

Phonetic variation and contrast neutralization patterns in Romanian fricatives across different speech styles

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Research Objectives

Apply speech processing tools to investigate phonetic trends in contemporary spoken Romanian:

- Explore voicing patterns in fricatives
- Identify acoustic realizations and distribution patterns of /h/

Background

Previous findings with controlled speech

Voiced fricatives: "the complex interaction of articulatory constraints from three separate goals: the formation of the appropriate oral constriction, the control of airflow through the constriction so as to achieve frication, and the maintenance of glottal oscillation by attending to transglottal pressure" (Proctor et al., 2010, p. 1507).

European Portuguese: heavy devoicing in VC position – 76.5% full devoicing for [z] and 48.4% for [v] + partially devoiced segments (Jesus & Shadle, 2002; Pape & Jesus, 2015).

Romanian: /f/ distinguished from /v/ 95% of the time when all regions of a segment are used together, but not when each region considered separately. First region: 90%; marked decrease for the other two regions (Spinu & Lilley, 2016).

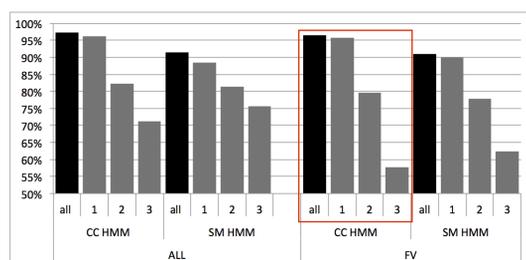


Figure 1: Voicing classification results for two parameter sets.

Dorsal fricative in Romanian: /h/ realized word-finally as glottal (13%) and velar (87%) when plain and palatal (100%) in the presence of the -i suffix (Spinu et al. 2012, Spinu & Lilley 2016).

Classification of place of articulation: 95.1% accuracy – corpus of 3,674 Romanian fricatives - labiodental, dental, postalveolar, dorsal (Spinu & Lilley, 2016).

Current Study

Speech register: investigate these trends in semi-controlled, broadcast speech (understudied for this language).

Sample size: expand from 31 to 86 speakers.

Acoustic measures: test efficiency of a classification method based on cepstral coefficients which was found to outperform alternative measures (Spinu & Lilley 2016, Spinu, Kochetov & Lilley ms.)

Fricatives

Corpus

	Initial	Medial	Final
Dental (s, z)	47.7%	64.4%	73.9%
Dorsal (h)	0.8%	0.9%	0.0%
Labiodental (f, v)	32.2%	22.8%	12.9%
Postalveolar (ʃ, ʒ)	19.3%	11.9%	13.2%
TOTAL (count)	5,160	6,255	356

Broadcast speech (Vasilescu, Vieru & Lamel 2014)

- Prepared speech from news shows; semi-spontaneous TV debates - 7 hours, 86 adult speakers (M & F)

Acoustic Analysis

- 6 Bark-frequency cepstral coefficients (CC 0-5)
- 20-ms-wide Hamming windows spaced 10 ms apart
- Hidden Markov Models (HMMs) used to divide the fricatives & adjacent vowels into 3 regions of internally minimized variance

Statistical Analysis

- Mean CCs from each fricative region + third region of preceding segment + first region of following segment
- Multinomial logistic regression analyses with *place* or *voicing* as the dependent variable and 6-30 measures as continuous explanatory variables

Results

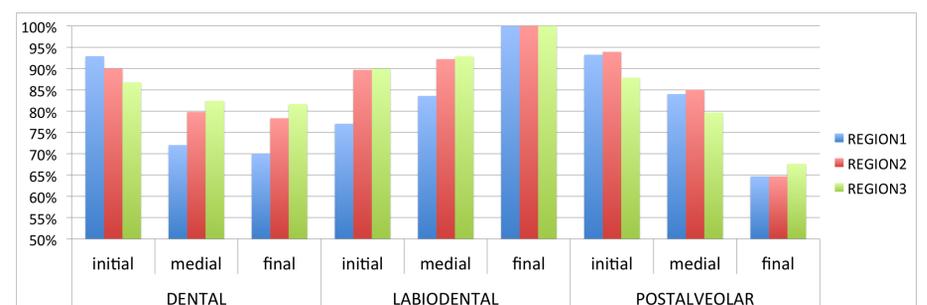


Figure 2: Correct classification of voicing by region for three places of articulation, in word-initial, -medial, and -final position. NOTE: only consonantal info used.

Table 1: Dorsal fricative realization (total count 96).

	Word-Initial				Word-Medial			
	sil_V	C_V	V_V	V_C	sil_V	C_V	V_V	V_C
Voiced glottal	1	7	6	1	0	1	14	10
Voiced palatal	0	0	0	0	0	0	1	3
Voiced velar	0	2	0	0	0	0	2	0
Voiceless glottal	10	0	4	2	0	0	4	3
Voiceless palatal	0	0	0	0	0	0	3	2
Voiceless velar	3	1	4	1	0	0	0	1

Overall classification of place of articulation: 90.7% (compare to 95.1% for controlled speech). NOTE: vocalic info used here, but not in Spinu & Lilley (2016).

Main findings

Little support for voicing neutralization in Romanian (restricted to palatalization environment?).

In less controlled speech, the dorsal fricative is realized in 6 distinct ways, mostly governed by allophonic variation.

Conclusion

- New segmented (semi-)naturalistic corpora help identify morpho-phonetic patterns in contemporary spoken Romanian.
- Results differ from lab findings: hypoarticulation, coarticulation, sociolinguistic factors, and intrinsic variability in continuous speech.
- The classification method developed in Spinu & Lilley (2016) based on controlled lab speech fared very well with this corpus.