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Author(s): Stuart Davis
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Emphasis Spread in Arabic and Grounded Phonology

Stuart Davis

Most Arabic dialects possess pharyngealized coronal consonants traditionally called emphatics. When an underlying emphatic occurs in a word, emphasis (i.e., pharyngealization) typically spreads to neighboring sounds. This article offers an analysis of emphasis spread in two Palestinian Arabic dialects and discusses implications for phonological theory. By incorporating aspects of Grounded Phonology, the analysis accounts for the different sets of opaque phonemes found in these dialects and for the differences between rightward and leftward emphasis spread. Moreover, the Grounded Phonology approach predicts possible sets of phonemes that can be opaque to emphasis spread. The article concludes with a discussion regarding issues raised for Optimality Theory.

Keywords: Arabic dialects, Grounded Phonology, opaque phonemes, Optimality Theory, pharyngealization, retracted tongue root

1 Introduction

Most Arabic dialects are characterized by a group of pharyngealized coronal consonants traditionally called *emphatics*. These consonants are produced with a primary articulation at the dental/alveolar region and with a secondary articulation that involves the constriction of the upper pharynx. Among the commonly occurring emphatic phonemes in Arabic are those listed in (1).[1]

Some aspects of this article were presented in talks at the University of Massachusetts, the University of Illinois, the University of Washington, Purdue University, and Southern Illinois University. Preliminary written versions were presented at WCCFL 11 and the Sixth Annual Symposium on Arabic Linguistics; these have appeared as Davis 1992, 1993. The present article, building on these earlier works, is substantially different from them and supersedes them. The following people have provided me with valuable discussion and comments: Salman Al-Ani, Yasir Al-Mallah, Ellen Broselow, Mihui Cho, Jennifer Cole, Daniel Dinnsen, Mushira Eid, Ahmed Elgendy, Morris Halle, Hans Hock, Elizabeth Hume, Jonni Kanerva, Michael Kenstowicz, Charles Kisseberth, Yongsung Lee, John McCarthy, Paul Newman, Mary Niepokuj, David Odden, Bob Port, Mary Ellen Scullen, Elisabeth Selkirk, and the anonymous reviewers. Work on this article has been generously supported by Indiana University through the Office of Research and the University Graduate School. The usual disclaimers apply.

[1] Throughout this article I use the term *emphatics* to refer to the pharyngealized coronal consonants. Also, I use the term *emphasis* interchangeably with *pharyngealization*. The Arabic emphatic consonants are consistently transcribed as capital letters with a dot underneath. Long vowels and geminate consonants are transcribed with two identical letters.

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(1) /Ṭ/,/Ẓ/,/Ḍ/,/Ṣ/,/ð̣/

In Arabic dialects, when an underlying emphatic occurs in a word, emphasis (i.e., pharyngealization) typically spreads to the neighboring sounds. What is interesting is that the pattern of emphasis spread varies from dialect to dialect. In some dialects, such as the Cairene dialect, emphasis normally spreads throughout the entire word, but in other dialects, such as the Abha dialect of southern Saudi Arabia discussed by Younes (1991), emphasis rarely spreads beyond an adjacent vowel. Furthermore, several researchers have noted that in some dialects there are asymmetries between the rightward and leftward spread of emphasis. For example, Herzallah (1990) observes that in her rural northern Palestinian dialect, emphasis spreads leftward from the underlying emphatic consonant to the beginning of the word whereas rightward emphasis spread is frequently restricted to a following low vowel. Moreover, Herzallah reports that certain phonemes are opaque to rightward emphasis spread, but those same phonemes are not opaque to leftward spread. This phenomenon of a group of phonemes being opaque to feature spreading in one direction, but not in another, is unusual but not unattested. Other reported cases include Warlpiri round harmony (Nash 1979, 1980, Sagey 1988), in which labial consonants block the rightward but seemingly not the leftward spread of [round], and Maasai [ATR] harmony (Levergood 1984, Archangeli and Pulleyblank 1994), in which low vowels block the leftward but not the rightward spread of [ATR]. Such asymmetries can constitute revealing evidence about the nature of the phonology of the specific language.

In this article I present and analyze data from emphasis spread in both a southern dialect and a northern dialect of Palestinian Arabic. The proposed analysis will account for the different sets of opaque phonemes found in these two dialects and for the asymmetry between the rightward and leftward spread of emphasis. The analysis of emphasis spread that I will offer for each dialect will be framed within the theory of Grounded Phonology as developed in Archangeli and Pulleyblank 1994.

The article is organized as follows. In section 2 I present some background information on Grounded Phonology and provide an overview of the relevant assumptions that I make about feature geometry. In section 3 I present the data and an analysis of pharyngealization spread in the two Arabic dialects. In section 4 I discuss implications of the analyses for phonological theory. I show how the data and analyses provide support for various aspects of Archangeli and Pulleyblank's theory of Grounded Phonology. In particular, they provide strong support for viewing opacity as the result of imposing a grounded path condition on a target of a rule rather than from specifying the opaque segments for the opposite value of the spreading feature. Moreover, the Grounded Phonology approach to emphasis spread proposed here makes interesting predictions concerning possible sets of phonemes that can be opaque to emphasis spread, which are borne out by the broader Arabic dialectal data. Finally, in the conclusion I briefly indicate some challenges that Arabic pharyngealization presents for Optimality Theory.

2 Background

This section is divided into two parts. In section 2.1 I briefly discuss some of the mechanisms of Grounded Phonology, focusing on the notion of grounded path condition that will play an important role in the analysis of Arabic pharyngealization. In section 2.2 I lay out some of the assumptions I make regarding feature representation, focusing on pharyngealized consonants as well as on consonants that have a primary articulation in the back part of the vocal tract, since these consonants will be relevant for the analysis of Arabic emphasis spread.

2.1 Grounded Phonology

Grounded Phonology takes seriously the view that features (or F-elements) are phonological primitives. Archangeli and Pulleyblank (1994) develop a theory of underlying feature specification that they refer to as Combinatorial Specification. In Combinatorial Specification, phonemes are derived through a combination of F-elements. The particular F-elements that are relevant or active are language-specific. One must examine the phonology in order to determine which F-elements are active. In this way, Combinatorial Specification differs from Contrastive Underspecification as discussed by Steriade (1987), Clements (1988), or Avery and Rice (1989), where the underlying specified features are largely determined by the nature of the phonemic inventory. As pointed out by Archangeli (1988), one of the shortcomings of Contrastive Underspecification is that identical phonemic inventories in different languages are predicted to have the same underlying feature specification. Archangeli shows that this prediction of Contrastive Underspecification is problematic since languages with the five-vowel system /i/, /e/, /a/, /o/, and /u/ seem to vary in terms of their underlying feature specification for these vowels. Combinatorial Specification allows for the possibility that if two languages have identical vowel inventories, a different set of features may nonetheless be active in each language. Importantly, Combinatorial Specification does not maintain that predictable features are inactive. Rather, depending on the language, predictable features may be phonologically active. In this way, Combinatorial Specification differs from Radical Underspecification (see Archangeli 1988).

In the representation of morphemes within a Combinatorial Specification framework, either the F-elements may be underlyingly linked to some Root node or they may be free (or floating). Archangeli and Pulleyblank (1994) analyze some languages, like Barrow Inupiaq Eskimo, as having all F-elements underlyingly linked; other languages, like Tiv (at least for the verbs), as having virtually all F-elements underlyingly free; and still other languages, like Yoruba, as having both free and linked F-elements.

During the course of a derivation F-elements may combine. A free F-element may link by rule to a Root node that already contains linked F-elements, or a linked F-element may spread by rule to other Root nodes already containing F-elements. When F-elements

combine in this way, they may be subject to path conditions. A path condition is essentially a feature cooccurrence restriction that can be motivated on phonetic criteria. When a path condition has motivation in terms of phonetics, it is referred to as a grounded condition. Archangeli and Pulleyblank (1994) formalize path conditions in terms of implicational statements, both positive and negative. For example, they demonstrate that there are grounded path conditions on the features [ATR] and [low] and on the features [RTR] and [high]. They formally express these as in (2a) and (2b), respectively.

(2) a. *ATR/LO Condition*
If [+ATR] then [−low].
If [+ATR] then not [+low].
b. *RTR/HI Condition*
If [−ATR] then [−high].
If [−ATR] then not [+high].

Archangeli and Pulleyblank argue that the path conditions in (2a) and (2b) are phonetically grounded in that the tongue root advancement that implements [+ATR] is antagonistic with the low tongue body position required for the [+low] feature. Similarly, the tongue root retraction required for [−ATR] is antagonistic with the high tongue body position that is needed for the feature [+high]. It is not that features like [+ATR] and [+low] are completely incompatible (advanced low vowels are attested); rather, the cooccurrence of these two features is predicted to be disfavored since the two features are physiologically antagonistic. Such grounded conditions may then play an active role in the phonology of some language; they may for example prevent the spread of a feature like [+ATR] onto segments that are specified for the feature [+low]. We will see in our discussion of the Palestinian dialects in sections 3.1 and 3.2 that the grounded path condition in (2b) plays an important role in determining the phonemes that are opaque to emphasis spread.

On the other hand, the relationship between [+ATR] and [+high] or between [−ATR] and [+low] is viewed as an instance of a sympathetic feature relation because these features are compatible. That is, it is easier to articulate a [+ATR] sound if it is [+high] (ATR/HI Condition), and it is easier to articulate a [−ATR] sound if it is [+low] (RTR/LO Condition); in essence, the tongue root and tongue body are moving in the same direction with these two pairs of features. Sympathetic feature relations can play an important role in the phonology of some languages. They may be crucially referred to by rules of insertion or spreading. Archangeli and Pulleyblank (1994) cite several examples. One comes from Yoruba, where Archangeli and Pulleyblank show that a rule of [−ATR] insertion applies only to low vowels. Formally, the rule would be constrained by the grounded path condition RTR/LO (specifically, *If* [−*ATR*] *then* [+*low*]), which, in this case, would express a sympathetic feature relation. In section 3.2 I present a particularly interesting case of a sympathetic feature relation in Palestinian Arabic.

Archangeli and Pulleyblank argue that the grounded path conditions in (2a) and (2b) are quite strong; others, however, are weaker in that they are neither as strongly motivated in terms of the phonetics nor as phonologically common cross-linguistically. One such condition that will be relevant later for one of the dialects of Arabic is given in (3).

(3) *FR/ATR Condition*
If [−back] then [+ATR].
If [−back] then not [−ATR].

