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Morphophonemic Alternations in Arabic Noun Formation

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Abstract

This paper investigates various morphophonemic alternations which are mainly found in the morphology of Modern Standard Arabic (MSA) nouns, with a special reference to the morphophonological rules that account for these alternations. Arabic is a highly inflectional language. It employs a wide variety of inflectional affixes which are either attached to the stem as prefixes or suffixes. This inflectional nature makes the language susceptible to several morphophonemic changes occurring particularly at morpheme boundaries. Arabic morphology is so highly interconnected with phonology that most morphological processes are triggered by phonology. That is why most of the morphological operations are often phonologically conditioned in a systematic way. Morphologically conditioned alternations also occur but in fewer contexts. The paper focuses on the alternations which occur within morphemes, or across morpheme or word boundaries in Arabic noun formation.

Keywords: Arabic Noun Formation, MSA, morphophonemic alternations, affixes, morpheme boundaries, phonologically conditioned, morphologically conditioned

1. Introduction

Morphophonemics (American linguistics), morphophonology (European linguistics), or sometimes morphonology has been defined differently by various linguists and investigators. Below we cite some of these definitions:

> Morphophonemics is the study of the alternation between corresponding phonemes in alternant shapes of the same morpheme. When the morpheme alternants of a language, or of some form-class in a language, have been listed in full, a statement of the morphophonemics will serve as a convenient index to the listing. (Bloch, 1947: 414)

Jensen (1990: 157) defines it as "a general term referring to processes affecting the phonological shape of morphemes and sequences of morphemes. The type of processes involved ranges from purely phonetic rules (post lexical rules) to genuine suppletive allomorphs with nothing phonological in common". Hockett (1958: 135) views morphophonemics as a code and states "The ways in which the morphemes of a given language are variously represented by phonemic shapes can be regarded as a kind of code. This code is the morphophonemic system of the language". The multiple definitions and the problem of the terminology of morphophonemics show that there is a deeper debate about it, its specific subject matter, the subject's boundaries, whether it belongs to morphology or phonology or it has an autonomous status, and its position within the general framework of linguistic theory. Morphophonemics is therefore a highly controversial area of linguistics. Talking about its terminology, Gleason (1965: 226) points out that '"morphophonemic' … is one of the most vexed technical terms in linguistics. In no two systems of linguistic theory is it used in the same way".

Sandhi is another term for morphophonemics. The ancient Indian grammarians used the term sandhi (Sanskrit *sam* 'together' + *dhi* 'put') to describe the morphophonemic alternations (Lass, 1984). Sandhi, thus, refers to the assimilative sound changes which are produced in combined sounds of neighboring morphemes. It is "morphophonemic changes which occur when words are combined into phrases" (Nida, 1946: 227). There are two types of sandhi, internal and external sandhi. External sandhi takes place across word boundaries, while internal sandhi appears between successive morphemes within a word. Bloomfield (1939), cited in Kilbury (1976: 49), defines internal sandhi or morphophonemics as "the variation of morphological elements as they enter into different combinations; it is to be distinguished from 'morpholexical variation', which is irregular, yet still involves phonetic modification rather than suppletion". Morphophonemic studies have their roots that go back to "the early classical studies of sandhi in Sanskrit by Panini and other Indian grammarians, and the studies of vocalic alternations in the Semitic languages undertaken by early Arab and Hebrew linguistic investigators" (Harasowska, 1999: 15).

Because morphophonemics stands between phonology and morphology, the morphophonemic processes are not purely phonological, since they apply to morphological elements and they may require morphological conditions for their operation. But either are they purely morphological because they do not change the meanings of forms (Jensen, 1990: 63) . They are transitional between phonology and morphology (Matthews, 1991:146).

2. Related Literature

To our knowledge, there are no available studies which are devoted to deal separately with Arabic morphophonemics in detail. Most of the current works are either morphology-oriented or phonology-oriented. The interplay between morphology and phonology is often overlooked. Yet, some

works have discussed some of the morphophonemic changes briefly. Brame (1970) and Al-Qannoor (1983) discussed the definite article prefix alternation in which the lateral /l/ of the definite article *ʾal-* assimilates to following coronal sounds. Alfozan (1989) examined vowel harmony in Arabic which occurs across morpheme and word boundaries as well as within the same word. Based on the direction of influence, Alfozan identified two types of vowel harmony, progressive and regressive. He also claimed that there is no contiguous vowel harmony in Arabic. Hoberman (1996) studied alternation in pausal forms at morpheme boundaries. This paper, however, illustrates various morphophonemic processes attested in Modern Standard Arabic noun formation like assimilation, deletion, insertion, metathesis, pausal form alternations, and vowel harmony.

