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العدد السادس والعشرون

شوال ١٤٢٤ هـ - ديسمبر ٢٠٠٣ م



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ملخص البحث

هندسة السمات وامتدادها
تحليل تنضيدي للصوامت المشددة
في اللغة العربية
د. محمد لھلال

عولجت في هذا البحث ظاهرة مماثلة الصوامت باعتبارها قاعدة تُغيّر السمات (Features) بمقتضاها، حيث تغير قِطْعَة ما (Segment) بناء على قيم السمات المميزة لها كي تصير مماثلة للقطعة التي تجاورها مقطعيًا. قدم هذا الطرح في إطار النظرية التنضيدية لتفسير مختلف التغيرات الصوتية التي تحدث، إذ تجعل المماثلة (Assimilation) قاعدة التغيير هاته موسعة أو تأليضية للمجال الزمني للقطع بإضافة خطوط تضام، تقدم قطعاً منقولة بواسطة الحذف إبان إجراء القاعدة، كما يعالج البحث قوة وكفاية النظرية الصوتية التنضيدية في مقارنة ظاهرة المماثلة الصامتية.

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- d) Lack of inherent order between features is a consequence of the logic of under specification.

4. Conclusion:

This article presents further evidence to support the superiority of non-linear phonology and its related principles, notions and mechanisms over linear phonology which describes assimilation as a feature changing rule, producing an output which violates the Obligatory Contour Principle and is, therefore, blocked as shown below:

$$[\alpha-f] \longrightarrow [\alpha F] / \longrightarrow [\alpha F] \quad (\text{Yip (1988:96)})$$

Non-linear phonology considers assimilation as a spreading rule, association/reassociation of features occurring at different tiers, and the output of assimilation displaying geminate or geminate like properties. The Obligatory Contour Principle requires that there be an explicit mechanism to state such rules. Our analysis supports Yip's (1988:97) position that the Obligatory Contour Principle predicts that no language could ever have an assimilation rule of the feature-changing type whose output fails to behave like a geminate. Moreover, non-linear phonology provides an explicit formal implementation and theoretical expression and at the same time a concrete analysis coupled with simplicity.

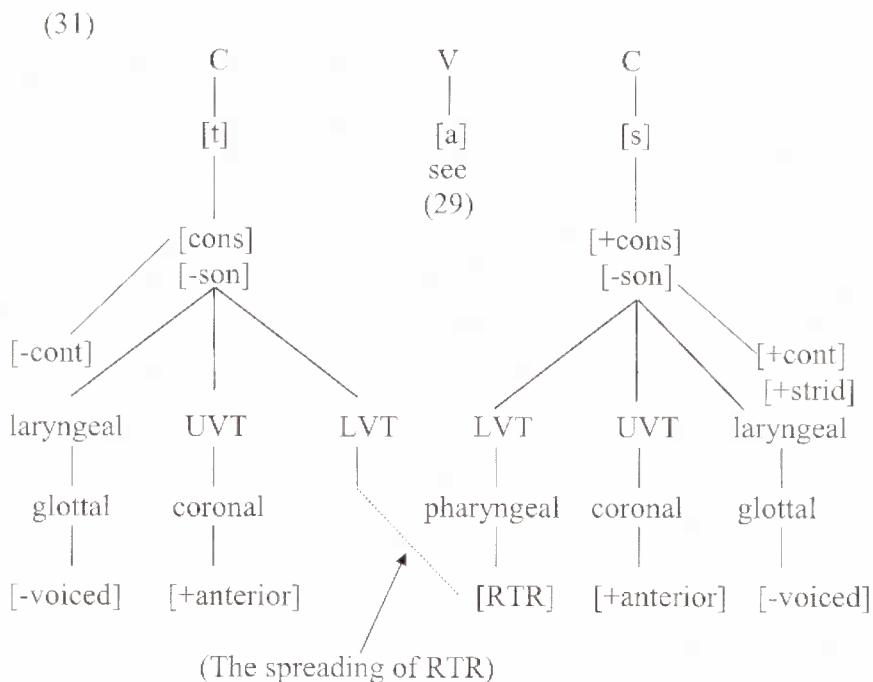
At another level, the notion of feature geometry organization receives ample support from our analysis of emphasis spread in Arabic. The paper shows that the process operates on consistent subsets of distinctive features within a segment, which allows associations/reassociations of lines or features to take place at different levels or tiers. This mechanism expresses in an explicit way the nature of assimilation: total assimilation which produces geminate consonants or partial A assimilation limited to, for example, place or manner of articulation, and voicing. At the same time, the independence of each type of assimilation is guaranteed since they occur at separate tiers. In this way, the constraints on assimilation rules are clear, thereby providing a more predictive framework.

Finally, the article uses the notion of under specification to overcome the problems created by a linear analysis. The examples in (28) and the relevant illustrations in (29), (30) and (31) demonstrate the benefits of making use of this notion.



/t/ and /t/ in the diagram above are considered adjacent because the feature specifications of the intervening vowel are irrelevant to the consonants before and after; they are under specified. Consequently, the [RTR] can spread to the preceding without the vowel between them blocking the operation. Here we have an example of assimilation which results in two identical consonants. Consequently, we adopt either the rule in (21), which achieves spreading between the root nodes, or rule (18) above, which spreads the [RTR] feature.

The second example, /ʔintasafa/, can be explained in the same manner except that the spreading is that of the [RTR] feature only. This is illustrated in (31):

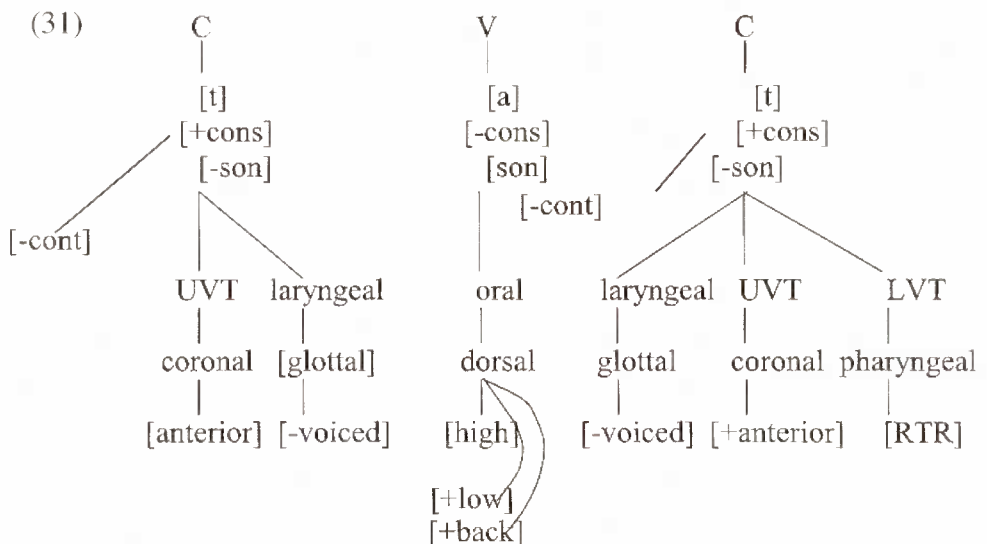


The above discussion supports McCarthy's (1989:71-99) assumptions:

- Morphological distinctions do not play a direct role in planar segregation.
- Planar segregation occupies a somewhat prominent role in phonology.
- Elements on separate planes have no inherent linear order relations to one another.

sal feature. The basic idea of under specification is the organization of distinctive features in a tree structure. The tree structure, as indicated in section 2 on feature geometry, is as follows: the cv-tier is linked to/ associated with a root node which dominates other feature nodes such articulator and class nodes that dominate single terminal features. Therefore, the features are organized into constituents which could behave as units in rules, either spreading features at a given node (place, voicing, or secondary feature node) or deleting a node. In this tree, similar features on neighboring pages (tiers) are adjacent. For example, the place node of two adjacent consonants are adjacent for place node. Another important feature of the tree is a non-terminal node present only if the articulator is activated. For example, only coronal consonants have coronal nodes and non-coronal consonants do not exist (Archangeli (1984); pulleyblank (1986)). This kind of organization within the notion of under specification provides a very interesting mechanism. For instance, if a node/feature is under specific for a given segment, then the comparable node(s)/feature(s) of the next segment will be adjacent, since nothing will intervene. Consequently, it is possible to predict the existence of long-distance effects from the structure of the feature system within under specification (Yip (1988:70)). This lack of inherent order of features is the result of the logic of under specification. The literature is full of examples which show the power of the mechanisms of feature organization and under specification (see Kenstowicz (1994:145-158 and chapters 8 and 9).

Within under specification, the examples in (28) can be accounted for in a straightforward manner. We will consider two examples to illustrate the operation of emphasis spread. /ʔihtataba/ is discussed in (30) and /ʔintasafa/ in (31) below.

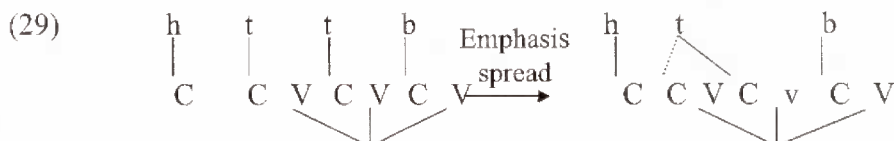


(28)	hataba	----->	?ihtataba	'to bring wood for fire'
	naðara	----->	intaðara	'to wait for'
	nasafa	----->	?intasafa	'to be in the middle'
	fadaha	----->	?iftadaha	'to be exposed'

Al-Shorafat discusses assimilation in these examples in traditional generative terms and shows the shortcomings of such an approach. He concludes: "What this indicates is that some of the premises of the standard theory are erroneous and inadequate and that there is an urgent need for more investigation and research of like phenomena in natural languages in order to arrive at higher, formal devices that can adequately characterize such cases at hand." (p. 99) However, Al-Shorafat does not propose any solution for the problem he raises.

Within traditional generative phonology, a new rule or a modified version of an already existing assimilation rule has to be added to the grammar in order to account for the examples in (28). This means more complication in spite of the fact that these examples involve the same process noticed in examples discussed above, i.e. assimilation.

In an auto segmental approach making use of feature geometry, we can account for the examples in (28) as well as for other examples of assimilation by the same operation, feature spreading between the tiers concerned. To make this point clear, there are two ways that non-linear phonology offers. The first one is to represent the consonantal tier and the vocalic tier on different planes following the lead of McCarthy's (1979) analysis. In this representation, we get rid of the vocalic pattern that intervenes between the consonants. Consequently, the emphatic and nonemphatic consonants will be adjacent. Therefore, the association and emphasis spreading-principles will be the same for the examples in (28) as for other examples discussed so far in this paper and no modification or new stipulation need to be made. To illustrate this kind of analysis in which the two discontinuous morphemes of Arabic are represented on separate tiers, the form /?ihtataba/ can be derived as in (29), after disregarding the initial epenthetic /?/?:



The second way of avoiding the complications of linear rules is using the feature geometry organization with the notion of under specification. This approach is not language specific and can be considered a language univer-

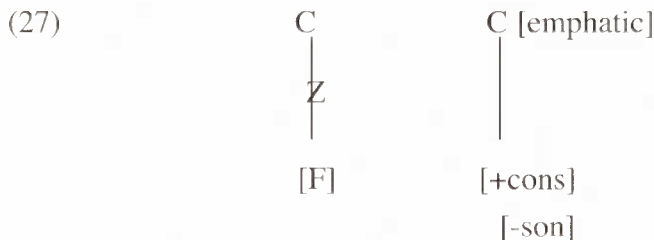
plete assimilation. With feature geometry based on a non-linear approach, the distinction is made clear: complete assimilation spreads/associates features at the root node; partial assimilation spreads/associates features at the terminal feature or some intermediate node.

Other cases of regressive assimilation occur in the examples in (26), taken from Colloquial Jordanian Arabic:

(26), taken from Colloquial Jordanian Arabic:

- (26) ?ittaayar -----> ?ittaayar (root = t-y-r) 'evaporated'
 ?itsaalah -----> ?issaalah (root = s-l-h) 'reconciled with each other'
 ?itθaahar -----> ?iθθaahar (root = θ-h-r) 'pretended'
 ?itaarab -----> ?iddaarab (root = d-r-b) 'clashed'

These examples can be accounted for by a rule like those proposed for progressive and regressive assimilation (see (18) and (24) above). Ignoring particular feature details pertinent to the consonant which undergoes assimilation, we can represent the spreading features at the root node tier as in (27):