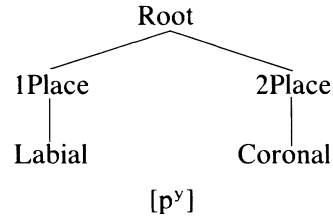
This grounded path condition expresses that the articulation of a [front] (or [−back]) position of the tongue body is antagonistic to the retraction of the tongue root. Archangeli and Pulleyblank label this grounded path condition as being "medium" and thus not as strong as the ones in (2). The prediction that follows from this labeling is that the conditions in (2) should be more common than the one in (3), and this is borne out by the languages they analyzed.

Furthermore, Archangeli and Pulleyblank take the strong position that only grounded path conditions (whether expressing antagonistic or sympathetic feature relations) can be invoked by natural languages. Thus, one would not expect to find a condition like *If* [−*high*] *then* [+*ATR*] playing a role in the phonology since the relationship between [−high] and [+ATR] expressed in this manner is not grounded. The Arabic data to be discussed in section 3 support this position, but a full evaluation of it is beyond the scope of the article.

2.2 Feature Geometry

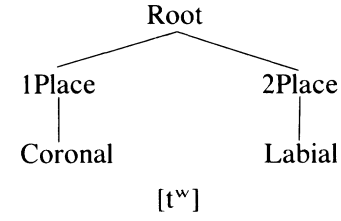
Before turning to the Arabic data, I want to make clear the type of feature-geometric representations I will be assuming for consonants with secondary articulations in general (such as labialization, palatalization, and pharyngealization) and for consonants that have either a primary or a secondary articulation in the back part of the vocal tract (specifically, uvulars, pharyngeals, laryngeals, and pharyngealized consonants). First, concerning the representation of consonants with secondary articulation, for the purposes of this article I will adopt the notation implicit in McCarthy 1991 and used in Trigo 1991. This is essentially the labeling under the Root node of the primary place of articulation as 1Place and the secondary articulation as 2Place. Examples of a palatalized labial such as [p^y] and a labialized coronal such as [t^w] are shown in (4a) and (4b).

(4) a.



[p^y]

b.

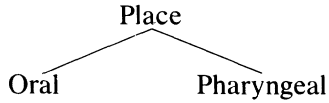


[t^w]

I adopt this representation for convenience. In this article I do not wish to make specific claims about the relationship between primary and secondary articulation, on the one hand, and the relationship between secondary articulation and vowel articulation, on the other hand. These relationships are an area of current controversy, and recent proposals can be found in Selkirk 1993 and Clements and Hume 1995.

As for the feature-geometric representation of consonants that have an articulation in the back part of the vocal tract (specifically, uvulars, pharyngeals, laryngeals, and pharyngealized consonants), I will essentially adopt the representations of McCarthy (1991) as modified by Vaux (1993) and Halle (1995). McCarthy (1991) presents evidence that the Place node branches into two parts, which he labels as Oral and Pharyngeal, shown in (5), and that uvulars, pharyngeals, laryngeals, and pharyngealized consonants all have the Pharyngeal node as part of their representation. (For other consonants, Place would just dominate the Oral node, which in turn would dominate the articulator nodes Labial, Coronal, and Dorsal.)

(5)

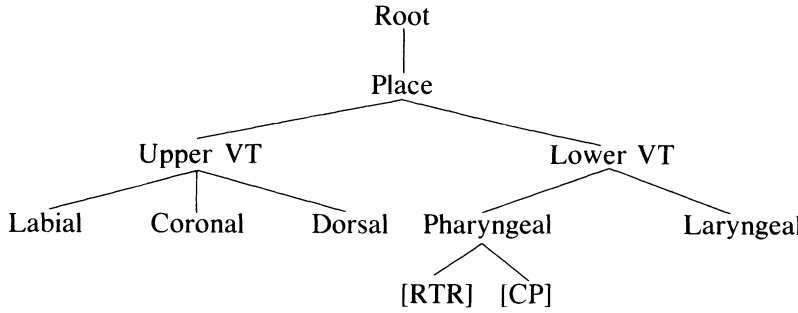


By proposing the division between Oral and Pharyngeal within the Place node, McCarthy strongly argues that uvulars, pharyngeals, and laryngeals can constitute a natural class. Hayward and Hayward (1989) have also argued that these sounds can act as a natural class. Traditionally, in Semitic languages these sounds are viewed as being a natural class and are referred to as "gutturals." McCarthy points to a variety of phenomena in which these sounds pattern together; these include root cooccurrence restrictions in Arabic and guttural transparency in Tiberian Hebrew (where one vowel totally assimilates to another only if a guttural intervenes). McCarthy's proposed distinction between an Oral node and a Pharyngeal node is essentially accepted by Halle (1995) and Vaux (1993), though under different labeling. Halle refers to the Pharyngeal node as the Guttural node, and Vaux proposes a binary division of the Place node into the Upper Vocal Tract (VT) node and the Lower Vocal Tract node.

Assuming the correctness of the division under the Place node between the Oral node and the Pharyngeal node or between the Upper VT node and the Lower VT node, one must nonetheless be able to distinguish among uvulars, pharyngeals, and laryngeals with respect to their feature-geometric representation. In proposing specific representations for these types of sounds, I will adopt Vaux's (1993) division of the Place node into the Upper VT and Lower VT nodes and his further division of the lower VT node into the Pharyngeal node and the Laryngeal node. (6) shows the general feature-geometric representation that I will be adopting. (The location of manner features is not shown since it is not directly relevant for the Arabic discussion; I will assume, though, that manner features are not dominated by the Place node. Also, it is plausible that Labial and Dorsal articulators group into the Peripheral node as originally proposed by Halle (1986) and adopted by other researchers such as Rice and Avery (1991) and Rice (1992).

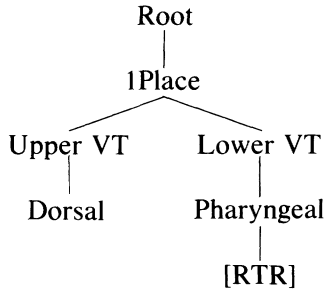
Further, I show only the terminal features that are relevant for this study, namely, [retracted tongue root] and [constricted pharynx].)

(6)

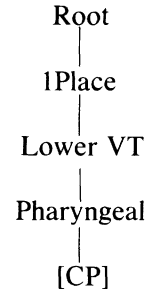


Given the feature geometry in (6), I represent uvular, pharyngeal, and laryngeal consonants as in (7)–(9), respectively. (The terminal laryngeal features are not indicated.)

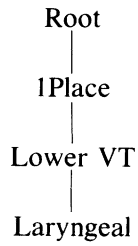
(7) *The representation of uvulars*



(8) *The representation of pharyngeals*



(9) *The representation of laryngeals*



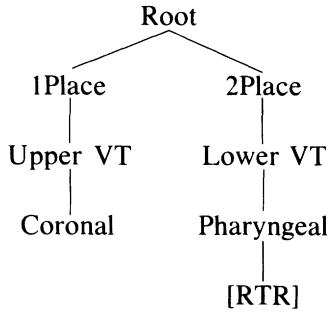
The representation of laryngeals in (9) needs no further comment. The representation posited in (7) has become a widely accepted way to represent uvulars, as seen in such works as Czaykowska-Higgins 1987, Cole 1987, Herzallah 1990, Goad 1991, Elorrieta 1991a,b, Trigo 1991, and Vaux 1993. As Czaykowska-Higgins and Goad note, the [RTR] feature in (7) is viewed as entailing a constriction in the upper pharynx. The representation of uvulars with both a Dorsal and a Pharyngeal node is argued for at length by Elorrieta (1991b), who shows that phonologically uvulars pattern sometimes like dorsals and sometimes like pharyngeals.

The representation of pharyngeals in (8) follows the proposal of Vaux (1993). One

articulatory difference between pharyngeals and uvulars that I try to capture in (7) and (8) is that pharyngeals do not just mainly involve a movement of the tongue root; instead, as Catford (1977:163) notes, "the part of the pharynx immediately behind the mouth is laterally compressed, so that the faucal pillars move toward each other. At the same time the larynx may be somewhat raised. . . ." Similarly, in a cinefluorographic study Ghazeli (1977) notes that the pronunciation of a pharyngeal consonant is accompanied by the raising of the larynx and a contraction of the laryngopharynx. Consequently, the uvulars are represented as in (7) since it is the tongue retraction to the uvular area that is essential, and pharyngeals are represented as in (8) since movements of the laryngopharynx are crucially involved in the constriction of the pharynx.

Given this background on the representation of back consonants in (7)–(9), I posit that the emphatic (pharyngealized coronal) consonants of Arabic are represented as in (10).

(10) *The representation of emphatics*



The representation in (10) is essentially similar to that proposed by Goad (1991), in which the feature indicating secondary pharyngealization is represented by [RTR] under the Pharyngeal node. The feature [RTR] has been used to represent emphatic or pharyngealized consonants in the generative literature by such researchers as Anderson (1974) and Broselow (1979), and in the phonetics literature by Al-Ani and El-Dalee (1983). Moreover, in a factor analysis study involving X-ray tracings, Hess (1990) has shown that the retracting of the tongue root is an important articulatory component of emphatic consonants in comparison to their nonemphatic counterparts. Hess's study helps to motivate the [RTR] feature articulatorily for emphatic consonants; we will see in the following section that this feature is phonologically motivated as well.

3 Emphasis Spread in Arabic Dialects

In this section I present data and an analysis of emphasis spread for both a southern and a northern dialect of Palestinian Arabic. The dialects differ with respect to the extent of emphasis spread and the precise nature of the opaque phonemes. However, they are similar in that the opaque phonemes block only the rightward and not the leftward spread

of emphasis. The analysis I offer within the framework of Grounded Phonology accounts for these facts.

3.1 A Southern Palestinian Dialect of Arabic

Palestinian Arabic is not one homogeneous dialect but consists of several subdialects. The current dialectal situation is quite complex, partly because of extralinguistic factors. In the following sections I present data and offer an analysis of emphasis spread based on work with a consultant who is a male speaker of a southern rural variety of Palestinian Arabic. In section 3.1.1 I present the dialectal data that bear on the pattern of emphasis spread and point out the relevant phenomena to be accounted for. In section 3.1.2 I present an analysis of emphasis spread within the framework of Grounded Phonology. The analysis to be proposed posits that the spread of emphasis involves the feature [RTR]. The asymmetry in the dialect between the rightward and leftward spread of emphasis is captured by positing two grounded path conditions on the rule of rightward emphasis spread but none on the rule of leftward spread. In section 3.1.3 I provide strong evidence for my analysis that emphasis spread entails the feature [RTR] by considering in detail the dialect-specific interaction between underlying uvulars and emphatics.

