Assimilation of Segments in Modern Standard Arabic: Schane's (1973) Views on Generative Phonology

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ABSTRACT

The objective of this work is to elaborate the phonological process of assimilation in controlling the output of phonological segments at the phonetic form in Modern Standard Arabic phonology in view of Schane’s (1973) perspective in generative phonology. The researcher suggests that there are two types of assimilation, namely, (i) progressive and (ii) regressive. In each type, there is either a partial or total transfer of features to the adjacent segment so that the assimilated segments are classified into natural classes without influencing the semantic interpretation. The change is regarded partial if a segment changes its place but maintains its manner of articulation. However, the change is total if the same segment loses its manner of articulation whether the place is toughed or not. To get clear results, phonological rules are posited to check (i) which segments change, (ii) how they change and (iii) under what conditions they change. In case of variables, certain notations such as alpha, beta, sigma etc… are used to avoid confusions in results. Though gemination is seen similar to assimilation in the output at the phonetic form, it is a kind of consonant cluster in the base meant to create new lexical items which constitute minimal pairs with non geminated forms.

Keywords: Assimilation, Segment, Regressive, Progressive, Partial, Total, Consonant, Vowel.

INTRODUCTION

Assimilation is a phonological process in which certain features of a consonant or vowel are transferred to the adjacent segment to become partially or totally the same. There are basically two types of assimilation that take place in a language, namely, progressive and regressive. In each type, there might be: (i) a total transfer of features, in which case, the assimilated segment adopts all the features of the neighboring segment, or (ii) a partial transfer of features, in which case, the assimilated segment inherits some features of the adjacent segment.

In the literature, Jonse (1972) defines assimilation as “the process of replacing a sound by another sound under the influence of a third sound which is near to it in the word or sentence. The term may also be extended to include cases where a sequence of two segments coalesce and gives place to a single new sound different either of the original sounds; this type of change may be termed coalescent assimilation” (p. 217). He introduced two chief kinds of assimilation: (i) historical and (ii) contextual. By the former, he meant an assimilation that has taken place in the course of development of a language and by which a word which has was once pronounced in a certain way came to be pronounced subsequently in another way as is the situation of [m] to [n]. For instance, the word ‘ant’ [ænt] normally came from ‘amete’ [æmatə] and ‘amte’ [æmt]. Thus, A is replaced by B under the influence of C i.e., /m/ has been replaced by the phoneme /n/ under the influence of /t/ in modern English. An example of historical coalescence assimilation is the reduction of the segments [tʃ] to the affricate [tʃ] as in ‘picture’ [piktʃ] which some hundreds of years ago were pronounced [piktiʃ]. Hence, A and C have influenced each other and coalesced into a single B i.e., [t] and [j] have
become [ð]. By contextual assimilation, he meant one segment occurs next to another in a sentence, or in the formation of compounds and pronounced differently when it is said by itself as in the change of [s] to [ʃ] when ‘horse – shoe’ are put together to form [hʊʃ:]. Thus, A is replaced by B under the influence of C i.e., [s] is replaced by [ʃ] under the influence of [ʃ]. An example of contextual coalescence assimilation is when ‘don’t you’ /dount [ju:] are put together to be pronounced [doun[tː] in which case [tː] has come to be [ð]. Thus, A and C influence each other and coalesce into a single B i.e., [t] and [ʃ] have become [ð] (p. 217).

Ladefoged (1982) explains assimilation when one sound is changed into another because of the influence of a neighboring sound. For instance, there is assimilation of the nasal [n] to the dental [n] because of inter-dental [θ] in the phrase ‘in the’ [ɪn ðə].

Gimson (1982) illustrates that the mutual influence of contiguous phonemes in English may function predominantly in regressive direction, i.e. features of phoneme are anticipated in the articulation of the preceding phoneme; or it is progressive, i.e. one phoneme markedly influences the following phoneme; and, sometimes, a fusion or coalescence of phonemes may take place. The former involves allomorphic variations in which case the realization of any phoneme differs according to the context in which it occurs. It involves (1) a change of place of articulation as in /t/ goes to dental [θ] in word boundary in ‘not that’, (2) voicing- usually devoicing of continuants following a fortis consonant within a word as in /t/ ‘cry’, (3) lip position happens due to the influence of the adjacent vowel or semi-vowel as in /p/ ‘pea’ and /k/ ‘thick one’ and (4) position of the soft palate resulting from anticipatory or prolonged lowering of the soft palate in the vicinity of a nasal consonant as in /i/ ‘men’ and /s/ ‘brin another’. As far as the latter is concerned, there can be no question of assimilation involving phonemic change in English as compared to allophonic variation. Nevertheless, different pronunciations of the same word ( either between two speakers or between two different styles of speech in the same speaker) sometimes exhibit a different choice of internal phone depending on the degree of assimilatory pressure of the word environment felt by the speaker as in ‘length’ may be /lɛŋθ/, /lɛŋkθ/, or /lɛŋθ/. However, in the contemporary English, it is visible at a word boundary in connected speech that most cases of phonemic change occur (i.e. change as compared with the phonemic pattern of the isolated word form given ahead). Such phonemic variation is found within the pairs of (1) fortis/lenis in it changes involving both voicing and energy of articulation when word final lenis fricatives followed by a word initial fortis consonant may with some speakers be realized as the corresponding fortis fricative, if the two words form part a close- knit group. Thus, isolate final /ð/ of ‘with, breathe’, may be replaced by /θ/ in ‘with thanks breathe slowly’ and /z/ of ‘these, was, chose’ by /s/ in ‘these socks, he was sent, we chose six’, (2) in changes involving modification of place of articulation such changes are normal in colloquial speech, when native speakers are usually unaware that are made. It is evident in the instability of final alveolars when final /t/ assimilates to /p/ before /p, b, m/ in word boundary ‘that pen’, that boy and ‘that man’ /ðeип pens/; and in coalescence of /t/ + /j/ become /θj/ in ‘what you want’ /wʌθ ju want/ and /s/ + /j/ become /ʃj/ in ‘in case you need it’ /ɪŋ kəsju ni:d it/ and (3) a combination of voicing and place of articulation as in /d/ changes /g/ then to /g/ in ‘he wouldn’t go’ /hɪ wʊŋ(k) gəʊ/ and /d/ changes to /b/ then to /m/ in ‘good morning’ /gʊm ˈm2:niŋ/ (p. 286-292).

Abu Salim (1984) argues that the major consonant assimilation processes occurring in classical and colloquial Arabic are listed and classified as progressive or regressive, partial or complete. He focuses merely on consonantal assimilation without tackling other segments, namely, vowels. He also argues that the application of auto -segmental approach to the underlying representation of segments and to the application of phonological rule indicate that partial and complete assimilation rule are just two forms of the same process since they apply in the same manner. Both types involve a transfer of either partial or total features to the neighboring segment to become somehow a like or the same. The only difference between the two types is found in their outcome without disturbing the phonological rules used.

O’grady and et al (1996) explicates that assimilation is a result from the influence of one segment on another. It always results from a sound becoming more like another nearby sound in terms of one or more of its phonetic features. For instance, nasalization of a vowel before a nasal consonant as in [mæn] is caused by speakers anticipating the lowering of the velum in advance of any nasal segment. The result is that the preceding segment [n] takes on the nasality of the following [n]; this type of assimilation is known a regressive assimilation. Thus the nasality is moving backwards to the preceding segment. However, if the nasalization of vowels following nasal consonant as in Scots Gaelic as in [mě:r, ‘big’, nǐ ‘cattle’, mù ‘about’ and ně:l ‘cloud’], it is a progressive assimilation since the nasality moves forward from the nasal
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segment onto the vowels (p. 53). Assimilation is devoicing if liquids and glides occur after voiceless stops and become voiceless as in words ‘please’ [pliːz], ‘proud’ [praʊd] and ‘pure’ [pjʊə]. However, it is voicing if fricative [f] in the preposition ‘off / over’, in Dutch, assimilates to the voicing of stops in words such as afbelen ‘to ring off’ [avbelen] and afdeken ‘to cover over’ [avdeken] (p. 53). Assimilation extends to cover not only manner of articulation but to place of articulation as in the negative suffix ‘in’ before ‘possible’ to become [imposibl] due to the influence of the voiceless bilabial stop [p].

Odden (2005) defines assimilation as a phonological process in which two segments become more alike by having one segment take on values for one or more features from the neighboring segment. An example of regressive assimilation is the front – back vowel harmony process in Turkish. In this language, vowels within a word are all front or all back, and suffixes alternate according to the frontness or backness of the preceding vowel as in [ip] (nom-sg), [ip-in] (gen-sg), [ip-ler] (nom pl), [ip-ler-in] (gen pl) ‘rope’ and [pul] (nom-sg), [pul-un] (gen-sg), [pul-lar] (nom pl), and [pul-lar-in] (gen pl) ‘stamp’ respectively. Another example of assimilation is the assimilation of a nasal to the place of articulation of a following consonant in Kimatuumbi. The plural prefix /ã/ takes on the place of articulation of the following consonant as in [lwûmo] (sg), [ňîmo] (pl) ‘land being weeded’ and [lwaámbo] (sg), [ňaámbo] (pl) ‘bead’ (p. 228-234).

