Vowel height variation due to prosodic strengthening

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Vowel reduction is one of the most noticeable characteristics of the unstressed vowel system of Galician [9]. This reduction yields the neutralization of mid-high and mid-low vowels in both front and back mid vowels, /e/-/ɛ/ and /o/-/ɔ/. However, some authors [7, 8] pointed out that there is an exception to this reduction process that leads to the lowering of word initial mid vowels of neologisms (i.e. [ɛˈlɛktɾikʊ] *electric*, [ɔˈβeʁʊ] *overweight*) which contrasts with the traditional mid-high vowels in such position (i.e. [o̝ˈβeʌ̯ą] *sheep*, [e̝ˈsowtɾʊs] *those others*) [9]. Moreover, it seems that there is some variation on the degree of lowering, and speakers reveal having a certain degree of uncertainty in their production of unstressed word-initial vowels. Despite the effort made by some authors to describe this exception the reason for the lowering of the initial vowels remains an unsolved question.

Prosodic constituents are domains of application for some phonological rules [3]. Furthermore, some authors have investigated variation within the edges of prosodic domains, and they found domain-initial strengthening for consonants [4] and vowels [5] in different languages. This leads us to consider that the position of the segment within the prosodic domain can affect vowel articulation in Galician, causing the aforementioned lowering.

The aim of this research is to examine domain-initial strengthening for word-initial vowels at the beginning of different prosodic domains, namely: prosodic word, phonological phrase, intonational phrase and phonological utterance. The hypothesis we propose is that initial boundary position in the prosodic domain will trigger the strengthening of the initial vowel.

In order to verify our hypothesis, a production experiment with eleven female native speakers of Galician has been carried out. Speakers read a series of statements where the tested vowel ([e], [ɛ], [o] and [ɔ]) appeared in a [V'CVCV] structure at the beginning of the aforementioned prosodic domains. Vowel segments were acoustically analyzed, considering F1 and F2 as they are the primary cues concerning the vowel height contrast. Data was then normalized using the Lobanov method [1]. A linear mixed effect analysis (LMM) of the relationship between the formant values –F1 and F2– and prosodic domain has been performed in R with *lme4* [2] for each vowel, with an intercept for participant as a random factor. A intercept-only models were carried out since it takes account for the residual error related to the subject without overfitting the model [6].

Results show a significant main effect of *domain* in both the F1 and the F2 for the four vowels (Figures 1 and 2). Pairwise comparisons reveal that the higher the prosodic domain is in the hierarchy, the higher the F1, meaning a gradual lowering. Moreover, for the front vowels, the higher the prosodic domain, the higher the F2, whereas for the back vowels, the higher the prosodic domain, the lower the F2, meaning more extreme realizations within the higher domains (Figure 2). In spite of those trends, the prosodic word has not behaved consistently.

Those results have several implications on the phonological processes related to the unstressed vowel system of Galician. On the one hand, they do not support the existence of seven phonological unstressed initial vowels, as various authors stated. However, it seems that there is a neutralization towards the mid-high vowel, at least for the mid back vowels. Furthermore, results show that there is phonetic variation within unstressed mid front and mid back vowels which is triggered by the prosodic structure.

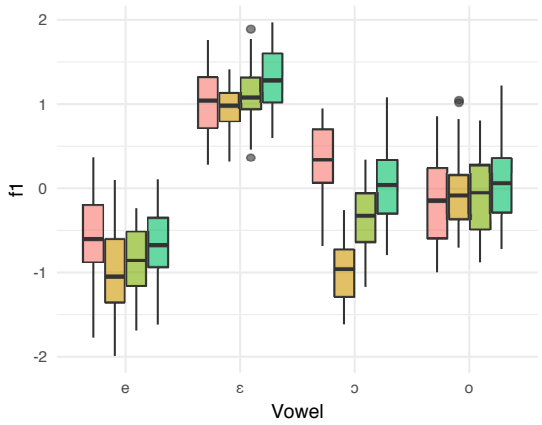

Figure 1a. Boxplots showing F1 values for each vowel within the initial boundary of four prosodic domains tested.

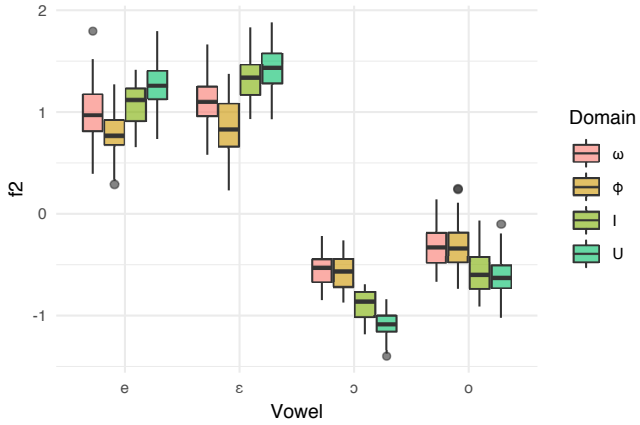

Figure 1b. Boxplots showing F2 values for each vowel within the initial boundary of the four prosodic domains tested.

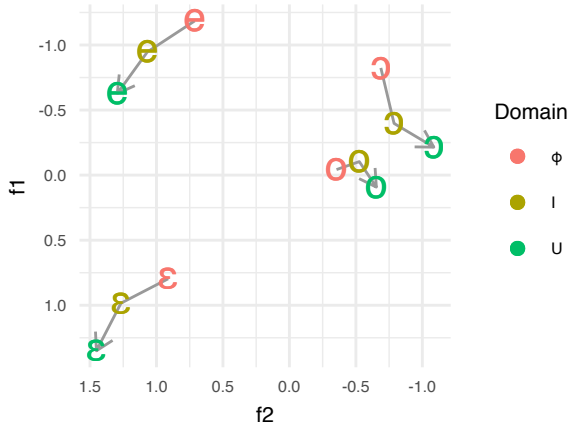

Figure 2. Average normalized F1 and F2 frequencies for each vowel and domain (excluding the prosodic word).

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