

The Nose Knows: Differences in nasal and nasalized vowels as produced by native and L3 speakers of Brazilian Portuguese



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BACKGROUND

- Spanish and Portuguese, although related, diverge in their phonological inventory
 - Portuguese has a larger vowel inventory than Spanish and contrastive nasal vowels
 - e.g. *la* [la] 'there' and *lã* [lɛ̃] 'yarn'
 - Vowel nasality only allophonic in Spanish
 - e.g. *pan* [pã] 'bread' and *bien* [bjɛ̃] 'well'; no minimal pairs
- Previous work has established acoustic and articulatory differences between nasal and nasalized vowels
 - Chen (1997):** Measures of A1-P0 and A1-P1 revealed differences in nasality in English nasalized vowels and French nasal vowels, especially at onset
 - Fails (2011):** Nasal airflow measures were greater for Brazilian Portuguese (BP) nasal vowels than Mexican Spanish vowels, except *ĩ*
 - Medeiros (2011):** Nasal airflow measures were greater in BP nasal vowels than nasalized (optional nasality) vowels; nasal airflow began sooner in nasal vowels
 - Aly Bailey (to appear):** Spanish-English bilinguals (L3 BP) produced BP nasal vowels with longer durations than Spanish nasalized vowels, but similar formant frequencies

RESEARCH QUESTIONS

- Do native and L3 BP speakers (L1 Spanish/L2 English) have similar levels of nasalization (as determined by A1-P1/P0) when producing BP nasal vowels?
- Do L3 BP speakers produce BP nasal vowels and Spanish nasalized vowels with similar levels of nasality?

PARTICIPANTS

- L1 BP speakers ($n = 11$)
 - 6 males, 5 females
 - From northwest, southeast, and southern regions of Brazil
- L3 BP speakers ($n = 4$)
 - 2 males, 2 females
 - Peninsular, Caribbean, and Latin American origin

