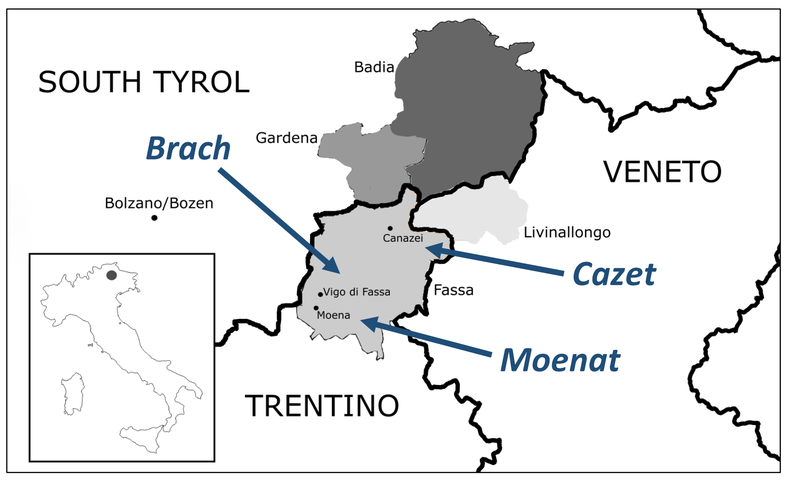
Variation of Sibilants in Three Ladin Dialects

Yifan Yang[1], Rachel Walker[2] and Alessandro Vietti[3]
[1, 2]*University of Southern California,* [3]*ALPS - Alpine Laboratory of Phonetic Sciences, Free University of Bozen-Bolzano*
[1]*yangyifa@usc.edu,* [2]*rwalker@usc.edu,* [3]*Alessandro.Vietti@unibz.it*

1. Introduction

- This paper presents an acoustic study of **Ladin**, a threatened minority Romance language spoken in Northeastern Italy; 31,000 speakers (2013); threatened status[1].

- The focus is on the sibilants of three dialects: ***Brach***, ***Cazet***, and ***Moenat.***



- **Main Contributions:**
  1) It provides up-to-date phonetic data for younger-generation speakers;
  2) It reveals the nature of phonetic variation across dialects;
  3) It exhibits a benefit of using statistical methods (SSANOVA) in the study of threatened or endangered languages.

2. Sibilants in Ladin

- **Sibilants in Ladin: the problem**
  - Previous research has identified two series sibilant fricatives in Fassa dialects (denti-)alveolar and postalveolar.
  - However, the post-alveolar series have been variously characterized as palatal(ized) or retroflex[2], [3], [4], and no consensus has been reached.

alveolar	post-alveolar
[s, z]	[ʃ, ʒ]? [ʂ, ʐ]?

  - Acoustic recordings of Ladin words are used to investigate the nature of the post-alveolar series.

3. Data Collection

- **Data Collection**:
  - Four speakers spanning three dialects of Fassa Ladin were recorded: Two speakers of Brach (both F), one speaker of Cazet (F), and one speaker of Moenat (M) (age range: 18-35);
  - The recordings were made onto a laptop computer using a head-mounted USB microphone and Praat software at a sampling frequency of 44,100 Hz and saved as a wav file.

- **Materials**
  - Stimuli for this study were drawn from our database acquired in Vigo di Fassa. (Some examples are given in the table below)

	Brach	***Cazet***	***Moenat***
alveolar	6 words; 28 tokens	10 words; 20 tokens	21 words; 41 tokens
	das [da**s**] ‘give 2.SG.PRS’ sauch [sa**s**uk] ‘cricket’	das [da**s**] ‘give 2.SG.PRS’ sauch [sa**s**uk] ‘cricket’	asenz [a**s**ɛn**s**] ‘absinthe’ son [**s**on] ‘sound’
post-alveolar	6 words; 25 tokens	8 words; 16 tokens	39 words; 106 tokens
	dasc [da**ʃ**] ‘give 3.SG.PRS’ scial [**ʃ**al] ‘shawl’	dasc [da**ʃ**] ‘give 3.SG.PRS’ scial [**ʃ**al] ‘shawl’	dasc [da**ʂ**] ‘give 3.SG.PRS’ stolz [**ʂ**tols] ‘proud’

  - Words were embedded in a carrier sentence [ˈdime __ ˈmaria] for Brach and Cazet and [ˈdimo __ ˈMaria] for Moenat (‘say __, Maria’).
  - These analyses are preliminary, since the sibilants were not controlled for syllable position and neighboring vowel quality.