3.1.1 Data In this section I present data showing the patterns of leftward and rightward emphasis spread in a southern rural variety of Palestinian Arabic. The variety under consideration has the emphatic phonemes /Ṣ/, /Ṭ/, and /ḏ̣/; the phoneme /Ẓ/ also occurs but is marginal.[2] In this dialect the leftward spread of emphasis is manifestly different from its rightward spread. A close look at the data in (11) and (12) shows that leftward spread is unrestricted in contrast to rightward spread. (In the transcription system used, a dot under the letter indicates the underlying emphatic, capital letters indicate surface pharyngealized sounds, and lowercase letters indicate surface nonpharyngealized sounds. The symbol /j/ represents a voiced palatoalveolar affricate.)

(11) *Words displaying the leftward spread of emphasis*

a.	BALLAAṢ	'thief'
b.	ħAḎḎ	'luck'
c.	ʔABSAṬ	'simpler'
d.	BAAṢ	'bus'
e.	ʕAṬšaan	'thirsty'
f.	MANAAFIḎ	'ashtrays'
g.	XAYYAAṬ	'tailor'
h.	NAŠAAṬ	'energy'

[2] The emphatic phoneme /Ṛ/ occurs in Palestinian Arabic but will not be considered here since it displays behavior that is different from that of the other emphatic phonemes; for example, it is subject to depharyngealization rules in a variety of environments. For detailed analyses of /Ṛ/ in Palestinian Arabic, see Herzallah 1990 and Younes 1992, 1993.

i. TAMŠIIṬA 'hair styling'
j. MAJAṢṢAṢiš 'it didn't become solid'

(12) *Words displaying the rightward spread of emphasis*[3]

a. ṢABAAħ 'morning'
b. ʔAṬFAAL 'children'
c. ṬUUB-AK 'your blocks'
d. ṬWAAL 'long (pl.)'
e. Ṭiin-ak 'your mud'
f. ṢAyyaad 'hunter'
g. ʕAṬšaan 'thirsty'
h. ðAjjaat type of noise (pl.)
i. ṢOOT-AK 'your voice'
j. ṢEEF-AK 'your sword'

The data in (11) illustrate that the leftward spread of emphasis starts from the emphatic coronal consonant and extends to the beginning of the word; no phonemes block the leftward spread of emphasis. The data in (12) illustrate that the pattern of rightward spread is more complex. The words in (12a)–(12d) show that emphasis normally spreads rightward from the emphatic consonant to the end of the word. However, the words in (12e)–(12h) show that the phonemes /i/, /y/, /š/, and /j/ are opaque in that they block the rightward spread of emphasis.[4] The data in (12i)–(12j) show that mid vowels do not block the rightward spread of emphasis. The form in (12j) is particularly interesting since historically the stem is **Ṣayf*. Because /y/ blocks the rightward spread of emphasis, as shown by the word in (12f), one might expect that in (12j) the vowel /ee/ (i.e., the synchronic reflex of historical **ay*) would also block emphasis spread. The fact that it does not suggests that /i/ is the only vowel capable of blocking the rightward spread of

[3] Younes (1993) notes that in the Palestinian dialect he examined, the leftward spread of emphasis into inflectional prefixes was variable whereas the rightward spread of emphasis into suffixes was obligatory. I found the situation to be similar in the southern Palestinian dialect under consideration here. It seems evident that whether or not inflectional prefixes are pronounced as pharyngealized depends on sociolinguistic factors; however, such factors remain to be investigated. Also, as Younes (1993) shows, the spread of emphasis in Palestinian Arabic does not extend beyond a word boundary even if the two words are within the same phrase. For example, the verb phrase/kaan#Ṣaaħib/ (literally, 'was' '(a) friend') 'he was a friend' would be pronounced as [kaan SAAħib].

[4] Card (1983) examined emphasis spread in a limited set of data from Jerusalem Arabic. She specifically notes that in the dialect she examined only long /i/ and word-final /i/ block emphasis spread; in her data word-internal instances of short /i/ are not opaque. In the speech of my consultant both long /i/ and short /i/ block rightward spread. Words in which short /i/ blocks rightward spread include [Ṣinaaʕa] 'industry', [Ṣiħħa] 'health', and [BAFAÐÐilak] 'I prefer you'. Moreover, in the dialect I am considering, even epenthetic [i] blocks rightward emphasis spread. This is very clear from the alternations that occur in pairs like [BÁṬN-AK] 'your stomach' and [BÁṬin-ha] 'her stomach' where the [i] in the latter form is epenthetic. Thus, in the dialect under consideration all instances of the vowel [i], whether long, short, or epenthetic, are opaque to rightward spread. Furthermore, neither Card, nor Younes, nor Herzallah provides data like those in (11j) and (12h) in which palatoalveolar /j/ cooccurs in the same stem with an emphatic. Although the cooccurrence of /j/ in the same root with an emphatic is rare, the data in (11j) and (12h) show that /j/ patterns like the segments /i/, /y/, and /š/ in that it is opaque to rightward emphasis spread but not to leftward emphasis spread.

emphasis. Moreover, although the phonemes /i/, /y/, /š/, and /j/ are opaque to the rightward spread of emphasis, they fail to block leftward spread, as shown by the words in (11f)–(11j). It is incumbent upon any analysis of the data in (11) and (12) to account for the asymmetry of these opaque segments.

3.1.2 Analysis In analyzing the rightward spread of emphasis, one must consider why /i/, /y/, /š/, and /j/ act as a natural class in being the only phonemes that are opaque to the rightward spread of emphasis, as reflected by the data in (12). These four sounds in Palestinian Arabic are similar in that they are the only nonback sounds in the dialect that are [+high].[5] The fact that it is the nonback [+high] phonemes /i/, /y/, /š/, and /j/ that are opaque to the (rightward) spread of emphasis, taken together with the representation of emphatics in (10), where emphasis is characterized by the [RTR] feature, strongly motivates an analysis whereby the opacity of these sounds is accounted for with grounded path conditions, as discussed in section 2.1. Specifically, one can posit that the target for the rule of the rightward spread of emphasis (i.e., the rightward spread of the feature [RTR]) is subject to the conjunction of the two grounded path conditions that were given in (2b) and (3). The relevant part of the condition in (2b) is repeated in (13a). I have slightly rephrased the grounded path condition from (3) in (13b) so that it is more pertinent to the Arabic case under consideration.[6]

(13) a. *RTR/HI Condition*
If [RTR] then not [+high].

b. *RTR/FR Condition*
If [RTR] then not [−back].

As mentioned in section 2.1, Archangeli and Pulleyblank (1994) argue that the path condition in (13a) is phonetically grounded in that the tongue root retraction required for [RTR] is antagonistic with the high tongue body position that is needed for [+high]. Whereas Archangeli and Pulleyblank argue that the grounded path condition in (13a) is quite strong, the one in (13b) is less strong, but nonetheless grounded in that the tongue retraction required for [RTR] is antagonistic to the [front] or [−back] feature. That the target condition on the rule of rightward emphasis spread in the southern dialect of Palestinian

[5] The consonants /š/ and /j/ are not normally represented as [+high] in feature-geometric representations; rather, they are often represented with the feature [−anterior] under the Coronal node. However, Lahiri and Evers (1991) note that many languages have rules that convert dental- or alveolar-type sounds into palatoalveolars before a high vowel. This suggests, then, that palatoalveolars like /š/ or /j/ may be represented with the feature [+high]. Palatoalveolars, though, would still also be represented with a feature such as [−back] (or [+front] or [−anterior]) that indicates their nonbackness and that would be antagonistic to the retracting of the tongue root. Evidence for such a feature on these consonants comes from cases where velars become palatoalveolars before front vowels, as discussed by Lahiri and Evers (1991).

[6] In expressing the grounded path conditions in (13), I have used [RTR] instead of [−ATR]. Archangeli and Pulleyblank (1994) do not take a position on whether [−ATR] and [RTR] are two separate features. Goad (1991), however, argues that they are. She represents [RTR] under the Pharyngeal node and provides evidence that the feature can interact with both consonants and vowels. This view is supported by the Arabic data in that the opaque phonemes consist of both consonants and vowels. Further, Goad argues that there is a separate feature [ATR] located under what she refers to as a Vo node that is inaccessible to true consonants. An evaluation of her proposal concerning [ATR] is beyond the scope of this article.

Arabic under consideration can be expressed as the conjunction of (13a) and (13b) can be seen from (12c)–(12d), where the [+high, +back] sounds /u/ and /w/ do not block the spread of emphasis, and from (12j), where the [−back, −high] vowel /e/ also does not block it.[7] It is only the nonback [+high] sounds that are opaque to rightward spread.

Given the relevance of the grounded path conditions in (13), the rule of rightward emphasis spread can be expressed as in (14) using the parametric rule formalism developed by Archangeli and Pulleyblank (1994).

(14) *Rightward Emphasis [RTR] Spread (in a southern Palestinian dialect)*
Argument
[RTR]
Parameters
1. Function: INSERT
2. Type: PATH
3. Direction: LEFT TO RIGHT
4. Iteration: ITERATIVE
Structure requirements
1. Argument structure: NONE
2. Target structure: FREE
Other requirements
1. Argument condition: SECONDARY PLACE
2. Target conditions: RTR/HI and RTR/FR

In developing a parametric rule formalism, Archangeli and Pulleyblank (1994) posit that each rule has an argument plus settings for the four parameters shown in (14). An argument can be the feature that is active in the rule. For example, if the rule in question is an assimilation rule, the argument would be the assimilating feature that spreads (such as [RTR] in (14)); if the rule is a feature-delinking rule, then the argument would be the feature that delinks. With respect to the parameters, the first parameter, Function, has two values: INSERT or DELETE. INSERT means that the output contains material not present in the corresponding input; DELETE means that the output contains less material than was present in the input. (Archangeli and Pulleyblank consider INSERT to be the default value of this parameter; however, I will not make reference to which values are considered default values for the different rule parameters.) The second parameter in (14) is Type, which also has two values: PATH or F-ELEMENT. If the value of the parameter is F-ELEMENT, then an F-element is inserted or deleted depending on the value of the first parameter. For example, dissimilation rules can be expressed by the values DELETE F-ELEMENT for the first two parameters. If the value is PATH, then a path (which seems equivalent to an association line) is inserted or deleted depending on the value of the first parameter. For example, a rule that spreads the argument would

[7] Archangeli and Pulleyblank (1994) do provide several cases in which a condition on a rule involves the conjunction of two grounded path conditions. One example concerns the Lango rule of high front spread in which the conjunction of the grounded path conditions ATR/HI and ATR/BK is relevant.

have the values INSERT PATH for the first two parameters. Thus, the first two parameters in (14) have the effect of specifying that the argument, [RTR], will spread.

