

## **Degree of voiced stop weakening depends on place of articulation in Buenos Aires Spanish**

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In Spanish spirantization, the voiced stops /b d g/ alternate with a lenited approximant allophone [e.g. [4]]. Acoustic studies have found that the approximant variant weakens to different degrees depending on factors such as stress placement, position of the consonant within a word, and quality of the surrounding vowels ([1], [2], [3], [10]).

Previous work has explored the variability of the approximant allophone in two ways. In the first way, individual productions are categorized into surface realizations using perceptual or visual characteristics of the spectrogram (e.g. [2]). For example, Martínez-Celdrán ([5], [6]) proposes a categorization scheme where approximants may be closed (least weakened), open, or vocalic (most weakened). In the second way, the productions are analyzed acoustically to investigate the effects of factors such as stress and to determine whether weakening is continuous or discrete. The current study uses both approaches to explore the variability of the lenited approximant at all three places of articulation in Buenos Aires Spanish (BAS) with the following aims:

1. To improve our knowledge of interdialectal variation in spirantization by considering BAS, which has not been investigated in this way before;
2. To explore whether the acoustic measure of relative intensity supports the existence of the three subtypes of spirant approximant;
3. To determine if there is any effect of the place of articulation of the voiced stops on the degree of weakening, since many studies do not include all three places (e.g. [3], [10]).

Six native speakers of BAS were recorded reading aloud 60 Spanish tokens containing /b d g/, controlled for stress, target position, and surrounding vowels. First, the data were classified as one of three subtypes of approximant, following Martínez-Celdrán's visual taxonomy ([5], [6]). Second, the productions were analyzed for relative intensity (RI) in decibels (dB), commonly used to quantify degree of lenition (e.g. [10]).

### Results for Aim #1:

The categorization analysis showed that the lenited allophone was realized as the open approximant in 50% of tokens, the relatively less weakened closed approximant in 20% of tokens, and as the relatively more weakened vocalic approximant in 30% of tokens. These findings suggest that BAS might be a more leniting dialect when compared to results for Peninsular Spanish ([6]) and Galician ([7]).

### Results for Aim #2:

Statistical analysis found that the subtypes of spirant approximant all have statistically significantly different RIs, where the mean RI of the closed variant is significantly lower than the open variant (-4.23 dB vs. -2.54 dB,  $p < 0.001$ ) and the mean RI of the vocalic variant was significantly higher than the open variant (-1.60 dB vs. -2.65 dB,  $p < 0.001$ ). This finding suggests that the three subtypes occupy different positions on a continuum of weakening.

### Results for Aim #3:

The categorization analysis also found an asymmetry by place of articulation where the BAS labial was realized as the closed variant significantly more often (41% of tokens) than the

dentals (9%,  $p < 0.001$ ) and velars (11%,  $p < 0.001$ ). This pattern held at the individual level as well, with 5 of the 6 participants producing the closed variant more often for /b/ than for the other places. We appeal to the Aerodynamic Voicing Constraint ([9]) to argue that this asymmetry is due to differences in the aerodynamics of maintaining voicing in labials as compared to other places. To maintain voicing, voiced stops frequently shorten and as a result, spirantize ([8]). Labials can maintain voicing without shortening their duration as much as dentals and velars due to a larger surface of compliance, which allows expansion of the vocal tract. An aerodynamic account of this asymmetry is consistent with previous work that has found that the closed variant is longer than its weaker counterparts ([6], [7]).

This study contributes to our understanding of the nature of phonetic variation and to the body of knowledge about dialect variation in Spanish.

## References

- [1] Carrasco, P., Hualde, J. I., & Simonet, M. (2012). Dialectal differences in Spanish voiced obstruent allophony: Costa Rican versus Iberian Spanish. *Phonetica*, 69(3), 149–179.
- [2] Colantoni, L., & Marinescu, I. (2010). The scope of stop weakening in Argentine Spanish. In *Selected Proceedings of the 4th Conference on Laboratory Approaches to Spanish Phonology* (pp. 100–114).
- [3] Cole, J., Hualde, J. I., & Iskarous, K. (1999). Effects of prosodic and segmental context on /g/-lenition in Spanish. (O. Fujimura, B. D. Joseph, & B. Palek, Eds.), *4th International Linguistics and Phonetics Conference*.
- [4] Harris, J. (1969). *Spanish phonology*. Cambridge: MIT Press.
- [5] Martínez-Celdrán, E. (2004). Problems in the classification of approximants. *Journal of the International Phonetic Association*, 34, 201–210.
- [6] Martínez-Celdrán, E. (2013). Caracterización acústica de las aproximantes espirantes en Español. *Estudios de Fonetica Experimental*, 22(1), 11–35.
- [7] Martínez-Celdrán, E., & Regueira, X. L. (2008). Spirant approximants in Galician. *Journal of the International Phonetic Association*, 38(01).
- [8] Ohala, J. J. (1997). Aerodynamics of phonology. *Proceedings of the 4th Seoul International Conference on Linguistics [SICOL]*, 1–6.
- [9] Ohala, J. J., & Riordan, C. J. (1979). Passive Vocal Tract Enlargement During Voiced Stops?. In J. L. Wolf & D. H. Klatt (Eds.), *Speech Communication Papers* (pp. 89–92). New York: Acoustical Society of America.
- [10] Ortega-Llebaria, M. (2004). Interplay between phonetic and inventory constraints in the degree of spirantization of voiced stops: Comparing intervocalic /b/ and intervocalic /g/ in Spanish and English. In T. L. Face (Ed.), *Laboratory Approaches to Spanish Phonology* (pp. 239–253). Berlin: Mouton de Gruyter.