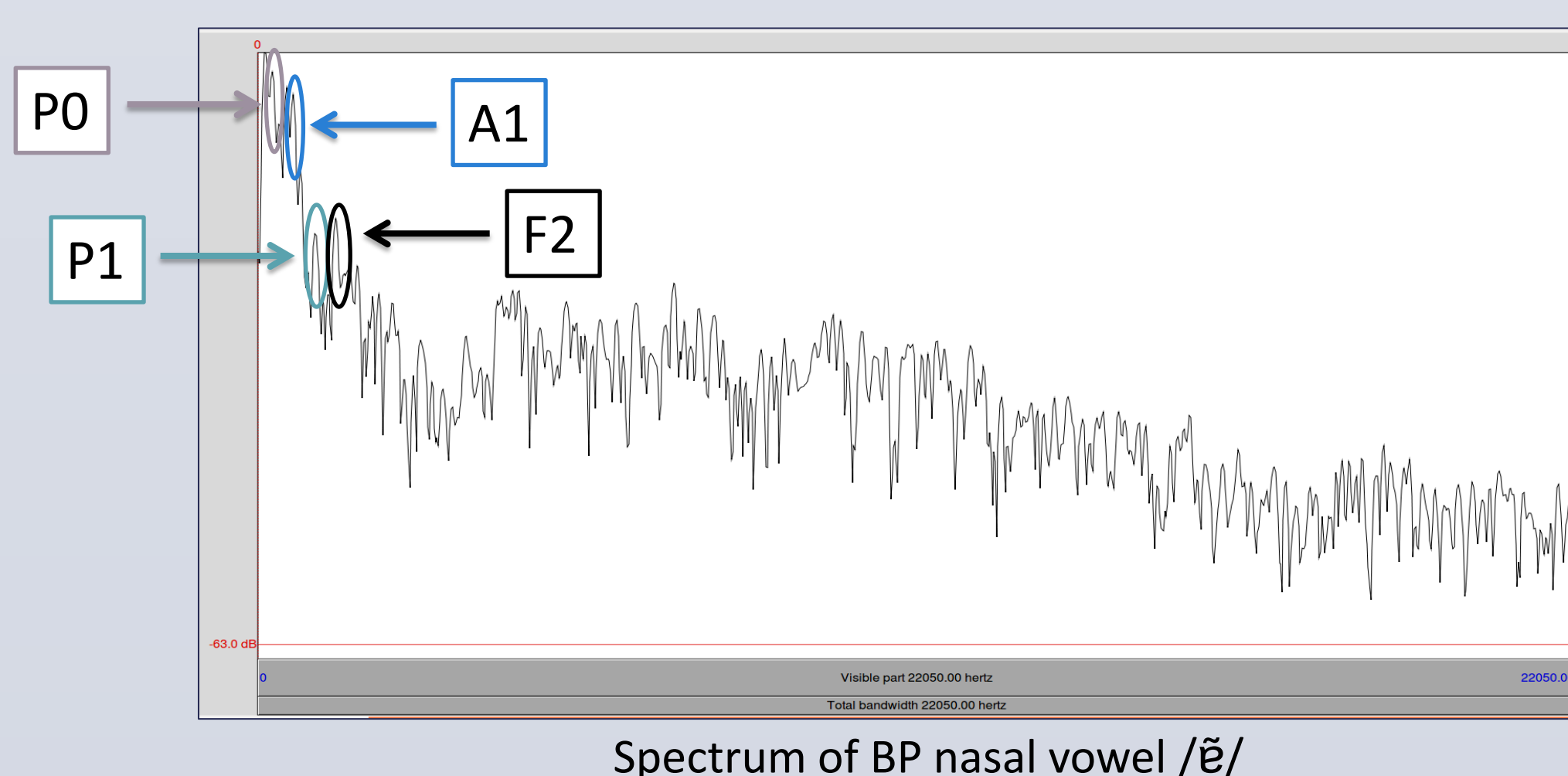
EXPERIMENT

Tasks

- Paragraph with Spanish tokens (nasalized vowels, $n = 5$)
 - Completed by L3 speakers only
- Sentences with Portuguese tokens (nasal vowels, $n = 10$)
- Carrier sentence with Portuguese tokens
 - Tasks 2 and 3 completed by all participants
 - Total tokens analyzed, $n = 610$

Data analysis

- Acoustic analysis: *Praat* (Boersma and Weenink 2013)
 - Script to measure A1-P0 and A1-P1 at three equidistant points in target vowels