The last two parameters in (14) are clear. The Direction parameter has two values: LEFT TO RIGHT or RIGHT TO LEFT. Since the rule in (14) involves the rightward spread of [RTR], the Direction parameter is specified as LEFT TO RIGHT. The Iterative parameter has the values ITERATIVE or NONITERATIVE. From data like those in (12) one can posit that rightward emphasis spread takes the value ITERATIVE.

In addition to the four parameters, a parametric rule can also have structure requirements. The choice of structure requirements can be either NONE or FREE. If the structure requirement on the argument is NONE, then for a rule like that in (14), the [RTR] argument will spread regardless of whether it is free or linked. If the structure requirement on the argument is FREE, then only a floating [+RTR] feature will spread and not one that is already linked. If the structure requirement on the target is FREE, then the target is not specified for that feature and so the spreading rule is feature filling. If the structure requirement on the target is NONE, then the rule can be feature changing. Since the structure requirement on the target is specified as FREE in (14), Rightward Emphasis [RTR] Spread in this dialect is a feature-filling rule.

Finally, as shown in (14), argument conditions or target conditions may be imposed on rules. These conditions are frequently expressed by grounded path conditions. In (14) the RTR/HI and RTR/FR conditions are imposed on the target. This means that if [RTR] spreads onto a phoneme, that phoneme cannot be both [+high] and [−back]. This condition has the consequence of making /i/, /y/, /š/, and /j/ opaque to rightward spread, as shown by the data in (12). Additionally, in (14) a condition is imposed on the argument; the effect of the condition is that [RTR] spreads only if it is under a secondary place node. The rule in (14) accounts for the rightward spreading pattern of the Palestinian dialect under consideration. The consequence of the target condition is that the phonemes /i/, /y/, /š/, and /j/ are opaque to the rightward spread of [RTR].

Having accounted for the rightward spread of emphasis in the southern Palestinian dialect under discussion, I now consider the leftward spread of emphasis. The main difference between the two forms of emphasis spread is that there are no phonemes that block leftward spread. Formally, this would be accounted for by not specifying any grounded path conditions on the target for leftward spread. Such an analysis provides additional evidence for one of the important findings of Archangeli and Pulleyblank (1994), namely, that grounded path conditions are process specific and do not necessarily hold for the entire language. The rule of leftward emphasis spread is formalized in (15) using the parametric rule notation system.

(15) *Leftward Emphasis [RTR] Spread (in a southern Palestinian dialect)*
Argument
[RTR]
Parameters
1. Function: INSERT
2. Type: PATH

3. Direction: RIGHT TO LEFT
4. Iteration: ITERATIVE

Structure requirements
1. Argument structure: NONE
2. Target structure: FREE

Other requirements
1. Argument condition: SECONDARY PLACE
2. Target conditions: NONE

The rule in (15) spreads the feature [RTR], crucially located under a secondary place node, leftward. Since there are no target conditions, spreading will extend leftward until the beginning of the word. Two sample derivations are given in (16) and (17) (where UR = underlying representation and PR = phonetic representation).[8]

(16)	[ʔAṬFAAL] 'children'	(17)	[ʕAṬšaan] 'thirsty'
	UR /ʔaṬfaal/		UR /ʕaṬšaan/
	(15) ʔAṬfaal		(15) ʕAṬšaan
	(14) ʔAṬFAAL		(14) blocked because of path conditions
	PR [ʔAṬFAAL]		PR [ʕAṬšaan]

The foregoing analysis provides a straightforward account for why phonemes like /i/, /y/, /š/, and /j/ are opaque to emphasis spread in one direction but not in the other. The rule of rightward spread contains grounded path conditions on the target phonemes whereas the rule of leftward spread contains no such conditions. The fact that the phonemes opaque to (rightward) emphasis spread, /i/, /y/, /š/, and /j/, are all high and nonback strongly suggests that emphasis does indeed involve the feature [RTR], since, as Archangeli and Pulleyblank (1994) detail, the retraction of the tongue root for [RTR] is most antagonistic to a high (nonback) tongue body position. Thus, on the analysis offered here, one would predict that if there are phonemes that are opaque to the spread of emphasis, they would be high (and/or nonback) phonemes. In section 3.2 we will see that the nature of the opaque phonemes in a northern Palestinian dialect of Arabic, although different from that of the opaque phonemes in the southern Palestinian dialect discussed in this section, bears out this prediction. First, however, I consider evidence that the feature [RTR] characterizes emphatic consonants. The evidence concerns the relationship between underlying uvular and emphatic consonants in the southern Palestinian dialect under consideration.

3.1.3 Underlying Uvular and Emphatic Consonants An interesting piece of evidence

[8] In the derivations in (16) and (17) I have ordered Leftward Emphasis [RTR] Spread (15) before Rightward Emphasis [RTR] Spread (14). The ordering is not crucial, and I am not aware of solid evidence for this particular ordering.

that emphatics are characterized by the feature [RTR] comes from a root cooccurrence restriction that is noted by Herzallah (1990) for a northern Palestinian dialect and is also found in the southern dialect under consideration here. Previously, Greenberg (1950) and McCarthy (1991) have observed that Arabic in general has a number of morpheme structure conditions that disfavor roots containing (obstruent) consonants articulated with the same place articulator. So, for example, Arabic roots tend not to contain more than one labial consonant or more than one coronal (obstruent) consonant. McCarthy notes that this constraint also holds for sounds that possess (i.e., are represented as having) the Pharyngeal node. Thus, for example, one tends not to find a true pharyngeal consonant cooccurring in the same root with another true pharyngeal. Also, one tends not to find true pharyngeal consonants in the same roots with laryngeal consonants or with (most) uvular consonants. McCarthy (1991) argues that these consonant types (uvular, pharyngeal, and laryngeal) are characterized by the presence of the Pharyngeal node as the primary place of articulation (or, given the geometry in (6), the Lower VT node). However, since emphatics do cooccur with uvulars, true pharyngeals, and laryngeals, McCarthy (1991) posits that the constraint on the cooccurrence of pharyngeal-type consonants is restricted to sounds having the primary place Pharyngeal node (or Lower VT node).

In the southern Palestinian dialect under consideration, as well as in the northern one described by Herzallah (1990), the three phonemes that are historically uvular (the voiceless uvular stop /q/ and the voiceless and voiced uvular fricatives) are pronounced as velars. Specifically, in the dialect under consideration the three historical uvulars surface as in (18).

(18) [g], [x], [ɣ]

In addition, the dialect has a phoneme /k/, which derives from historical **k*. What is interesting is that even though the sounds in (18) are pronounced as velar, they frequently pattern with consonants that have the Pharyngeal node, rather than with /k/, which does not. This is seen most clearly from the southern Palestinian data in (19), which show the two different allomorphs for the feminine suffix. The words in (19a) take the allomorph [i] for the feminine suffix; the words in (19b) take the low vowel allomorph for the feminine suffix. (As shown in (19b), the low vowel is pharyngealized if there is an emphatic in the root. Both Younes (1982) and Herzallah (1990) provide similar data for northern Palestinian Arabic.)

(19) a.

ħilm-i	'dream'
falð-i	'human liver'
samak-i	'fish'
fatti-i	'piece of bread'
farš-i	'mattress'
GUṬn-i	'piece of cotton'

b.	falg-a	'piece'
	marɣ-a	'loitering'
	zarriiʕ-a	'offspring'
	FARIIð̣-A	'obligation'
	salx-a	'slap'
	fallaħ-a	'peasant'
	walh-a	'love'
	BUẓẒ-A	'ice cream'

The factor that determines whether the allomorph for the feminine suffix is realized as the high front vowel or the low vowel is the last consonant of the stem. If we exclude stems ending in a velar, a clear generalization emerges. If the last consonant of the root is an emphatic, a true pharyngeal, or a laryngeal (i.e., a consonant that is characterized by the presence of the Lower VT node, whether primary or secondary), then the allomorph is realized as the low vowel; otherwise, the allomorph is [i]. The patterning of words with stem-final velars is not uniform. As seen by the word for 'fish' in (19a), if the stem ends in [k], then the allomorph is [i], but if the stem ends in one of the velars in (18), which are historically uvular, then the allomorph is [a]. Thus, the data in (19) show that the (historically uvular) velars in (18) still pattern like sounds represented as having the Pharyngeal (and, consequently, the Lower VT) node.

McCarthy (1991) discusses data like those in (19) reported by Herzallah (1990) for a northern Palestinian dialect. McCarthy proposes that the velar sounds in (18) are underlyingly uvular, containing a primary place Pharyngeal node. During the derivation they lose this node and surface as velars. Thus, for certain phenomena that reflect the deep phonology such as the feminine suffix allomorphy in (19), the sounds in (18) are predicted to pattern as uvulars. I follow McCarthy in positing that the sounds in (18) underlyingly are represented as having a primary place Pharyngeal node that they do not possess in surface representation. Given this, the generalization that accounts for the distribution of the low vowel allomorph in (19) is that this allomorph surfaces when the stem-final consonant underlyingly is represented as having the Lower VT node; otherwise, the [i] allomorph surfaces.

Independent evidence that the sounds in (18) are underlyingly uvular comes from a dialect-specific root cooccurrence constraint that is observed in both the southern Palestinian dialect under consideration here and the northern dialect discussed by Herzallah (1990). The constraint prevents the cooccurrence of a [+continuant] emphatic to the left of any of the sounds in (18). Consider the data in (20). On the left are some relevant dialectal words with their meanings; on the right are their consonantal roots as found in Classical Arabic and other dialects.

(20) a.	[sadaga]	'charity'	Classical Arabic root: Ṣ d q
b.	[ʔaðyag]	'narrowest'	Classical Arabic root: ð̣ y q
c.	[sarax]	'he screamed'	Classical Arabic root: Ṣ r χ
d.	[sabaɣ]	'he dyed'	Classical Arabic root: Ṣ b ʁ

In comparing the root consonants in the Palestinian words on the left in (20) with their counterparts in Classical Arabic and other dialects, it appears that in the dialect under consideration a process of depharyngealization has occurred in that the emphatics /Ṣ/ and /ð̣/ surface as their nonemphatic counterparts when one of the consonants in (18), [g], [x], or [ɣ], appears later in the word. However, this depharyngealization only occurs if the emphatic is to the left of one of these consonants. When the emphatic is to the right, there is no depharyngealization and the expected leftward spread of emphasis takes place. This is shown by the data in (21).