Faric and et al (2006) comment that a segment may assimilate one or two features of the neighboring segment and sometimes it will totally assimilate the same segment in a process called substitution. For instance, in a study in colloquial Arabic, the initial segments [d] in words such as dafter ‘notebook’, daktu:r ‘a doctor’ and duka:n ‘a shop’ are pronounced as [t], ( p. 100).

In short, assimilation is a universal phonological process applied to all languages. Thus, the researcher decides to elaborate it in Modern Standard Arabic from the point of view of generative phonology following Schane’s views (1973) and try to posit phonological rules for each segment change; however, the rules cannot be applied to gemination as it is base generated in the lexicon and no phonological process is involved.

The problem of this Study

A segment assimilates another one either in a regressive or progressive style but one cannot decide on what basis the change of features is partial or total in Arabic phonology. The researcher suggests clear cut proofs to the problem and argues that it is not necessary if a segment copies all the features of the second, the change is total. Thus, the change is decided on the basis of the new quality of features inherited by a segment after the change takes place in the assimilation process.

Objectives and Questions of the Study

The objective of this study is to examine accurately the concepts of partial and total feature change in a regressive and progressive assimilation in Modern Standard Arabic in the light of Schane's (1973) views on generative phonology in an attempt to reach new results far away from redundancy. It attempts to answer the following questions:

A. On what basis does the researcher decide the change is partial?
B. On what basis does the researcher decide the change is total?
C. how do the distinctive features of Generative Phonology help specify the change?
D. How do the posited phonological rules tackle the kind of change?
E. Is gemination a result of assimilation or not?

Theoretical Perspectives and Analyses

The basic assumption of this work is to illustrate in what sense phonology has its foundations in phonetics in the assimilation process. Schane (1973, p. 25-34) argues that it is evident that an utterance is composed of a sequence of discrete segments; each segment is regarded as the smallest unit of phonological analysis and cannot further be decomposed into anything smaller. Segments ought to differ from each other if they share the same phonetic traits. The traits are not only used to classify sounds but also they can account for different phonological processes observed in a language. For instance, the segment [k] alternates with [s] in the environment of ‘electric’ and ‘electricity’. Once it becomes evident that it is advantageous to view segments as composed sets of properties rather than as indivisible entities, the
The researcher can illustrate the relationships by listing explicit features for each segment. For instance, [d] has the dental, stop, and voiced while [n] has dental, nasal and voiced features. They are similar in having dental and voiced features but differ in their manner of articulation. The phonetic parametric features which will be posited for this analysis are ideally to fulfill three basic functions. (i) They are capable of describing the systematic phonetics- a phonetic function. (ii) At the more abstract level, they serve to differentiate lexical items- a phonemic function. (iii) They define natural classes, that is, those segments which as a group undergo similar phonological processes as is the situation in assimilation as a specimen in this work. There will be two types of features: those which come in pairs and represent the presence or absence of an attribute such as nasal-oral, voiced-voiceless, tense-lax, palatalized- non palatalized, labialized- non-labialized, round-unround, back-front, or sonorant-obstruent and those which represent values along scale such as high, mid, low for vowels, or the place of articulation features for consonants such as labial, dental, palato-alveolar, velar and so on. For features indicating opposite traits, the researcher employs the binary system (plus and minus) to show whether or not the attribute is present. The binary notation is ideal for all features indicating opposite qualities. The advantage of a binary system is that one can illustrate explicitly how members of pairs such as voiced-voiceless or nasal-oral are related to each other in a way in which other possible pairings such as voice-oral or voiceless-nasal are not. This system allows the researcher to illustrate whether all features, including those which at first are not obviously binary such as the height features for vowels or the place of articulation features for consonants which are capable of being a binary interpretation.

The appropriate features that are used to analyze assimilation in this work are: (a) the major class features which include the features of (i) syllabic, (ii) sonorant and (iii) consonantal. These three features are used to find similarities and differences between vowels and consonants. The feature syllabic characterizes the role a segment plays in the structure of a syllable. In general, vowels are [+syllabic] whereas consonants are [-syllabic]. This feature is also essential for differentiating syllabic nasals and liquids ([+syllabic]) from nonsyllabic counterparts if available in a language. The feature sonorant refers to the resonant quality of a sound to distinguish obstruents from sonorants and glides from other consonants. Vowels, nasals, liquids and semi-vowels are always [+sonorant]; however, obstruents (stops, fricatives, affricates and laryngeal glides) are [-sonorant]. The feature consonantal refers to a narrowed constriction in the oral cavity—either total occlusion or frication to distinguish consonants from others. Stops, fricatives, affricates, nasals, and liquids are [+consonantal] while vowels, semi-vowels are [-consonantal]. Laryngeal glides are also classified as [-consonantal] since they have got no constriction within the oral cavity (c.f. Chomsky and Halle 1968, p. 302 for more of the features). (b) Manner of articulation features which involve the features of (i) continuant, (ii) nasal, (iii) lateral and (iv) delayed release. The first feature is used to distinguish stops, fricatives and affricates from each other, the second to distinguish nasals from liquids, the third to distinguish laterals from non-laterals and the fourth to distinguish affricates from stops and fricatives. Among the obstruents, fricatives are always [+continuant] while stops and affricates are [-continuant]. This feature distinguishes between [?] which is [-continuant] from [h] [+ continuant]. The features [nasal] and [lateral] differentiate several of sonorant consonants. Nasals are opposed to liquids as [+nasal] to [-nasal]. This feature is used to differentiate nasalized vowels [+nasal] from oral ones [-nasal]. Among liquids, laterals are opposed to non-laterals as [+lateral] to [-lateral]. The feature delayed release considers affricates as [+ delayed release] while stops are [-delayed release] (c.f. Chomsky and Halle 1968, p. 302, 316-321 for more of the features). (c) Place of articulation features which involve (i) [coronal – noncoronal] and (ii) [anterior – nonanterior]. These two features are used, on one hand, to distinguish consonants from vowels and, on the other hand, to distinguish consonants from each other with reference to the amount of stricture involved in the place of articulation. Coronal sounds are produced with the blade of the tongue raised from its neutral position while noncoronal sounds are produced with the blade of the tongue in the neutral position. The former involves dental, alveolar, glides [j] and [w] and palato-alveolar whereas vowels are non-coronal. Anterior sounds are produced with an obstruction that is located in front of the palato-alveolar region of the mouth while non-anterior sounds are produced without an obstruction. It follows from the proposed characterization that vowels are always non-anterior. Consonants and liquids are anterior when they are formed with an obstruction that is located farther forward than the obstruction for [f]. Thus, labials, dentals and alveolar are anterior while palato-alveolar, retroflex, palatal, uvular and pharyngeal are non-anterior (c.f Chomsky and Halle 1968, p. 302-303-304 for more of the analysis). (d) Body of tongue features involve (i) low, (ii) back and (iii) round. In the classification of consonants that are pharyngealized (i.e. emphatic dentals) and vowels, the researcher makes use of such features to distinguish plain segments from emphatic and front from back vowels etc…
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Insofar as the phonological rules are concerned, they state the exact conditions under which assimilation takes place. Each phonological rule has formal generative notations that are suitable for expressing the environment and the type of assimilation taking place in process of assimilation in phonology. The researcher shall consider three types of rules: (i) rules for regressive, (ii) rules for progressive and (iii) rules with variables for both partial and total assimilation. The rules will involve the notational convention of C for consonants and V for vowels in reference to the major divisions of segments. In variables, if two or more rules are identical except for one or two values, then the rules are conjoined in one and the Greek notations of Alpha [α], Beta [β], Epsilon [ε], Upsilon [υ], Sigma [σ], Lambda [λ], Gamma [γ], MU [µ] are used. Schane (1973, p. 70) argues that theoretically when a nasal consonant becomes homorganic to the following obstruent it takes some or all its features; for example, if the obstruent is a labial ([+ anterior, - coronal]), then the nasal must also have the value [+] for the feature [anterior] and [-] for the feature [coronal]; however, if the obstruent is a dental ([+ anterior and + coronal]), then nasal must have the corresponding values. More than one variable is needed to express the assimilation of this type as in the given rule (1).

1. \[ C \]^{[\alpha \text{ anterior}]} / - \text{[- sonorant]} + \text{nasal} \quad \beta \text{ coronal} \quad \alpha \text{ anterior} \quad \beta \text{ coronal}

The following rule, which makes use of a single variable on the features [anterior] and [coronal], says something quite different as in (2).

2. \[ C \]^{[\alpha \text{ anterior}]} / - \text{[- sonorant]} + \text{nasal} \quad \alpha \text{ coronal} \quad \alpha \text{ anterior} \quad \alpha \text{ coronal}

This rule states that whenever the obstruent has identical values for the features [anterior] and [coronal], the nasal must also have the same identical values- that is, if the obstruent is [+ anterior, + coronal] or [- anterior, - coronal], the assimilation takes place. However, the assimilation would not occur if the obstruent has the opposite values for the features [anterior] and [coronal]- that is, when the obstruent is [+ anterior, - coronal] or [- anterior, + coronal]. This rule would change /mt/ and /mk/ to [nt] and [nk] respectively but it would not have an effect on /mp/ or /mč/. The assimilation happens in a vowel harmony as in Turkish in which case a rule requires more than one variable. A high suffix vowel agrees in backness and rounding with the preceding vowel, so that if that vowel is [- back, - round], the suffix is [- back, - round]; if the vowel [- back, + round], the suffix is [- back, + round] as in (3).