3. Types of Morphophonemic Alternations in Arabic

In this section, six morphophonemic alternations will be discussed, supported by extensive examples.

3.1 Assimilation

Assimilation may be adequately defined as follows:

> Assimilation is the main type of conditioned sound changes. It means that sounds become more alike. There is partial and total assimilation, contiguous and distant, progressive and more often regressive, and reciprocal assimilation. Assimilation may take place between consonants, between vowels, and between a consonant and a vowel. (Lipiński, 2001:186)

In Arabic nouns, certain consonants assimilate completely to the following consonants. For example, the prefix morpheme of the Arabic definite article *ʾal-*, ending with the lateral consonant /l/, assimilates completely to the first sound in the nouns that begin with the following coronal or apical consonants: (/ð/, /θ/, /ẓ/, /d/, /t/, /ṭ/, /ḍ/, /z/, /s/, /ṣ /, /n/, /r//l/, and /š/). Thus, the places of articulation involved here are interdental, dental, and alveolar. Such assimilation results in the germination of the initial consonant of the word. In standard Arabic orthography, the geminated consonants are not written as two letters of the same consonant but always as a single letter over which an optional diacritical mark is used to indicate consonant germination. In transliteration, however, it appears as doubled letters. The assimilation can be morphophonologically illustrated by the rule in (1):

(1) $l\ [+def] \rightarrow C_i\ /\ \_\_\_\_\_\ C_i \begin{bmatrix} +consonant \\ +coronal \end{bmatrix}$ (*l*-Assimilation)

In all the following examples /*l*/ assimilates completely to the first sound of each word. Morpheme boundaries are demarcated with a hyphen:

(2)	**Underlying Form**	**Surface Form**	**Gloss**
	/ʾal-θawb/	[ʾaθθawb]	‘the dress’
	/ʾal-raʒul/	[ʾarraʒul]	‘the man’
	/ʾal-šams/	[ʾaššams]	‘the sun’
	/ʾal-ṣanam/	[ʾaṣṣanam]	‘the idiot’
	/ʾal-zirr/	[ʾazzirr]	‘the button’

/ʔal-lawn/	[ʔallawn]	‘the color’
/ʔal-ðail/	[ʔaððail]	‘the tail’
/ʔal-naas/	[ʔannaas]	‘the people’
/ʔal-ẓuhr/	[ʔaẓẓuhr]	‘the noon’
/ʔal-ṭariiq/	[ʔaṭṭariiq]	‘the road’
/ʔal-ḍabaab/	[ʔaḍḍabaab]	‘the fog’

There is only one exception where /*l*/ does not assimilate to /ʒ/ though it is coronal. It is because, as Brame (1970) assumes, that /ʒ/ transformed from the underlying /g/ which is [-coronal]. Brame postulates the following rule:

(3) g - to - ʒ: /g/ → /ʒ/

This explains why it is that *ʔal-* does not assimilate to /ʒ/ as in the following examples:

(4)	**Underlying Form**	**Surface Form**	**Gloss**
	/ʔal-ʒama/	[ʔalʒamal]	‘the camel’
	/ʔal-ʒabal/	[ʔalʒabal]	‘the mountain’

However, */l/* does not assimilate to labials, velars, uvulars, pharyngeals, and laryngeals. This can be seen in (5):

(5)	**Underlying Form**	**Surface Form**	**Gloss**
	/ʔal-baab/	[ʔalbaab]	‘the door’
	/ʔal-maal/	[ʔalmaal]	‘the money’
	/ʔal-faras/	[ʔalfaras]	‘the horse’
	/ʔal-xaruuf/	[ʔalxaruuf]	‘the lamb’
	/ʔal-kalb/	[ʔalkalb]	‘the dog’
	/ʔal-qalb/	[ʔalqalb]	‘the heart’
	/ʔal-ḥarf/	[ʔalḥarf]	‘the letter’
	/ʔal-ʔab/	[ʔalʔab]	‘the father’

3.2 Deletion

Deletion or elision is another common phonological process. It is quite the opposite process of insertion. It involves the omission of a sound either initially, medially or finally. “The deletion of the initial sound of a word is called aphaeresis. Deletion of a medial sound is called syncope. Apocope is deletion of a final sound” (Jensen, 1990: 161). In what follows, we discuss five types of deletion.