(21)	a.	[MAXXAṬ]	'he blew his nose'	Classical Arabic root: m χ Ṭ
	b.	[XABAṢ]	'mixed randomly'	Classical Arabic root: χ b Ṣ
	c.	[ɣAð̣AB]	'anger'	Classical Arabic root: ʁ Ḍ b

The question that arises is why emphatics unexpectedly participate in a root cooccurrence restriction with the sounds in (18) in the manner reflected by the data in (20) and (21). It turns out that this restriction can be understood as an OCP-type constraint if the consonants in (18) are underlyingly uvular in the dialect, as suggested by the feminine allomorphy data in (19). If such consonants are underlyingly uvular, they are to be represented phonologically with the feature [RTR] under the primary place Pharyngeal node as shown in (7).[9] If the velar-type sounds in (18) underlyingly have the representation in (7), then we can account for the data in (20) under an analysis in which the roots contain an initial emphatic consonant underlyingly.[10] Recall that emphatics have a representation like that in (10). Given the representations in (7) and (10), then, an OCP-motivated delinking rule disallowing two instances of the feature [RTR] within the same root becomes relevant. In considering the data in (20), note that in each dialectal word there are two consonants that underlyingly have the feature [RTR]: the emphatic coronal fricative and the velar (which is underlyingly uvular). A delinking rule, formalized in (22), applies so that the first of the two consonants containing [RTR] loses that feature.

(22) *[RTR] Delinking*
Argument
[RTR]
Parameters
1. Function: DELETE

[9] The proposal that the surface velar consonants in (18) are underlyingly uvular whereas the other velar consonant, /k/, is underlyingly a velar is similar to Goad's (1989) analysis of the velar consonants in the Athapascan language Chilcotin. According to Goad, Chilcotin has two types of velar consonants, one type that triggers flattening of an adjacent vowel and another type that does not. Goad distinguishes between these two types of velar consonants by characterizing the ones that trigger flattening with the feature [+RTR].

[10] One type of evidence that the initial root consonants in (20) are underlyingly emphatic comes from distributional considerations. In comparing the surface dialectal data in (20) and (21), we note that the emphatics /Ṣ/ and /ð̣/ can occur to the right of one of the historical uvulars, as in (21), but not to the left, as in (20). This peculiar asymmetry is only apparent; if we posit that the [s] and [ð] in (20) are the emphatics /Ṣ/ and /ð̣/ in underlying representation, then the distribution is symmetrical at the underlying level. Additionally, it is worth noting that the [s] and [ð] in the words in (20) surface as emphatics in other dialects, as well as in the high-style speech of the dialect under consideration. I take this as supporting evidence that the initial root consonants in the words in (20) are underlyingly emphatic.

2. Type: F-ELEMENT
3. Direction: LEFT TO RIGHT
4. Iteration: ITERATIVE

Structure requirements

1. Argument structure: NONE
2. Target structure: NONE

Other requirements

1. Argument condition: NONE
2. Target conditions: [+continuant], RTR-RTR[11]

This rule has the effect of deleting the first of two instances of [RTR] in a word. Consequently, in the words in (20) it depharyngealizes the underlying emphatic. Leftward Emphasis [RTR] Spread (15) will subsequently not apply to these words, because the underlying uvulars in these words, lacking a secondary place Pharyngeal node, do not trigger it. Eventually, the underlying uvular loses its Pharyngeal node and so surfaces as velar. The derivation of the word in (20a), [sadaga], from underlying /Ṣadaqa/, is provided in (23).

(23) [sadaga] 'charity'

UR	/Ṣadaqa/
(Note: /Ṣ/ and /q/ are both [RTR].)	
(22)	sadaqa[12]
(15)	DNA
(14)	DNA
[RTR] loss on uvulars	sadaga
PR	[sadaga]

Furthermore, [RTR] Delinking (22) applies to the data in (21) as well. The rule delinks the [RTR] feature of the underlying uvular consonant since there is a following emphatic (with the feature [RTR]) in the word. However, because the emphatic does not lose its [RTR] feature, Leftward Emphasis [RTR] Spread (15) applies, pharyngealizing all the sounds before the emphatic, including the original uvular. The derivation of the word [XABAṢ] in (21b) is provided in (24).

[11] The use of RTR-RTR indicates that for the target RTR to delink, there must be another instance of the feature [RTR] in the word. Although Archangeli and Pulleyblank (1994) do not specifically discuss delinking examples like (22), they do seem to allow rule environments to be stated as part of the target condition. For example, the target condition that they give for the Kukuya rule of Final H Association is L ___ ##. The use of RTR-RTR in (22) can be viewed as another example of including a rule environment as part of the target condition.

[12] [RTR] Delinking (22) applies even though the two instances of [RTR] are not strictly adjacent (even under the assumption that consonants and vowels are represented on different tiers), since phonemic material intervenes between the two phonemes with the [RTR] feature. According to Archangeli and Pulleyblank (1994), this does not constitute an OCP violation. However, their evidence comes strictly from tonal phenomena. In addition to this rule in Palestinian Arabic, other cases of feature delinking where the two identical features are not strictly adjacent include Lyman's Law in Japanese and Grassmann's Law in Sanskrit. The issue of what exactly constitutes an OCP violation is beyond the scope of this article.

(24) [XABAṢ] 'mixed randomly'

UR	/χabaṢ/
(22)	xabaṢ
(15)	XABAṢ
(14)	DNA
PR	[XABAṢ]

The phenomenon of depharyngealization illustrated by the data in (20) strongly supports the view that uvulars and emphatics are characterized by a common underlying [RTR] feature. This view has been argued for previously by Czaykowska-Higgins (1987) and Goad (1991). Moreover, it is revealing that the depharyngealization phenomenon is not triggered by the occurrence of a primary pharyngeal [ħ] or [ʕ] in the root, but only by a uvular. This supports Goad's (1991) specific proposal that primary pharyngeals do not have the feature [RTR] underlyingly. This is consistent with the phonetic evidence of Catford (1977) and Ghazeli (1977) regarding the articulation of Arabic pharyngeals discussed in section 2.2 and reflected in the feature-geometric representation of pharyngeals in (8), in which they do not have the feature [RTR].

The cooccurrence restriction on emphatics and uvulars reflected by the data in (20) does not seem to be characteristic of other dialects of Arabic. Other dialects have uvulars and emphatics that can cooccur in the same root. I would maintain that uvulars and emphatics are underlyingly represented in the same way in other dialects, with representations like those shown in (7) and (10); the Palestinian Arabic innovation is the rule [RTR] Delinking (22). That is, in Palestinian the presence in the same root of the feature [RTR] both with a phoneme having the secondary place Pharyngeal node and with a phoneme having the primary place Pharyngeal node constitutes an OCP violation whereas in other dialects it does not. The delinking phenomenon in Palestinian constitutes evidence that emphatics are characterized by the feature [RTR] and thus supports the analysis of emphasis spread and opaque segments presented in section 3.1.2. Next I consider emphasis spread in a northern dialect of Palestinian Arabic, which lends additional support to the view that emphasis spread involves the feature [RTR].

3.2 A Northern Palestinian Dialect of Arabic

In this section I examine pharyngealization in the northern rural Palestinian dialect that has been described by both Herzallah (1990) and Younes (1993). The dialect differs from the southern Palestinian dialect discussed in the previous section in that it manifests two different rules of rightward emphasis spread, each having different target and triggering elements. In section 3.2.1 I present the dialectal data, and in section 3.2.2 I present an analysis of the data couched in the framework of Grounded Phonology.

3.2.1 Data Herzallah (1990) and Younes (1993) present data from the same northern Palestinian dialect of Arabic. Even though at times they consider identical acoustic data (from Younes 1982), they differ slightly on the description and interpretation of the data.

For the most part, I follow the description and interpretation presented by Younes (1993). One way that I follow Herzallah, though, relates to whether nonlow vowels are pharyngealized immediately after an emphatic consonant. Younes (1993) interprets such nonlow vowels as being pharyngealized because they differ somewhat acoustically from nonlow vowels after plain consonants. On the other hand, Herzallah (1990) argues that such vowels are not (phonologically) pharyngealized. First, the acoustic difference in such vowels is largely in the transition from the preceding emphatic consonant. Second, emphasis never spreads rightward beyond a nonlow vowel. And, third, as Herzallah notes, to native speakers the nonlow vowels after emphatic consonants are not auditorily distinct from the nonlow vowels after plain consonants; however, a low vowel after an emphatic is auditorily distinct from a low vowel after a plain consonant. For these reasons, then, Herzallah does not consider nonlow vowels following an emphatic consonant to be (phonologically) pharyngealized, although there is some low-level phonetic coarticulatory effect. Consequently, in my presentation of the data from the northern Palestinian dialect, I follow Herzallah (1990) in considering nonlow vowels after emphatic consonants as plain and not pharyngealized.

In (25)–(26) data are provided showing the leftward spread of emphasis. The data in (25) show that emphasis normally spreads leftward from the underlying emphatic consonant to the beginning of the word. The data in (26) show that leftward spreading into an inflectional prefix is optional. (The data cited in this section come from Younes 1982, 1993, and Herzallah 1990.)

(25) *Words displaying the leftward spread of emphasis*

a.	BALAAṬA	'tile'
b.	BALLAAṢ	'thief'
c.	KABAǪNA	'we caught'
d.	ɣALIIǪ	'thick'
e.	XAYYAAṬ	'tailor'
f.	ŠALALIIṬ	'kicks'
g.	MAXŠUUṬ	'scratched'
h.	MANFUUḌ	'shaken'
i.	WAṢLAAt	'arrived'
j.	NAṢiiħa	'advice'

(26) *Words displaying the leftward spread of emphasis into prefixes*

a.	ma/MA-XAṬAb-iš	'he did not get engaged'
b.	ba/BA-ṢAwwir	'I take pictures'

Although emphasis spreads leftward to the beginning of the stem (and optionally into inflectional prefixes), the pattern of rightward emphasis spread is more complicated and restricted. First, consider the data in (27).