3. \[ V \]^{[\alpha \text{ back}]} / \text{[V ] } C_0 \quad + \text{high} \quad \beta \text{ round} \quad \alpha \text{ back}

(Schane, 1973, p. 70)

In so far the feature changing rules are concerned, the researcher wants to know three things when segments undergo a change. They are: (i) which segments change, (ii) how they change and (iii) under what conditions they change. The segment or class of segments which undergoes a change is characterized by the minimal set of features necessary for unique identification. The change is explained in feature notation. What changes and how it changes are then connected by an arrow pointing in the direction of the change. The researcher follows Schane's (1973) views on generative phonology given above in an attempt to elaborate the phonological process and rules of assimilation in Arabic phonological system in a new manner in the environments of: (i) a vowel assimilates a consonant feature, (ii) a consonant assimilates a semi-vowel feature, (iii) a consonant assimilates another consonant feature and (iv) a vowel assimilates another vowel feature. The study attempts to differentiate between the two types not only in terms of the output but also in terms of the phonological rules applied at the phonetic level. It is argued that the phonological rules do not interact with gemination as there is no kind of assimilation involved. It is also argued that assimilation is explicated in terms: (i) the distance between the two segments whether they occur in the lexical, phrasal or clausal environments and (ii) the direction of influence whether the assimilated segment is influenced by a following segment (i.e., regressive) or by the preceding (i.e., progressive) (c.f. O’grady and et al (1996) and Gimson (1982) for the direction of influence).
Regressive Assimilation

Schane (1973, p. 49) defines assimilation as “In assimilatory processes a segment takes on features from a neighboring segment. A consonant may pick up features from a vowel, a vowel may take on features of a consonant, one consonant may influence another, or one vowel may have an effect on another”. Basically, there are two types of assimilation: regressive and progressive. The researcher starts with the former in this section then move to discuss the latter in the next section. Regressive type of assimilation occurs in specimens in which the second segment influences the first as in the lexical item ‘width’ [witθ] in which d > t because of [θ] and as in the noun phrase ‘horse shoe’ [hɔːʃuː] in which s > j because of the following [ʃ] in the next word. This type of phonological process takes place in Arabic, in which case, the segment is affected by the features of the next segment in direction. There are a number of specimens which will be discussed in the following manner:

A vowel assimilates a consonant features

In this kind of assimilation, a vowel can carry certain features of a consonant in a regressive direction at the lexical level as in English ‘man’ [mæn], ‘seem’ [sɪm] and ‘seen’ [sɪŋ] in which case the vowels [a], [i:] and [i] are nasalized to due the nasal consonants [n, m and ŋ] that follow in direction (c.f. Schane, 1973, p. 50). This process is applicable to Arabic whenever a vowel is followed by the nasal consonants [n and m] as in (4-7):

4. /ɪŋkasara/ [ɪŋkasar] got broken ‘Got broken’
5. /mɪmmə/ [mɪmmə] that ‘That’
6. /fɑː- nqata’ɑ/ al- hablu [fɑː- nqata’ɑ al-hablu] Thus got cut det rope ‘Thus, the rope got cut’
7. /mɑː- naama/ nuuhun [mɑː-naama nuuhun] not slept det boy ‘Noah did not sleep’

In (4), the high lax vowel [ɪ] is nasalized because of the occurrence of the neighboring alveolar nasal [n] that follows. It is evident that Arabic does not have the segment [ŋ] in its consonantal system as that of English (c.f Farić and et al 2006, p. 68). In (5), the same vowel has been nasalized because of the bilabial [m] next to it in the context. In (6), the low short vowel [ɑː] has been nasalized due to the occurrence of [n] next to it at a clausal level. In (7), the low vowels [ɑː] in ma ‘not and [ɑːɑ] in naama ‘slept’ are nasalized in articulation because of [n and m] next to them at both lexical and clausal levels respectively. In short, nasalization of a vowel, in Arabic, is allophonic as that of English in which the phoneme /i/ has the allophone [ɪ] as an example of the phenomenon if it occurs after a nasal consonant and the vowel [i] occurs else where. Thus, they are in complementary distribution where one segment occurs the other does not. It is obvious that this process happens at all levels, namely, lexical, phrasal and clausal and can be represented in the phonological rule (8).

8. V → [+ nasalized] / - [ + nasal] {$/ or #}

A consonant assimilates a semi- vowel /or vowel features

Generally, they are the features of a vowel that are extended to affect a consonant in a secondary modification. For instance, in palatalization, the tongue position of the front portion is superimposed on an adjacent consonant; in labialization, the lip position of a round vowel produces a secondary articulation onto a consonant that occurs before it. To clarify the issues, the specimens in (9) are from Russian in which phenomenon certain consonants are palatalized whenever they precede front vowels.
9. /vkús/ 'taste (noun) [vkús\textsuperscript{y}en] 'tasty'
/dár/ 'gift' [dár\textsuperscript{r}it] 'to give'
/dóm/ 'house' [dóm\textsuperscript{i}sko] 'cottage'

(Shane, 1973, p. 50)

In (9), the fricative [s], the liquid [r] and the bilabial nasal [m] are palatalized before the front vowels [e and i] in regressive assimilation. It is a fact that Slavic languages are well known for their palatalized consonants. Russian p\textsuperscript{r}, b\textsuperscript{r}, t\textsuperscript{r}, d\textsuperscript{r}, k\textsuperscript{r}, f\textsuperscript{r}, v\textsuperscript{r}, z\textsuperscript{r}, m\textsuperscript{r}, n\textsuperscript{r}y, l\textsuperscript{r}, and r\textsuperscript{r} contrast with the corresponding plain consonants (c.f., Shane, 1973, p. 21-22). In Nupe, a West African language, a consonant is palatalized before front vowels and labialized before round ones as in (10i and ii) respectively.

10i. [eg\textsuperscript{y}i] 'child' [eg\textsuperscript{y}e] 'beer'
   ii. [eg\textsuperscript{y}u] 'mud' [eg\textsuperscript{y}o] 'grass'

(Shane, 1973, p. 50)

In (10i), the velar [g] is palatalized before [i and e]. However, in (10ii), the same consonant is labialized before the back round vowel [u and o]. There is a contrast between palatalized, labialized and the plain consonants in the phonemic level (c.f., Shane 1973, p. 22). However, the situation, in Arabic, is different in the sense that the semi vowels [y] and [w] influence the preceding consonant in secondary modification processes called palatalization and labialization as in (11) and labialization in (11i) respectively:

11i. /?akyaas/ [?ak\textsuperscript{y}yaas] 'bags'
    /azy aa?/ [az\textsuperscript{y}ya?] 'fabrics'
    /alyaa/ [al\textsuperscript{y}yaaf] 'fibers'
    /ashya ?/ [a\textsuperscript{y}ya?] 'things'
    /?afy aa ?/ [ ?af\textsuperscript{y}ya?] 'graces'
    /fyaa ?/ [i\textsuperscript{y}ya?] 'axhaustion'
    /ahya?/ [ah\textsuperscript{y}ya?] 'living beings'

ii. /amwaal/ [am\textsuperscript{w}waal] 'money'
    /alw aan/ [al\textsuperscript{w}waan] 'colors'
    /aqwaal/ [aq\textsuperscript{w}waal] 'sayings'
    /aatwaal/ [at\textsuperscript{w}waal] 'heights'
    /ashwaaq/ [a\textsuperscript{w}waaq] 'affections'
    /aswaar/ [as\textsuperscript{w}waar] 'sieges'
    /ahwaal/ [ah\textsuperscript{w}waal] 'situations'
    /adwaa ?/ [ad\textsuperscript{w}wa ?] 'lights'

In (11i), the consonants [k\textsuperscript{r}, z\textsuperscript{r}, l\textsuperscript{r}, ñ, f, s, h] become slightly high in secondary articulation because of the occurrence of the adjacent semi-vowel [y]. It is obvious that the lexical words do not constitute a contrast with the same either at the underlying level or at the phonetic levels. In (11ii), the semi vowel [w] affects the preceding consonants [m\textsuperscript{r}, l\textsuperscript{r}, q\textsuperscript{r}, s\textsuperscript{r}, h\textsuperscript{r}, and d\textsuperscript{r}] in the sense that the consonants become round in secondary articulation. The consonants do not constitute contrast with the plain ones in both underlying and phonetic levels. The above two phonological processes are seen in the phonological rules (11iii and iv):

11iii. C → [ + palatalized ] / - [-consonantal] $\text{- vocalic } + \text{ high}$

iv. C → [ + labialized ] / - [-consonantal] $\text{- vocalic } + \text{ round}$

Not only a semi vowel but also a vowel feature shifts to the neighboring segment in a process called labialization at all levels as in (12).
In (12), the phonemes \([k, d, dz, ð, n]\) are labialized in a secondary process as they are followed by the round vowel \([u]\) whether tense or lax. They do not constitute a contrast with the non round consonants in Arabic phonology. This phenomenon cannot occur if the same segments are followed by the vowels \([a]\) as in \(kaan\) ‘was’ and \([i]\) as in \(kitaab\) ‘a book’ since the lips remain open as specimens for the rest of consonants. The labialization phenomenon is captured by the phonological rule (13).