3.2.1 Glide-Deletion

Arabic has the glide consonants /w/ and /y/ which are identical in quality with the high vowels /u/ and /i/, respectively (Ratcliffe, 1998: 65). A good deal of variability comes from these high glides. They are liable to various phonological processes because of their inherent instability. However, they

play a significant role in the morphophonology of Arabic. These glides delete automatically if they occur in the environment between /a/ and another short vowel /a__ V/ and also between two short homorganic high vowels /V___ V/:

(6) $\begin{Bmatrix} y \\ w \end{Bmatrix}$ → ∅ / V_1 ___ V_2, where V_1 and V_2 are short (*Glide*-Deletion)

Glide deletion often results in the creation of a long vowel from the surrounding short vowels. First, these two short vowels undergo progressive assimilation and produce a long one. Second, if this long vowel happens to occur in a final closed syllable (i.e., CVVC#), it is shortened to comply with Arabic syllable structure constraint which stipulates that the long vowel should be reduced if it occurs in a closed final syllable (Ratcliffe, 1998: 66). Otherwise, it remains long. A good number of Arabic nouns end in glides. When suffixes are attached to the stem, the glides undergo significant reductions and mutations in certain vocalic environments. For example, when *-u-n* or *-i-n* (indefinite nominative and genitive case suffixes) are attached to the noun *muḥamiy* 'a lawyer', it yields **muḥaamiun*, and **muḥaamiin* with the glide /y/ deleted because it occurs between two short high vowels. In the nominative case, these vowels are subject to assimilation. The first vowel affects the second in progressive assimilation. Thus, /u/ assimilates to /i/ yielding long /ii/. In the following rules, (7a) accounts for assimilation and (7b) for vowel lengthening:

(7) a. u → i / i____ C # (*i*-Assimilation)
b. i-i → ii /_____ C # (Vowel Lengthening)

In both indefinite nominative and genitive cases, the result is **muḥaamiin*. The long vowel is further subject to reductions in a process of vowel shortening to meet the Arabic syllable structure constraint. The surface form is then realized as *muḥaamin*. The process of vowel shortening is illustrated in the following rule:

(8) VV → V/_____C # (Vowel Shortening)

The rule (8) indicates that a long vowel becomes a short in a final closed syllable. The complex morphophonemic alternation of the previous example can be summarized as follows:

(9)
/muḥaamiy-u-n/	Underlying Form
/muḥaami-u-n/	*Glide*-Deletion
/muḥaami-i-n/	*i*-Assimilation
/muḥaamii-n/	Lengthening
/muḥaami-n/	Shortening
[muḥaamin]	Surface Form

The ordering of the rules is important. It is evident from (9) that the rule of glide deletion applies first, vowel assimilation follows glide deletion and precedes lengthening, and vowel shortening applies last. However, in other environments like /V__a/, the glide will not delete. It is

obvious when the indefinite accusative case suffix *-a-n* is added. The /y/ is retained in /i__ a/ environment:

(10)		**Underlying Form**	**Surface Form**	**Gloss**
	Acc.	/muḥaami**y**-a-n/	[muḥaami**y**an]	'a lawyer'

3.2.2 *CV*-Deletion

Sometimes more than one phoneme is deleted at morpheme or word boundaries. For example, the final CV-sequence of the sound masculine plural suffixes *-uuna* and *-iina*, and the dual suffixes *-aani* and *-ayni* is subtracted if these suffixes are followed by further possessive suffixes (*-ii, -naa, -ka, -kumaa, -kum, -ki, -kunna, -hu, -humaa, -hum, -haa, -hunna*) or by construct state (being the first term in the construct noun phrase). It corresponds to a whole syllable deletion.

(11) $\begin{Bmatrix} na \\ ni \end{Bmatrix} \rightarrow \emptyset \; / \; \_\_\_\_ \begin{bmatrix} +\text{Possessive Suffixes} \\ \#\ \text{Construct State} \end{bmatrix}$ (*CV*-Deletion)

The following are illustrative examples:

(12)		**Possessive**	**Construct State**
a.	yad-**aani**	yad-**aa**-ka	yad-**aa** # l-walad-i
	hand-Dual.Nom	hand-Dual-Poss2ms	hand-Dual # Def-boy-Gen
	'two hands'	'your hands'	'boy's hands'
b.	ʕayn-**ayni**	ʕayn-**ay**-ka	ʕayn-**ay** # ʔal-walad-i
	'eye-Dual.AccGen'	eye-Dual.AccGen-Poss2ms	eye-Dual # Def-boy-Gen
	'two eyes'	'your eyes'	'the boy's eyes'
c.	mudarris-**uuna**	mudarris-**uu**-hu	mudarris-**uu** # ṭ-ṭullaab-i
	teacher-Pl.Nom	teacher-Pl.Nom-Poss3ms	teacher-Pl.Nom Def-students-Gen
	'teachers'	'his teachers'	'students' teachers'
d.	mudarris-**iina**	mudarris-**ii**-hi	mudarris-**ii** # ṭ-ṭullaab-i
	teacher-Pl.AccGen	teacher-Pl.AccGen-Poss3ms	teacher-Pl.AccGen Def-students-Gen
	'teachers'	'his teachers'	'the students' teachers'

In the possessive, the alternation occurs at morpheme boundary, while in the construct state it arises at the word boundary, which is indicated by '#' sign. The latter can be described as external sandhi.

