Geminates in Libyan Arabic: Investigating Articulatory Correlates.

Geminates are phonologically contrastive in many of the world's languages and are typically distinguished from singletons by longer duration. While temporal differences are well-documented, a growing body of research has explored non-durational articulatory cues to gemination (e.g., Payne 2005; Arvaniti 1999). In particular, articulatory studies in languages like Italian have revealed systematic differences in tongue configuration and contact patterns between singletons and geminates. However, such articulatory correlates remain largely unexplored in Arabic, despite the language's extensive use of gemination. This study addresses this gap by examining the articulatory realization of singleton and geminate consonants in Tripolitanian Libyan Arabic (TLA), a variety spoken in northwestern Libya.

Using Electropalatography (EPG) with the WinEPG system (Articulate Instruments Ltd.), this study examines the articulation of the sonorants /l, n, r/ in trisyllabic minimal or near-minimal word pairs, focusing on intervocalic medial position. Articulatory analyses were conducted with Articulate Assistant software, with measurements targeting the alveolar region (rows R1–R3) for Amount of Contact (AoC), Centre of Gravity (CoG), Articulatory profiles, and visual palatographic inspection.

The AoC results show consistent and systematic differences between singletons and geminates in TLA. An ANOVA testing the AoC at the mid-frame show that the phonological status is not significant ($F(3,5)=0.102$, $p=0.955$), the sound category is significant ($F(2,5)=54.608$, $p<0.001$), and the interaction between them is significant ($F(5,22)=3.724$, $p<0.05$). An ANOVA testing the AoC at the frame with the maximum electrode activation shows that the phonological status is significant ($F(3,5)=6.186$, $p<0.05$), the sound category is significant ($F(2,5)=80.829$, $p<0.001$) and the interaction between them is not significant ($F(5,22)=2.188$, $p=0.092$). These results indicate that geminates display significantly greater linguopalatal contact, and longer articulatory durations.

The results show that singletons have significantly higher CoG than their geminate counterparts. ANOVA testing the CoG at the mid frame shows that the phonological status is not significantly different ($F(3,5)=1.609$, $p=0.299$), the sound category is significant ($F(2,5)=11.913$, $p<0.05$) and the interaction between them is significant ($F(5,22)=30.119$, $p<0.001$). Post hoc LSD tests show that the CoG for singletons is significantly higher than geminates ($p<0.001$). The CoG at the maximum frame are generally similar to those obtained at the mid-frame. These CoG values indicate more posterior tongue contact in geminates, consistent with a laminal articulation, while singletons show more anterior contact associated with apical gestures. Visual inspection further supports this distinction, revealing firmer and broader constriction patterns for geminates. These findings align with Payne's (2005, 2006) results for Italian and demonstrate that gemination in TLA is not merely temporal but also involves articulatory restructuring.

This study provides the first articulatory analysis of gemination in a Libyan Arabic dialect and contributes new empirical data to the broader typology of geminate consonants. The results support the view that gemination entails both temporal and spatial enhancements in articulatory gestures, suggesting a strengthening effect on the articulatory level (see e.g. Keating, 2003; Cho and Keating, 2001; Onaka, 2003; Fougeron and Keating 1997). These findings have implications for models of phonological representation and articulatory planning in geminate production.