13. \[ C \rightarrow [+ labialized] / - [ -consonantal ] \] $ \\
+ vocalic \\
+ round \\
+ nasal \\
+ anterior \\
+ coronal \\
+ high \\

In short, the palatalized and labialized segments, in Arabic, are allophonic in Arabic; however, in Russian the segments \([p, b, t, d, k, g, f, v, z, m, n, l, r, y]\) are contrasted with the corresponding plain consonants in meaning as the constitute minimal pairs. Similarly, in Nupe, spoken, in Nigeria, there are contrasts between real (palatal and labial) and (palatalized and labialized) consonants (c.f. Schane, 1973, p. 21-22). Likewise, labialization of segments before rounded vowels in Arabic is also allophonic as that of English in words like ‘coo’ ‘do’, pull’ …etc. (c.f. Farić and et al (2006, p. 100). Not only partial but also total assimilation is also shown in Standard Arabic when semi-vowel \([j]\) affects the preceding nasal consonant \([n]\) in a word boundary as in (14):

14i. tathkiratun / liman/ yaghsha \\
Remembrance to who forget \\
\[\text{'Remembrance to those who get forgotten'}\]

The nasal \(/n/\) is followed by the semi-vowel \(/y/\); therefore, the segment \(/n/\) totally assimilates the semi-vowel as in (14ii); thus, the change happens in manner of articulation as well as the place of articulation of the segment. The same phenomenon happens in the sentence \(/fa ma lahu min waal/\ 'he has no supportive person' in which the same nasal consonant totally assimilates \(/w/\) in labialization though it remains nasalized as in \([mi\ w\ waal]\). In short, this type of total regressive assimilation is seen in the rule (14iii).

14iii. \[ C \rightarrow [- consonantal] / - [ -consonantal ] \] $ \\
+ nasal \\
- vocalic \\
+ anterior \\
σ round \\
+ coronal \\
σ round \\
+ high \\
+ high \\

The rule (14iii) states that the semi vowels \([j]\) and \([w]\) are different in one variable which is \([-round]\); the former is \([-round]\) and the latter is \([+ round]\). Thus, Greek notation Sigma \([σ]\) is needed for the variable.

A consonant assimilates another consonant feature

Regressive assimilation is found in English in which case the nasal consonant \(/n/\) assimilates the plosive segment \(/p/\) in word boundary in a backward direction as in (15):

15i. I saw \(ten\ pigs\) \\
i. I saw \([tim\ pigs]\).

In (15i), the nasal phoneme \(/n/\) pronounced as \([m]\) because it is followed by the voiceless plosive phoneme \(/p/\) in the word boundary 'ten'. Thus, the words are phonetically written as \([tim\ pigz]\) in (15ii). The segment, in question, loses the coronal feature and gains the anterior in partial assimilation because nasality remains prominent and the change is only in the place of articulation i.e., from alveolar to bilabial due to the occurrence of \([p]\)in the word 'pigs'. The same process is visible in French as in (16):
16i. /i l est in possible/.  
   he is neg possible
   'He is impossible'

In (16i), the consonant /n/ is pronounced [m] in (16ii) as it is followed by voiceless plosive [p]. The segment lost the coronal but retained the anterior feature as that of English in a partial assimilation. This kind of partial assimilation of nasal, in fact, is also common in Standard Arabic phonology in which case it occurs at the phrase level as in (17i, ii) and at the lexical level as in (17iii, iv).

17i. /min ba'd/  
   from after
   'From then’

   ii. /baitun baidaawiyun/  
       a house oval
   'An oval house’

   iii. /ya nbuuc /  
       spring
   'Spring’

   iv. /?i nbacatha/  
       sent out
   'Sent out’

As the nasal consonant /n/ in (17) is followed by the bilabial plosive voiced /b/ in all the environments, it is changed into [m] at the phonetic level; the coronal feature is lost; however, the anterior is retained whether the phenomenon is in a word boundary as in (17i and ii) or in the same syllable as in (17iii and iv). These two phenomena are represented in the phonological rule (17v):

17v. [ C ]  
   [ C] / - [- continuant ] # and $  
   + nasal   + nasal   + anterior
   + anterior + anterior - coronal
   + coronal - coronal + voiced

The researcher agrees with Farić and et al (2006, p. 100-101) in the sense that this phenomenon is quite obvious in spoken Arabic; the voiced plosive [d] that occurs at the initial position in the lexical words /daftar/ ‘notebook’, /daktuur/ ‘doctor’ and /dukaan/ ‘shop’ is changed to [t] in [taftar], [taktuur] and [tukaan] respectively. The partial assimilation occurs because the short vowels [a and u] are followed by the voiceless fricative [f] and the voiceless plosive [k] respectively as shown in the phonological rule (17vi). This phenomenon cannot occur if the vowels are tense as in /d aafic/, [*/t aafic*] ‘repellent/payer/’ and /d aakin/ [*/t aakin*] ‘dark- colored’.

17vi. [ C ]  
   [ C] / - [+ vocalic] + [C] $  
   + voiced - voiced + short - voiced
   + anterior + anterior σ round γ anterior
   + coronal + coronal θ low - coronal
   - continuant - continuant - τ continuant

The rule (17vi) states that the obstruents of [f] and [k] that follow the vowels are different from each other with regard to the variables [anterior] and [continuant] which are shown by the Greek notations Gamma [γ] and Tau [τ] and. The former carries the features of [- voiced, + anterior, - coronal and + continuant]; however, the latter has the features of [- voiced, - anterior, - coronal and - continuant]. The variables [+ anterior, + continuant] differentiate [f] from [k]; while, the variable [- anterior, - continuant] differentiates [k] from [f]. Likewise, the vowels are different from each other with the variables [round] and [low] which are labeled with the Greek notations Sigma [σ] and Theta [θ] respectively. If the vowel is [+ low, - round], makes it [a] but [u]; however, if it is [-low] and [+round], it is [u] but not [a]. In short, /d/ has lost the feature [+ voiced] but retained all other features, namely, [+ anterior, + coronal, - continuant].

If the plain dental voiced stop /d/ and the pharyngealized dentals (i.e. emphatic in other terms) /d/ and /t/ are followed
by the dental voiceless stop /t/, they lose partial features but they retain the place and manner of articulations in the clausal level as in (18).

18. (i) /?ara d-ta/                                               [?arat\(\text{ta}\)]
     ‘You wanted’
     (ii) /cara d-ta/                                             [carat\(\text{ta}\)]
     ‘You exposed’
     (iii) /basat-tum/                                            [basat\(\text{um}\)]
     flattened
     ‘They flattened’

In (18i and ii) the voiced dentals /d/ and /d/ retain the cavity features [+coronal and + anterior] but lose the source feature [+voiced] to assimilate the voiceless dental consonant [t]. It is significant to draw a distinction between the tense [t] and [t] and the lax [d] and [d]. For the former segments, the tense vocal tract configuration implies a rigid vocal wall which does not expand to permit the increase in volume for a voicing; whereas, for the latter segments, the tense vocal tract implies a lax cavity thus it expands and voicing occurs even during the closure. In short, tense dentals need a deliberate, accurate and maximally distinct gesture that involves considerably muscular effort while lax stops are produced rapidly and somehow indistinctly. It is strange to notice that the native speaker tends to use the plain dental [t] as it is relatively tense. However, in (17iii), the pharyngealized voiceless dental /t/ assimilates the next voiceless dental /t/ in a regressive way. The native speaker deliberately avoids the emphatic pressure in the glottis and selects for the plain form [t]. The three phenomena are seen in the phonological rule (18iv).

18iv. \[\begin{array}{c|c|c}
+ voiced & - voiced & # \\
\hline
+ coronal & + coronal & + coronal \\
+ anterior & + anterior & + anterior \\
- continuant & - continuant & - continuant \\
\theta \text{ low} & - \text{ low} & - \text{ low} \\
\upsilon \text{ back} & - \text{ back} & - \text{ back}
\end{array}\]

The rule (17iv) states that the changed segments are different from each other with three variables. The variable [+ voiced] distinguishes the voiced [d, d] from the voiceless [t]; however, the variables [\theta low] differentiates the [+ low] [t, d] from the [- low] [d]. The variable [\upsilon back] distinguishes between the [+ back] [t, d] and the [- back][d].

Partial regressive assimilation is visible if the liquid /l/ which is a part of the functional morphophoneme al ‘the’ is followed by the other liquid /r/, the former is forced to copy minor [-lateral] feature in a partial regressive assimilation as in (19).