References: [1] Simons, Gary F. & Charles D. Fennig (eds.). 2018. *Ethnologue: Languages of the World, Twenty-first edition.* Dallas, Texas: SIL International. Online version: http://ethnologue.com. **[2]** Heilmann, L. 1955. *La Parlata di Moena*. Bologna: Zanichelli. **[3]** Chiocchetti, A. 2017. Muamenti fonetici e fonematici nel ladino fassano dagli anni ’60 ad oggi. Mondo Ladino (41). 13-90. **[4]** Salvi, G. 2016. Ladin. In The Oxford Guide to the Romance languages, ed.by A. Ledgeway & M. Maiden, pp. 154-168. Oxford University. **[5]** Gu, C. 2002. *Smoothing Spline ANOVA Models*. New York: Springer. **[6]** Gordon, M, P. Barthmaier & K. Sands. 2002. A cross-linguistic acoustic study of voiceless fricatives. *JIPA* 32(2). 141–174.

4. Results and Discussion

- **Analysis:**
  - This study uses SSANOVA[5] to provide a comparative illustration of the acoustic properties of the sibilants;
  - For each token, a 10-ms window in the middle of the sibilant was selected, and the spectral envelope of the window was extracted;
  - SSANOVA models were fitted to the extracted spectral envelopes of the sibilants.

- **Results and Discussion:**
  - *SSANOVA model for each dialect*:

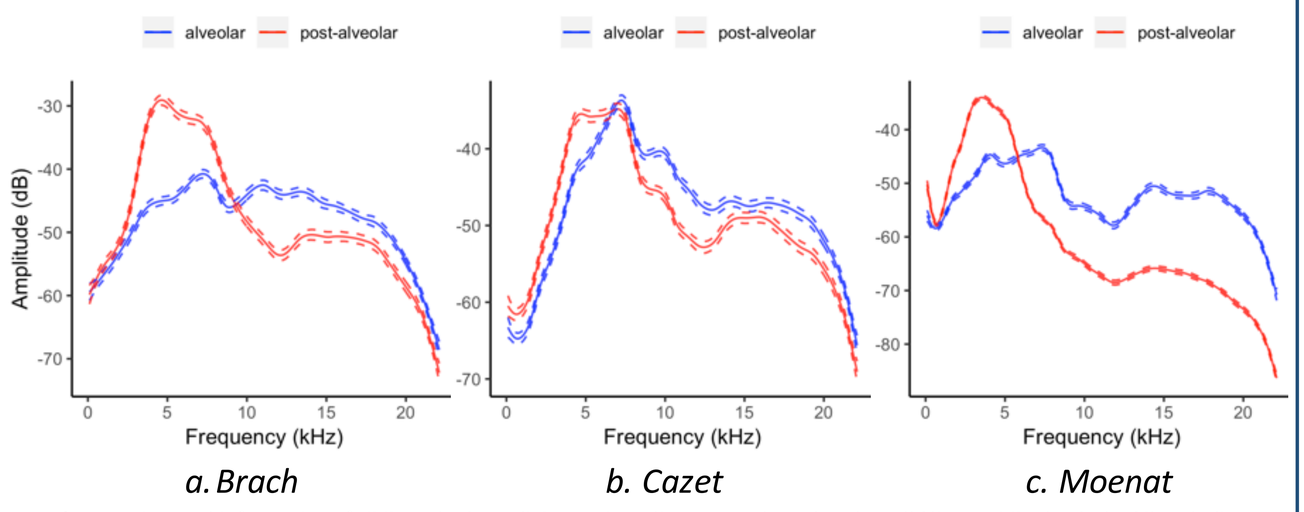


Figure 1. *Spectral information of sibilants in three dialects. The splines were plotted as the solid lines, while the dashed lines indicate the upper and lower boundary of 95% Bayesian confidence interval.*

  - *The interaction plots:* Alveolar (top row) and Post-alveolar (bottom row)

