)



It has been argued that the final consonant in final CVC syllables is extrametrical and the final unfooted light syllable is also extrametrical in MA. As a result, one might ask if the final foot is extrametrical in MA as well. The simple answer is that MA allows the final foot to be extrametrical. A word like *madrasi*, ‘school’, surfaces with penultimate stress as represented in (71). The penultimate syllable attracts stress since it is heavy. Thus, it could not surface with the main stress without deeming the final foot extrametrical, as stress is governed by the ERR principle.

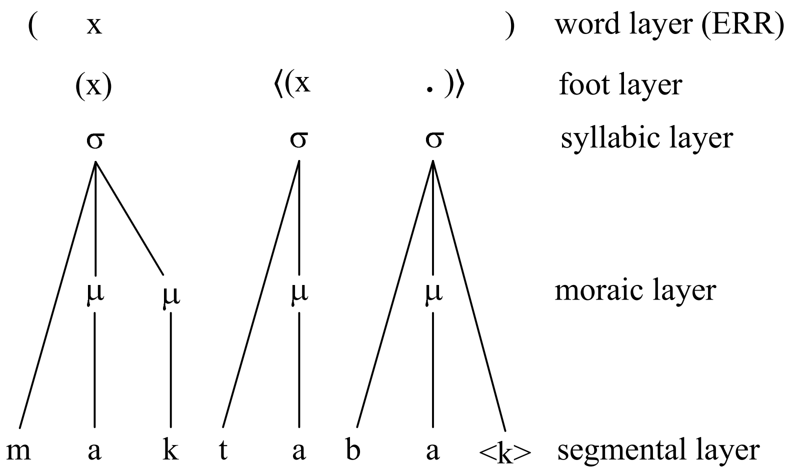
[14] *ʔabb* is underlying sub-minimal because when a suffix like *k* is added the word surfaces as *ʔabuuk* without a geminate.
[15] This process has been reported for other Arabic dialects like Cairene (Watson, 2002: 88).

(71)



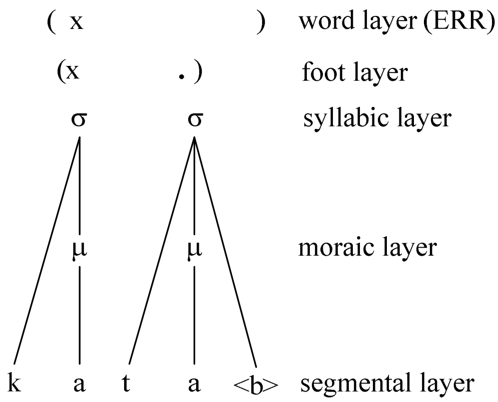
Two points should be highlighted before we end this discussion: first, the presence of an extrametrical consonant does not prevent foot extrametricality. This is due to the fact that the extrametrical consonant is contained within the peripheral foot and does not come between the foot and the rightmost edge (Hayes, 1995; Watson, 2002). This fact is not unique to MA, since it has been reported for other Arabic dialects such as Palestinian and Bani-Hassan (Hayes, 1995). Accordingly, a word like *maktabak*, 'your office', surfaces with antepenultimate stress due to consonant and foot extrametricality as shown in (72).

(72)



The second point is that foot extrametricality is blocked if the peripheral foot is the only foot in the word and if extrametricality would exhaust the entire domain of stress rules. Hayes refers to this condition as nonexhaustivity (cf. Section 3.2.1). Nonexhaustivity ensures that the foot in a word like *katab*, ‘he wrote’, does not undergo foot extrametricality.

(73)



3.2.2 Section Summary

In the above sections, different ways of representing the syllable were outlined. The effect of sonority on syllable structure was introduced. Then, a brief comparison was established between the different syllable types in four different JA dialects in addition to MA dialect. The main finding was that all JA dialects allow complex onset due to the deletion of the unstressed high short vowel in open syllable. Furthermore, JA dialects differ in licensing complex codas. The dialects of MA, KA and NJA allow complex codas with falling sonority, while the rest of JA dialects strictly prohibit them unless the final cluster is a geminate. Finally, the different foot types exhibited by JA speakers have been outlined, as I argued that the foot in MA is moraic trochee. Finally, Extrametricality was introduced in two sections. In the first section, the notion of extrametricality was introduced and the application of this phenomenon to the final consonant in final CVC syllables. In the second section, I show that extrametricality, following Hayes (1995), can be extended to cover final syllable and final foot if it does not exhaust the entire domain of stress rules.

3.3 Stress in MA

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 (Prince and Smolensky 2004, Hyman 1985). 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. In general, stress in Levantine Arabic falls on the rightmost heavy syllable.

Stress in JA (AbuAbbas 2003), Syrian Arabic (Adra 1999) and Egyptian Arabic (McCarthy 1979b) is in line with the principles of the 3-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 preantepenultimate syllable as reported by Brame, (1973, 1974); Kenstowicz and Abdul-Karim (1980); Abu-Salim (1982); and Hayes (1995).

3.3.1 General Stress Pattern in MA

Stress in MA falls on one of the last three syllables in the 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 3-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, as mentioned earlier, is a count system that counts moras and its foot inventory includes ('LL) 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 (cf. Section

3.3.1). Finally, stress is governed by the End Rule Right (ERR) principle. These rules of stress assignment are summarised in (74).

(74)

a. Consonant Extrametricality	C → ⟨C⟩ /___]$_{word}$
b. Foot Construction	Form moraic trochees from left to right. Degenerate feet are forbidden absolutely.
c. Foot Extrametricality	Foot → ⟨Foot⟩ /___]$_{word}$
d. Word Layer Construction	End Rule Right: Stress to right-most foot

Before accounting for these facts within OT, it is better to give examples of the different word patterns that occur in MA.

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 in (75).

(75) Monosyllabic words

a.	/CVV/	/'fii/	there is
b.	/CVCC/	/'kalb/	dog
c.	/CVVC/	/'dʒaar/	neighbour
d.	/CVVCC/	/'maadd/	he strengthened

In disyllabic words there are four possible patterns viz. /'LL/, /L'H/, /'HL/ and /H'H/. These patterns are exemplified in (76) below.

(76) Disyllabic word patterns

a.	('LL)	/'ða.hab/	gold
b.	L('H)	/ṭa.'wiil/	tall
c.	('H)L	/'xaa.tim/	ring
d.	(H)('H)	/muf.'taaḥ/	key

As can be noticed, 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, as can be seen in (77), stress falls on the rightmost heavy syllable; the antepenult is stressed in the absence of heavy syllables.

(77)

a.	('LL)L	/'ʃa.dʒa.ra/	tree
b.	(LL)('H)	/ba.ga.'raat/	cows
c.	L('H)L	/sa.'fii.ni/	ship
d.	L(H)('H)	/ma.dʒarr.'teen/	two galaxies
e.	('H)LL	/'muḥ.ta.ram/	respectable
f.	(H)L('H)	/mus.ta.'ʃaar/	consultant
g.	(H)('H)L	/mis.'taʕ.dʒil/	in a hurry
h.	(H)(H)('H)	/midʒ.tam.'ʕiin/	are gathered

The rules that govern stress assignment for trisyllabic words are almost the same rules that govern stress assignment for 4-syllable and more words without forgetting that stress cannot exceed the antepenult. The examples in (78) illustrate this idea.

(78) 4-syllable word patterns

a.	(LL)('H)L	/ʃa.dʒa.'raat.ha/	her trees
b.	L(H)('H)L	/sa.far.'dʒal.ha/	her quince
c.	(H)('LL)L	/muḥ.'ta.ra.mi/	respectable (f.)
d.	(H)(LL)('H)	/mam.la.ka.'teen/	two kingdoms
e.	(H)L('H)L	/stig.ba.'laat.hin/	their receptions
f.	(H)L(H)('H)	/mis.ta.ʕidʒ.'liin/	are in a hurry
g.	(H)('H)LL	/tit.'kal.la.min/	you (f.) talk
h.	(H)(H)L('H)	/til.fiz.yo.'neen/	two televisions
i.	(H)(H)('H)L	/tis.tag.'bil.hin/	she receives them

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

In the next sections, the author will account for transparent stress assignment rules in MA by using classic OT since cases of opaque stress will be considered when epenthesis and syncope are discussed where Stratal OT will be adopted.

3.3.2 Transparent Stress Rules

The stress rules in (74) above have been recast within the framework of OT. Foot and syllable extrametricality has been replaced in OT by a constraint against final stress, i.e. NONFINALITY. Final consonant extrametricality has been introduced in OT as a constraint that prohibits assigning a mora to the last consonant in PrWd, i.e. *FINAL-C-μ. The RIGHTMOST constraint has the effect of the pre-OT principle of ERR. These constraints are introduced in (79-81).

(79)
NONFINALITY (Prince and Smolensky 2004)
No head of PrWd is final in PrWd.

(80)
*FINAL-C-μ (Hayes 1989)
Word-final coda consonant is weightless.

(81)
RIGHTMOST (Prince and Smolensky 2004)
The right most foot of the word is the head.

The interaction of these with other OT constraints accounts for the transparent stress rules in MA. For convenience, stress rules are going to be discussed under two subsections: monosyllabic words stress and polysyllabic words stress.

3.3.2.1 Monosyllabic words

In MA, monosyllabic words (as discussed earlier) can take one of the canonical shapes in (82) since they must satisfy the minimal word condition (McCarthy and Prince 1990). The PrWd in MA is minimally bimoraic.

(82)

a. /CVV/
b. /CVCC/
c. /CVVC/
d. /CVVCC/

It has already been established that long vowels are assigned to two moras and short vowels to one. On the other hand, final coda consonants are weightless i.e. extrametrical. A monosyllabic word that has the shape /CVV/should surface as /$CV_{\mu}V_{\mu}$/ and not as /$CV_{\mu}V$/. To achieve the desired output the following constraints are introduced:

(83)
MAX-μ-IO (McCarthy and Prince 1995, Moren 1999)
Every mora in S_1 has a correspondent in S_2.
(no deletion of moras)

(84)
*$MORA_{[V]}$ (Moren 1999)
No mora is associated with a vowel

Obviously, the faithfulness constraint MAX-μ-IO must outrank the markedness constraint *$MORA_{[V]}$ in order to get the optimal output /$CV_{\mu}V_{\mu}$/. Consider the example in tableau (85) below.

(85)

/$fi_{\mu}i_{\mu}$/	MAX-μ-IO	*$MORA_{[V]}$
a. ☞ /$fi_{\mu}i_{\mu}$/		**
b. /$fi_{\mu}i$/	*!	*

Although output (85.b) incurs less violations of the constraint *MORA$_{[V]}$, it loses since it incurs a fatal violation of the higher ranked constraint MAX-μ-IO. Attaching two moras to the long vowels is also required by the minimal word constraint that requires the PrWd to be minimally bimoraic.

(86)
*PrWd
A prosodic word is minimally bimoraic.

The monosyllabic words of the shape /CVVC/ can be achieved by the interaction of the constraints *PrWd,*MORA$_{[V]}$ and *FINAL-C-μ. The tableau in (87) shows how the optimal output /CV$_\mu$V$_\mu$<C>/ is achieved:

(87)

/dʒaar/	*PrWd	*FINAL-C-μ	*MORA$_{[V]}$
a. ☞ /dʒa$_{\mu\mu}$<r>/			**
b. /dʒa$_\mu$r$_\mu$/		*!	*
c. /dʒa$_\mu$<r>/	*!		*

Candidate (87.a) wins because it satisfies the highly ranked constraints *PrWd and *FINAL-C-μ. Candidate (87.b) and (87.c) incur fatal violation of the constraints *FINAL-C-μ and *PrWd respectively. There is no dominance relation that holds between the constraints *PrWd and *FINAL-C-μ.

The third shape of the monosyllabic words in MA is /CVCC/, in which the final two consonants form a coda cluster. To account for this shape, the constraint WEIGHT-BY-POSITION (WBP), which is of equal importance to the other constraints, should be introduced. WBP requires coda consonants to be moraic.

(88)
WEIGHT-BY-POSITION (WBP) (Hayes 1989)
Coda consonants are moraic.

In tableau (89), a dominance relation is established between the constraints *FINAL-C-μ and WBP where *FINAL-C-μ >> WBP.

(89)

/kalb/	*FINAL-C-μ	WBP
a. ☞/$ka_{\mu}l_{\mu}b$/		*
b. /$ka_{\mu}l_{\mu}b_{\mu}$/	*!	
c. /$ka_{\mu}lb$/		**!

The last shape of the monosyllabic words is /CVVCC/, where the coda consonants are geminates. This will be discussed in chapter six.

3.3.2.2 Polysyllabic Word Stress

This section is divided into three sub-sections: stressing light syllable words, stressing heavy syllable words and stressing light and heavy syllable words.

3.3.2.2.1 Stressing Light Syllable Words

Light syllable words can be disyllabic *LL* or trisyllabic *LLL*. MA does not allow any sequence of more than three light syllables in a word. In the disyllabic words of the shape /LL/, stress lodges on the first syllable /'LL/ but not on the second one */L'L/. This is due to the fact that feet in MA are trochaic, in which the left syllable is the head of the foot. This fact can be accounted for by the interaction of the alignment constraints in (90) and (91).

(90)
ALIGN (Hd-σ, Ft, L) (McCarthy and Prince 1993)
Align the head syllable with the left edge of the foot.

(91)
ALIGN (Hd-σ, Ft, R) (McCarthy and Prince 1993)
Align the head syllable with the right edge of the foot.

Obviously, ALIGN-Hd-LEFT should outrank ALIGN-Hd-RIGHT as stated in (92)

(92)
ALIGN-Hd-LEFT >> ALIGN-Hd-RIGHT

The tableau in (93) demonstrates how these two constraints interact with one another to produce the desired output.

(93)

/LL/	ALIGN-Hd-LEFT	ALIGN-Hd-RIGHT
a. ☞('LL)		*
b. (L'L)	*!	

When adding a new candidate to the tableau in (93) like /(L)(L)/, it becomes clear that the alignment constraints cannot account for degenerate feet, which are prohibited in MA. Consider the tableau in (95). The constraint that can rule out such a candidate is given in (94).

(94)
FTBIN (McCarthy and Prince 1993)
Feet are bimoraic.

(95)

/LL/	FTBIN	ALIGN-Hd-LEFT	ALIGN-Hd-RIGHT
a. ☞('LL)			*
b. (L'L)		*!	
c. ('L)(L)	*!		

FTBIN should outrank the constraint NONFINALITY to avoid ('L)L, as shown in (96). The constraint NONFINALITY measures the distance between the head foot, and the head syllable and the right edge of the PrWd, then penalizes feet according to finality of foot and syllable.

(96)

/LL/	FTBIN	NONFINALITY
a. ☞('LL)		*
b. ('L)L	*!	

Stress in trisyllabic words of the shape /LLL/ is achieved in the same way, i.e. ranking FTBIN over NONFINALITY. There is no dominance relation that can hold between NONFINALITY and ALIGN-Hd-LEFT. Thus, ALIGN-Hd-LEFT outranks NONFINALITY by transitivity. Trisyllabic words of the shape /LLL/ surface with antepenultimate stress, i.e. ('LL)L as shown in (97)[16].

(97)

LLL	FTBIN	ALIGN-Hd-LEFT	NONFINALITY
a. ☞('LL)L			
b. L('LL)			*!
c. (L'L)L		*!	
d. ('LL)(L)	*!		*

Accordingly, stressing light syllable words in MA requires three main constraints, as shown in the constraint hierarchy in (98).

(98)
FTBIN , ALIGN-Hd-LEFT >>NONFINALITY

A word like /'ʃadʒara/ then surfaces with antepenultimate stress according to the above constraint hierarchy, as shown in (99).

[16] The optimal candidate ('LL)L violates the constraint PARSE$_{\sigma}$ which will be introduced later in this chapter.

(99)

ʃadʒara	FTBIN	ALIGN-Hd-LEFT	NONFINALITY
a. ☞('ʃa.dʒa).ra			
b. ʃa.('dʒa.ra)			*!
c. (ʃa.'dʒ).ara		*!	
d. (ʃa.dʒa).('ra)	*!		*

3.3.2.2.2 Stressing Heavy Syllable Words

Polysyllabic heavy syllable words in MA can contain two or three syllables maximum. In quantity sensitive languages, Heavy syllables, by their nature, attract stress. To this end, the constraint WEIGHT-TO-STRESS-PRINCIPLE (WSP), introduced in (100) below, is supposed to be highly ranked in the grammar of MA.

(100)
WEIGHT-TO-STRESS-PRINCIPLE (WSP) (Prince and Smolensky 2004)
Heavy syllables are prominent both on the grid and foot structure.

The question that arises when you first look at a HH sequence is how is this sequence best footed? To answer this question, we need first to see the different possibilities of footing this sequence and then evaluate them to choose the right one. The HH sequence can be footed as ('H)H, (H)('H), ('H)(H) or H('H).

The footing of HH as H('H) or ('H)H violates the higher ranked constraint WSP. On the other hand, footing it as ('H)(H) satisfies WSP but fatally violates the other high ranked constraint that demands the rightmost foot to be the head, i.e.

RIGHTMOST. The optimal footing *(H)('H)* satisfies both WSP and RIGHTMOST but it violates NONFINALITY.[17]

As a result, we get three main constraints competing with each other. Violating the constraint NONFINALITY is better than leaving a heavy syllable unfooted. Accordingly, the dominance hierarchy in (101) is achieved. Consider the tableau in (102).

(101)
WSP>> NONFINALITY

(102)

/HH/	WSP	NONFINALITY
a. ☞(H)('H)		*
b. ('H)H	*!	
c. H('H)	*!	*

A candidate like ('H)(H) cannot be ruled out without ranking the constraint RIGHTMOST over the constraint NONFINALITY. The tableau in (103) shows the interaction of these constraints. No dominance relation holds between RIGHTMOST and WSP.

(103)

/HH/	WSP	RIGHTMOST	NONFINALITY
a. ☞(H)('H)			*
b. ('H)H	*!		
c. ('H)(H)		*!	*
d. H('H)	*!		*

[17] Unfooted heavy syllables violate WSP since the author assumes that all heavy syllables are stressed, i.e. secondary stress. The idea of secondary stress is proved when cases of long vowel shortening are examined.

The tableau in (103) shows that violating the constraint NONFINALITY does not affect candidate (103.a) to surface as the optimal output, since it satisfies the other high ranked constraints. On the other hand, any violation of the undominated constraints WSP or RIGHTMOST would result in ruling out the candidate under evaluation.

There is no crucial ranking between the constraints WSP and RIGHTMOST on the one hand and the constraints FTBIN and ALIGN-Hd-LEFT on the other. Accordingly, the following sub-hierarchy is achieved.

(104)
FTBIN ,WSP , RIGHTMOST, ALIGN-Hd-LEFT >> NONFINALITY

The word /midʒ.tam.'ʕiin/ surfaces with ultimate stress by virtue of the above constraint hierarchy as shown in (105).

(105)

midʒtamʕiin	FTBIN	WSP	RIGHTMOST	ALIGN-Hd-LEFT	NONFINALITY
a. ☞/(midʒ).(tam).('ʕiin)/					*
b. /midʒ.tam.('ʕiin)/		*!			*
c. /(midʒ).('tam).(ʕiin)/			*!		*
d. /(midʒ).('tam).ʕiin/		*!			

However, one more constraint is still needed. The optimal footing of a heavy syllable word requires all syllables to be footed, i.e. (H)('H) and (H)(H)('H). Such types of footing violate the *CLASH constraint, which militates against two adjacent stressed syllables.

(106)
*CLASH (Kager 1999)
Adjacent prominent syllables are prohibited.

Since I argued in favour of footing the sequence HH as (H)('H) rather than H('H) or ('H)H, then the constraint WSP crucially outranks the constraint *CLASH, as shown in (107) below.

(107)

/HH/	WSP	*CLASH
a. ☞(H)('H)		*
b. ('H)H	*!	
c. H('H)	*!	

The constraints *CLASH and NONFINALITY are not mutually ranked against each other. Eventually, the constraint hierarchy in (108) is achieved.

(108)

FTBIN ,WSP , RIGHTMOST, ALIGN-Hd-LEFT >> NONFINALITY, *CLASH

Consider the tableau in (109), in which the desired output *(muf).('taaḥ)* is achieved.

(109)

muftaaḥ	FtBin	WSP	Rightmost	Align-Hd-Left	Nonfinality	*Clash
a. ☞(muf).('taaḥ)					*	*
b. (muf.'taaḥ)	*!			*!	*	
c. muf.('taaḥ)		*!			*	
d. ('muf).(taaḥ)			*!		*	*
e. ('muf).taaḥ		*!				

3.3.2.2.3 Stressing Light and Heavy Syllable Words

In heavy syllable words, every single syllable is footed alone and the last syllable receives the main stress causing a violation of NONFINALITY. Leaving a heavy syllable unfooted would cause a fatal violation of the high ranked constraint WSP. In light syllable words, i.e. LL and LLL, FTBIN crucially dominates NONFINALITY to optimise the desired output. Accordingly, in light syllable words of the shape LLL, NONFINALITY should outrank the constraint PARSE$_{\sigma}$, which requires syllables to be parsed into metrical feet.

(110)
PARSE$_{\sigma}$ (Prince and Smolensky 2004)
All syllables must be parsed into feet.

This dominance relation between NONFINALITY and PARSE$_{\sigma}$ is confirmed when a word of the shape HLL is considered.

(111)

HLL	NONFINALITY	PARSE$_\sigma$
a. ☞('H)LL		**
b. (H)('LL)	*!	

Before moving on, it is necessary to highlight the dominance relation between PARSE$_\sigma$ and *CLASH. In the optimal footing of the shape HLLL, the constraint NONFINALITY is satisfied. However, the constraints PARSE$_\sigma$ and *CLASH are violated. The optimal output *(H)('LL)L* violates *CLASH and PARSE$_\sigma$ once, while a suboptimal candidate like ('H)LLL satisfies *CLASH but violates PARSE$_\sigma$ three times. Therefore, one can assume that PARSE$_\sigma$ dominates *CLASH, as shown in (112).

(112)

HLLL	NONFINALITY	PARSE$_\sigma$	*CLASH
a. ☞(H)('LL)L		*	*
b. ('H)LLL		**!*	

This dominance relation can be further highlighted by examining a word of the shape HLLH, which surfaces as (H)(LL)('H).

(113)

HLLH	NONFINALITY	PARSE$_\sigma$	*CLASH
a. ☞(H)(LL)('H)	*		*
b. (H)LL('H)	*	**!	

However, I believe that demoting *CLASH below PARSE$_\sigma$ cannot be justified in MA. One piece of evidence to reconsider this dominance relation comes from cases of long vowel shortening (cf. Section 5.2). To account for the shortening of the long vowel in a word like /baabiin/ ‘two doors’ which surfaces as /ba.biin/, the constraint *CLASH should outrank a constraint like MAX-IO$_{V[LONG]}$. The constraint MAX-IO$_{V[LONG]}$ prohibits the shortening of long vowels. Consider the tableau in (114).

(114)

baab-iin	*CLASH	MAX-IO$_{V[LONG]}$
a. ☞ba.('biin)		*
b. (baa).('biin)	*!	

Consequently, ranking PARSE$_{\sigma}$ over *CLASH, as assumed above, results in optimising the suboptimal candidate (114.b), as shown in (115).

(115)

baab-iin	PARSE$_{\sigma}$	*CLASH	MAX-IO$_{V[LONG]}$
a. ☹ba.('biin)	*!		*
b. ☞(baa).('biin)		*	

In ligh of the above, I argue that the constraint *CLASH outranks PARSE$_{\sigma}$. Thus, the following constraint hierarchy is achieved:

(116)
NONFINALITY >> *CLASH >> PARSE$_{\sigma}$

The established constraint hierarchy in (116) would result in optimising the suboptimal candidates in (112.b) and (113.b), as shown in (117) and (118) respectively.

(117)

HLLL	NONFINALITY	*CLASH	PARSE$_{\sigma}$
a. ☹(H)('LL)L		*!	*
b. ☞ ('H)LLL			***

(118)

HLLH	NONFINALITY	*CLASH	PARSE$_\sigma$
a. ☹(H)(LL)('H)	*	*!	
b. ☞(H)LL('H)	*		**

This failure to group adjacent syllables into feet must be seen as violating a certain constraint, rather than merely violating the constraint PARSE$_\sigma$. In the literature, this phenomenon is known as stress lapse (cf. Selkirk, 1984; Green and Kenstowicz, 1995). Hayes (1995:114-5) argues for what he calls *persistent footing* to overcome this problem.

(119) Persistent Footing (Hayes: 1995: 114)

a. Single stray syllables are adjoined to existing feet if the result is well-formed.
b. Otherwise, sequences of stray syllables may be converted into feet.

In what follows, I discuss two proposals that have been used in OT to overcome this problem, i.e. Kager (1994) and McCarthy (2007). Kager (1994) proposed a constraint which he calls PARSE-2 that militates against adjacent unfooted stress units. The constraint PARSE-2 is introduced in (120).

(120)
PARSE-2 (Kager, 1994: 9)
One of two adjacent stress units must be parsed by a foot.

PARSE-2 would be violated in MA in the following cases:

(121)

a. two adjacent unfooted light syllables,
b. unparsed heavy syllable,
c. and two successive moras.

The constraint PARSE-2 should outrank the constraints *CLASH and PARSE$_\sigma$, as shown in (122).

(122)

HLLH	PARSE-2	*CLASH	PARSE$_{\sigma}$
a. ☞(H)(LL)('H)		*	
b. (H)LL('H)	*!		**
c. H('LL)(H)	*!		

Candidate (122.a) wins by satisfying the constraint PARSE-2, which is fatally violated by the other candidates. Candidate (122.c) can be ruled out by the undominated constraint, i.e. WSP.

The dominance relation between PARSE-2 and NONFINALITY becomes clear when a word of the shape HLL is examined.

(123)

HLL	NONFINALITY	PARSE-2
a. ☞('H)LL		*
b. ('H)(LL)	*!	

McCarthy (2007: 165) uses constraints that prohibit long lapses, drawing on arguments proposed by Elenbass and Kager (1999), Gordon (2003), Steriade (1997), and Das (2002). In his analysis of Levantine Arabic, McCarthy used three constraints; the first is against the sequence of three unstressed moras; the second prohibits nonfinal sequences of three unstressed moras, and the third prohibits sequences of three unstressed moras which are not adjacent to the stress peak. These constraints are given in order in (124), (125) and (126) below.

(124)
*LONG-LAPSE
Assign one violation mark for every sequence of three unstressed moras.

(125)
LONG-LAPSE-AT-END (LNGLPSEND)
Assign one violation mark for every nonfinal sequence of three unstressed moras.

(126)
LONG-LAPSE-AT-PEAK (LNGLPSPK)
Assign one violation mark for every sequence of three unstressed moras that is not adjacent to the stress peak.

The constraint *LONG-LAPSE is systematically violated in MA in words of the pattern HLL, since in bimoraic syllables the first mora is the one that is stressed, as argued by Kager (1993) and Prince (1983) (cf. McCarthy, 2007: 149-150). The other two constraints, LNGLPSEND and LNGLPSPK, should be satisfied in MA. However, I suggest that the constraint LNGLPSEND is of greatest interest in terms of our discussion. The comparison between the two constraints (127) shows that LNGLPSEND can account for cases which LNGLPSPK cannot handle.

(127)

	Footing	LNGLPSEND	LNGLPSPK
a.	(H)(LL)L	√	√
	(H)LLL	X	X
b.	(H)(LL)(H)	√	*vacuously satisfied*
	(H)LL(H)	X	*vacuously satisfied*

In (127.a), both constraints have the same effect in that one of them can rule out the sub-footing *(H)LLL. In (127.b), both types of footing are vacuously satisfied by the constraint LNGLPSPK, i.e. LNGLPSPK cannot distinguish between (H)(LL)(H) and (H)LL(H). LNGLPSEND, by contrast, distinguishes between the two types of footing, which results in optimising the former over the latter. Therefore, LNGLPSEND is the constraint that is most relevant to our discussion.

I see no point in including the constraint *LONG-LAPSE, as we could account for the cases in which this constraint is violated by ranking the constraint NONFINALITY over PARSE$_{\sigma}$. This was discussed in relation to the pattern HLL considered in tableau

(111) above. The effect of the constraint LngLpsEnd is attained by the constraint PARSE-2, as shown in (128).

(128)

Footing	LngLpsEnd	PARSE-2
(H)(LL)L	√	√
(H)LLL	X	X

Moreover, the constraint PARSE-2 can account for far more cases than the LngLpsEnd constraint as explained in (129).

(129)

Footing	LngLpsEnd	PARSE-2
(LL)(H)	*vacuously satisfied*	√
LL(H)	*vacuously satisfied*	X

Accordingly, if we incorporate the constraint LngLpsEnd in our analysis and disregard the constraint PARSE-2, then the footing of a word like /bagaraat/ 'cows' as */ba.ga.(raat)/ will be ruled out by the low ranked constraint PARSE$_\sigma$, as shown in (130)[18].

(130)

bagar-aat	FtBin	WSP	Rightmost	Align-Hd-Left	LngLpsEnd	Nonfinality	*Clash	Parse$_\sigma$
a. ☞/(ba.ga).('raat)						*		
b. /ba.ga.('raat)/						*		**!
c. /('ba.ga).raat/		*!						*

The same result can be achieved by incorporating the constraint PARSE-2 as shown in (131).

---

[18] The constraints LngLpsEnd and Nonfinality are not ranked in respect to each other.

(131)

bagar-aat	FTBIN	WSP	RIGHTMOST	ALIGN-Hd-LEFT	NONFINALITY	PARSE-2	*CLASH	PARSE$_\sigma$
d. ☞/(ba.ga).('raat)					*			
e. /ba.ga.('raat)/					*	*!		**
f. /('ba.ga).raat/		*!						*

To this end, it is very difficult to choose among the two constraints, i.e. LNGLPSEND and PARSE-2. However, I will opt for the constraint PARSE-2 rather than LNGLPSEND, since it will play a major role in accounting for other JA dialects[19]. Accordingly, the following constraint hierarchy is established.

(132)
FTBIN, WSP, RIGHTMOST, ALIGN-Hd-LEFT>> NONFINALITY >> PARSE-2 >> *CLASH >> PARSE$_\sigma$

Before ending this section, it is necessary to evaluate some real examples since in the above analysis we abstract away from real data. In what follows, I will examine words that contain light syllables only, heavy syllables only and those which contains light and heavy syllables. In the tableaux in (133), the words /ðahab/ 'gold' and /waraga/ 'paper', i.e. LL and LLL respectively, are evaluated.[20]

[19] In accounting for other JA dialects which do not require exhaustive footing (cf. Section 6.3.3), a minor refinement to the constraint PARSE-2 helps to account for stress assignment. This will not be achieved by using the constraint LNGLPSEND.

[20] The constraint *FINAL-C-μ is supposed to be satisfied unless otherwise indicated.

(133)

ðahab	FTBIN	WSP	RIGHTMOST	ALIGN-Hd-LEFT	NONFINALITY	PARSE-2	*CLASH	PARSE$_\sigma$
g. ☞/('ða.hab)/					*			
h. /(ða.'hab)/				*!				
i. /('ða).hab)/	*!							*
waraga								
a. ☞/('wa.ra).ga/								*
b. /wa.('ra.ga)/					*!			*
c. /('wa.ra).(ga)/	*!		*!		*			

The tableaux in (133) show that the constraint hierarchy smoothly accounts for the light syllable words. In the tableaux in (134), we will validate this constraint hierarchy by examining other data that contain heavy syllables only. The words /miḥraab/ ‘Mihrab, niche’ and /midʒtamʕiin/ ‘gathered (m. pl.)’ represent HH and HHH respectively.

(134)

miḥraab	FTBIN	WSP	RIGHTMOST	ALIGN-Hd-LEFT	NONFINALITY	PARSE-2	*CLASH	PARSE$_\sigma$
a. ☞/(miḥ).('raab)/					*		*	
b. /('miḥ).raab/		*!				*		*
c. /('miḥ).(raab)/			*!		*		*	
midʒtamʕiin								
a. ☞/(midʒ).(tam).('ʕiin)					*		**	
b. /midʒ.tam.('ʕiin)/		*!			*	*		**
c. /(midʒ).('tam).(ʕiin)/			*!		*		**	
d. /(midʒ).('tam).ʕiin/		*!				*	*	*

The constraint hierarchy singles out the optimal outputs in the above tableaux as predicted. Finally, the patterns HLLL and HLLH are represented with the words /muḥ.'ta.ra.mi/ ‘respectable (f.)’ and /mam.la.ka.'teen/ ‘two kingdoms’ respectively.

(135)

muḥtaram-i	FtBin	WSP	Rightmost	Align-Hd-Left	NonFinality	Parse-2	*Clash	Parse$_\sigma$
a. ☞/(muḥ).('ta.ra).mi/							*	*
b. /('muḥ).ta.ra.mi/						*		***
c. /(muḥ). ta.('ra.mi)/					*!			*
d. /muḥ.('ta.ra).mi/		*!				*		**
mam.la.ka.teen								
e. ☞/(mam).(la.ka).('teen)/					*		*	
f. /(mam).la.ka.('teen)/					*	*!		**
g. /mam.la.ka.('teen)/					*	*!		***
h. /(mam).('la.ka). teen/		*!				*	*	*

3.3.3 Comparison with other Accounts

There have only been a few studies that have investigated stress assignment rules in JA and only a small number of them have used OT in their analysis. Amongst them is AbuAbbas (2003) who accounted for stress and other phonological process that take place in a city called Ajlūn using data from Alghazo (1987) and data from Al-Sughayer (1990) in his PhD dissertation. Furthermore, AbuAbbas' account is very similar to the account of transparent stress proposed by Adra (1999) on Syrian Arabic[21]. Therefore, the comparison, for convenience, will only be made between

[21] This implies that all Levantine Arabic dialects, with respect to some differences among them, have the same stress transparent rules.

the account that was established in this chapter and the account proposed in AbuAbbas (2003), with some indications about Adra’s account as well.

Before making the comparison, it is necessary to give a brief overview of stress assignment rules in JA as described by AbuAbbas. The basic idea about his analysis depended on two main assumptions: the first is that the language is trochaic right oriented that only allows a single stress per word; and the second assumption is that preantepenultimate syllables are never stressed, i.e. stress cannot fall outside the three syllable window. However, he ignores foot directionality completely as he assumes one foot per word.

AbuAbbas (2003:51) states that ‘*FTBIN in JA is not specified at the moraic or syllabic level. This means that departure from binarity in one of the two levels is permitted’.* Accordingly, feet in JA can have one of the following shapes:

(136) Foot Structure in JA (AbuAbbas, 2003: 51)
('H), ('HL), ('LL), and ('LH)

The absence of (HH) feet in JA is a result of constraint interaction. The language under investigation is trochaic, in which the left syllable in a foot bears stress and at the same time it assigns stress to the rightmost heavy syllable. Therefore, a word that contains two heavy syllables is footed as H(H) but not (HH), as in /saam.('ʕiin)/ ‘we heard’ (AbuAbbas, 2003: 51-54). The foot *(LH)* is allowed when an epenthetic vowel is inserted to break up a consonant cluster, as shown in (137).

(137) (LH) with Epenthetic Vowels (AbuAbbas, 2003: 51)

Input	output	Gloss
kalb-na	('ka.lib).na	‘our dog’
gabr-hum	('ga.bir).hum	‘their grave’

However, I maintain that feet in JA are specified at the moraic level yet not at the syllabic level. In disyllabic words of the shape LH, stress always fall on the heavy syllable, as shown in (138).

(138)

Input	Output	Gloss
ṭawiil	ṭa.('wiil) *('ṭa.wiil)	tall (m.)
xaṭiir	xa.('ṭiir) *('xa.ṭiir)	dangerous
falaaḥ	fa.('laaḥ) *('fa.laaḥ)	[Proper Name]

The above table shows that stress falls on the heavy syllable since the language is moraic trochee. If the language was syllabic trochee, then one would expect stress to fall on the left branch of the foot, i.e. in this case the light syllable. The examples in (137), that have been cited in AbuAbbas to support the surfacing of ('LH) feet in JA, include epenthetic vowels that are invisible to stress since they are inserted postlexically, i.e. after stress assignment[22]. Furthermore, the claim that JA has ('HL) feet contradicts the universal belief that such feet '*are known to be marked or even absent in trochaic systems.*' (Prince & Smolensky 1993: 63). Accordingly, Prince & Smolensky (1993) propose a constraint that disfavours ('HL) '*on ground of **rhythmic** structure which favours length at the end of constituents.*' (Prince & Smolensky 1993: 63).

(139) Rhythmic Harmony
(RHHRM)
*('HL)

[22] Chapter four of this thesis is devoted for the interaction of stress and epenthesis.

Therefore, I think that AbuAbbas should have argued for his claim that feet in JA are not specified at the moraic or syllabic level or at least he should have justified his claim about ('HL) feet.

To return to the central point of this section, the constraint hierarchy which is responsible for stress assignment in JA as proposed by AbuAbbas (2003: 71) is given in (140) below.

(140)
STRESS-CONDITION-RIGHT (SCR) >> WSP >> RM('H) >> NONFINALITY >> RM ('L)

The definitions for above constraints are given in (119.a-c) below

(141)
a. STRESS-CONDITION-RIGHT (SCR)
Two successive unparsed syllables are not allowed at the right edge of the word.

b. RM('H)
A stressed heavy syllable lies at the right edge of a word.

c. RM ('L)
A stressed light syllable lies at the left edge of a word.

AbuAbbas follows Adra (1999) by using the same constraints in (119). The same justifications were also given by the two authors for the use of these constraints. The justification for the constraint (SCR) is that the language permits syllabic lapse up to two syllables at the left edge of the word but not the other way round since stress cannot fall on syllables behind the preantepenultimate. In order to account for stress in trisyllabic words of the pattern LLL and the pattern HHH, both writers found it imperative to split the constraint RM('σ), which requires the right most syllable to be stressed, into two constraints in which the first requires the right most heavy syllable to be stressed while the second requires the leftmost light syllable to be stressed. This is shown in (141.b) and (141.c) respectively. This failure of the constraint RM('σ) is represented in tableau (142) below.

(142)[23]

ʃadʒara	FTBIN	WSP	RM('σ)	NONFINALITY
a. ☹('ʃa.dʒa)ra			σσ!	
b. ☞ʃa('dʒa.ra)			σ	*F
midʒtamʕiin				
a. ☞midʒ.tam('ʕiin)				*F *σ
b. midʒ('tam)ʕiin			σ!	
c. ('midʒ)tam.ʕiin			σ!σ	

As can be noticed from the tableau in (142), the constraint hierarchy is able to derive the right stress for words of the pattern HHH but not for those of the pattern LLL. Therefore, the constraint RM('σ) has been split. Accordingly, the constraint NONFINALITY outranks the constraint RM('L) and is outranked by constraint RM('H). By ranking the constraint SCR over the constraint RM('H), the right stress is achieved in other word patterns[24].

[23] This tableau is from AbuAbbas (2003: 62) with some modification to illustrate the point.
[24] It is not clear how the constraint WSP is satisfied in (120). Adra (1999: 58) argues that a form like ('H)HLL is '*in line with WSP (only footed σ is evaluated*).' Therefore, ('H)H satisfies WSP while H('LL) does not. However, I never come across any argument in the literature to support such proposal. Walker (1997: 51) argues in favour of a constraint which he called *GRIDSTRUC. The function of this constraint is to assign a violation for each grid mark and it was proposed to account for languages which assign only a single stress per word, i.e. (H)H or H(H) is more harmonic than (H)(H). Moreover, leaving a word without footing is ruled out by another constraint that requires every PrWd to be stressed. Ranking *GRIDSTRUC over WSP optimise H(LL)L over (H)(LL)L. Thus, this argument has not been adopted by Adra (1999) or by AbuAbbas (2003).