3.2.3 *n*-Deletion

Similarly, the indefinite suffix *-n* which appears at the end of indefinite nouns is dropped automatically in all cases before attaching the possessive pronoun suffixes or when the indefinite noun is being the first term in the construct noun phrase:

(13)		**Indefinite**	**Possessive**	**Construct State**
	Nom.	kitaab-u-**n**	kitaab-u-hu	kitaab-**u** # ṭ-ṭaalib-i
	Acc.	kitaab-a-**n**	kitaab-a-hu	kitaab-**a** # ṭ-ṭaalib-i
	Gen.	kitaab-i-**n**	kitaab-i-hi	kitaab-**i** # ṭ-ṭaalib-i
	Gloss	'a book'	'his book'	'student's book'

3.2.4 *a*-Deletion

Since Arabic stands as a synthetic language, various particles such as prepositions or conjunctions can be attached or more formally cliticized to either the beginning or the end of noun stems. Their attachment is usually subject to several complex morphophonemic alternations. For instance, when the prepositions *li* 'for or to' is prefixed to a definite noun, that is a noun having the definite article *ʔal-,* the /a/ of the article is omitted. This is reflected in both spelling and pronunciation.

The deletion of the initial vowel of the prefix can be accounted for by postulating the rule of truncation in (14):

(14) a → Ø / V____ (*a*-Deletion)

The rule in (14) will operate upon a representation such as /li + ʔal/ to yield [li1] as in (15a). The same rule also applies to the definite article attached to a noun which is the second element in a construct noun phrase. The /a/ is dropped if the first element of the phrase ends in a vowel as in (15b):

(15)	**Underlying Form**	**Surface Form**	**Gloss**
a.	/li-ʔ**a**l-madras-at-i/	[lilmadrasati]	'to the school'
b.	/kitaab-**u** # ʔ**a**l-walad-i/	[kitaabu lwaladi]	'boy's book'
c.	/ʕayn-a**y** # ʔ**a**l-walad-i/	[ʕayna**y** ʔ**a**lwaladi]	'boy's eyes'

In (15c), it can be observed that /a/ deletion does not apply because the preceding word ends in /y/. Deletion applies if there is a clash of two successive vowels as in (15a, b).

a-Deletion also appears in the derivation of verbal nouns in Arabic. In one process of the formation of verbal nouns (the so-called masdar) from the triconsonantal verb stem, the short vowel /a/ after the second consonant is dropped by a syncope process. The noun differs from its verbal stem only with respect to one vowel as in (16):

(16)	**Verb**	**Gloss**	**Noun**	**Gloss**
a.	raq**a**s	'to dance'	raqs	'dancing'
b.	fat**a**ḥ	'to open'	fatḥ	'opening'

Vowel deletion in (16) is not phonologically triggered. Rather it is purely morphologically conditioned because there exists no phonological reason or constraint that motivates vowel deletion in the verbal noun formation (Kurisu, 2001). Segment deletion of this type "commonly occurs as a morphologically conditioned phonological process" (Inkelas, 2014: 30).

3.2.5 (*u, a, i)*-Deletion

Arabic does not readily tolerate adjacent heterosyllabic vowels at morpheme boundaries. A cluster of vowels often leads to what is known as vowel hiatus. Hiatus is the clash of two adjacent vowels (Jensen 1990: 172). In such cases, the deletion may apply. Deleting one of the adjacent vowels is a very common means of resolving hiatus created, especially at morpheme boundaries (Casali, 1997). This occurs specifically with the first person singular possessive suffix *-ii* when attached to nouns after their short vowels case markers. These vowels are deleted and then the suffix is immediately added to the stem. It is so in order to avoid such impermissible sequences as *VVV. In Arabic phonotactics, a sequence of vowels like *VVV is prohibited because it is a case of vowel hiatus, which is resolved via deletion of the first vowel. So, the sequence *VVV necessarily reduces to VV. The deletion rule is shown in (17):

(17) $\begin{Bmatrix} u \\ a \\ i \end{Bmatrix} \rightarrow \emptyset \; / \; \_\_\_\_\_ \; +ii \; \#$ (*V*-Deletion)

Examples in (18) provide grammatical situations under which vowel deletion may apply.

(18)		**Underlying Form**	**Surface Form**	**Gloss**
	Nom.	/qalam-**u**-ii/	[qalamii]	
	Acc.	/qalam-**a**-ii/	[qalamii]	'my pen'
	Gen.	/qalam-**i**-ii/	[qalamii]	

Deletion in (18) is phonologically conditioned because the variation is triggered by the plain phonological context.

