

# An Acoustic Description of Palatalization in Romanian

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# Introduction

A perceptual study (Spinu 2006) of 3 places of articulation found that while native speakers produce plain and palatalized consonants in all three places, only labials and dentals are accurately differentiated, postalveolars are not. In this talk we will present an acoustic description of 3 Romanian palatalized consonants comparing them with plain consonants both word finally and in a fronting environment.

# Morphological palatalization?

Palatalized consonants are taken to be morphologically predictable in Romanian (Chitoran 2001). They are generally associated with the presence of two suffixes: the plural for nouns (1a) and adjectives (1b), and the 2nd person singular in the present indicative of verbs (1c).

(1)

- |    |         |                  |
|----|---------|------------------|
| a. | lup     | lup <sup>j</sup> |
|    | 'wolf'  | 'wolves'         |
| b. | alb     | alb <sup>j</sup> |
|    | 'white' | 'white-pl'       |
| c. | sar     | sar <sup>j</sup> |
|    | 'I jump | 'you jump'       |

# Morphological palatalization?

A number of roots also show alternations in the primary place and/or manner of articulation of the final consonant (2)

- (2)
- |    |                   |                     |
|----|-------------------|---------------------|
| a. | rak               | ratʃʲ               |
|    | <i>'crawfish'</i> | <i>'crawfishes'</i> |
| b. | pas               | paʃʲ                |
|    | <i>'step'</i>     | <i>'steps-pl'</i>   |

This study focuses on cases where the primary place of articulation of the root-final consonant remains unaffected.

# Monomorphemic palatalization

Closer examination reveals the existence of monomorphemic words (3) exhibiting the secondary palatalization of (1) as well as the lack of word-final short [i] in the language.

- (3)
- a. ung<sup>j</sup>  
    'angle'
  - b. puft<sup>j</sup>  
    'kid'

It may be the case that secondary palatalized consonants are due to a more general process occurring at the edge of a prosodic word.

# Breaking down the process

There are at least 2 processes behind surface palatalization in Romanian

- the reduction of word final unstressed high vowels (/i/,/u/)
- a copy/spreading process resulting in a secondary articulation

Previous accounts agree that the reduction of the vowel occurs prior to the output of phonology. However they disagree on where the process behind the secondary articulation lies.

## 2 outputs of phonology

Previous accounts of Romanian can be divided into two groups based on the output of phonology

- consonant with a secondary specification (Petrovici 1956, Schane 1971, Chitoran 2001, Iscrulescu 2003)
- sequences of consonant-glide (Rulen 1973, Steriade 1984)



# Palatalization, only surface cue to plural

- As palatalization is the only surface cue to plural, a perceptual study (Spinu 2006) investigated whether native speakers of Romanian use palatalization to distinguish meaning, particularly in the case of palatalized postalveolars where there is considerable debate among native linguists.
- Three places of articulation were investigated, bilabial, dental and postalveolar

# Palatalization, in the context of other morphological cues

Matched:

După ce am spălat rufele nu am mai găsit **patru ciorapi**. [tʃjorapʲ]  
*'After doing the laundry, I couldn't find four socks.*

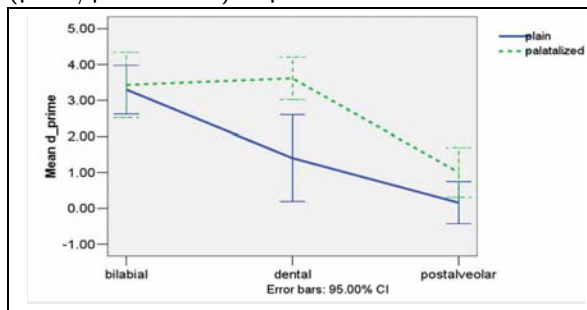
Mismatched:

După ce am spălat rufele nu am mai găsit **patru ciorap**. [tʃjorap]  
*'After doing the laundry, I couldn't find four sock.*

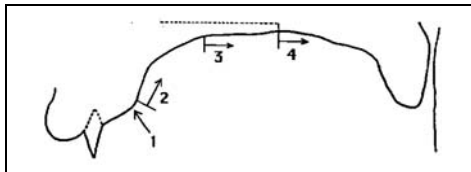
- Forced choice task “acceptable” and “not acceptable”
- 20 subjects
- Each subject heard 36 targets and 72 fillers (matched + mismatched)

# Subjects were not sensitive to plain or palatalized on post alveolars, with varying sensitivity to plain in dentals

Dprime scores were analyzed to take into account response bias. A high score indicates correct identification when the signal (plain/palatalized) is present.



# Articulatory Description (Keating & Lahiri 1993)

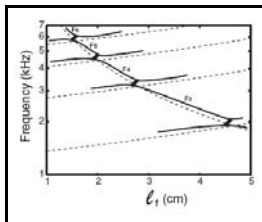


1. corner of the alveolar ridge
2. diagonal
3. roof
4. soft palate

- Tongue blade: the front 2-3 centimeters of the tongue
- Tongue body: the rest of the tongue
- Palatal articulations have lateral tongue body contact.  
Tongue blade location, shape and degree of constriction differ crosslinguistically.

# Acoustic Description (Stevens 1989, 2003)

- Spectral prominence is related to the ratio of the front and back cavity lengths.
- For both palatals and postalveolars (due to the extension of the front cavity under the tongue) the front cavity length is roughly 3.5cm.
- The spectral prominence is associated with the third natural resonance (F3) for [ç] & [ʝ], with F4 & F5 for [s], with F2 for [x].