The assumption that only one foot is built per word means that the language has no secondary stress. As far as I am aware, secondary stress has not been reported for JA or any other Levantine Arabic dialects. However, Abu-Salim (1982) argues that long vowels are shortened when immediately followed by a stressed syllable, i.e. /baa.biin/ would surface as /ba.biin/. This behaviour, which is exhibited in many JA dialects, suggests that the language is trying to avoid stress clash. Therefore, avoiding stress clash implies that the language practices exhaustive parsing of syllables into feet. In what follows, I will show that the constraint hierarchy proposed by AbuAbbas himself cannot validate his claims.

Footing the string HLLL as H(LL)L should be the optimal footing according to AbuAbbas. However, the constraint hierarchy (140) prefers (H)(LL)L over H(LL)L as shown in (143).

(143)

HLLL	SCR	WSP	RM(H)	NONFINALITY	RM (L)
a. ☹H('LL)L		*!			**
b. ☞(H)('LL)L			***		**
c. ('HL)LL	*!		***		
d. (HL)('LL)			***	*!	*
e. ('H)LLL	*!		***		
f. HL('LL)		*!		*!	*

The tableau in (143) erroneously predicts that candidate (143.b) is the optimal candidate[25]. There is no way in which candidate (143.a) surfaces as the optimal output under this constraint hierarchy.

[25] Candidate (143.b) is the optimal candidate in MA but in JA according to AbuAbbas it should be candidate (143.a).

The stress assignment rules that have been developed in this thesis are able to derive the correct stress for JA as described by AbuAbbas (2003) after assuming that feet in JA are moraic trochee, i.e. it only allows feet of the shapes H and LL. The claim that JA has no secondary stress can be right since the dialect that has been investigated by AbuAbbas does not shorten long vowels in open syllables, i.e. /baabiin/ surfaces as /baa.biin/. Accordingly, it is possible to assume one foot per word. In order to account for the possibility of building one foot only, the constraint *GRIDSTRUC is introduced.

(144)
*GRIDSTRUC (Walker, 1997: 51)
Do not have grid marks.

The constraint *GRIDSTRUC is dominated by one constraint which requires every word to be stressed. However, I will not include such a constraint. Rather it will be assumed to be satisfied by every word. The last point to emphasise is that we need to acknowledge that stress lapse is violated at the right edge of the word only. However, I am not going to use the constraint *SCR* that has been proposed by AbuAbbas since it is only violated when two successive unparsed syllables happen to be at the right edge of the word. Instead, I will modify the constraint PARSE-2 to PARSE-2-R as shown in (145). This minor refinement makes it superior to SCR since it is violated when a heavy syllable at the right edge of the word is left unparsed. Accordingly, PARSE-2-R eliminates the need for the two constraints RM('H) and RM('L). The constraint PARSE-2-R outranks NONFINALITY and there is no dominance hierarchy that can hold between the former and the high rank constraints.

(145)
PARSE-2-R
One of two adjacent stress units at the right edge of the word must be parsed by a foot.

In the following tableaux, words of the shape HL, HHH, LLL, and HLLL are examined[26]. The constraints RIGHTMOST and *CLASH will not be used, since we are assuming one foot per word. Accordingly, the same constraint hierarchy that has been established in this thesis is assumed but ignoring the aforementioned constraints and the addition of the constraint *GRIDSTRUC. Therefore, the constraint hierarchy in (146) is established.

(146)[27]
*GRIDSTRUC >> FTBIN, WSP, ALIGN-Hd-LEFT, PARSE-2-R >> NONFINALITY >> PARSE_σ

(147) HL /'tsaa.wa/ 'become equal'

tsaawa	*GRIDSTRUC	FTBIN	WSP	ALIGN-Hd-LEFT	PARSE-2-R	NONFINALITY	PARSE_σ
a. ☞('tsaa).wa	*						*
b. ('tsaa.wa)	*	*!				*	
c. tsaa.('wa)	*		*!			*	*

(148) HHH /midʒ.tam.'ʕiin/ 'gathered'

midʒtamʕ-iin	*GRIDSTRUC	FTBIN	WSP	ALIGN-Hd-LEFT	PARSE-2-R	NONFINALITY	PARSE_σ
a. ☞ midʒ.tam.('ʕiin)	*		*			*	**
b. midʒ.('tam).ʕiin	*		*		*!		**
c. ('midʒ).tam.ʕiin	*		*		*!		**
d. midʒ.('tam.ʕiin)	*	*!	*			*	*

[26] All the examples in the tableaux are from AbuAbbas (2003).
[27] Although this constraint hierarchy is able to derive the desired outputs without any problems, it is possible to make more dominance relations between the constraints, i.e. FTBIN can outrank WSP.

(149) LLL /'ʃa.dʒa.ra/ ‘tree’

ʃadʒara	*GRIDSTRUC	FTBIN	WSP	ALIGN-Hd-LEFT	PARSE-2-R	NONFINALITY	PARSE$_\sigma$
a. ☞ ('ʃa.dʒa).ra	*						*
b. ʃa.('dʒa.ra)	*					*!	*
c. ('ʃa.dʒa.ra)	*	*!					

(150) HLLL /muḥ.'ta.ra.ma/ ‘respectable (f.)’

muḥtarama	*GRIDSTRUC	FTBIN	WSP	ALIGN-Hd-LEFT	PARSE-2-R	NONFINALITY	PARSE$_\sigma$
a. ☞ muḥ.('ta.ra).ma	*		*				**
b. ('muḥ).ta.ra.ma	*				*!		***
c. muḥ.ta.('ra.ma)	*		*			*!	**
d. ('muḥ.ta).ra.ma	*	*!			*!		**

The tableau in (148) justifies the dominance hierarchy between PARSE-2-R and NONFINALITY in which the former outranks the latter. Tableau (149) shows the role of NONFINALITY in ruling out suboptimal candidates like L(LL). Tableau (150) justifies ranking PARSE-2-R high in the grammar of this dialect.

To summarise, the account that has been established in this chapter proves superior to other accounts that have been conducted on JA. The current account takes into consideration all the possible ways in which a word could be footed. Exhaustive parsing of syllables into metrical feet is required in MA to account for vowel shortening and other phonological processes as indicated above. In the JA dialect investigated by AbuAbbas, it seems that iterative footing is not required since no case of avoiding stress clash has been reported. Apart from iterative footing, the superiority of the current account can be seen from the following points:

I. The constraint hierarchy that has been established in this thesis is able to account for other JA dialects with minor refinements, while the other accounts can by no means account for stress in MA.

II. In the above discussion, it has been pointed out that there is no need for the constraints RM('H), RM('L) and SCR in this JA dialect, which assumes one foot per word, since the position of the foot is determined mainly by the constraints WSP, PARSE-2-R and NONFINALITY.

III. Most importantly, the current account assumes foot binarity at the moraic level, which is assumed by most authors who discuss different Arabic dialects and in particular the Levantine dialects. Stating that foot binarity in JA is not specified at the moraic or syllabic level should have been motivated.

3.4 Conclusion

This chapter has investigated the prosodic features of MA. Therefore, it consists of three main sections: the syllable, the foot and stress assignment rules. In the first section, the notion of the syllable and how it is represented in the literature were outlined. Then the effects of sonority on the structure of the syllable have been introduced. A brief comparison was conducted between different JA dialects to outline the different types of syllable structure. Finally, the notion of extrametricality and the application of this phenomenon to the final consonant in final CVC syllables were introduced.

In the second main section, I argued that the foot in MA is moraic trochee; degenerate feet are prohibited and feet are built from left-to-right. This section shows that extrametricality can apply to the final foot in MA as long as it does not exhaust the entire domain of stress rules.

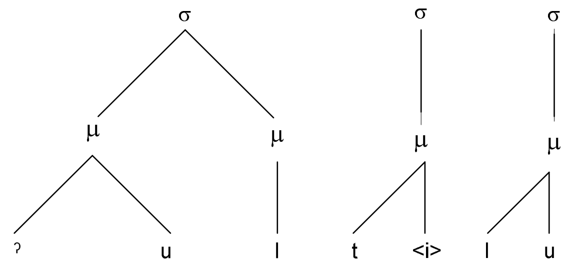
In the last section, transparent stress assignment rules in MA were comprehensively investigated. This section was divided into three subdivisions: monosyllabic word stress, polysyllabic word stress and comparison with other accounts. The general outcome of these sections is that transparent stress rules in MA and other JA dialects can be captured by a limited set of universal constraints. Therefore, the author has neither found it imperative nor important to use ad hoc or language-specific constraints as other accounts.

4 Stress-Epenthesis Interaction

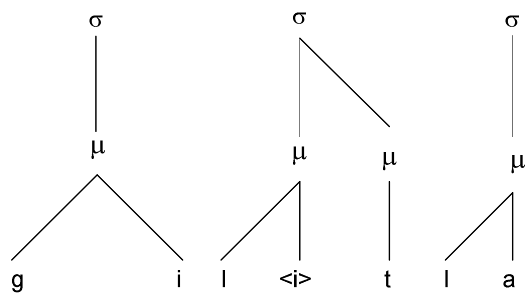
Many researchers have investigated epenthesis processes in Arabic dialects (Broselow 1979, 1992; Abu-Salim 1982; Haddad 1984; Ito 1986, 1989; Abu Mansour 1987, 1991; Farwaneh 1995; Adra 1999; Zawaydeh 1997; AbuAbbas 2003; Kiparsky 2003; Gouskova and Hall 2007; Watson 2007; McCarthy 2007). These scholars, among others, shed light on three main issues: the site of the epenthetic vowel, the quality of the epenthetic vowel and the interaction of stress with epenthesis.

The site of the epenthetic vowel in Arabic dialects determines whether a certain dialect is a coda dialect or an onset dialect (Broselow 1992; Farwaneh 1995). Kiparsky (2003) argues that Arabic dialects are divided into three divisions, depending on the locus of the epenthetic vowel. These are known as C-dialects, CV-dialects and VC-dialects. VC-dialects or coda dialects are those in which the unsyllabified consonant forms the coda of the epenthetic vowel. The unsyllabified consonant in CV-dialects or onset dialects forms the onset to the epenthetic vowel. C- dialects, by contrast, maintain the consonant cluster, i.e. no epenthesis takes place. Watson (2007) argues that Arabic dialects should be divided into four types instead of three. The fourth type are the dialects that exhibit both the epenthesis patterns of CV-dialects and VC-dialects. The difference between CV-dialects and VC-dialects respectively is exemplified in (1.a) and (1.b) below (Ito 1989).

(1.a) Onset Dialect ‘CV’
Cairene Arabic



(1.b) Coda Dialect ‘VC’
Iraqi Arabic (Broselow 1992)



In the Cairene Arabic example, i.e. CV-dialect, the consonant /t/ forms the onset for the newly created syllable and the output is /ʔul.ti.lu/ ‘I told him’. The consonant /t/ in the Iraqi Arabic example, on the other hand, forms the coda for the epenthetic vowel and the output is /gi.lit.la/ ‘I told him’.

Regarding the second issue that researchers have addressed, namely the quality of the epenthetic vowel, there are two points that should be discussed. First, what is the default epenthetic vowel in Arabic dialects? Second, are epenthetic and lexical vowels identical? The default epenthetic vowel for most Arabic dialects (e.g. Egyptian, Iraqi, Lebanese, Jordanian, and Palestinian) is /i/, while it is /a/ for Makkan (Kabra 2004) and Sudanese Arabic (Hamid 1984). The second point receives less attention, although some researchers have mentioned that there are some differences between the lexical and epenthetic vowels. In their acoustic study on the nature of the epenthetic vowel in Lebanese Arabic, Gouskova and Hall (2007) found that the epenthetic vowel is either shorter, backer or both.

The third issue that has been addressed by scholars is the interaction of stress and epenthesis. Epenthetic vowels can either be visible or invisible to stress assignment. In general, the epenthetic vowel in Makkan Arabic is visible to stress assignment, while it is invisible in Jordanian Arabic.[1]

4.1 Epenthesis in MA

MA, the dialect under investigation, displays two different types of epenthetic vowels regarding their sensitivity to stress. Vowels that are epenthesized word-initially are stressed in accordance with the general stress assignment rules. Vowels that are epenthesized word-finally, by contrast, never receive stress. Word-medial epenthetic vowels do not bear stress unless the epenthetic vowel breaks up a sequence of four consonants. Consider the examples in (2) below.

(2)

input	output	Gloss
a. ftaḥ	'ʔ**i**f.taḥ	open! (m.s.)
b. katab-t-l-ki	ka.tab.'t**i**l.ki	I wrote for you (f.s.)
c. katab-t	ka.'ta.b**i**t	I wrote
d. galb-ha	'ga.l**i**b.ha	her heart

The table in (2) shows that the epenthetic vowels in (2.a) and (2.b) receive stress, while in (2.c) and (2.d) they do not. In (2.a), the glottal stop */ʔ/* is inserted since the language does not allow onsetless syllables (cf. Section 3.1.6.1). The claim about (2.a) is that the epenthetic vowel is inserted to satisfy the minimal word

[1] See McCarthy (2007) for latest detailed discussion on the interaction of stress and epenthesis in Levantine Arabic.

requirement (cf. McCarthy and Prince, 1990b and Kiparsky, 2000). However, I will show that word-minimality is not the decisive factor in word-initial epenthesis. A quick comparison between the examples in (2.b) and (2.d) shows that the epenthetic vowel in the former receives stress, while in the latter it does not in spite of the fact that it occupies the nucleus of a heavy syllable which should attract stress. The light penult in (2.c) unexpectedly receives stress, although in light-syllable words the antepenultimate syllable receives stress (cf. Section 3.3.2.2.1).

The author investigates these phenomena to show the consequences of the interaction of stress and epenthesis in MA. For convenience, this chapter will be divided into two major sections: initial epenthesis and non-initial epenthesis. These phenomena will be analysed by using Stratal OT, as introduced in chapter two. However, I will first show why parallel OT cannot account for stress-epenthesis interaction in MA.

4.1.1 Parallel OT Account

In this section, I will show how parallel OT cannot handle the opaque interaction of stress and epenthesis in MA[2]. Consider the examples in (3) below.

(3)

input	output	Gloss
a. fataḥ-t	fa.'ta.ḥ**i**t	I opened
b. galb-ha	'ga.l**i**b.ha	her heart
c. katab-t-l-ki	ka.tab.'t**i**l.ki	I wrote for you (f.s.)
d. dʒaab-l-ki	'dʒaa.b**i**l.ki	he brought to you (f.s.)
e. ftaḥ	'ʔ**i**f.taḥ	open! (m.s.)

[2] In this section, only the most relevant constraints will be used.

In the previous chapter, we established the fact that feet in MA are specified at the moraic level. Therefore, feet in MA can be composed of a heavy syllable or two consecutive light syllables. The example in (3.b) raises a serious question about foot binarity in MA. There are two possible ways in which the word */'ga.lib.ha/* could be footed, i.e. /('ga.lib).ha/ and /('ga).lib.ha/. Both types of footing violate the constraint FTBIN. Accordingly, Kager (1999: 223-4) argues that moraic trochee feet should include /'LH/. Kager supports his claim by citing examples from Old English, where the initial light syllable in [('fæ.rel).du] receives stress. He also analysed data from Palestinian Arabic according to this assumption. Kager (1999: 223) states that /LH/ feet ‘occurs under duress’. In Palestinian Arabic, this foot surfaces due to vowel epenthesis in medial clusters. Acknowledging the existence of /LH/ in MA implies we need two constraints. The first constraint recognises the existence of /'LH/ while the second prevents epenthetic vowels from bearing stress. The two constraints are introduced in (4) and (5) respectively.

(4)
MORAIC-TROCHEE (MT)
Moraic trochee Feet are (H), (LL) or (LH).

(5)
HEAD-DEP(O/I) (Alderete 1995)
Every vowel in the output prosodic head has a correspondent in the input.

Both constraints should outrank the constraint FTBIN. The constraint MT should outrank the constraint HEAD-DEP(O/I), as shown in (6).

(6)

galb-ha	MT	HEAD-DEP(O/I)	FTBIN
a. ☞('ga.lib).ha			*
b. ('ga).lib.ha	*!		*
c. ('ga.lib.ha)	*!		*
d. ga.('lib).ha		*!	

The above tableau shows that violating the constraint MT cannot be tolerated in MA. Accordingly, candidates (6.b) and (6.c) are ruled out. Candidate (6.d) loses by fatally violating the constraint HEAD-DEP(O/I). The same constraint hierarchy can optimise the example in (3.d) above, as demonstrated in (7).

(7)

dʒaab-l-ki	MT	HEAD-DEP(O/I)	FTBIN
a. ☞('dʒaa).(bil).ki			
b. (dʒaa).('bil).ki		*!	
c. ('dʒaa.bil).ki	*!		*
d. dʒaa.('bil.ki)	*!	*!	*

The optimal candidate (7.a) does not violate any of the established constraints. However, it violates the constraint RIGHTMOST, which is not ranked with respect to FTBIN, according to our discussion in the previous chapter. To account for the example in (3.c), the constraint RIGHTMOST should outrank the constraint HEAD-DEP(O/I), as shown in (8).

(8)

katab-t-l-ha	RIGHTMOST	HEAD-DEP(O/I)
a. ☞ka.(tab).('til).ha		*
b. ka.('tab).(til).ha	*!	

Such a dominance relation between RIGHTMOST and HEAD-DEP(O/I) would result in optimising the suboptimal candidate *(7.b)* in the tableau in (7), as shown in (9) below.

(9)

dʒaab-l-ki	RIGHTMOST	HEAD-DEP(O/I)
a. ☹('dʒaa).(bil).ki	*!	
b. ☞(dʒaa).('bil).ki		*

This behaviour of the epenthetic vowel in MA cannot be accounted for by using Classic OT. Therefore, we need to establish an O-O faithfulness analysis (cf. Section 2.2.2). Accordingly, we have to argue that /ka.(tab).('til).ha/ is baseless, while /('dʒaa).(bil).ki/ is derived from the base /('dʒaab)/ 'he brought'. To optimise candidate (9.a), we need to formulate a constraint like IDENT-STRESS(B/O), which requires that the stressed syllable in the base be stressed in the output.

(10)
IDENT-STRESS(B/O)
The Stressed syllable in the base is also stressed in the output.

The constraint IDENT-STRESS(B/O) should outrank the constraint RIGHTMOST, as shown in (11) and (12).

(11)

dʒaab-l-ki *base* 'dʒaab	IDENT-STRESS(B/O)	RIGHTMOST	HEAD-DEP(O/I)
a. ☞('dʒaa).(bil).ki		*	
b. (dʒaa).('bil).ki	*!		*

(12)

katab-t-l-ha *base NONE*	IDENT-STRESS(B/O)	RIGHTMOST	HEAD-DEP(O/I)
a. ☞ka.(tab).('til).ha			*
b. ka.('tab).(til).ha		*!	

In the above tableaux, candidate (11.b) loses by incurring a fatal violation of the constraint IDENT-STRESS(B/O) which is satisfied by the optimal candidate. In tableau (12), both candidates vacuously satisfy the aforementioned constraint since the word /ka.tab.til.ha/ is baseless.

In the example in (3.e) */'ʔ**i**f.taḥ/*, one might argue that the /i/ is inserted to satisfy the requirement of the constraints FTBIN and MT. Accordingly, we could argue that the word */'ʔ**i**f.taḥ/* is baseless and surfaces by virtue of the following constraint hierarchy.

(13)
MT, IDENT-STRESS(B/O) >> RIGHTMOST >> HEAD-DEP(O/I) >> FTBIN

(14)

ftaḥ *base NONE*	MT	IDENT-STRESS(B/O)	RIGHTMOST	HEAD-DEP(O/I)	FTBIN
a. ☞('ʔif).taḥ				*	
b. ('ftaḥ)	*!				*

However, stressing the penultimate syllable in a word like the one in (3.a) */fa.'ta.ḥit/* cannot be achieved since the constraint NONFINALITY would choose /'fa.ta.ḥit/ over /fa.'ta.ḥit/ as shown in (15).

(15)

fataḥ-t *base NONE*	MT	IDENT-STRESS(B/O)	RIGHTMOST	HEAD-DEP(O/I)	FTBIN	NONFINALITY
a. ☞('fa.ta).ḥit						
b. ☹fa.('ta.ḥit)						*!

The only way in which candidate (15.b) can surface as the optimal output is by claiming that a word like /fa.'taḥ.ha/ 'he opened it' is the base for /fa.'ta.ḥit/[3]. However, we have to explain why /fa.'taḥ.ha/ is the base but not /'fa.ta.ḥat/ 'she opened', since both words can serve as the base for /fa.'ta.ḥit/ according to Kager's definition (cf. Section 2.2.2). Furthermore, any O-O faithfulness constraint that

[3] The constraint NONFINALITY can by no means outrank FTBIN. See the previous chapter For further information

would affect /fa.'ta.ḥit/ would resist all stress alternations throughout the paradigm, so we would expect consistent stress on the second syllable: */fa.'ta.ḥat/ for 'she opened' and */fa.'taḥ/ for 'he opened' (cf. McCarthy 2007: 46). As a result, an O-O analysis cannot handle the opaque behaviour of the epenthetic vowel in MA.

The other parallel OT model that has been used to account for the opacity of the epenthetic vowel in Arabic is Sympathy Theory (cf. Section 2.2.3). In chapter two, it was argued that adopting Sympathy Theory leads to a proliferation of sympathy constraints as different sympathy constraints are needed to refer to the same selector constraint to account for different opaque processes (cf. Kiparsky 2000: 356). In this section, however, I will show that Sympathy Theory cannot account for the interaction of stress and vowel epenthesis in MA.

I will first start from the point where O-O analysis fails. Optimising /fa.('ta.ḥit)/ over */('fa.ta).ḥit/ requires a sympathetic constraint that favours the former over the latter. A sympathetic constraint like ❀IDENT-STRESS, which refers to a sympathetic candidate like ❀/fa.('taḥt)/, would optimise /fa.('ta.ḥit)/ over */('fa.ta).ḥit/. The sympathetic candidate satisfies the constraint DEP-(I/O), which is violated by the other two candidates. Accordingly, the constraint DEP-(I/O) is going to serve as the selector constraint. The sympathetic constraint loses by incurring a fatal violation of the constraint SONSEQ (cf. Section 3.1.6.2). However, to account for (3.b) */'ga.l**i**b.ha/*, a constraint which prohibits internal coda clusters is needed as the sequence /lb/ does not violate the constraint SONSEQ. Accordingly, the constraint CLUSTER-CONDITION (McCarthy, 2007) will be introduced. These facts are considered in tableaux (17. I-II) below.

(16)
CLUSTER-CONDITION (CL-CON) (McCarthy, 2007)
Nonfinal Coda clusters are not allowed.

(17. I)

fataḥ-t	CL-CON	SONSEQ	❀IDENT-STRESS	✦DEP-IO
a. ☞ /fa.('ta.ḥit)/				*
b. /('fa.ta).ḥit/			*!	*
c. ❀/fa.('taḥt)/		*!		

(17.II)

galib-ha	CL-CON	SONSEQ	❀IDENT-STRESS	✦DEP-IO
a. ☞ /('ga.lib).ha/				*
b. ga.('lib).ha/			*!	*
c. ❀/('galb).ha/	*!			

In the tableau in (17.I), it is assumed that the sympathetic constraint ❀*IDENT-STRESS* outranks the constraint WSP in accordance with our discussion above. Accounting for /('dʒaa).(bil).ki/, moreover, can be achieved by the same constraint hierarchy. In the tableau in (18) below, the constraint ❀IDENT-STRESS outranks the constraint RIGHTMOST.

(18)

dʒaab-l-ki	CL-CON	SONSEQ	❀IDENT-STRESS	RIGHTMOST	✦DEP-IO
a. ☞('dʒaa).(bil).ki				*	*
b. (dʒaa).('bil).ki			*!		*
c. ❀ ('dʒaabl).ki	*!	*!			

One of the problematic examples that cannot be handled by Sympathy Theory is that in which the epenthetic vowel transparently receives stress, i.e.

/ka.(tab).('til).ha/. In accounting for /ka.(tab).('til).ha/, it is not clear what the sympathetic candidate should be. The assumption that the sympathetic candidate is /ka.('tabtl).ha/ cannot hold, since the optimal output violates the sympathetic constraint ❀IDENT-STRESS. Ranking the constraint RIGHTMOST over the constraint ❀IDENT-STRESS is not possible because the suboptimal candidate */(dʒaa).('bil).ki/ in (18) would be optimised over the desired output /('dʒaa).(bil).ki/. Accordingly, there is no way in which /ka.(tab).('til).ha/ can surface as the optimal output under Sympathy Theory analysis.

(19)

katab-t-l-ha	CL-CON	SONSEQ	❀IDENT-STRESS	RIGHTMOST	✦DEP-IO
a. ☹/ka.(tab).('til).ha/			*!		*
b. ☞/ka.('tab).(til).ha/				*	*
c. ❀ /ka.('tabtl).ha/	*!	*!			

Finally, the prosthetic /ʔi/ in the example in (3.e) is one of the cases that cannot be explained using Sympathy Theory. It was indicated earlier that the vowel /i/ is inserted to satisfy the constraint FTBIN, while the glottal stop is inserted since onsetless syllables are not allowed in MA. Therefore, we could argue that Sympathy Theory is not needed to account for initial epenthesis in this case. However, considering more examples in which /ʔi/ is inserted reveals that initial epenthesis is an opaque process in MA.

(20)

	Input	Output	Gloss
a.	ftaḥ	/('ʔif).taḥ/	open! (m.s.)
b.	ftaḥ-i	/('ʔif).ta.ḥi/	open! (f.s.)
c.	ftaḥ-ha	('ftaḥ).ha	open! (m.s) it

Although FTBIN is satisfied in (20.b) and (20.c), they behave in different ways. In the former, the prosthetic /ʔi/ is inserted while in the latter it is not. Accordingly, this discrepancy cannot be attributed to the satisfaction of FTBIN. It is not clear how such a discrepancy can be explained by adopting Sympathy Theory. The sympathetic candidate, which is the most harmonic member of the set of candidates that satisfy the selector constraint, cannot be identified for the example in (20.b). The most relevant set of candidates for (20.b) are given in (21).

(21)

Input	Candidates
ftaḥ-i	a. 'ʔif.ta.ḥi
	b. 'fta.ḥi
	c. 'if.ta.ḥi
	d. 'ta.ḥi

Candidate (21.a) is the desired output, so it can not serve as a sympathetic candidate. Candidate (21.b) cannot serve as a sympathetic candidate since it would rule out the desired output, i.e. the desired output would violate the sympathetic constraint ❀IDENT-STRESS. Candidate (21.d) is not an option, since a constraint like MAX-IO$_C$ is ranked high in the grammar of MA. Finally, candidate (21.c) is the most relevant one. However, it is not clear which input-output faithfulness constraint (selector constraint) is satisfied by (21.c) and violated by (21.a) and (21.b). As a result, we cannot establish an analysis by using Sympathy Theory.

To summarise, neither classic OT nor semiparallel OT models can account for the opacity of vowel epenthesis in MA. The problem with the semiparallel OT models is that they cannot differentiate between lexical and postlexical epenthesis. Kiparsky (2000: 354) states that '*epenthetic vowels in Arabic are not just unstressable, they are invisible to stress'*. The invisibility of epenthetic vowels to stress implies that stress is assigned before vowel epenthesis. To this end, the aforementioned OT models are inadequate. Accordingly, in the following sections, a Stratal OT account will be developed to explain the opaque behaviour of the epenthetic vowels.

4.2 Stratal OT Account

4.2.1 Initial Epenthesis

One case that can represent initial epenthesis in MA is that of the imperative form. The imperative form in Arabic, as argued by Brame (1970), Benmamoun (1996) and Al-Shboul (2007), is derived from the imperfective form[4]. Consider the examples from MA in (22) below.

(22)

	Imperfective		Imperative	
a.	ji-**ftaḥ**	'he open'	ʔi-**ftaḥ**	'open! (m.s.)'
b.	ju-**drus**	'he study'	ʔu-**drus**	'study! (m.s)'
c.	ji-**ʃrab**	'he drink'	ʔi-**ʃrab**	'drink ! (m.s)'
d.	ji-**ʃrab-**ha	'he drink it'	**ʃrab-ha**	'drink ! (m.s) it'
b.	yu-**drus-**ha	'he study'	**drus-**ha	'study! (m.s) it'

[4] Benmamoun 1996 argues that the imperative form is derived from the imperfective form and in particular from the indicative, while Al-Shboul 2007 argues that it is derived from the jussive mood. These arguments lie beyond the scope of this thesis; accordingly, it would be enough for our purpose here to say that the imperative is derived from the imperfective without going into further morphological and or syntactical details.

Examining the data in (22) reveals three main points. First of all, it is clear that the imperative is derived from the imperfective by deleting the imperfective marker */yi/*. Secondly, in (22.b) one can notice a case of vowel harmony between the prosthesis /i/ and the vowel of the stem[5]. Finally, the examples show that the prosthesis */i/* is attached to stems that: (a) contain complex onset clusters and; (b) are monomoraic.

In the literature, there are two claims regarding the status of the vowel */i/* in the imperative. The /i/ in the imperative is a prosthesis vowel that is inserted before consonant clusters (McCarthy and Prince, 1990b: 18-9, Kiparsky 2000: 357; Watson, 2002: 233). Angoujard (1990: 125) reluctantly gives the /i/ in the imperative the status of a morphological marker. I think the /i/ in the imperative is a prosthetic vowel rather than a prefix since /i/ is not used in forming the imperative form of hollow and doubled verbs[6]. This is shown in (23).

(23)

input	output	Gloss
a. guul	guul *ʔiguul	say! (m.s.)
b. ʃidd	ʃidd *ʔiʃidd	pull! (m.s.)

Another piece of evidence that supports treating /i/ as a prosthetic vowel stems from the fact that this process is not restricted to the imperative form. Consider the examples in (24).

(24)

input	output	Gloss
a. n-faham	ʔin.fa.ham	it was understood
b. n-gatal	ʔin.ga.tal	he was killed

[5] Vowel harmony is not going to be discussed in this dissertation.
[6] Hollow verbs are those verbs with a medial glide while doubled ones are those which have a final geminate consonant.

In Syrian Arabic (Adra 1999), the imperative is formed by lengthening the stem vowel as in /kbos/, which surfaces as /kboos/ ‘press 2nd (m.s). There is a great deal of evidence to support our claim; however, I think the above examples are sufficient for our purpose.

4.2.1.1 The Imperative Form and the Prosthetic /i/

Words in MA are minimally bimoraic (cf. 3.2.1). As a result, when an underlying form does not satisfy this requirement it motivates the insertion of a segment. In the case of the imperative, a prosthetic /i/ is inserted. Since onsetless syllables are not allowed in MA, a glottal stop /ʔ/ is inserted word-initially before the prosthetic /i/. This idea was discussed earlier in the thesis to support the claim that the constraint ONS is undominated in MA. This discussion is repeated here for the purposes of clarification. The examples in (25) show how the glottal stop is inserted.

(25)

	Input	Output	Gloss
a.	zraʕ	'ʔiz.raʕ	plant! (m. s.)
b.	ftaḥ	'ʔif.taḥ	open! (m. s.)
c.	ʃrab	'ʔiʃ.rab	drink! (m. s.)

In order to account for these output forms, it was crucial to produce the preliminary constraint hierarchy in (26).

(26)
ONS >> MAX-IO >> DEP-IO

A further two constraints are needed to fully account for the examples in (25). The constraint FTBIN would rule out faithful candidates like /zraʕ/, while the constraint CONTIGUITY-IO would ensure that no medial segments can be epenthesized or deleted. The constraints FTBIN and ONS are not ranked against each other. These facts are demonstrated in tableau (28).

(27)
CONTIGUITY-IO (McCarthy and Prince 1995)
The portion of S_1 standing in a correspondence forms a contiguous string as does the correspondent portion of S_2. (No medial epenthesis or deletion of segments)

(28)

zraʕ	FTBIN	ONS	MAX-IO	CONTIGUITY-IO	DEP-IO
a. ☞('ʔiz).raʕ					**
b. ('iz).raʕ		*!			*
c. ('zraʕ)	*!				
d. ('raʕ)	*!		*		
e. ('zi.raʕ)				*!	*
f. ('zaʕ)	*!		*	*	

It is true that this hierarchy is sufficient to derive the desired output for the examples in (25). However, considering more examples shows that: (a) the prosthetic /i/ is not inserted to mainly satisfy foot binarity; and (b) the prosthetic /i/ is lexically inserted only at the stem level. Consider the examples in (29) below.

(29)

		Input	Stem Output	Word Output	Postlexical Output	Gloss
Stem Level	a.	ftaḥ	/'ʔif.taḥ/	/'ʔif.taḥ/	/'ʔif.taḥ/	open! (m. s.)
	b.	ftaḥ-i	/'ʔif.ta.ḥi/	/'ʔif.ta.ḥi/	/'ʔif.ta.ḥi/	open! (f. s.)
		ftaḥ-u	/'ʔif.ta.ḥu/	/'ʔif.ta.ḥu/	/'ʔif.ta.ḥu/	open! (m. pl.)
		ftaḥ-in	/'ʔif.ta.ḥin/	/'ʔif.ta.ḥin/	/'ʔif.ta.ḥin/	open! (f. pl.)
Word Level	c.	'ʔiftaḥ-ha	----------	/ʔif.'taḥ.ha/	/'ftaḥ.ha/	open! (m. s.) it
		'ʔiftaḥ-ii-ha	----------	/ʔif.ta.'ḥii.ha/	/fta.'ḥii.ha/	open! (f. s.) it
		'ʔiftaḥ-u-u	----------	/ʔif.ta.'ḥuu/	/fta.'ḥuu/	open! (m. pl.) it
		'ʔiftaḥ-in-ha	----------	ʔif.ta.'ḥin.ha	fta.'ḥin.ha	open! (f. pl.) it

The inputs for the examples in (29.c) are the outputs of the examples in (29.a) and (29.b) since MA distinguishes between two lexical levels, i.e. stem and word levels (cf. Section 2.3). At the stem level, the prosthetic /i/ is inserted regardless of the satisfaction of FTBIN. McCarthy and Prince (1990) and Kiparsky (2000) argue that word minimality plays a role in the surfacing of the prosthetic /i/, since a word such as /ftaḥ/ cannot surface as it does not satisfy the minimal word constraint which is bimoraic. As a result, the prosthetic /i/ surfaces and the glottal stop is inserted. The resultant output is /ʔif.taḥ/. In contrast, a word like /ftaḥ-ha/ satisfies the word minimality constraint, thus, the output appears without the prosthetic /i/. This argument seems to be valid, although considering the examples in (29.b) show that a word like /ftaḥi/ satisfies FTBIN. Thus, it surfaces with a prosthetic /i/. Accordingly, such an argument cannot hold in MA.

The other observation regarding the set of data in (29) is that the examples in (29.c) surface postlexically without the prosthetic /i/. At the word level, the prosthetic vowels cannot be deleted since they have been stressed at the stem level. Therefore, we expect that the constraint which forces the examples at the stem level to surface with the prosthetic /i/ to be demoted at the word level.

Carefully examining the data in (29) shows that the constraint *COMPLEX$_{\text{ONS}}$ plays a major role in the grammar of MA. To account for the prosthetic /i/ at the stem level, we need to incorporate the constraint *COMPLEX$_{\text{ONS}}$ with the constraints that have been used in (28) above. The constraint *COMPLEX$_{\text{ONS}}$ is not ranked with respect to the constraints MAX-IO or CONTIGUITY-IO. Accordingly, the constraint hierarchy in (30) is achieved.

(30)
FTBIN, ONS >> *COMPLEX$_{\text{ONS}}$, MAX-IO, CONTIGUITY-IO >>DEP-IO

The constraint hierarchy in (30) is able to derive the desired outputs for all the examples in (29.a) and (29.b), i.e. the stem level. Consider the following tableau, which accounts for the word /'ʔif.ta.ḥu/.

(31) Stem Level

ftaḥ-u	FTBIN	ONS	*COMPLEX$_{\text{ONS}}$	MAX-IO	CONTIGUITY-IO	DEP-IO
a. ☞('ʔif).ta.ḥu						**
b. ('if.ta).ḥu		*!				*
c. ('fa.ḥu)				*!		
d. ('ta.ḥu)				*!	*!	
e. ('fta.ḥu)			*!			
f. ('fta.ḥu)					*!	*

The tableau in (31) shows that the optimal output wins over the other suboptimal candidates by satisfying all the high ranked constraints. The most stubborn competitor *(31.f)* loses by fatally violating the constraint CONTIGUITY-IO.

The same constraint hierarchy in (30), moreover, is able to derive the desired outputs at the word level as shown in (32).

(32) Word Level

'ʔiftaḥ-u-u	FTBIN	ONS	*COMPLEX$_{ONS}$	MAX-IO	CONTIGUITY-IO	DEP-IO
a. ☞(ʔif).ta.('ḥuu)						**
b. fta.('ḥuu)			*!	*!*		
c. (if.ta).('ḥuu)		*!		*		*
d. ta.('ḥuu)				*!**		
e. fa.('ḥuu)				*!**	*!	
f. (fi.ta).('ḥuu)				*!**	*!	*

However, the constraint hierarchy in (30) cannot account for the examples in (29) at the postlexical level. We will not be able to handle these examples regardless of how the constraints in (30) are re-ranked. The tableau in (33) shows this failure of the constraint hierarchy.

(33) Postlexical Level

ʔifta'ḥuu	ONS	*COMPLEX$_{ONS}$	MAX-IO	CONTIGUITY-IO	DEP-IO
a. ☞ʔif.ta.'ḥuu					**
b. ☹fta.'ḥuu		*!	*!*		
c. if.ta.'ḥuu	*!		*		*
d. ta.'ḥuu			*!**		
e. fa.'ḥuu			*!**	*!	
f. fi.ta.'ḥuu			*!**	*!	*

The desired output (33.b) loses the competition by fatally violating the constraint *COMPLEX$_{ONS}$. Arguing that the constraint DEP-IO outranks the constraint *COMPLEX$_{ONS}$ would result in optimising the suboptimal candidate (32.d). Therefore, there is little point in re-ranking these constraints.

However, re-examining the data in light of these facts reveals that the insertion of the prosthetic /i/ at the stem level should not be merely understood as a violation of the constraint DEP-IO. Surfacing of the prosthetic /i/ should rather be understood as an interaction between the constraint *COMPLEX$_{ONS}$ and an alignment constraint that requires the left edge of the stem to coincide with the left edge of the PrWd.

(34)
ALIGN-L (McCarthy and Prince 1993a)
Align (Stem, L, PrWd, L)
The left edge of each stem coincides with the left edge of a PrWd.

The constraint ALIGN-L is violated by any segment inserted to the left of the PrWd, i.e. it bans prosthetic segments. At the stem level, the constraint ALIGN-L should be ranked below the constraints *COMPLEX$_{ONS}$, MAX-IO and CONTIGUITY-IO.

Moreover, there is no dominance relation that can hold between ALIGN-L and DEP-IO. Accordingly, a word like /('ʔif.ta).ḥu/ is derived by virtue of the following hierarchy.[7]

(34) Stem Level
FTBIN, ONS >> *COMPLEX$_{ONS}$, MAX-IO, CONTIGUITY-IO >> ALIGN-L, DEP-IO

(35) Stem Level

ftaḥ-u	FTBIN	ONS	*COMPLEX$_{ONS}$	MAX-IO	CONTIGUITY-IO	ALIGN-L	DEP-IO
a. ☞('ʔi|f).ta.ḥu						*	**
b. ('i|f.ta).ḥu		*!				*	*
c. (|'fa.ḥu)				*!	*!		
d. (|'ta.ḥu)				*!			*
e. (|'fta.ḥu)			*!				
f. ('fi.ta).ḥu					*!		*

At the word level, the same ranking can account for the examples in (29). However, MA allows complex onsets at the word level like /sta.'giil/ 'resign 2nd (m.s.)'. In order to optimise /sta.'giil/ over */ʔis.ta.'giil/ at the word level, the constraint ALIGN-L should outrank *COMPLEX$_{ONS}$[8]. Taking this observation into consideration implies that at the word level there is an active constraint that prevents the deletion of the stressed prosthetic /i/. This constraint should outrank the constraint ALIGN-L to ensure that /('ʔif.ta).ḥu/ surfaces intact at the word level. In

[7] The vertical line '|' will be used to indicate the left edge of the stem.
[8] Imperative forms which contain a heavy syllable in their inputs will be discussed later in this section.

the literature, Kiparsky (2000) proposes the constraint MAX-['V], which prevents stressed vowels in the input from being deleted.

