Phonetic Cues to Gemination in Lebanese Arabic

Ghada Khattab & Jalal Al-Tamimi

Speech and Language Sciences Section, Newcastle University, UK; ghada.khattab@ncl.ac.uk; jalal.al-tamimi@ncl.ac.uk

This paper reports on phonetic and phonological patterns of gemination and vowel length in Lebanese Arabic (LA). Both short and long vowels occur before singleton and geminate consonants in LA leading to the following permissible syllable structures:

<table>
<thead>
<tr>
<th>CV(C)</th>
<th>CVCCV(C)</th>
<th>CVVCV(C)</th>
<th>CVVCCV(C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/ˈtʰabaʔ/</td>
<td>/ˈtʰaabaʔ/</td>
<td>/ˈtʰabbaʔ/</td>
<td>/ˈtʰaabbe/</td>
</tr>
<tr>
<td>‘dish’</td>
<td>‘he matched’</td>
<td>‘he persuaded’</td>
<td>‘she is bending over’</td>
</tr>
</tbody>
</table>

The phonetic realisation of the geminate contrast and the temporal relationship between medial consonants and their surrounding vowels has been the subject of many cross-linguistic and cross-dialectal studies (e.g. Al-Tamimi, 2004; Arvaniti, 2001; Ghalib, 1984; Ham, 2001; Hassan, 2003). While the emphasis has mainly been on durational cues to gemination, some studies have suggested that other non-temporal characteristics contribute to the perceptual effect of gemination. These include a palatalised resonance for geminate sonorants (Local & Simpson, 1988) and palatal contact for geminate stops (Payne, 2005), laminal contact for geminates as opposed to apical contact for singletons (Payne, 2006), a flatter shape of the tongue in geminate articulation (Payne, 2006), more lenited stops in singleton contexts (Ridouane, 2007; Ladd & Scobbie, 2003), and lower burst amplitude and occasional absence of bursts in singleton stops (Local & Simpson, 1999; Ridouane, 2007). Some of these cues have led researchers to suggest a tense/lax distinction between singleton and geminate consonants alongside the durational contrast; this is thought to enhance the perceptual distance between singletons and geminates. The domain of gemination has also been found to extend to the surrounding vowels and sometimes across the whole word. For instance, preceding vowels have been found to be longer and more centralized before singleton than before geminate consonants (Local & Simpson, 1988), and whole words have been found to be produced with an overall lax setting in singleton as opposed to geminate contexts.

This study contributes to the literature on gemination by providing a detailed examination of LA. There are very few phonetic studies of LA (Nasr, 1960), and only a pilot study on the acoustic patterns of consonant and vowel length in the colloquial variety (Khattab, 2007). While consonant gemination in LA is very frequent (all 27 LA consonants can be geminates) and plays an important morpho-syntactic role in the language, little is known about the phonetic realisation of singleton and geminate consonants in this dialect or about the role played by the preceding vowel. The same is true regarding phonemic vowel length. And while most studies on gemination in Arabic have concentrated in durational cues to the singleton/geminate contrast, this study looks at a variety of non-temporal cues in order to investigate whether these play an important role in the implementation of this phonological contrast.

Twenty Lebanese males and females were recorded reading target word-lists containing medial singleton and geminate consonants (nasals, fricative, liquids, and approximants) preceded by long and short vowels. Acoustic and auditory analyses of medial consonants (C(C)) and of preceding (V1) and following (V2) vowel durations were made. Temporal measurements included V1, V2, and medial C(C) duration. Non-temporal measurements included formant frequencies at mid-point and offset of V1, mid-point of sonorant consonants, onset and mid-point of V2, and intensity and f0 in V1, C(C) and V2.

Temporal results suggest a robust role for duration in distinguishing between short and long consonants and vowels in LA. There were separate durational distributions for singleton and geminate consonants and for target short and long vowels. The duration of geminate consonants in this study is generally comparable to what has been found for Jordanian (Al-Tamimi, 2004), Iraqi (Hassan, 2003), Berber (Ridouane, 2007),...
and Malayalam (Local & Simpson, 1988). However, it is much shorter than what has been found for other languages such as Greek (Arvaniti, 2001), Swedish (Hassan, 2003), and Finnish (Kunnari, Nakai, & Vihman, 2001). A surprising result for duration is that consonant and vowels did not exhibit temporal compensation at the absolute durational level, i.e. vowels were not shorter before geminate than singleton consonants as is often found in the literature. This might be due to the fact phonological length plays an important role in vowels as well as consonants in Arabic, but temporal compensation has been found to occur in Iraqi and Jordanian Arabic (e.g. Al-Tamimi, 2004; Hassan, 2003) so this matter will be investigated further.

Non-temporal results also show a surprising lack of difference in the spectral cues in vowels preceding and following singleton and geminate consonants, suggesting a lack of vowel quality difference in the implementation of this contrast. There is a slight tendency for vowels surrounding geminate consonants to be raised and fronted compared with vowels surrounding singleton consonants, but this is more prominent in the data for females than males. Moreover, vowel quality, intensity and f0 vary more depending on whether the preceding vowel is phonemically long or short rather than depending on the phonemic length of the consonant itself.

More work is underway to look at stops since some differences have been reported in VOT, burst amplitude and consonant and vowel intensity, but results so far highlight the role of temporal cues over spectral and other non-temporal cues such as tense/lax realisations in the distinction between singleton and geminate consonants in LA. This may suggest that the underlying contrast for gemination in LA is mainly temporal and its domain is restricted the 2nd syllable.

References


