

Gradient epilaryngeal constriction in Levantine Arabic “gutturals”: A Generalised Additive Modelling approach to ultrasound tongue surface

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This study aims to quantify the gradient nature of epilaryngeal constriction in Levantine Arabic (LA) “guttural” consonants. Following the Laryngeal Articulator Model (LAM) (Esling, 2005; Moisik, Czaykowska-Higgins, & Esling, 2012), an epilaryngeal constriction causes tongue root/epiglottis retraction and voice quality changes; vowels become “retracted” and produced with a tense/laryngealised voice quality. Recent acoustic evidence showed that pharyngealised consonants in Arabic have this type of constriction (Al-Tamimi, 2017), albeit to a lesser degree compared with true pharyngeals. This exploratory study looks specifically at the “guttural” class, i.e., uvular, pharyngeal, pharyngealised, compared with velars and plain alveolar consonants, in order to shed light into the underlying articulatory and acoustic mechanisms responsible for this type of constriction in Arabic and other languages. Data from 8 LA speakers (4 males) were collected using synchronised ultrasound tongue imaging (60fps deinterlaced), acoustic and EGG data. We concentrate here on ultrasound imaging data. Tongue shapes and splines were automatically estimated with Articulate Assistant Advanced 2.17 (AAA), and hand corrected. Speakers produced three consequent repetitions of nonce-words using the frame: /ʔVVCVV/ (VV= symmetrical /i: a: u:/; C=/t d ð s l k q g x ɣ tʕ dʕ ðʕ sʕ lʕ ħ ʕ/ as produced in LA, to probe symmetric V-C-V coarticulation. Measurements were taken at the onset, midpoint and offset of the release. A Generalised Additive Modelling of tongue surfaces was conducted to statistically compare the tongue surfaces. Preliminary results presented in Figure 1 show gradience in tongue surface and root changes. Pharyngealised contexts show the most tongue “retraction” with a back and down gesture followed by pharyngeals but with a fronter position; uvulars have a back and up gesture. Pharyngeals show a raised tongue root potentially because of a raised larynx posture. Vowel context has a major effect in shaping the type of epilaryngeal constriction seen in LA: most constricted in /a:/ and least in /u:/. The results confirm that pharyngealisation in LA is not uvularization due to a different tongue configuration and is still different from that of true pharyngeals. The implications of these results are discussed and confirm the gradient nature of an epilaryngeal constriction at least in LA.

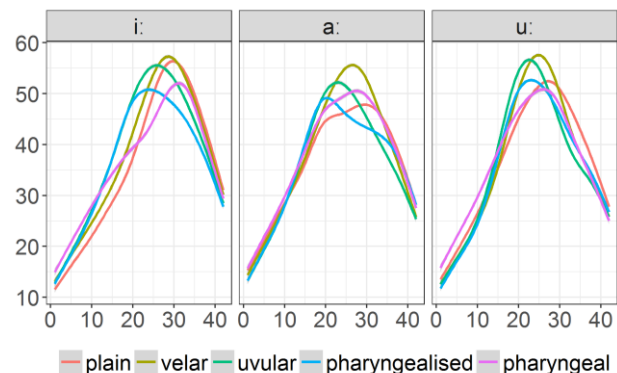


Figure 1: Tongue surfaces for various types of consonants according to vowel types

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