(36)
MAX-IO['V] (Kiparsky 2000)
Stressed vowels of the input have correspondent in the output.

The word /(ʔif).ta.('ḥuu)/ surfaces at the word level by virtue of the following hierarchy.

(37) Word Level
FTBIN, ONS, MAX-IO['V] >> ALIGN-L >> *COMPLEX$_{ONS}$, MAX-IO, CONTIGUITY-IO >> DEP-IO

(38) Word Level

'ʔiftaḥ-uu	FTBIN	ONS	MAX-IO['V]	ALIGN-L	*COMPLEX$_{ONS}$	MAX-IO	CONTIGUITY-IO	DEP-IO
a. ☞(ʔi|f).ta.('ḥuu)				*				
b. (i|f.ta).('ḥuu)		*!		*		*		*
c. (|fi.ta).('ḥuu)			*!			**	*	*
d. |fta.('huu)			*!		*	**		
e. |ta.('huu)			*!			***		

Candidates (38.c) and (38.d) fatally violate the constraint MAX-IO['V] by deleting the stressed vowel of the input. The optimal output at the word level incurs a minimal violation of the constraint ALIGN-L, while candidate (38.b) is ruled out by not satisfying the high ranked constraint ONS.

To ensure the word /(ʔif).ta.('ḥuu)/ surfaces postlexically as /fta.('ḥuu)/, the constraint CONTIGUITY-IO should be promoted. There is no dominance relation that can hold between CONTIGUITY-IO and ALIGN-L. The constraint MAX-IO should outrank the constraint *COMPLEX$_{ONS}$ to optimise /fta.('ḥuu)/ over /ta.('ḥuu)/. Consider the tableau in (40) below.

(39) Postlexical Level
ONS, MAX-IO['V] >> CONTIGUITY-IO , ALIGN-L >> MAX-IO >> *COMPLEX$_{ONS}$ >> DEP-IO

(40) Postlexical Level

ʔifta'ḥuu	ONS	MAX-IO['V]	CONTIGUITY-IO	ALIGN-L	MAX-IO	*COMPLEX$_{ONS}$	DEP-IO
a. ☞ |fta.'ḥuu					**	*	
b. ʔi|f.ta.'ḥuu				*!			
c. |fi.ta.'ḥuu			*!		**		*
d. i|f.ta.'huu	*!			*	*		
e. |ta.'ḥuu					***!		

The argument that has been developed in this section can explain why a word like /sta.'giil/ 'resign 2nd (m. s.)' surfaces postlexically without prosthetic segments in MA, i.e. */ʔis.ta.'giil/. Consider the following examples.

(41)

Input	Stem Output	Word Output	Postlexical Output	Gloss
stagiil	/ʔis.ta.'giil/	/sta.'giil/	/sta.'giil/	resign! (m. s.)
stafsir	/ʔis.'taf.sir/	/'staf.sir/	/'staf.sir/	inquire! (m. s.)
staʕmil	/ʔis.'taʕ.mil/	/'staʕ.mil/	/'staʕ.mil/	use! (m.s.)

The examples in (41) surface with prosthetic /i/ at the stem level since complex onsets are not allowed. At the word level, the prosthetic /i/ is deleted because of the alignment constraint. The prosthetic /i/ is not immune to deletion at the word level in the above examples since they have not been stressed at the previous level, i.e. deletion of the prosthetic /i/ in (41) does not cause a violation of the constraint MAX-IO['V]. The constraint DEP-IO plays a major role at the word level since it favours the desired output /sta.'giil/ over the suboptimal candidate */si.ta.'giil/ as shown in (42). Moreover, a minor refinement at the word level is required to rule out a candidate like /ta.'giil/[9]. The constraint MAX-IO should outrank the constraint *COMPLEX$_{ONS}$. This ranking is required since the suboptimal candidate /ta.'giil/ does not violate MAX-IO['V] in contrast to /ta.'huu/ in (38.e) above.

(42) Word Level

ʔista'giil	FTBIN	ONS	MAX-IO['V]	ALIGN-L	MAX-IO	*COMPLEX$_{ONS}$	CONTIGUITY-IO	DEP-IO
a. ☞ |sta.('giil)					**	*		
b. (ʔi|s).ta.('giil)				*!				
c. (|si.ta).('giil)					**		*	*!
d. ta.('giil)					***!			

The optimal candidate (42.a) can win the competition over the suboptimal candidate (42.c) by using the constraint *i]σ, which prohibits unstressed high short

[9] This suboptimal candidate can be ruled out by proposing a constraint like MAX-IO[C-STEM] which prohibits the deletion of any consonants that belongs to a stem which I will adopt latter on in this chapter.

vowels in nonfinal open syllables. However, I will not include this constraint at the moment since we are not dealing with syncope processes in this chapter[10]. The word /sta.'giil/ surfaces intact postlexically as shown in (43).

(43) Postlexical Level

sta'giil	ONS	MAX-IO['V]	CONTIGUITY-IO	ALIGN-L	MAX-IO	*COMPLEX$_{ONS}$	DEP-IO
a. ☞ |sta.'giil						*	
b. ʔi|s.ta.'giil				*!			**
c. |si.ta.'giil			*!	*!			*
d. ta.giil					*!		

The analysis that has been developed so far, accurately predicts that the prosthetic /i/ is only inserted when the input contains a complex onset. Therefore, the imperative forms of the hollow and doubled verbs never surface with a prosthetic /i/ at any level. Consider the examples in (44) below.

(44)

	Input	Stem Output	Word Output	Postlexical Output	Gloss
Hollow Verbs	guum	/'guum/	/'guum/	/'guum/	stand up! (m. s.)
	ruuḥ	/'ruuḥ/	/'ruuḥ/	/'ruuḥ/	go! (m. s.)
Doubled Verbs	/ʕidd/	/'ʕidd/	/'ʕidd/	/'ʕidd/	stretch! (m. s.)
	/ḥuṭṭ/	/'ḥuṭṭ/	/'ḥuṭṭ/	/'ḥuṭṭ/	put down! (m. s.)

[10] The constraint CONTIGUITY-IO can be promoted over the alignment constraint. However, I think that there is no need for such movement since unstressed high short vowels are systematically deleted in MA. This issue will be discussed in chapter five.

To show the validity of the constraint rankings, the word /guum/ will be evaluated at the three levels. Consider the tableaux in (45-7).

(45) Stem Level

guum	FtBin	Ons	*Complex$_{ONS}$	Max-IO	Contiguity-IO	Align-L	Dep-IO
a. ☞(|'guum)							
b. ʔi|.('guum)						*!	**!
c. (|'guu)				*!			

(46) Word Level

'guum	FtBin	Ons	Max-IO['V]	Align-L	Max-IO	*Complex$_{ONS}$	Contiguity-IO	Dep-IO
a. ☞(|'guum)								
b. ʔi|.('guum)				*!				**
c. (|'guu)					*!			

(47) Postlexical Level

'guum	Ons	Max-IO['V]	Contiguity-IO	Align-L	Max-IO	*Complex$_{ONS}$	Dep-IO
a. ☞|'guum							
b. ʔi|.'guum				*!			**
c. |'guu					*!		

4.2.1.1.1 Problematic Examples

It has been already stated that the imperative is derived from the imperfective. In the case of /ʔ/, initial verbs like /ʔa.xað/ 'to take' the imperfective form is /yaa.xuð/ where, as can be noted, the glottal stop is deleted. Accordingly, the input of the imperative form is then /xuð/. In other cases, the glottal stop is not deleted in the imperfective. Therefore, it appears in the imperative as in the verb /ʔa.mar/ 'to command'. Consider the following examples.

(48)

	Root	Imperfective		Imperative	
a.	ʔmr	/juʔ.mur/	he command	/ʔuʔmur/	command! (m. s.)
	ʔðn	/jiʔ.ðan/	he give permission	/ʔiʔ.ðan/	give permission! (m. s.)'
b.	ʔxð	/juu.xuð/	he take	/xuðð/	take! (m. s.)
	ʔkl	/juu.kul/	he eat	/kull/	eat! (m. s.)

The examples in (48.b) lose the glottal stop in the imperfective form[11]. As a result, the imperfective prefix /ji/ undergoes compensatory lengthening, i.e. surfaces as /jVV/. The final consonant in the imperative of the examples in (48.b) is geminated to satisfy the minimal word requirement, i.e. the input /xuð/ surfaces as /xuðð/. On the other hand, the glottal stop remains in the examples in (48.a). Since the imperative is derived from the imperfective, the glottal stop appears in the imperfective when it appears in the imperative and vice versa.

[11] The discussion regarding the deletion of the glottal stop is beyond the scope of this dissertation. For further discussion see Adra (1999) and Odden (1978).

The examples in (48) are unproblematic since the analysis that has been developed in the previous section can account for them. For convenience, I will show how we can account for the word /xuðð/ at the stem level.

(49) Stem Level

xuð	FTBIN	ONS	*COMPLEX$_{ONS}$	MAX-IO	CONTIGUITY-IO	ALIGN-L	DEP-IO
a. ☞(│'xuðð)							*
b. ('ʔi|.xuð)						*!	**!
c. (|'xuuð)					*!		*
d. ('i.|xuð)		*!				*	*

The constraint hierarchy chooses the desired output as expected. The problematic examples that require attention are actually those which begin with a glottal stop. To highlight the problem, let us consider the following examples. (50)

	Input	Stem Output	Word Output	Postlexical Output	Gloss
a. Stem Level	ʔmur	/'ʔuʔ.mur/	/'ʔuʔ.mur/	/'ʔuʔ.mur/	command! (m. s.)
	ʔmur-i	/'ʔuʔ.mu.ri/	/'ʔuʔ.mu.ri/	/'ʔuʔ.mu.ri/	command! (f. s.)
b. Word Level	'ʔuʔmur-ha	----------	/ʔuʔ.'mur.ha/	/ʔuʔ.'mur.ha/	command! (m. s.) her
	'ʔuʔmur-ii-ha	----------	/ʔuʔ.mu.'rii.ha/	/ʔuʔ.mu.'rii.ha/	command! (f. s.) her

The problem in the examples in (50) is that the words /ʔuʔ.'mur.ha/ and /ʔuʔ.mu.'rii.ha/ unexpectedly surface postlexically with unstressed prosthetic /i/. In the examples in (29) above, we have seen that the unstressed prosthetic /i/ never surfaces in the imperative form in MA (cf. /fta.'ḥii.ha/). The question is, then, why is the unstressed prosthetic high short vowel in /ʔuʔ.'mur.ha/ and /ʔuʔ.mu.'rii.ha/ are immune to deletion? Before giving an answer, I will show how the analysis developed in the previous section chooses the suboptimal candidate */'ʔmur.ha/.

(51) Word Level

'ʔuʔmur-ha	FtBin	Ons	Max-IO['V]	Align-L	Max-IO	*Complex$_{ONS}$	Contiguity-IO	Dep-IO
a. ☞(ʔu|ʔ).('mur).ha				*				
b. (|'ʔmur).ha			*!		**			
c. (|'mur).ha			*!		***			

(52) Postlexical Level

ʔuʔ'mur-ha	Ons	Max-IO['V]	Contiguity-IO	Align-L	Max-IO	*Complex$_{ONS}$	Dep-IO
a. ☹ʔu|ʔ.'mur.ha				*!			
b. ☞|'ʔmur.ha					**	*	
c. |'mur.ha					***!		

One possible answer regarding the immunity of the prosthetic /ʔi/ to deletion in /(ʔu|ʔ).('mur).ha/ can be fount by considering its behaviour in terms of sonority.

However, antisonority onset clusters surface in MA and in all JA dialects (cf. Section 3.1.6.1). In MA, the unstressed high short vowels are deleted: thus, creating complex onset clusters which violate the sonority hierarchy. Consider the examples in (53) below.

(53)

input	output	Gloss
kitaab	/ktaab/	book
ḥimaar	/ḥmaar/	donkey
silaaḥ	/slaaḥ/	weapons
lisaan	/lsaan/	tongue

The examples in (53) show that complex onset clusters in MA surface regardless of violating the sonority hierarchy. Moreover, the high short vowel is not deleted in a words like /ʔu.dʒuur/ 'rents' and /ʔu.muur/ 'matters'. Therefore, the immunity of /ʔi/ to deletion is not related to sonority.

I propose that the prosthetic vowels in (50.b) are not deleted because of an ad hoc constraint in MA that prohibits onset clusters beginning with a glottal stop. This constraint is given in (54) below.

(54)
*[ʔC
Complex onset cannot begin with a glottal stop.

The function of this constraint is to penalise complex onsets that begin with a glottal stop and followed by another consonant. This constraint is of an undominated nature in MA. Therefore, at the postlexical level, the following constraint hierarchy is established.

(55) Postlexical Level
ONS, MAX-IO['V], *[ʔC >> CONTIGUITY-IO , ALIGN-L >> MAX-IO >> *COMPLEX$_{ONS}$ >> DEP-IO

The above constraint hierarchy can optimise /ʔuʔ.'mur.ha/ over /'ʔmur.ha/ but not over the suboptimal candidate /'mur.ha/, as shown in tableau (56).

(56) Postlexical Level

ʔuʔ'mur-ha	ONS	MAX-IO['V]	*[ʔC	CONTIGUITY-IO	ALIGN-L	MAX-IO	*COMPLEX$_{ONS}$	DEP-IO
a. ☹ ʔu|ʔ.'mur.ha					*			
b. |'ʔmur.ha			*!			**	*	
c. ☞ |'mur.ha						***		

In an earlier footnote, it was pointed out that the suboptimal output at the word level */ta.('giil)/ can be ruled out by the constraint MAX-IO$_{[C\text{-}STEM]}$ (cf. Tableau 42). The constraint MAX-IO$_{[C\text{-}STEM]}$ has not been adopted, since */ta.('giil)/ was ruled out by the constraint MAX-IO. However, the importance of the constraint MAX-IO$_{[C\text{-}STEM]}$ reintroduces itself in the above tableau.

(57)
MAX-IO$_{[C\text{-}STEM]}$
Every consonant of the stem in the input has a correspondent in the output.

The function of this constraint is to preserve the consonants of the stem. Therefore, MAX-IO$_{[C\text{-}STEM]}$ penalises output candidates that delete any consonant of the stem. In MA, MAX-IO$_{[C\text{-}STEM]}$ is of an undominated nature since, as far as I know, it is not violated. Consequently, the final constraint hierarchy at the postlexical level in (58) is established.

(58)
ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$ >> CONTIGUITY-IO , ALIGN-L >> MAX-IO >> *COMPLEX$_{ONS}$ >> DEP-IO

(59) Postlexical Level

ʔuʔ'mur-ha	ONS	MAX-IO['V]	*[ʔC	MAX-IO$_{[C\text{-}STEM]}$	CONTIGUITY-IO	ALIGN-L	MAX-IO	*COMPLEX$_{ONS}$	DEP-IO
a. ☞ʔu|ʔ.'mur.ha						*			
b. |'ʔmur.ha			*!				**	*	
c. |'mur.ha				*!			***		

The resistance of the prosthetic /ʔi/ to deletion at the postlexical level is explained by using the constraints *[ʔC and MAX-IO$_{[C\text{-}STEM]}$. The former militates against complex onsets that begin with a glottal stop, while the latter prohibits the deletion of stem consonants. The aforementioned constraints are also undominated at the lexical levels, i.e. the stem level and the word level.

To this end, we have discussed the relationship between the imperative and the prosthetic /i/ in MA. For convenience, I will conclude this section by giving the constraint hierarchies that govern this relationship at the three levels.

(60) Stem Level
FTBIN, ONS, *[ʔC, MAX-IO$_{[C\text{-}STEM}$ >> *COMPLEX$_{ONS}$, MAX-IO, CONTIGUITY-IO >> ALIGN-L, DEP-IO

(61) Word Level
FTBIN, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C-STEM}$ >> ALIGN-L >> MAX-IO >> *COMPLEX$_{ONS}$, CONTIGUITY-IO >> DEP-IO

(62) Postlexical Level
ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C-STEM]}$ >> CONTIGUITY-IO , ALIGN-L >> MAX-IO >> *COMPLEX$_{ONS}$ >> DEP-IO

4.2.2 Summary and Consequences

In the previous sections, the imperative form was comprehensibely discussed as I proved that different parallel OT models cannot account for the opaque behaviour of the prosthetic /i/. Stratal OT proves to be superior to other OT models owing to its ability to smoothly account for the aforementioned phenomenon.

The prohibition against complex onsets at the stem level motivates the insertion of a prosthetic /i/. The glottal stop is attached to the prosthetic /i/ due to the ban on onsetless syllables in MA. The alignment constraint, which requires the left edge of the stem to coincide with the left edge of the PrWd, is violated by the insertion of the prosthetic /ʔi/. Thus, the desired outputs surface with prosthetic /ʔi/ since the constraint *COMPLEX$_{ONS}$ outranks the constraint ALIGN-L. The stressed prosthetic /i/ at the stem level is immune to deletion at the next level by the force of the constraint MAX-IO['V]. The unstressed prosthetic /i/ at the stem level, by contrast, can be deleted at the next level since it cannot be preserved by the constraint MAX-IO['V]. To allow such deletion, it is imperative that the constraint ALIGN-L outrank the constraint *COMPLEX$_{ONS}$ at the word and the postlexical levels. The need to include more constraints stems from the immunity of the unstressed prosthetic /i/ in /ʔ/ initial verbs to deletion. The constraint *[ʔC prevents the deletion of the unstressed prosthetic /i/ at the word and postlexical levels.

The analysis that has been developed to account for the relationship between the prosthetic /i/ and the imperative form in MA can be generalised to explain other cases. The verb forms VII and VIII have initial consonant clusters (cf. Section 2.4.2). These forms behave in the same way as the imperative. In other words, the initial consonant clusters are syllabified by prosthesis. Consider the examples in (63).

(63)

	Input	Stem Output	Word Output	Postlexical Output	Gloss
VII	nfaham	/'ʔin.fa.ham/	/'ʔin.fa.ham/	/'ʔin.fa.ham/	it was understood
	nkasar	/'ʔin.ka.sar/	/'ʔin.ka.sar/	/'ʔin.ka.sar/	it was broken
VIII	xtaraʕ	/'ʔix.ta.raʕ/	/'ʔix.ta.raʕ/	/'ʔix.ta.raʕ/	he invented
	ktaʃaf	/'ʔik.ta.ʃaf/	/'ʔik.ta.ʃaf/	/'ʔik.ta.ʃaf/	he discovered

For convenience, I will examine the word /xtaraʕ/ with different suffixes at the lexical and postlexical levels.

(64)

	Input	Stem Output	Word Output	Postlexical Output	Gloss
Stem	xtaraʕ	/'ʔix.ta.raʕ/	/'ʔix.ta.raʕ/	/'ʔix.ta.raʕ/	he invented
	xtaraʕ-at	/ʔix.'ta.ra.ʕat/	/'xta.ra.ʕat/	/'xta.ra.ʕat/	she invented
Word	'ʔixtaraʕ-ha	-----------------	/xta.'raʕ.ha/	/xta.'raʕ.ha/	he invented it (f.)

(65) Stem Level

xtaraʕ	FtBin	Ons	*[ʔC	Max-IO$_{[C\text{-}STEM]}$	*Complex$_{ONS}$	Max-IO	Contiguity-IO	Align-L	Dep-IO
1.a. ☞('ʔi|x).ta.raʕ								*	**
1.b. (|'xta.raʕ)					*!				
xtaraʕ-at									
2.a. ☞(ʔi|x).('ta.ra).ʕat								*	**
2.b. (|'xta.ra).ʕat					*!				

(66) Word Level

'ʔixtaraʕ	FtBin	Ons	Max-IO['V]	*[ʔC	Max-IO$_{[C\text{-}STEM]}$	Align-L	Max-IO	*Complex$_{ONS}$	Contiguity-IO	Dep-IO
1.a. ☞('ʔi|x).ta.raʕ						*				
1.b. (|'xta.raʕ)			*!				**	*		
ʔix'taraʕat										
2.a. ☞(|'xta.ra).ʕat							**			
2.b. (ʔi|x).('ta.ra).ʕat						*!		*		
'ʔixtaraʕ-ha										
3.a. ☞(ʔi|x).ta.('raʕ).ha						*				
3.b. (|xta.('raʕ).ha			*!				**	*		

(67) Postlexical Level

'ʔixtaraʕ	ONS	MAX-IO['V]	*[ʔC	$\text{MAX-IO}_{[\text{C-STEM}}$	CONTIGUITY-IO	ALIGN-L	MAX-IO	$\text{*COMPLEX}_{\text{ONS}}$	DEP-IO
1.a. ☞'ʔi|x.ta.raʕ						*			
1.b. |'xta.raʕ		*!					**	*	
'xtaraʕat									
2.a. ☞|'xta.ra.ʕat								*	
2.b. ʔi|x.'ta.ra.ʕat						*!			**
ʔixta'raʕ-ha									
3.a. ☞|xta.'raʕ.ha							**	*	
3.b. ʔi|x.ta.'raʕ.ha						*!			

The above self-explanatory tableaux end our discussion regarding the opacity of the prosthetic /i/ in MA. In the next sections, non-initial vowel epenthesis is going to be discussed.

4.3 Non-initial Epenthesis

4.3.1 Introduction

In chapter three, MA stress assignment rules were thoroughly discussed. The result of that discussion was the constraint hierarchy in (68), which accounts for the cases of transparent stress.

(68) Transparent Stress Constraints Hierarchy

FTBIN ,WSP , RIGHTMOST, LNGLPSEND >> ALIGN-Hd-LEFT >> ALL-FT-LEFT, *CLASH >> PARSE_{σ}

However, this hierarchy fails to derive the optimal output in cases where a vowel is epenthesized, as in /ʃa.'ra.ḥit.ha/ 'I explained it (f.)'.

(69)

ʃaraḥ-t-ha	FtBin	WSP	Rightmost	Align-Hd-Left	Nonfinality	Parse-2	*Clash	Parse$_\sigma$
e. ☞/(ʃa.ra).('ḥit).ha)/								
f. /ʃa.('ra$_\mu$ḥ$_\mu$t$_\mu$).ha/	*!							
g. ☹/ʃa.('ra.ḥit).ha/	*!	*!						

According to the transparent stress constraint hierarchy, candidate (69.a) surfaces as the optimal output. However, the actual output in MA is /ʃa.'ra.ḥit.ha/, where the stress fall on the antepenultimate syllable.

The epenthetic vowel /i/ is inserted in MA to break up medial consonant clusters and final consonant clusters which violate the sonority sequencing principles. The opaque interaction between stress and epenthesis stems from the fact that when the epenthetic vowel is inserted to break up a medial consonant cluster , it transforms it into a sequence of light and heavy syllables /LH/, i.e. /...CVCC.../ becomes /...CVC*V*C.../, in which the second vowel is epenthetic. According to the stress assignment rules, the heavy syllable in /LH/ should be the stress bearer, but the fact is that it is the light syllable that receives stress in such cases. Consider the examples in (70) below. These illustrate all the different cases of vowel epenthesis and their interaction with stress.

(70)

1. Final CC Clusters

Input	Output	Gloss
xubz	/'xu.biz/ */xu.'biz/	bread
ʃaraḥ-t	/ʃa.'ra.ḥit/	I explained

2. Medial CCC Clusters

Input	Output	Gloss
xubz-na	/'xu.biz.na/ */xu.'biz.na /	our bread
ʃaraḥ-t-ha	/ʃa.'ra.ḥit.ha/ */ʃa.ra.'ḥit.ha/	I explained it (f.)
dʒaab-l-ha	/'dʒaa.bil.ha/ */dʒaa.bil.ha/	He brought to her
dʒaab-l-ki	/'dʒaa.bil.ki/ */dʒaa.bil.ki/	He brought to you (f.)

3. Medial CCCC Clusters

Input	Output	Gloss
ʃaraḥ-t-l-ha	/ʃa.raḥ.'til.ha/ */ʃa.'raḥ.til.ha/	I explained to her
katb-t-l-ki	/ka.tab.'til.ki/ */ka.'tab.til.ki/	I wrote to you (f.)

Two main observations can be detected from the set of data in (70) regarding the behaviour of the epenthetic vowel. First, the locus of the epenthetic vowel is between morphemes, unless the input contains coda clusters where it is inserted between the consonants to break up the cluster. Second, the epenthetic vowel is invisible to stress in most cases. However, it is visible to stress in one case like those in (70.3). In order to account for the behaviour of the epenthetic vowel in MA, I will first of all establish some facts about the syllable and moras in MA.

As previously discussed, syllables of the shape /CVC/ are monomoraic or bimoraic depending on their position in a given word. In OT terms, final C in final /CVC/ and /CVVC/ syllables is not assigned a mora in Arabic because of the ranking of the constraint FINAL-C-μ over the constraint WBP. In nonfinal positions, by contrast, the final C is assigned a mora, i.e. /$CV_{\mu}C_{\mu}$-/. However, assigning a mora to the final C in nonfinal syllables of the shape /CVVC/ fatally violates the undominated constraint $*3_{\mu}$ that requires syllables not exceed two moras. To account for such behaviour, Broselow (1992) and Broselow (1997) proposed a mora sharing representation, which has also been adapted by Watson (2007). Depending on the statistical result for a Jordanian speaker, Broselow (1997) argues that long vowels in open syllables are longer than those in closed ones. Second, short vowels in open and closed syllables have the same duration. Finally, coda consonants that follow long vowels are shorter than consonants that follow short vowels. Consider the following statistical results.

(71) Statistical result for Jordanian speaker (Broselow, 1997 : 59)

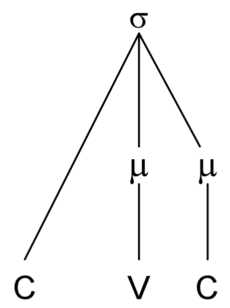
Vowel Duration	μ μ VV	>	μ + shared μ VVC	>	μ V	>	μ VC
Consonant Duration	shared μ VVC	<	μ VC				

According to the above results, the final C in CVVC shares a mora with the previous long vowel, since long vowels in open syllables are longer than those in closed ones and at the same time the duration of the final consonant in /VVC/ is shorter than the final consonant in /VC/. By contrast, the final C in /VC/ syllables does not share a mora with the previous vowel as the final consonant in /VC/ is longer than the final consonant in /VVC/ and the vowel in open and closed short syllables has the same duration.

Thus far, the following representations in (72) for CVC and CVVC are assumed.

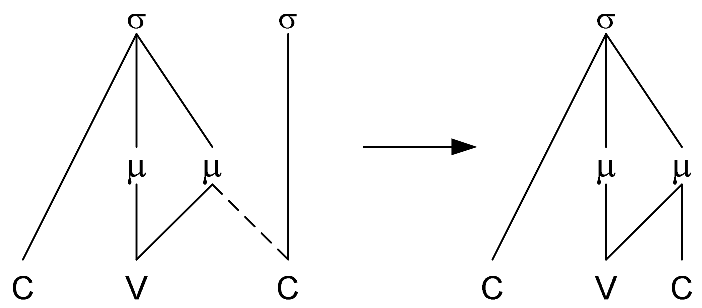
(72)

a) CVC Representation



b) CVVC Representation (Broselow (1992: 14–15); Watson (2007: 349)

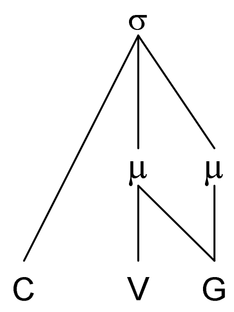
Adjunction-to-Mora



The representations in (72.a), however, might apper confusing when considered in relation to a syllable closed by a geminate. In the dialect under investigation, CV(G)eminate surfaces in medial positions without being linked to the onset of the following syllable. Representing the geminate as a coda of the first syllable and an onset of the following one suggests that the first part of the geminate is moraic, while the second part is not. In relation to the above discussion, when a geminate follows a short vowel it shares the mora with the previous vowel[12]. Accordingly, I follow Watson (2007) in assuming the following representation for tautosyllabic geminates.

[12] see chapter six for further information.

(73) CVG Representation



The last point to discuss in this section is the syllabification and the assignment of moras to the syllable of the canonical shape /CVCC/. It is a well known fact in Moraic theory that a single coda consonant is linked to a mora because of the Weight-by-Position rule, but not the second one. The second thing to bear in mind here is that all Arabic dialects differentiate between two types of weight, light and heavy[13]. In other words, the presence of /CVCC/ in a given word does not attract stress more than the normal heavy syllable. Therefore, this syllable type could be represented as a normal syllable followed by a semisyllable[14] (cf. Kiparsky 2003), or by assuming that the coda consonant clusters share one mora, as has been suggested by McCarthy (2007: 147-148) and Farwaneh (1995: 66-70). At first sight, McCarthy's proposal seems more appealing than the semisyllable proposal. By adapting the mora sharing solution, it will be assumed that epenthesis is phonetically driven, i.e. takes place because of sonority violation as in /ʔi.b*i*n/ but not in /kalb/ which does not violate the sonority hierarchy. However, in many Arabic dialects, as far as I am aware, epenthesis takes place regardless of sonority violation or satisfaction. The reason is that these dialects do not allow coda clusters.

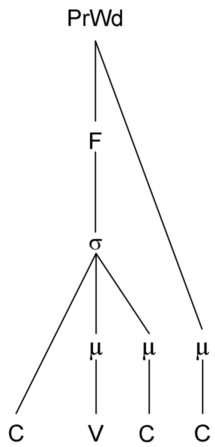
[13] Compare this fact with Hindi language which makes distinction between light, heavy and superheavy syllables. For further information, see Broselow (1997) and Moren (1999).

[14] The semisyllable notion or a very similar notion has been used in analysing Arabic by many researchers like Watson 2007, Kiparsky 2003, Farwaneh 1995, Broselow 1992, McCarthy and Prince 1990a, 1990b, Selkirk 1981 and Aoun 1979.

To account for the opacity of stress and epenthesis interaction, two main ideas will be adopted. First, mora sharing is only permitted if the syllable rhyme contains a long vowel, as discussed above. Mora sharing between two vowels or two consonants is not allowed, since mora sharing is linked to sonority profiles (cf. Broselow 1992, 1997; Watson 2007). To this end, I argue against McCarthy (2007: 147-148) and Farwaneh (1995: 66-70), who assume that two consonants can share a mora. This will be discussed after introducing the semisyllable.

The second idea is the notion of the semisyllable. I will follow Kiparsky (2003) in assuming that the semisyllable in VC-dialects is a moraic consonant directly linked to the PrWd, as shown in the representation in (74).

(74)



The presence of a semisyllable violates the Strict Layering Hypothesis (SLH) (Selkirk 1984; Nespor and Vogel 1986; Itô 1986), which requires every non-highest prosodic element to be in its entirety a constituent belonging to the next highest category on the prosodic hierarchy.

(75) Prosodic Hierarchy (Roca, 1994: 195)

Phonological Utterance
↓
Intonational Phrase
↓
Phonological Phrase
↓
Clitic Group
↓
PrWd
↓
Foot
↓
Syllable
↓
Mora
↓
segment

However, linking the final C in (74) to the syllable or foot nodes results in a fatal violation of the undominated constraints on syllable and foot binarity. Therefore, the final C in (74) must be linked to the next highest prosodic domain, the PrWd, which is not subject to the foot and syllable size constraints.

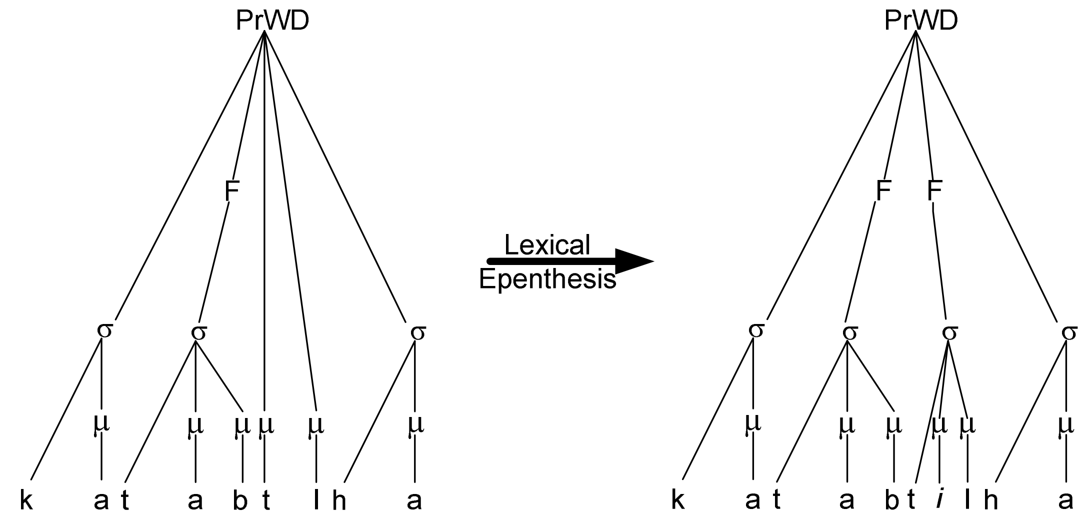
Kiparsky (2003:156) cites the following characteristics in order to justify treating unsyllabified moras as semisyllables:

a. *Unstressed, toneless, or reduced tonal contrasts*
b. Restricted segmental inventory
c. Can be less sonorous than syllable nuclei
d. Restricted shape (e.g. no onset, or no branching onset, no coda)
e. Sometimes restricted to peripheral position (typically word edges)
f. Prosodically invisible
g. Can be subject to minimum sonority requirement

In MA, semisyllables are only allowed at the lexical levels. The semisyllable at the word level is repaired by postlexical epenthesis, i.e. after stress is assigned.

Lexical epenthesis, by contrast, is motivated by the presence of two adjacent semisyllables, as in /katab-t-l-ki/. Consider the representations in (76).

(76)



The remaining question that needs to be addressed before analysing the data in (70) is why is it unlikely that two consonants can share a mora in Arabic? To answer this question, let us suppose that a certain VC-dialect allows internal complex codas with falling sonority[15]. Consider the examples in (77).

(77) Data from Ammani Arabic

Input	Output	Gloss
a. ʕayyan-t	/ʕay.'yant/	I appointed
b. katab-t	/ka.'ta.b*i*t/	I wrote
c. ʕayyan-t-ha	/ʕay.'yant.ha/	I appointed her
d. katab-t-ha	/ka.'ta.bit.ha/	I wrote it (f.)
e. ʕayyan-t-l-ha	/ʕay.yan.'til.ha/	I appointed for her
f. katab-t-l-ha	/ka.tab.'til.ha/	I wrote for her

[15] Ammani Arabic is one of those dialects. The data in (77) is from the author himself

In accounting for the examples in (77), I will assume that semisyllables are allowed at the lexical level only. Therefore, the presence of a semisyllable motivates postlexical epenthesis. In (77.a) and (77.c), postlexical epenthesis is not motivated since the consonants /nt/ share a mora because they do not violate sonority. In (77.b) and (77.d), by contrast, postlexical epenthesis is motivated since the consonants /bt/ cannot share a mora as they violate sonority. However, the problem arises when we try to account for the examples in (77.e-f). The example in (77.f) motivates lexical epenthesis since it is syllabified with two adjacent semisyllables, i.e. /ka.tab.t.l.ha/. Since two adjacent semisyllables are not allowed, a vowel is epenthesized at the lexical level[16]. However, the example in (77.e) lacks the motivation for lexical epenthesis since it ends up having one semisyllable at the lexical level which only motivates postlexical epenthesis, i.e. /ʕay.yant.l.ha/. Therefore, the example in (77.e) should surface postlexically as */ʕay.'yan.t*i*l.ha/ which, as far as I am aware, is unacceptable in all Levantines dialects. Accordingly, the claim that two consonants can share a mora in Arabic (cf. McCarthy, 2007: 147-148; Farwaneh, 1995: 66-70) cannot be justified.

One point worth mentioning before analysing the data in (70) is the difference between /CVC/ and /CVCC/. The failure of the final /CVC/ to attract stress in Arabic is due to the fact that the final C is extrametrical (cf. Section 3.1.5.1). In nonfinal positions, the final C in /CVC/ is assigned a mora by the force of the constraint WBP (3.3.2.1). By contrast, /CVCC/ is a syllable which is followed by a moraic semisyllable (cf. Kiparsky 2003). The final C in /CVCC/ is a moraic semisyllable, i.e. /CVC.C_{μ}/. The evidence for the moracity of the final C in /CVC.C/ is that epenthesis takes place to its left, i.e. before the unsyllabified consonant (cf.

[16] This is evident since it receives stress. Compare the epenthetic vowel in (77.b) to the one in (77.f).

Kiparsky 2003: 158). Moreover, word-final moraic semisyllables do not violate the constraint *FINAL-C-μ as they do not form coda consonants. The difference between /CVC.C_μ/ and /CVC.C/ should be understood as violating the constraints LICENSE-$_\mu$ and LICENSE-$_C$ respectively. In order to optimise /CVC.C_μ/ over /CVC.C/, the constraint LICENSE-$_C$ should outrank the constraint LICENSE-$_\mu$, as shown in (80).

(78)
LICENSE-$_\mu$ (Kiparsky 2003)
A mora must be affiliated with a syllable.

(79)
LICENSE-$_C$ (Kiparsky 2003)
A segment must be licensed by a syllable or mora.

(80)

CVCC	LICENSE-$_C$	LICENSE-$_\mu$
$CV_\mu C_\mu.C_\mu$		*
$CV_\mu C_\mu.C$	*!	

This argument is assumed at all levels. However, in MA postlexically, semisyllables are forced to be properly syllabified as will be explained later in this chapter.

The rest of the chapter is devoted to analysing the data in (70). The above arguments regarding the semisyllable and mora sharing will be accounted for within the framework of Stratal OT.

4.3.2 Stratal OT Account of Non-initial Epenthesis

Using Stratal OT in analysing the set of data in (70), repeated in (81) for convenience, means that two main assumptions should be clearly established at the outset. First, the presence of the semisyllable at the lexical level invokes epenthesis postlexically because the language does not allow semisyllables on the surface. Second and most importantly is that the invisibility of the epenthetic vowel to stress is because the former takes place after the latter, i.e. stress is assigned at the lexical level, while epenthesis takes place at the postlexical one.

(81)

1. Final CC Clusters

Input	Output	Gloss
xubz	/'xu.biz/ */xu.'biz/	bread
ʃaraḥ-t	/ʃa.'ra.ḥit/	I explained

2. Medial CCC Clusters

Input	Output	Gloss
xubz-na	/'xu.biz.na/ */xu.'biz.na /	our bread
ʃaraḥ-t-ha	/ʃa.'ra.ḥit.ha/ */ʃa.ra.'ḥit.ha/	I explained it (f.)
dʒaab-l-ha	/'dʒaa.bil.ha/ */dʒaa.bil.ha/	He brought to her
dʒaab-l-ki	/'dʒaa.bil.ki/ */dʒaa.bil.ki/	He brought to you (f.)

3. Medial CCCC Clusters

Input	Output	Gloss
ʃaraḥ-t-l-ha	/ʃa.raḥ.'til.ha/ */ʃa.'raḥ.til.ha/	I explained to her
katb-t-l-ki	/ka.tab.'til.ki/ */ka.'tab.til.ki/	I wrote to you (f.)

In OT, the presence of a semisyllable violates the constraint LICENSE-$_{\mu}$. The constraint LICENSE-$_{\mu}$ should be outranked by the constraints MAX-IO and DEP-IO at the stem level, as shown in (82).