19i. / aI-raml/      [ ar- raml] 
     det sand
     ‘The sand’

The phenomenon in (19i) is obvious in the phonological rule (19ii).

ii. \[\begin{array}{c|c|c}
+ lateral & - lateral & # \\
\hline
+ coronal & + coronal & + coronal \\
+ anterior & + anterior & + anterior \\
- continuant & - continuant & - continuant \\
\theta \text{ low} & - \text{ low} & - \text{ low} \\
\upsilon \text{ back} & - \text{ back} & - \text{ back}
\end{array}\]

The rule (19ii) states that the liquid /l/ is changed to [-lateral] maintaining both the place and manner of articulations; thus, the change is partial but not total. (19i) is contrasted with the examples (22i-iv and 23i-vii) bellow in which the liquid [l] is totally forced to copy new features of the neighboring segment in total assimilation in which case the change is in the manner of articulation. It is forced to become stops, fricatives and nasal though the place of articulation may or may not be toughed. On the contrary, Arabic phonology has total assimilation in which the nasal /n/ is changed to liquid as in (20).

20i. / min rabi- hi/.                             [mir rabih\(\text{i}\)]
     from threw he
     ‘From his God’
     ii. /?an la/                                               [?al la]
     if not
‘If not’

In (20i and ii) the nasal /n/ is totally changed to liquids [r] and [l] at the phonetic level; it retains the cavity features of [+anterior and + coronal] and the major class feature of [+sonorant] but gains the feature of [+vocalic]. Meanwhile, it loses the manner of articulation feature of [+nasal]. The above environment is shown in the phonological rule (20iii).

20iii. \[+ nasal \] \[\beta lateral\] / - \[\beta lateral\] \#

+ coronal + coronal + coronal
+ anterior + anterior + anterior

The rule (20iii) states that the liquids [r] and [l] are different from each other with regard to the inner feature [\beta lateral]. The former is [- lateral]; whereas, the latter is [+ lateral]. Thus, total assimilation is decided in terms of manner of articulation. However, if any other segment occurs other than those in (20i and ii), the assimilation cannot occur as in /?in sa?ala/, *[?i ssa?ala] ‘if he asked’ and /?in khatafa/, *?[i ?a?atafa] ‘if he kidnapped’.

Total regressive assimilation is clear in Arabic phonology if the plain dental fricatives phonemes /dh/ and /th/ and the pharengealized dental /z/ which are pronounced phonetically as [ð], [Ө] and [ð] respectively are followed by the dental voiceless stop /t/, they lose their entire features at the clausal level as in (21).

21i. /?itakhdh - tum / [?itayttum]

'you (pl) took’
ii. /labi th - tu/ [labittu]

'stayed’
iii. /lafaz - tu/ [lafattu]

'I pronounced’

In (21i, ii and iii) the plain inter-dentals fricatives /dh/ and /th/ and the emphatic dental /z/ have been stripped from their features of place as well as manner of articulations and acquire the new features of the palin dental voiceless plosive [t]. These phenomena are represented in the phonological rule (21iv) and (21v).

21iv. \[a voiced\] \[- voiced\] / - \[- voiced\] \#

+ coronal + coronal + coronal
+ anterior + anterior + anterior
+ continuant - continuant - continuant
- strident
v back
\theta low

The rule (21iv) states that the feature \[a voiced\] distinguishes the [+voiced] [ð] and [ð] from the [-voiced] [Ө]. The feature \[v back\] distinguishes the pharyngealized [+ back] [ð] from the [- back] [ð] and [Ө]. The feature \[\theta low\] differentiates the pharyngealized [+ low] [Ө] from [- low] [ð] and [Ө].

Another example of total regressive assimilation is when the liquid, /l/ which is a part of the morphophoneme al ‘the’ is influenced by the neighboring next segments which are the stops /t, t, d and d/ as in (23).

22i. /al- tamru/ [at-tamr]

'date’
ii. /al- ti?l/ [at - t il]

'baby’
iii. /al- damaar [ad-damaar]

'destruction’
iv. / al- d?an/  
   det sheep

‘The sheep’
The phenomena in (22) are represented in the phonological rules (22v and vi).

22v. [+ lateral]  
   [α voiced] / - [α voiced ] #
      - continuant - continuant
      + coronal + coronal
      + anterior + anterior
     u back       u back
     0 low        0 low

The rule (22v) states that the feature [α voiced] differentiates the [+voiced] [d] and [d] from the voiceless [t] and [t]. The features [+ back, + low] differentiate [t] and [d] from the [-back, - low] [t] and [d].

(22i-iv) are contrasted with (22vii) in which [l] cannot be assimilated to the affricate /j/ [d3] in Arabic standard phonology.

22vii. / al- jaamic]/  
   det mosque

‘The mosque’
However, in the Iraqi dialect, the affricate /j/ can be assimilated as that of the above.

The fricative phonemes /th/, /s/, /s/, /sh/, /dh/, /z/ and /z/ which are pronounced as [θ], [s], [s], [ʃ], [ð], [ð] and [z] enforce the liquid /l/ to gain their features in a total regressive assimilation in the phonetic level as in (23):

23i. / al- thawb/  
   det garment

‘The garment’
ii. /al- dhail/  
   det tail

‘The tail’
iii / al- sumu/  
   det poison

‘The poison’
iv. / al- zaman/  
   det time

‘The time’
v. / al- shamsu/  
   det sun

‘The sun’
vi. /al- gawt/  
   det sound

‘The sound’
vii / al- zulmu/  
   det injust

‘The injust’
The phenomena in (23) are illustrated in the phonological rules (23viii).

23viii. [+ lateral]  
   [α voiced] / - [α voiced ] #
      + continuant + continuant
      + coronal + coronal
     γ anterior γ anterior
Assimilation of Segments...

Atef Jalabneh

The rule (23viii) states that the feature [+voiced] differentiates the [+voiced] [ð], [z] and [ð] from the [-voiced] [ʃ], [s] and [θ]. The feature [+anterior] differentiates the [-anterior] [ʃ] from the [+anterior] which are the rest of the segments. The [+strident] differentiates [-strident] segments of [ð], [θ] and [θ] from the [+strident] segments of [s], [z], [ʃ] and [s]. The features [υ back, θ low] distinguish the [+back, +low] [s] and [θ] from the [-back, -low] segments of [s], [z], [ʃ] and [θ]. Thus, the change is total assimilation because it occurs merely in manner of articulation features.

The liquid phoneme /l/ is also enforced to assimilate the following segment of /n/ in a total regressive assimilation as in (24).

\[
\begin{align*}
\text{24i. / al- nada/} & \rightarrow [\text{an-nada}] \\
\text{det dew} & \phantom{\rightarrow} \text{The dew}
\end{align*}
\]

The phenomenon in (24i) is visible in the phonological rule (24ii).

\[
\begin{align*}
\text{ii. [+ lateral]} & \rightarrow [-\text{ lateral}] / - [-\text{ lateral}] # \\
& + \text{nasal} + \text{nasal} \\
& + \text{coronal} + \text{coronal} \\
& + \text{anterior} + \text{anterior}
\end{align*}
\]

The rule means that the lateral [ʃ] carries the features of the neighboring segment which are [-lateral, +nasal, +coronal, +anterior]; thus, the change is in manner of articulation.

A vowel assimilates another vowel feature

Schane (1972, p. 52) argues that this phenomenon is visible in English, in which case the irregular plurals such as ‘foot /feet’ and ‘mouse/ mice’ are vestiges of an umlauting process. The vowel of one syllable may become more like the vowel of some other syllable. Thus, there is a distinction between a vowel harmony in Turkish in (25) and umlauting in German in (26).

\[
\begin{align*}
\text{25i. /diš/} & \rightarrow [\text{dišim}] \text{ ‘tooth’} \\
\text{ii. /ev/} & \rightarrow [\text{evim}] \text{ ‘house’} \\
\text{iii. /gônül/} & \rightarrow [\text{gônülü}] \text{ ‘heart’} \\
\text{iv. /kol/} & \rightarrow [\text{kolum}] \text{ ‘arm’}
\end{align*}
\]

It is clear that in (25), the high vowel [i] of the suffix [im] ‘my’ assimilates the vowel of the stem of some features. For instance, in (25a and b) the vowel remains front open and short; however, in (25iii and iv), it assimilates the backness and rounding with the stem vowel.

\[
\begin{align*}
\text{26i. /yår/} & \rightarrow [\text{yârïç}] \text{ ‘year’} \\
\text{ii. /gût/} & \rightarrow [\text{gûtç}] \text{ ‘good’} \\
\text{iii. /got/} & \rightarrow [\text{gütin}] \text{ ‘god’} \\
\text{iv. /hunt/} & \rightarrow [\text{hûndin}] \text{ ‘dog’}
\end{align*}
\]

(Schane, 1973, p. 52)

Likewise, in German, in (26) the short low front vowel [ä] in the adjective [yârîç] ‘annual’ assimilates the vowel of the suffix [ç] in fronting. In other words, the vowel of the adjective [ä] in /yår/ ‘year’ is a short low back before the adjectival suffix is added. The high back round tense vowel [u] in /gût/ ‘good’ is changed to high front open tense [u] in [gûtç] ‘kind’ because of [i] of the same suffix. Likewise, the back short vowels /o/ in /got/ ‘god’ and /u/ in /hunt/ ‘dog’ assimilate the vowel [i] in the nominal suffix [in] and become umlauted short front open as in [götin] and [hûndin] respectively. However, the situation in Standard Arabic is somehow the same in the sense that there is a vowel harmony at the sentential level but with the addition of the prefix /ná/ ‘we’ as in the specimen (27).

\[
\begin{align*}
\text{27i. / na - ‘budu/ al- llaha.} & \rightarrow [\text{an-buda}] \text{ ‘we worship God} \\
\text{we worship det God} & \phantom{\rightarrow} \text{we worship det God}
\end{align*}
\]
'We worship God'

In (27i), the low back short vowel /a/ assimilates totally the high short back vowel /u/ in the stem verb /budu/ 'worship' to become [nu'budu] as shown in (27ii) in some dialects of standard Arabic. However; both of the forms in (27) are commonly used in Arabic as the change is allophonic. This phonetic phenomenon is seen in the phonological rule (27iii).