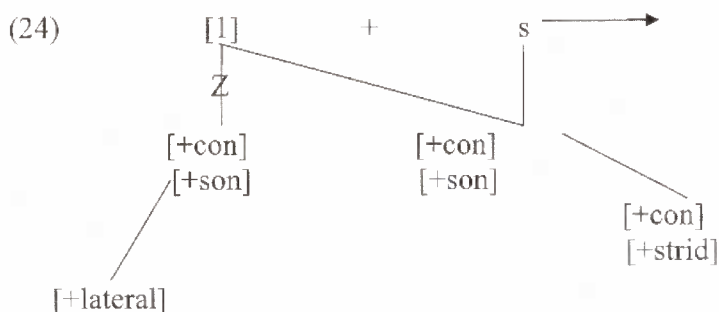


3.4 Further Evidence:

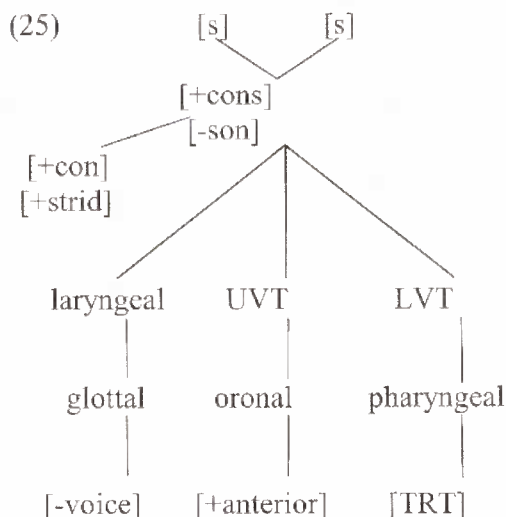
It has now become clear that analysis of assimilation spread based on phonological models of multitiered feature representation is superior to another that does not recognize such hierarchy because of the former's simplicity and its avoidance of all the complications of a feature-changing, linear model. The feature geometry, auto segmental model receives further support from the examples in (28) below, which involve infixing /t/ before the emphatic sound and after the first radical. They differ from previous examples in that a vowel intervenes between the emphatic consonant (the middle one in a triconsonantal stem) and the underlyingly plain infixed /t/. These examples are taken from Al-Shorafat (1985:88-101).

- (23)
- | | | | |
|-----------|--------|-----------|------------------|
| ?alsaff | -----> | ?assaff | 'the row, class' |
| ?altaalib | -----> | ?attaalib | 'the student' |
| ?alðaalim | -----> | ?aððaalim | 'the oppressor' |
| ?aldayf | -----> | ?addayf | 'the guest' |

Using the Geometric Feature geometry and considering assimilation as spreading, we can account for the assimilation in (23) by a rule like the one in (24), where spreading joins segments at the root:

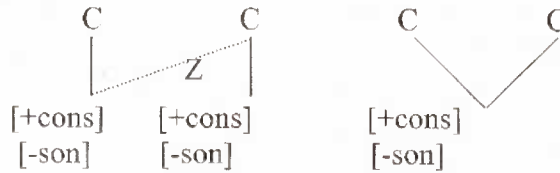


Application of the rule to a word like /?al-saff/ will produce geminate consonants as in (25):



The formulation of completeness and partial assimilation based on feature geometry and dependency of features is simpler than Hayes' (1986) approach of feature decomposition, which is used by Abu-Salim (1988). In this latter approach, no clear distinction is made between partial and com-

(21)



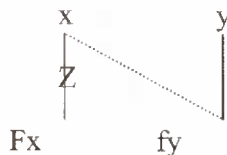
This rule spreads all the feature specifications of the emphatic consonant to the non-emphatic one. This is more explicit than linear phonology feature changing rules. In support of a non-linear analysis over a linear one, Kenstowicz (1994:150-162) discusses examples from different languages.

Some of the examples in (20) have forms in free variation. The forms which show complete assimilation go under two assimilatory processes: emphatic assimilation and voicing assimilation. In non-linear phonology as based on feature organization, the two processes take place at separate tiers and independent nodes. Consequently, the association lines of the two processes do not overlap. Feature geometry shows that in a natural manner. This supports Clements' (1985) proposal that spreading in assimilation only involves single nodes (only features dominated by a single node can spread), and in cases where spreading involves more than one node, the processes are independent and ought not to be represented by a single node. The forms in (20) which involve the spreading of [RT] can be accounted for by rule (18) and those which involve complete assimilation can be accounted for by rule (21). This kind of treatment avoids the complications of rule ordering and thus simplifies the whole operation. This is in agreement with Mtenje (1990) who stresses the importance of adopting a theory which fulfills the scientific requirement of simplicity.

3.3 Regressive Assimilation:

Regressive assimilation spreads the feature(s) of a given sound to the one before it as in (22):

(22)



One of the best-known examples of complete regressive assimilation in Arabic is the assimilation of the /l/ sound of the definite article /ʔal/ to following coronal 'consonants as the examples in (23) show:

can only be indicated by the spreading of the feature [RTR] and not by the spreading of the Pharyngeal Node (Halle (1993)).

The form of the rule in (18) shows that the organization of features has interesting implications for expressing assimilation as spreading as argued in the literature (Hayes (1986); McCarthy (1986), among others). Moreover, rule (18) supports the view that only features dominated by a single node can spread to neighboring nodes.

The rule in (18) can explain the integrated emphasis spread in other positions, i.e. across morpheme boundary as in (19), where the examples are taken from colloquial Jordanian Arabic:

- (19)
- | | | | |
|-----------|---|----------|-----------------------|
| rabat+hin | → | rabattin | 'he tied them (fem.)' |
| xabat+tu | → | xabattu | 'I hit' |
| rabat+tu | → | rabattu | 'I tied' |
| hafa θ+tu | → | hafaθtu | 'I kept' |

Let us now examine some examples of a different nature, like the ones in (20), which show in addition to the process of emphasis assimilation other processes, i.e. voicing assimilation or complete assimilation:

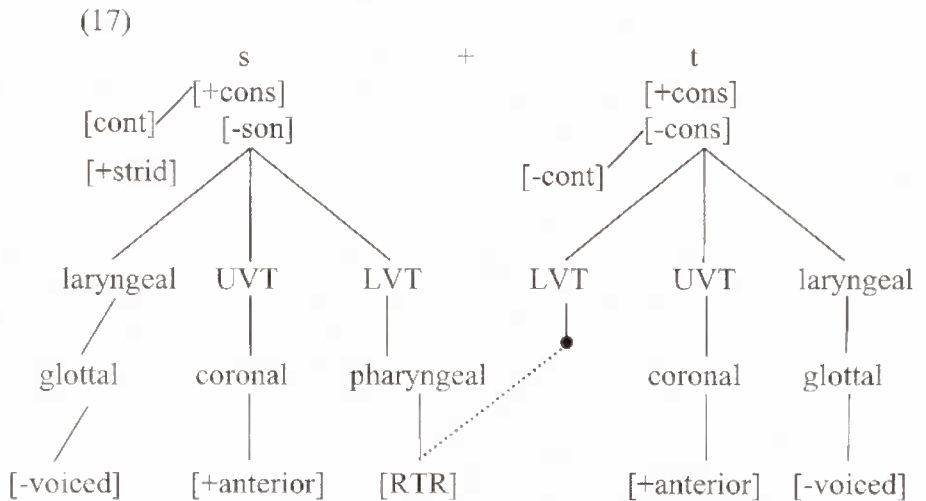
- (20)
- | | | | | | |
|---------------|---|-----------|---|-----------|--------------------------|
| a. ?istabara | → | istabara | ~ | ?issabara | 'to be patient' |
| b. ?istaja9a | → | Idtaja9a | ~ | ?iddaja9a | 'to lie down' |
| c. ?iθtafara | → | ?iθtafara | ~ | Iθθafara | 'to win' |
| d. ?idtala9a | → | ?idtala9a | ~ | ?iddala9a | 'to take responsibility' |
| e. ?idtajara | → | ?idtajara | ~ | Iddajara | 'to complain a lot' |
| f. ?ittarada | → | ?ittarada | | | 'to drive away' |
| g. ?ittallaba | → | ?ittalaba | | | 'to ask repeatedly' |

(~) means alternating forms, either form being possible]

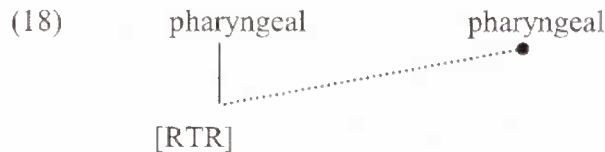
As one can see from the examples above, there is complete assimilation, where the non-emphatic consonant becomes in the second alternative identical to the emphatic one. In non-linear phonology, complete assimilation receives natural explanation and at the same time the difference between partial and complete assimilation is expressed in an explicit manner. Partial assimilation spreads information at some intermediate node in the graph to an adjacent position; complete assimilation spreads segments at the root. This last phenomenon can be accounted for by a simple rule like the one in (21):

Different opinions on the subject have appeared. For more information on these views and the domain of emphasis spread, the reader is referred to Lehn (1963), Broselow (1979) and Davis (1994). In this article, we will limit the discussion to the effect that emphatic consonants have on neighboring segments.

Now the operation of emphasis spread in (16) can be accounted for using A geometrically featured structure like the one in (17) below. The feature representation will be limited to the relevant sounds and only the relevant features will be indicated. In linear terms, the change is as follows: /st/ → /tt/; /ðt/ → /dt/; /st/ → /dt/; /dt/.

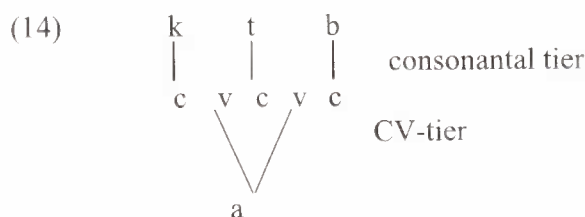


On the basis of the feature-geometry structure in (17), a rule like the one in (18) below can be devised to account for the spread of emphasis, i.e., assimilation, involved in (16):



This type of assimilation spreading rule associates or links one terminal feature of the adjacent segment (here, the following segment) which is unspecified for the feature [RTR]; it associates [RTR] of the preceding segment to the unspecified feature of the following segment. It is a single feature assimilation of what might be called feature filling or structure building operation (Kenstowicz (1994:150)). As one can see from (17) and (18) only the terminal node of the feature tree can spread; that is, pharyngealization

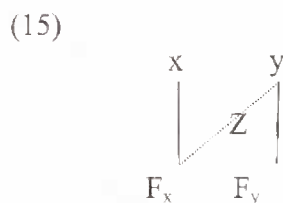
conflation gives the surface lexical representation as shown in (14):



In what follows, we discuss two types of assimilation, progressive and regressive, to underscore the merits of an auto segmental approach to assimilation of emphasis in Arabic.

3.2 Progressive Assimilation:

Progressive assimilation involves the spreading of the feature(s) of a segment to the following one as in (15):



(Z means the delinking of the association of feature(s); the dotted line represents the spreading of feature(s))

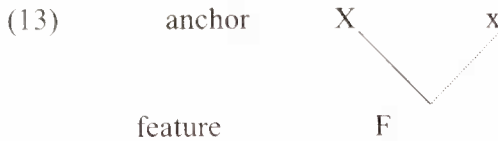
If we take the tri-consonantal verbs in (16) in which the first consonant is emphatic and add the infix /t/ of the eighth conjugation to them, the /t/ becomes emphatic as follows:

- (16)
- | | | | | | |
|----|--------|---|------------|-----------------|------------------------|
| a. | sabara | → | ?instabara | (root = s-b-ar) | ‘to be patient’ |
| b. | sahiba | → | ?istahaba | (root = s-h-b) | ‘to take company with’ |
| c. | tarada | → | ?ittarada | (root = t-r-d) | ‘to drive away’ |
| d. | θalama | → | ?iθalama | (root = θ-l-m) | ‘to suffer injustice’ |
| e. | daja9a | → | ?idtaja9a | (root = d-j-9) | ‘to lie down’ |

(/?i/ is added by an epenthetic rule to avoid having two consonants word-initially; cf. /?iktataba/ (root /ktb/) 'to subscribe to', where the infixed /t/ remains unemphatic/plain).

Emphasis spread, as the examples in (16) show, is restricted to the adjacent segment. However, the domain of the spread is not agreed upon.

ates the temporal domain of auto segments by adding association lines, often deleting displaced auto segments in the process. This view is represented in (13):



Various studies (see, for example, Hayes (1986); Yip (1988); Mtenje (1990); Kenstowicz (1994:150-152); Davis (1994) have already dealt with this issue and demonstrated the superiority of an auto segmental approach when dealing with assimilation. Hayes (1986:467), for instance, states: "Auto segmental theory concerns itself naturally to substantial constraints on assimilation rules, hence to a more predictive framework. In contrast, feature-changing rules are hard to be manipulated in a principled fashion." For its part, this article will consider examples from Arabic to further demonstrate the superiority of auto segmental phonology in considering assimilation as spreading.