(82) Stem Level

xubz	MAX-IO	DEP-IO	LICENSE-$_{\mu}$
a. ☞/'xub.z$_{\mu}$/			*
b. /'xu.biz/		*!	
c. /'xub/	*!		

Candidate (82.a) wins by satisfying the high ranked constraints MAX-IO and DEP-IO. However, two more constraints are needed to eliminate other candidates, such as /$xu_\mu b_\mu z_\mu$/ and /$xu_\mu b_\mu z$/. The candidate /$xu_\mu b_\mu z_\mu$/ is ruled out since it violates syllable binarity, i.e. the constraint $*3_\mu$ (Kager 1999). The other candidate violates the ban on complex codas, i.e. *COMPLEX$_{CODA}$ (cf. Section 3.1.6.2). The constraint $*3_\mu$ is undominated in MA. The constraint *COMPLEX$_{CODA}$ is not ranked with respect to the constraint MAX-IO.

(83)
$*3_\mu$ (Kager 1999)
No trimoraic syllables.

(84) Stem Level

xubz	$*3_\mu$	*COMPLEX$_{CODA}$	MAX-IO	DEP-IO	LICENSE-μ
a. ☞/('xub).z_μ/					*
b. /('xu.biz)/				*!	
c. /('xub)/			*!		
d. /('$xu_\mu b_\mu z_\mu$)/	*!	*			
e. /('$xu_\mu b_\mu z$)/		*!			

The same stem constraint hierarchy can account for vowel epenthesis in medial three-consonant clusters at the word level. Words like /'xu.biz.na / and /ʕa.'ra.ḥit.ha/ are accounted for at the word level as shown in (85).

(85) Word Level

'xubz-na	*3$_\mu$	*COMPLEX$_{CODA}$	MAX-IO	DEP-IO	LICENSE-μ
1.a. ☞/('xub).z$_\mu$.na/					*
1.b. /xu.('biz).na/				*!	
1.c. /('xu$_\mu$b$_\mu$z$_\mu$).na/	*!	*			
1.c. /('xub).na/			*!		
ʃa'raḥ-t-ha					
2.a. ☞/ʃa.('raḥ).t$_\mu$.ha/					*
2.b. /(ʃa.ra).('ḥit).ha/				*!	
2.c. /ʃa.('ra$_\mu$ḥ$_\mu$t$_\mu$).ha/	*!	*			
2.c. /ʃa.('raḥ).ha/			*!		

The above tableaux show that violating the low ranked constraint LICENSE-μ does not prevent the desired outputs, (1.a) and (2.a), from being optimised over the other suboptimal candidates. Syllabifying the semisyllables in (85) by vowel epenthesis causes a fatal violation of the constraint DEP-IO, i.e. candidates (1.b) and (2.b). A fatal violation of the constraint *3$_\mu$, moreover, is caused by syllabifying the semisyllables as codas of the previous syllables, i.e. candidates (1.c) and (2.c).

However, the stem constraint hierarchy cannot account for medial three-consonant clusters, which contain long closed syllables, i.e. /'dʒaa.bil.ha/ and /'dʒaa.bil.ki/ in (81.2). At the stem level, one can argue that a word like /'dʒaab/ ‘to bring’ is syllabified as a heavy syllable which is followed by a semisyllable, i.e. /'dʒaa.b$_\mu$/. However, such a syllabification cannot be justified at the word level when a consonantal suffix is attached. Accepting that /'dʒaa.b$_\mu$/ is the best syllabification would mean that we will end up by having two adjacent semisyllables which motivate lexical epenthesis, as will be argued latter on. Consider the tableau in (86).

(86) Word Level

'dʒaab-l-ki	$*3_\mu$	$*\text{COMPLEX}_{\text{CODA}}$	MAX-IO	DEP-IO	LICENSE-μ
a. ☞/('dʒaa).b_μ.l_μ.ki/					**
b. /(dʒaa).('bil).ki/				*!	
c. /('dʒaa).b_μ.ki/			*!		*
d. /('dʒ$a_\mu a_\mu b_\mu$)l_μ.ki/	*!				*

The tableau in (86) shows that the constraint hierarchy chooses candidate (86.a) as the optimal output as it satisfies all the high ranked constraints. To overcome such a problem, Watson (2007) proposed a mora sharing solution following Broselow (1992, 1997) in assuming that consonants that follow long vowels share a mora with the previous vowel[17]. The proposed constraint is given in (87).

(87)
NOSHAREDMORA (*SHARED-μ) (Watson 2007)
Moras should be linked to single segments.

In her discussion of Arabic dialects, Watson says: "*I propose that medial CVVC syllables in VC dialects and the intermediate Cv dialects be accounted for an analysis that recognises an intermediate status for the mora – not an unlicensed mora, but rather a mora that dominates two constituents*" Watson (2007: 349). The outstanding issue is where the constraint *SHARED-μ should be ranked in the hierarchy. First of all, it should be ranked below DEP-IO, as shown in (88).

[17] Recall the discussion in section (4.3.1).

(88) Word Level

'dʒaab-l-ki	DEP-IO	*SHARED$_{\mu}$
a. ☞/'(dʒaab).l$_{\mu}$.ki/		*
b. /(dʒaa).('bil).ki/	*!	

To optimise candidate (86.a) over candidate (86.b), we need to establish a dominance relation between the constraints *SHARED-μ and LICENSE-μ. The latter constraint should outrank the former one as shown in (89).

(89) Word Level

'dʒaab-l-ki	LICENSE-μ	*SHARED-μ
a. ☞/('dʒaab).l$_{\mu}$.ki/	*	*
b. /('dʒaa).b$_{\mu}$.l$_{\mu}$.ki/	**!	

Candidate (89.b) can be ruled out by a constraint, to be introduced shortly, that prohibits two adjacent semisyllables from taking place at the lexical level. However, I think the dominance relation between the constraints *SHARED-μ and LICENSE-μ is still needed to ensure that the coda consonants in words like /dʒaab.ha/ 'he brought it (f.)' and /baab.ki/ 'your (f.) door' are not syllabified as semisyllables. Consider the tableaux in (90).

(90) Word Level

'dʒaab-ha	LICENSE-μ	*SHARED-μ
1.a. ☞/('dʒaab).ha/		*
1.b. /('dʒaa).b_μ.ha/	*!	
'baab-ki		
1.a. ☞/('baab).ki/		*
1.b. /('baa).b_μ.ki/	*!	

Accordingly, long closed syllables are syllabified as bimoraic syllables by assuming mora sharing between the coda and previous vowel. In other words, maintaining syllable binarity is preferred over violating the constraint *SHARED$_\mu$. The following constraint hierarchy accounts for all cases of medial three-consonant clusters.

(91) Word Level
*3_μ >> *COMPLEX$_{CODA}$, MAX-IO >> DEP-IO >> *SHARED-μ >> LICENSE-μ

(92) Word Level

'dʒaab-l-ki	*3_μ	*COMPLEX$_{CODA}$	MAX-IO	DEP-IO	LICENSE-μ	*SHARED-μ
a. ☞/('dʒ$a_\mu a_\mu$b).l_μ.ki/					*	*
b. /('dʒaa).b_μ.l_μ.ki/					**!	
c. /(dʒaa).('bil).ki/				*!		
d. /('dʒaa).b_μ.ki/			*!		*	
e. /('dʒ$a_\mu a_\mu b_\mu$).l_μ.ki/	*!				*	

However, the constraint hierarchy in (91) is unable to produce the desired output in words that contain medial four consonant clusters. This can be seen in the example in tableau (93).

(93) Word Level

ka'tab-t-l-ki	$*3_\mu$	*COMPLEX$_{CODA}$	MAX-IO	DEP-IO	LICENSE-μ	*SHARED-$_\mu$
a. ☹/ka.(tab).'til.ki/				*!		
b. ☞/ka.('tab).t_μ.l_μ.ki/					**	
c. /ka.('tab).t_μ.ki/			*!		*	

The special nature of the medial four consonant clusters stems from the fact that the epenthetic vowel, which is inserted between the two adjacent semisyllables, receives stress contrary to the behaviour of the other epenthetic vowels which are inserted postlexically. To solve the problem, Kiparsky (2000, 2003) argues that epenthetic vowels that receive stress must be lexically inserted. Furthermore, he adds in his article on syllables and moras (2003:162) that, to avoid the possibility of having two neighbouring semisyllables, "*we must assume that some constraint prohibits two adjacent semisyllables*." Btoosh (2006) follows Kiparsky's suggestion on his analysis of Karaki Arabic 'a Jordanian dialect' by proposing the constraint in (94) below.

(94)
ςς=σ (Btoosh 2006)
Two adjacent semisyllables must form a major syllable.

The obligation of the two adjacent semisyllables to form a major syllable requires the newly formed syllable to have a vocalic nucleus since there is no evidence in the language for consonantal nuclei. In other words, the epenthetic vowel is lexical as major syllables need vowels. Consequently, lexical epenthetic vowels bear stress by transparent stress assignment rules. The last point regarding the constraint ςς=σ is its position on the constraint hierarchy. The constraint ςς=σ should outrank the constraint DEP-IO, as shown in (95).

(95) Word Level

ka'tab-t-l-ki	ςς=σ	DEP-IO
a. ☞/ka.(tab).('til).ki/		*
b. /ka.('tab).t_{μ}.l_{μ}.ki/	*!	

Moreover, the constraint ςς=σ is not ranked with respect to the constraint $*3_{\mu}$ as shown in tableau (96) below.

(96) Word Level

ka'tab-t-l-ki	ςς=σ	$*3_{\mu}$	DEP-IO
c. ☞/ka.(tab).('til).ki/			*
d. /ka.('tab).t_{μ}.l_{μ}.ki/	*!		
e. /ka.('$ta_{\mu}b_{\mu}t_{\mu}$).l_{μ}.ki/		*!	

At the word levels, the optimal output /ka.tab.'til.ki/ is achieved by virtue of the following constraint hierarchy.

(97) Word Level
$*3_{\mu}$, ςς=σ >> *COMPLEX$_{\text{CODA}}$, MAX-IO >> DEP-IO >> *SHARED-$_{\mu}$ >> LICENSE-$_{\mu}$

(98) Word Level

ka'tab-t-l-ki	$*3_\mu$	σ=ςς	$*\text{COMPLEX}_{\text{CODA}}$	MAX-IO	DEP-IO	LICENSE-μ	*SHARED-μ
a. ☞/ka.(tab).('til).ki/					*		
b. /ka.('tab).t_μ.l_μ.ki/		*!				**	
c. /ka.('tab).t_μ.ki/				*!		*	
d. /ka.('$ta_\mu b_\mu t_\mu$).l_μ.ki/	*!		*				

Violating the constraint DEP-IO does not prevent candidate (98.a) from being the optimal output, since all other candidates violate one or more of the high ranked constraints.

Before discussing constraint interaction at the postlexical level, I will show how a word like /ʕaraḥit/ is syllabified at the lexical levels.

(99) Stem and Word Levels

Stem Level ʃaraḥ-t	$*3_\mu$	*COMPLEX$_{CODA}$	MAX-IO	DEP-IO	LICENSE-μ	*SHARED-μ
1.a. /ʃa.('raḥ).t_μ/					*	
1.b. /('ʃa.ra).ḥit/				*!		
1.c. /ʃa.('raḥt)/		*!				
1.d./ʃa.('$ra_\mu ḥ_\mu t_\mu$)/	*!	*				
1.e. /('ʃa.rat)/			*!			

Word Level ʃa'raḥ-t	$*3_\mu$	$\sigma = \xi$	*COMPLEX$_{CODA}$	MAX-IO	DEP-IO	LICENSE-μ	*SHARED-μ
2.a.☞/ʃa.('raḥ).t_μ/						*	
2.b. /('ʃa.ra).ḥit/					*!		
2.c. /ʃa.('raḥt)/			*!				
2.d. /ʃa.('$ra_\mu ḥ_\mu t_\mu$)/	*!		*				
2.e. /('ʃa.rat)/				*!			

So far, we have accounted for the different outputs at the lexical levels by virtue of the constraint hierarchy in (97). The lexical constraint hierarchy, in most cases, prefers keeping a mora unsyllabified rather than epenthesizing a vowel. Postlexically, however, unsyllabified moras are prohibited. Therefore, we would expect that epenthesizing a vowel would be preferred to keeping a mora unsyllabified. In OT terms, the constraint LICENSE-μ should outrank the constraint DEP-IO as shown in (100).

(100) Postlexical Level

ʃa'raḥ-t	LICENSE-μ	DEP-IO
a. ☞/ʃa.'ra.ḥit/		*
b./ʃa.'raḥ.t_μ/	*!	

Candidate (100.a) surfaces postlexically as the optimal output by satisfying the high ranked constraint LICENSE-μ. However, the optimal output loses out in favour of a candidate like /ʃa.'raḥ<t>/, where the final consonant is weightless as shown in the following tableau.

(101) Postlexical Level

ʃa'raḥ-t	LICENSE-μ	DEP-IO
a. ☹/ʃa.'ra.ḥit/		*!
b.☞/ʃa.'raḥ<t>/		

To get the desired output optimised, one might argue the constraint *COMPLEX$_{\text{CODA}}$ should outrank the constraint DEP-IO. Although this solution optimises candidate (101.a) over the candidate (101.b), it cannot be justified. Consider the following tableau, which accounts for the word /galb/ ‘heart’ in which DEP-IO must outrank *COMPLEX$_{\text{CODA}}$.

(102) Postlexical Level

'galb	DEP-IO	*COMPLEX$_{\text{CODA}}$
a. ☞/'galb/		*
b. /'ga.lib/	*!	

The above tableau shows that the optimal output surfaces with a complex coda unlike the actual optimal output in the previous tableau. To this end, there should be a constraint that accounts for this discrepancy. It has been argued that MA allows final complex codas if they comply with sonority i.e. falling sonority from sonorants to obstruents (cf. Section 3.1.6.2). Therefore, the constraint SONSEQ should outrank the constraint DEP-IO.

(103) Postlexical Level

ʃa'raḥ-t	SONSEQ	DEP-IO	*COMPLEX$_{\text{CODA}}$
1.a. ☞/ʃa.'ra.ḥit/		*	
1.b. /ʃa.'raḥ<t>/	*!		*
'galb			
2.a. ☞/'gal<b>/			*
2.b. /'ga.lib/		*!	

Internal complex codas are prohibited in MA since syllable binarity would be violated. Accordingly, the undominated constraint $*3_\mu$ should be able to rule out any candidate that surfaces with a word-medial complex coda, as shown in (104).

(104) Postlexical Level

ʃa'raḥ-t-ha	$*3_\mu$	SONSEQ	DEP-IO	*COMPLEX$_{\text{CODA}}$
1.a. ☞/ʃa.'ra.ḥit.ha/			*	
1.b. /ʃa.'ra$_\mu$ḥ$_\mu$t$_\mu$.ha/	*!	*		*
'galb-ha				
2.a. ☞/'ga.lib.ha/			*	
2.b. /'ga$_\mu$l$_\mu$b$_\mu$.ha/	*!			*

However, candidates like */ʃa.'raḥt.ha/ and */'galb.ha/, where the coda consonants share a mora, cannot be ruled out by the established constraint hierarchy. Obviously, the aforementioned candidates violate the constraint *SHARED-$_{\mu}$. The constraint *SHARED-$_{\mu}$ in MA must outrank the constraint DEP-IO, as demonstrated in tableau (105) below.

(105) Postlexical Level

ʃa'raḥ-t-ha	*3$_{\mu}$	SONSEQ	*SHARED-$_{\mu}$	DEP-IO	*COMPLEX$_{CODA}$
1.a. ☞/ʃa.'ra.ḥit.ha/				*	
1.b. /ʃa.'ra$_{\mu}$ḥ$_{\mu}$t$_{\mu}$.ha/	*!	*			*
μμ 1.c. /ʃa.'raḥt.ha/		*!	*		
'galb-ha					
2.a. ☞/'ga.lib.ha/				*	
2.b. /'ga$_{\mu}$l$_{\mu}$b$_{\mu}$.ha/	*!				*
μμ 2.c. /'galb.ha/			*!		

Ranking the constraint *SHARED-$_{\mu}$ over the constraint DEP-IO would result in optimising a suboptimal candidate like */'dʒaa.bi.ha/ over the actual output /'dʒaab.ha/. Consider the following tableau.

(106) Postlexical Level

'dʒaab-ha	*SHARED-$_{\mu}$	DEP-IO
a. ☹/'dʒaab.ha/	*!	
b. ☞/'dʒaa.bi.ha/		*

To overcome this problem, we need the constraint *i]σ which prohibits unstressed high short vowels in open syllables (cf. Section 3.1.6.1). The constraint *i]σ should outrank the constraint *SHARED-$_{\mu}$, as shown in (107).

(107) Postlexical Level

'dʒaab-ha	*i]σ	*SHARED-$_{\mu}$	DEP-IO
a. ☞/'dʒaab.ha/		*	
b. /'dʒaa.bi.ha/	*!		*

The argument that has been developed so far can account for the data from MA. However, it cannot account for other closely related dialects like Ammani Arabic (AM), a Jordanian dialect, in which internal complex codas are allowed postlexically. Consider the following examples from AM[18].

(108) Data from AM

Input	Word level	Postlexical level	Gloss
a. kalb-na	/'kal.b.na/	/'kalb.na/	our dog
b. fataḥ-t-ha	/fa.'taḥ.t.ha/	/fa.'taḥt.ha/	I opened it (f.)
c. ʔalb-ha	/'ʔal.b.ha/	/'ʔalb.ha/	Her heart
d. ḍarab-t-na	/ḍa.'rab.t.na/	/ḍa.'rabt.na/	You (m.s.) hit us
e. kitf-ha	/'kit.f.ha/	/'ki.tif.ha/	Her shoulder
f. ʔabr-hum	/'ʔab.r.hum/	/'ʔa.bir.hum/	Their grave

The table shows that the examples in (108.a-d) surface postlexically with internal complex codas, while those in (108.e-f) surface with epenthetic vowels. The difference between the two groups is that in the former a vowel is not epenthesized as

[18] The author is the source of these data. These data are also approved by Mrs Hana Dana, a phonologist whose AM is her native dialect.

the coda consonants comply with sonority, while in the latter group epenthesis is required under the same condition[19].

To solve the problem raised by the examples in (108.a-d), two questions should be posed. First, are nonfinal /CVCC/ syllables trimoraic? Second, do the coda consonants in these examples share a mora? I think it is highly unlikely that syllable binarity can be violated in most if not all Arabic dialects (cf. Watson 2007). This assumption about syllable binarity can be justified by a relatively complex example from AM. A word like /ṣul.ṭaan.tiin/ ‘two (f.) sultans’ is derived from the input /ṣulṭaan-it-iin/, as explained in the following table.

(109)

input	Stem Output	word Output	Postlexical Output
ṣulṭaan-it-iin	(ṣul).(ṭaa).ni.('tii<n>)	/(ṣul).(ṭaan).('tii<n>)/	/ṣul.ṭaan.'tii<n>/

If we argue that syllable binarity is violated in AM, we would expect the penultimate syllable to receive stress at the word level by virtue of the constraint WSP since it is heavier than the ultimate syllable. The fact that the ultimate syllable receives stress implies that both syllables have the same weight. However, one might also argue that syllable binarity is not violated at the lexical levels. Therefore, the final consonant in /-taan/ is a semisyllable and stress lodges at the final heavy one. Postlexically, the unsyllabified mora should be included in a syllable.

(110)

input	Stem Output	word Output	Postlexical Output
ṣulṭaan-it-iin	/(ṣul).(ṭaa).ni.(tiin)/	/(ṣul).(ṭaa).n.('tiin)/	ṣul.ṭaan.'tiin

[19] Complex codas with falling sonority are allowed in AM while codas with raising or plateau sonority are not allowed.

If we believe the table in (110) is correct then we have to explain why the syllable /taa/ at the word level is not shortened. Unstressed long vowels in open syllables are shortened in AM. The fact that the long vowel is not shortened in this case implies that it is a part of a long closed syllable. Since the long closed syllable does not attract stress, it is bimoraic, i.e. the final consonant shares a mora with the previous vowel.

It is not possible for AM to allow semisyllables at the postlexical level as a vowel is epenthesized in the examples in (108.e-f). Accordingly, the mora sharing constraint is violated while syllable binarity is maintained. Therefore, I think assuming that two consonants can share a mora is preferable to assuming the existence of trimoraic syllables. Mora sharing between two consonants is only allowed at the postlexical level and is governed by sonority. To account for the data (108) at the lexical levels, the same constraint hierarchies that have been used to account for MA are assumed for AM.

(111) Lexical Level

Stem Level kalb	$*3_\mu$	$*\text{COMPLEX}_{\text{CODA}}$	MAX-IO	DEP-IO	LICENSE-μ	*SHARED-μ
1.a. ☞/('kal).b_μ/					*	
1.b. /('ka.lib)/				*!		
1.c. /('kalb)/ (μμ)		*!				*
1.d. /('$ka_\mu l_\mu b_\mu$)/	*!	*				

Word Level 'kalb-na	$*3_\mu$	σ=ξξ	$*\text{COMPLEX}_{\text{CODA}}$	MAX-IO	DEP-IO	LICENSE-μ	*SHARED-μ
2.a.☞/('kal).b.na/						*	
2.b. /ka.('lib).na/					*!		
2.c. /('kalb).na/ (μμ)			*!				*
2.d. /('$ka_\mu l_\mu b_\mu$).na/	*!		*				

The difference between the two dialects lies at the postlexical level. MA ranks the constraint *SHARED-μ over the constraint DEP-IO, while AM ranks the constraint DEP-IO over the constraint*SHARED-μ as shown in (112).

(112) Postlexical Level

'kalb-na	$*3_\mu$	LICENSE-μ	SONSEQ	DEP-IO	*SHARED-μ	$*\text{COMPLEX}_{\text{CODA}}$
a. ☞/'kalb.na/ (μμ)					*	*
b. /'kal.b.na/		*!				
c. /'ka.lib.na/				*!		
d. /'$ka_\mu l_\mu b_\mu$.na/	*!					*

The lexical output /'kit.f_{μ}.ha/ surfaces postlexically as /'ki.tif.ha/ because of the violation of the sonority constraint, as shown in (113).

(113) Postlexical level

/'kit.f.ha/	*3_{μ}	LICENSE-μ	SONSEQ	DEP-IO	*SHARED-μ	*COMPLEX$_{CODA}$
a. ☞/'ki.tif.ha/				*		
b. /'kit.f.ha/		*!				
c. /'kitf.ha/ ($\mu\mu$)			*!		*	*
d. /'$ki_{\mu}t_{\mu}f_{\mu}$.ha/	*!		*			*

The above tableau shows that the constraint SONSEQ rules out the most stubborn competitor (113.c). This ends our discussion about internal complex codas in AM.

In our discussion of the data from MA, the following constraint hierarchy has been established.

(114) Postlexical Hierarchy[20]
*3_{μ} >> SONSEQ >> *SHARED-μ >> DEP-IO >> *COMPLEX$_{CODA}$

However we still need to identify the exact positions of the constraints LICENSE-μ and MAX-IO in the constraint hierarchy. The constraint MAX-IO should outrank the constraint *SHARED-μ, as shown in (115).

[20] I will not include the constraint *i]σ in this hierarchy since the ranking of this constraint will be discussed in the next chapter.

(115) Postlexical Level

'dʒaab-ha	MAX-IO	*SHARED-$_{\mu}$
a. ☞/'dʒaab.ha/		*
b. /'dʒaa.ha/	*!	

There is no dominance relation that can hold between the constraints MAX-IO and SONSEQ. Moreover, the constraint LICENSE-$_{\mu}$ outranks the constraint MAX-IO as the latter is violated in MA (cf. 4.2.1.1) while the former is not. There is no dominance relation that can hold between the constraints LICENSE-$_{\mu}$ and *3$_{\mu}$. Accordingly, the following constraint hierarchy is established at the postlexical level.

(116) Postlexical Hierarchy[21]

*3$_{\mu}$, LICENSE-$_{\mu}$ >> MAX-IO, SONSEQ >> *SHARED-$_{\mu}$ >> DEP-IO >> *COMPLEX$_{CODA}$

The last point to discuss, before moving onto our next section, is stress at the postlexical level. Stress, as discussed earlier, is a lexical process, while vowel epenthesis can be both lexical and postlexical. Epenthetic vowels that are inserted lexically can receive stress by the transparent stress rules (cf. chapter 3), while those inserted postlexically cannot bear stress since they are invisible to stress assignment rules, i.e. takes place after stress has been assigned. In order to account for these facts, we need a constraint that prevents stress from being shifted at the postlexical level. The identity constraint *IDENT-STRESS* (Pater 2000) requires the stressed syllable at the lexical level be stressed at the postlexical one.

[21] I will not include the constraint *i]σ in this hierarchy since the ranking of this constraint will be discussed in the next chapter.

(117)
IDENT-STRESS (Pater 2000)
If α is stressed, then *f* (α) must be stressed.
where *f* is the correspondence relation between input (lexical) and output (surface) strings of segments.

The constraint IDENT-STRESS is inviolable in the grammar of MA. Therefore, the final constraint hierarchy at the postlexical level becomes, as shown in (117).

(117) Postlexical Constraint Hierarchy
IDENT-STRESS , $*3_\mu$, LICENSE-μ >> MAX-IO, SONSEQ >> *SHARED-μ >> DEP-IO >> $*\mathrm{COMPLEX}_{\mathrm{CODA}}$

Finally, I will demonstrate how words like /ʃa.'ra.ḥit.ha/ and /ka.tab.'til.ki/ are dealt with at the different levels, i.e. stem, word and postlexical levels. The following tableaux conclude our discussion for this section.

(118) Stem Level

ʃaraḥ-t	$*3_\mu$	$*\mathrm{COMPLEX}_{\mathrm{CODA}}$	MAX-IO	DEP-IO	LICENSE-μ	*SHARED-μ
1.a. ☞/ʃa.('raḥ).t_μ/					*	
1.b. /('ʃa.ra).ḥit/				*!		
1.c. /ʃa.('raḥt)/ (μμ)		*!				*
1.d. /ʃa.('$ra_\mu$$ḥ_\mu$$t_\mu$)/	*!	*				
katab-t						
2.a. ☞/ka.('tab).t_μ/					*	
2.b. /('ka.ta).bit/				*!		
2.c. /ka.('tabt)/ (μμ)		*!				*
2.d. /ka.('$ta_\mu$$b_\mu$$t_\mu$)/	*!	*				

(119) Word Level

ʃa'raḥ-t-ha	*3$_{\mu}$	ςς=σ	*COMPLEX$_{CODA}$	MAX-IO	DEP-IO	LICENSE-$_{\mu}$	*SHARED-$_{\mu}$
1.a. ☞/ʃa.('raḥ).t$_{\mu}$.ha/						*	
1.b. /(ʃa.ra).('ḥit).ha/					*!		
μμ 1.c. /ʃa.('raḥt).ha/			*!				*
1.d. /ʃa.('ra$_{\mu}$ḥ$_{\mu}$t$_{\mu}$).ha/	*!		*				
ka'tab-t-l-ki							
2.a. ☞/ka.(tab).('til).ki/					*		
2.b. /ka.('tab).t$_{\mu}$.l$_{\mu}$.ki/		*!				**	
μμ 2.c. /ka.('tabt).l$_{\mu}$.ki/			*!			*	*
2.d. /ka.('ta$_{\mu}$b$_{\mu}$t$_{\mu}$).l$_{\mu}$.ki/	*!		*			*	

(120) Postlexical Level

ʃa'raḥ-t-ha	IDENT-STRESS	*3$_{\mu}$	LICENSE-$_{\mu}$	MAX-IO	SONSEQ	*SHARED-$_{\mu}$	DEP-IO	*COMPLEX$_{CODA}$
1.a. ☞/ʃa.'ra.ḥit.ha/							*	
1.b. /ʃa.('raḥ).t$_{\mu}$.ha/			*!					
μμ 1.c. /ʃa.('raḥt).ha/					*!	*		*
1.d. /ʃa.('ra$_{\mu}$ḥ$_{\mu}$t$_{\mu}$).ha/		*!			*			*
1.e. /ʃa.ra.'ḥit.ha/	*!						*	
katab-'til-ki								
2.a. ☞/ka.tab.'til.ki/								
2.b. /ka.'tab.t$_{\mu}$.l$_{\mu}$.ki/	*!		*!*	*				
μμ 2.c. /ka.'tabt.l$_{\mu}$.ki/	*!		*!	*	*	*		*
2.d. /ka.'ta$_{\mu}$b$_{\mu}$t$_{\mu}$.l$_{\mu}$.ki/	*!	*!	*!	*	*			*
2.e. /ka.tab.'ti.li.ki							*!	

4.3.3 A Note on the Applicative Morpheme

In MA, the applicative morpheme /l/ is assigned at the word level. This is evident by examining a word like /'dʒaa.bil.ha/ 'he brought to her'. If the applicative morpheme is assigned at the stem level, then we would expect the word to be syllabified as /dʒaab.l_{μ}/. However, nonfinal long closed syllables at the stem level are shortened as in /ʃaaf-t/, which surfaces as /'ʃi.fit/[22]. Therefore, if the applicative morpheme is assigned at the stem level, /'dʒaa.bil.ha/ would surface as /'dʒi.bil.ha/. Accordingly, the applicative morpheme is a word level suffix.

In other Arabic dialects, by contrast, it is not clear at which level the applicative morpheme is attached to the stem. In AM, for example, /dʒaab-l-ha/ surfaces postlexically as /dʒa.'bil.ha/, with a stressed epenthetic vowel which implies it is inserted at one of the lexical levels. To account for /dʒa.'bil.ha/ in AM, I think there is an active alignment constraint that requires the applicative morpheme to attach to the right edge of a light syllable.

(121)
Align (Applicative, Left; Light Syllable, Right)
ALIGN-APP
The left edge of the applicative morpheme must coincide with the right edge of a light syllable.

The constraint ALIGN-APP should outrank the constraint DEP-IO to allow epenthesis. Accordingly, we can propose that the applicative is attached at the stem level creating the output /'dʒaa.bil/. At the word level, where the object pronoun /ha/ is attached, stress is shifted to the rightmost heavy syllable and the syllable /dʒaa/ is

[22] When long closed syllables are shortened in Arabic the quality of the vowel is changed from low to high as in /ʃaaf-t/, /dʒaab-t/ and /gaal-t/ which surface as /ʃu.fit/, /dʒi.bit/ and /gu.lit/ respectively.

shortened to avoid stress clash. Therefore, it surfaces at the word level as /dʒa.'bil.ha/. Finally, /dʒa.'bil.ha/ surfaces intact postlexically. We could also argue that the applicative morpheme is attached at the word level. The input /'dʒaab-l-ha/ surfaces at the word level as /dʒa.'bil.ha/ because of the alignment and stress clash constraints. Although attaching the applicative morpheme at either level does not create any problems, I will assume that it is attached at the word level since it is evident in other VC-dialects such as MA.

The constraint ALIGN-APP, moreover, explains why the applicative morpheme is geminated in AM. Consider the following examples.

(122)

Input	Output	Gloss
ʃaraḥ-t-l-u	/ʃa.raḥ.'til.lu/	I explained to him
ʃaraḥ-l-ak	/ʃa.ra.'ḥil.lak/	He explained to you (m.s.)
ʃaraḥ-l-i	/ʃa.ra.'ḥil.li/	He explained to me
dʒaab-t-l-u	/dʒib.'til.lu/	I brought to him
dʒaab-l-ak	/dʒa.'bil.lak/	He brought to you (m.s.)
dʒaab-l-u	/dʒa.'bil.lu/	He brought to him

The examples in (122) show that the applicative morpheme is geminated when it is followed by vowel initial suffixes. However, gemination of the applicative does not apply when it is followed by consonant initial suffixes or when it is preceded by long open syllables, as shown in (123) and (124) respectively.

(123)

Input	Output	Gloss
ʃaraḥ-l-ha	/ʃa.ra.'ḥil.ha/	He explained to her
ʃaraḥ-l-kum	/ʃa.ra.'ḥil.kum/	He explained to you (m.pl.)
ʃaraḥ-l-na	/ʃa.ra.'ḥil.na/	He explained to us
dʒaab-l-ha	/dʒa.'bil.ha/	He brought to her
dʒaab-l-kum	/dʒa.'bil.kum/	He brought to you (m.pl.)
dʒaab-l-na	/dʒa.'bil.na/	He brought to us

(124)

Input	Output	Gloss
ʃaraḥ-uu-l-u	/ʃa.ra.'ḥuu.lu/	They explained to him
ʃaraḥ-uu-l-ha	/ʃa.ra.'ḥuul.ha/	They explained to her
ʃaraḥ-uu-l-i	/ʃa.ra.'ḥuu.li/	They explained to me
dʒaab-t-uu-l-u	/dʒib.'tuu.lu/	you (pl.) brought to him
dʒaab-uu-l-ak	/dʒa.'buu.lak/	They brought to you (m.s.)
dʒaab-uu-l-kum	/dʒa.'buul.kum/	They brought to you (m. pl.)

The above examples are accounted for by virtue of the following constraint hierarchy[23].

(125)

MAX-IO >> ALIGN-APP >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$

The following tableaux show how we account for the gemination of the applicative morpheme at the word level.

[23] The most relevant constraints are used.

(126) Word Level

'ʃaraḥ-l-u	MAX-IO	ALIGN-APP	DEP-IO	LICENSE-μ	*SHARED-μ
1.a. ☞/(ʃa.ra).('ḥil).lu/			*		
1.b. /ʃa.('raḥ).lu/		*!			
'ʃaraḥ-l-ha					
2.a. ☞/(ʃa.ra).('ḥil).ha			**		
2.b. /ʃa.('raḥ).l_{μ}.ha/		*!		*	
'ʃaraḥ-uu-l-u					
3.a. ☞/(ʃa.ra).('ḥuu).lu/		*			
3.b. /(ʃa.ra).('ḥuul).lu/		*	*!		*
'ʃaraḥ-uu-l-ha					
4.a. ☞/(ʃa.ra).('ḥuul).ha/		*			*
4.b. /(ʃa.ra).('ḥuu).l_{μ}.ha/		*		*!	

Postlexically, we would expect the alignment constraint to be demoted to a lower state than the constraint DEP-IO. Therefore, the outputs at the word level surface intact postlexically.

To this end, we have completed our discussion about non-initial epenthesis in MA. In what follows, I will discuss the consequences of adopting the notion of the semisyllable on MA.

4.4 Conclusion and Consequences

This chapter began by introducing the opaque behaviour of vowel epenthesis and stress in MA. Epenthetic vowels do not usually bear stress in MA. However, under certain conditions, an epenthetic vowel might bear stress. To account for this discrepancy, I have shown that Classic OT and other semiparallel OT models cannot handle the opacity of vowel epenthesis and stress. Accordingly, the Stratal OT model has been followed to explain the aforementioned problem.

Vowel epenthesis was discussed in two main sections, i.e. initial epenthesis and non-initial epenthesis. In accounting for non-initial epenthesis, two main ideas were adopted, i.e. semisyllables and mora sharing. A consonant that cannot be properly accommodated by a syllable is syllabified as a moraic consonant, i.e. a semisyllable, if the syllable rhyme contains a short vowel. If the syllable rhyme contains a long vowel, the final consonant shares a mora with the previous vowel. Semisyllables are only allowed at the lexical levels while mora sharing is allowed at the lexical and postlexical levels. In non-initial epenthesis in MA, a vowel can only be stressed if it breaks up a four-consonant cluster, since two adjacent semisyllables are prohibited. The prohibition of two adjacent semisyllables motivates lexical epenthesis which is visible to stress assignment rules.

Initial epenthesis, by contrast, has been represented by discussing the imperative form in MA. A prosthetic vowel is inserted since complex onsets are not allowed at the stem level. At the word level, the prosthetic vowel can be deleted if it has not been stressed in the previous stratum because of an alignment constraint that requires the left edge of the stem to coincide with the left edge of the PrWd.

Postlexically, the same process applies, i.e. the prosthetic vowel can be deleted if it has not been stressed in the previous stratum.

In accounting for initial epenthesis, we have not adopted the notion of the semisyllable. However, I think we can account for initial epenthesis by using semisyllables. In his analysis of Arabic, Kiparsky (2003) argues that phrase-initial onset CC- clusters are allowed in VC dialects where the initial consonant is syllabified as a moraic semisyllable at the lexical levels, i.e. /ki.taab/ surfaces at the word level as /k_{μ}.taab/.

We can re-analyse the data from MA by following the above assumption. Therefore, we need to incorporate the constraint LICENSE-μ into the constraint hierarchy that accounts for initial epenthesis (cf. Section 4.2.1). Accordingly, the following constraint hierarchy is assumed at the stem level.

(127) Stem Level
FTBIN, ONS, *[ʔC, MAX-IO$_{\text{[C-STEM}}$ >> *COMPLEX$_{\text{ONS}}$, MAX-IO, CONTIGUITY-IO >> ALIGN-L, DEP-IO >> LICENSE-μ

The above constraint hierarchy prefers syllabifying the word /ftaḥ-i/ as /f_{μ}.ta.ḥi/ rather than the optimal syllabification /ʔif.ta.ḥi/, as shown in (128).

(128) Stem Level

ftaḥ-i	FTBIN	ONS	*[ʔC	MAX-IO[C-STEM	*COMPLEX$_{ons}$	MAX-IO	CONTIGUITY-IO	ALIGN-L	DEP-IO	LICENSE-μ
a. ☹/('ʔif.ta.ḥi)/								*!	*!	
b. ☞/(f$_{\mu}$.'ta.ḥi)/										*
c. /('fi.ta.ḥi)/							*!		*	
d. /('ta.ḥi)/				*!		*				
e. /('fta.ḥi)/					*!					

Optimising the desired candidate (128.a) over candidate (128.b) can be achieved by ranking the constraint LICENSE-$_{\mu}$ over the constraints ALIGN-L and DEP-IO. However, such a ranking will cause chaos in the grammar of MA since DEP-IO should outrank LICENSE-$_{\mu}$. Therefore, we need a constraint that prevents initial consonant clusters.

(129)
*CC-
Word initial consonant clusters are not allowed.

The function of the above constraint is to rule out syllabifying words like /ftaḥ-i/ as /f$_{\mu}$.ta.ḥi/. The constraint *CC- should outrank the constraints ALIGN-L and DEP-IO. Moreover, there is no dominance relation that can hold between the constraint *CC- and the constraint *COMPLEX$_{ONS}$, MAX-IO and CONTIGUITY-IO. Accordingly, the following constraint hierarchy is established[24].

[24] The constraint *CC- cannot replace the constraint *COMPLEX$_{ONS}$ since the former prevents initial consonant clusters while the latter prevent complex onsets in initial and non-initial positions.

(130) Stem Level

FTBIN, ONS, *[ʔC, MAX-IO$_{[C\text{-}STEM}$ >> *COMPLEX$_{ONS}$, MAX-IO, CONTIGUITY-IO, *CC- >> ALIGN-L, DEP-IO >> LICENSE-$_{\mu}$

(131) Stem Level

ftaḥ-i	FTBIN	ONS	*[ʔC	MAX-IO$_{[C\text{-}STEM}$	*COMPLEX$_{ons}$	MAX-IO	CONTIGUITY-IO	*CC-	ALIGN-L	DEP-IO	LICENSE-$_{\mu}$
a. ☞/('ʔif.ta.ḥi)/									*	*	
b./(f$_{\mu}$.'ta.ḥi)/								*!			*
c. /('fi.ta.ḥi)/							*!			*	
d./('ta.ḥi)/				*!		*					
e. /('fta.ḥi)/					*!						

At the word level, the constraint LICENSE-$_{\mu}$ is still demoted. The constraint *COMPLEX$_{ONS}$ should outrank the constraint *CC- to optimise /s$_{\mu}$.ta.('giil)/ over /sta.('giil)/. Therefore, the following constraint hierarchy at the word level is established.