3.3 Insertion

Insertion is the morphophonemic process in which a sound is added to a word. "When a vowel is inserted, this is usually called epenthesis. If insertion occurs at the beginning of a word, it is called prosthesis. Insertion of a consonant can be called epenthesis also, or else excrescence" (Jensen, 1990: 161). Glide and vowel insertion are discussed below.

3.3.1 Glide-Insertion

When the deletion of a segment cannot rectify vowel hiatus, the insertion of a segment occurs. A clash of two long vowels arising at stem-suffix or sometimes suffix-suffix boundaries is resolved in most cases by glide insertion. Glide epenthesis, therefore, is one of the strategies used in Arabic to repair vowel hiatus mostly occurring at morpheme boundaries. Glide epenthesis applies when vowel-initial suffixes are attached to vowel-final stems. There are two types of glide insertion, *w*-Insertion and *y*-Insertion. The following rule inserts a glide at a morpheme boundary between two long vowels:

(19) $\emptyset \rightarrow \begin{Bmatrix} y \\ w \end{Bmatrix} \; / \; VV \_\_\_ VV,$ where VVs are long (*Glide*-Insertion)

3.3.1.1 *w*-Insertion

The epenthetic /w/ appears before dual or sound feminine plural suffixes added to singular nouns ending in /aa/ or /aaʔ/. In the case of stems ending in /aa/ as in (20a), the long vowel is shortened to /a/ and then /w/ is inserted between the stem and the suffix. Stems ending in /aaʔ/ as in (20b), however, lose only the glottal stop. The glide /w/ is inserted directly between the stem and suffixes. Here, /w/ is epenthesized to break up an unallowable vowel cluster like *VVVV (super-long vocalic hiatus) whose reduction does not occur. Thus, the resulting hiatus is resolved by first syllabification of this cluster and then by glide insertion. Glides are, therefore, hiatus breakers inserted between vowels coming together at morpheme boundaries. They serve to offer an onset to an otherwise onsetless syllable. The inserted glide can now constitute the onset of the newly created syllable.

(20)		**Underlying Form**	**Surface Form**	**Gloss**
	a.	/ʕaṣaa-aani/	[ʕaṣa**w**aani]	‘two sticks’
		/bašaa-aat/	[bša**w**aat]	‘pashas’
	b.	/ḥarbaaʔ-aani/	[ḥarbaa**w**aani]	‘two chameleons’
		/samaaʔ-aat/	[samaa**w**aat]	‘heavens’

w-Insertion also occurs particularly in inflection for number of biconsonantal stems. Arabic has singular nouns that consist superficially of two consonants. However, their underlying forms are assumed to have a third consonant. In this case, a glide is assumed to be the default filling consonant that surfaces in the inflected form. The /w/ preceded by a short vowel is typically infixed in biconsonantal and defective stems before suffixation to regularize the stems and to allow them to take the inflectional suffixes.

(21)		**Singular**	**Dual**	**Gloss**
	a.	ʔab	ʔab**aw**-aani	‘two fathers’
	b.	ʔax	ʔax**aw**-aani	‘two brothers’

/w/ is also inserted between the first and the second consonants of irregular plurals (traditionally called broken plurals (BPs)) formed from singular nouns, especially those having a long vowel in the first syllable. Since BPs formation usually involves vowel lengthening in the second syllable (i.e., <CV**V**+VV>), this subsequent plural lengthening often leads to super-long vocalic hiatus, which is repaired by /w/ insertion.

(22)		**Singular**	**BP**	**Gloss**
	a.	ʒaamuus	ʒa**w**aamiis	‘buffalos’
	b.	qaarib	qa**w**aarib	‘boats’

3.3.1.2 *y*-Insertion

The same thing can be said about /y/ insertion. The /y/ is inserted before dual or sound feminine plural suffixes which are attached to nouns ending with /aa/ to prevent the clash of two adjacent long

vowels. Therefore, the potential sequence *VVVV is resyllabified by reinterpreting one of the V's as an onset (C) slot, which is filled by a glide: VVVV → VGVV (Ratcliffe, 1998: 61).