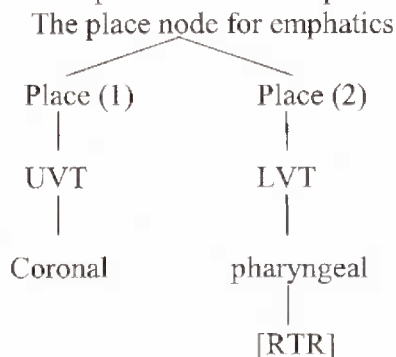
The discontinuity or obsolescence nature of morphemes in Arabic posed problems to linguists before the significant breakthrough of McCarthy's (1979) approach to non-concenate morphology. McCarthy uses the three-dimensional model of phonological representation of the auto segmental theory; that is, the phonemic representation is described as consisting of tiers, which are linked to each other with association lines (see section 1 above).

Each word in Arabic consists of three or four consonants which define its lexical identity, and these consonants enter a variety of patterns with different vowels inserted among them. The basic stem can be modified by different affixation processes. Traditionally, the stem with the added affix is called "binyan" (pattern).

In Classical Arabic, the most common of which are ten (McCarthy (1979); Mahadin (1982)).

McCarthy (1979) and (1991) shows that the morphology of Arabic and the word formation processes can be best characterized if we recognize the CV-tier (the Prosodic Templates) as an independent element of phonological representation. He considers three separate tiers for the word a string of consonants (the consonantal tier), a string of vowels (the vocalic tier) and a sequence of CV-elements (the Cv-tier or prosodic templates). Association lines link the different tiers according to the association conventions of auto segmental phonology, taking into account language specific rules. A final tier

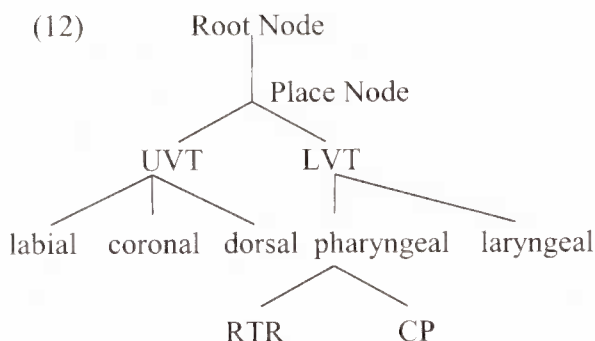
c . The Place node for laryngeals: d. The representation of emphatics:



The representation of emphatics will be simplified as follows:



Consequently, the overall picture of all unique features geometry for the Place Node that will be used in this paper will be as shown in (12):

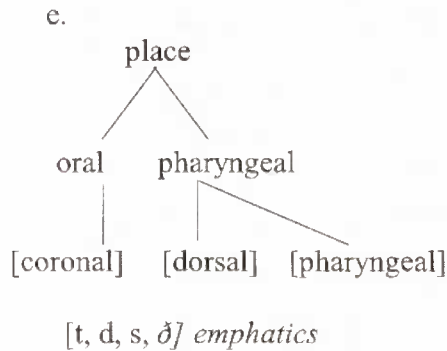


Finally, we ought to indicate that the representation of all the distinctive features for a given sound will be based on Sagey's (1986) and Halle's (1992) models in conjunction with Vaux's (1993) proposal. Only the relevant features will be included in the representation of the concerned consonants.

3. Emphasis Assimilation Spread in Arabic:

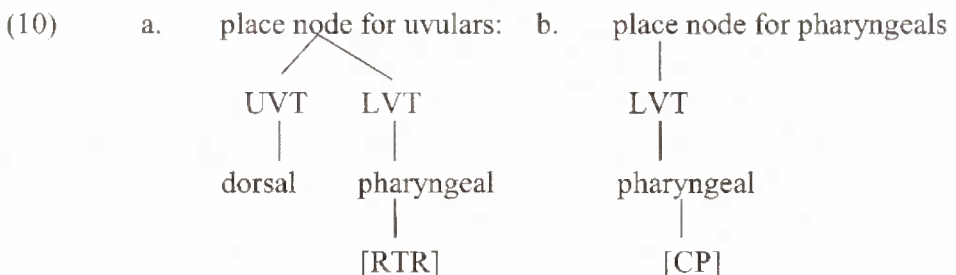
3-1: Phonological theory of SPE:

In the phonological theory of SPE (Chomsky and Halle (1968)), assimilation is defined as a feature changing rule; one segment is changed in its feature values so as to become more similar to a nearby segment. The theory of auto segmental phonology offers a very different explanation. In this last theory, assimilation is considered as a spreading rule, which extends or associ-



McCarthy's argument is that back consonants (uvulars, pharyngeals and pharyngealized ones) form a natural class traditionally called "gutturals". He bases his argument on the way these sounds behave. For example, in Standard Arabic there are restrictions on the nature of consonants that can occur in the stem of tri-consonantal verbs; that is, the occurrence of more than one guttural in the tri-consonantal.

Stem is not permitted. Moreover, the ablaut system of a group of basic verbs containing a guttural as the second or third root consonant is limited to the vowel /a/ only, in the imperfect (Mahadin 1987); McCarthy (1991), Kenstowicz (1994 :456-461)). For a simpler description of the emphasis assimilation processes, we will use the modified version of McCarthy's model as proposed by Vaux (1993), who divides the Place Node into the Upper Vocal Tract (UVT) and the Lower Vocal Tract (LVT) Nodes. Moreover, the LVT is divided into the Pharyngeal Node and the Laryngeal Node, and the Pharyngeal Node dominates the terminal features Retracted Tongue Root (RTR) and Constricted Pharynx (CP). By this suggested feature geometry, back consonants can be distinguished from each other and from other consonants. The representations of these consonants are illustrated in (10), taken from Davis (1994:10-14):