(132) Word Level

FTBIN, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM}$ >> ALIGN-L >> MAX-IO >> *COMPLEX$_{ONS}$, CONTIGUITY-IO >> *CC- >> DEP-IO >> LICENSE-$_{\mu}$

(133) Word Level

ʔista'giil	FTBIN	ONS	MAX-IO['V]	*[ʔC	MAX-IO$_{[C\text{-}STEM}$	ALIGN-L	MAX-IO	*COMPLEX$_{ONS}$	CONTIGUITY-IO	*CC-	DEP-IO	LICENSE-μ
a. ☞ |s_{μ}.ta.('giil)							**			*		*
b. |sta.('giil)							**	*!				
c. (ʔi|s).ta.('giil)						*!						
d. (|si.ta).('giil)							**		*!		*	
e. ta.('giil)					*!		***					

Because the constraint LICENSE-μ is ranked high in the grammar of MA at the postlexical level, unsyllabified moras should be properly syllabified by a syllable. The constraints *COMPLEX$_{ONS}$ and *CC- are not ranked with respect to each other at the postlexical level. The constraint hierarchy at the postlexical level is given in (134).

(134) Postlexical level
LICENSE-μ, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$ >> CONTIGUITY-IO, ALIGN-L >> MAX-IO >> *COMPLEX$_{ONS}$, *CC- >> DEP-IO

(135) Postlexical Level

sta'giil	LICENSE-μ	ONS	MAX-IO['V]	*[ʔC	MAX-IO$_{[C\text{-}STEM}$	CONTIGUITY-IO	ALIGN-L	MAX-IO	*COMPLEX$_{ONS}$	*CC-	DEP-IO
a. ☞ |sta.'giil									*		
b. |s$_{μ}$.ta.'giil	*!									*	
c. ʔi|s.ta.'giil							*!				**
d. |si.ta.'giil						*!					*
e. ta.'giil					*!			*			

One advantage of assuming that the first member of phrase-initial onset CC-clusters is a semisyllable is that it gives consistency to our analyses. To this end, we can assume that MA does not allow complex margins at the lexical levels. As far as I am aware, this generalisation is also valid in relation to other VC-dialects such as AM.

In this chapter, we have focussed on the interaction of stress and vowel epenthesis in MA. The following chapter, by contrast, will be concerned with vowel syncope and vowel shortening.

5 Vowel Syncope and Vowel Shortening

Syncope is the deletion of short vowels in nonfinal open syllables, while vowel shortening refers to the reduction of long vowels in open syllables. In Arabic dialects, both phenomena are attested as a decent amount of studies have demonstrated (Brame, 1970; Broselow, 1976; McCarthy, 1979, 2007; Kenstowicz and Abdul-Karim, 1980, Abu-Salim, 1982; Haddad 1984; Hamid, 1984; Irshied, 1984; Abu-Mansour, 1987; Al-Sughayer, 1990; Angoujard, 1990; Farwaneh, 1995; Kager, 1995; Zawaydeh, 1997; Adra, 1999; Sakarna, 1999; Kiparsky 2000; Watson, 2002, 2007; AbuAbbas 2003; Kabrah, 2004) to name but a few.

Long vowel shortening can be found in many Arabic dialects. As is the case in all other phonological phenomena, these dialects differ in how they allow and prohibit long vowels. In Egyptian Arabic, long vowels are shortened even if they are closed like in /baab-ha/ which surfaces as /bab.ha/. On the other hand, in some Levantine Arabic dialects like Palestinian and Jordanian, open syllables with long vowels are shortened in certain environments, as in /baab-een/ which surfaces as /ba.been/, but not in /baab.ha/.

The deletion of short vowels in nonfinal syllables, however, is commonly practiced in many Arabic dialects. It is more common for high short vowel(s) in open syllables to undergo syncopation than the low short vowel. In the literature, Arabic dialects are divided into two groups regarding the deletion of short vowels. *Differential* and *Nondifferential* dialects; differential dialects refer to those that only delete weak high short vowel(s) in open syllables; nondifferential ones, on the other hand, are those which delete weak short vowels in open syllables, i.e. high and low short vowels. Furthermore, Farwaneh (1995) differentiates between the two types by concluding that onset dialects delete high short vowels, while coda dialects syncopate high and low short vowels.

Nondifferential dialects include some Levantine variants as Syrian Arabic (Adra, 1999) and Tripolitanian Arabic (Al-Ageli, 1996)[1]. The examples in (1) show that Syrian Arabic deletes weak high and low short vowels in open syllables.

(1) Examples from Adra (199: 38)

Input	Output	Gloss
nizil-na	'nzil-na	We descended
laḥam-t	'lḥam-t	I welded

The table in (1) shows that syncopation rules in such dialects do not distinguish between high and low vowels as long as they are weak and short.

Differential dialects, on the other hand, are divided into two subgroups. The first deletes any weak high short vowels in open syllables, i.e. high front short vowel /i/ and high back short vowel /u/. Egyptian Arabic, as can be seen in table (2) below best exemplifies this group.

(2) Data from Watson (2002: 71)

Input	Output	Gloss
wiḥiʃ-a	'wiḥ.ʃa	bad (f.)
xulus-it	'xul.sit	she finished

The second subgroup in the differential dialects is that which only deletes high front short vowels. Makkan Arabic is one of the most common dialects that only syncopates high front short vowels. The examples below illustrate this restriction in Makkan Arabic.

[1] The motivation for short vowel deletion is not the same in the aforementioned dialects. Al-Ageli (1996) argues that the motivation for short vowel deletion is the ban on CV syllables in his dialect. This does not seem to be the case in Syrian Arabic.

(3) Data from Kabrah (2007: 132)

Input	Output	Gloss
katab-u	'ka.ta.bu	they wrote
kutub-u	'ku.tu.bu	his books
misik-u	'mis.ku	they held

The examples from Makkan Arabic precisely show that the high front short vowel is the only one that undergoes syncopation.

JA is a differential dialect that deletes all high short vowels in nonfinal open syllables. However, the low short vowel /a/ is deleted systematically in Bedouin Jordanian dialects when it is followed by a nonfinal open syllable (Irshied, 1984; Sakarna, 1999). This phenomenon, which is known in the literature as *trisyllabic elision,* is common in many Bedouin dialects as it has been reported to take place in Najdi and Hijazi Arabic (Al-Mozainy, 1982). The following table illustrates this point.

(4) Data from Sakarna (1999: 47-48)

Input	Output	Gloss
bagara	'bga.ra	cow (s.)
bagar-i	'bga.ri	my cows
bagar-hin	'ba.gar.hin	their (f.) cows

The table in (4) shows that the short low vowel in these dialects is deleted when it is followed by a nonfinal open syllable. However, the language is still differential as it does not delete the low short vowel because it happens to be in an open syllable rather the deletion of /a/ is motivated by other phonological rule.

Finally, the dialect under investigation shortens long vowels in open syllables and deletes all high short vowels in nonfinal open syllables, i.e. a differential dialect. In what follows, we will be mainly concerned with accounting for these phenomena in MA.

5.1 Vowel Deletion

In this section, two main points will be discussed. The first considers the deletion of unstressed high short vowels in nonfinal open syllables, while the second examines the deletion of unstressed low short vowels in nonfinal open syllables. Since MA is a differential dialect, the deletion of the low short vowel is not governed by the same phonological motivation that controls the deletion of high short vowels.

5.1.1 High Short Vowels Deletion

MA, like many other Arabic dialects, deletes high short vowels in unstressed open syllables. High short vowel deletion takes place at the lexical levels only. To see how this rule works, consider the set of examples in (5) below.

(5)

	Input	Stem Output	Word Output	Postlexical Output	Gloss
	a. nikid	/'ni.kid/	/'ni.kid/	/'ni.kid/	grouchy
1	b. ʕaali	/'ʕaa.li/	/'ʕaa.li/	/'ʕaa.li/	high
	c. raami	/'raa.mi/	/'raa.mi/	/'raa.mi/	[Proper name]
	a. nikid-i	/'nik.di/	/'nik.di/	/'nik.di/	grouchy (f)
2	b. ʃarib-it	/'ʃar.bit/	/'ʃar.bit/	/'ʃar.bit/	she drank
	c. ʃarib-u	/'ʃar.bu/	/'ʃar.bu/	/'ʃar.bu/	they drank
	a. kitaab	/ki.'taab/	/k_{μ}.'taab/	/'ktaab/	book
	b. ʕið̣aam	/ʕi.'ð̣aam/	/$ʕ_{\mu}$.'ð̣aam/	/'ʕð̣aam/	bones
	c. faahim-i	/'faa.hi.mi/	/'faah.mi/	/'faah.mi/	she understood
3	d. ṣaaḥib-u	/'ṣaa.ḥib/	/'ṣaaḥ.bu/	/'ṣaaḥ.bu/	his friend
	e. ʕaarif-u	/'ʕaa.rif/	/'ʕaar.fu/	/'ʕaar.fu/	I know him
	f. kutub-u	/'ku.tub/	/'kut.bu/	/'kut.bu/	his books
	g. ṣuwar-na	/'ṣu.war/	/ṣu.'war.na/	/ṣu.'war.na/	our photos

In the examples in (5.1), no deletion takes place since the high short vowel is stressed in (5.1.a) while it is final in (5.1.b-c). The unstressed high short vowels are deleted at the stem and word levels as exemplified in (5.2) and (5.3) respectively. If the deletion of the unstressed high short vowel at the stem level creates word-initial consonant cluster or a non-final long closed syllable then deletion is not allowed. Accordingly, we would expect the constraint *i]σ to be ranked relatively low in the grammar of MA at the stem level. This is evident by examining the example in (5.3.c) /*faahim-i/*, which surfaces postlexically as /'faah.mi/. If the constraint *i]σ is ranked high at the stem level, the stem output is */faah.mi/ which is not allowed in many Arabic dialects. This includes MA, since nonfinal long closed syllables at the stem level are prohibited. Nonfinal long closed syllables at the stem level are shortened and raised in MA as in /dʒib.na/ 'we brought' from the input /dʒaab-na/. By analogy, we would expect /faahim-i/ to surface as */fih.mi/ if we assume that the high short vowel is ranked high at the stem level. Accordingly, the constraint *VVC- which prohibits nonfinal long closed syllables and the constraint MAX-IO$_{V[LONG]}$ which prohibits shortening of long vowels should outrank the constraint *i]σ. Therefore, the word /faahim-i/ should be syllabified as /faa.hi.mi/ to satisfy the above mentioned constraints. High short vowel deletion is not allowed at the stem level, moreover, if it creates word-initial consonant clusters as in /kitaab/ which surfaces at the stem level as /ki.'taab/. Therefore, the constraint *CC- outranks the constraint *i]σ. At the word level, by contrast, all nonfinal unstressed high short vowels are deleted, unless they happen to be stressed in the preceding stratum, as exemplified in (5.3). To this end, we assume that the constraint *i]σ is ranked high in the grammar of MA at the word level. Postlexically, high short vowel deletion is not allowed.

To account for the set of data in (5), we need seven essential constraints: MAX-IO['V], RIGHT-ANCHORING-IO, *i]$_{\sigma}$ MAX-IO, *VVC-, MAX-IO$_{V[LONG]}$ and LICENSE-$_{\mu}$. The constraint MAX-IO['V] prevents stressed vowels from being deleted. The function of the constraint RIGHT-ANCHORING-IO is to preserve the right edge of the word, i.e. it penalises candidates that undergo deletion or epenthesis at the right edge of the word. The constraint *i]$_{\sigma}$, on the contrary, requires the deletion of unstressed high short vowels in open syllables. The constraint MAX-IO prevents deletion of any segment, while MAX-IO$_{V[LONG]}$ prohibits the shortening of long vowels. Finally, the constraint *VVC- forbids nonfinal long closed syllables and long open syllables which are followed by moraic consonants. These constraints are stated below respectively.

(6)
MAX-IO['V] (Kiparsky 2000)
Stressed vowels of the input have correspondents in the output.

(7)
RIGHT-ANCHORING-IO (RT-ANCHOR) (McCarthy and Prince, 1995)
Any element at the designated periphery of S_1 has a correspondent at the designated periphery of S_2. (No epenthesis or deletion at the right edge)

(8)
*i]σ (Kenstowicz 1995)
High short unstressed vowels in open syllables are not allowed.

(9)
MAX-IO
Every segment of the input has a correspondent in the output (no deletion).

(10)
MAX-IO$_{V[LONG]}$
Assign one violation mark for every long vowel that undergoes shortening.

(11)[2]
*VVC- (Kiparsky, 2003)
Nonfinal long closed syllables or long open syllables which are followed by a moraic consonant are not allowed.

[2] Kiparsky (2003) argues that the constraint *VVC- prevents nonfinal long closed syllables only. However, I think that *VVC- should also prevents sequences like /VV.C_{μ}/ because if such sequences are allowed then the input /ʃaaf-na/ 'we saw' would surface as */ʃaa.f_{μ}.na/ at the stem level, i.e. does not undergo vowel shortening (cf. Section 5.2.1).

At the stem level, we will use all the above constraints except the constraint MAX-IO['V] since there is no stressed vowel in the input. The examples in (5.2) establish the dominance relation between the constraints *i]$_\sigma$ and MAX-IO. The former must outrank the latter, since nonfinal unstressed high short vowels are deleted in the optimal outputs. This fact is depicted in tableau (12) below.

(12) Stem Level

nikid-i	*i]$_\sigma$	MAX-IO
a. ☞/('nik).di/	*	*
b. /('niki).di/	**!	

The tableau in (12) clearly shows that satisfying the constraint *i]$_\sigma$ is favoured over satisfying the constraint MAX-IO. Thus, candidate (12.a) is chosen as the optimal output. However, a candidate like /'nik.d$_\mu$/ would surface as the optimal output if the constraint RT-ANCHOR is not included in the constraint hierarchy. The constraint RT-ANCHOR should outrank the constraint *i]$_\sigma$ as shown in (13).

(13) Stem Level

nikid-i	RT-ANCHOR	*i]$_\sigma$	MAX-IO
c. ☞/('nik).di/		*	*
d. /('niki).di/		**!	
e. /('nik).d$_\mu$/	*!		**

High short vowel deletion fails to apply if it results in a violation of the constraint *VVC-, i.e. the constraint *VVC- outranks the constraint *i]$_\sigma$. The constraint LICENSE-$_\mu$ is outranked by the constraint MAX-IO (cf. chapter 4). Accordingly, the example in (5.2.d) surfaces as /faa.hi.mi/ at the stem level, as shown in tableau (14) below.

(14) Stem Level

faahim-i	*VVC-	RT-ANCHOR	*i]$_\sigma$	MAX-IO	LICENSE-μ
a. ☞/('faa).hi.mi/			**		
b. /('faa).h$_\mu$.mi/	*!		*	*	*
c. /'faah.mi/	*!		*	*	
d. ('faa).him/		*!			

The faithful candidate (14.a) wins the competition despite violating the constraint *i]$_\sigma$ twice. Candidates (14.b-c) lose by incurring fatal violations of the undominated constraint *VVC-. Finally, candidate (14.d) loses by fatally violating the constraint RT-ANCHOR. The last basic constraint that is needed to account for the examples in (5) at the stem level is MAX-IO$_{V[LONG]}$. The importance of the constraint MAX-IO$_{V[LONG]}$ stems from its ability to rule out a hypothetical candidate like /'fah.mi/ from the input /faahim-i/. No dominance relation can hold between MAX-IO$_{V[LONG]}$ and the constraints *VVC- and RT-ANCHOR[3]. Accordingly, the following constraint hierarchy is established at the stem level.

(15) Stem Level
MAX-IO$_{V[LONG]}$, *VVC- , RT-ANCHOR >> *i]$_\sigma$ >> MAX-IO >> LICENSE-μ

(16) Stem Level

faahim-i	MAX-IO$_{V[LONG]}$	*VVC-	RT-ANCHOR	*i]$_\sigma$	MAX-IO	LICENSE-μ
a. ☞/('faa).hi.mi/				**		
b. /('faa).h$_\mu$.mi/		*!		*	*	*
c. /'faah.mi/		*!		*	*	
d. ('faa).him/			*!			
e. /('fah).mi/	*!			*	*	

[3] A dominance hierarchy will be established between the constraints *VVC- and MAX-IO$_{V[LONG]}$ when cases of vowel shortening are considered (cf. Section 5.2.1)

However, the established constraint hierarchy cannot explain the immunity of the unstressed high short vowel to deletion at the stem level in the examples (5.3.a-b). Moreover, the same constraint hierarchy cannot justify the deletion of the second high short vowel in /nikid-i/ but not the first, i.e. why the optimal output is /nik.di/ but not */nki.di/ or /n_{μ}.ki.di/. To explain this, we need to recall our discussion about the imperative form in MA in the previous chapter. In accounting for the imperative form in MA, the following constraint hierarchy has been established at the Stem level (cf. Section 4.4).

(17) Stem Level
FTBIN, ONS, *[ʔC, MAX-IO$_{[C\text{-STEM}}$ >> *COMPLEX$_{ONS}$, MAX-IO, CONTIGUITY-IO, *CC- >> ALIGN-L, DEP-IO >> LICENSE-μ

In our discussion regarding the imperative form in MA, I argued that initial epenthesis is motivated by the fact that phrase-initial consonant clusters are absolutely prohibited at the stem level. The aforementioned fact explains the immunity of the unstressed high short vowel to deletion at the stem level in the examples in (5.3.a-b) and the deletion of the second rather than the first high short vowel in /nikid-i/. Accordingly, incorporating the constraint hierarchy in (17), with the one in (15) can account for initial epenthesis and high short vowel deletion.

The constraints MAX-IO$_{V[LONG]}$, *VVC- and RT-ANCHOR in (15) are not ranked with respect to the undominated constraints FTBIN, ONS, *[ʔC and MAX-IO$_{[C\text{-STEM}]}$. Accordingly, the ranking of the constraints *i]$_{\sigma}$ and MAX-IO to the rest of the constraints in (17) should be developed.

We have already established the fact that the constraint *i]$_{\sigma}$ outranks the constraint MAX-IO. In the constraint hierarchy in (17) the constraint MAX-IO is not ranked with respect to the constraints *COMPLEX$_{ONS,}$ *CC- and CONTIGUITY-IO. Therefore, if the constraint *i]$_{\sigma}$ outranks all of the aforementioned constraints by transitivity, we would expect a word like /kitaab/ to surface as /ktaab/ or /k_{μ}.taab/ at the stem level. However, the optimal output at the stem level is /ki.ttab/, which implies that the constraints *COMPLEX$_{ONS,}$ *CC- outrank the constraint *i]$_{\sigma}$. Moreover, the constraint *i]$_{\sigma}$ should outrank the constraint CONTIGUITY-IO to allow medial high short vowel deletion. The constraints CONTIGUITY-IO and MAX-IO are already not ranked with respect to each other. However, I think including the constraint CONTIGUITY-IO in the new constraint hierarchy is redundant since the constraint *i]$_{\sigma}$ is responsible for the deletion of the unstressed high short vowels, while the constraint MAX-IO$_{[C\text{-}STEM]}$ will insure that no stem consonant is deleted. Accordingly, I will not include the constraint CONTIGUITY-IO in our discussion. Consequently, the following constraint hierarchy is established at the stem level.

(18) Stem Level
FTBIN, ONS, *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, *VVC- , RT-ANCHOR >> *COMPLEX$_{ONS}$, *CC- >> *i]$_{\sigma}$ >> MAX-IO >> ALIGN-L, DEP-IO >> LICENSE-$_{\mu}$

(19) Stem Level

nikid-i	FTBIN	*[ʔC	ONS	MAX-IO$_{[C\text{-}STEM]}$	MAX-IO$_{V[LONG]}$	*VVC-	RT-ANCHOR	*COMPLEX$_{ONS}$	*CC-	*i]$_{\sigma}$	MAX-IO	ALIGN-L	DEP-IO	LICENSE-$_{\mu}$
1.a. ☞/('nik).di/										*	*			
1.b. /('niki).di/										**!				
1.c. /('nik).d$_{\mu}$/							*!				**			*
1.d. /('nki.di)/								*!	*!	*	*			
1.e. /n$_{\mu}$.('ki.di)/									*!	*	*			*
kitaab														
2.a. ☞/ki.('taab)/										*				
2.b. /('ktaab)/								*!	*!		*			
2.c. /k$_{\mu}$.('taab)/									*!		*			*
2.d. /('kitab)/					*!									
faahim-i														
3.a.☞ /('faa).hi.mi/										**				
3.b. /('faa).h$_{\mu}$.mi/						*!				*	*			*
3.c. /'faah.mi/						*!				*	*			
3.d. ('faa).him							*!				*			
3.e. /('fah).mi/					*!					*	*			

The tableaux in (19) show that the integration of the constraint hierarchies in (15) and (17) produce the desired output at the stem level. The constraint hierarchy in (18) correctly predicts that the optimal output in (19.1.a) should surface with deletion of the high short vowel and that the optimal outputs in (19.2.a) and (19.3.a) should surface without deletion.

At the word level, high short vowels are deleted unless they have been stressed in the preceding stratum, as in the example in (5.3.g). This immunity to deletion is achieved by virtue of the undominated constraint MAX-IO['V]. Consider the following tableau.

(20) Word Level

'ṣuwar-na	MAX-IO['V]	$*i]_\sigma$
a. ☞/ṣu.('war).na/		*
b. /('ṣwar).na/	*!	

At the word level, the optimal output at the stem level /('faa.hi.mi/) surfaces as /('faah).mi/ because nonfinal long closed syllables are allowed Therefore, the constraint $*i]_\sigma$ should outrank the constraint LICENSE-$_\mu$, which in turn should outrank the constraint *VVC-. These facts are depicted in the following tableau.

(21) Word Level

'faahim-i	$*i]_\sigma$	LICENSE-$_\mu$	*VVC-
a. ☞/('faah).mi/	*		*
b. /('faa).h$_\mu$.mi/	*	*!	*
c. /('faa).hi.mi/	**!		

The ranking of the other basic constraints is kept as it was at the stem level. Accordingly, the following constraint hierarchy is established for the basic constraints.

(22) Word Level

MAX-IO['V], MAX-IO$_{V[LONG]}$, RT-ANCHOR >> $*i]_\sigma$ >> MAX-IO >> LICENSE-$_\mu$ >> *VVC-

Because phrase-initial consonant clusters are allowed at the word level, the examples in (5.3.a-b) surface as /k$_\mu$.'taab/ and /ʕ$_\mu$.'ð̣aam/ respectively. To account for the aforementioned examples, we should integrate the constraint hierarchy in (22) with the constraint hierarchy that has been used to account for the imperative form in MA at the word level (cf. Section 4.4).

(23) Word Level

FTBIN, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM}$ >> ALIGN-L >> MAX-IO >> *COMPLEX$_{ONS}$, CONTIGUITY-IO >> *CC- >> DEP-IO >> LICENSE-$_\mu$

The integration of the two constraint hierarchies in (22) and (23) yields the following constraint hierarchy at the word level.

(24) Word Level
FTBIN, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR >> ALIGN-L, *i]$_{\sigma}$ >> MAX-IO >> *COMPLEX$_{ONS}$ >> *CC- >> DEP-IO >> LICENSE-$_{\mu}$ >> *VVC-

In (24), The constraints *i]$_{\sigma}$ and ALIGN-L outrank the constraint MAX-IO. The constraint MAX-IO['V] outranks *i]$_{\sigma}$ (see 20 above) and ALIGN-L (cf. Section 4.4). The constraint RT-ANCHOR is not ranked with respect to the constraint MAX-IO['V]. Accordingly, the constraint RT-ANCHOR outranks the constraint *i]$_{\sigma}$ and ALIGN-L. Finally, no dominance relation can hold between *i]$_{\sigma}$ and ALIGN-L. Consider the following tableaux.

(25) Word Level

'ʕaali	MAX-IO['V]	RT-ANCHOR	*i]$_{\sigma}$	ALIGN-L	MAX-IO
1.a. ☞/('ʕaa).li			*		
1.b. /('ʕaal)		*!			*
'ṣuwar-na					
2.a. /ṣu.('war).na/			*		
2.b. /('ṣwar).na/	*!				*

Consequently, the constraint hierarchy in (24) can produce the desired outputs for the imperative form and for the deletion of the unstressed high short vowels at the word level as shown in the following tableaux.

(26) Word Level

ʔista'giil	FTBIN	ONS	MAX-IO['V]	*[ʔC	MAX-IO$_{[C\text{-}STEM}$	MAX-IO$_{V[LONG]}$	RT-ANCHOR	ALIGN-L	*i]$_\sigma$	MAX-IO	*COMPLEX$_{ONS}$	*CC-	DEP-IO	LICENSE-$_\mu$	*VVC-
1.a.☞ |s$_\mu$.ta.('giil)										**		*		*	
1.b. |sta.('giil)										**	*!				
1.c. (ʔi|s).ta.('giil)								*!							
1.d. (|si.ta).('giil)									*!	**			*		
1.e. ta.('giil)					*!					***					
ki'taab															
2.a. ☞/k$_\mu$.('taab)/										*		*		*	
2.b. /('ktaab)/										*	*!	*			
2.c. /ki.('taab)/									*!						
2.d. /('taab)/					*!										
'faahim-i															
3.a.☞ /('faah).mi/									*	*					*
3.b. /('faa).h$_\mu$.mi/									*	*				*!	*
3.c. /('faa).hi.mi/									**!						
3.d. ('faa).him							*!			*					

The deletion of the prosthetic /ʔi/ in (26.1.a) is required by the alignment constraint ALIGN-L, while the deletion of the unstressed high short vowels in (26.2.a) and (26.3.a) are required by the constraint *i]$_\sigma$. Accordingly, we have accounted for high short vowel deletion and initial epenthesis at the word level.

To account for the deletion of unstressed high short vowels at the postlexical level, the constraint MAX-IO should outrank the constraint *i]$_\sigma$ since we believe that this process is a lexical process. This dominance hierarchy between the aforementioned constraints is justified when the following examples are considered.

(27)

Input	Stem output	Word Output	Postlexical Output	Gloss
a. ṣuwar-na	/'ṣu.war/	/ṣu.'war.na/	/ṣu.'war.na/	our photos
b. ġuraf-ha	/'ġu.raf/	/ġu.'raf.ha/	/ġu.'raf.ha/	her rooms

Another piece of evidence that supports our assumption that high short vowel deletion is not a postlexical process comes from the well-known example of the cycle in Levantine Arabic, i.e. the /'fi.him/ example (cf. Sections 2.2.2 and 2.2.4.2). Consider the following table.

(28)

Input	Stem output	Word Output	Postlexical Output	Gloss
a. fihim-na	/fi.'him.na/	/f_{μ}.'him.na/	/'fhim.na/	we understood
b. fihim-na	/'fi.him/	/fi.'him.na/	/fi.'him.na/	he understood us

At the postlexical level, no high short vowel deletion takes place. This fact is accounted for by virtue of the following constraint hierarchy.

(29) Postlexical Level
LICENSE-$_{\mu}$, ONS, MAX-IO['V], *[ʕC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR >> ALIGN-L >> MAX-IO >> *i]$_{\sigma}$,*COMPLEX$_{ONS}$, *CC- >> DEP-IO, *VVC-

As discussed in the previous chapter, the constraint ALIGN-L outranks the constraint MAX-IO. The constraint MAX-IO outranks the constraint *i]$_{\sigma}$ (see 27 and 28 above). Furthermore, no dominance relation can hold between the constraint *i]$_{\sigma}$ and the constraints *COMPLEX$_{ONS}$ and *CC- . Accordingly, the constraint *i]$_{\sigma}$ outranks the constraint DEP-IO by transitivity. Finally, no dominance relation can hold between the constraint DEP-IO and the constraint *VVC-. The following examples are examined to validate our argument.

(30) Postlexical Level

sta'giil	LICENSE-$_{\mu}$	ONS	MAX-IO['V]	*[ʔC	MAX-IO$_{[C\text{-}STEM}$	MAX-IO$_{V[LONG]}$	RT-ANCHOR	ALIGN-L	MAX-IO	*i]$_{\sigma}$	*COMPLEX$_{ONS}$	*CC-	DEP-IO	*VVC-
1.a. ☞|sta.'giil											*	*		
1.b. |s$_{\mu}$.ta.'giil	*!											*		
1.c. ʔi|s.ta.'giil								*!					**	
1.d. |si.ta.'giil										*!			*	
1.e. ta.'giil					*!				*					
k'taab														
2.a. ☞/'ktaab/											*	*		
2.b. /k$_{\mu}$.'taab/	*!											*		
2.c. /ki.'taab/										*!			*	
2.d. /'taab/					*!				*					
ṣu'war-na														
3.a. ☞/ṣu.'war.na/										*				
3.b. /'ṣwar.na/									*!		*	*		
3.c. /ṣ$_{\mu}$.'war.na/									*!			*		
3.d. /ʔiṣ.'war.na/								*!	*!				**	
'ʕaarf-u														
4.a. ☞/'ʕaar.fu/										*				*
4.b. /'ʕar.fu/						*!				*				
4.c. /'ʕaa.ri.fu/										**!			*	

The optimal output in (30.3.a) proves that high short vowel deletion is not a postlexical process. The unsyllabified moras in the inputs of the optimal outputs in (30.1.a) and (30.2.a) are properly syllabified at the postlexical level since complex onsets are allowed. Finally, the optimal output (30.4.a) surfaces intact since it does not violate any high ranked constraint.

To this end, we have been able to account for high short vowel deletion and initial epenthesis at the lexical and postlexical levels. However, there are other cases where lexical high short vowel deletion motivates postlexical epenthesis which cannot be accounted for by depending on the above argument. In the following section, I will account for initial epenthesis, non-initial epenthesis and high short vowel deletion in one constraint hierarchy.

5.1.1.1 Syncope, Epenthesis and Stress

In the previous chapter, non-initial vowel epenthesis was comprehensively explored and discussed. The result was the constraint hierarchies, given in (31-33), which account for all cases of non-initial vowel epenthesis at the stem, word and postlexical levels in MA.

(31) Stem Level

$*3_{\mu}$ >> *COMPLEX$_{\text{CODA}}$, MAX-IO >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$

(32) Word Level

$*3_{\mu}$, ςς=σ >> *COMPLEX$_{\text{CODA}}$, MAX-IO >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$

(33) Postlexical Level

IDENT-STRESS ,$*3_{\mu}$,LICENSE-$_{\mu}$ >> MAX-IO , SONSEQ >> *SHARED-$_{\mu}$ >> DEP-IO >> *COMPLEX$_{\text{CODA}}$

Our goal in this section is to integrate the above constraint hierarchies with the constraint hierarchies that have been established in the previous section to account for initial epenthesis and vowel syncope. Before establishing this integration, let us first consider the following examples.

(34)

Input	Stem output	Word Output	Postlexical Output	Gloss
a. muʃkili	/('muʃ).k_{μ}.li/	/('muʃ).k_{μ}.li/	/'mu.ʃik.li/	problem
b. mulfiti	/('mul).f_{μ}.ti/	/('mul).f_{μ}.ti/	/'mu.lif.ti/	attractive (f.)
c. ʃarib-it-u	/('ʃar).bit/	/('ʃar).b_{μ}.tu/	/'ʃa.rib.tu/	she drank it
d. ʃarib-t-u	/ʃa.('rib).t_{μ}/	/ʃa.('rib).tu/	/ʃa.'rib.tu/	I drank it

The examples in (34.a-c) demonstrate the interaction between vowel deletion and vowel epenthesis. These examples support our idea that deletion takes place at the lexical levels, while epenthesis applies postlexically except in certain cases[4]. In the examples in (34.a-b), deletion takes place first at the stem level since deleting unstressed high short vowels is more harmonic in the grammar of MA than syllabifying a mora. At the postlexical level, by contrast, a vowel is inserted as unsyllabified moras and internal complex codas are absolutely prohibited. Two high short vowels undergo deletion in the example in (34.c); the first vowel is deleted at the stem level. After the attachment of the suffix /u/ at the word level, an open syllable with an unstressed high short vowel is created. The unstressed high short vowel in the newly created syllable should be deleted. As a result, we end up with an unsyllabified mora. Postlexically, a vowel is epenthesized to syllabify the unsyllabified mora. Although the same string of segments surface for both examples in (30.c) and (30.d), they differ with regard to stress, which falls on the penultimate and antepenultimate syllables respectively.

To account for the set of data in (34), the constraint rankings that have been established to account for high short vowel deletion and initial epenthesis in the previous section need to be incorporated with those in (31-33) which account for non-initial vowel

[4] See chapter four for full discussion.

epenthesis. This integration would allow us to account for high short vowel deletion and vowel epenthesis in one constraint hierarchy.

At the stem level, we need to combine the following two constraint hierarchies together. This combination should be straight forward, since most of the constraint that have been used to account for non-initial epenthesis are used by the constraints hierarchy which accounts for initial epenthesis and high short vowel deletion.

(35) Non-initial epenthesis (stem Level)
$*3_{\mu}$ >> *COMPLEX$_{CODA}$, MAX-IO >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$

(36) Initial epenthesis and high short vowel deletion (stem level)
FTBIN, ONS, *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, *VVC- , RT-ANCHOR >> *COMPLEX$_{ONS}$, *CC- >> $*i]_{\sigma}$ >> MAX-IO >> ALIGN-L, DEP-IO >> LICENSE-$_{\mu}$

The constraint $*3_{\mu}$ is undominated in MA; therefore, it will be ranked with the other undominated constraints in (36) since no dominance relation can hold between $*3_{\mu}$ and the other constraints. The constraint *COMPLEX$_{CODA}$ is not ranked with respect to the constraint MAX-IO in (35). In (36) ,the constraint $*i]_{\sigma}$ outranks the constraint MAX-IO. The constraint $*i]_{\sigma}$ outranks the constraint COMPLEX$_{CODA}$ by transitivity since the former outranks the constraint MAX-IO. Finally, the dominance relation between the constraints LICENSE-$_{\mu}$ and *SHARED-$_{\mu}$, in which the former outranks the latter, is kept as it is. Accordingly, the following constraint hierarchy is established.

(37) Epenthesis and deletion (stem level)
FTBIN, $*3_{\mu}$, ONS, *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, *VVC- , RT-ANCHOR >> *COMPLEX$_{ONS}$, *CC- >> $*i]_{\sigma}$ >> *COMPLEX$_{CODA}$, MAX-IO >> ALIGN-L, DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$

To validate the constraint hierarchy in (37), we will examine three different examples in which initial epenthesis is motivated. In the first example, high short vowel deletion is blocked in the second one and in the last example high short vowel deletion is motivated.

(38) Stem Level

ftaḥ-u	FTBIN, $*3_{\mu}$, *[ʔC, ONS , MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, *VVC-, RT-ANCHOR	*COMPLEX$_{ONS}$	*CC-	*i]$_{\sigma}$	*COMPLEX$_{CODA}$	MAX-IO	ALIGN-L	DEP-IO	LICENSE-μ	*SHARED-μ
1.a. ☞/('ʔif).ta.ḥu/				*			*	**		
1.b. /('if.ta).ḥu/	*! ONS			*			*	*		
1.c. /('fta.ḥu)/		*!	*!	*						
1.d. /(f$_{\mu}$.'ta.ḥu)/			*!	*					*	
1.e. /('ta.ḥu)/	*!MAX-IO$_{[C\text{-}STEM]}$			*		*				
kitaab										
2.a. ☞/ki.('taab)/				*						
2.b. /('ktaab)/		*!	*!			*				
2.c. /k$_{\mu}$.('taab)/			*!			*			*	
2.d. /('kitab)/	*! MAX-IO$_{V[LONG]}$									
muʃkili										
3.a.☞ /('muʃ).k$_{\mu}$.li/				*		*			*	
3.b. /mu.('ʃik).li/				**!		*		*		
3.c. /('mʃik).li/		*!	*!	*		*		*		
3.d. /('muʃ).ki.li/				**!						
3.e. /('muʃk).li/	*! $*3_{\mu}$			*	*	*				

Because of the prohibition on initial consonant clusters at the stem level, the optimal output in (38.1.a) surfaces with a prosthetic /ʔi/ and the process of unstressed high short vowel deletion is blocked in the optimal output in (38.2.a). The unstressed high short vowel is deleted in the optimal output (38.3.a), since violating the constraint LICENSE-μ is more harmonic than violating the constraint *i]$_{\sigma}$.

The integration of the constraint hierarchies in (24) and (32) above, repeated in (39) and (40) for convenience, can account for the interaction of syncope and epenthesis at the word level. A high short vowel is epenthesized at the word level owing to the ban on two successive semisyllables at the word level (cf. Section 4.3.2). Nonfinal unstressed high short vowels in open syllables are deleted at the word level, except if they are stressed in the previous stratum (cf. Section 5.1.1).

(39) Initial epenthesis and high short vowel deletion (word level)
FTBIN, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR >> ALIGN-L, *i]$_{\sigma}$ >> MAX-IO >> *COMPLEX$_{ONS}$ >> *CC- >> DEP-IO >> LICENSE-$_{\mu}$ >> *VVC-

(40) Non-initial epenthesis (word level)
*3$_{\mu}$, ςς=σ >> *COMPLEX$_{CODA}$, MAX-IO >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$

No dominance relation can hold between the constraints *3$_{\mu}$ and ςς=σ in (40) and the undominated constraints in (39). Therefore, they will be of an undominated nature in the new constraint hierarchy in (41). The constraint *i]$_{\sigma}$ outranks the constraint MAX-IO in (39), which is not ranked with respect to the constraint *COMPLEX$_{CODA}$ in (40). However, the constraint *i] outranks the constraint *COMPLEX$_{CODA}$ in (41) by transitivity since the former outranks MAX-IO. The ranking of the constraints DEP-IO, LICENSE-$_{\mu}$ and *SHARED-$_{\mu}$ is kept as it is. Finally, the constraints *SHARED-$_{\mu}$ and *VVC- are not ranked against each other.

(41) Epenthesis and deletion (word level)
FTBIN, *3$_{\mu}$, ςς=σ , ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR >> ALIGN-L, *i]$_{\sigma}$ >> *COMPLEX$_{CODA}$, MAX-IO >> *COMPLEX$_{ONS}$ >> *CC- >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$, *VVC-

In the following tableau, three examples will be examined. Vowel epenthesis is motivated in the first one, while medial vowel deletion is motivated in the second one. In the third example, the deletion of the unstressed high short vowel is preferred over creating a phrase initial complex cluster.

(42) Word Level

ka'tab-t-l-ki	FTBIN, *3$_{\mu}$, ςς=σ , ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[\text{C-STEM}]}$, MAX-IO$_{\text{V[LONG]}}$, RT-ANCHOR	ALIGN-L	*i]$_{\sigma}$	*COMPLEX$_{\text{CODA}}$	MAX-IO	*COMPLEX$_{\text{ONS}}$	*CC-	DEP-IO	LICENSE-$_{\mu}$	*SHARED-$_{\mu}$	*VVC-
1.a. ☞/ka.(tab).('til).ki/			*					*			
1.b. /ka.('tab).t$_{\mu}$.l$_{\mu}$.ki/	*! ςς=σ		*						**		
1.c. /ka.('tab).t$_{\mu}$.ki/	*! MAX-IO$_{[\text{C-STEM}]}$		*		*				*		
1.d. /ka.('ta$_{\mu}$b$_{\mu}$t$_{\mu}$).l$_{\mu}$.ki/	*! FTBIN *! *3$_{\mu}$		*	*					*		
'ʕarbit-u											
2.a. ☞/('ʕar).b$_{\mu}$.tu/			*		*				*		
2.b. /('ʕar).bi.tu/			**!								
2.c. /ʕa.('rib).tu/			*		*			*!			
ki'taab											
3.a. ☞/k$_{\mu}$.('taab)/					*		*		*		
3.b. /ki.('taab)/			*!								
3.c. /('ktaab)/					*	*!	*				
3.d. /('kitab)/	*!MAX-IO$_{\text{V[LONG]}}$										

Epenthesizing a vowel in (42.1.a) is preferred over leaving two adjacent semisyllables (42.1.b), deleting a consonant (42.1.c), or violating foot and syllable binarity (42.1.d). In (42.2.a), deleting the unstressed high short vowel is more harmonic than keeping it as in (42.2.b). Epenthesizing a vowel in (42.2.c) is not optimised, since violating the constraint DEP-IO is less harmonic than violating LICENSE-$_{\mu}$. Finally, creating a cluster word-initially is motivated by the constraint hierarchy in (41) as shown in (42.3.a).

