Squibs

Becky Butler Thompson

The Pharyngeal Hierarchy[1]

Abstract

Emphasis spread (or pharyngealization) can be described as the act of sounds with a primary or secondary pharyngeal constriction affecting neighboring sounds by pulling them lower and farther back in the mouth. Emphasis spread is blocked by sounds that are phonetically antagonistic to it because of the height and frontness of their places of articulation. However, the sets of blocking segments differ between and even within dialects. I explain these differences using constraints in an Optimality Theoretic framework that are based on a phonetically motivated hierarchy of sounds.

1. Introduction

Most dialects of Arabic contain a set of consonants known as emphatics, which are defined by a primary constriction in the oral cavity with a secondary constriction in the pharynx. Some common examples are [tˤ, dˤ, sˤ, ðˤ]. In the production of emphatics, not only do the pharyngeal walls constrict but the epiglottis tilts backwards and the tongue root is backed and lowered as well (Laufer and Baer 1988). Emphasis spread, or pharyngealization, as discussed in this squib is the phonological effect emphatics have on neighboring sounds by pulling them farther back and lower in the mouth. Emphatic segments will be said to have the feature [+phar]. In Arabic, regressive emphasis spreads unbounded to the beginning of the phonological word. However, progressive spread occurs to

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differing degrees, so it is progressive spread that will be discussed in this work.[2]

In what follows, I present data from two Palestinian dialects. I describe two facts about these data (involving the types of sounds that block emphasis spread), which have not yet been adequately explained in terms of phonological theory. I discuss three previous attempts to account for the data within the framework of Optimality Theory (henceforth, OT) (Prince and Smolensky 1993), and then I propose a more adequate solution by appealing to constraints based on a phonetically grounded hierarchy. Finally, I demonstrate the constraints in a series of tableaux and present my conclusions.

2. Differing blocking segments

Emphasis spread is blocked by the intervention of certain sounds that are phonetically antagonistic to pharyngealization because they are high or forward in the mouth. However, different dialects of Arabic contain differing blocking segments. Davis (1995) presents data from two Palestinian dialects, Southern and Northern. In Southern, emphasis spread is blocked by [i, j, ʃ, ʒ].[3]

(1) /tˤiin-ak/ ⇨ [**t̲ˤ**iinak]

'your mud'

(2) /sˤajjaad/ ⇨ [**s̲ˤa**jjaad]

'hunter'

(3) /ʕatˤʃaan/ ⇨ [**ʕat̲ˤ**ʃaan]

'thirsty'

(4) /ðˤaʒʒaat/ ⇨ [**ð̲ˤa**aat]

'type of noise'

Otherwise, it spreads to the end of the word.

(5) /tˤaʕn-ak/ ⇨ [**t̲ˤaʕnak̲**]

'your stabbing'

[2] There is no phonetic reason why progressive spread is blocked and regressive spread is unbounded. For an example of unbounded progressive spread but bounded regressive spread in Aramaic, see Hoberman 1988.

[3] Hereafter, emphasis spread in the phonetic representation is denoted by bold and underline.

In Northern Palestinian, emphasis spread is blocked by [i, j, ʃ, ʒ] as well as [u, w].

(6) /tˤwaal/ ⇨ [**tˤ**waal]
'long'

(7) /katˤtˤuuʕa/ ⇨ [**katˤtˤ**uuʕa]
'piece of mat'

The question, then, is how to account for this difference in blocking segments between dialects. If emphasis spread is blocked due to articulatory antagonism to pharyngealization because of phonetic properties of certain segments, why do some sounds only block in some dialects but not others?

3. Spread-to-[a]-and-stop

A second issue yet to be adequately explained in the extant literature about emphasis spread is what I dub the "spread-to-[a]-and-stop" problem of Northern Palestinian also presented in Davis (1995). The set of blocking segments listed in §2 holds true except when following [a], in which environment the set is expanded to include all non-guttural consonants, where 'guttural' comprises uvular, laryngeal, pharyngeal and glottal consonants as in traditional Arabic grammars referred to by McCarthy (1994).

(8) /tˤaaza/ ⇨ [**tˤaa**za]
'fresh'

(9) /sˤnaaf/ ⇨ [**sˤnaa**f]
'brands'

If after spreading through [a], the pharyngeal feature does not immediately encounter a non-guttural sound, it continues until it does reach a blocking segment (10) or until the end of the word if there is no blocker present (11).

(10) /tˤaʕn-ak/ ⇨ [**tˤaʕ**nak]
'your stabbing'

(11) /masˤlaha/ ⇨ [**masˤlaha**]
'interest'

This issue is even more problematic than the set of blockers differing between dialects because given these data, the set appears to change *within* one dialect. If the blocking of pharyngealization is due to intrinsic phonetic properties, one would not expect this to be the case.

