Patterns of vowel laxing and vowel harmony in Peninsular Spanish
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Vowel harmony is a process whereby vowels in a particular morphological or prosodic domain agree in one or more phonological features. Vowel-to-Vowel (V-to-V) coarticulation, a universal property of speech, is generally understood as the natural phonetic motivation for processes of vowel harmony (Öhman, 1966; Beddor et al., 2002). The impetus for this project is to understand whether processes of vowel harmony and/or V-to-V coarticulation are at work in two varieties of Peninsular Spanish. Specifically, Eastern Andalusian Spanish (spoken in southeastern Spain) is claimed to exhibit vowel harmony in contexts in which word-final /s/ deletion triggers a vowel quality change in the word-final vowel (V2) as well as in the preceding vowel (V1). Thus, words like /nenes/ ‘boys’ and /konos/ ‘cones’ would be pronounced as [nene] and [konə], respectively. However, the descriptive and theoretical literature is inconsistent on which vowels participate in word-final laxing, which vowels trigger and participate in the harmony process, and whether word-final laxing derives from a more general laxing process common to CVC syllables (e.g., Zubizarreta, 1979). Additionally, to our knowledge there is no comprehensive phonetic study of laxing/harmony processes in Spanish. With these motivations in mind, we collected data from speakers of two varieties of Peninsular Spanish: Eastern Andalusian Spanish (EAS) and North-Central Peninsular Spanish (NCPS). We devised the following research questions, addressed in two experiments: 1.) For speakers of EAS and NCPS, which vowels undergo laxing in V2 position in <V1CV2s> words? If there is laxing, do speakers produce such vowels based on functional motivations (i.e., to mark plural /s/) (e.g., Kiparsky, 1972)? 2.) For speakers of EAS and NCPS, which vowels exhibit vowel quality shifts in V1 position when followed by a lax vowel in <V1CV2s> words?

Twelve EAS speakers (from Granada, Spain) and twelve NCPS speakers (from Salamanca, Spain) participated in two experiments in which they read aloud carrier phrase sentences with bisyllabic test words. In Experiment 1 we measured F1 and F2 values in V2 (i.e., word-final) position based on two experimental factors. The first factor was V2 (/a e i o u/), in order to determine which vowels undergo laxing in /s/-final words. The second factor was WORDCONDITION, in order to determine the effect of the morphological status of /s/ on vowel quality. There were four conditions: 1) singular, vowel-final (e.g., nene ‘boy’); 2) plural, no article (e.g., nenes ‘boys’); 3) plural, with article (e.g., los nenes ‘the boys’); and 4) singular, /s/-final (e.g., jueves ‘Thursday’). We extracted F1 and F2 at midpoint and normalized data using the Lobanov procedure. For F1, the LMEM returned an effect of the 3-way interaction V2 X WORDCONDITION X DIALECT. Figure 1 shows that EAS speakers lower /a e o/ (i.e., higher F1) in WORDCONDITIONs 2, 3, 4 (i.e., /s/-final words) compared to 1. For F2 the LMEM returned an effect of the 2-way interaction V2 X WORDCONDITION, implying that both dialects behaved similarly on this measure. Figure 2 shows that speakers produce a more fronted /a/ (i.e., higher F2) and a more centralized /e/ (i.e., lower F2) in WORDCONDITIONs 2, 3, 4 compared to 1. Overall, these data indicate that EAS speakers lax /a e o/ in /s/-final words, whereas NCPS speakers exhibit patterns in the direction of laxing for /a e/.

The same 24 speakers participated in Experiment 2, for which we extracted F1 and F2 values from V1 in a new set of bisyllabic test words. We created the test words based on three factors: V1 (/a e i o u/); V2 (/a e o/); and NUMBER (singular, plural). For both F1 and F2 the LMEMs returned significant effects of the 4-way interaction V1 X V2 X NUMBER X DIALECT. The distributional results, illustrated in Figures 3 and 4, show that for both speaker groups the point vowels /a i u/ display stable F1 and F2 values in singular vs. plural words. More important to our research, /e o/ show differential behavior in EAS vs. NCPS. In NCPS /e/ and /o/ remain stable in V1 position regardless of V2 and of NUMBER. However, in EAS when V1 is /e/, it lowers and centralizes in the plural (compared to the singular), whereas when V1 is /o/ it lowers only. Moreover, when /e/ and /o/ occupy V1 position in the plural, they do not consistently agree at the phonetic level with V2. For example, /e/ exhibits F1 and F2 shifts in V1 position when preceding a V2 /o/ (which exhibits an F1 shift only). These data are suggestive of a phonologized harmony process that operates over abstract cognitive categories and that has moved beyond phonetic V-to-V coarticulation. The fact that both F1 and F2 shift in V1 even when only one of them does so in V2 is evidence for this. Finally, we note certain incongruities for /a/: it laxes in V2 (Exp. 1) and also triggers harmony in V2 (Exp. 2), but does not harmonize when it occupies V1 position (Exp. 2).
To conclude, our results suggest that neither laxing nor harmony is motivated by functional considerations—i.e., these processes do not happen in order to compensate for the loss of the morphological /s/. First, laxing occurs when /s/ is lost from monomorphemes as well as from plurals. Second, laxing also occurs when the plural is marked by other words (i.e., articles) in the sentence. Our data from Experiment 2 reveal that harmonized mid vowels constitute a category change from tense to lax vowels rather than a phonetic assimilation process with word-final vowels. Altogether, we would argue that the sound changes involving vowel laxing and harmony were not introduced to mark the plural after the loss of the /s/. However, because /s/ has been lost, EAS appears to co-opt the pre-existing, independently motivated laxing/harmony patterns as a plural marker.