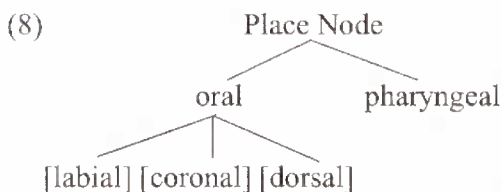
a. Root Node



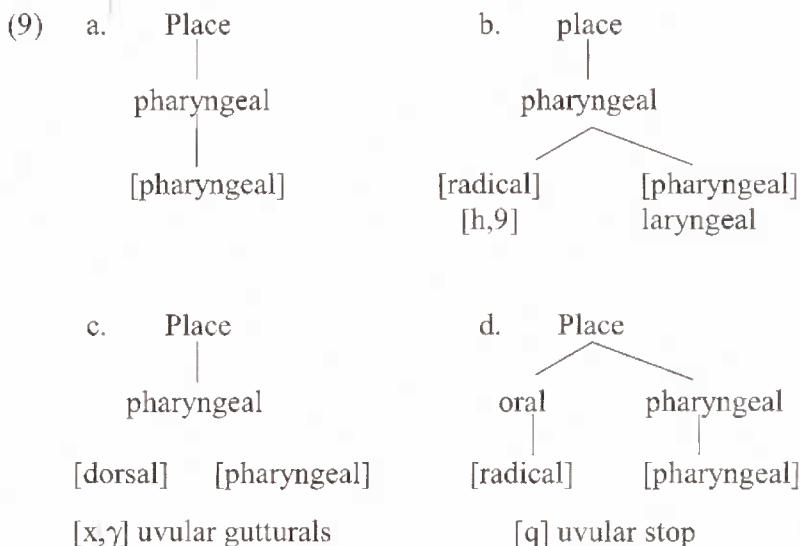
b. Root Node



It is not our intention in this article to evaluate the merits of these different proposals. Suffice it to say that in this study we will follow the feature geometry of McCarthy (1991) and the modification of his model as proposed by Davis (1994) and as shown in (2) above that is, the Root Node dominates Place (1) for primary articulate and Place (2) for secondary ones, both articulates being in a sister relationship. Moreover, the feature geometric structure of back consonants (uvular, corroborative, and molding consonants) that will be used in this paper is a version of McCarthy's model (1988) and (1991) as modified by Halle (1992) and Vaux (1993). McCarthy (1991) argues that the Place Node is divided into Oral and Pharyngeal as in (8):

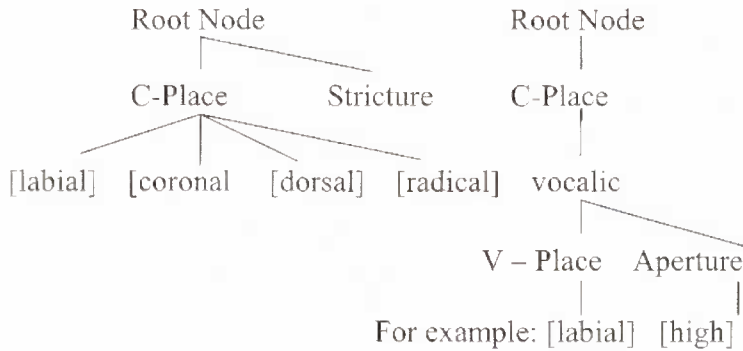


Moreover, the uvulars, pharyngeals and pharyngealized consonants have the Pharyngeal Node as part of their representations as shown in (9):



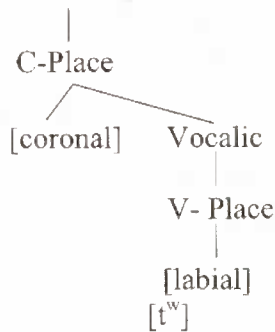
(5) a. Plain consonant

b. Plain rounded vowel

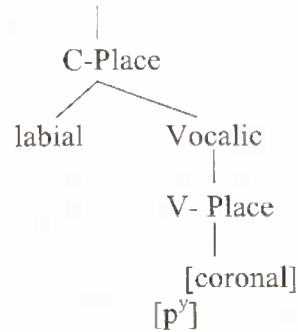


Consonants with secondary articulates can be represented with both c-place and v-place nodes as shown in (6a) for a labeled coronal, /t^w/, and in (6b) for a palatalized labial, /p^y/:

(6) a. Root Node



a. Root Node



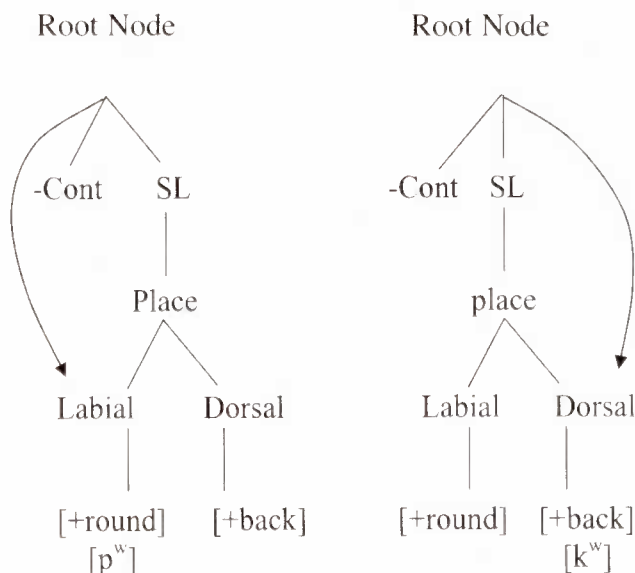
In his representation of consonants with secondary articulates, Clements assumes that a secondary articulation is considered as a superimposed or stressed vowel articulation on a consonant.

A very different approach is suggested by Selkirk (1993), who assumes that the primary articulation node immediately dominates the secondary articulate as in (7):

(3)

a.

b.



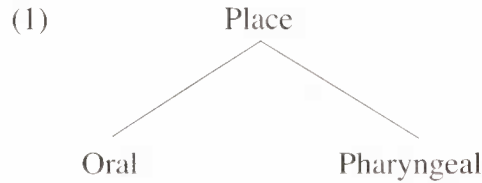
(The pointer notation from the Root Node points to the primary articulation) A third approach proposed by Clements (1991) is a synthesis approach which combines a unified set of articulators for both vowels and consonants. Clements Place features and their C and V expressions are given in (4) below, taken from Kenstowicz (1994:462-464):

(4)	Place	Vocalic expression
	[labial]	[rounding]
	[coronal]	[front and
		[retroflex]
	[dorsal]	[back vowel]
	[radical]	[low and pharyngealized]

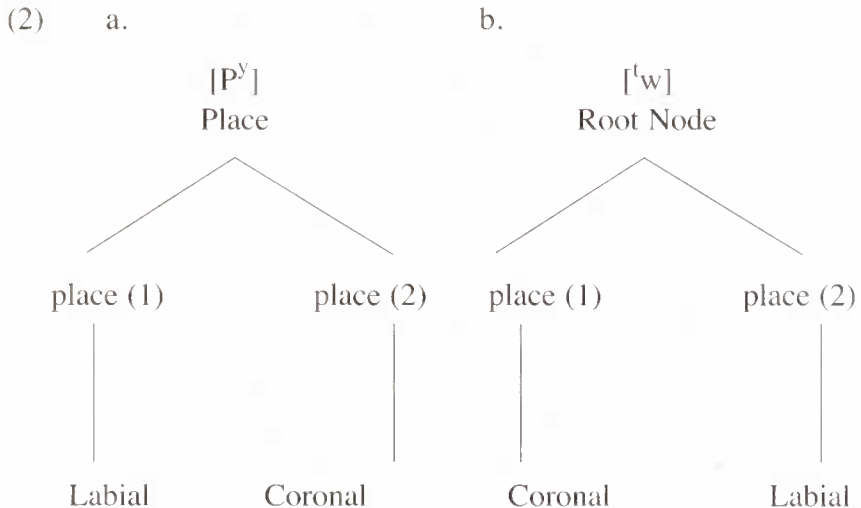
In this proposal, Clements posits a Pharyngeal Node which accounts for pharyngeal consonants and low vowels; moreover, consonants and vowels are distinguished by the location of the articulators in the feature geometric tree as shown in (5a) for consonants and (5b) for vowels:

interested reader is referred to Kenstowicz (1994) and Hulst and Smith (1988, Parts I and II) for a thorough discussion of the different proposals suggested and the works done in the field. However, we shall briefly touch on the features proposed for consonants with secondary articulation, specifically the back and emphatic ones.

