

# Gradient allophones of Brazilian Portuguese alveolar stops in a dialect contact situation

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The aim of this study is to investigate the effect of the vowel /i/ on the alveolar stops /t/ and /d/ in a contact situation of Brazilian Portuguese (BP), between a dialect that has affrication and another which is undergoing change in the same direction. We present a cross-sectional study of the spectral differences between the allophones involved and a longitudinal study of two speakers of the dialect undergoing change.

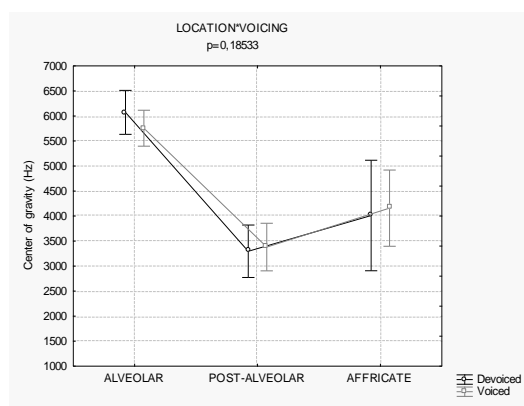
Observations of the phenomenon were motivated by a group of speakers from Jundiaí, who are implementing this change, as a result of commuting between Jundiaí and Campinas. Leite (2010) reports that the dialect spoken in Campinas is considered more prestigious than the dialects of neighboring cities.

The research involved two steps. In the first step, we performed a cross-sectional study in which gradient aspects of the emerging affricates of five male students were analyzed. The corpus consisted of a set of texts with words containing alveolar stops before /i/ (e.g. *sétimo* ‘seventh’ and *código* ‘code’). Recordings of alveolar fricatives /s, ʃ, z, ʒ/ (e.g. *acima* ‘above’, *cochilo* ‘nap’, *cozido* ‘stewed’, *argila* ‘clay’) were also made to compare constriction locations of the noise. The first four spectral moments of the resulting affricates were measured: center of gravity, standard deviation, skewness and kurtosis (Forrest et. al., 1988; Jongman et. al., 2000). Higher center of gravity and standard deviation values and negative skewness and kurtosis indicate alveolar constriction. Such measurements were confronted with analogous measurements of spectral moments of alveolar and post-alveolar fricatives. Repeated measures Analysis of Variance (ANOVA) was run, followed by Tukey’s post-hoc pairwise test.

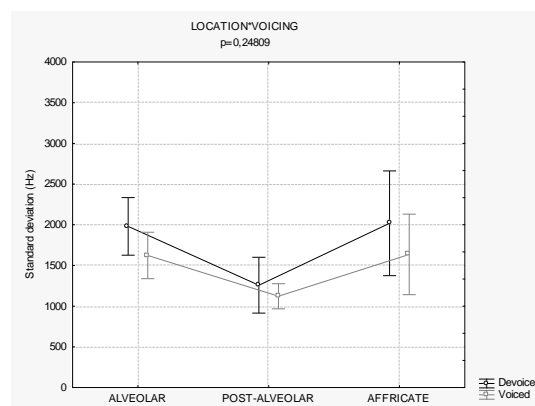
The second part of the study was conducted with two subjects from the same student group (henceforth, S1 and S2). We conducted a longitudinal analysis in which two additional data recordings with both subjects were performed every three months, using the same corpus of the first recording. For each subject, statistical descriptions of the three recordings were compared, in order to observe the consistency of affricate production over time. Conservative speakers were expected to prefer alveolar production, and less conservative ones were expected to prefer post-alveolar production.

The cross-sectional analysis revealed important aspects of variation in the group. As shown in figures 1 and 2, affricate noise can be produced in different locations, according to the parameters that turned out to be the most consistent: center of gravity and standard deviation. Center of gravity indicates a post-alveolar production, while standard deviation indicates characteristic values of the alveolar region. These results show the instability of the noise following occlusion and a large oscillation between the two constriction locations.

**Figure 1:** Center of gravity (Hz) of alveolar fricatives, post-alveolar fricatives and affricates for five subjects

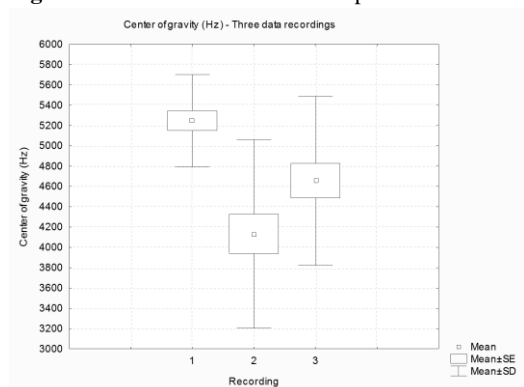


**Figure 2:** Standard deviation (Hz) of alveolar fricatives, post-alveolar fricatives and affricates for five subjects

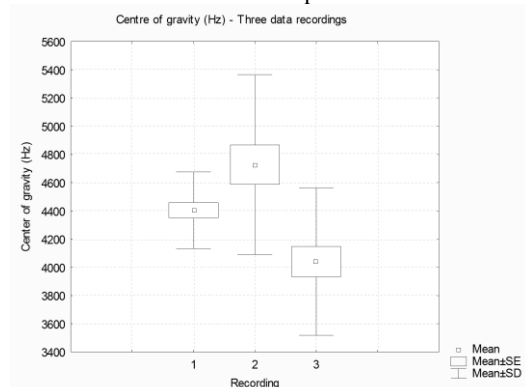


Longitudinal analysis of the two subjects reveals different patterns of change regarding consistency. In S1's third recording, the values of center of gravity, for instance, are more similar to the ones of an alveolar fricative (figure 3), revealing that the effects of exposure to affricates are reversible. S2, on the other hand, seems to be more inclined to dialectal change, despite the instability shown by center of gravity in the second recording (figure 4).

**Figure 3:** Timeline of the first spectral moment for S1



**Figure 4:** Timeline of the first spectral moment for S2



In further analyses, we intend to compare this dialect with others where affricates are the default. Correlation between consonant and vowel durations is also under investigation. Finally, analysis of pole and zero locations of the noise are being considered, as they can help determine the constriction location of the affricates at hand.

According to Ohala (2005), turbulence increases with decreasing constriction area as the tongue moves to the post-alveolar region. For the five subjects, frication has not been fully optimized, that is, it does not yet approach the expected location in the prestigious dialect. This adjustment is still under way, resulting in gradient allophones. The interpretation of these data requires a dynamical view of phonology not only with respect to synchronic variation but also with respect to diachronic change.

## References

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