Tongue root and voicing in Hungarian singleton and geminate obstruents

Maida Percival[1], Tamás G. Csapó[2,3], Andrea Deme[2,4], Tekla E. Gráczi[2,5], and Alexandra Markó[2,4]

[1]University of Toronto, Canada, [2]MTA-ELTE „Lendület" Lingual Articulation Research Group, Hungary, [3]Budapest University of Technology and Economics, Hungary, [4]Eötvös Loránd University, Hungary, [5]Research Institute for Linguistics HAS, Hungary

Introduction

- Voiced geminates: cross-linguistically uncommon & voicing has been found to vary in some languages (Kawahara, 2015).
- Hungarian has variable voicing in singleton obstruents (Gráczi, 2013), but voicing in geminates remains largely unexplored.
- We use electroglottography (EGG) and ultrasound to investigate voicing in geminate and singleton consonants in Hungarian.

Research questions

EGG: What is the status of voicing in Hungarian voiced geminates?

Ultrasound: Are Hungarian voiced obstruents produced with advanced tongue root, an articulatory strategy which facilitates voicing?

Phonetic vs. phonological voicing: Can Hungarian provide evidence for phonological patterning of the relationship between voicing and advanced tongue root (c.f., Ahn, 2018)?

Methodology

Participants

- 5 native speakers of Hungarian

Material

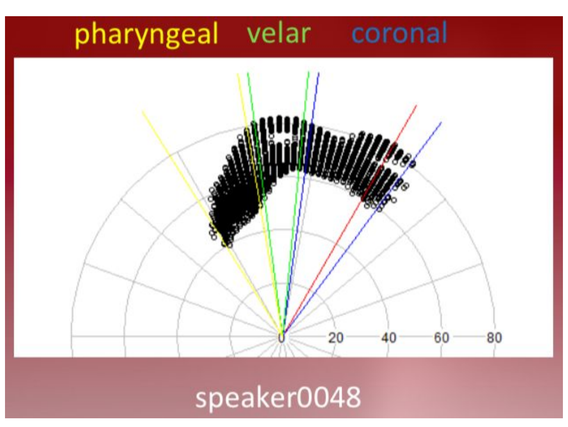
- ultrasound and audio in Articulate Assistant Advanced (AAA) and with simultaneous audio and EGG in Audacity
- six repetitions of a word list of target consonants in post-tonic position for a total of 960 tokens.

Bilabial stops	Alveolar stops	Alveolar fricatives	Velar stops
p b p: b:	t d t: d:	s z s: z:	k g k: g:

Analysis

Ultrasound data:

- Tongue contours traced in AAA for frames at the point of maximum consonant constriction
- Tongue divided into regions



- Linear mixed effects regression (lmer) models

Dependent variable: polar coordinates of contours

Predictors:

- consonant type (bilabial stop, alveolar stop, alveolar fricative, velar stop)
- gemination (singleton, geminate)
- voicing (voiced, voiceless)
- normalized point along the tongue contour

EGG data:

- Synced with ultrasound data
- Percent voicing measured in Praat
- Lmer models: effect of gemination and phonological voicing on percent voicing

Phonetic vs. phonological voicing:

- percent voicing vs. phonological voicing in the ultrasound lmer

Results

EGG:

- No significant difference in voicing between singleton and geminate consonants
- Voiceless consonants were generally voiceless (range = 0-33%, mean = 8.7%, median = 7.5%)
- Voiced consonants, both singleton and geminate, were generally voiced but varied considerably in percent voicing (range = 3-100%, mean = 73%, median = 77%)
- Similar to what Gráczi (2013) found for singletons.

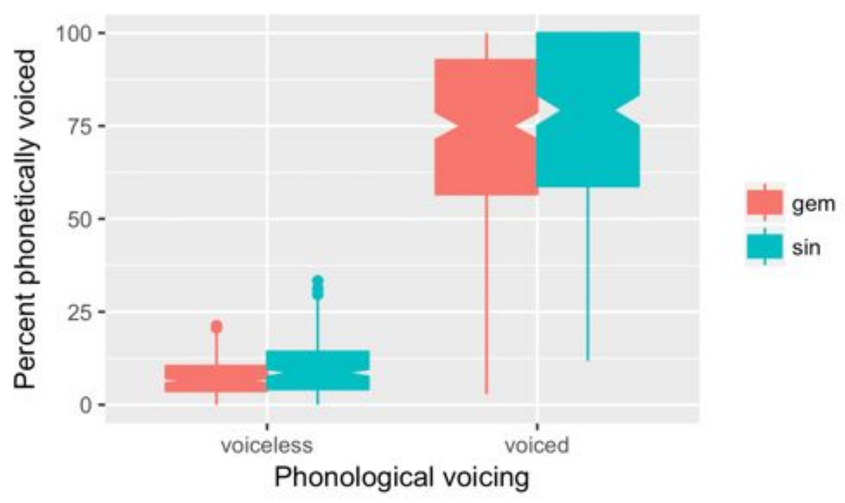


Figure 1. EGG percent voiced aggregated across all obstruents and speakers

Ultrasound:

- Radius length did not significantly differ based on voicing (a factor with two levels based on phonological category: voiced, voiceless)
- But: some significant interactions with place of articulation and radius number in pharyngeal and velar regions suggestive of advanced tongue root for many voiced obstruents

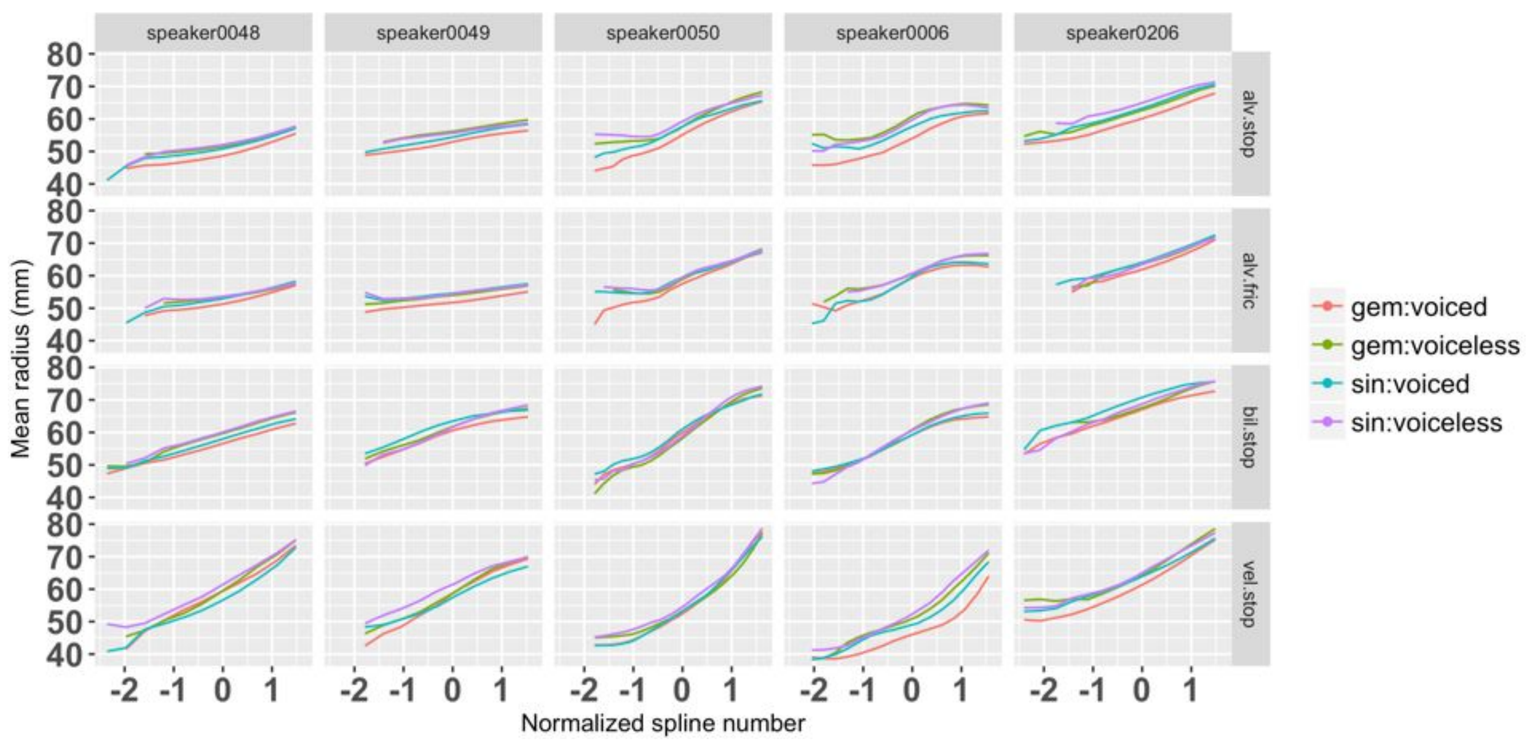


Figure 2. mean radius length between ultrasound probe and tongue surface in pharyngeal region

Phonetic vs. phonological voicing:

- In a model with both phonetic and phonological voicing in the lmer model, phonological voicing remained significant only in certain interactions, while percent voiced was a significant main effect (p = 0.0056).

Discussion

- Tentatively suggests that tongue root is better predicted by phonetic than phonological voicing in Hungarian, contrary to what Ahn (2018) found for devoiced stops in English. This may suggest that advanced tongue root is not automatically implemented as a strategy to enhance voicing in Hungarian.
- Follow-up research:
  - Investigate the robustness of the findings with more participants and further analysis methods
  - Compare to other languages with variable and semi-voiced geminates

References

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Gráczi, Tekla Etelka. 2013. Zörejhangok akusztikai fonetikai elemzése a zöngésségi oppozíció függvényében (Acoustic phonetic approach to the voicing opposition of obstruents). PhD thesis, ELTE, Budapest, Hungary.

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