(23)	**Underlying Form**	**Surface Form**	**Gloss**
a.	/mustašfaa-aani/	[mustašfa**y**aani]	'two hospitals'
b.	/mustašfaa-aat/	[mustašfa**y**aat]	'hospitals'
c.	/fataa-aani/	[fata**y**aani]	'two boys'

From the examples in (20), (22) and (23), it can be argued that the main motivation behind insertion is to avoid any potential heterosyllabic sequence like *VVVV, which represents a super-long vocalic hiatus (Topintzi 2010: 115). So, in order to resolve the hiatus, the sequence is resyllabified as V.GVV, VV.GV or VV.GVV where a glide is inserted to fill an empty onset position. On the other hand, "consonant-final stems are always syllabifiable on their own and never create vowel hiatus with a following vowel-initial suffix" (Downing, 2006: 214). Epenthesis is a very general process and a mechanism breaking vowel hiatus and resolving consonant clustering (Casali 1996; Clements & Keyser, 1983; Downing, 2006; Hayes & Abad, 1989; Hyman, 1985; Inkelas, 2014; Itô, 1989; McCarthy & Prince 1993, 1994; Payne, 1981; Topintzi, 2010; Zimmermann, 2017). Here, glide epenthesis is phonotactically motivated in the intervocalic context to avoid vowel hiatus, especially at stem-suffix or suffix-suffix edges. It applies where deletion fails to resolve the hiatus.

3.3.2 *a*-Insertion

A short low vowel /a/ is inserted after the second consonant of the feminine singular noun stems of the patterns *CiCC-at* and *CuCC-at* to form their plurals, with the suffix *-at* dropped. The following morphophonemic rule inserts a short vowel /a/ between two consecutive consonants.

(24) Ø → a / C ____ C (*a*-Insertion)

	Singular	**Plural**	**Gloss**
a.	birk-at	bir**a**k	'pools'
b.	ɣurf-at	ɣur**a**f	'rooms'
c.	xirq-at	xir**a**q	'old rags'
d.	nisb-at	nis**a**b	'ratios
e.	furṣ-at	fur**a**ṣ	'opportunities'

3.4 Vowel harmony

Vowel harmony is one of the most common types of distant assimilation between vowels across morpheme and word boundaries or within a word form (Alfozan, 1989). It "is the phenomenon that all vowels of a word share certain properties" (Booij, 2005). It affects not only adjacent segments but also segments that occur at some distance from each other, i.e., "it involves a relation between nonadjacent sounds" (Hulst & Weijer, 1995). Rules of vowel harmony and assimilation typically apply from vowel to vowel, regardless of intervening consonants (Clements & Hume, 1995: 260). Based on the direction of the influence, two types of vowel harmony are attested in Arabic. These are regressive

and progressive harmony. In progressive harmony, the vowels in each morpheme adapt to the preceding vowels (Matthews, 1991: 150). Arabic progressive vowel harmony is based on high front-back harmony. That is, harmonized sound within the word must either be all front or all back and must agree on the feature [+high]. This type of harmony causes suffix vowels to agree in frontness or backness with stem vowels or semivowels. Alternations here involve the vowels /i/ and /u/. For example, the third person possessive morphemes (*-hu, -humaa, -hum, -hunna*) are subject to vowel harmony when they are preceded by high front sounds such as /i /, /ii/ or by the semivowel /y/. The high back vowel of the suffix /u/ converts to a high front vowel /i/ after a stem-final high front sounds. Vowel harmony process may be represented in the following rule:

(25) u → i / $\begin{bmatrix}+\text{high}\\-\text{back}\end{bmatrix}$ +h _____ (Progressive Vowel Harmony)

The preceding segments are usually the case markers which affect only the nearest vowel of the following morpheme. The vowel /i/ is the genitive case ending of the singular noun, sound feminine plural and BP. The /ii/ is the accusative and genitive marker of the sound masculine plural and /ay/ is the dual case marker in both accusative and genitive. This is illustrated by the examples in (26):

(26)

Nom.	**Gen.**
a. kitaab-**u**-h**u** book-Nom-Poss3ms 'his book'	c. bi-qalam-**i**-h**i** with-pen-Gen-Poss3ms 'with his pen'
b. maktab-at-**u**-h**u**nna library-Fem.Sg-Nom-Poss3fp 'their library'	d. ka-mudarris-**ii**-h**i**nna like-teacher-Pl.Masc.AccGen-Poss3fp 'like their teachers'

From these examples, it can be seen that the third person possessive suffixes have two allomorphs each alternating between *-hu_* with a back vowel and *-hi__* with a front vowel. The choice between these allomorphs (*-hu_* and *hi_*) is wholly determined by the preceding sound. If the immediately preceding vowel is /i/, /ii/ or the semivowel /y/, then the suffix *-hi_* occurs as in (26c, d); if the preceding vowel is /u/, then *-hu_* is used as in (26a, b). Thus, it follows that a front vowel and back vowel cannot co-occur at the stem-suffix boundary. The morphophonemic rule that regulates the allomorphic distribution of these suffixes is simplified in the following way: when added to a stem with a high front vowel or semivowel, the vowel in the suffix would be high front and when added to a stem with a high back vowel, the vowel in the suffix would be also back. It is left-to-right (progressive) harmony. In such cases, stem vowels control harmony. Hulst and Weijer (1995) refer to this type of vowel harmony as stem-controlled.

