The Perception of Emphasis in Qassimi Arabic

Abdulmajeed Alrashed[1] and Harim Kwon[2]

[1]Majmaah University (Saudi Arabia), [2]Seoul National University (South Korea)

In Qassimi Arabic (QA), emphatic and plain consonants are contrastive, and they influence the surrounding segments differently. Most notably, emphatic consonants realized as pharyngealized are reported to influence the adjacent vowels by lowering their F2 (e.g., [1, 2, 3, 4]). This study investigates how native QA listeners use phonetic cues on adjacent vowels, either immediately preceding or following the source consonant, to disambiguate the consonants /s t/ and their emphatic counterparts /sˤ tˤ/.

Methods: Using a gating paradigm [5], we conducted two perception experiments: leftward examining the effects of the vowel preceding the source consonant and rightward examining the cues on the following vowel. To investigate leftward emphasis, 12 CVC$^{(ˤ)}$ minimal pairs differing in their final consonant were created (e.g, /hiːs/-/hiːsˤ/). The minimal pairs included two manners of articulation (stop, fricative) and six QA phonemic vowels /i a u iː aː uː/. Additional 12 C$^{(ˤ)}$VC minimal pairs were constructed for the rightward emphasis that are differing in the onset consonant (e.g., /siːh/-/sˤiːh/). The stimuli were all CVC nonwords and produced by a native QA speaker and assessed by another native QA speaker. Each nonword yielded five gates: Gate 1 (1/3 of the vowel that are furthest away from the source C$^{(ˤ)}$), Gate 2 (2/3 of the vowel), Gate 3 (entire vowel, no C$^{(ˤ)}$), Gate 4 (entire vowel and ¼ of frication or ¼ closure/aspiration), and Gate 5 (entire word). The stimuli were blocked by the gates and presented to the listeners from the shortest to the longest gate. Within each block, the presentation order was randomized. Upon hearing each stimulus item, native QA listeners (n=56) were asked to determine whether the source consonant was plain or emphatic. Their responses were statistically analyzed using logistic regression models with the lme4 packages [6].

Leftward results: QA listeners consistently attended to vocalic cues to the emphatic consonant even at Gate 1, the shortest gate furthest from the source consonant (Fig.1). In addition, listeners were more attentive to the vocalic cues in some cases than in others. Specifically, when source consonants were stops /t tˤ/, listeners' accuracy was higher than the fricative sources /s sˤ/. Also, emphatic source consonants yielded higher accuracy compared to plain source consonants.

Rightward results: As shown in Fig. 2, in Gates 1 and 2, QA listeners' responses did not differ from the chance level (50%). Only when presented with the entire vowel duration (Gate 3), listeners were able to identify the preceding consonant as emphatic/plain. This suggests that only the vocalic cues in the onset of the vowel closest to the source consonant were informative to the listeners. Finally, rightward cues from /t tˤ/ yielded higher accuracy than /s sˤ/ in Gate 3.

Discussion: The current outcome shows that QA listeners use the coarticulatory vocalic cues to determine whether the consonant is emphatic or plain, but they attend to the cues in the preceding or following vowels to different extents. Listeners use the vocalic cues to predict the upcoming (leftward) emphatic early on when they heard only 1/3 of the vowel farthest away from the source C$^{(ˤ)}$, while they needed the cues in the temporal vicinity closest to the source consonant in rightward emphasis. The presence of emphasis cues seems to be more informative than their absence, corroborating Ali and Daniloff [7]. Also, as stops provide less phonetic information about their place of articulation during the consonant itself (compared to fricatives), listeners seem to be more prone to use vocalic cues in stops than fricatives. Taken together, these suggest that coarticulatory vocalic cues are variably important in QA emphasis perception.

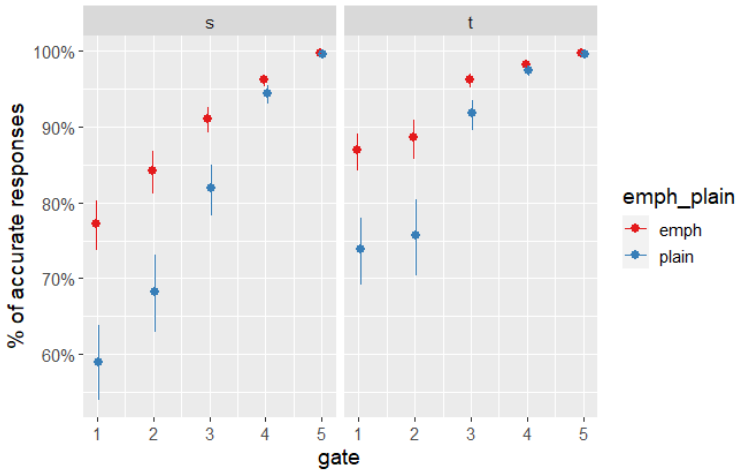

Figure 1. Percentage of accurate identification of the coda consonant in leftward emphasis perception, derived from the leftward emphasis logistic regression model

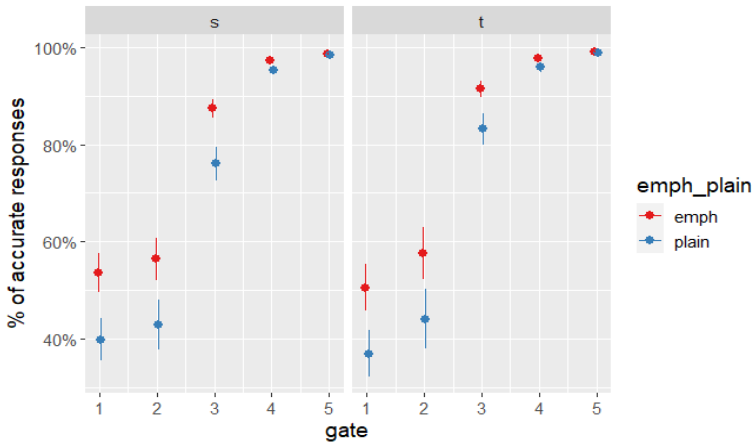

Figure 2. Percentage of accurate identification of the onset consonant in rightward emphasis perception, derived from the rightward emphasis logistic regression model

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