(27) *Words displaying the rightward spread of emphasis*

a.	ṬAAza	'fresh'
b.	ṢAbaaħ	'morning'
c.	ðAlam	'he wronged'
d.	MANṬAka	'area'
e.	ʔAðLAm	'most unjust'
f.	ṢNAAf	'brands'
g.	ʕAṬšaan	'thirsty'
h.	Ṣyaam	'fast'
i.	Ṭwaal	'long'
j.	Ṣiħħa	'health'
k.	KAṬṬuuʕa	'piece of mat'

The data in (27a–d) show that emphasis spreads rightward to an adjacent low vowel; the data in (27e–f) show that this spreading occurs even if there is an intervening consonant and that the intervening consonant is pharyngealized. The data in (27g–i) show that the consonants /š/, /y/, and /w/ are opaque to the rightward spread of emphasis; if these consonants occur immediately after an emphatic and before a low vowel, they block the spread of emphasis onto that low vowel. The data in (27j–k) show that high vowels also block the spread of emphasis. Thus, the phonemes in this dialect that are opaque to the rightward spread of emphasis are /š, y, w, i, u/;[13] however, these same phonemes are not opaque to the leftward spread of emphasis, as evidenced by the data in (25d–i).[14]

From the data in (27) it would seem that emphasis spreads rightward from an emphatic trigger, but can only extend as far as a following (low) vowel and not beyond. This is seen most clearly in (27a–d), where there is a low vowel in the syllable following the one that begins with an emphatic, yet emphasis does not spread to that syllable. However, there is one case where emphasis can spread to a following syllable with a low vowel. This is the case in which a primary pharyngeal or laryngeal occurs between the two low vowels; it is exemplified by the data in (28).

[13] On the basis of a small amount of data found in both Younes 1993 and Herzallah 1990, it seems that mid vowels are opaque in this dialect, unlike the southern one. The only potentially relevant word cited by Younes is [Ṛooħak] 'your soul', in which long /o/ blocks the rightward spread of emphasis from /Ṛ/. Herzallah cites [Ṣeef] 'summer', in which only the initial emphatic is indicated as pharyngealized. However, I do not include the mid vowels in the list of opaque segments for this dialect because I follow Herzallah, who considers mid vowels as derived in this dialect. The mid vowel qualities [e] and [o] historically derive from **ay* and **aw*, respectively, through monophthongization. If, synchronically, [e] and [o] in this dialect can be analyzed as deriving from /ay/ and /aw/, then the apparent opaqueness of [e] and [o] is not unexpected since /y/ and /w/ are opaque. Although the assumption that mid vowels are derived in this dialect is not crucial for my analysis in section 3.2.2, it does make the analysis somewhat simpler.

[14] It is quite probable that /j/ patterns with the other opaque phonemes (and this is what I will tacitly assume, though I do not specifically mention it in the text). However, neither Younes (1993) nor Herzallah (1990) provides relevant data. As mentioned in footnote 4, words in which /j/ cooccurs with an emphatic are extremely rare.

(28) a. MAṢLAħA 'interest'
b. ṢAħħAA-HA 'he awakened her'
c. ṬAʕn-ak 'your stabbing'
d. ṢAħn-ak 'your plate'
e. ṢAħAn 'he ground'
f. ṢAHHAb 'he leveled a layer of small stones'
g. ṬAAʕAn 'he stabbed repeatedly'
h. Ṣiħħa 'health'
i. KAṬṬuuʕa 'piece of mat'
j. saʔal 'he asked'
k. ʕazam 'he invited'

Whereas the data in (27) show that emphasis spreads from an emphatic consonant to the following low vowel, the data in (28) show that emphasis additionally spreads from a pharyngealized low vowel to contiguous segments that are of the class of pharyngeals, laryngeals, or low vowels. Specifically, the data in (28a–b) show that when all segments after the pharyngealized low vowel (which is the first vowel after /Ṣ/ in these words) are pharyngeals, laryngeals, or low vowels, then all segments are pronounced as pharyngealized. The data in (28c–g) show that this spread of emphasis from the pharyngealized low vowel is blocked by consonants with a primary articulation above the pharynx. The data in (28h–k) show that the trigger for the pharyngealization spread in (28a–g) is indeed a pharyngealized low vowel. The data in (28h–i) show that a high vowel cannot trigger this pharyngealization spread; nor can a nonpharyngealized low vowel, as shown by the data in (28j–k).

The data in (27) and (28) illustrate two different processes of rightward pharyngealization spread. The data in (27) reflect a rule of rightward spread in which the trigger is an emphatic and spreading only goes as far as the syllable nucleus. The phonemes /š, y, w, i, u/ are opaque to this emphasis spread, but all other sounds can become pharyngealized. The data in (28) not only reflect the same rule that applies to the words in (27) but also show that there is a subsequent rule triggered by a pharyngealized low vowel that pharyngealizes only laryngeal consonants, pharyngeal consonants, and other low vowels. Other sounds do not become pharyngealized by this additional rule. The fact that there are two different processes of rightward emphasis spread is clearly seen by comparing (27f) with (28c). In (27f) /n/ does not block the spread of emphasis since it is not one of the opaque phonemes, /š, y, w, i, u/. On the other hand, in (28c) /n/ does block the spread of pharyngealization from the low vowel since it is a consonant that is neither laryngeal nor pharyngeal. Thus, an analysis of pharyngealization spread in this dialect must account for the two different types of rightward spread as well as the leftward spreading process exemplified by the data in (25)–(26).

3.2.2 Analysis The pattern of leftward spread illustrated by the data in (25)–(26) for the northern Palestinian dialect is virtually identical to the pattern of leftward spread

illustrated by the data in (11) for the southern dialect. Hence, the relevant rule for the northern dialect is essentially identical to that for the southern dialect. This is given in (29).[15]

(29) *Leftward Emphasis [RTR] Spread (in a northern Palestinian dialect)*
Argument
[RTR]
Parameters
1. Function: INSERT
2. Type: PATH
3. Direction: RIGHT TO LEFT
4. Iteration: ITERATIVE
Structure requirements
1. Argument structure: NONE
2. Target structure: FREE
Other requirements
1. Argument condition: SECONDARY PLACE
2. Target conditions: STEM-BOUND (optional)

This rule spreads the emphatic feature [RTR] leftward from a coronal emphatic to the beginning of a stem or word. There are no path conditions; thus, no specific phoneme or group of phonemes blocks leftward spread.

As discussed in section 3.2.1, the data in (27) and (28) reveal that in this dialect there are two different rules for the rightward spread of emphasis. The data in (27) reflect a rule in which the spread of emphasis from the triggering emphatic does not go beyond the following syllable nucleus and where the phonemes /š, y, w, i, u/ are opaque. The opaque segments can be captured through a grounded path condition on the target. This first rule of rightward emphasis spread is given in (30).

(30) *Rightward Emphasis [RTR] Spread I (in a northern Palestinian dialect)*
Argument
[RTR]
Parameters
1. Function: INSERT
2. Type: PATH
3. Direction: LEFT TO RIGHT
4. Iteration: ITERATIVE
(Domain: Iterate to a following syllable nucleus.)

[15] One apparent difference between the rule in (29) and Leftward Emphasis [RTR] Spread (15) for the southern Palestinian dialect is that the northern Palestinian rule is optionally stem-bound, as exemplified by the data in (26). However, there is evidence that this same condition also holds for southern Palestinian. For example, the word in (11j) can be pronounced either as [MA-JAṢṢAṢ-iš] or as [ma-JAṢṢAṢ-iš] 'it didn't become solid'.

Structure requirements
1. Argument structure: NONE
2. Target structure: FREE

Other requirements
1. Argument condition: SECONDARY PLACE
2. Target conditions: RTR/HI (*If* [*RTR*] *then not* [+*high*])

The target condition RTR/HI prevents [RTR] from spreading onto any phoneme that has the feature [+high]. Notice that it is just the high vowels (/i/ and /u/) and the high consonants (/š/, /y/, and /w/) that block rightward spread. It is interesting to compare the target condition in (30) with that in (14) for the southern Palestinian dialect. Recall that in the southern dialect the phonemes /u/ and /w/ do not block pharyngealization, as shown by the data in (12c–d). This requires the conjunction of the path condition RTR/HI with the path condition RTR/FR. The fact that the northern dialect requires only the path condition RTR/HI can be seen as a simplification when compared with the southern dialect. The complication in the northern dialect, however, is that rightward spread of this type is iterative only up to the following syllable nucleus; it does not spread beyond the nucleus. The iterativity is reflected in a word like [ʔAǫ̈LAm] in which both the /l/ and the low vowel after it become pharyngealized, but emphasis does not spread beyond that. I suggest that this is stipulated as a condition on the domain of the iterativity, as shown in (30); note that this is more restrictive than what is found with the similar rule in (14) for the southern dialect, where emphasis spreads iteratively to the end of the word. Derivations for [ʔAǫ̈LAm] and [Ṭwaal] are shown in (31) and (32), respectively.

(31) [ʔAǫ̈LAm] 'most unjust'

UR	/ʔaǫ̈lam/
(29)	ʔAǫ̈lam
(30)	ʔAǫ̈LAm
PR	[ʔAǫ̈LAm]

(32) [Ṭwaal] 'long'

UR	/Ṭwaal/
(29)	DNA
(30)	blocked because of path condition
PR	[Ṭwaal]

The data in (28) reflect a second rule of rightward emphasis spread that is quite different from the one in (30) or the ones discussed in section 3.1.2. As shown by the data in (28), the triggering segment for this second rule is not an emphatic but a low vowel that has already been pharyngealized by (30). The pharyngealization from such a low vowel then spreads rightward (iteratively) to any phoneme of the class of pharyngeals, laryngeals, or low vowels. Intervening sounds that are not of this class block the spread of pharyngealization from the low vowel. The second rule of rightward pharyngealization has conditions on both the target and the trigger that differ from those on the first rule in (30). This second rule is formulated in (33).