27iii. [ V ] \rightarrow [ V ] / [ C ] - [ V ]
+ low - low + nasal - low
+ back + back + coronal + back
- round + round + anterior + round

The rule (27iii) means that the vowel [a] is changed to [u] if it occurs in the environment [+ nasal] and [V]. The vowel enforces the features of [- low, + back, + round] to shift to the preceding one in total vowel harmony in Arabic phonology. No other notations are needed because the nasal feature has no influence on the following vowel of the prefix. In a similar situation, the vowel harmony phenomenon happens in the sentential level as in (28).

28i. /ukhtiira/ zaidun has been chosen Zaid

ii. [ iytira ] zaidun has been chosen Zaid

‘Zaid has been chosen’

It is obvious that the high back short vowel /u/ in ukhtiira 'has been chosen' in (28i) has been totally changed to high front short vowel [i] in (28ii). This kind of regressive assimilation is acceptable in some standard dialects of Arabic and it is clear in the phonological rule (28iii):

28iii. [ V ] \rightarrow [ V ] / [ C ] - [ V ]
+ back - back - voiced - back
+ round - round + continuant - round
- low -low - coronal - low
- anterior + tense + back
- low

The rule (28iii) states that the vowel [u] assimilates [i] if it is followed by [χ] and the tense vowel [uu]. It is obvious that the uvular voiceless obstruct [χ] has no effect on the vowel change.

It is evident that some dialects of Standard Arabic involve a kind of total assimilation in which case the low front lax vowel /a/ is assimilated with the high front lax /i/ if it is followed by the stop /b/, fricative /h/ and trill /r/ respectively. This is visible in the adjectival phrases in (29- 31).

29i. /kabiir/ [kibiir] great

ii. /rahiim/ [rihiim] merciful

iii. /kariim/ [kriim] beneficent

‘Great’

‘Merciful’

‘Benificent’

In (29i-iii), the low front vowel /a/ assimilates the high /i/ that follows within the same syllable. This phenomenon is represented in the phonological rules (29iv) for (291 and ii) and (29v) for (29iii).

29iv. [ V ] \rightarrow [ V ] / [ C ] - [ V ]
+ back - back ι voiced - back
- round - round τ continuant - round
+ low -low - coronal - low

The rule (29iv) and (29v) states that the vowel [a] assimilates [i] if it is followed by [ι] and the tense vowel [uu].
The rule (29iv) states that the vowel [a] is changed to [i] because the vowel of the second environment has the features of [- back, - round, -back, - low, + tense]. The feature [α voice] differentiates the [+ voiced] [b] from the [- voiced] [h]. The feature round [τ continuant] distinguishes the [+ continuant] [h] from the [- continuant] [b]. The feature [γ anterior] makes a difference between [+ anterior] [b] and the [- anterior] [h]. The features [υ back, θ low] differentiate [+ back and + low] [h] from [- back and - low] [d].

29v.    [    V  ]                          [  V  ]  /         [   C  ]      -              [      V        ]
+ back                         + back        - voiced                      + back
+ low                           - low          - coronal                 - low
- tense                          + tense                               + tense
+ back                           + back             + lateral                   + back
- round                         + round                                           + round
+ low                           - low          - coronal                 - round
- low                           - low          - coronal                 - round
+ back                           + back             + nasal                      + back
+ low                           - low          - coronal                 - round
- tense                          + tense                               + tense

The rule (29v) states that the vowel [a] is changed to [i] if followed by [- lateral] and the vowel [u] that has the features of [- back, - round, -back, - low, + tense]. Thus, the change in both is total assimilation.

A regressive assimilation of vowels takes place in a situation in which the vowels /a/, /i/ and /u/ assimilate totally the high back round vowel /u/ if the noun singular phrase is changed to plural as in (30).

30i. /bahr/                                [buhuur]
    sea                                    seas
    ‘Seas’
ii. /jild/                                [d\\umlaut u]\text{luud}
    a skin                                 skins
    ‘Skins’
iii. /jund/                               [d\\umlaut u]nuud
    a military force                       military forces
    ‘Military forces’

In (34i-iii), the vowels /a/, /i/ and /u/ assimilate /u/ if the latter is tensed. These phenomena are shown in (30iv,v and vi) respectively.

30iv. [    V  ]                          [  V  ]  /         [   C  ]      -              [      V        ]
+ back                         + back        - voiced                      + back
- round                         + round                                           + round
+ low                           - low          - coronal                 - low
- tense                          + tense                               + tense
+ back                           + back             + lateral                   + back
+ low                           - low          - coronal                 - round
- low                           - low          - coronal                 - round
- tense                          + tense                               + tense

30v.    [    V  ]                          [  V  ]  /         [   C  ]      -              [      V        ]
- back                         + back             + lateral                   + back
- round                         + round                                           + round
- low                           - low          - coronal                 - low
- tense                          + tense                               + tense

30vi.    [    V  ]                          [  V  ]  /         [   C  ]      -              [      V        ]
+ back                         + back             + nasal                      + back
- low                           - low          - coronal                 - low
- round                         + round                                           + round
- tense                          + tense                               + tense

The rules (30iv, v and vi) state that the vowel [uu] which is being assimilated has the features of [+ back, + round, - low, + tense] which shifted to the vowels /a/, /i/ and /u/. The rules are different with regard to the environment of consonant that precedes it. For instance, in (30iv), [h] has the features of [- voiced, + continuant, - coronal, - anterior, +
back, [+ low], [l] has the feature of [+ lateral] and [n] has the features of [+ nasal, + coronal, + anterior]. It is evident that these consonants do not have any effect on the vowels /a/, /i/ and /u/ insofar as the total assimilation is concerned. Similar other possible plurals of noun phrases that involve vowel harmony are listed in (31).

31i. /naf/  [nufuus]
      self  selves
      ‘Selves’

ii. /kah/  [kuhuul]
       a middle aged man  middle aged men
      ‘Middle aged men’

iii. /dirs/  [duruus]
       a molar tooth  molar teeth
      ‘Molar teeth’

iv. /burd/  [buruud]
       a robe  robes
      ‘Robes’

In short, this phenomena is common in Arabic because the regular plural in Arabic is formed in this fashion for some nouns.

Progressive Assimilation

This type of assimilation takes place in the forward direction as in ‘dogs’ [d^g]z and ‘it is ready’ [it s red]i; in the former s > z due to the influence of the voiced stop [g]; however, in the latter z > s because of the stop [t]. Assimilation occurs in Arabic phonological system in which case a segment is affected by the features of the preceding segment either at the lexical or clausal level. In other words, the features of the first segment shift to the next one. There are a number of specimens which will be discussed as follows:

A vowel assimilates a semi vowel / or a consonant features

Shane (1973, p. 51) illustrates that in Chatino, spoken in Mexico, unstressed vowels are voiceless between voiceless consonants as in (32).

32i. i. la?â ‘side’
    nguta ‘seed’

ii. tâ?â ‘fiesta’
    kuta ‘you will give’

In (32i), as the short vowel [a] and [u] are preceded by the voiced segments [l] and [g], they remain voiced; however, as they occur between the voiceless consonants as [t and ?] for the former and [k and s] for the latter, the short vowels are changed to voiceless as (32ii).

In Arabic, there is a situation of partial assimilation in which case a vowel must be doubled if the semi vowel segments [w and j] are already doubled in the same lexical word. This phenomenon takes place in the adjectival phrases root form of ‘faccaal’ as in (33):

33i. /nuwwaam/ ;  [nuwwaam] ‘asleep sg’
/khawwaan/ ;  [zawwaan] ‘treacherous’
/khawwaaf/ ;  [zawwaaf] ‘timid’
/nuyyaam/ ;  [nuyyaam] ‘asleep pl’

(c.f. Cowan 1976, p. 265, 266, etc)

As the semi vowels /w/ and /y/ are doubled in (33i), the neighboring vowel /a/ has become tensed [aa]. It is evident that Arabic involves different lexical adjectives with lax [a] such as [nuwaam], [zawwaan], [zawwaaf] and [nuyaam] that have different meanings from those in (33i). The phenomenon in (33i) is shown in (33ii).