Let us now examine the behavior of the low vowel in Arabic. The low vowel /a/ has a distinctly anomalous status. Consider the following examples:

(27)

Acc.
a. kitaab-**a**-h**u**

book-Acc-Poss3ms
'his book'

b. sayyaar-at-**a**-h**u**nna
car-Fem.Sg-Acc-Poss3fp
'their car'

Examples in (27) do not show symmetry of vowel harmony as /i/ and /u/ vowels do. The low vowel /a/ does not have a harmonic counterpart. That is, the suffix vowel does not agree with the stem vowel. Moreover, the low vowel /a/ fails to alternate and trigger the expected vowel harmony. The potential distinction is neutralized (Hulst & Weijer, 1995). It is neutralized because /a/ lacks the [+high] value. Whereas the vowel of the suffix has the [+high] value, /a/ has [+low]. They have different height values. Vowel harmony applies between homorganic vowels of the same height, i.e., [+high]. Vowels that do not participate or play a role whatever in harmony processes are called 'neutral vowels' (Clements, 1980; McCarthy, 1984; Spencer, 1986). Clements (1980: 6) states that "when the feature [High] is present in a root or word, it establishes a domain or 'span' of harmony across strings of neighboring segments". The feature is identified as Advanced Tongue Root [ATR]. Clements (1980) in his analysis of vowel harmony in Akan and Turkish languages argues that the low vowel /a/ does not undergo harmony and that neutral vowels are excluded from the set of elements that are P-bearing with respect to the spreading of the harmonic feature. McCarthy (1984) supports Clements' claim that [+low] vowels are excluded from harmony because they neither trigger nor participate in [High] harmony. Spencer (1986) also accounts for the exclusion of the low vowels from participating in the vowel harmony process. In Spencer's account, "the neutral vowel /a/ is unaffected by [High] Harmony, it doesn't block harmony and it doesn't initiate harmony of its own". Based on [ATR] harmony rule, all high vowels are [+ATR]. The value [+ATR] is then said to be responsible for triggering vowel harmony since vowels with [-ATR] value fail to trigger or undergo vowel harmony and this includes /a/, the only low vowel in the language which happens to be [-ATR].

The low vowel /a/, however, participates in vowel harmony alternations if it occurs to the right (regressive harmony) but not if it occurs to the left (progressive harmony). From this point of view, it is only the height of the vowels that is of importance, because their alternations in frontness and backness are governed by progressive vowel harmony. In regressive harmony, it is the suffixes that control harmony (Hulst & Weijer, 1995). In this case, it is the vowel of the stem that harmonizes with the vowel of the suffix. This is observed in stems containing short vowels in the last syllable. The stem vowel /u/ assimilates regressively to the vowels of case suffixes. It can be attributed to the fact that case suffixes are invariable suffixes. They retain their form independent of the vowels in the base (Bauer, 2003). Examples in (28) illustrate this type of harmony.

(28)

	Underlying Form	**Surface Form**	**Gloss**
Nom.	/ʔimr**u**ʔ-un/	[ʔimr**u**ʔun]	
Acc.	/ʔimr**u**ʔ-an/	[ʔimr**a**ʔan]	'a man'
Gen.	/ʔimr**u**ʔ-in/	[ʔimr**i**ʔin]	

3.5 Metathesis

Hume (2004: 203) defines metathesis as "the process whereby in certain languages the expected linear ordering of sounds is reversed under certain conditions". Metathesis plays a vital role in the formation of BPs in Arabic. It occurs in four productive plural patterns, ʔaCCuC, ʔaCCaaC, ʔaCCiCat, and ʔaCCiCaaʔ. Levy (1971), cited in (McCarthy & Prince, 1990a), observes that the surface plurals of the canonical pattern ʔaCCaaC can be derived from underlying *CaCaaC by a metathesis rule. McCarthy and Prince (1990a) follow Levy's observation and posit a rule for this process which they call stem-initial *Ca* Metathesis. Thus, plural nouns such as ʔabhur 'seas', ʔaqlaam 'pens', ʔaqniʕat 'masks' and ʔaSdiqaaʔ 'friends' would reflect the underlying *bahur, *qalaam, *qaniʕat, and *Sadiqaaʔ respectively. However, deriving plurals from their underlying forms by *Ca* Metathesis would result in an initial onsetless syllable. There is no syllable like 'VC' in Arabic. Arabic phonology forbids onsetless syllables. So, to get the syllable well-formed, an epenthetic glottal stop /ʔ/ is inserted to fill the empty onset. This can be stated as follows:

(29)	a.	Ca	→	aC	(metathesis)
	b.	aC	→	ʔaC	(prosthesis)

In this connection, the appearance of metathesis is morphologically conditioned. It is regarded as morphological metathesis because it happens under specific morphological conditions. It is used to derive the surface forms of plurals from their underlying forms irrespective of the surrounding phonological environment.