(33) *Rightward Emphasis [RTR] Spread II (in a northern Palestinian dialect)*
Argument
[RTR]
Parameters
1. Function: INSERT
2. Type: PATH
3. Direction: LEFT TO RIGHT
4. Iteration: ITERATIVE
Structure requirements
1. Argument structure: NONE
2. Target structure: FREE
Other requirements
1. Argument condition: RTR/LO (*If* [*RTR*] *then* [+*low*])
2. Target conditions: RTR/Lower VT (*If* [*RTR*] *then Lower VT*)

Before we look at a derivation illustrating the rule in (33), several matters concerning the rule need to be discussed. First, the conditions RTR/LO and RTR/Lower VT on the argument and target differ in nature from the RTR/HI Condition in (30). Using the terminology of Archangeli and Pulleyblank (1994), and as discussed in section 2.1, the condition in (30) on RTR/HI is a condition on antagonistic features, whereas the conditions in (33) are conditions on sympathetic features (or nodes). For example, if one considers the argument condition in (33), the feature [RTR] spreads only from a sound that also has the feature [+low]. These two features are sympathetic since the retracting of the tongue root needed to implement [RTR] normally entails a lowering of the tongue body. Thus, in many languages, sounds that are [+low] are also [RTR]. As discussed in section 2.1, sympathetic feature relations can play an important role in the phonology. The example given earlier was Yoruba, where [−ATR] Insertion is subject to the grounded path condition RTR/LO, expressed as a sympathetic feature relation on the target (i.e., *If* [−*ATR*] *then* [+*low*]). Archangeli and Pulleyblank also note that some languages have rules that require a sympathetic path condition on the argument. For example, they point out that in the Lango rule of +ATR/HI Spread, the feature [ATR] spreads only from a vowel that is [+high]. The Lango rule and the rule in (33) are both examples of a rule in which a sympathetic condition is required on the argument.

Second, as shown by the data in (28), [RTR] spreads from the low vowel onto segments that are pharyngeals, laryngeals, or low vowels. Such segments, then, are being treated as a natural class. I suggest that these segments form a natural class in that they all are characterized by the presence of the Lower VT node. The representations for pharyngeals and laryngeals given in (8) and (9) show that they have the Lower VT node in common. I posit that low vowels have a Lower VT node as well. Given the general view of feature geometry that I adopt in (6), the assumption that low vowels are characterized by the presence of the Lower VT node is compatible with the view of Herzallah

(1990) and McCarthy (1991), who hold that low vowels can be represented as having a Pharyngeal node. Crucially, however, they do not have the feature [RTR] underlyingly; they can acquire it, though, as a result of the spread of emphasis.[16] Thus, the target condition on [RTR] spread shown in (33) expresses that [RTR] can only spread onto a phoneme that already has a Lower VT node in its representation. This can be understood as another example of a sympathetic relation.[17] Sample derivations of the words [MAṢLAħA], [ṢAħAn], [Ṣiħħa], and [saʔal] are shown in (34)–(37), respectively.

(34) [MAṢLAħA] 'interest'

UR	/maṢlaħa/
(29)	MAṢlaħa
(30)	MAṢLAħa
(33)	MAṢLAħA
PR	[MAṢLAħA]

(35) [ṢAħAn] 'he ground'

UR	/Ṣaħan/
(29)	DNA
(30)	ṢAħan
(33)	ṢAħAn
PR	[ṢAħAn]

(36) [Ṣiħħa] 'health'

UR	/Ṣiħħa/
(29)	DNA
(30)	blocked because of RTR/HI
(33)	DNA (no appropriate trigger)
PR	[Ṣiħħa]

(37) [saʔal] 'he asked'

UR	/saʔal/
(29)	DNA
(30)	DNA
(33)	DNA (no appropriate trigger)
PR	[saʔal]

4 Implications for Grounded Phonology

In section 3 I presented data and an analysis on emphasis spread for two dialects of Arabic. In this section I discuss implications that the posited analyses have for the theory of Grounded Phonology and for the representation of opaque phonemes. I will conclude that the patterns of emphasis spread in Arabic dialects can best be understood through the framework of Grounded Phonology.

[16] Evidence that low vowels are not underlyingly [RTR] comes from the fact that the low vowel allophone normally has a fronted pronunciation except in contexts where it undergoes emphasis spread. I assume that low vowels have the feature [+low] underlyingly, and I do not take any specific position on where [+low] is located on a feature geometry tree. There is some controversy on this point. (See, for example, Odden 1991.) Because I am positing that low vowels are not underlyingly represented as having the feature [RTR], Rightward Emphasis [RTR] Spread II (33) must be ordered after Rightward Emphasis [RTR] Spread I (30), as shown by the derivations in (34) and (35).

[17] The target condition in (33), RTR/Lower VT, which I suggest is a sympathetic-type relation, differs from similar conditions discussed here in that it involves, not two features, but a feature ([RTR]) and a class node (Lower VT). Archangeli and Pulleyblank (1994) posit a similar target condition in their analysis of Japanese mimetic palatalization. They propose that there is a distinct rule of coronal palatalization that spreads the feature [−back] onto a sound that is characterized by the presence of the Coronal node. In their formal analysis of this rule, they posit the target condition FR/COR (i.e., *If* [−*back*] *then Coronal*]). They consider this condition to be grounded, though they do not state how. Perhaps it would be grounded in that the unmarked Coronal is [−back]. The relation between [−back] and Coronal would be sympathetic. Perhaps one can view the relationship between [RTR] and the Lower VT node in a similar way.

4.1 Support for Grounded Phonology

The data and analyses in section 3 offer support for the various aspects of Grounded Phonology put forward by Archangeli and Pulleyblank (1994) and discussed in section 2 of this article. First, they provide an independent source of evidence for the importance of grounded path conditions involving the feature [RTR] with both [+high] and [+low]. The Arabic pharyngealization phenomenon discussed here differs from the phenomena considered by Archangeli and Pulleyblank. For the most part, they focus on interactions among vowels and find support there for grounded path conditions. Now, given Goad's (1991) proposal (supported here) that [RTR] is a feature that can be relevant for both consonants and vowels, one might expect cases where [RTR] spread is restricted by a grounded path condition that pertains to both consonant and vowel phonemes. The Palestinian Arabic case is just such an example. For instance, the RTR/HI Condition on the target for Rightward Emphasis [RTR] Spread I (30) for the northern Palestinian dialect prevents [RTR] from spreading onto a [+high] phoneme regardless of whether that phoneme is a [+high] consonant or a [+high] vowel. Moreover, the RTR/Lower VT Condition on the target for Rightward Emphasis [RTR] Spread II (33) allows [RTR] to spread onto a phoneme with a Lower VT node regardless of whether that phoneme is a consonant or a vowel. Thus, Palestinian Arabic both exemplifies and further elaborates on the nature of grounded path conditions involving the feature [RTR].

Second, the Arabic pharyngealization phenomenon provides additional evidence for the strong position of Archangeli and Pulleyblank (1994) that the specific path conditions on the target and on the argument must be phonetically grounded. All such conditions in the Arabic analyses proposed here are phonetically grounded. The RTR/HI and RTR/FR Conditions posited for Rightward Emphasis [RTR] Spread (14) for the southern Palestinian dialect are phonetically grounded as discussed in section 2.1. The RTR/LO and RTR/Lower VT Conditions found on Rightward Emphasis [RTR] Spread II (33) for the northern Palestinian dialect are also phonetically grounded as discussed in section 3.2.2. Furthermore, the conditions in (14) and (33) exemplify that path conditions expressing both antagonistic and sympathetic feature relations can play a role in the phonology. The grounded path conditions in (14) are instances of antagonistic relations, and those in (33) exemplify sympathetic ones.

Third, Archangeli and Pulleyblank (1994) argue that grounded path conditions are process specific; that is, within a language they can pertain to individual processes without necessarily pertaining to the language as a whole. The fact that no phonemes are opaque to leftward spread in the Palestinian dialects but several are opaque to rightward spread supports the process-specific nature of grounded path conditions.

4.2 On the Representation of Opaque Segments

In the preceding section I have assumed the correctness of the view that opacity results from a grounded path condition imposed on the target of a rule. Traditionally in auto-

segmental phonology, segments are opaque if they are specified for the opposite value of the spreading feature (or, at least, if they have a specification for the spreading feature); see, for example, Van der Hulst and Smith 1982. However, I would argue that the opacity observed in Arabic emphasis spread can only be analyzed by means of a grounded path condition on the target. It is not susceptible to a reanalysis in which the opaque phonemes are specified for the opposite value of the spreading feature. Moreover, if opacity is taken to be a consequence of a grounded path condition on the target, predictions are made regarding the possible set of phonemes opaque to Arabic emphasis spread. These predictions are borne out by the dialectal data.

To understand why an analysis of the opacity of the phonemes /i/, /y/, /š/, and /j/ that specifies them for the opposite value of the spreading feature is not a viable alternative, it is worth considering the analysis of emphasis spread in a dialect of Palestinian Arabic proposed by Hoberman (1989). In the dialect that Hoberman (1989) considers, the phonemes long /i/, /y/, and /š/ are said to be opaque to both the rightward and leftward spread of emphasis.[18] Hoberman's analysis is outlined in (38).

(38) *Hoberman's (1989) analysis of emphasis spread in Palestinian Arabic*
   a. Pharyngealization involves the spread of the feature [+CP].
   b. The emphatic phonemes /Ṭ/, /Ḍ/, /Ṣ/, /Ẓ/ have the feature [+CP].
   c. Phonemes of the quality /i/, /y/, and /š/ have the feature [−CP].
   d. All other phonemes have no underlying specification for the feature [CP].
   e. The feature [+CP] spreads bidirectionally onto neighboring sounds until it reaches a phoneme that is [−CP]. Since phonemes of the quality /i/, /y/, and /š/ are [−CP], they block the spread of pharyngealization.