The integration of the constraint hierarchies in (29) and (33) above, repeated in (43) and (44) below for convenience, should be able to account for the interaction of epenthesis and deletion at the postlexical level. The integration of the aforementioned hierarchies is not straight forward, since epenthesis is mostly a postlexical process while deletion is a lexical process[5]. For convenience, I will give the integrated constraint hierarchy and then explain how it has been established.

(43) Non-initial epenthesis (postlexical level)

IDENT-STRESS ,$*3_{\mu}$,LICENSE-$_{\mu}$ >> MAX-IO , SONSEQ >> *SHARED-$_{\mu}$ >> DEP-IO >> *COMPLEX$_{CODA}$

(44) Initial epenthesis and high short vowel deletion (postlexical level)

LICENSE-$_{\mu}$, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR >> ALIGN-L >> MAX-IO >> $*i]_{\sigma}$,*COMPLEX$_{ONS}$, *CC- >> DEP-IO, *VVC-

(45) Epenthesis and deletion (postlexical level)

IDENT-STRESS ,$*3_{\mu}$, LICENSE-$_{\mu}$, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR >> ALIGN-L >> MAX-IO , SONSEQ >> $*i]_{\sigma}$ >> *SHARED-$_{\mu}$, *COMPLEX$_{ONS}$, *CC- >> DEP-IO, *VVC- >> *COMPLEX$_{CODA}$

The constraint SONSEQ outranks the constraint $*i]_{\sigma}$ by transitivity, since the constraint MAX-IO outranks $*i]_{\sigma}$ and is not ranked with respect to the constraint SONSEQ[6]. The constraint $*i]_{\sigma}$, moreover, should outrank the constraint *SHARED-$_{\mu}$ in order to prevent epenthesizing a vowel after long closed syllables, as shown in (46).

(46) Postlexical Level

'dʒaar-na	$*i]_{\sigma}$	*SHARED-$_{\mu}$
a. ☞/'dʒaar.na/		*
b. /'dʒaa.ri.na/	*!	

[5] Initial deletion is a lexical and postlexical process (cf. Section 4.4).

[6] In Chapter six it will be argued that the constraint $*i]_{\sigma}$ outranks the constraint SONSEQ.

The constraint *SHARED-$_{\mu}$ is not ranked against the constraints *COMPLEX$_{ONS}$ and *CC-. These constraints should outrank the constraint DEP-IO, which in its turn outranks the constraint *COMPLEX$_{CODA}$. These dominance relations allow complex onsets, prohibit internal complex codas and allow final complex codas if they comply with sonority, as shown in (47).

(47) Postlexical Level

'galb-ha	MAX-IO	SONSEQ	*i]$_{\sigma}$	*SHARED-$_{\mu}$	*COMPLEX$_{ONS}$	*CC-	DEP-IO	*COMPLEX$_{CODA}$
1.a. ☞/'ga.lib.ha/							*	
μμ 1.b. /'galb.ha/				*!				*
'kitf-ha								
2.a. /'ki.tif.ha/							*	
2.b. /'kitf.ha/		*!		*				*
'galb								
3.a. 'galb								*
3.b. 'galib							*!	
sta'giil								
4.a. ☞|sta.'giil					*	*		
4.b. |si.ta.'giil			*!				*	
'muʃkli								
☞/'muʃik.li/			*				*	
5.a. /'muʃ.ki.li/			**!				*	
5.b. /'muʃk.li/		*!	*					*

The partial constraint hierarchy in (47) is able to produce the optimal outputs when compared with the basic candidates. Examining more examples and adding other candidates to the above tableaux enable us to use the constraint hierarchy in (45) above.

The constraint hierarchies that have been established to account for epenthesis and deletion at the three levels are able to explain the relation between stress, epenthesis and deletion, as shown in the following tableaux.

(48) Stem Level

ʃarib-it	FTBIN, $*3_{\mu}$, *[ʔC, ONS , MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, *VVC- , RT-ANCHOR	*COMPLEX$_{ONS}$	*CC-	*i]$_{\sigma}$	*COMPLEX$_{CODA}$	MAX-IO	ALIGN-L	DEP-IO	LICENSE-$_{\mu}$	*SHARED-$_{\mu}$
1.a. ☞/('ʃar).bit/						*				
1.b. /('ʃa.ri).bit/				*!						
μμ 1.c. /('ʃarb).t$_{\mu}$/						**!			*	*
μμμ 1.d. /('ʃarb).t$_{\mu}$/	*! FTBIN *! $*3_{\mu}$					**			*	
ʃarib-t										
2.a. ☞/ʃa.('rib).t$_{\mu}$/									*	
2.b. /('ʃa.ri).bit/				*!				*		
2.c. /('ʃar).bit/						*!		*		

(49) Word Level

'ʃarb-it-u	FTBIN, $*3_{\mu}$, ςς=σ , ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR	ALIGN-L	*i]$_{\sigma}$	*COMPLEX$_{CODA}$	MAX-IO	*COMPLEX$_{ONS}$	*CC-	DEP-IO	LICENSE-$_{\mu}$	*SHARED-$_{\mu}$	*VVC-
1.a. ☞/('ʃar).b$_{\mu}$.tu/			*		*				*		
1.b. /ʃa.('rib).tu/			*		*			*!			
1.c. /('ʃar).bi.tu/			**!								
ʃa'rib-t-u											
2.a. ☞/ʃa.('rib).tu/			*								
2.b. /ʃa.('rib).t$_{\mu}$/	*! RT-ANCHOR				*				*		
2.c. /('ʃar).bi.tu/			**!		*			*			

(50) Postlexical Level

'ʃarb-t-u	IDENT-STRESS ,*3_{μ} , LICENSE-$_{\mu}$, ONS, MAX-IO['V], *[ʕC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR	ALIGN-L	MAX-IO	SONSEQ	*i]$_{\sigma}$	*SHARED-$_{\mu}$	*COMPLEX$_{ONS}$	*CC-	DEP-IO	*VVC-	*COMPLEX$_{CODA}$
1.a. ☞/'ʃa.rib.tu/					*				*		
1.b. /'ʃar.bi.tu/					**!				*		
1.c. /ʃa.'rib.tu/	*! IDENT-STRESS				*				*		
1.d. /'ʃar.b$_{\mu}$.tu/	*! LICENSE-$_{\mu}$				*						
ʃa'rib-t-u											
2.a. ☞/ʃa.'rib.tu/					*						
2.b. /'ʃar.bi.tu/	*!IDENT-STRESS *! MAX-IO['V]		*		**				*		
2.c. /'ʃrib.tu/			*!		*		*	*			

The tableaux in (48-50) show how the words /'ʃa.rib.tu/ 'she drank it' and /ʃa.'rib.tu/ 'I drank it' are derived at the lexical and postlexical levels. Although the same string of segments surface for both words, they differ with regard to stress, which falls on the penultimate and the antepenultimate syllables respectively. The word /'ʃa.rib.tu/ 'she drank it' proves our assumption that high short vowel deletion takes place at the stem and word levels. If high short vowel deletion is a word level process only, the word /ʃarib-it-u/ would surface as */ʃa.'rib.tu/ postlexically.

So far, we have accounted for all cases of initial and non-initial epenthesis and deletion that take place in the grammar of MA. However, there are a group of words in which the unstressed high short vowels are not deleted. Theses words will be discussed in the following section.

5.1.1.2 Problematic Examples

According to the discussion in the previous sections, high short vowels are immune to deletion at the word level if they are stressed at the stem level. This resistance to deletion is achieved by virtue of the constraint MAX-IO['V]. Postlexically, all unstressed high short vowels escape deletion because the constraint MAX-IO outranks the constraint $*i]_{\sigma}$. Although this is generally true, there are words in which the high short vowels have never been stressed, thus they surface postlexically. Consider the examples in (51) below.

(51)

Input	Stem output	Word Output	Postlexical Output	Gloss
a. mudiir	/mu.('diir)/ */m.('diir)/	/mu.('diir)/ */m.('diir)/	/mu.'diir/	manager
b. maliki	/('ma.li).ki/ */('mal).ki/	/('ma.li).ki/ */(mal).ki/	/'ma.li.ki/	queen
c. muḥaafiḍ̣	/mu.('ḥaa).fiḍ̣/ /m.('ḥaa)fiḍ̣/	/mu.('ḥaa).fiḍ̣/ /m.('ḥaa)fiḍ̣/	/mu.'ḥaa.fiḍ̣/	governor
d. rusul-u	/('ru.sul)/	/('ru.su).lu/ */('rus).lu/	/'ru.su.lu/	his messengers

The unstressed high short vowels in the above examples are immune to deletion although they occur in appropriate environments to be syncopated. Accordingly, there is no way in which this behaviour can be justified from a phonological or a morphological point of view. However, these words cannot merely be disregarded. I think these words are governed by standard Arabic phonology rather than MA phonology since they are loan words. This assumption can be proved by examining the following examples.

(52)

Input	output	Gloss
a. muḥaafiḍ̣	/mu.'ḥaa.fiḍ̣/	governor
b. muḥaafiḍ̣	/'mḥaa.fiḍ̣/	to keep doing (something)

Although the words in (52) are derived differently, they have the same input. The difference between them, however, is the fact that the unstressed high short vowel in (52.a) surfaces at the output while it is syncopated in (52.b). This fact about the two different pronunciations supports my assumption about using the phonology of standard Arabic for certain words, as discussed above.

Accounting for the examples in (51) should be done using SA phonology, which is not difficult since SA has no rule that deletes unstressed high short vowels. Accordingly, the constraint MAX-IO should outrank the constraint *i]$_\sigma$ at all levels.

Yet, there is another set of data that is very dialect-specific as the author has never come across such examples in other Levantine dialects or any other surrounding Arabic dialects. These examples are presented in (53) below.

(53)

	Singular		Plural	
	Input	Output	Output	Gloss
1.	a. ʕilb-i	/'ʕil.bi/	/'ʕlabb/ */'ʕi.lab/	can /cans
	b. rikb-i	/'rik.bi/	/'rkabb/ */'ru.kab/	knee /knees
	c. burk-i	/'bur.ki/	/'brakk/ */'bu.rak/	pool /pools
2.	a. ġurf-i	/'ġur.fi/	/'ġu.raf/ */'ġraf/	room / rooms
3.	a. giṭʕ-a	/'giṭ.ʕa/	/'gṭaʕʕ/ ≈ /'gi.ṭaʕ/	piece /pieces

The set of data in (53) is very interesting since it opens a new window that allows us to explore the mysterious notion of the input. Before discussing these examples, it is essential to give a brief overview of the ways in which the canonical shapes /CVCC/ and /CVCCat/ are pluralized in Standard Arabic. According to Ratcliffe (1998: 77-116), the plural of the underived singular masculine nouns of three consonants with no long vowel, i.e. /CVCC/, can be associated almost exclusively with one of four different canonical shapes. This can be seen in (54) below.

(54) Data from Ratcliffe (98 : 77)[7]

Shape	Singular	Plural	Gloss
CaCC	qalb kalb nadʒm	quluub kilaab ʔandʒum	heart dog star
CiCC	θiql	ʔaθqaal	weight
CuCC	qufl	ʔaqfaal ≈ qufuul	lock

The table in (54) shows that singular nouns of the shape /CVCC/ can surface in the plural form as /CuCuuC/, /CiCaaC/, /ʔaCCuC/ or /ʔaCCaaC/. The above forms represent the most common shapes; however, there are other plural forms that can be associated with the singular /CVCC/, i.e. some nouns have two, sometimes more plural forms.

Underived feminine nouns of three consonants, on the other hand, are associated with plural forms in (55). Please note that some nouns can have different plural forms, and I refer to the most common ones only.

(55)

Shape	Singular	Plural	Gloss
CaCCat	dʒabhat farxat	dʒabahaat firaax	face hen
CiCCat	xirqat	xiraq	rag
CuCCat	ġurfat	ġuraf	room

[7] The examples are minimally altered for convenience.

According to the table in (55), singulars of the shape /CVCCat/ surface in the plural form by taking one of three shapes, i.e. /CVCaat/, /CVCaaC/ or /CVCaC/. Of greatest significance to our discussion in this section is the plural shape of the singulars /CiCCat/ and /CuCCat/[8].

Examining the examples from MA in (53) shows that the plural of the singular shape /CiCC-i/ is almost always /CCaCC/ where the last two consonants form a geminate. However, some singulars of the canonical shape /CiCC-i/ surface as /CCaCC/ and /CiCaC/ as in the example in (53.3). Moreover, the example in (53.2) of the shape /CuCC-i/ surfaces as /CuCaC/ and never /CCaCC/. The first impression one gets is that the language is trying to get rid of the high short vowel in open syllables by inserting a consonant to create a heavy syllable. This argument, however, is proved to be invalidated, when considering the rest of the examples since the language allows plurals of the forms /CuCaC/ and /CiCaC/. One might argue that the language differentiates between the deletion of the high short vowels /i/ and /u/ in open syllables, yet this is also incorrect as the language, discussed earlier, deletes both of them when they happen to be in an unstressed open syllable. Therefore, the key to sorting out the problem in these examples lies somewhere else within these tokens. What is peculiar about these examples is that all of them are attached to the feminine suffix.

The question that should be answered to uncover the motive behind the discrepancy in the data in (53) is that, is the feminine suffix part of the stem or is it attached as a suffix to the stem? The answer to this question is very difficult, since almost all the words in (53) and many other words that have the same canonical shape in the language lack the masculine cognate. Thus, the author managed to find one word,

[8] For further information about the formation of the plural in Arabic see McCarthy (1979, 2000); McCarthy and Prince (1986,1990a,b); and Al-Suhaibani (2004) to mention but few.

exemplified in (53.3), which can surface with and without the feminine suffix[9]. In MA, the token in (53.3) in the singular form is used only when attached to the feminine suffix, while in standard Arabic it could be used with and without the feminine suffix, i.e. /qiṭʕ-at/ and /qiṭʕ/[10]. The solution I am proposing is that when the feminine marker is original, i.e. part of the stem /Ci/uCCat/, the plural takes the canonical shape of /CCaCC/ where the last two consonants form a geminate. When, on the other hand, the feminine suffix is attached to the stem, i.e. /Ci/uCC-at/, then the plural is of the canonical shape /Ci/uCaC/. Accordingly, the feminine marker in the examples in (53.1) is original while it is attached to the stem in the example in (53.2). Furthermore, this proposal would assume that the example in (53.3) has two different inputs; in the first one the feminine marker is original and in the second it is attached to the stem[11]. This is a very tentative analysis owing to the lack of data.

The last problematic example to be addressed in this section is the alternating pronunciations of a word like /tiksir-u/ 'she breaks it'. This surfaces in MA as /'tiks.ru/ or /'ti.kis.ru/ in which the former is more common than the latter. This alternation contradicts our argument that MA does not allow internal complex codas, whether antisonority or those which respect sonority. However, there is no apparent reason in the grammar of MA that can explain the motivation behind this alternation. In fact, I could not find any underlying principle that can fully explain this behaviour; however, it seems that the consonant /s/ behaves mysteriously when it happens to be part of a cluster in many languages. In English, for example, initial three consonant clusters should begin

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[9] There might be other words in the language but I could not find but this one.
[10] This word is used in holy Quran in Chapter 11 verse 80.
[11] In MA the plural /giṯaʕ/ usually used to describe pieces that have regular shapes like pieces of land while the form /gṯaʕʕ/ is used to describe pieces that resulted from an accident like when a glass is broken or when a paper is torn off. I am not sure if that means that an interface between semantics and phonology is taking place in such cases. Accordingly, I will leave this phenomenon to future research since it needs more data.

with /s/, as in *splash*. In African American English, moreover, metathesis takes place when /s/ is a part of a coda cluster, as in *ask*, *grasp*, and *gasp*, which surface as /æks/, /græps/ and /gæps/ respectively. Consequently, I suggest further investigations need to take place in order to find the answer about this behaviour in MA that should take into consideration the acoustic proprieties of /s/ sound in MA which I will leave for future research.

5.1.2 Low Short Vowel Deletion

In differential Arabic dialects, the low short vowel /a/ does not undergo syncopation when it occupies the nucleus of an unstressed open syllable. This is in contrast to the high short vowels in the same position. However, the unstressed low short vowel in an open syllable is deleted in many JA dialects under certain conditions. The author managed identify of three different cases in JA in which the low short vowel is deleted.

The first case is a feature of JA Bedouin dialects and many other related Bedouin dialects. In these dialects, the unstressed low short vowel is deleted when it is followed by a nonfinal open syllable. This phenomenon is known as trisyllabic elision, which I considered at the beginning of this chapter.

The second case is widely spread in many JA and Palestinian dialects[12]. In the Ammani dialect, the low short vowel which precedes the feminine suffix /at/ is systematically deleted. This is exemplified in (56) below.

[12] All examples are from the author himself who consulted some native speakers of that dialect since he could not find examples on the literature about this phenomenon in Ammani Arabic.

(56)

		Input	Output	Gloss
1.	a.	katab	/'ka.tab/	he wrote
	b.	katab-t	/ka.'ta.bit/	I wrote
	c.	katab-u	/'ka.ta.bu/	they wrote
	d.	katab-na	/ka.'tab.na/	we wrote
	e.	katab-tu	/ka.'tab.tu/	you (pl.) wrote
	f.	katab-ti	/ka.'tab.ti/	your (f.s) wrote
2.	a.	katab-at	/'kat.bat/	she wrote
	b.	ʔakal-at	/'ʔak.lat/	she ate
	c.	fataḥ-at	/'fat.ḥat/	she opened
3.	a.	ʃaal-at-u	/'ʃaa.la.tu/	she carried him

The above table shows that the unstressed low short vowels in open syllables in (56.1) are not deleted. On the other hand, the same vowel is deleted in the examples in (56.2). The first observation we can make about these examples is that the language does not delete the low short vowel because it is in an unstressed open syllable as is the case for the high short vowels, since /a/ unconditionally appears in the examples in (56.1). Therefore, the deletion of the low short vowel does not take place because of the rule that bans low short vowels in open syllables. Examining the data in (56) reveals that the low short vowel is deleted when the feminine subject morpheme is attached to stems. However, this assumption is not always valid, as shown in the examples in (57).

(57)

Input	Output	Gloss
ʃadʒar-a(t)	/'ʃa.dʒa.ra/	tree
ḥaʃar-a(t)	/'ḥa.ʃa.ra/	insect

The examples in (57) challenge our assumption, since the low short vowel is not deleted in these examples in spite of the presence of the feminine marker. However, recalling our discussion in the previous section about the distinction between the behaviour of the feminine suffix when it is originally part of the stem and when it is suffixed to the stem seems the key to explaining this deletion process. All the tokens in (57) are nouns in which the feminine marker /at/ is originally part of the stem, i.e. underived feminine nouns. By contrast, the examples in (56.2) are verbs where the feminine morpheme is not originally part of the stem. This phenomenon will not be perused further as it is not applicable in MA.

In MA, the unstressed low short vowel is not deleted when followed by the feminine suffix. However, it is deleted systematically owing to another active constraint in the language. Before discussing this process, it is necessary to consider the examples in (58).

(58)

		Input	Output	Gloss
	a.	katab-at	/'ka.ta.bat/	she wrote
	b.	ʔakal-at	/'ʔa.ka.lat/	she ate
	c.	ð̣arab-at	/'ð̣a.ra.bat/	she hit
	a.	'katab-at-ha	/ka.ta.'bat.ha/	she wrote it (f.)
	b.	'ʔakal-at-na	/ʔa.ka.'lat.na/	she ate us
	c.	'ð̣arab-at-hum	/ð̣a.ra.'bat.hum/	she hit them
	a.	'katab-at-u	/'kat.ba.tu/ */ka.ta.'ba.tu/	she wrote it
	b.	'ʔakal-at-u	/'ʔak.la.tu/ */ʔa.ka.'la.tu/	she ate it
	c.	'ð̣arab-at-u	/'ð̣ar.ba.tu/ */ð̣a.ra.'ba.tu/	she hit him

It is clear from the table in (58) that the low short vowel is not deleted when the feminine suffix is attached to a verb, as demonstrated in (58.1) and (58.2). The low short vowel, however, is deleted in the examples in (58.3). The reason for the deletion of the low short vowel is an active constraint in the language which does not allow four successive light syllables in one word. This constraint is presented in (59) below.

(59)
*LIGHT$_{\sigma}$
Assign one violation mark for any sequence of more than three successive light syllables.

The question to be addressed is: which low vowel should be deleted? When considering one of the tokens in (58.3) like /katabat-u/ which after resyllabification is /ka.ta.ba.tu/ it becomes clear which vowel should be deleted once we can figure out which vowels cannot be deleted. Re-considering the examples in (58) show that the object morpheme /u/ is attached to the output of the stem level in which the antepenultimate syllable bears stress. Because stressed vowels cannot be deleted by force of the high ranked constraint MAX-IO['V], the first vowel in /ka.ta.ba.tu/ is rescued.

The object morpheme /u/ is protected by virtue of the constraint RT-ANCHOR, which bans deletion and epenthesis at the right edge of the word. I think there is another active constraint in MA which protects suffixes from being deleted, i.e. a constraint that bans the deletion of a suffix. Such a constraint would then protect the vowel of the feminine morpheme from being deleted.

(60)
MAX-IO-$_{\text{[SUFFIX]}}$
Every suffix in the input must have a correspondent in the output

As a result, the only vowel that remains exposed for deletion is the one that occupies the nucleus of the antepenultimate syllable. Accordingly, the constraint hierarchy in (61) is able to produce the optimal outputs for the examples in (58.3) by virtue of the constraint hierarchy in (61). This partial constraint hierarchy is active at the word level since at the stem level there is no word in MA which might contain more than three light syllables.

(61) Word Level
*LIGHT$_{\sigma}$, MAX-IO[V́] , MAX-IO-$_{[SUFFIX]}$, RT-ANCHOR>> MAX-IO$_{V}$

The tableau in (62) shows the interaction of theses constraints to derive the desired output for the token in (58.3.b).

(62) Word Level

'ʔakalat-u	*LIGHT$_{\sigma}$	MAX-IO['V]	MAX-IO-$_{[SUFFIX]}$	RT-ANCHOR	MAX-IO$_{V}$
a. ☞/('ʔak).la.tu					*
b. /(ʔa.ka).('la.tu)	*!				
c. ('ʔka).la.tu		*!			*
d. ʔa.('kal).tu			*!		*
e. /('ʔa.ka).lat			*!	*!	*

The above tableau concludes our discussion concerning the deletion of the low short vowel in MA. In the following section we will consider cases of long vowel shortening.

5.2 Long Vowel Shortening

Long vowel shortening, as with many other Arabic phonological processes, has been discussed by many researchers[13]. In MA, there are two types of vowel shortening that are relevant to our discussion. The first is closed syllable shortening, in which nonfinal long vowels in closed syllables are reduced when attached to certain suffixes. The second is

[13] For some works that have been conducted on this issue, see the references at the beginning of this chapter.

the shortening of the unstressed long vowels in open syllables. These processes are discussed below under two subheadings.

5.2.1 Closed Syllable Shortening

The table in (63) below examines the word /dʒaab/ when attached to different suffixes. These examples show that shortening in MA takes place only when attached to certain consonantal suffixes. The forms that undergo shortening and those which resist shortening will be discussed in order to find a suitable explanation for both of them.

(63)

Input	Output	Gloss
1. Stem Level Vowel Suffix		
a. dʒaab	/'dʒaab/	he brought
b. dʒaab-at	/'dʒaa.bat/	she brought
c. dʒaab-u	/'dʒaa.bu/	they brought
2. Word Level Suffix		
a. dʒaab-ha	/'dʒaab.ha/	he brought her
b. dʒaab-ki	/'dʒaab.ki/	he brought you (f.s.)
c. dʒaab-na	/'dʒaab.na/	he brought us
d. dʒaab-ak	/'dʒaa.bak/	he brought you
e. dʒaab-l-ha	/'dʒaa.bil.ha/	he brought to her
3. Stem Level Consonantal Suffix		
a. dʒaab-t	/'dʒi.bit/	I brought
b. dʒaab-na	/'dʒib.na/	we brought
c. dʒaab-tu	/'dʒib.tu/	you brought
d. dʒaab-ti	/dʒib.ti/	you (s.f) brought

Scrutinising the examples in (63) shows that when vowel initial-suffixes of any level are attached to a long closed syllable no shortening takes place. Consider the examples in (63.1) and (63.2.d). Furthermore, attaching a consonantal suffix at the word level does not trigger shortening, as can be seen in (63.2). However, shortening is activated when a consonantal or a consonant initial suffix is attached at the stem level, as demonstrated in (63.3). These observations reveal that vowel shortening is a lexical process and that it takes place at the stem level only. Accordingly, it should be assumed that there is a high ranked constraint at the stem level that bans long closed syllables from surfacing. As discussed at the beginning of section (5.1.1), Kiparsky (2003) argues that the constraint *VVC- prevents nonfinal long closed syllables only. However, I think that *VVC- should also prevent sequences like /VV.C_{μ}/ because if such sequences are allowed, the input /dʒaab-na/ 'we brought' would surface as /dʒaa.b_{μ}.na/ at the stem level, i.e. does not undergo vowel shortening.

In order to explain the shortening of the long vowels in (63.3), the constraint *VVC- should outrank the constraint MAX-IO$_{V[LONG]}$ as shown in (64).

(64) Stem Level

dʒaab-na	*VVC-	MAX-IO$_{V[LONG]}$
a. ☞ ('dʒib).na		*
b. ('dʒaab).na	*!	
c. ('dʒaa).b_{μ}.na	*!	

In our discussion in the previous sections, the constraint *VVC- and the constraint MAX-IO$_{V[LONG]}$ were not ranked against each other since the dominance relation between the two constraints was not motivated. Moreover, this dominance hierarchy between the aforementioned constraints would not cause any problem in relation to our analysis in the previous sections, as long as the constraint MAX-IO$_{V[LONG]}$ outranks the constraint *i]$_σ$. Consider the following tableau.

(65) Stem Level

faahim-i	*VVC-	MAX-IO$_{V[LONG]}$	*i]$_σ$
a. ☞ /('faa).hi.mi/			**
b. /('faa).h$_μ$.mi/	*!		*
c. /('faah).mi/	*!		*
d. /('fah).mi/		*!	*

The tableau in (65) shows that violating the constraint *i]$_σ$ is more harmonic than violating the constraints MAX-IO$_{V[LONG]}$ and *VVC-. According to the above discussion, we can make a small refinement to the constraint hierarchy that has been established in (37) above to account for epenthesis and deletion at the stem level. This will explain the shortening of nonfinal long vowels in closed syllables. The new constraint is given in (66) below.

(66) Stem Level
FTBIN, *3$_μ$, ONS, *[ʔC, MAX-IO$_{[C-STEM]}$, *VVC- , RT-ANCHOR >> MAX-IO$_{V[LONG]}$,*COMPLEX$_{ONS}$, *CC- >> *i]$_σ$ >> *COMPLEX$_{CODA}$, MAX-IO >> ALIGN-L, DEP-IO >> LICENSE-$_μ$ >> *SHARED-$_μ$

The constraint MAX-IO$_{V[LONG]}$ outranks the constraint *i]$_σ$ as explained above. Moreover, the constraint MAX-IO$_{V[LONG]}$ is not ranked with respect to the constraints *COMPLEX$_{ONS}$ or *CC-[14]. At the word and postlexical levels, no amendments are required since the constraint *VVC- is demoted, i.e. nonfinal long closed syllables are allowed. However, another constraint is needed to account for the shortening of

[14] In the next section it will be argued that COMPLEX$_{ONS}$ and *CC- should outrank the constraint MAX-IO$_{V[LONG]}$.

unstressed long vowels in open syllables which should outrank the constraint MAX-IO$_{V[LONG]}$. This will be our main focus in the next section.

5.2.2 Shortening of Unstressed Long Vowels in Open Syllables

It is clear from the title that this process of vowel shortening affects long vowels in open syllables when they are unstressed. To see how this phenomenon works, let us first consider the examples in table (67) below.

(67)

	Input	Stem Output	Word Output	Postlexical Output	Gloss
	a. muftaaḥ	/(muf).('taaḥ)/	/(muf).('taaḥ)/	/muf.'taaḥ/	key
	b. ʕaalim	/('ʕaa).lim/	/('ʕaa).lim/	/'ʕaa.lim/	scholar
1.	c. ṣuurat-iin	/(ṣuu).ra.('tiin)/	/(ṣuu).ra.('tiin)/	/ṣuu.ra.'tiin/	two pictures
	d. ʕaalam-iin	/(ʕaa).la.('miin)/	/(ʕaa).la.('miin)/	/ʕaa.la.'miin/	two worlds
	e. ʕaalim-iin	/(ʕaa).li.('miin)/	/(ʕaal).('miin)/	/ʕaal.'miin/	two scholars
	a. baab-iin	/ba.('biin)/	/ba.('biin)/	/ba.'biin/	two doors
2.	b. muftaaḥ-iin	/(muf).ta.('ḥiin)/	/(muf).ta.('ḥiin)/	/muf.ta.'ḥiin/	two keys
	c. ṭaa.buun	/ṭa.('buun)/	/ṭa.('buun)/	/ṭa.'buun/	kiln
3.	a. 'ʃaariʕ-ki	/('ʃaa).riʕ/	/(ʃaa).('riʕ).ki/	/ʃaa.'riʕ.ki/	your (f.s.) street
	b. 'ʕaalam-ha	/('ʕaa).lam/	/(ʕaa).('lam).ha/	/ʕaa.'lam.ha/	her world

The first observation that can be made on the set of data in table (63) is that shortening takes place at the stem level only. In the examples in (67.1) and (67.3), no shortening is allowed. The question is then what motivates shortening in the examples in (67.2.), but not in (67.1) and (67.2)?

As outlined in chapter three, all heavy syllables in a word receive stress, i.e. main or secondary stress. Therefore, I think the process of long vowel shorting in open syllables is a way to avoid stress clash. Accordingly, the constraint *CLASH should outrank the constraint MAX-IO$_{V[LONG]}$ at the stem level, as shown in (68).

(68) Stem Level

ʕaalim	*CLASH	MAX-IO$_{V[LONG]}$
a. ☞/('ʕaa).lim/		
b. /('ʕa.lim)/		*!

This dominance hierarchy between the constraints *CLASH and MAX-IO$_{V[LONG]}$ explains why shortening is not applicable in the examples in (67.1.b-d) but is applicable in the examples in (67.2). Consider the following tableau.

(69) Stem Level

baab-iin	*CLASH	MAX-IO$_{V[LONG]}$
a. ☞/ba.('biin)/		*
b. /(baa).('biin)/	*!	

The example in (67.1.e) escapes deletion by virtue of the constraint hierarchy that has been established in the previous section when accounting for the shortening of nonfinal long closed syllables. Consider the following tableau.

(70) Stem Level

ʕaalim-iin	*VVC-	MAX-IO$_{V[LONG]}$	*i]$_\sigma$
a. ☞ /(ʕaa).li.('miin)/			*
b. /(ʕaa).l$_\mu$.('miin)/	*!		
c. /(ʕal).('miin)/		*!	

Since the constraint *CLASH plays the major role in explaining the shortening of unstressed long vowels, it should be incorporated with the constraints in (70). No dominance relation can hold between the constraint *CLASH and the constraint *VVC-. However, I think the constraint *VVC- outranks the constraint *CLASH by transitivity since the latter can be violated at the stem level while the former is undominated. This is evident by examining a word like /(mis).('taʕ).dʒil/, in which we have two adjacent heavy syllables. Avoiding stress clash in such a word can be achieved by the deletion of a consonant or a vowel, i.e. */('mis).ta.dʒil/ and */('mstaʕ).dʒil/ respectively. Therefore, the following partial constraint hierarchy is established.

(71) Stem Level
*VVC- >> *CLASH >> MAX-IO$_{V[LONG]}$ >> *i]$_\sigma$

(72) Stem Level

ʕaalim-iin	*VVC-	*CLASH	MAX-IO$_{V[LONG]}$	*i]$_\sigma$
a. ☞ /(ʕaa).li.('miin)/				*
b. /(ʕaa).l$_\mu$.('miin)/	*!			
c. /(ʕal).('miin)/		*!	*	
d. /(ʕa.li).('miin)/			*!	*

The constraint hierarchy in (71) is sufficient to produce the desired output at the stem level. The outstanding concern is to combine the aforementioned constraint hierarchy with the constraint hierarchy that has been established to account for epenthesis, deletion and closed syllable shortening at the stem level in (66) above and repeated in (73) for convenience.

(73) Epenthesis, deletion and Closed Syllable shortening (stem level)
FTBIN, *3$_\mu$, ONS, *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, *VVC- , RT-ANCHOR >> MAX-IO$_{V[LONG]}$,*COMPLEX$_{ONS}$, *CC- >> *i]$_\sigma$ >> *COMPLEX$_{CODA}$, MAX-IO >> ALIGN-L, DEP-IO >> LICENSE-$_\mu$ >> *SHARED-$_\mu$

The constraint MAX-IO$_{[C\text{-}STEM]}$ should outrank the constraint *CLASH to optimise /(mis).('taʕ).dʒil/ over */('mis).ta.dʒil/. The constraint *CLASH, moreover, should be outranked by the constraints *COMPLEX$_{ONS}$ and *CC- in order to optimise /(mis).('taʕ).dʒil/ over /('mstaʕ).dʒil/ and /(m$_\mu$.'staʕ).dʒil/. Finally, the constraint

*CLASH outranks the constraint MAX-IO$_{V[LONG]}$, as discussed above. Therefore, the following constraint hierarchy, which accounts for epenthesis, deletion, closed syllable shortening and unstressed long vowel shortening, is established.

(74) Stem Level
FTBIN, *3$_{\mu}$, ONS, *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, *VVC- , RT-ANCHOR >> *COMPLEX$_{ONS}$, *CC- >> *CLASH >> MAX-IO$_{V[LONG]}$ >> *i]$_{\sigma}$ >> *COMPLEX$_{CODA}$, MAX-IO >> ALIGN-L, DEP-IO >> LICENSE-μ >> *SHARED-μ

(75) Stem Level

mistaʕdʒil	FTBIN, *3$_{\mu}$, *[ʔC, ONS , MAX-IO$_{[C\text{-}STEM]}$, , *VVC- , RT-ANCHOR	*CC-	*COMPLEX$_{ONS}$	*Clash	MAX-IO$_{V[LONG}$	*i]$_{\sigma}$	*COMPLEX$_{CODA}$	MAX-IO	ALIGN-L	DEP-IO	LICENSE-μ	*SHARED-μ
1.a.☞/(mis).('taʕ).dʒil/				*								
1.b. /('mstaʕ).dʒil/		*!	*!					*				
1.c. /('mis).ta.dʒil/	!*MAX-IO$_{[C\text{-}STEM]}$							*				
1.d. /m$_{\mu}$.('staʕ).dʒil/		*!						*			*	
ʕaalim-iin												
2.a. ☞/(ʕaa).li.('miin)/						*						
2.b. /(ʕaa).l$_{\mu}$.('miin)/	*! *VVC-							*			*	
2.c. /(ʕal).('miin)/				*!	*							
2.d. /(ʕa.li).('miin)/					*!	*						

The examples in (67.3) show that shortening unstressed long vowels is not active at the word level. To this end, the constraint MAX-IO$_{V[LONG]}$ should outrank the constraint *CLASH. Consider the following tableau.

(76) Word Level

'ʃaariʕ-ki	MAX-IO$_{V[LONG]}$	*CLASH
a. ☞ /(ʃaa).('riʕ).ki/		*
b. /ʃa.('riʕ).ki/	*!	

To account for the word /ʕaalim-iin/ at the word level, the constraint *i]$_{\sigma}$ must outrank the constraints *CLASH and *VVC-, which are not ranked with respect to each other. Consider the following tableau.

(77) Word Level

'ʕaalim-iin	MAX-IO$_{V[LONG]}$	*i]$_{\sigma}$	*VVC-	*CLASH
c. ☞ /(ʕaal).('miin)/			*	*
d. /(ʕaa).li.('miin)/		*!		
e. /(ʕal).('miin)/	*!			*
f. /(ʕa.li).('miin)/	*!	*		

The tableau shows that satisfying the constraints MAX-IO$_{V[LONG]}$ and *i]$_{\sigma}$ is more harmonic than violating the constraints *CLASH and *VVC-. In (77), the constraint MAX-IO$_{V[LONG]}$ outranks the constraint *i]$_{\sigma}$ since the former is undominated at the word level while the latter can be violated if the high short vowel in question has been stressed in the previous stratum. The last point to consider before discussing the postlexical level is the integration of the constraints in (77) with the constraint hierarchy that has been developed to account for epenthesis and deletion at the word level in (41) above and repeated in (78) for convenience.

(78) Epenthesis and deletion (word level)
FTBIN, *3$_{\mu}$, ςς=σ , ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR >> ALIGN-L, *i]$_{\sigma}$ >> *COMPLEX$_{CODA}$, MAX-IO >> *COMPLEX$_{ONS}$ >> *CC- >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$, *VVC-

Since we believe that the constraint MAX-IO$_{\text{V[LONG]}}$ is undominated at the word level, we will keep the same ranking. The constraint *CLASH is not ranked against the constraints *SHARED-$_{\mu}$ and *VVC-. At the same time, it should be outranked by the constraint LICENSE-$_{\mu}$ to optimise /(ʕaal).('miin)/ over /(ʕaa).l$_{\mu}$.('miin)/ at the word level, as shown in (80.1). Accordingly, the following constraint hierarchy, which accounts for epenthesis, deletion, closed syllable shortening and unstressed long vowel shortening at the word, is established.

(79) Word Level
FTBIN, *3$_{\mu}$, ςς=σ , ONS, MAX-IO['V], *[ʔC, MAX-IO$_{\text{[C-STEM]}}$, MAX-IO$_{\text{V[LONG]}}$, RT-ANCHOR >> ALIGN-L, *i]$_{\sigma}$ >> *COMPLEX$_{\text{CODA}}$, MAX-IO >> *COMPLEX$_{\text{ONS}}$ >> *CC- >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$, *VVC-, *CLASH

(80) Word Level

'ʕaalim-iin	FTBIN, *3$_{\mu}$, ςς=σ , ONS, MAX-IO['V], *[ʔC, MAX-IO$_{\text{[C-STEM]}}$, MAX-IO$_{\text{V[LONG]}}$, RT-ANCHOR	ALIGN-L	*i]$_{\sigma}$	*COMPLEX$_{\text{CODA}}$	MAX-IO	*COMPLEX$_{\text{ONS}}$	*CC-	DEP-IO	LICENSE-$_{\mu}$	*SHARED-$_{\mu}$	*VVC-	*CLASH
1.a. ☞/(ʕaal).('miin)/					*					*	*	*
1.b. /(ʕaa).l$_{\mu}$.('miin)/					*				*!			
1.c. /(ʕaa).li.('miin)/			*!									
1.d. /(ʕa.li).('miin)/	*!MAX-IO$_{\text{V[LONG]}}$		*									
'ʃaariʕ-ki												
2.a. ☞/(ʃaa).('riʕ).ki/			*									*
2.b. /ʃa.('riʕ).ki/	*!MAX-IO$_{\text{V[LONG]}}$		*									
2.c. /('ʃaar).ʕ$_{\mu}$.ki/			*		*!				*	*	*	

At the postlexical level, no adjustments are required to the constraint hierarchy, which has been developed to account for epenthesis and deletion at the postlexical level in (45) above and repeated in (81) for convenience, since unstressed long vowel shortening is not active. Accordingly, the constraint hierarchy in (81) accounts for epenthesis, deletion, closed syllable shortening, and unstressed long vowel shortening phenomena. Finally, the constraint *CLASH is not included in the constraint hierarchy since stress is a lexical process.