# The timing of Russian secondary palatalization (Kochetov 1998, 2001, 2006)

- Bilabial: raising (16/18mm) and fronting (24/26mm) of the tongue body beginning less than 30ms before primary closure and coinciding with release of the lips.
- Coronals: a raising (15-22mm) and fronting (although fronting was not contrastive) of the tongue body beginning earlier than 30ms before primary closure, and coinciding with tongue blade closure. The primary articulator changes as well, plain are gesturally [dental, apical], and palatalized are [alveolar, laminal].

# The timing of Russian secondary palatalization (Kochetov 1998, 2001, 2006)

- The relative timing and degree of the secondary constriction varies by syllabic position, speaker, and dialect. More independent articulators (lips and tongue body) vary more than less independent articulators (tongue blade and tongue body).
- Palatalized consonants are longer than their non-palatalized counterparts

# Conditions

As the palatalized consonants under debate appear only word-finally in Romanian, both syllable position (onset and coda) and frontness of the environment (back and front) were controlled for.

Coda position

- |    |               |           |                   |
|----|---------------|-----------|-------------------|
| a. | [plain]       | [ko.koʃ]  | <i>'rooster'</i>  |
| b. | [palatalized] | [ko.koʃʲ] | <i>'roosters'</i> |

Onset position

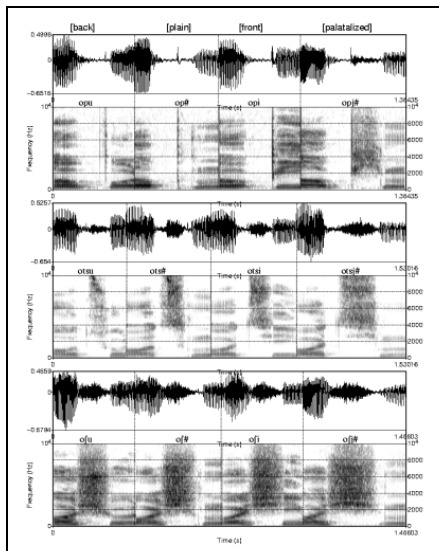
- |    |         |             |                       |
|----|---------|-------------|-----------------------|
| c. | [back]  | [ko.ko.ʃul] | <i>'the rooster'</i>  |
| d. | [front] | [ko.ko.ʃii] | <i>'the roosters'</i> |



# Data collection

- Due to limitations of the Romanian lexicon a fricative series or stop series were unavailable, thus a labial stop, dental affricate and post-alveolar fricative, were chosen for investigation.
- 4 words for each of the three places of articulation were chosen with a stressed /o/ preceding the target consonant
- The 4 target words for 3 places of articulation were repeated 3 times in each of the 4 contexts with an equal number of filler items, for a total of 288 items ( $4 \times 3 \times 3 \times 4 \times 2$ )
- The items were randomized and presented in the carrier phrase: Aș vrea să văd \_\_\_\_ mâine când vin prietenii mei. ("I'd like to see \_\_\_\_ tomorrow when my friends arrive.")
- Data was recorded using a 22kHz sampling rate by a male native speaker of Romanian

# Description



Preceding Vowel

F2 height

[palatalized] highest

[front]

[plain]

[back] lowest

Release in front contexts

increased amp 2600Hz

antiresonance 2000Hz

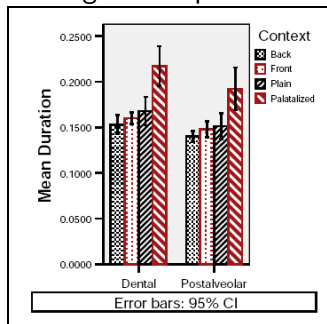
formant-like structure

Duration in [palatalized]

40ms longer

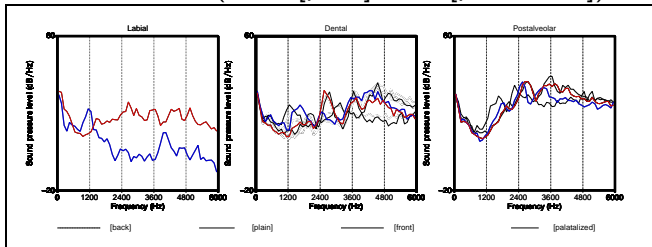
# Duration

The consonants were measured from offset of F2 in the preceding vowel until offset of release. Palatalized consonants were found to be longer than plain in word final position.



# Release Spectra

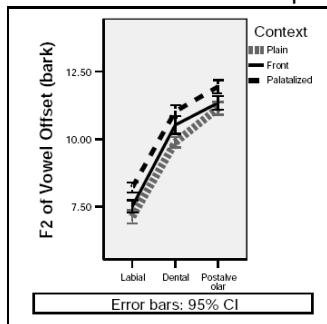
FFT spectra were generated over a 512 (25.6ms) point window aligned with the offset of the fricated release. Only conditions displaying fricated releases were compared to maintain consistency (thus excluding labial stops in onset position). The mean spectra are shown below (blue: [plain], red: [palatalized]).



The front environments showed increased amplitude around 2600kHz and very little amplitude below 2000kHz.

## Height of F2 in the preceding vowel

There was an expected main effect of place of articulation on the height of F2 with labials causing F2 to fall, dentals showing a rise and post-alveolars showing a greater rise. The F2 was significantly higher in both frequency (hertz) and human perceptibility (bark) in the [palatalized] condition than in the [plain] and the [front] conditions for all three places of articulation.



# Summary

- Palatalized consonants are longer
- Palatalized consonants show coarticulation

While our design did not permit us offer much in the understanding of where the secondary articulation is specified, we hope to have shown that there is co-articulation on the surface which is shared by both palatalized consonants and consonants in a fronting environment, and that palatalized consonants, including postalveolars, are acoustically different from plain consonants.

## Selected References

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Thank you!