An acoustic investigation of the categorical and gradient spread of pharyngealization in Urban Najdi Arabic

Abdulaziz Alarifi & Benjamin V. Tucker
Department of Linguistics, University of Alberta, Canada; aalarifi@ualberta.ca

Some Arabic phonemes have a secondary constriction located in the pharynx in addition to a primary one in the dental/alveolar areas. It is well established that this secondary constriction, referred to as pharyngealization, affects adjacent vowels by mainly lowering their F2 values (e.g. Al-Ani, 1970; Ghazali, 1977; Yeou, 2001). Interestingly, the pattern of pharyngealization spread varies greatly across Arabic dialects. In some dialects, such as Cairene Arabic, pharyngealization spreads to the entire word, whereas in other dialects the spread is restricted to the adjacent vowel (Younes 1993, Lehn 1963; among others). A number of phonological accounts have been proposed to explain posited categorical patterns, but most of these accounts are based on impressionistic data drawn from few informants (Davis 1995; Watson 1999). Recent studies have shown that pharyngealization is gradient and susceptible to distance (Hassan and Esling, 2007; Al-Masri and Jongman, 2004; Zawaydeh and de Jong, 2011). The current research provides an acoustic investigation of the spread of pharyngealization in Urban Najdi Arabic (UNA), a dialect mainly spoken in the central region of Saudi Arabia. In particular, this study seeks to determine whether the spread is categorical or gradient and whether it interacts with morphology.

To this end, 5 female and 5 male speakers of UNA produced bisyllabic and trisyllabic minimal pairs containing pharyngealized and plain consonants. The target consonants occurred either in word-initial or word-final position in order to examine both regressive and progressive spread. In addition, the speakers produced minimal pairs containing low vowels and target consonants separated by morpheme boundaries. The F2 values of low vowels in pharyngealized and plain environments were measured and then normalized (Lobanov, 1971) in order to reduce inter-speaker variation. The data was analyzed using Linear Mixed Effects Regression (Bates et al., 2014) with Context (pharyngealized vs. plain), Distance (for bisyllabic and trisyllabic words), Direction (progressive vs. regressive) and Gender as fixed effects with Subject and Item as random effects.

The results reveal that the secondary constriction in pharyngealized consonants affects, with varying degrees, all vowels in bisyllabic and trisyllabic words both regressively and progressively. At no point were the F2 values of vowels in pharyngealized environments not significantly lower than that of their plain counterparts regardless of their positions in the word. However, progressive spread exhibits more sensitivity to distance than regressive spread. Distant vowels are more likely to be less pharyngealized than vowels immediately following the source segment that initiates the spreading. By contrast, pharyngealization seems to be less susceptible to distance effects in regressive spread, especially for female speakers (illustrated in Figure 1). In addition, morpheme boundaries block progressive spread on suffixes, while allowing pharyngealization to affect prefixes in regressive spread.

Taken together, the findings suggest that pharyngealization in UNA displays both phonetic and phonological properties. The gradient nature of progressive spread seems to indicate a phonetic process, whereas the regressive categorical spreading of pharyngealization and its interaction with morphology suggest a phonological process. These findings are consistent with many instrumental studies that have found some forms of gradience in phonological patterns (Ernestus, 2011) such as regressive voice assimilation in Dutch (Jensen, 2007) and Romanian nasal devoicing (Tucker and Warner, 2010). The highly intertwined nature of the categorical and gradient spread in pharyngealization requires a unified analysis that models this interaction.
Figure 1 Mean F2 values (normalized) of the three vowels preceding pharyngealized and plain consonants for female and male speakers. The x-axis represents the position of the vowel relative to the trigger (“1” refers to the vowel in same syllable as the trigger, “2” refers to the vowel in the second syllable and “3” refers to the vowel in the third syllable of the trisyllabic word).

References