The major problem with Hoberman's analysis relates to (38c), that phonemes of the quality /i/, /y/, and /š/ underlyingly have the feature [−CP]. Given a standard view of feature geometry, the [constricted pharynx] feature, whether [+CP] or [−CP], is dependent on the Pharyngeal node as shown in (6). Consequently, for a phoneme to manifest the feature [±CP], it must possess the Pharyngeal node. Since phonemes of the quality /i/, /y/, and /š/ do not possess the Pharyngeal node (given that they are neither articulated in the back part of the vocal tract nor pharyngealized), they cannot be assigned the feature [−CP], even by a feature redundancy rule. Nonetheless, we see that phonemes like /i/, /y/, and /š/ can act as opaque. The opacity of these segments then is best analyzed by a path condition (RTR/HI, *If* [*RTR*] *then not* [+*high*]) on the target of the rule of emphasis spread. Not only is the path condition grounded in the phonetics, as discussed

[18] Hoberman's Palestinian dialectal data come from Card 1983. Card claims that the phonemes long /i/, /y/, and /š/ are opaque to emphasis spread in both directions; however, she does not present what can be considered crucial data from actual words regarding the opaqueness of these phonemes to leftward spread. Crucial data showing this would include words of a form like /našaaṬ/ 'energy' where an entire syllable occurs before the supposedly opaque /š/. On the basis of her description for the dialect she examined, Card predicts that the initial syllable of /našaaṬ/ should not be pronounced as emphatic because of the supposed opaqueness of /š/ to leftward spread. However, it is emphatic in the Palestinian dialect I examined, as shown in (11h).

in section 2.1, but it can be seen as another instance of the cross-linguistically common interaction between the feature [RTR] and tongue height features that Archangeli and Pulleyblank (1994) document. Moreover, as discussed in section 4.1, an analysis in which opacity is determined by a grounded path condition can more readily account for the opaque-segment asymmetry phenomenon seen in the Palestinian dialects in sections 3.1 and 3.2; the grounded path condition on the target holds for spreading in one direction but not in the other. Such asymmetries are more difficult to explain if opacity is accounted for by specifying the opaque phonemes as having the opposite value of the spreading feature.[19] For these reasons, then, the Palestinian Arabic case represents a compelling example where opacity is determined by the implementation of a grounded path condition on a target of a rule rather than by having the opaque phoneme specified for the opposite value of the spreading feature.[20]

One of the interesting implications of analyzing segments opaque to Arabic emphasis spread by means of a grounded path condition on the target is that this analysis makes predictions about which phonemes are potentially opaque to emphasis spread and what would constitute an impossible group of opaque phonemes. The specific prediction is that the class of opaque phonemes in any given dialect is expressible as a possible grounded path condition (or conditions) involving the feature [RTR]. In this way, the two dialects discussed here represent two possible outcomes. In the northern Palestinian dialect, all high phonemes are opaque to leftward emphasis spread, as reflected by the rule in (30). This is expressed by the grounded path condition RTR/HI. In the southern Palestinian dialect, only high nonback phonemes are opaque to rightward emphasis spread, as reflected by the rule in (14). This is accounted for by the conjunction of two grounded path conditions: RTR/HI and RTR/FR.

Now, given that opaque segments are determined by the grounded path conditions

[19] Herzallah (1990) analyzes the opacity of the phoneme qualities /y/ and /š/ to emphasis spread by specifying them for the opposite value of the spreading feature. However, Herzallah's analysis requires making the nonstandard assumption, which I do not follow, that place articulator nodes like Dorsal or Pharyngeal can have binary values. Given this view, Herzallah then analyzes the opaqueness of these phonemes by proposing that they are specified for [−Dorsal] (which refers to a nonback tongue body articulation) whereas emphasis spread entails the spreading of [+Dorsal]. Crucially, the rule that specifies /y/ and /š/ as [−Dorsal] applies after the rule of leftward emphasis spread, but before the rule of rightward emphasis spread. By doing this, Herzallah is able to account for the fact that these segments are opaque only to rightward spread and not to leftward spread. Her analysis, though, seems problematic. First, the use of Dorsal as a binary feature is open to criticism. Second, this analysis requires crucially ordering the application of a redundancy rule (the specification of [−Dorsal] onto the opaque segments) between leftward and rightward emphasis spread. Third, Herzallah does not deal with the opacity of /w/ in such words as [ṭwaal] 'long', which is clearly not [−Dorsal]. (Herzallah does seem to assume that /w/ is indeed part of the phonemic inventory, given her statement (1990: 146) that the long vowel [o] is underlyingly /aw/.) These problems do not arise in the analysis in section 3 where the grounded path condition RTR/HI is invoked; as discussed, such a condition is quite common cross-linguistically, and the analysis making use of it does not crucially need to posit the extrinsic ordering of a redundancy rule to arrive at the correct result.

[20] Although I believe the Palestinian case to be a compelling example where opacity is determined by the implementation of a grounded path condition on the target, I do not want to make the claim that all cases of opacity are analyzable in a similar way. Archangeli and Pulleyblank (1994) do conclude that some cases of opacity, as in Kalenjin, derive from the avoidance of crossing association lines.

on the target, it is predicted that there should be no dialect in which only the phonemes /u/ and /w/ are opaque. The case where just /u/ and /w/ were opaque would require a conjunction of the RTR/HI Condition and a hypothetical RTR/BK Condition expressed as *If* [*RTR*] *then not* [+*back*]. But this latter (negative) condition is not phonetically grounded since the features [RTR] and [+back] are not antagonistic. The prediction that /u/ and /w/ alone cannot be opaque segments seems to be correct: the small literature on opaque segments in Arabic dialects contains no reported instances where only /u/ and /w/ are opaque. For example, Heath (1987) finds that just the high nonback phonemes /i/, /y/, /š/, and /ž/ tend to be opaque to rightward spread in the dialect of Moroccan Arabic that he investigated. The opacity of these segments to rightward spread could be analyzed by formulating a rule similar to the southern Palestinian rule in (14). Further, Ghazeli (1977) reports that in some dialects such as Libyan the front vowels /i/ and /e/ are opaque to rightward emphasis spread. Such a dialect can be accounted for by the application of the single grounded path condition RTR/FR (i.e., *If* [*RTR*] *then not* [−*back*]). Ghazeli (1977) also reports that a certain dialect of southern Tunisian Arabic has no opaque phonemes, and Schulte (1985) and Younes (1993) report that Cairene Arabic has no phonemes opaque to emphasis spread. In these two dialects there would be no grounded path conditions on the target. Thus, there do not seem to be dialects in which only /u/ and /w/ are opaque. This is exactly what is predicted by an analysis of Arabic emphasis spread that accounts for opaque segments by grounded path conditions on the target. Consequently, the nature of the segments opaque to emphasis spread in the Arabic dialects provides strong support for the view developed by Archangeli and Pulleyblank (1994) that the opacity of certain phonemes to spreading processes can be accounted for by grounded path conditions.[21]

4.3 Conclusion

I conclude that the evidence from Arabic pharyngealization provides strong independent support for various aspects of the theory of Grounded Phonology. In particular, a Grounded Phonology analysis is able to account for the asymmetry found between leftward and rightward emphasis spread in the Arabic dialects (in which opaque segments are found for rightward spread but not for leftward spread) by imposing target conditions on the rule of rightward spread but not on the rule of leftward spread. The nature of the phonemes opaque to rightward emphasis spread is determined by the specific grounded path conditions (involving the spreading feature [RTR]) that are imposed on the target

[21] In all the dialects discussed here that exhibit opaque phonemes, it is always the case that the phonemes are opaque to rightward spread of emphasis but not to leftward spread. Although there may be some articulatory explanation for this involving a difference between anticipatory pharyngealization and perseveratory pharyngealization, it may also be an accident of the dialects surveyed, given that very few dialects have been described carefully with the aim of determining phonemes that are opaque to emphasis spread. In this regard, on the basis of very preliminary work that I have done, the phoneme /y/ seems capable of blocking leftward spread in a Saudi Arabic dialect. Although emphasis in this dialect normally spreads leftward from the underlying emphatic to the beginning of the word, as shown by a form like [ʔABSAṬ] 'simplest', emphasis spread is blocked if a /y/ precedes the underlying emphatic, as shown by a form like [ʔabyAḌ] 'whitest'.

of the rightward spread rule. As pointed out in section 4.2, the opacity of phonemes like /i/, /y/, and /š/ to emphasis spread seems impossible to account for in a traditional manner since these sounds cannot have a specification for the spreading feature, given that they do not possess the Pharyngeal node. Furthermore, the Grounded Phonology analysis both accounts for the attested sets of opaque segments and predicts the potential sets of opaque phonemes for emphasis spread. The path conditions involving the feature [RTR] that are needed to express the sets of opaque phonemes attested in the different dialects are just those grounded path conditions discussed in section 2.1, which Archangeli and Pulleyblank (1994) have shown to play a role in a wide variety of languages. A potential set of opaque segments would be determined by the imposition of one or more possible grounded path conditions involving the feature [RTR]. That the Grounded Phonology analysis is able to both account for the sets of opaque segments that do occur and make predictions concerning possible sets of opaque segments can be taken as providing strong evidence for the Grounded Phonology framework.

A final point concerns Optimality Theory, developed in Prince and Smolensky 1993 and McCarthy and Prince 1993. Although a more complete discussion of the Arabic pharyngealization data from the perspective of Optimality Theory remains for future research, it is worth noting that these data and the analysis offered here present at least two challenges for this theory. One challenge pertains to the contention advanced here that pharyngealization involves process-specific constraints; namely, how can the effect of process-specific constraints be produced within Optimality Theory just by constraint ranking, without reference to processes or derivations? Specifically, with regard to the southern Palestinian dialect discussed in section 3.1, how can Optimality Theory account for the fact that rightward emphasis spread, but not leftward emphasis spread, is subject to the grounded conditions RTR/HI and RTR/FR, under the view that these conditions are general constraints in the language and not process specific? Relatedly, how would Optimality Theory analyze a possible dialect in which rightward spread of emphasis is subject to one grounded condition whereas leftward spread is subject to a different grounded condition? If such a dialect were reported, it would be potentially problematic for an Optimality Theory account. Additionally, in the northern Palestinian dialect discussed in section 3.2, how would Optimality Theory account for the fact that the two different rules governing rightward spread of [RTR] in (30) and (33) are subject to two different target conditions? The argument [RTR] is subject to the RTR/HI Condition in (30) but to the RTR/Lower VT Condition in (33). The effect of the two different conditions can be seen by comparing (27f), in which the phoneme /n/ fails to block [RTR] spread, with (28c), in which /n/ does block it. In an Optimality Theory analysis, where these two conditions would be general constraints on the language (and not process specific), the variant behavior of /n/ with regard to an [RTR] feature to its left would appear to be unexpected.

A second challenge concerns the interaction of epenthesis and pharyngealization mentioned in footnote 4. In the southern Palestinian dialect, epenthesis blocks the spread of emphasis, as shown by the alternation that occurs in pairs like [BÁṬN-AK] 'your

stomach' and [BÁṬin-ha] 'her stomach'. The opaque [i] in the latter form is clearly epenthetic, as evidenced by the conspicuous lack of stress on the heavy penultimate syllable; such syllables normally bear stress except when their vowel is epenthetic. In standard Optimality Theory, the effect of epenthesis results from a violation of Fill. The site of epenthesis is viewed as an empty syllabic position lacking feature content. The features of a vowel realized by a violation of Fill are supplied by a later interpretive component (perhaps equivalent to a phonetic component) that provides featural structure to a Root node. Given that pharyngealization is arguably phonological, in that it only applies optionally into prefixes (as mentioned in footnote 3 for the southern Palestinian dialect and as shown by the data in (26) for the northern dialect), it is unexpected in Optimality Theory for a feature of a vowel resulting from a violation of Fill to have the effect of blocking the spread of pharyngealization.

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Department of Linguistics
Indiana University
Bloomington, Indiana 47405

davis@ucs.indiana.edu