A pilot corpus acoustic analysis on the alveolar tap in Turkish

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1. Introduction

- Pronunciation of alveolar tap [ɾ] in Turkish changes based on phonetic environment (Table 1) [1, 2, 3]

Table 1. *Impressionistic description of [ɾ] based on within-word placement.*

Placement	Turkish	IPA	Gloss
Word initial	resim	[ɾesim] or [r̆esim]	‘painting’
Word medial	araba	[ɑɾʌbə]	‘car’
Word final	var	[vɑr̥̆]	‘to have’

- Minimal acoustic analysis has been conducted [2]
- Acoustic analyses for taps include duration and phonetic environment; analyses for fricatives also include mel frequency cepstral coefficients (MFCCs) [4, 5]

Research question

- Do MFCCs, duration, and/or phonetic environment predict frication on the Turkish tap?

2. Materials and methods

- Mozilla Common Voice Turkish dataset [6]
  - 1,676 speakers; 410,385 sentences; 21,620 <r> segments
  - Male: 42%; Female: 32%; No information: 25%
- Generated transcriptions using eSpeak grapheme-to-phoneme model
- Aligned using Montreal Forced Aligner [7]
- Extracted duration, 12 MFCCs, and phonetic environment for [r] and [ɾ] using Praat
- Fit a logistic regression model (Table 2)
  - Outcome: fricated or not
  - Fixed effects: MFCCs 1-3, duration, and segment position
  - Model would not converge with random effects

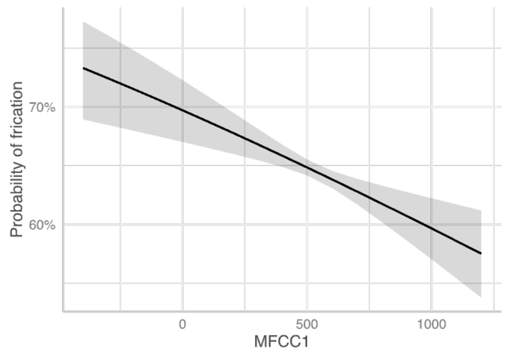

Fig 1. *Effect plot of MFCC1 on whether the segment is fricated.*

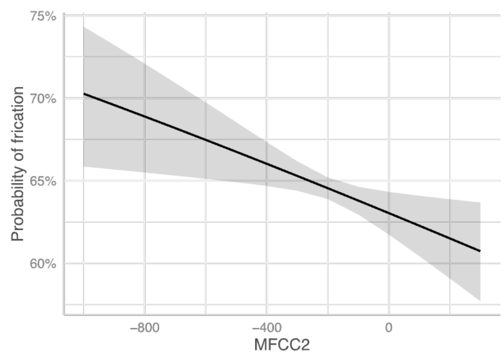

Fig 2. *Effect plot of MFCC2 on whether the segment is fricated.*

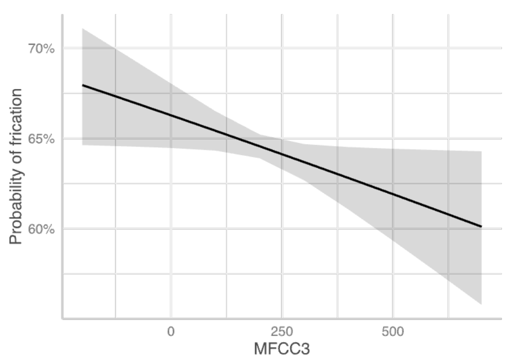

Fig 3. *Effect plot of MFCC3 on whether the segment is fricated.*

3. Results

- MFCCs 1-3 and duration found to be significant predictors of frication

Table 2. *Table of coefficients for logistic regression.*

	Estimate	Std. Error	z value	Pr(>|z|)
Intercept	1.222	0.106	11.513	< 0.001
MFCC1	-4.42e-4	1.15e-4	-3.837	< 0.001
MFCC2	-3.26e-4	1.27e-4	-2.570	0.010
MFCC3	-3.80e-4	1.82e-4	-2.081	0.037
Duration	-0.626	0.066	-9.454	< 0.001
Word-final	12.049	97.059	0.124	0.901

4. Discussion

- MFCCs 1-3 and duration significant for predicting frication, mirroring results for other languages [4, 5]
- Segment position not significant in the model, unlike impressionistic descriptions [1, 2, 3]
- Possible difficulties due to low audio quality and generated transcriptions

5. Conclusion

- MFCCs are useful for measuring frication
- Further exploratory acoustic analyses required
- More accurate automatic transcription model needed
- Future directions: GAMM, collect experimentally designed data with better audio quality

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