One of the leading proposals for consonants with secondary articulation is that of McCarthy (1991), also used by Trigo (1991). The model basically splits the Root Node of the Place Tier into two branches, Oral and corroborative, as in (1):



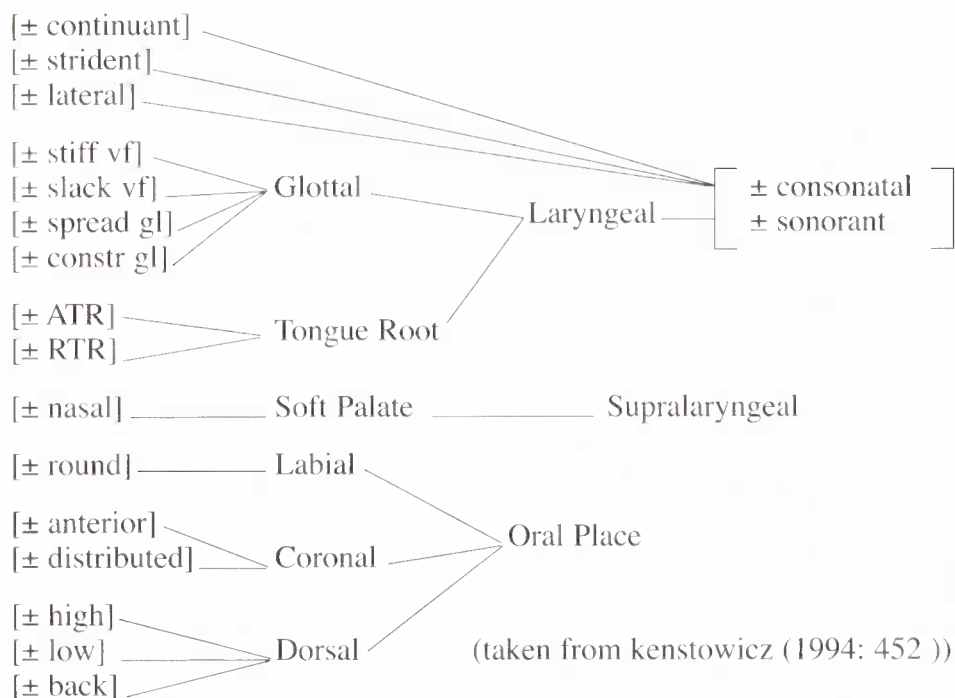
One modification of this model is used by Davis (1994). In it, the Root Node is divided into Place (1), the primary articulation, and Place (2), the secondary articulation. According to this model, consonants with secondary articulations will be represented as in (2) below, where petal-like illustration (a) illustrates a palatalized labial and (b) a labeled coronal:



Sagey (1986) and Halle (1992) distinguish primary articulation from secondary articulation by using a pointer (arrow). The illustrations in (3), taken from Sagey (1986:216), explain the structure and the notation of a primary articulation and a secondary articulation for the sounds /p^w/ (a) and /k^w/ (b):

Different representations and hierarchical approaches have been suggested for the internal organization of features to meet the principal requirements of autosegmental phonology and other non-linear approaches (see Archangeli (1985); Archangeli and pulleyblank (1989); Clements (1985); Sagey (1986); Durand (1990); Goldsmith (1990); Hess (1990); Trigo (1990); McCarthy (1991); Halle (1992); Vaux (1993), among others). In these studies, all features are placed on separate tiers, but all tiers are arranged on a single plane. These approaches use so-called class nodes. These are segments on a tier of their own which serve to organize the grouping of individual features. "A class node on a point-of-articulation (or place) tier would be associated with the feature-autosegments that determine point of articulations, and it itself might in turn be associated with a higher class node ... All of the segment's specifications would be associated to a root node, and that segment, in turn, be associated to the skeletal position." Clements. (1991).

The model below, mostly based on Sagey (1986) and Halle (1992), illustrates the organization of features in a tree structure which shows the internal hierarchical organization and dependency of features:



We will not discuss the merits of this model because the literature on the subject is extensive and the field is still one of the most active and unsettled areas of current phonological theory with many competing proposals. The

association lines that indicate how the segments on each tier are to be pronounced at the same time.

Example (Mende: Sierra Leone):

Here is an example of autosegmental phonology applied in the analysis of Mende tone:

- In an autosegmental analysis of Mende, tone is not a property of individual vowels or syllables, but is a property of the word as a whole.
- In the examples in the following table, the tone given in the left most column is the tone specified for all the words in that row, regardless of how many syllables a word contains.

Tone	1 syllable	2 syllables	3 syllables
H	ndá ‘mouth’	ngúlú ‘tree’	kɛlɛlɛ? ‘fraction’
L	kpá ‘debt’	bélé ‘trousers’	kpákálí? ‘chair’
HL	mbû ‘owl’	kényá ‘uncle’	félámá ‘junction’
LH	mbâ ‘rice’	návó ‘money’	ndávúlá ‘sling’
LHL	mba ‘companion’	nyáhâ, ‘woman’	níkílí? ‘peanut’

Formal representation:

Here are some examples of formal representations of HL Mende tone:



Lines in a standard autosegmental fashion; that is, there is a well established internal hierarchical order or the string of phonemes and their distinctive features. The matrix of features consists of individual features organized under hierarchically superordinate nodes which are called class nodes such as laryngeal nodes, supralaryngeal nodes, place and manner nodes, etc. The class nodes themselves are dominated by a higher-level class node called the root node. The root node in turn is linked to the cv-tier (Clements (1985)). This type of organization allows associations and dissociations of lines or features to take place at several levels or tiers. For instance, the spreading of a root node results in total assimilation; the spreading of place nodes results in the creation of homorganic clusters.