33ii. [ V]  [ - V & -C]  -  $
Assimilation of Segments...  

Atef Jalabneh

\[ + \text{low} \quad + \text{low} \quad - \text{vocalic} \]
\[ - \text{tense} \quad + \text{tense} \quad - \text{consonantal} \]
\[ + \text{back} \quad \text{σ round} \quad \text{σ round} \quad + \text{tense} \]

The rule (33ii) means that the semi vowels that precede the vowel [aa] are different from each other with regard to the variable [σ round]. [j] is [- round] but [w] is + round. The feature [tense] is only enforced to the preceding vowel. If the glottal stop [ʔ] is doubled, the preceding vowels [a] and [u] are also doubled in the formation of the lexicon as in (34).

34i. /naʔaat/ ; [naʔaat] ‘to leave repeatedly’
/saʔaat/ ; [saʔaat] ‘inquisitive’
/raʔaat/ ; [raʔaat] ‘to be in chief repeatedly’
/suʔaat/ ; [suʔaat] ‘inquisitive’
/naʔuum/ ; [naʔuum] ‘slugabed’

(c.f. Wright 1984, p. 14)

The phenomenon of (34i) is capture by the phonological rule (34ii).

34ii. [ V ] \rightarrow [ V ] / [ C ] - $\
\[ \text{θ low} \quad \text{θ low} \quad - \text{continuant} \]
\[ - \text{tense} \quad + \text{tense} \quad + \text{tense} \]
\[ \text{σ round} \quad \text{σ round} \quad - \text{coronal} \]
\[ + \text{back} \quad + \text{back} \quad - \text{anterior} \quad + \text{low} \]

The rule (34ii) states that the feature [θ low] differentiates the [+ low] [a] from the [-low] [u]. The feature [σ round] distinguishes the [+ round] [u] from the [- round] [a]. The glottal stop that precedes the assimilated vowel carries the features [- continuant, + tense, - coronal, - anterior, +low]. This is important to notice that Arabic does not accept the adjectival structures of [naʔaat], [saʔaat], [raʔaat] and [suʔaat] in the lexicon; however, it has the adjective [naʔuum ‘slugabed’] that has the root [jɛuul] of the same exaggerated meaning as that of [naʔuum]. There is another phenomenon in Arabic in which the vowel [a] is doubled in the base if the preceding consonants are the fricative obstruent [c] and [h] as in (34iii).

34iii. /faʔaal/ ; [faʔaal] ‘effective’
/lahhaam/ ; [lahhaam] ‘butcher’

(c.f. Cowan 1976, p. 278, 279 etc)

The phenomenon in (34iii) is seen in the rule (34iv).

34iv. [ V ] \rightarrow [ V ] / [ C ] - $\
\[ + \text{low} \quad + \text{low} \quad + \text{continuant} \]
\[ - \text{tense} \quad + \text{tense} \quad + \text{tensed} \]
\[ + \text{back} \quad + \text{back} \quad - \text{coronal} \quad - \text{anterior} \quad + \text{low} \quad + \text{back} \quad α \text{ voiced} \]

The rule (34iv) means that the obstruents that precede the assimilated vowel are different from each other with regard to [α voiced] that differentiates [+ voiced] [c] from the [-voiced] [h]. The rest of features [+ continuant, + tensed, - coronal, - anterior, + low, + back] are shared by both of them; thus, it is [c]. The last environment in which the vowel [a] is doubled if the preceding consonant is the liquid [r] is shown in (34v), and it is captured by the phonological rule (34vi).

34v. /darraas/ ; [darraas] ‘eager student’
/darraasa/ ; [darraasa] ‘threshing machine’
/durrāa’a/ ; [durrāa’a] ‘loose outer garment with sleeves’
/darrāa’a/ ; [darrāa’a] ‘armored cruiser’

(c.f. Cowan 1976, p. 278, 279 etc)
The rule (3vi) means that the vowel [aa] is doubled if the preceding liquid carries the features [-lateral, + tensed]; thus, it is [rr]. The obstruent shifts only the feature [tense] to the preceding vowel. If any consonant is doubled in the structure fa'adl and fi'ild ‘do’, the neighboring vowels of /a/ and /i/ are to be made tensed. However, if the vowel remains lax, Arabic, in stead, can have the verb root [[fa’al] ‘to make effective’ and [lahham] ‘to act butchery’ [darras] ‘to teach’, [hassada] ‘to make someone harvest’ and [darr’al] ‘to make someone armored’ which do not have the same adjective meaning in contrast. It is noted that the lexicon [durra’al] and [fi‘ib] with lax vowel are not available in the lexicon of Arabic. In short, the process of doubling the vowel cannot happen in gemination as will be shown in the course of analysis in section (3).

A consonant assimilates another consonant feature

If the voiceless stop /t/ is preceded by the voiced stops /d/ and the voiceless pharyngealized (emphatic) obstruent /t/, the former is partially changed in assimilation in some dialects of Standard Arabic at the sentential level as in (35) and (36) respectively.

35. / cu -tu/ [cu - du]

‘I returned’

36i. hal / rabt - ta / sha’ra ka ?

‘Did you tie your hair?’

36ii. hal [rabt ta] sha’ra ka ?

The environment in (35 and 36) in which a consonant is partially changed is captured by the rule (37).

37. [ C ] [ C ] [ C ] - #

The rule (37) states that the feature [α voiced] differentiates the segment the [+voiced] [d] from [- voiced] [t]. The features [υ back, θ low] differentiate [+ back, - low] segment of [t] from [- back, - low] segment of [d]. In short, the change of features does not tough the manner of articulation and thus it does not create a contrast between [t] and [d] in (35) and between [t] and [t] in (36). In other words, the change is allophonic but not phonemic.

A vowel assimilates another vowel feature

This is a very rare phenomenon in Arabic in which case the first vowel enforces the following vowel to lose or gain some of its actual features in certain contexts in progressive style. Whenever the trilateral form of the verb fa’al is changed to fa’adl in a sentence level as the subject is added, the first vowel enforces the next one to be the same as in (38):

38i. /qasa/ ‘became hard’

ii. [qasahu] ‘he made himself hard against him’

iii. /afa/ ‘forgave’

iv. [aafaaka al-laahu] ‘God keep you well’

In (38i), as the verbs qasa ‘became hard’ is used in sentence in which the third person singular is used, the partial
assimilation of progressive takes place as in (38ii). Doubling the vowel [a] illustrates the third person singular subject. Likewise, in (38iii), the vowel /a/ in the verb ‘afa ‘forgave’ has been made tense in (38iv) because the same verb is used in a sentence. Doubling the vowel in this sentence has nothing to do with subject but with the object ka ‘you’ because the subject is illustrated by al-laahu ‘God’. The phenomenon is captured by the phonological rule (38v).

38iv. [ V ] ——> [V] / [ C ] [V, V ] - $
- tensed + tensed + continuant + tensed
+ low + low + coronal + low
+ back + back \(\gamma\) anterior + back
- voiced

The rule (38iv) states that the lax vowel [a] becomes [+ tensed] if the following vowel has the features of [+ tensed, + low, + back]. The following consonants [s] and [f] have no effect on the vowel at all. However, they are distinct from each other in the sense that the feature \(\gamma\) anterior\] make the [+ anterior] [f] different from the [- anterior] [s]. It is obvious that no formal notation is needed as there no contrast in imparted features.

The same type of progressive assimilation happens in a nominal sentence form whenever the context shows the dual number as in (39)

39i. /maata/ ‘died’
   ii /naama/ ‘slept’
   iii. [al-waladaani maataa] ‘The two boys died’
   iv. [al-waladaani naamaa] ‘The two boys slept’

In (39i and ii), the dual marker /a/ is made tensed in (39iii and iv) due to the influence of the preceding vowel which imposes the partial assimilation in this regard. In other words, the vowel in question remains [+low, + back] but the quality of [tense] is changed. However, Arabic does not accept nominal syntactic constructions spoken phonetically without dual markers such as [*huma qaala] ‘both said’, [*naama al-waladaani] ‘the two boys slept’ and [*al-waladaani laama bd duhuma al-b’d da] ‘the two boys blamed each other’. In short, the dual number is inflected on both the verb as well as the subject in subject-verb concord, simultaneously.

Gemination

Gemination is not a kind of assimilation at all; it is a kind of doubling a consonant in a cluster in the language base to create: (A) a phonemic difference and constitutes minimal pairs as in (40i and ii) and (B) a new lexical item is created which is not available already in Arabic as in (41) respectively.

40i. /?amara/ ‘to order’
   ii. /?ammara/ ‘to appoint someone as a commander’

In (40i), there is no kind of assimilation takes place, and the lexical item ?amara ‘ordered’ is verb that subcategorizes noun phrase (NP) and inflectional phrase (IP) as internal arguments as in [IP1?amara [NP zaidun [NP ‘amran [IP2 ?an ya‘aba]]] ‘Zaid ordered Amr to play’]; however, in (40ii), the nasal phoneme /m/ is doubled to form the new verb /?ammara/ ‘to appoint someone as a commander’, which subcategorizes only an NP as an internal argument as in [?ammara zaidun [NP ‘amran]]. Doubling the consonant creates a phonemic minimal pairs with [?amara ‘to order’]. Other similar instances of the type are in (40iii) in which case the verbs of action are listed.