4. Past attempts to explain the 'spread-to-[a]-and-stop' problem

There have been several previous OT attempts to explain the difference in the set of blocking segments pre- and post- [a]. However, each attempt proves insufficient. First, Van de Vijver (1996) proposes a constraint EMPHATIC-NUC: "Only a nucleus must be emphatic if its onset is emphatic." This constraint attempts to play two roles at once: faithfulness (a coda must be the same in the input and the output) and markedness (spread emphasis to a nucleus). In OT, this effect should be enforced by two different constraints, one which requires emphasis to spread and one which blocks it. By combining these roles into one constraint, this phenomenon is not represented as a result of two universal violable principles but is reminiscent of a rule-based approach, which probably lacks cross-linguistic explanatory power. Additionally, de Vijver gives no phonetic justification of this constraint, so we are left wondering why it is true at all.

Similarly, Adra (1999) proposes the constraint ALIGN(RTR, a): ALIGN ([RTR]-domain, R; a, R). This constraint, which aligns [RTR] (Adra's choice of feature to describe emphasis) to [a], like that of Van de Vijver, lacks phonetic justification. What phonetic explanation is there for a [+phar] feature to spread only up to [a]? His proposal is that [a] is opaque to emphasis spread, which is why the sounds following it are not pharyngealized. However, if it were truly opaque, one would expect that [a] itself would not be pharyngealized either.

Finally, McCarthy (1997) suggests a constraint RTR-TO-*a*, saying that some markedness constraint "spreads RTR no further than a following (C)V sequence." He refers to the idea that harmony, in part, serves to maximize perceptual salience. For McCarthy's analysis, this means that emphasis would not spread further than a nucleus because violating any further faithfulness constraints would not produce any greater perceptual cues. Therefore, an equally salient and more faithful form would be preferred to a candidate in which emphasis has spread through the next consonant, whether coda or onset. However, though it may be the case that some consonants are hard to perceive as pharyngealized, it seems doubtful that that is always the case, considering that the most salient measures of

pharyngealization are the raising of F1 and, even more noticeably, the lowering of F2. Since formants are quite perceptible in many non-nucleic sounds (like sonorants, for example), McCarthy's suggestion about saliency is probably not justified.

5. Solution: The Pharyngeal Hierarchy

In light of the data, I propose the following phonetically based solution which accounts for all the data presented but does not require a constraint that causes emphasis to spread to [a] and stop. The proposal is that all segments are antagonistic to emphasis. However, some are more antagonistic than others due to their height and frontness in the mouth. Therefore, classes of sounds can be ranked on a scale of antagonism to pharyngealization called the pharyngeal hierarchy. Here, sounds are listed in order of decreasing antagonism to emphasis.

(12) The Pharyngeal Hierarchy

[+P]: [i, j, ʃ, ʒ] This feature (defined as "fronted tongue body") applies to front vowels, palatoalveolars, alveopalatals, palatals, and palatalized segments. (Hall 1997)

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[-cons, +hi]: [u, w] High non-front vowels and glides

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[+cons, -gutt]: [t, k, b, d, f, θ, s, ð, z, m, n, l, ɾ] All other consonants without a primary or secondary guttural (uvular, laryngeal, pharyngeal, glottal) constriction

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[+cons, +gutt]: [ʔ, h, ʕ, ħ, X, ʁ] Guttural consonants

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[-cons, -hi]: [a] Low vowel

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[+phar]: [tˤ, dˤ, sˤ, ðˤ] Emphatics

6. Stringency Hierarchy constraints

Based on the pharyngeal hierarchy above, it is possible to form the hierarchy of constraints in (13). The idea of Stringency Hierarchy is taken from de Lacy (2004) (citing earlier work from Prince). Each constraint (i) is freely rankable and (ii) "refers to contiguous ranges of the hierarchy." Each constraint is referred to by its abbreviated name (given first), and each refers to the categories listed to its right. For example, *Ph/[+cons, -gutt] is violated if any of the sounds [i, j, ʃ, ʒ, u, w, t, k, b, d, f, θ, s, ð, z, m, n, l, ɾ] is pharyngealized, i.e. is [+phar].