3.6 Pausal Form Alternations

In Arabic, most words have two forms, full form and pause form. Pause form occurs in final syntactic positions in which a word seems to be shorter than the full form in a non-final position. Before a pause in speech, it is normal to decrease the sound of the final word (Fischer 2002:32). "The pausal form is shorter than the full form by up to the whole part or part of as many as three morphemes" (Hoberman, 1995). Consider the following:

(30)	**Pause Form**	**Full Form**	**Gloss**
a.	qalam	qalam-i-n	'pen-Gen-Indef'
b.	maktaba[h]	maktab-at-u-n	'library-Fem.Sg-Nom-Indef'
c.	ʔal-qalb	ʔal-qalb-a	'Def-heart-Acc'

The alternations in (30) cannot be accounted for in terms of purely phonological conditions. There are certain morphological rules for such alternations, which would determine how much is missing in a pausal form. These morphological rules which add inflectional suffixes are constrained not to apply in pause (Hoberman, 1995: 161). They first have to recognize the morpheme boundary and second to identify a specific morpheme to work. Three inflectional suffix categories are subject to full and pausal form alternations, the three short vowels of case-marking suffixes, nominative *-u*, accusative *-a* and genitive *-i*, the indefinite marker suffix *-n*, and the feminine suffix *-at*. Case suffixes

which are final short vowels are lost in pause. The morphological rule that deletes them is constrained to vowels which are part of a suffix; it does not apply to stem vowels (Hoberman, 1995: 161).

(31)	**Pause Form**	**Full Form**	**Gloss**
a.	ʔal-bayt	ʔal-bayt-u	'Def-house-Nom'
b.	ʔal-bayt	ʔal-bayt-a	'Def-house-Acc'
c.	ʔal-bayt	ʔal-bayt-i	'Def-house-Gen'

In the pause form of examples above, the case suffixes are absent and that a single form ʔal-bayt stands for all cases. The whole category of case is neutralized. Likewise, the indefinite suffix *-n* is absent in pause. This is manifested in the genitive and nominative cases where the suffix *-n* together with the preceding vowel of case-marking are dropped and hence one allomorph stands for both. In the accusative, however, the case suffix is retained and lengthened as in (32b):

(32)	**Pause Form**	**Full Form**	**Gloss**
a.	naʒm	naʒm-u-n	'star-Nom-Indef'
b.	naʒm-aa	naʒm-a-n	'star-Acc-Indef'
c.	naʒm	naʒm-i-n	'star-Gen-Indef'

The suffix *-at* which often but not always marks the feminine gender has two allomorphs, *-at* in full form and a[h] in pause:

(33)	**Pause Form**	**Full Form**	**Gloss**
a.	madiin-a[h]	madiin-at-u-n	'city-Fem.Sg-Nom-Indef'
b.	ɣurf-a[h]	ɣurf-at-a-n	'room-Fem.Sg-Acc-Indef'
c.	ṣala-a[h]	ṣala-at-i-n	'prayer-Fem.Sg-Gen-Indef'

4. Conclusion

This paper discussed several morphophonemic alternations found in Modern Standard Arabic noun morphology and outlined the morphophonemic rules and their conditioning environments which account for general alternations in surface forms. Two types of contiguous assimilation are attested, consonant assimilation, and vowel assimilation. Consonant assimilation takes place at the prefix-stem boundary in which the lateral /l/ of the prefix definite article *ʔal-* assimilates completely to nouns beginning with coronal consonants. Vowel assimilation occurs at the stem-suffix boundary as a secondary consequence of glide deletion. Insertion and deletion are two repair strategies for dealing with ill-formed outputs of surface forms like onsetless syllables and vowel hiatus arising at stem-suffix or suffix-suffix boundaries. These strategies are functioning to break up underlying clusters of vowels which are not allowed on the surface. They appear mostly when two vowels come together through suffixation. It has been observed that insertion applies where deletion fails to resolve vowel hiatus. In other words, if the vowels sequence is *VVV (a short vowel and a long V-VV), deletion applies and deletes the first short vowel. If the sequence is *VVVV (two long vowels VV-VV), insertion occurs instead. Vowel harmony, a type of distance assimilation, is also attested across morpheme boundaries causing certain suffixes to have two allomorphs.

In terms of conditioning, it has been observed that assimilation, insertion, vowel harmony, and deletion at morpheme or word boundaries are all phonologically conditioned alternations, whereas deletion within morphemes, metathesis and pausal alternation are morphologically conditioned.

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