VELAR SOFTENING: AN ACOUSTIC STUDY IN MODERN GREEK

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Velar palatalization in Greek

- In Greek, velar stops become palatalized before front vowels (/i/ and /e/) following an allophonic rule.
- *For example:*
  - /kapa/ → ['kapa] “letter k”
  - /kita/ → ['kjita] “look”
  - /kefi/ → ['kjefi] “fun”
- Velar palatalization is a common feature of all Greek dialects, including standard Greek.
Velar palatalization in south-eastern dialects

- In many South-eastern Greek varieties velar stops before front vowels undergo **softening**, in addition to palatalization
  - **Velar softening**: a change in manner of articulation from stop to an affricate
  - **Cretan-Greek**:
    /kita/ → [ʨita] “look”
  - **Standard-Greek**:
    /kita/ → [kjita] “look”
- However, accounts on the exact nature of the phenomenon in Greek are scarce and mainly impressionistic.
Velar softening and the Greek affricate /ts/

- Greek has a voiceless affricate /ts/ that is found in all dialects
- *Example:* 
  
  /tsita/ → ['tsita] “fish bone; cheetah”

- In dialects, such as Cretan-Greek, which are characterized by velar softening, the affricate /ts/ exists alongside the affricate realizations of front /k/.
- *Example:* 
  
  /kita/ → ['ʨita] “look”

- Velar softening before front vowels in Cretan is overt and depicted in popular culture as [ts] for [kj] substitutions when imitating ‘Cretan-speech’.
- This suggests there might be a narrower categorization of [ts] and [kj] in different Greek dialects.
Study Aims

• Velar softening *proposed* as important classification feature of Modern Greek dialects*
• However, it has been little studied instrumentally.
• **Aims:**
  • Examine acoustic characteristics of velar palatalization/softening in two Greek dialects:
    • A southern dialect spoken in Crete
    • A northern dialect spoken in Thessaloniki
  • Examine gender effects, prosodic position and stress placement on velar palatalization/softening.
  • Examine acoustic characteristics of /ts/ in the context of dialectal variation.
Participants

- 12 Greek-speaking adults
  - 6M & 6F, age 21-61 yrs.
- Thessaloniki (N. Greece)
  - 6 participants
- Ierapetra, Crete (S. Greece)
  - 6 participants
- Age and level of education were balanced across dialects.
Stimuli and Procedure

- Two- or three-syllable real words containing /k/ or /ts/ word-initially or word-medially before the vowels /i/, /e/, /a/

  **Examples:**
  
  /kima/ ['kjima]   /fakes/ [fa'kjes]   /fatsa/ ['fatsa]
  “wave”         “lentils”       “face”

- The syllable containing the target sound was either stressed or unstressed.

- Participants read sentences of the form:

  __________τώρα είπα ['tora 'ipa] “I’ve just said” __________

- For Cretan speakers, we replaced the standard form ['torα] “now, just” with the dialectal form [e'ða] to facilitate elicitation of the dialectal features.

- Only the words elicited utterance-initially are presented in the current study.
Acoustic analysis

• Burst spectrum analysis:
  • Power spectrum of 10 ms Hamming window centered at the burst.
  • Linear values (Hz) transformed into Equal Rectangular Bandwidth (ERB) to better capture the cues crucial to the auditory system.
  • The frequency in ERB of the most prominent peak (Peak ERB) was identified.
    • Higher peak ERB values indicate a shorter front cavity (or a more anterior place of articulation).
Acoustic analysis (cont.)

- **Intensity analysis:**
  - Relative intensity of 25 ms centered at midpoint of plosive release with reference to the maximum intensity of following vowel.

- **Duration analysis:**
  - Temporal interval between burst and voice onset.
Burst analysis: Females

- Peak ERB values of [k] (allophone of /k/ before non-front vowels) lower than those of [kj] (allophone of /k/ before front vowels).
- No clear dialectal differences in peak ERB values of [kj] and [ts].
- Clear separation of the three categories in terms of peak ERB.
Burst analysis: Males

- Peak ERB values of [k] (allophone of /k/ before non-front vowels) lower than those of [kj] (allophone of /k/ before front vowels) similar to females.
- The difference between peak ERB values of [k] and [kj] is greater in Cretan than in Thessalonikan speakers.
- Overlap in peak ERB of [kj] and [ts] for Cretan speakers in word-medial context.
  - More posterior realization of [ts] and wider range of values relative to females.
Intensity by Duration: All speakers

- The affricate [ts] is both longer and higher in intensity than [kj] in Thessalonikan speakers.
- There is overlap in intensity and duration of [kj] and [ts] in Cretan speakers.
Summary of findings

Acoustic evidence of velar palatalization in both dialects
Acoustic evidence of velar softening in Cretan-Greek

**Burst analysis:**
- More anterior realizations of [kj] in Cretan speakers compared to Thessalonikan speakers, especially for male speakers.
- The peak ERB values of [kj] and [ts] overlapped more in male than female speakers, as well.
  - Male speakers produced [ts] with a wider range of peak ERB values and often had more posterior realizations of [ts] compared to females.

**Intensity by Duration analysis:**
- More overlap in relative intensity and duration between [kj] and [ts] in Cretan than in Thessalonikan speakers.
- Similar patterns for males and females across all prosodic environments and stress conditions.
Discussion

• Observed dialectal variation in degree of velar fronting in Greek suggests velar palatalization/softening can be used as a classification feature of Greek dialects.
• Acoustic similarity of [kj] and [ts] in Cretan could explain anecdotal [ts] for [kj] substitutions in Cretan-Greek as perceived by non-Cretan speakers.
• The more posterior realization of [ts] in male speakers and the less separation between [kj] and [ts] may also contribute to perceptual confusion between the two categories.
• Finally, the study adds to the literature on the acoustic factors that play a role in the implementation of velar softening.
Future directions

- Supplement acoustic data with articulatory data (EPG) to examine differences in place of articulation.
- Conduct a perception experiment to examine whether the acoustic similarity of [kj] and [ts] in Cretan leads to perceptual confusions among Cretan and non-Cretan dialect speakers of Greek.
Acknowledgments

• Research supported by NSF grant BCS-0729140 to Jan Edwards and by a Callier Postdoctoral Fellowship to Asimina Syrika.
• Thanks to Katerina Derdemezis for assistance with data segmentation and analysis.
• Thanks also to Mary E. Beckman (Ohio State University) and Marios Fourakis (University of Wisconsin-Madison) for helpful comments.
• Special thanks to the people who took part in the study!
Thank you!