(13)

*Ph/[+P]:	*Ph/[+P]
*Ph/[-cons, +hi]:	*Ph/[+P], [-cons, +hi]
*Ph/[+cons, -gutt]:	*Ph/[+P], [-cons, +hi], [+cons, -gutt]
*Ph/[+cons, +gutt]:	*Ph/[+P], [-cons, +hi], [+cons, -gutt], [+cons, +gutt]
*Ph/[-cons, -hi]:	*Ph/[+P], [-cons, +hi], [+cons, -gutt], [+cons, +gutt], [-cons, -hi]
*Ph/[+phar]:	*Ph/[+P], [-cons, +hi], [+cons, -gutt], [+cons, +gutt], [-cons, -hi], [+phar]

7. Putting the constraints to use

By using the stringency hierarchy constraints based on the pharyngeal hierarchy, the issues addressed in §2 and §3 can be explained in a phonetically motivated way. These constraints interact with ALIGN constraints as well as AGREECC to produce the correct surface forms.

7.1 Differing blocking segments solution

By interaction with ALIGNR(PHAR), the Stringency Hierarchy constraints yield the correct results in the following tableaux. In Southern Palestinian, (15) shows that ALIGNR(PHAR) (14) is ranked higher than *Ph/[-cons, +hi], so that [w] does not block emphasis spread. In (16), however, the ranking is reversed so that despite the alignment violations, [w] does indeed block spread.

(14) ALIGNR(PHAR)[4]: Align(PrWd, R, [+phar], R): The [+phar] feature must be aligned to the right edge of the prosodic word (based on McCarthy and Prince 1993).

(15) Southern Palestinian: *Ph/[+P] >> ALIGNR(PHAR) >> *Ph/[-cons, +hi]

/tˤwaal/	*Ph/[+P]	ALIGNR(PHAR)	*Ph/[-cons, +hi]
tˤwaal	✓	*!**	✓
☞ **tˤwaal**	✓	✓	*

(16) Northern Palestinian: *Ph/[+P] >> *Ph/[-cons, +hi] >> ALIGNR(PHAR)

/tˤwaal/	*Ph/[+P]	*Ph/[-cons, +hi]	ALIGNR(PHAR)
☞ **tˤ**waal	✓	✓	***
tˤwaal	✓	*!	✓

7.2 Spread-to-[a]-and-stop solution

The problem presented for Northern Palestinian in §3 is easily resolved using the stringency hierarchy constraints as long as the emphatic consonant is immediately followed by [a], such that *Ph/[+cons, -gutt] outranks ALIGNR(PHAR), as in (17). However, when there is an intervening non-guttural consonant, as in (18), an incorrect candidate is predicted as the winner.

(17) Northern Palestinian: *Ph[-cons, +hi] >> *Ph[+cons, -gutt] >> ALIGNR(PHAR)

/tˤaaza/	*Ph[-cons, +hi]	*Ph[+cons, -gutt]	ALIGNR(PHAR)
tˤaaza	✓	✓	***!
☞ **tˤaa**za	✓	✓	**
tˤaaza	✓	*!	*
tˤaaza	✓	*!	✓

[4] ALIGN violations of long vowels, which are represented by two adjacent identical vowels, are only assigned one asterisk. Assigning two violations to long vowels does not change the analysis.

(18) Northern Palestinian: *Ph/[-cons, +hi] >> *Ph/[+cons, -gutt] >> ALIGNR(PHAR)

/sˤnaaf/	*Ph[-cons, +hi]	*Ph[+cons, -gutt]	ALIGNR(PHAR)
💣 **sˤ**naaf	✓	✓	***
sˤnaaf	✓	*!	**
☞ **sˤnaa**f	✓	*!	*
sˤnaaf	✓	*!*	✓

This problem is solved by appealing to a constraint AGREECC, which is based on the propensity of consonant clusters to agree for place of articulation (See Lombardi 1999 for a similar constraint related to voicing). Tableau (20) shows that this constraint eliminates the false winner from (18).

(19) AGREECC: *[C[αphar]C[-αphar]]: Adjacent consonants must have the same specification for [phar].

(20) Northern Palestinian: AGREECC >> *Ph/[+cons, -gutt] >> ALIGNR(PHAR)

/sˤnaaf/	AGREECC	*Ph[+cons, -gutt]	ALIGNR(PHAR)
sˤnaaf	*!	✓	***
sˤnaaf	✓	*	**!
☞ **sˤnaa**f	✓	*	*
sˤnaaf	✓	**!	✓

8. Conclusion

I have shown that it is possible to account for the difference of blocking segments both within and between dialects using an OT framework, such that the relevant constraints are based on a phonetically motivated hierarchy. The pharyngeal hierarchy may need to be divided even further into more distinct levels as it is tested on other dialects. Nonetheless, at this point, it not only accounts for the data presented here but it allows for cross-linguistic predictions of the behavior of emphasis spread.

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Contact information:

Becky Butler Thompson
Department of Romance Languages
University of North Carolina at Greensboro
Mossman Building, PO Box 26170
Greensboro, NC 27402-6170
USA
e-mail: butlerthompson(at-sign)triad(dot)rr(dot)com