40iii. [?iiba] ‘to play’
   [saqa] ‘to water’
   [kataba] ‘to write’
   [akala] ‘to eat’
   [qara?aa] ‘to read’
   [kasara] ‘break’
   [qata’a] ‘to cut’
   [faraqa] ‘to separate’
   [la‘aba] ‘to make someone play’
   [saqa] ‘to make someone water’
   [kattaba] ‘to make someone write’
   [akkala] ‘to make someone eat’
   [qarra?aa] ‘to make someone read’
   [kassara] ‘to break in pieces’
   [qutta’a] ‘to cut in pieces’
   [farraqa] ‘to disperse’
Gemination takes place in Arabic to add a new lexical item to Arabic to create a contrast as in (41i); however, with the contrast is not available as in (41ii):

41i. /murrun/ ‘bitter’
   /tafatatat/ ‘to be broken into pieces’
   /allaqa/ ‘to hang’
   /al-kulla/ ‘everyone’
   /kullan/ ‘each one’
   /al-sammu/ ‘poison’
   /ra??aasan/ ‘to make a boss a number of times’
   /sa??aalar/ ‘to ask a number of times’
   /la??alaa/ ‘perhaps’

41ii. * /murun/  
   * /tafatat/  
   * /allaqa/  
   * /al-kula/  
   * /kulan/  
   * /al-samu/  
   * /ra?aasan/  
   * /sa?aalar/  
   * /la?alaa/

In short, gemination in Arabic is different from that of English in the sense that in the former, syntactically, it creates new terms not found before and to constitute minimal pairs; however, in the latter, doubling a consonant is influenced by the addition of certain suffixes if a consonant is preceded by a short vowel as in ‘plan’ /planning/ pronounced as [plæniŋ].

If gemination is contrasted with coalescence, there is a kind of assimilation that takes place in coalescence whenever two segments are amalgamated to become one as in (42).

42. /jawarrib/ ii. [djawarrib]
   /jaamic/ [djaamic]
   /jamiil/ [djaamiil]
   /jununun/ [djununun]

(42) illustrates that the two segments [d] and [r] are mad one affricate after coalescence takes place. It is evident that Arabic does not have the phonemes /t/ and /sh/ to become [tʃ] after coalescence happens as that of the English [tʃ].

**CONCLUSION**

This study accounts accurately for the concept of partial and total feature change in regressive and progressive assimilation of consonants and vowels in Modern Standard Arabic phonology at the lexical, phrasal and clausal levels in the light of Schane’s (1973) views on generative phonology. The change is partial if a segment takes some features from the neighboring segment, but it retains its manner of articulation whether the place of articulation is changed or not. In regressive style, a vowel partially assimilates the consonant feature of nasalization in (4 and 5) at the lexical level and in (6 and 7) at the clausal level. A consonant assimilates the semi vowels [j] and [w] features of palatalization as in (11i), labialization in (11ii) and a vowel feature of roundness in (11iii) at the lexical level. A consonant assimilates another consonant feature at the phrasal level as in (17i- iv), at the clausal level in (18i- iii) and the phrasal level in (19i). A vowel assimilates other vowel features of tense at the clausal level as in (38i-iv) and (39i-iii). In progressive assimilation, the partial style happens when a vowel assimilates semivowels features at the lexical level as in (33i), at the clausal and lexical in (34i), at the lexical level in (34ii) and at the phrasal level in (34v). A consonant assimilates another consonant features as in (35) and (36i, ii) at the clausal level. However, the change is total if a segment takes some features from the neighboring segment, but it loses its manner of articulation though the place of articulation is changed or not. In regressive assimilation, a consonant totally assimilates features of semi-vowels as in (14i and ii). A consonant assimilates other features of consonants as in (20i, ii), (21i-iii), (22i-iv), (23i-vii) and (24i). A vowel assimilates other features of vowels as in (27i, ii), (28i-iii), (29i-iii), (30i-iii) and (31i-iv). To sort out the phonemes that assimilated from those which are not, the researcher made use of the generative features proposed in the approach to differentiate phonemic function from the phonetic one. It is proved that all segments that succumb to partial and total assimilations are allophonic rather that phonemic. They are not contrasted with the actual phonemes in the underlying form, and thus they cannot constitute
minimal pairs. For instance, when the [+lateral] [l] which is a part of the morphophoneme al ‘the’ is totally assimilated to the stops [t], [d], [d] and [d] and the fricatives [θ], [s], [ʃ], [ʃ] and [z], it does not create new morphophonemes as [att, att, aθθ, ass ...etc.]; the morphophoneme retains the same syntactic function but with different phonetic forms.

Likewise, when the nasal [n] becomes [m] in /min ba’d/ [mim ba’d] ‘after then’, the new phonetic form does not create new phoneme contrasted with min ba’d. Another example of phonetic change is the palatalized, labialized and rounded segments which are not contrasted with non ones. The researcher refers to the features of generative phonology to sort out phonemes in natural classes. For instance, [nasal] feature makes [n] and [m] are different from other [-nasal/ oral] obstruents of fricatives, stops and affricates, [+voiced] feature makes [d, d̪, ʔ, x, ʔ, i] and [z] different from the [-voiced] [t], [t], [θ], [s], [ʃ], [ʃ], [h], [z] and [h]. [+tense] differentiates phonetically [??], [ww] and [jj] from [-tense] [?], [w] and [j] and [+sonorant] feature involves all vowels, semi-vowels, nasals and liquids; however, [-sonorant] has all obstruents of fricatives, stops and affricates. The features involve the manner of articulation features of [+syllabic] to differentiates vowels, nasals and liquids from others, [+consonantal] involves fricatives, stops, affricates, liquids but [-consonantal] involves vowels and semi-vowels, [+continuant] distinguishes fricatives from stops and affricates, [+lateral] makes [l] different from [-lateral] [r] and [+ delayed release] makes affricates [dz] different from stops and fricatives. The place of articulation of [+coronal] distinguishes dentals, alveolars, glides [w, j] and palato- alveolar [ʃ] from [-coronal] vowels and [+anterior] makes labials, dentals, alveolars from [-anterior] palato-alevor, palatal, uvular, and pharyngeal. The body of tongue feature [+back] sorts out [a] and [u] from [-back] [i], [+low] differentiates [a] from [i and u] and [+round] makes [u] different from [a and i]. The features [+low and + back] differentiates phrengealised (emphatic obstruents) of [s, t, d and θ] from the plain ones with regard to the position of the tongue. Insofar as the feature changing phonological rules are concerned, they sort out the segments that are assimilated from those that are not, show how the segments are changed and specify the conditions under which they are change as mentioned in the analysis. In case of variables, when two or more segments share certain features, the Greek notations are used; for instance, Alpha [α] is used for [voice], Beta [β] for [lateral], Upsilon [υ] for [back], Sigma [σ] for [round], Gamma [γ] for [anterior], MU [µ] for [strident], Tau [τ] for [continuant], Theta [θ] for [low], Eta [η] for [coronal]. The last question to be answered is relevant to gemination; it is proved that it is not a result of assimilation. Therefore, doubling a consonant in a cluster in the base is done to create a phonemic difference and constitutes minimal pairs as in (40i and ii) and to create new lexical items which are not available in Arabic as in (41). If gemination is contrasted with coalescence, there is a kind of assimilation that takes place in coalescence whenever two segments are amalgamated to become one as in the affricate [ʃ] in (42).
## Standard Arabic Phonetic symbols of Consonants as per IPA

<table>
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<tr>
<th></th>
<th>Labial</th>
<th>Inter-</th>
<th>Dental/</th>
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<th>pharyngeal</th>
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### Transliteration of the Arabic phonemic symbols of Consonants

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<th>Transliteration</th>
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Notice: the researcher has a reference to both the transliteration and the phonetic symbols while writing the Arabic phonemic segments in the text (c.f. Jalabneh, 2007)
Standard Arabic Phonetic symbols of Vowels

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<th>Back</th>
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<td>uː/uu</td>
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<tr>
<td>Low</td>
<td>aː/aa</td>
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</tbody>
</table>

(c.f. Fari and et al, 2006, p. 74)

Symboles

1. [ ] used for phonetic transcription
2. / / used for phonemic transcription
3. / in the environment
4. – place before or after the segment(s) that determine the change; for instance, if the slash is put before the environment of change, then the second segment influences the first as is the situation in nasalisation in English [+vocalic ] [+nasal] / [nasal]
   consonantal
   however, if the slash is placed after the environment, it means the former segment influences the latter as in
   [+vocalic ] [+nasal] / [nasal]-
   consonantal
5. $ syllable boundary
6. # word boundary

REFERENCES


- 518 -
لا يوجد نص يمكن قراءته بشكل طبيعي من الصورة المقدمة.