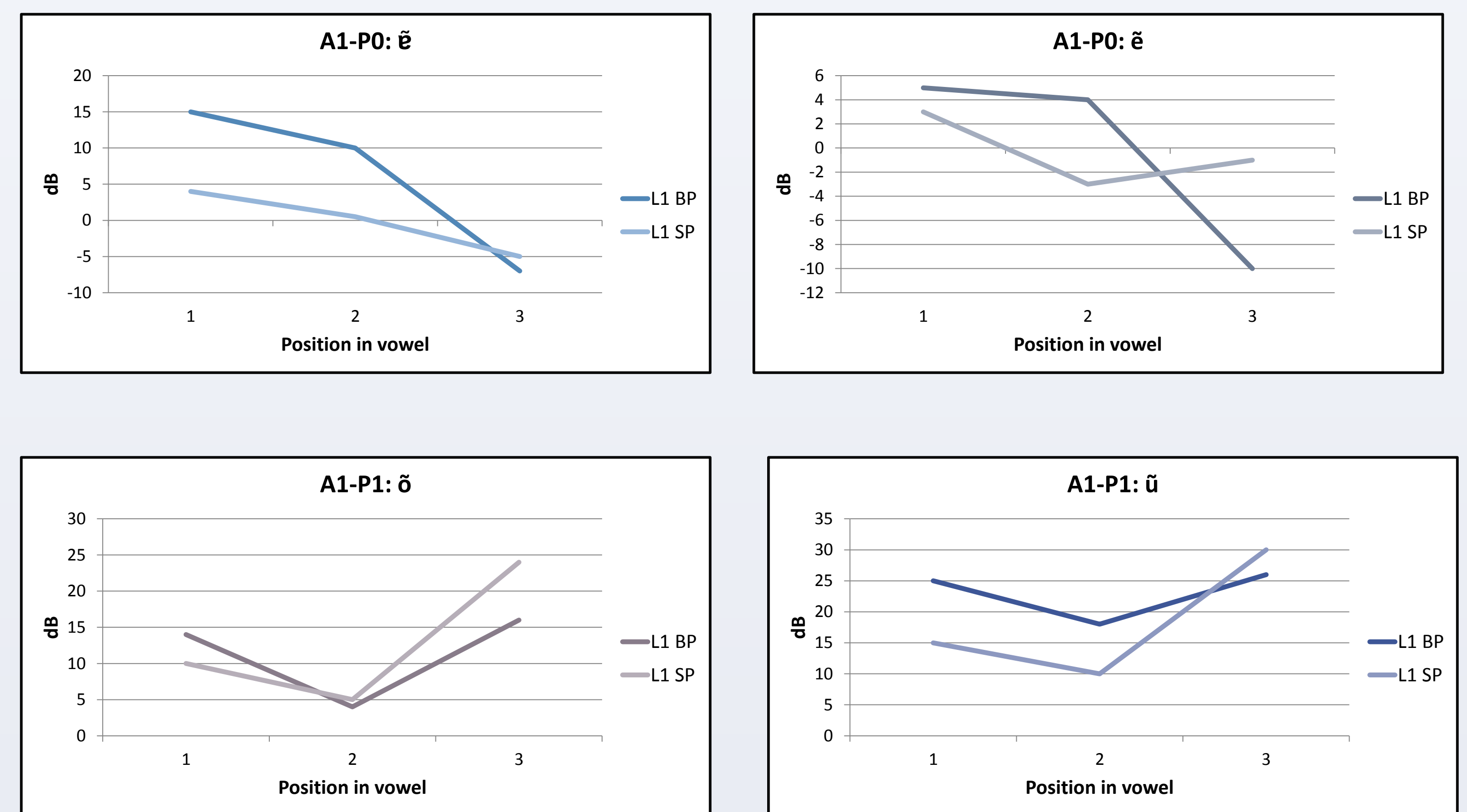
- A1: Amplitude of first formant (F1)
- P0: Amplitude of extra formant before F1
- P1: Amplitude of extra formant between F1 and F2