(81) Epenthesis and deletion (postlexical level)
IDENT-STRESS ,*3$_{\mu}$, LICENSE-$_{\mu}$, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{\text{[C-STEM]}}$, MAX-IO$_{\text{V[LONG]}}$, RT-ANCHOR >> ALIGN-L >> MAX-IO , SONSEQ >> *i]$_{\sigma}$, >> *SHARED-$_{\mu}$, *COMPLEX$_{\text{ONS}}$, *CC- >> DEP-IO, *VVC- >> *COMPLEX$_{\text{CODA}}$

(82) Postlexical Level

ṣuura'tiin	IDENT-STRESS ,*3$_{\mu}$, LICENSE-$_{\mu}$, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{\text{[C-STEM]}}$, MAX-IO$_{\text{V[LONG]}}$, RT-ANCHOR	ALIGN-L	MAX-IO	SONSEQ	*i]$_{\sigma}$	*SHARED-$_{\mu}$	*COMPLEX$_{\text{ONS}}$	*CC-	DEP-IO	*VVC-	*COMPLEX$_{\text{CODA}}$
1.a. ☞/ṣuu.ra.'tiin/											
1.b. /ṣu.ra.'tiin/	*!MAX-IO$_{\text{V[LONG]}}$										
1.c. /ṣuur.'tiin/			*!			*				*	
ʃaa'riʕki											
2.a. ☞ /(ʃaa).('riʕ).ki/					*						
2.b. /ʃa.('riʕ).ki/	*!MAX-IO$_{\text{V[LONG]}}$				*						
2.c. /('ʃaar).ʕ$_{\mu}$.ki/	*! LICENSE-$_{\mu}$		*		*	*					

In the discussion developed so far in this section, we have managed to account for almost all the examples in (67). The example in (67.1.a), however, cannot be handled by our constraint hierarchy. Shortening, as discussed above, is motivated to avoid stress clash, i.e. *CLASH outranks MAX-IO$_{\text{V[LONG]}}$. Thus, the optimal output /(muf).('taaḥ)/ violates the constraint *CLASH and satisfies MAX-IO$_{\text{V[LONG]}}$. To clarify the problem, consider the following tableau.

(83) Stem Level

muftaaḥ	*CLASH	MAX-IO$_{V[LONG]}$
a. ☹/(muf).('taaḥ)/	*!	
b. ☞/('muf).(taḥ)/		*

The first observation one can make is that the long vowel in /(muf).('taaḥ)/ occurs in a final long closed syllable. This satisfies the constraint *VVC- since this constraint prohibits nonfinal long closed syllables only. Earlier we accounted for the shortening of long vowels in open syllables. However, our account cannot rule out the suboptimal candidate in (83.b). To this end, we need a constraint which favours candidate (83.a) over (83.b), i.e. we need a constraint which prohibits the shortening of long closed syllables. I propose the constraint *SHORTENING-$_{V[LONG\ CLOSED]}$ (*SHORT), which requires long vowels in closed syllables to keep their length[15]. The aforementioned constraint should outrank the constraint *CLASH and must be outranked by the constraint *VVC-, as shown in (85).

(84)
*SHORTENING-$_{V[LONG\ CLOSED]}$ (*SHORT)
No shortening is allowed in long closed syllables.

(85) Stem Level

muftaaḥ	*VVC-	*SHORT	*CLASH	MAX-IO$_{V[LONG]}$
a. ☞/(muf).('taaḥ)/			*	
b. /('muf).(taḥ)/		*!		*

[15] I did not use a correspondent constraint like MAX-IO$_{V[LONG\ CLOSED]}$ since at the stem level we refer to an input which has not been syllabified yet, i.e. it is not possible to know if the long vowel occurs in open or closed syllable. The use of such a constraint is possible at the word and postlexical level only. Therefore, I think the constraint *SHORTENING-$_{V[LONG\ CLOSED]}$ is better than the constraint MAX-IO$_{V[LONG\ CLOSED]}$ since it can be used at the three levels.

The tableau in (85) shows that candidate (85.a) surfaces as the optimal output since it satisfies the high ranked constraint *SHORT which is fatally violated by candidate (85.b).

Finally, I do not think that we need to use the constraint *SHORT at the word and postlexical levels because of the undominated nature of the constraint MAX-IO$_{V[LONG]}$ at these levels.

5.3 Conclusion

This chapter was divided into two main sections; the first addressed the issue of vowel deletion while the second explored the phenomena of vowel shortening. The author argued that different JA dialects, in general, belong to the subset of dialects known as differential dialects, which delete unstressed high short vowels in open syllables, although there are cases in which the unstressed low short vowel is deleted. The low short vowel is deleted in JA dialects because of some phonological processes, at least one of which are active in each dialect. In Bedouin JA dialects, the low short vowel is deleted when it is followed by a nonfinal open syllable. In MA, the low short vowel is deleted since the language does not allow sequences of more than three light syllables.

The second main section has dealt with vowel shortening, in which the author argued that there are two types of vowel shortening in MA that are active at the stem level only. Long closed syllables are shortened in nonfinal positions to satisfy the constraint *VVC-, while long vowels in open syllables are shortened to avoid stress clash.

6 Geminates

An extensive range of material can be found on the nature of geminates (Swadesh, 1937; Hockett, 1955; Delattre, 1971; Ladefoged, 1971; Kenstowicz and Pyle, 1973; Guerssel, 1978; McCarthy, 1979; Leben, 1980; Browman and Goldstein, 1986, 1990; Schein and Steriade 1986; Miller, 1987; Odden, 1988; Hayes, 1989; Goldsmith, 1990), to mention but a few. Generally, these works fall into two broad categories with regard to the representation of geminates. The first point of view represents geminates as a monosegmental unit while in the second, geminates are regarded as a bisegmental unit. This discrepancy between phonologists on the nature of geminates resultes from the ambiguous behaviour of geminates crosslinguistically.

Delattre (1971), who treats gemination in terms of syllable structure, believes that gemination is a process of consonant rearticulation that differentiates it from long segment, i.e. geminates have two phases in their articulation while long segments do not. According to him, the geminate is a cluster of two identical consonants in which the first one forms the coda of a syllable and the second occupies the onset of a following syllable. Ladefoged (1971), on the other hand, argues that geminates are long segments, i.e. monosegmental. He supports his argument by giving examples from Italian, where a long consonant like *fatto* [fat:o] “done” contrasts with a short one as in *fato* [fato] “fate”. A combination of the two points of view was proposed by McCarthy (1979) and Leben (1980) using an autosegmental analysis. In their view, geminates are analysed as single segments mapped onto two skeletal slots. Within the frame work of moraic theory, as argued by Hyman (1985) and Hayes (1989), geminates are intrinsically moraic. This is what distinguishes them from a sequence of consonants.

Geminate inalterability and inseparability are well documented in the literature (Kenstowicz & Pyle 1973; Guerssel 1978; Schein & Steriade 1986; Hayes 1986; Itô 1986; Kenstowicz 1994). Kenstowicz and Pyle (1973) defined two main properties regarding the structure of geminates; the immunity of geminates to vowel epenthesis '*inseparability*' is the first feature while the second, which is known as *inalterability*, refers to the resistance of one half of the geminate to undergo a phonological rule that leaves the other half intact. Inalterability of geminates is usually exemplified by the spirantization process which takes in Biblical Hebrew, as can be seen in (1). Spirantization turns a postvocalic stop into a fricative but it is blocked when the stop is a geminate.

(1)

	Input	Output	Gloss
a.	katab	kaθav	write
b.	gibbor	gibbor	hero

6.1 Geminates in Arabic

Geminates in Arabic are found in biliteral verbs in which the last consonant is a geminate, as shown in (2).

(2) Biliteral verbs

Consonantal Root	Input	Output	Gloss
a. ʃd	ʃadd	ʃadd	stretched
b. md	madd	madd	extended
c. sm	samm	samm	poisoned

The second type of geminates are those which are morphologically driven. This type of geminate is exemplified by the formation of causative verbs in Arabic, as can be seen in (3) below.

(3) Causative Verbs

Verb	Causative	Gloss
a. ka.tab	kat.tab	cause to write
b. da.ras	dar.ras	cause to study
c. ʃa.rib	ʃar.rab	cause to drink

However, it is not always clear whether geminates that appear in nouns are derived or underlying. There are some obvious cases where geminates are derived when the definite article /il/ is assimilated with the following coronal consonants, as demonstrated in (4) below.

(4)

a. il-ʃams	/ʔiʃ.ʃams/ ≈ /ʃʃams/	the sun
b. il-naar	/ʔin.naar/ ≈ /nnaar/	the fire

The above examples show that the definite article assimilates with the following consonants, which results in creating a geminate. Another well-known example, in which geminates are considered to be derived in nouns, is in the formation of instrumental nouns. Instrumental nouns are believed to be morphologically derived from form I verbs and sometimes from nouns by geminating the second radical and lengthening the following vowel, as can be seen in table (5) below.

(5)

a. ġa.sal	to wash	ġas.saa.li	washing machine
b. ʕa.ṣar	to squeeze	ʕaṣ.ṣaa.ra	squeezer

In other cases, moreover, geminates are employed to satisfy the minimal word requirement, i.e. bimoraic, like in /ʔabb/ 'father' and /ʔaxx/ 'brother'. Consider the examples in (6) below.

(6)

Input	Output	Gloss
a. ʔab[1]	ʔabb	father
b. ʔax	ʔaxx	brother
c. ʔab-uu-na	ʔa.buu.na	our father
d. ʔax-uu-na	ʔa.xuu.na	our brother

As can be noticed from the examples in (6), the unsuffixed forms undergo gemination, while those in (6.c) and (6.d) do not since they satisfy the minimal word requirement. This becomes clear when comparing the examples in (7) below, in which geminates are believed to be underlying with the examples in (6) where geminates are derived.

(7)

Input	Output	Gloss
a. ʔumm	ʔumm	mother
b. ʕamm	ʕamm	uncle
c. ʔumm-i	ʔum.mi	my mother
d. ʕamm-i	ʕam.mi	my uncle

[1] The actual input for (6.a-b) might be /ʔabw/ and /ʔaxw/ respectively where /w/ is deleted and the previous consonant is geminated to satisfy the minimal word requirement.

The examples in (7) represent underlying geminates in final and medial positions. There are other cases in which medial geminates surface in nouns in Arabic, like the ones in (8).

(8)

Input	Output	Gloss
a. dukkaan	duk.kaan	shop
b. dabbuur	dab.buur	wasp

The examples in (2-8) above show that gemination is a wide spread phenomenon in Arabic. It is obviously beyond the scope of this thesis to account for every single case. However, in the following sections we will account for some of the main features of geminates in MA.

6.1.1 Geminates in MA

Before analysing geminates in MA, it is necessary to give some examples which are very similar to those in (2-8) above.

(9) Geminates in MA

	Input	Output	Gloss
1.	a. ʃadd	/'ʃadd/ */'ʃa.did/ */'ʃad/	fasten
	b. madd	/'madd/ */'ma.did/ */'mad/	extended
2.	a. ʃadd-u	/'ʃad.du/	he fastened him
	b. madd-at	/'mad.dat/	she extended
3.	a. ʃadd-na	/'ʃadd.na/ */'ʃa.did.na/ */'ʃad.na/	he fastened us
	b. madd-ki	/'madd.ki/ */'ma.did.ki/ */'mad.ki/	he extended you (f.s)
4.	a. sakkir-i	/'sakk.ri/ */'sak.ri/	close (imperative) (f.s.)
	b. muddaris-i	/'mdarr.si/ */'mdar.si/	teacher (f.)

The examples in (9) show that geminates are immune to epenthesis, i.e. inseparable. The inseparability of geminates is not specific to MA, since most languages respect the integrity of geminates (cf. Kenstowicz and Pyle, 1973).

Moreover, degemination does not take place in MA in contrast to other Arabic dialects such as Iraqi Arabic. Consider the following examples from Iraqi Arabic (Broselow, 1980:15).

(10) Iraqi Arabic (Broselow, 1980:15)

Input	Output	Gloss
a. dazz	/daz/	he sent
b. dazz-u	/daz.zu/	he sent it
c. dazz-l-a	/daz.la/	he sent to him
d. dazz-l-ha	/daz.zil.ha/	he sent to her

The examples in (10) show that degemination takes place in Iraqi Arabic because tautosyllabic geminates are not allowed. In MA, by contrast, tautosyllabic and heterosyllabic geminates are allowed.

Finally, the example in (9.4.b) shows that unstressed high short vowels are deleted after geminates. This type of deletion proves that the /r/ in the aforementioned example is a geminate, as if they were considered a sequence of identical consonants, then we would end up having a medial three-consonant cluster which motivates postlexical epenthesis.

To account for the examples in (9), we need two essential constraints. The first constraint preserves the integrity of geminates, i.e. prevents epenthesis, while the second prevents degemination from taking place. These constraints are given in (11) and (12) respectively.

(11)
GEMINATE-INTEGRITY (GEM-INTEG) (Kenstowicz and Pyle, 1973)
Geminates are inseparable (a vowel cannot be inserted into a geminate).

(12)

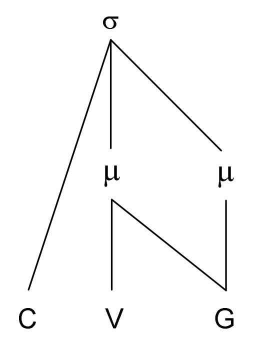
LINKFAITH (Watson, 2007)

If the number of syllable positions linked to S_I = n, and S_I R S_O, then the number of syllable positions linked to S_O = n.

The function of the constraint GEM-INTEG is to prevent epenthesis from separating a geminate. The aforementioned constraint is undominated in the grammar of MA. As far as I am aware, this is the case in most, if not all, Arabic dialects. Since geminates are long segments, they cannot be separated by epenthesis; however, their length can be shortened. Accordingly, degemination is a process of consonant shortening rather than of consonant deletion.

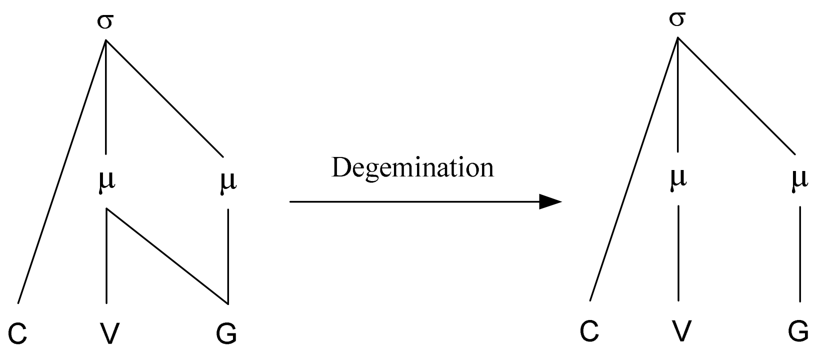
Watson (2007: 352) argues that the tautosyllabic geminate in Arabic '*both shares a mora with the preceding vowel and exclusively occupies a mora within the same syllable*'. This is proved phonetically, since a geminate consonant that follows a short vowel is longer than a simplex consonant (cf. Section 4.3.1). Therefore, the following representation is assumed for syllables of the shape /CVG/.

(13) Tautosyllabic Geminates



Tautosyllabic geminates violate the constraint *SHARED-$_\mu$. When a geminate undergoes the process of degemination, it is shortened, i.e. it no longer shares a mora with the preceding vowel. Consider the following representations.

(14) Degemination



To this end, I follow (Watson, 2007) in assuming that degemination violates the constraint LINKFAITH, while maintaining the geminate causes a violation of the constraint *SHARED-$_{\mu}$. Since degemination is not active in MA, the constraint LINKFAITH outranks the constraint *SHARED-$_{\mu}$. The above argument can account for the examples in (9.1-3). Consider the following tableau.

(15) Lexical Levels

ʃadd-na	GEM-INTEG	LINKFAITH	*SHARED-$_{\mu}$
a. ☞/('ʃadd).na/			*
b. /ʃa.('did).na/	*!		
c. /('ʃad).na/		*!	

This shows that candidate (15.a) surfaces as the optimal output since it satisfies the high ranked constraints GEM-INTEG and LINKFAITH. Candidate (15.b) fatally violates the top ranked constraint GEM-INTEG by epenthesizing a vowel. Finally, candidate (15.c) is ruled out by violating the constraint LINKFAITH.

To account for the examples in (9.4), we need the constraint *i]$_{\sigma}$ since the unstressed high vowels are deleted. The deletion of the high short vowels after the geminates in (9.4) changes the heterosyllabic geminates into tautosyllabic ones. No dominance relation can be established between the constraint *i]$_\sigma$ and the constraint LINKFAITH; however, I think the former outranks the latter, as will be discussed shortly.

(16) Lexical Levels

mudarris-i	GEM-INTEG	*i]$_\sigma$	LINKFAITH	*SHARED-$_\mu$
a. ☞/'mdarr.si/		*		*
b. /'mdar.si/		*	*!	
c. /'mdar.ri.si/		**!		

The constraint *i]$_\sigma$ outranks the constraint LINKFAITH by transitivity since the former outranks the constraint LICENSE-$_\mu$ as discussed in the previous chapters. The constraint LICENSE-$_\mu$ is not ranked with respect to the constraint LINKFAITH; therefore, the constraint *i]$_\sigma$ outranks the constraint LINKFAITH, as shown in (17).

(17) Lexical Levels

mudarris-i	GEM-INTEG	*i]$_\sigma$	LICENSE-$_\mu$	LINKFAITH	*SHARED-$_\mu$
a. ☞/'mdarr.si/		*			*
b. /'mdar.si/		*		*!	
c. /'mdar.ri.si/		**!			
d. /'mda.rr$_\mu$.si/		*	*!		

The above argument is able to derive the desired outputs at the lexical levels. At the postlexical level, the constraints LICENSE-$_\mu$ and GEM-INTEG are not ranked with respect to each other. Accordingly, the following constraint hierarchy is established.

(18) Postlexical Level
LICENSE-$_\mu$, GEM-INTEG >> *i]$_\sigma$ >> LINKFAITH >> *SHARED-$_\mu$

(19) Postlexical Level

'ʃadd	LICENSE-$_\mu$	GEM-INTEG	*i]$_\sigma$	LINKFAITH	*SHARED-$_\mu$
a. ☞ /'ʃadd/					*
b. /'ʃad/				*!	
c. /'ʃa.dd$_\mu$/	*!				
d. /'ʃa.did/		*!			

To this end, we have accounted for the examples in (9) above, where we argued that epenthesizing a vowel to separate a geminate is not tolerated in MA. Moreover, it has been argued that degemination is not allowed since the constraint LINKFAITH outranks the constraint *SHARED-$_\mu$ at all levels in MA (cf. Watson, 2007).

In the next section, we will discuss a problematic set of examples where long vowels are followed by geminates. A long closed syllable that is closed by a geminate is problematic since it violates the undominated constraints on foot and syllable binarity in MA.

6.2 Problematic Examples

In MA, as is the case in some other Levantine dialects, final and nonfinal long closed syllables which are closed by geminates surface at the postlexical level. Consider the following examples from MA.

(20)

Output	Gloss
a. /'zaatt/	he threw
b. /'ʕaadd/	he fasten
c. /'maadd/	he extended
d. /'zaatt.hum/	he threw them
e. /'ʕaadd.na/	he fastened us
f. /'maadd.kin/	he extended you (f.pl.)
g. /ʕaad.'dil.hin	he is fastening for them (f.pl.)

In the examples in (20), I deliberately did not include the inputs since they are crucial for our discussion. I think the surface geminates in the above examples are fake, i.e. they result from the deletion of vowels between identical consonants[2]. The inputs for /zaatt/, /ʕaadd/ and /maadd/ are /zaatit/, /ʕaadid/ and /maadid/ respectively. This assumption is evident when the following points are considered:

a. In Palestinian Arabic, words like /zaatt/, /ʕaadd/ and /maadd/ surface as /zaa.tit/, /ʕaa.did/ and /maa.did/ respectively (cf. Abu-Salim, 1982). In AJ, moreover, the same words surface as /zaat/, /ʕaad/ and /maad/, while in nonfinal positions they surface as /zaa.tit.hum/ /ʕaa.did.na/ and /maa.did.hum/ (cf. AbuAbbas, 2003). The above examples from Palestinian and AJ will be discussed later on in this chapter; however, the main point I am trying to demonstrate here is that the consonants in these examples are not geminates since geminates are inseparable (cf. Kenstowicz & Pyle 1973).
b. If we assume that the inputs for the examples in (20) is /CVVG/, it should surface as /CVG/ when they happen to be in nonfinal position owing to the ban

[2] A similar argument has been proposed by AbuAbbas (2003).

on long closed syllables at the stem level (cf. Section 5.2). In other words, if the input for a word like /maad.diin/ is /maadd-iin/ then the output at the stem level should be */mid.diin/ since nonfinal long closed syllables are shortened and raised. Consider the following examples:

(21)

input	output	Gloss
dʒaab-t	/dʒibit/	I brought
ʃaaf-na	/ʃuf.na/	we saw

The examples in (21) show that the vowels of nonfinal long closed syllables at the stem level are shortened and raised. To this end, we cannot claim that /maadd-iin/ is the input for /maad.diin/. On the contrary, the input should be /maadid-iin/, which surfaces at the stem level as /maa.di.diin/. At the word level, the unstressed high short vowel is deleted and the word surfaces as /maad.diin/. Postlexically, no change is required.

Furthermore, if we assume that the input for /maad.'diin/ is /CVVG-iin/ and that long syllables which are closed by a geminate escape the process of long closed syllable shortening, stress should fall on the penultimate syllable, i.e. /'maad.ddin/. The penultimate syllable should receive stress because it is heavier than the ultimate syllable, i.e. nonfinal /CVVG/ is trimoraic since geminates are underlyingly moraic.

c. In the example in (20.g), the epenthetic vowel /i/ is stressed. In chapter four, it was clearly stated that epenthetic vowels which are inserted lexically are stressed. Moreover, it has been argued that medial lexical epenthetic vowels are inserted to break up the sequence of four-consonant clusters as in /katab-t-l-ki/, which surfaces as /ka.tab.'til.ki/. Therefore, I suggest that the insertion of the vowel between /d/ and /l/ in /ʕaad.'dil.hin/ is motivated by the same fact, i.e. to break up the four consonants in /ʕaadd-l-hin/[3].

To summarise, I suggest that the inputs for the examples in (20) are /CVVCVC/, in which the high short vowel between the identical consonants is deleted at the word level. Accordingly, the input /maadid-hum/ surfaces at the word level as /maad.d_{μ}.hum/. At the postlexical level, /maad.d_{μ}.hum/ surfaces as /maadd.hum/. Finally, lexical epenthesis in the example in (20.g) supports our assumption that the double consonants in the above examples are not true geminates.

6.2.1 The Analysis

Two main consequences result from proposing that the geminates in the examples in (20) are fake, since true geminates are monosegmental and underlyingly moraic while fake geminates are sequences of identical consonants which are assigned moras by virtue of the constraint Weight-By-Position (cf. Section 3.1.1). The first observation is concerned with the permission of internal coda clusters, while the second is concerned with syllable binarity. Internal coda clusters are prohibited in many Arabic dialects, including the one under investigation. However, this prohibition is violated when it comes to sequences of identical consonants, since the constraint that does not allow high short vowels between such sequences is ranked above that forbids internal coda clusters. Syllable binarity, moreover, is subject to the same argument, i.e. the constraint that requires moras to be licensed by syllables is ranked over the constraint that prohibits trimoraic syllables. However, this is not the case in all dialects. Therefore, in this section I will begin by

[3] In MA, no epenthetic vowel is inserted after true geminates as in /ʔumm-kum/ which surfaces as /ʔumm.kum/. If the /m/ in /ʔumm.kum/ is not a geminate then a vowel should be inserted postlexically as in /gul-t-lu/ which surfaces as /gu.lit.lu/.

accounting for the sequence of two identical consonants in MA. I will then account for the same phenomenon in other dialects.

It is necessary to consider the following examples from MA before starting our analysis.

(22) Data from MA

Input	Stem Output	Word Output	Postlexical Output	Gloss
a. /zaatit/	/'zaa.tit/	/'zaat.t_{μ}/	/'zaatt/ (μμ)	he threw
b. /ʃaadid/	/'ʃaa.did/	/'ʃaad.d_{μ}/	/'ʃaadd/ (μμ)	he fasten
c. /maadid-iin/	/maa.di.'diin/	/maad.'diin/	/maad.'diin/ (μμ)	they extended
d. /zaatit-hum/	/'zaa.tit/	/'zaat.t_{μ}.hum/	/'zaatt.hum/ (μμμ)	he threw them
e. /ʃaadid-na/	/'ʃaa.did/	/'ʃaad.d_{μ}.na/	/'ʃaadd.na/ (μμμ)	he fastened us
f. /maadid-kin/	/'maa.did/	/'maad.d_{μ}.kin/	/'maadd.kin/ (μμμ)	he extended you (f.pl.)

The table shows that the high short vowels between identical consonants are only deleted at the word level. Although medial unlicensed moras motivate vowel epenthesis at the postlexical level, they are blocked when there is a cluster of identical consonants. To account for the aforementioned fact, we need the constraint $*V_{[C_iC_i]}$, introduced in (23) below, which bans high short vowels from separating two identical consonants. The constraint $*V_{[C_iC_i]}$ is violated at the stem level but not at the word and postlexical levels.

(23)
$*V_{[C_iC_i]}$
No short vowel is allowed between two identical consonants.

The constraint $*V_{[C_iC_i]}$ is violated when a short vowel is maintained or epenthesized between two identical consonants. Accordingly, the aforementioned constraint is violated if two identical consonants are separated by a low vowel or if they belong to two different morphemes; however, this is not always the case. Consider the following examples.

(24)

	Input	Output	Gloss
1.	a. xalal	/'xa.lal/	defect
	b. malal	/'ma.lal/	boredom
2.	a. sakat-t	/sa.'ka.tit/	I kept silent
	b. maʕaṭ-t	/ma.'ʕaṭ.it/	I tore

According to the above table, there are two cases where a short vowel is not deleted when it occurs between two identical consonants: the first is when the vowel in the position under question is a low short vowel, as demonstrated in the examples in (24.1); the second is exemplified by (24.2), where a high short vowel is epenthesized between two identical consonants that belong to two different morphemes.

The examples in (24.1) can be accounted for in one of two ways. The first is by proposing a constraint that prohibits the deletion of the low short vowel. This constraint is given in (25) below.

(25)
MAX-IO$_a$
Every low short vowel in S_1 has a correspondent in S_2. (No deletion of low short vowels)

Ranking MAX-IO$_a$ over the constraint $*V_{[C_1C_1]}$ allows the low short vowel to surface in forms like /C_1aC_1/. However, I do not think a new constraint is needed to account for this fact, rather it is necessary to make the constraint $*V_{[C_iC_i]}$ more specific by altering this constraint to read as no high short vowel is allowed between two identical consonants, as can be seen in (26) below.

(26)
$*i_{[CiCi]}$
No high short vowel is allowed between two identical consonants.

The author prefers the second alternative since there is no need to use two constraints as long as the desired output can be achieved by using one. However, the new constraint $*i_{[CiCi]}$ cannot account for the examples in (24.2), where the high short vowel /i/ appears between two identical consonants at the surface structure. This is of course due to the fact that the two identical consonants belong to two different morphemes. Once more, we do not need a new constraint to account for this behaviour. Rather we need to alter the constraint $*i_{[CiCi]}$ so it can distinguish between sequences of identical consonants that belong to one morpheme and those belong to two. This constraint is given in (27).

(27)
$*i_{[CiCi]\mathrm{MORPH}}$
No high short vowel is allowed between two identical consonants in the same morpheme.

The function of the constraint $*i_{[CiCi]\mathrm{MORPH}}$ is to prevent the high short vowel from surfacing between two identical consonants when they belong to the same morpheme. Therefore, when a low short vowel appears between two identical consonants, or when a high short vowel is epenthesized between two identical consonants which belong to two morphemes, the constraint $*i_{[CiCi]\mathrm{MORPH}}$ is not violated.

In order to account for the data in (22), the constraint $*i_{[CiCi]\mathrm{MORPH}}$ should be incorporated with the constraint hierarchy that has been established in the previous chapter to account for epenthesis, deletion, closed syllable shortening and unstressed long vowel shortening, since we are dealing with cases of vowel deletion. However, in what follows, I will only use the most relevant constraints.

At the stem level, the constraint $*i_{[CiCi]\mathrm{MORPH}}$ should be outranked by the constraints $*3_{\mu}$, MAX-IO$_{[\text{C-STEM}]}$ and *VVC-. Moreover, no dominance relation can hold between the constraint *i$_{[C\textit{i}C\textit{i}]MORPH}$ and the constraint LICENSE-$_{\mu}$. These facts are depicted in tableau (28) below.

(28) Stem Level

ʃaadid	*3$_{\mu}$	MAX-IO$_{[C\text{-}STEM]}$	*VVC	*i$_{[C\textit{i}C\textit{i}]MORPH}$	LICENSE-$_{\mu}$
a. ☞/'ʃaa.did/				*	
b. /'ʃaad.d$_{\mu}$/			*!		*
c. /'ʃaad/		*!			
$\mu\mu\mu$ d. /'ʃaadd/	*!				

The optimal output (28.a) minimally violates the constraint *i$_{[C\textit{i}C\textit{i}]MORPH}$, while the suboptimal candidates (28.b-d) fatally violates the constraints *VVC-, MAX-IO$_{[C\text{-}STEM]}$ and *3$_{\mu}$ respectively.

We can account for the example in (22.c) by using the same constraint. However, I think we need the constraint *i]$_{\sigma}$,which outranks the constraint *i$_{[C\textit{i}C\textit{i}]MORPH}$ by transitivity, since the former outranks the constraint LICENSE-$_{\mu}$, as discussed in the previous chapters.

(29) Stem Level

maadid-iin	*3$_{\mu}$	MAX-IO$_{[C\text{-}STEM]}$	*VVC	*i]$_{\sigma}$	*i$_{[C\textit{i}C\textit{i}]MORPH}$	LICENSE-$_{\mu}$
a. ☞/maa.di.'diin/				*	*	
b. /maad.'diin/			*!			
c. /maa.d$_{\mu}$.'diin/			*!			*

In the above tableau, a suboptimal candidate like */mad.diin/ is ruled out by the constraint MAX-IO$_{V[LONG]}$. To this end, we are able to account for the data in (22) at the stem level. The final constraint hierarchy at the stem level is given in (30) below.

(30) Stem Level
FTBIN, *3$_{\mu}$, ONS, *[ʔC, MAX-IO$_{[C\text{-STEM}]}$, *VVC- , RT-ANCHOR >> *COMPLEX$_{ONS}$, *CC- >> *CLASH >> MAX-IO$_{V[LONG]}$ >> *i]$_{\sigma}$ >> *COMPLEX$_{CODA}$, MAX-IO >> ALIGN-L, DEP-IO >> *i$_{[CiCi]MORPH}$, LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$

At the word level, the constraint *VVC- is demoted since nonfinal long closed syllables are allowed. Moreover, the constraint *i$_{[CiCi]MORPH}$ is not ranked against the other undominated constraints since it cannot be violated at this level. Accordingly, the following constraint hierarchy is established at the word level.

(31) Word Level
*3$_{\mu}$, MAX-IO$_{[C\text{-STEM}]}$,*i$_{[CiCi]MORPH}$ >> *i]$_{\sigma}$ >> LICENSE-$_{\mu}$ >> *VVC

(32) Word Level

'zaatit-hum	*3$_{\mu}$	MAX-IO$_{[C\text{-STEM}]}$	*i$_{[CiCi]MORPH}$	*i]$_{\sigma}$	LICENSE-$_{\mu}$	*VVC
a. ☞/'zaat.t$_{\mu}$.hum/					*	*
b. /'zaatt.hum/ (μμμ)	*!					*
c. /'zaa.tit.hum/			*!			
d. /'zaa.ti.hum/		*!		*		
e. /'zaat.hum/		*!				*

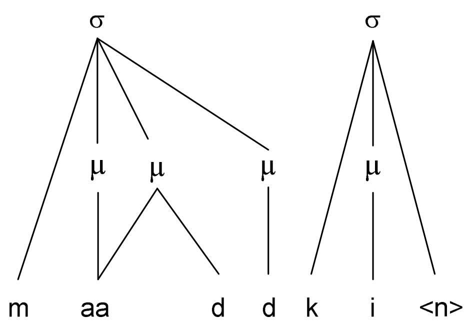
The tableau shows that keeping a high short vowel between two identical consonants is not tolerated at the word level; therefore, candidate (32.c) is ruled out. Violating the constraints *3$_{\mu}$ or MAX-IO$_{[C\text{-STEM}]}$ is not tolerated either; accordingly, candidates (32.b) and (32.d-e) fatally violate the aforementioned constraints. The winning candidate minimally violates the low ranked constraints LICENSE-$_{\mu}$ and *VVC.

At the word level, the final constraint hierarchy that can account for epenthesis, deletion, closed syllable shortening, unstressed long vowel shortening and the deletion of high short vowels between identical consonants is given in (33).

(33) Word Level
FTBIN, *3$_{\mu}$, ςς=σ , ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[\text{C-STEM}]}$, MAX-IO$_{\text{V[LONG]}}$, RT-ANCHOR , *i$_{[\text{C}i\text{C}i]\text{MORPH}}$ >> ALIGN-L, *i]$_{\sigma}$ >> *COMPLEX$_{\text{CODA}}$, MAX-IO >> *COMPLEX$_{\text{ONS}}$ >> *CC- >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$, *VVC-

At the postlexical level, semisyllables are absolutely prohibited in MA; therefore, every unlicensed mora should be properly syllabified, i.e. they should belong to a syllable. Unsuffixed words like /maadd/ and /zaatt/ present no problem to syllable binarity since final coda consonants are moraless, while the second to final consonants share a mora with the preceding long vowels. By contrast, nonfinal long syllables which are closed by a fake geminate like /maadd.kin/ and /ʕaadd.na/ violate syllable binarity, i.e. they are trimoraic syllables. The penultimate consonant shares a mora with the previous long vowel, while the final consonant receives a mora by virtue of the constraint Weight-By-Position. Accordingly, a word like /maadd.kin/ consists of a trimoraic syllable followed by a monomoraic syllable, as shown in (34) below.

(34)



Accounting for the surfacing of trimoraic syllables at the postlexical level requires a dominance relation between the constraints LICENSE-$_{\mu}$ and *3$_{\mu}$, in which the former outranks the latter. This is shown in (35) below.

(35) Postlexical Level

'maadd-kin	LICENSE-$_{\mu}$	*3$_{\mu}$
μμμ a. ☞/'maadd.kin/		*
b. /'maad.d$_{\mu}$.kin/	*!	

Ranking the constraint LICENSE-$_{\mu}$ over the constraint *3$_{\mu}$ optimises candidate (35.a) over candidate (35.b). Adding a candidate like */maad.kin/ requires a dominance relation between the constraint *3$_{\mu}$ and the constraint MAX-IO$_{[\text{C-STEM}]}$ in which the latter outranks the former, as shown in (36). Moreover, the constraint *i$_{[\text{C}i\text{C}i]\text{MORPH}}$ is undominated at the postlexical level.

(36) Postlexical Level

'maadd-kin	LICENSE-$_{\mu}$	*i$_{[\text{C}i\text{C}i]\text{MORPH}}$	MAX-IO$_{[\text{C-STEM}]}$	*3$_{\mu}$
μμμ a. ☞/'maadd.kin/				*
b. /'maad.d$_{\mu}$.kin/	*!			
c. /'maad.kin/			*!	
d. /'maa.did.kin/		*!		

The problem that now requires a solution is, to what degree can we demote the constraint *3$_{\mu}$. I think the aforementioned constraint should outrank the constraint *SHARED-$_{\mu}$ to optimise the analysis of nonfinal syllables of the shape /CVVC/ as bimoraic rather than trimoraic. Consider the following tableau.

(37) Postlexical Level

'dʒaar-na	*3$_{\mu}$	*SHARED-$_{\mu}$
μμ a. ☞/'dʒaar.na/		*
μμμ b. /'dʒaar.na/	*!	

The constraint $*3_\mu$ should be outranked by the constraint $*i]_\sigma$ in order to rule out candidates in which a vowel is epenthesized after the second identical consonants. Consider the following tableau

(38) Postlexical Level

'maadd-kin	LICENSE-μ	$*i_{[CiCi]MORPH}$	MAX-IO$_{[C\text{-}STEM]}$	$*i]_\sigma$	$*3_\mu$	*SHARED-μ
a. ☞/'maadd.kin/ (μμμ)					*	*
b. /'maad.d$_\mu$.kin/	*!					*
c. /'maad.kin/			*!			*
d. /'maa.did.kin/		*!				
e. /'maad.di.kin/				*!		*

At the postlexical level, the constraint SONSEQ plays a major role in prohibiting complex codas. Accordingly, it should be incorporated with the constraint hierarchy that has been developed so far. In the previous chapter, it was argued that the constraint SONSEQ outranks the constraint $*i]_\sigma$ by transitivity, since the former constraint is not ranked with respect to the constraint MAX-IO which outranks the constraint $*i]_\sigma$ (cf. Section 5.1.1.1). However, the constraint $*i]_\sigma$ should outrank the constraint SONSEQ to optimise /maadd.kin/ over /maad.di.kin/. Moreover, no dominance relation can hold between the constraints SONSEQ and $*3_\mu$. Consider the following tableau.

(39) Postlexical Level

'maadd-kin	LICENSE-μ	*i$_{[CiCi]MORPH}$	MAX-IO$_{[C-}$	*i]$_{\sigma}$	SONSEQ	*3$_{\mu}$	*SHARED-μ
a. ☞/'maadd.kin/ ($\mu\mu\mu$)					*	*	*
b. /'maad.d$_{\mu}$.kin/	*!						*
c. /'maad.kin/			*!				*
d. /'maa.did.kin/		*!					
e. /'maad.di.kin/				*!			*

Integrating the constraint hierarchy that has been established so far with the constraint hierarchy that has been developed in the previous chapter to account for epenthesis, deletion, closed syllable shortening and unstressed long vowel shortening at the postlexical level yields the following constraint hierarchy.

(40) Postlexical Level
IDENT-STRESS , LICENSE-μ , ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C-STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR , *i$_{[CiCi]MORPH}$ >> ALIGN-L >> MAX-IO >> *i]$_{\sigma}$ >> SONSEQ , *3$_{\mu}$ >> *SHARED-μ , *COMPLEX$_{ONS}$, *CC- >> DEP-IO, *VVC- >> *COMPLEX$_{CODA}$

The above constraint hierarchy accounts for epenthesis, deletion, closed syllable shortening, unstressed long vowel shortening and the deletion of high short vowels between identical consonants at the postlexical level. Moreover, the aforementioned constraint hierarchy allows the violation of syllable binarity only in the case discussed above. Consider the following examples.