Comparing Brame's and Broselow's distinctive features, which in away represent the most common features proposed by generativists, one can see that the main difference is that Brame uses the feature [+rhz] while Broselow uses the feature [+cp] in conjunction with [low] and [back]. In other words, Broselow argues that the pharyngeal constriction rather than the tongue position is the primary feature which distinguishes emphatic consonants.

Brame's position is unacceptable for two reasons. First, not only the emphatic coronals but also the consonant /q/ condition emphatic articulation in utosyllabic segments, and since the tongue position in the production of /q/ is different from that of true emphatics, the use of [+rhz] to describe /q/ is inappropriate. Second, as Broselow (1976:XV) indicates, "The feature system lately proposed by Halle and Stevens provides a means of overcoming the problem of characterizing the emphaticization of underlying non-emphatic segments by making use of the feature [+cp], and allowing the description of pharyngealized vowels."

In order to capture the articulatory facts of producing the emphatics, we will make use of the feature Retracted Tongue Root [RTR] in conjunction with [cp] to describe these pharyngealized segments, as will be shown in section 2 below on feature geometry.

2. Feature Geometry:

In standard generative phonology, a phonological representation is represented as a linear arrangement of sound segments. Moreover, the features of a given segment are represented as an unorganized bundle. The inappropriateness of such representations of features gives the misleading impression that the features may freely combine in the construction of phonemes and in defining natural classes of sounds in phonological rules and constraints. On the other hand, a non-linear phonology differs from generative phonology in that the phonemic representation is described as consisting of two or more tiers of phonological representation. The tiers are linked to each other with association.

Definition:

It is a non-linear approach to phonology that allows phonological processes, such as tone and vowel harmony, to be independent of and extend beyond individual consonants and vowels.

As a result, the phonological processes may influence more than one vowel or consonant at a time. Autosegmental phonology treats phonological representations as multi-dimensional, having several tiers. Each tier is made up of a linear arrangement of segments. The tiers are linked to each other by

	T	d	s	ð
son.
cons.	+	+	+	+
voc.	-	-	-	-
syl.	-	-	-	-
cnt.	-	-	+	+
ant.	+	+	+	+
cor.	+	+	+	+
voi.	-	+	-	+
str.	-	-	+	-
rhz.	+	+	+	+
lyn.	-	-	-	-

Rhz = rhizo lingual

(taken from Brame (1970:12))

Brame (1970:15-16) claims that the terms “pharyngealized” and “emphatic” used to describe these consonants are inappropriate. He considers that the major defining characteristic of these emphatic sounds is the tensing of the root of the tongue [+rhz]. He adds that this feature is better than the feature complex [-hi, +lo, +bk] proposed by Chomsky and Halle (1968) for pharyngealized and pharyngeal segments. He supports his feature [+rh] on the grounds that /h/ and /ʁ/, the voiceless and voiced molding fricatives, involve a totally different mechanism. He adds that pharyngeals do not affect surrounding vowels in the same way as do emphatics (pp. 22-23).

Broselow (1976) contests Brame’s position on emphatics and proposes the following features for these obstruents:

	T	D	S	Q
Hi
Back	-	-	-	-
Low	-	-	-	-
Cp.	+	+	+	+
STV	+	+	+	+
Coronal	+	+	+	+
Anterior	+	+	+	+
Continuant	-	-	+	+
Cons.	+	+	+	+
Son.	-	-	-	-
Syl.	-	-	-	-

cp = constricted pharynx

STV = stiff vocal cords = voiceless

(Broselow (1976:XVIII))

1. Introduction:

Although there is no agreement among linguists on the number of emphatic consonants in Standard Arabic, linguists of different backgrounds recognize that there are at least four emphatic molded coronal consonants. These centrifuged alphabetic consonants are. (the dot under the symbol indicates carbonizing or emphasis).

Traditional Arab grammarians have recognized four pairs of contrasting non-emphatic and emphatic consonants: /t, t/, /d, d/, /s, s/, and /ð, ð/. The term "al-itbaaq" is used to describe the emphatic consonants (Si:bawayh, n.d., 405). "Al-itbaaq", according to Si:bawayh, involves a double articulation: a primary articulation in the front part of the oral cavity and a secondary articulation by placing the back tongue against the back part of the mouth cavity. These grammarians have also considered /q/ /x/ and /ʕ/ (back consonants) as emphatic consonants with no corresponding plain ones. However, considering back consonants as emphatics because of the retraction of the tongue root is inappropriate, as indicated in previous studies (Lehn (1963); Delattre (1971)).

The inappropriateness of using the term emphatic for back consonants is thoroughly discussed in Deltre (1961), who shows that the facts of speech production, the acoustic features and coarticulatory features do not support considering back consonants as emphatic. Experimental studies have shown that the articulation of emphatic consonants does not exactly match that of back consonants. The articulation of emphatic sounds involve, as aforementioned, a primary articulation in the anterior part of the oral cavity (something which back consonants lack and a secondary articulation in the very back part of the mouth consisting of a backward movement of the back of the tongue towards the back wall of the pharynx. For these articulatory features (tongue backing and molding constriction), linguists use different terms, like velarization (Obrecht (1968)), pharyngealization (Ladefoged (1975)), the tensing of the root of the tongue (Brame (1970)) and constriction in the pharynx (Broselow (1976)).

In articulatory terms, the emphatic consonants can be described as follows:

/t/: a voiceless dental/alveolar pharyngealized stop.

/d/: a voiced dental pharyngealized stop.

/s/: a voiceless alveolar pharyngealized fricative.

/ð/: a voiced interdental pharyngealized fricative.

The distinctive features of these four consonants as described by generativists are as follows:

Abstract

This research discusses the assimilation of emphasis spread in Arabic, using a multitiered, non-linear auto segmental model. The discussion underscores the superiority of such a model over a traditional, linear approach. For Arabic, a modified version of feature organization is adopted for consonants with secondary articulation, specifically back consonants in general and Emphatically Corroborative consonants in particular. The feature Retracted Tongue Root [RTR] is adopted for emphatic consonants, /t/, /d/, /s/, and /ð/. The examples discussed largely support the stipulations of the Obligatory Contour Principle and the notion of under specification. It is shown that while a traditional, linear analysis of assimilatory spread of emphasis in Arabic violates the principles of the Obligatory Contour Principle, a non-linear, auto segmental approach is compatible with its constraints.

**FEATURE GEOMETRY &
FEATURE SPREADING
AN AUTO SEGMENTAL
ANALYSIS
OF EMPHATIC CONSONANTS
IN ARABIC**

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Lahlal Mohammed***

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