- Statistical analysis: *Stata*, version 12

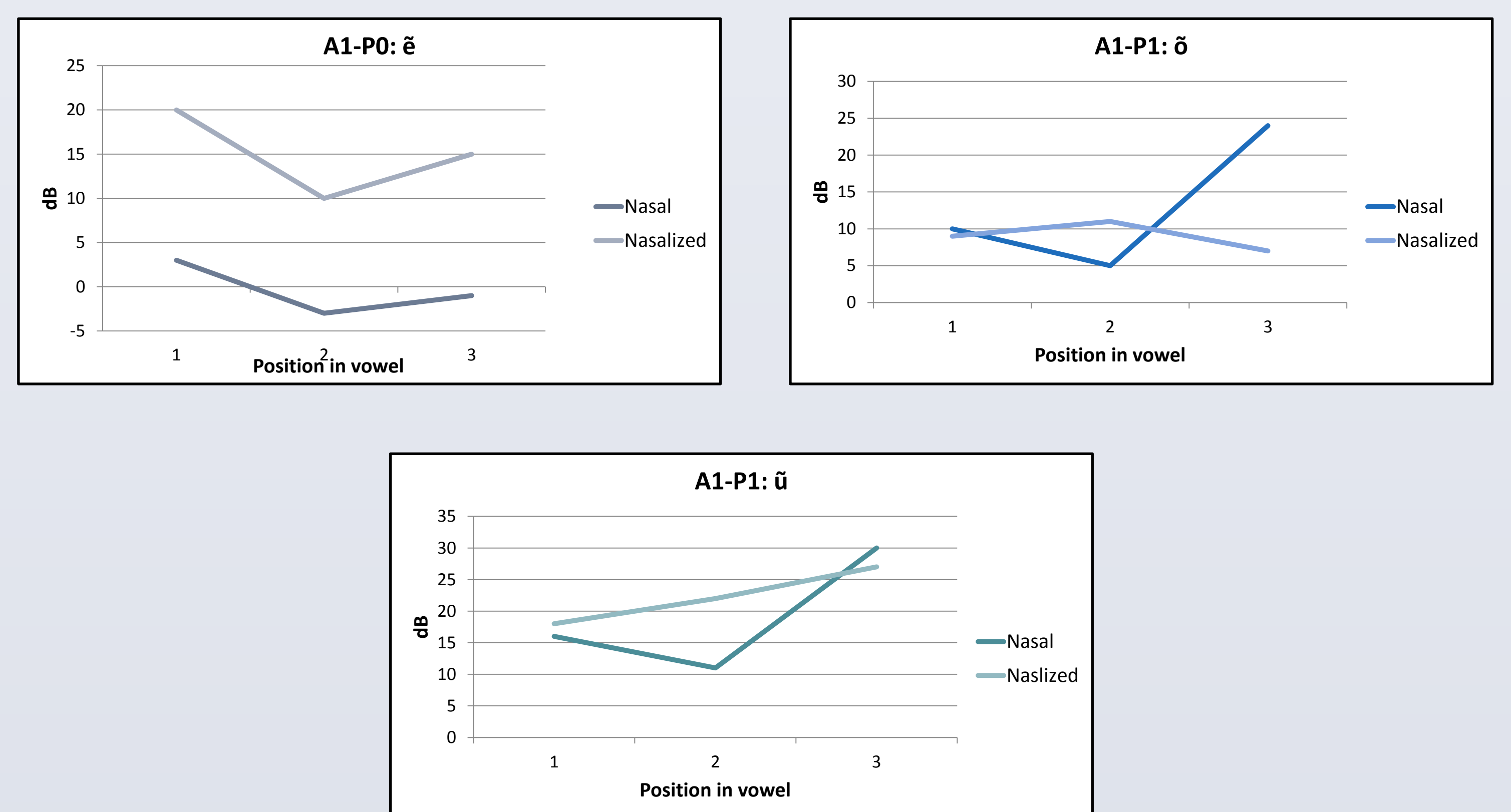
- Linear mixed models
 - Dependent variables: A1-P0, A1-P1
 - Fixed effects: L1 (between groups), nasal/nasalized vowel (within L3 BP group), vowel, time-point in vowel
 - Random effect: Speaker

RESULTS

Both L1 groups: Differences in BP nasal vowels



L3 BP group: Differences in Spanish (nasalized) and BP (nasal) vowels



DISCUSSION AND IMPLICATIONS

- Between L1 differences in nasality seen for all vowels except /ĩ/
 - Fails (2011) found that /ĩ/ had the highest levels of nasality in Spanish
 - Possible source of positive transfer in L3 production for participants
- Nasal/Nasalized differences
 - Differences in nasality seen for /ẽ/, /õ/, and /ũ/
 - /ĩ/: similar levels of nasality in nasal and nasalized; corroborates Fails (2011)
 - [ã] and /ẽ/: L3 speakers are not yet making this distinction
- Implications for acquisition and underlying types of vowels
 - Between and within-group differences show evidence of interlanguage forms for L3 speakers
 - L3 speakers produce BP vowels with different levels of nasality when compared to L1 speakers and differently from Spanish nasalized vowels
 - The nasal and nasalized vowels measured, like in Chen (1997), seem to have different acoustic targets due to their underlying functions (phonemic vs. allophonic)

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