(40) Postlexical Level

'dʒaab-l-ha	IDENT-STRESS, LICENSE-$_{\mu}$, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR, *i$_{[CiCi]MORPH}$	ALIGN-L	MAX-IO	*i]$_{\sigma}$	SONSEQ	*3$_{\mu}$	*SHARED-$_{\mu}$	*COMPLEX$_{ONS}$	*CC-	DEP-IO	*VVC-	*COMPLEX$_{CODA}$
1.a. ☞/'dʒaa.bil.ha/										*		
1.b. /'dʒaabl.ha/					*!	*!	*				*	*
1.c. /'dʒaab.l$_{\mu}$.ha/	*! LICENSE-$_{\mu}$						*				*	
1.d. /'dʒaab.li.ha/				*!			*			*	*	
'galb-na												
2.a.☞/'ga.lib.na/										*		
2.b. /'galb.na/							*!					*
2.c. /'$\overset{\mu\mu\mu}{\text{galb}}$.na/						*!						*
2.d. /'gal.bi.na/				*!						*		
'ʃaadd-na												
3.a. ☞/'$\overset{\mu\mu\mu}{\text{ʃaadd}}$.na/					*	*	*				*	*
3.b. /'ʃaad.d$_{\mu}$.na/	*! LICENSE-$_{\mu}$						*				*	
3.c /'ʃaa.did.na/	*! *i$_{[CiCi]MORPH}$											
3.d. /'ʃaad.na/	*! MAX-IO$_{[C\text{-}STEM]}$						*				*	
sakat-t												
4.a. /sa.ka.tit/										*		
4.b. /sa.katt/					*!							*
4.c. /sa.kat.t$_{\mu}$/	*! LICENSE-$_{\mu}$											

To summarize, the behaviour of sequences of identical consonants in MA has been explored where we found that MA grammar contains the constraint *i$_{[C_1C_1]MORPH}$ which crucially outranks the high ranked constraint *3$_{\mu}$. Although syllable binarity is highly respected in the grammar of MA, it is violated when the immunity of sequences of identical consonants is exposed to danger, i.e. vowel epenthesis. However, this immunity is not respected when the identical consonants belong to two different morphemes or when the low short vowel separates such sequences.

6.2.2 Sequences of Identical Consonants in other Related Dialects

In other Levantine dialects, like Palestinian Arabic, high short vowels are preserved when they happen to occur between two identical consonants. To illustrate how Palestinian Arabic distinguishes itself from MA, it is necessary to consider the set of data in (41) below[4].

(41) Data from Palestinian Arabic (Abu-Salim, 1982)

Input	Stem Output	Word Output	Postlexical Output	Gloss
a. /maarir/	/'maa.rir/	/'maa.rir/	/'maa.rir/	passer by
b. /ʃaadid/	/'ʃaa.did/	/'ʃaa.did/	/'ʃaa.did/	he fasten
c. /maarir-iin/	/maa.ri.'riin/	/maar.'riin/	/maar.'riin/	they extended
d. /ʃaadid-iin/	/ʃaa.di.'diin/	/ʃaad.'diin/	/ʃaad.'diin/	passers by
e. /ʃaadid-hum/	/ʃaa.'did.hum/	/ʃaa.'did.hum/	/ʃaa.'did.hum/	he fasten us

The table shows that Palestinian Arabic allows the surfacing of high short vowels between two identical consonants. To this end, we can propose that the constraint $*i_{[CiCi]MORPH}$ is inactive in the grammar of Palestinian Arabic.

In AJ Arabic, the high short vowels separating two identical consonants that belong to the same morpheme are deleted word-finally (AbuAbbas, 2003). In nonfinal positions, a high short vowel is kept to avoid the surfacing of a trimoraic syllable. Consider the following examples from AJ.

[4] These examples depend on data taken form Abu-Salim (1982).

(42) Data from AJ (AbuAbbas, 2003)[5]

Input	Stem Output	Word Output	Postlexical Output	Gloss
a. /ʃaadid/	/'ʃaa.did/	/'ʃaa.did/	/'ʃaad/	he fasten
b. /ʃaadid-na/	/'ʃaa.did/	/ʃaa.'did.na/	/ʃaa.'did.na/	he fasten us

The difference between AJ and Palestinian Arabic in the above examples is that the former does not allow high short vowels between identical consonants word-finally. Moreover, AJ prohibits complex codas. The deletion of the consonant in the example in (42.a) results from the prohibition of high short vowels between identical consonants word-finally and the prohibition against complex codas. In AJ, it seems that the constraint $*i_{[CiCi]MORPH}$ is ranked low at the lexical level but not postlexically.

In MA, violating syllable binarity is preferred over maintaining a vowel between identical consonants, while in AJ the opposite is preferred. In OT terms, the constraints LICENSE-$_{\mu}$ and $*3_{\mu}$ outrank the constraint $*i_{[CiCi]MORPH}$. Consider the following tableau[6].

(43) Postlexical Level

'ʃaadd-na	LICENSE-$_{\mu}$	$*3_{\mu}$	$*i_{[CiCi]MORPH}$
a. ☞/'ʃaa.did.na/			*
b. /'ʃaadd.na/ (μμμ)		*!	
c. /'ʃaad.d$_{\mu}$.na/	*!		

Accounting for the example in (42.a) requires more constraints since a consonant is deleted. The deletion of the consonant in the aforementioned example satisfies the high ranked constraint *COMPLEX$_{CODA}$ but violates the constraint MAX-IO$_{[C-STEM]}$.

[5] Stress in the examples in (28) is indicated by the author who consulted native speakers of AJ to confirm stress in these examples since AbuAbbas who is the source of this data does not indicated which syllable is stressed.
[6] Only the most relevant constraints are used in the following tableaux.

Therefore, these constraints should be integrated with the constraints in (43), as shown in (44)

(44) Postlexical Level

'ʃaadid	LICENSE-μ	*COMPLEX$_{CODA}$	*3$_{\mu}$	*i$_{[CiCi]}$MORPH	MAX-IO$_{[C\text{-}STEM]}$
a. ☞/'ʃaad/					*
b. /'ʃaadid/				*!	
c. /'ʃaadd/		*!			

The constraint hierarchy that has been established to account for AJ cannot rule out a suboptimal candidate like */'ʃaad.na/, which satisfies all the high ranked constraints. The constraint that rules out such a candidate is MAX-IO['V], which prohibits the deletion of stressed vowels. Consider the following tableau.

(45) Postlexical Level

ʃaa'did-na	LICENSE-μ	MAX-IO['V]	*COMPLEX$_{CODA}$	*3$_{\mu}$	*i$_{[CiCi]}$MORPH	MAX-IO$_{[C\text{-}STEM]}$
a. ☞/ʃaa.'did.na/					*	
b. /'ʃaadd.na/ (μμμ)		*!	*!	*!		
c. /'ʃaad.d$_{\mu}$.na/	*!	*!	*!			
d. /ʃaad.na/		*!				*

This speculative analysis of the behaviour of sequences of identical consonants in AJ concludes our discussion in this section.

6.3 Conclusion

For every controversial issue, there are pieces of evidence which support one view and counter-examples which support the other. Such contentious issues leave the door open for researchers to explore this complex reality a little further. The behaviour of geminates is one of those issues which has been tackled and thoroughly investigated by phonologists. In this chapter, the author accounts for true and fake geminates in MA. True geminates are inseparable and constitute one unit. Fake geminates, on the other hand, are sequences of identical consonants that result from the deletion of high short vowels.

The data from MA show that syllable binarity is violated postlexically, since the language does not allow high short vowels between identical consonants when they belong to one morpheme. AJ, on the other hand, respect syllable binarity by violating low ranked constraints in its grammar, i.e. MAX-IO$_{[C\text{-}STEM]}$ and $*i_{[C_1C_1]MORPH}$.

7 Concluding Remarks and Future Research

This chapter summarises the main points that have been discussed throughout this dissertation. It then then gives some suggestions for future investigations which may help enhance our understanding of phonology in general and phonological opacity in particular.

7.1 Conclusion

MA is one JA dialect that has never previously been studied. Therefore, this dissertation has been dedicated to the investigation of the phonology of MA. Special attention has been given on stress assignment, vowel epenthesis, syncope, geminates and the interaction of these processes.

The discussion developed to account for transparent stress assignment proves superior to other accounts conducted on JA. In chapter three, transparent stress assignment rules in MA were comprehensively investigated. The general outcome of this chapter was that transparent stress rules in MA and other JA dialects can be covered by a limited set of universal constraints. Unlike other accounts, the author has found it neither imperative nor important to use ad hoc or language-specific constraints. To this end, the current account is superior to other accounts.

Chapter four begins by introducing the opaque interaction of vowel epenthesis and stress in MA. Epenthetic vowels are invisible to stress in MA. However, under certain conditions, an epenthetic vowel might bear stress. This discrepancy of the visibility of epenthetic vowels to stress motivated the author to adopt Stratal OT since Classic OT and other semiparallel OT models cannot handle the opacity of vowel epenthesis and stress. The author accounted for the opaque interaction of stress and epenthesis by adopting two main notions i.e. the semisyllable and mora sharing. Vowel epenthesis was discussed in two main sections, i.e. initial epenthesis and non-initial epenthesis. Phrase-initial consonant clusters motivate the insertion of the prothesis /ʔi/ at the stem level. Non-initial epenthesis at the lexical level is motivated by the presence of two adjacent semisyllables. Postlexically, non-initial epenthesis takes place to avoid the surfacing of unlicensed moras. Word-medially, a vowel is inserted since medial coda clusters are not allowed. Word-finally, a vowel is epenthesized if the coda cluster violates the sonority sequencing principle.

Chapter five addressed two main issues: vowel deletion and vowel shortening. MA belongs to the subset of dialects known as differential dialects that delete unstressed high short vowels in open syllables, although there are cases in which the unstressed low short vowel is deleted. In our discussion, the author argued that unstressed high short vowel deletion is a lexical process which takes place at the stem and word levels only, i.e. this process does not apply postlexically. The second main section dealt with vowel shortening, in which the writer argued that there are two types of vowel shortening in MA that are active at the stem level only. Long closed syllables are shortened in nonfinal positions to satisfy the constraint *VVC-, while long vowels in open syllables are shortened to avoid stress clash.

In the same chapter, the constraint hierarchies at the different levels were developed to account for all the issues discussed, i.e. vowel epenthesis, unstressed high short vowel deletion and vowel shortening in open and closed syllables.

Chapter six devoted itself to the analysis of geminates in MA. True geminates are inseparable and constitute one unit. In accounting for tautosyllabic geminates, the author followed in the footsteps of Watson (2007) by assuming that the aforementioned geminates share a mora with the preceding vowels and have their own moras at the same time. The author showed that fake geminates are sequences of identical consonants rather than true geminates since they result from the deletion of high short vowels. Accordingly, we end up wih nonfinal sequences of the shape /CVVCC/, which violates the ban on syllable binarity. However, the author argued that such a syllable is only allowed postlexically. Moreover, the constraint hierarchy that has been developed only allows syllable binarity to be violated in relation to the aforementioned process.

Finally, it is necessary to give the constraint hierarchies that have been developed over the course of the thesis to account for epenthesis and deletion at the lexical and postlexical levels.

(A) Stem Level

FTBIN, *3$_{\mu}$, ONS, *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, *VVC- , RT-ANCHOR >> *COMPLEX$_{ONS}$, *CC- >> *CLASH >> MAX-IO$_{V[LONG]}$ >> *i]$_{\sigma}$ >> *COMPLEX$_{CODA}$, MAX-IO >> ALIGN-L, DEP-IO >> *i$_{[CiCi]MORPH}$, LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$

(B) Word Level

FTBIN, *3$_{\mu}$, $\varsigma\varsigma=\sigma$, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR , *i$_{[CiCi]MORPH}$ >> ALIGN-L, *i]$_{\sigma}$ >> *COMPLEX$_{CODA}$, MAX-IO >> *COMPLEX$_{ONS}$ >> *CC- >> DEP-IO >> LICENSE-$_{\mu}$ >> *SHARED-$_{\mu}$, *VVC-

(C) Postlexical Level

IDENT-STRESS , LICENSE-$_{\mu}$, ONS, MAX-IO['V], *[ʔC, MAX-IO$_{[C\text{-}STEM]}$, MAX-IO$_{V[LONG]}$, RT-ANCHOR , *i$_{[CiCi]MORPH}$ >> ALIGN-L >> MAX-IO >> *i]$_{\sigma}$ >> SONSEQ , *3$_{\mu}$ >> *SHARED-$_{\mu}$, *COMPLEX$_{ONS}$, *CC- >> DEP-IO, *VVC- >> *COMPLEX$_{CODA}$

7.2 Future Research

JA dialects, in general, receive less attention than other Levantine Arabic dialects. Moreover, no linguistic studies have been conducted on MA except the current piece of work, which sheds light on some of the main phonological phenomena exhibited by MA speakers. In order to keep this discussion of the dialect fresh, the author believes there are several points that should be targeted in future research:

1. An investigation should be made in relation to speakers who are originally from Maʿān al-Ḥijāziyyih and those from Maʿān iš-Šāmiyyih to find out if

there are any differences between the two groups. If there is, further studies will be needed that concentrate on the relation between the dialects of MA with other Arabic dialects, i.e. Syrian and Hijazi Arabic.

2. An acoustic study is also needed to explore the nature of the fricative /s/, as it behaves mysteriously regarding the allowance of epenthetic vowel in final coda clusters as in /*kils/* and /*ʕiris/* which surface with and without the epenthetic vowel. In nonfinal coda clusters which are not allowed in MA, on the other hand, a word like /tiks.ru/ surfaces unexpectedly without epenthesis.
3. More investigation is needed to uncover the relations between the plural system and phonology in Arabic in general. Recall our earlier discussion of words like /ʕlab/ in section (5.1.1.2) in this dissertation.
4. Finally, a crosslinguistic study is required to clearly show how many segments can share one mora. In other words, is it possible for more than two consonants to share one mora? Is it possible for two consonants that share one mora to share it with a preceding vowel? If these are possible, what is the limit, since coda consonants can be very long as is the case in Polish? Furthermore, such inquiries raise the question about the assignment of the mora itself, i.e. should moras be a feature of segments or a feature of syllables[1]?

Suffice to conclude that many more studies are needed that not only address phonology, but also other linguistic components.

[1] For further information about the last question see Lunden (2006) who 'argued for a categorization of syllable weight that does not take moras to be independent prosodic units, but rather a property of syllables' Lunden (2006: 89).

REFERENCES

Abdo, Daud A. (1969) *Stress and Arabic phonology*, Ph.D. Dissertation, University of Illinois at Urbana-Champaign.

Abdul-Karaim, K. W. (1980) *Aspects of the Phonology of Lebanese Arabic*, Ph.D. Dissertation, University of Illnois at Urbana.

AbuAbbas, Khaled Hasan (2003) *Topics in the Phonology of Jordanian Arabic: an Optimality Theory Perspective*. Ph.D. Dissertation, University of Kansas.

Abu-Mansour, Mahasen (1991) Epenthesis in Makkan Arabic: Unsyllabifiable Consonants versus Degenerate Syllables. In *Perspectives on Arabic Linguistics III: Papers from the third annual symposium on Arabic Linguistics*, eds. Mushira Eid and John J. McCarthy. Amsterdam: John Benjamins.

Abu-Mansour, Mahasen Hasan (1987) *A Nonlinear Analysis of Arabic Syllabic Phonology, With Special Reference to Makkan*. Ph.D. Dissertation, University of Florida.

Abu-Mansur, M. (1992) Closed syllable shortening and morphological levels. In E. Broselow, M. Eid, and J. McCarthy (eds.), *Perspectives on Arabic Linguistics IV* (pp. 47-75). Amsterdam: John Benjamins.

Abu-Salim, Issam. (1982) *A Reanalysis of Some Aspects of Arabic Phonology: A Metrical Approach*. Ph.D. Dissertation. University of Illinois at Urbana-Chamaign.

Adra, M. A. (1999). *Identity Effects and Opacity in Syrian Arabic: An Optimality Theory Analysis*. Ph.D. Dissertation, University of Illinois at Urbana-Champaign.

Al Shboul, Sabri (2007) *On Defaultness in Jordanian Arabic*. Ph.D. Dissertation, The University of Kansas.

Al-Ageli, H. (1996) *Syllabic and metrical structure in Tripolitanian Arabic: A comparative study in standard and Optimality Theory*. Ph.D. Dissertation, University of Essex.

Al-Ani, Salman (1970) *Arabic Phonology: An Acoustical and Physiological Investigation. Mouton*, The Hague: Paris.

Alghazo, M. H. (1987) *Syncope and Epenthesis in Levantine Arabic: A Nonlinear Approach*. Ph.D. Dissertation, University of Illinois at Champaign-Urbana

Al-Mozainy, Hamza (1982) *The Phonology of a Bedouin Hijazi Dialect*. Ph.D. Dissertation, Austin: University of Texas.

Al-Sughayer, Khalil Ibrahim (1990) *Aspects of Comparative Jordanian and Modern Standard Arabic Phonology*. PhD Dissertation. Michigan State University. USA.

Al-Suhaibani, Al-Waleed 2004 *Arabic Broken Plurals and Prosodic Circumscription: A Theroretcal and Experimental Investigation*. Ph.D. Dissertation, The University of Delaware.

Angoujard, Jean-Pierre (1990) *Metrical Structure of Arabic*. Foris Publications: Holland.

Aoun, J. (1979) Is the syllable or the supersyllable a constituent? *MITWPL* 1: 140-148.

Aronoff, M. (1976) *Word Formation and Generative Grammar*. Massachusetts: MIT Press.

Bani Yasin, R. and J. Owens (1984) The Bduul Dialect of Jordan. *Anthropological Linguistics* 26(2): 202-232.

Benhallam, A. (1980) *Syllable Structure and Rule Type in Arabic*, Ph.D. Dissertation, University of Florida.

Benmamoun, Elabbas (1996) The Derivation of the Imperative in Arabic. In *Perspectives on Arabic Linguistics IX*. M. Eid (ed), 151-164 John Benjamins

Benua, L. (1995) Identity Effects in Morphological Truncation. In: J. Beckman, L. Walsh Dickey and S. Urbanczyk (eds.) *University of Massachusetts Occasional Papers 18: Papers in Optimality Theory*, 77-136 Amherst: GLSA.

Benua, L. (1997). Transderivational Identity: Phonological Relations between Words. Ph.D. Dissertation. University of Massachusetts, Amherst. [ROA-259]

Bin-Muqbil, Musaed S. (2006) *Phonetic and Phonological Aspects of Arabic Emphatics and Gutturals*. Ph.D. Dissertation, University of Wisconsin-Madison.

Blevins, J. (1995) The Syllable in Phonological Theory, *Handbook of phonological theory*, ed. by John Goldsmith, Basil Blackwell, London, 206-44. [Reprinted in C. W. Kreidler 2001 (ed.), *Phonology: Critical Concepts*, Volume 3. London: Routledge. 75-113.]

Booij & Rubach (1987) Postcyclic versus postlexical rules in Lexical Phonology. Linguistic Inquiry 18, 1–44.

Booij, Geert (1997) Non-derivational phonology meets Lexical Phonology. In I. Roca (ed.), *Constraints versus Derivations in Phonology*. Oxford: Clarendon Press, 261-288.

Brame, M. K. (1970) *Arabic phonology: Implications for phonological theory and historical Semitic*. Ph.D. Dissertation, Dissertation, MIT.

Brame, Micheal K. (1971) Review Article “Stress in Arabic and Generative Phonology” Review of Daud A. Abdo. “On Stress and Arabic Phonology A Generative Approach” PhD Dissertation. *Foundation of Language* 7, pp. 556-591.

Brame, Micheal K. (1973) On Stress Assignment in Two Arabic Dialects. In Stephen Auderson and Paul Kiparsky (eds.) A Festschrift for Morris Halle. Pp. 14- 25.

Brame, Micheal K. (1974) The Cycle in Phonology: Stress in Palestinian, Maltese, and Spanish. *Linguistic Inquiry* 5, pp. 39- 60.

Broselow, E. (1976) *The phonology of Egyptian Arabic.* Ph.D. Dissertation, University of Massachusetts, Amherst.

Broselow, E. (1979) Cairene Arabic syllable structure. *Linguistic Analysis* 5: 345-382.

Broselow, E. (1992) Parametric Variation in Arabic Dialect Phonology. In E. Broselow, M. Eid, and J. McCarthy (eds.), *Perspectives on Arabic Linguistics IV: Papers from the Fourth Annual Symposium on Arabic Linguistics*. Amsterdam and Philadelphia: John Benjamins, pp. 7-45.

Broselow, E. (1995) Skeletal positions and moras. *The handbook of phonological theory*, ed. John A. Goldsmith, pp. 175-205. Cambridge, Mass.: Blackwell.

Broselow, E., S. Chen, & M. Huffman (1997) Syllable weight: convergence of phonology and phonetics. *Phonology* 14: 47-82.

Browman, C. P., & Goldstein, L. (1986) Towards an Articulatory Phonology. *Phonology Yearbook*, *3*, 219-252.

Browman, C. P., & Goldstein, L. (1990) Tiers in Articulatory Phonology, with some Implications for Casual Speech. In J. Kingston & M. E. Beckman (Eds.), *Papers in laboratory phonology I: Between the grammar and physics of speech*, (pp. 341-376). Cambridge: Cambridge University Press.

Btoosh, Mousa A. (2006) Constraint Interactions in Jordanian Arabic Phonotactics: An Optimality-Theoretic Approach. *Journal of Language and Linguistics* 5 (2), pp. 102- 221.

Butt, M. (1992) Sonority and the Explanation of Syllable Structure. *Linguistische Berichte* 137. Westdeutcher Verlag.

Chomsky, Noam & Morris Halle (1968) The Sound Pattern of English. NY: Harper & Row.

Chomsky, Noam (1970) Remarks on Nominalization. In: R. Jacobs and P. Rosenbaum (eds.), *Readings in English Transformational Grammar*, Ginn, Waltham, MA, 184-221.

Clements, G. N. (1990) The Role of the Sonority Cycle in Core Syllabification. In M. Beckman (Eds.), *Papers in laboratory phonology I: between the grammar and physics of speech* (pp. 282-333). Cambridge: Cambridge University Press.

Clements, G.N. & Keyser, K. (1983) *CV Phonology*. MIT Press.

Das, Shyamal. (2002) *Some Aspects of the Phonology of Tripura Bangla and Tripura Bangla English*. Ph.D. Dissertation, CIEFL, Hyderabad.

Delattre, Pierre (1971) Pharyngeal Features in the Consonants of Arabic, German, Spanish, French, and American English', *Phonetica* 23: 129-155.

Elenbass, Nine, & Rene, Kager (1999) Ternary rhythm and the lapse constraint. *Phonology* 16, 273-329.

Farwaneh, Samira (1995) *Directionality effects in Arabic dialect syllable structure*. Ph.D. Dissertation, University of Utah.

Fudge, E.C. (1969) Syllables. *Journal of Linguistics*, 5:253-286.

Gafos, Adamantios (2003) Greenberg's Asymmetry in Arabic: A consequence of stems in paradigms. *Language* 79.317–355.

Giegerich, H. J. (1988) Strict cyclicity and elsewhere. Lingua 75, 125-134.

Goldsmith, John (1976) *Autosegmental Phonology*. Ph.D. Dissertation, MIT.

Goldsmith, John (1990). Autosegmental and Metrical Phonology. Oxford: Basil Blackwell.

Gordon, Matthew (2003) The Puzzle of Onset-sensitive Stress: A Perceptually-driven Approach. *Proceedings of WCCFL XXII*, 217-230.

Gouskova, Maria (2004) Relational Hierarchies in Optimality Theory: The Case of Syllable Contact. *Phonology* 21: 201-250.

Gouskova, Maria and Nancy Hall (2007) Levantine Epenthesis: Phonology, Phonetics, and Learning. Stanford Workshop on Variation, Gradience, and Frequency in Phonology. Stanford, CA, July 6-8. With Nancy Hall.

Guerssel, Mohamed (1978) A condition on assimilation rules. *Linguistic Analysis* 4:225–254.

Haddad, G. (1984) *Problems and Issues in the Phonology of Lebanese Arabic*. Ph.D. Dissertation, University of Illinois-Urbana.

Halle, M. (1973) Prolegomena to a Theory of Word-Formation, *Linguistic Inquiry,* 4,3-16.

Halle, Morris and K. P. Mohanan (1985) Segmental phonology of Modern English. Linguistic Inquiry 16, 57-116.

Hamid, A. H. (1984) *A Descriptive Analysis of Sudanese Colloquial Arabic Phonology*. Ph.D. Dissertation, University of Illinois-Urbana.

Hayes, B. (1989) Compensatory Lengthening in Moraic Phonology. *Linguistic Inquiry 20*: 253-306.

Hayes, Bruce (1995) *Metrical Stress Theory: Principles and Case Studies*. Chicago: The University of Chicago Press.

Hironymous, Patricia (1999) Selection of the Optimal Syllable in an Alignment-Based Theory of Sonority. PhD Dissertation, University of Maryland.

Hockett, C. (1955) *A Manual of Phonology*. Baltimore: Waverly Press.

Hooper, Joan (1976) *An Introduction to Natural Generative Phonology*. New York: Academic Press.

Hooper, Joan B. (1972) The Syllable in Phonological Theory. *Language* 48.525-40.

Hulst, van der H. & N.A. Ritter (eds.) (1999) *The Syllable: Views and Facts.* Berlin: Walter de Gruyter.

Hyman, Larry M. (1985) *A theory of phonological weight*. Dordrecht: Foris. (Reprinted by CSLI, Stanford University, 2003).

Ibrahim, Mohammad H. (1984) On the notions 'Standard' and 'Prestigious' in Arabic Sociolinguistics. *In Issam Abu-Salim and Jonathan Owens (eds.),* Proceedings of the Third Annual Linguistics Conference. Department of English, Yarmouk University, Irbid, Jordan.

Idsardi, William J. (1997) Sympathy creates chaos. Ms., University of Delaware.

Irshied, Omar Musleh (1984) *The Phonology of Arabic: Bani Hasan- A Beduin Jordanian Dialect*. Ph.D. Dissertation, University of Illinois. Urbana- Champaign.

Irshied, Omar, & Michael Kenstowicz (1984) Some Phonological Rules of Bani-Hasan Arabic: A Bedouin Dialect. *Studies in the Linguistic Sciences* 14: 109-147.

Ito, Junko (1986) *Syllable Theory in Prosodic Phonology*. Ph.D. Dissertation, University of Massachusetts at Amhert.

Ito, Junko (1989) A Prosodic Theory of Epenthesis. *Natural Language and Linguistic Theory* 7, pp. 217- 260.

Ito, Junko and Armin Mester (2002) On the Sources of Opacity in OT: Coda Processes in German. In *The Syllable in Optimality Theory*, ed. by C. FJry and R. v. d. Vijver, 271-303. Cambridge: Cambridge University Press. [ROA-347.]

Jakobson, Roman (1962) *Selected writings I: Phonological studies*. The Hague: Mouton.

Kabrah, Rawiah S. (2004) *Opacity and Transparency in the Lexical and Post-lexical Phonology of Makkan Arabic: A Stratal Optimality Theoretic Approach*. Ph.D. Dissertation, Boston University.

Kager, R. (1993) Alternatives to the Iambic-Trochaic Law. *Natural Language and Linguistic Theory* 11, pp. 381-432.

Kager, R. (1994) Ternary rhythm in alignment theory. Ms. Utrecht University.

Kager, R. (1995a) Surface opacity of metrical structure in Optimality Theory. In B. Hermans and M. van Oostendorp (eds.) *The Derivational Residue in Phonology*. Amsterdam: John Benjamins. [ROA-207]

Kager, R. (1995b) The metrical theory of word stress. *The handbook of phonological theory*, ed. John A. Goldsmith, pp. 367–402. Cambridge, Mass.: Blackwell.

Kager, R. (1999) *Optimality Theory*. Cambridge: Cambridge University Press.

Kaye, Jonathan, Jean, Lowenstamm & Jean-Roger, Vergnaud (1985) The Internal Structure of Phonological Representations: A Theory of Charm and Government. *Phonology Yearbook* 2, 305-328.

Kaye, Jonathan, Jean, Lowenstamm & Jean-Roger, Vergnaud (1990) Constituent structure and government in phonology. *Phonology* 7. 193-232.

Kenstowicz, Michael & Charles Pyle (1973) On the Phonological Integrity of Geminate Clusters. In Michael Kenstowicz & Charles Kisseberth (eds) *Issues in phonological theory*, 27-43. The Hague: Mouton.

Kenstowicz, Michael & Kamal Abdul-Karim (1980) Cyclic Stress in Levantine Arabic. *Studies in the Linguistic Sciences* 10.55-76.

Kenstowicz, Michael (1981) A note on cyclic structure in Levantine Arabic. Epenthesis and degenerate syllables in Cairene Arabic. Borer, Hagit and Youssef Aoun (eds.) *Theoretical Issues in the Grammar of Semitic Languages*. MIT Working Papers in Linguistics 3.

Kenstowicz, Michael (1994) *Phonology in generative grammar*. Oxford: Blackwell.

Kenstowicz, Michael (1995) Base-identity and Uniform Exponence: Alternatives to Cyclicity, in Jacques Durand & Bernard Laks (eds.) *Current trends in phonology: models and methods*, University of Salford Publications, pp. 363-393.

Khabir, Moulay Ahmed (1998): *Issues in Arabic morphology and phonology: theoretical implications*, Ph.D. Dissertation, Université de Montreal, 236pp.

Kiparsky, P. (1973) Phonological representations. In O. Fujimura (ed.) *Three Dimensions of Linguistic Theory*. 1–136. Tokyo: TEC.

Kiparsky, P. (1979) Metrical structure is cyclic. *Linguistic Inquiry* 10(3):421-441.

Kiparsky, P. (1981) Remarks on the Metrical Structure of the Syllable. In Dressler, W., O. Pfeiffer and J. Rennison (eds.) *Phonologica 1980*. Innsbruck: Innsbrucker Beiträge zur Sprachwissenschaft. 245-256.

Kiparsky, P. (1982) Lexical morphology and phonology. In I.-S. Yang (Ed.), *Linguistics in the Morning Calm*, Vol. 2, 3{91. Seoul: Hanshin.

Kiparsky, P. (1985) Some Consequences of Lexical Phonology. *Phonology Yearbook* 2, 82-36.

Kiparsky, P. (1993) Blocking in nonderived environments. In S. Hargus & E. M. Kaisse (eds). *Studies in Lexical Phonology*. San Diego: Academic Press, 277-313.

Kiparsky, P. (2000) Opacity and cyclicity. *The linguistic review*17: 351-367.

Kiparsky, P. (2003) Syllables and Moras in Arabic. In Caroline Fery and Ruben Var De Vijver (eds.) *The Syllable in Optimality Theory*. Cambridge Unversity Press: Cambridge.

Kiparsky, P. (To appear) *Opacity and Paradigm Effects.* Stanford: CSLI.

Kirchner, Robert (1996) Synchronic Chain Shifts in Optimality Theory. *Linguistic Inquiry* 27, 341-349.

Kisseberth, C. W. (1970) On the functional unity of phonological rules. *Linguistic Inquiry* 1, 291–306.

Ladefoged, P. (1971) *Preliminaries to Linguistic Phonetics*. Chicago: University of Chicago Press.

Leben, William (1980) A metrical analysis of length. *Linguistic Inquiry* 11, 497-510.

Levin, J. (1985) *A Metrical Theory of Syllabicity*. Ph.D. Dissertation, MIT.

Liberman, M. (1975) *The intonational system of English*. Massachusetts Intitute of Technology. Ph.D. dissertation: Cambridge.

Liberman, M. and A. Prince (1977) On stress and linguistic rhythm. *Linguistic Inquiry* 8, 249–336.

Lunden, Anya (2007) *Weight, Final Lengthening and Stress: a Phonetic and Phonological Case Study of Norwegian*. Ph.D. dissertation, University of California, Santa Cruz. [ROA-833]

McCarthy, J. (1979a) *Formal Problems in Semitic Phonology and Morphology*, MIT.

McCarthy, J. (1979b) On Stress and Syllabification. *Linguistic Inquiry* 10, 443-465.

McCarthy, J. (1981) A prosodic Theory of Nonconcatenative Morphology. *Linguistic Inquiry* 12, 373-418.

McCarthy, J. (1982) Prosodic Structure and Expletive Infixation. *Language* 58, 574B590.

McCarthy, J. (1983) A Prosodic Account of Arabic Broken Plural. In I. R. Dihoff (ed.) *Current Approaches to African Linguistics*. Foris, Dordrech.

McCarthy, J. (1999) Sympathy and Phonological Opacity. *Phonology* 16, 331-99.

McCarthy, J. (2000) Faithfulness and Prosodic Circumscription. In Dekkers, Joost, van der Leeuw, Frank, & van de Weijer, Jeroen (Eds), *Optimality Theory: Syntax, phonology, and acquisition* (pp. 151-189). Oxford: Oxford University Press.

McCarthy, J. (2002) Comparative markedness. Ms., University of Massachusetts, Amherst. (ROA 489).

McCarthy, J. (2007) *Hidden Generalizations. Phonological Opacity in OT*. London: Equinox.

McCarthy, J. (2008) *Doing Optimality Theory*. Oxford: Blackwell Publishing.

McCarthy, John & Alan Prince (1986) Prosodic morphology. Ms., University of Massachusetts, Amherst, and Brandeis University, Waltham, Mass.

McCarthy, John & Alan Prince (1990a) Foot and Word in Prosodic Morphology: The Arabic Broken Plurals, *Natural Language and Linguistic Theory* 8, 209-282.

McCarthy, John & Alan Prince (1990b) Prosodic Morphology and Templatic Morphology. In M. Eid & J. McCarthy (eds.), *Perspectives on Arabic Linguistics: Papers from the Second Symposium* (pp. 1–54). Amsterdam: Benjamins, Amsterdam.

McCarthy, John & Alan Prince (1993) Generalized alignment. *Yearbook of Morphology*, pp. 79-153.

McCarthy, John & Alan Prince (1993) *Prosodic Morphology I: Constraint Interaction and Satisfaction*. Rutgers Center for Cognitive Science (RuCCs) Technical Report 3, University of Massachusetts, Amherst and Rutgers University.

McCarthy, John & Alan Prince (1995) Faithfulness and Reduplicative Identity. In Beckman, Dickey and Urbanczyk (eds.) *Papers in Optimality Theory*, 249-384. Amherst: University of Massachusetts Occasional Papers 18.

Miller, Ann (1987) Phonetic characteristics of Levantine Arabic geminates with differing morpheme and syllable structures. *Ohio State Papers from the Linguistics Laboratory* 36,120-140.

Mohanan, K. P. (1982) Lexical Phonology. Ph.D. dissertation, MIT, Cambridge, MA.

Moore, J. (1990) Doubled Verbs in Modern Standard Arabic. In M. Eid and J. McCarthy, (eds) *Perspectives on Arabic Linguistics II: Papers from the Second Annual Symposium on Arabic Linguistics*, pp. 55-93.

Morén, B. (1999) *Distinctiveness, Coercion and Sonority: A Unified Theory of Weight*. Ph.D. Dissertation, University of Maryland.

Murray, R. and T. Vennemann (1983) Sound Change and Syllable Structure in Germanic Phonology. *Language* 59.514-28.

Nespor, Marina, and Irene Vogel (1986) *Prosodic Phonology.* Dordrecht: Foris.

Odden, D. (1978) Aspects of Iraqi Arabic Verbal Phonology. *Studies in the linguistic sciences* 8.1.137-152

Odden, David (1988) Anti Antigemination and the OCP. *Linguistic Inquiry* 19:451-475.

Palva, Heikki (1976) *Studies in the Arabic Dialect of the Semi-nomadic Al-9ajarma Tribe* (al-Balqa district, Jordan). Goteborg: Acta Universitatis Gothoburgensis.

Palva, Heikki (1980) Characteristics of the Arabic Dialect of the Bani Saxar Tribe. *Orientalia Suecana* XXIX: 112-137.

Palva, Heikki (1986) Characteristics of the Arabic Dialect of the Bani Ḥwēṭāt Tribe. *Orientalia Suecana* XXXIII-XXXV: 295-312.

Paradis, Carole (1988) On Constraints and Repair Strategies. *The Linguistic Review,* 6(1):71-97.

Pater, Joe (2000) Nonuniformity in English Stress: the Role of Ranked and Lexically Specific Constraints. *Phonology* 17:2. 237-274. 2001

Postal, Paul (1968) *Aspects of Phonological Theory*. New York: Harper and Row.

Prince, A. & P. Smolensky (2004 [1993]) *Optimality Theory: Constraint Interaction in Generative Grammar*. Oxford: Blackwell.

Prince, Alan (1983) Relating to the Grid, *Linguistic Inquiry* 14, 19-100.

Pulgram, E. (1970) *Syllable, Word, Nexus, Cursus*. La Haye : Mouton.

Pulleyblank, D. (1986) *Tone in Lexical Phonology: Studies in Natural Language and Linguistic Theory* (Dordrecht: Reidel).

Pulleyblank, Douglas (1997) Optimality Theory and features. In Diana Archangeli & Terry Langendoen (eds.) *Optimality Theory: an overview*. Oxford: Blackwell. 59–101.

Ratcliffe, Robert R. (1998) *The Broken Plural Problem in Arabic and Comparative Semitic*. John Benjamin Publishing Company. Amsterdam.

Roca, Iggy & Johnson, Wyn (1999) *A Course in Phonology*. Malden, MA: Blackwell.

Sakarna, Ahmed (1999) *Phonological Aspects of 9Abady Arabic, a Bedouin Jordanian Dialect*. Ph.D. Dissertation, University of Wisconsin, Madison.

Schein, Barry & Donca Steriade (1986) On Geminates. *Linguistic Inquiry 17,* 691-744.

Selkirk, E. (1984) On the Major Class Features and Syllable Theory. In M. Aronoff and R. T. Oehrle (eds.), *Language Sound Structure* (pp. 107-136). Cambridge, MA: MIT Press.

Selkirk, Elisabeth (1981) Epenthesis and Degenerate Syllables in Cairene Arabic. Hagit Borer and Youssef Aoun (eds.) *Theoretical Issues in the Grammar of Semitic Languages*. MIT Working Papers in Linguistics 3.

Selkirk, Elisabeth (1982) The Syllable. In *The Structure of Phonological Representations,* Harry van der Hulst & Norval Smith, (eds.) Cinnaminson, N.J.: Foris Publications.

Selkirk, Elisabeth (1984) On the major class features and syllable theory. In Aronoff, Mark & Oehrle, Richard T. (eds.) *Language sound structure*. Cambridge, MA: MIT Press, 107-136.

Smolensky, Paul (1997) Constraint Interaction in Generative Grammar II: Local Conjunction. Paper presented at the Hopkins Optimality Theory Workshop/University of Maryland Mayfest 1997, May 8-12, 1997.

Steriade, D. (1997) *Phonetics in phonology: the case of laryngeal neutralization*. Ms., UCLA.

Stevens, K.N. & S.J. Keyser (1989) Primary Features and Their Enhancement in Consonants, *Language* 65, 81-106.

Swadesh, Morris (1937) The Phonemic Interpretation of Long Consonants. *Language* 13, 1-10.

Trask, R. L. (1996) *A Dictionary Of Phonetics And Phonology*, Routledge, London, UK.

Travis, D.A. (1979) *Inflectional Affixation in Transformational Grammar: Evidence from Arabic Paradigm*. Bloomington: Indiana University Linguistics Club

Vennemann, Theo (1972) Phonological Uniqueness in Natural Generative Grammar. *Glossa*: 105-61.

Walker, Rachel (1996) *Prominence-driven Stress*. MS. University of California, Santa Cruz. [ROA-172]

Walker, Rachel (1997) *Mongolian Stress, Licensing, and Factorial Typology*. University of California, Santa Cruz.

Watson, Janet C. E. (2002) *The Phonology and Morphology of Arabic*. Oxford University Press: England.

Watson, Janet C. E. (2007) Syllabification Patterns in Arabic Dialects: Long Segments and Mora Sharing. *Phonology* 24: 335-356.

Wilkinson, Karina (1988) Prosodic structure and Lardil phonology. *Linguistic Inquiry* 19, 25-34.

Zawaydeh, Bushra Adnan (1997) On an Optimality Theoretic Account of Epenthesis and Syncope in Arabic Dialects. In Mushira Eid and Robert Ratcliffe (eds.) *Perspectives on Arabic Linguistics* X, pp. 191- 213.

Zec, Draga (2007) The syllable. In Paul de Lacy (ed.) *The Cambridge Handbook of Phonology*. Cambridge University Press, ch.5.

Zuraw, Kie (2003) Optimality theory in Linguistics. In Michael Arbib (ed.) *Handbook of Brain Theory and Neural Networks*, 2nd editon. Cambridge, MA: MIT Press. Pp. 819-822.