Cues to Word-final Geminate Consonants in Maltese

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Introduction

- Word-final geminate consonants are typologically rare, though widespread in Maltese, appearing in over 400 lexical items.
- Geminates and singletons contrast for most manners and places of articulation used in the language.

e.g.

/lop/	/kopp/	'games' / 'butterfly net'
/bdot/	/dott/	'_' / '_'
/frak/	/frakk/	'_' / '_'
/daʔ/	/daʔʔ/	'to taste' / 'sound'
/ras/	/rass/	'head' / 'to cram'
/spraʤ/	/raʤʤ/	'_' / '_'
/dam/	/damm/	'he lingered' / 'he gathered'
/min/	/minn/	'_' / '_'
/gar/	/garr/	'type of fish' / 'to carry'
/kul/	/kull/	'_' / '_'

- In languages with geminates, singleton and geminate consonants are commonly distinguished by durational differences, as in the Thurgovian dialect of Swiss (Kraehenmann 2001).
- In Maltese, allophonic vowel duration may provide an additional cue: A vowel preceding a single consonant is typically longer than one before two identical or different consonants (Hume et al. 2009; Gett 2010).

Allophonic Differences in Vowel Duration

Longer	*Shorter*
[la:p] 'he played'	[lapt] 'I played'

Research Questions

- How and to what extent are singleton and geminate consonants differentiated by Maltese speakers? Do all consonants display the same patterns?
- To what extent does allophonic duration of the preceding vowel serve to distinguish singleton and geminate consonants?

Methods

Speakers

5 native speakers (3 female, 2 male) of Standard Maltese, aged 19-23. Subjects were undergraduate students at the University of Malta, where the study was conducted.

Stimuli

- 36 words; 18 geminate/singleton minimal or near-minimal pairs
- Factors:
  - Syllable number: 32 monosyllabic words; 4 bisyllabic words
  - Manner of articulation
    - stop: 16 words
    - fricative: 8 words
    - affricate: 2 words
    - nasal: 4 words
    - liquid: 6 words

Procedure

- Target words, along with 82 fillers (used for other studies), were presented to each speaker on individual PowerPoint slides in the carrier phrase "ghid _____ erba' darbiet" (translation: Say ___ four times) with English translations listed underneath the phrase.
- There were five randomized sets of the wordlist.
- Speakers were asked to pronounce the Maltese phrase on each slide at a comfortable speaking rate and to self-pace their progress throughout the stimuli.

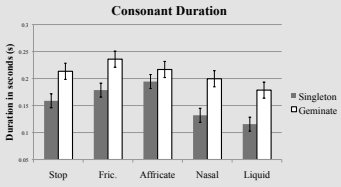
Data Extraction

- Consonant and rhyme durations were extracted from target words using Praat phonetic software (Boersma & Weenink 2005; Wood 2005) by two phonetically trained linguistics majors at The Ohio State University, both native speakers of American English. After reliability was confirmed on the basis of a subset of the same data extracted by both researchers (mean and absolute mean differences were less than 10% of average duration value), all data measurements were collapsed for the statistical analyses.
- Consonant duration was measured as follows:
  - Stop: beginning of closure to end of release aspiration
  - Fricative: beginning to end of frication
  - Affricate: beginning of closure to end of frication
  - Nasal: beginning to end of nasal formant structure
  - Liquid: beginning to end of liquid formant structure

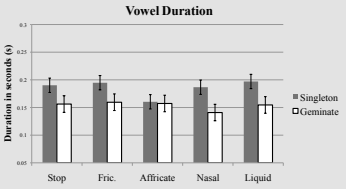
Statistical Analysis

- Consonant durations for singleton vs. geminate consonants, and duration of the preceding vowel (taken from rhyme durations) were calculated separately for bisyllabic and monosyllabic words.
- Comparison of means and standard errors were used.

MONOSYLLABIC WORDS

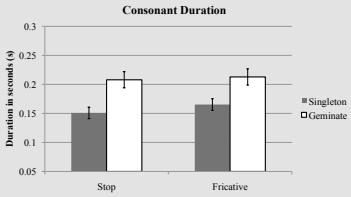


- Consonant duration is significantly longer for geminates vs. singletons, except for affricates

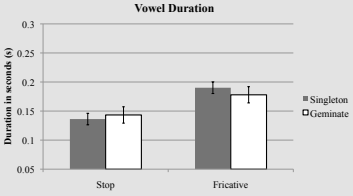


- Vowel duration is significantly longer before singletons vs. geminates, except for affricates (no diff.)

BISYLLABIC WORDS



- Consonant duration is significantly longer for geminates vs. singletons, except for affricates



- No significant difference in vowel duration before singletons vs. geminates (cf. monosyllabics)

Summary

- A word-final geminate consonant is consistently longer than the corresponding singleton for all consonant types except affricates. This holds regardless of whether the word is monosyllabic or bisyllabic.
- In monosyllabic words, non-phonemic vowel duration is longer before a singleton consonant (simple coda) than before the corresponding geminate consonant (complex coda). Affricates are again an exception: there is no significant difference in vowel duration.
- In bisyllabic words, vowel duration before stops and fricatives is **not** significantly different before singletons and geminates.

Discussion

Consonant and vowel duration

- Both consonant and vowel duration are used to distinguish geminate from singleton consonants in Maltese.
- However, they show different patterns: consonant durational differences occur in both mono- and bisyllabic words; vowel differences only occur in monosyllabics.
- A potential explanation for these patterns relates to the different status of the two properties in the Maltese sound system:
  - consonant length is contrastive
  - vowel durational differences before simple and complex codas are non-contrastive
- The observation that contrastive consonant length is consistently maintained while vowel duration is not, suggests that phonemic contrast is a more reliable and robust cue than allophonic vowel duration for distinguishing singleton and geminate consonants in Maltese.

Affricates

- Affricates are the only consonant type where geminates and singletons are not consistently distinguished.
- In the present study, affricate duration was measured on the basis of both closure and frication. A closer look at each property separately may reveal that geminates and singletons are distinguished by differences between either closure or frication, rather than both.

Follow-up

- Is the lack of vowel durational differences in the final syllable of bisyllabic words observed for simple and complex codas more generally, or is it particular to geminate/singletons?
- Does closure or frication duration alone distinguish between affricate singletons and geminates?
- Which cues do native Maltese listeners use to distinguish singleton and geminate consonants? Are similar patterns observed regarding contrastive and allophonic distinctions in monosyllabic and bisyllabic words?
- What theory of sound structure is best able to model the observed patterns?

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