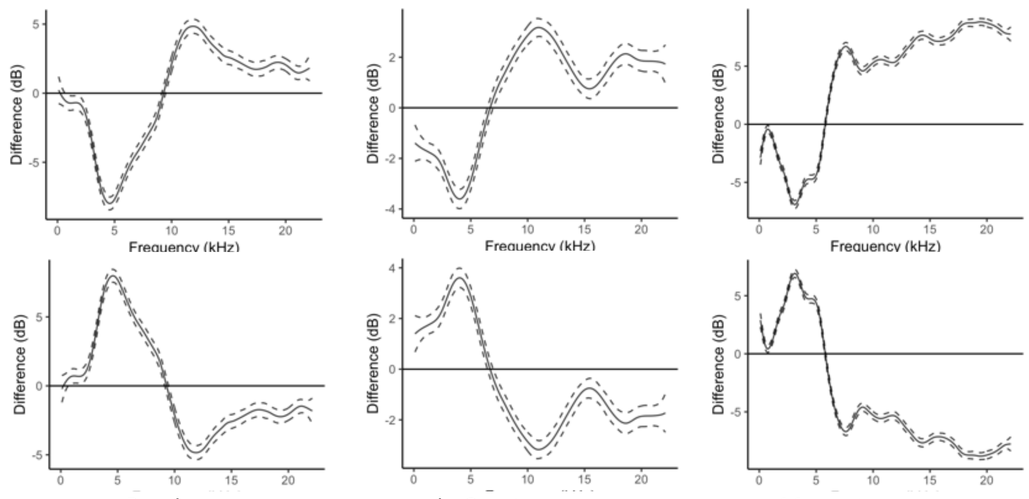


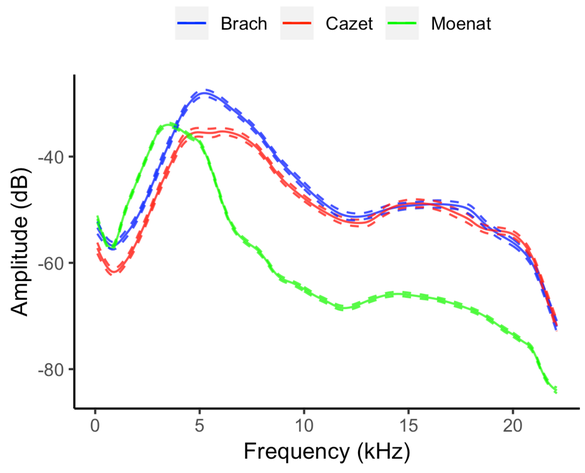
Figure 2. *Interaction effects with Bayesian confidence interval. The dashed lines indicate the upper and lower boundary of 95% Bayesian confidence interval.*

- **Within each dialect**, the spectral envelope of the alveolar sibilant is different from that of the post-alveolar since only a small portion of overlap can be observed between 5 kHz and 10 kHz in Fig.1, indicating the two sounds are distinctive.

- **Across dialects**, the alveolar sibilant in Cazet stands out due to the peak it presents at approx. 7 kHz (Fig.1b): *more retracted* compared to its counterparts in Brach and Moenat and *more similar spectrally to the post-alveolar*.

- **Also for Cazet:** The post-alveolar fricative shows a plateau between around 3.5 kHz and 7 kHz (Fig.1b). It is possible that post-alveolar sibilant has two allophones characterized by two peaks, one at 3.5 kHz and the other at 7 kHz.

  - *Comparison of the post-alveolar in three dialects:*



- **For the post-alveolar series**, the noise energy peak in Moenat has lower frequency compared to the other two dialects, shown in Figure 3, which might indicate a more back and retroflex nature for this sound[6].

Figure 3. *Post-alveolar sibilant in three dialects*

5. Closing Remarks

- The results of our study are suggestive that the three Fassa dialects under study have developed post-alveolar sibilants that are each distinct from one another.
- This research provides a basis for future in-depth investigation into the properties of sibilants in Ladin.

USC University of Southern California
unibz Freie Universität Bozen Libera Università di Bolzano Università Liedia de Bulsan
ALPS Alpine Laboratory of Phonetic Sciences