

Directionality in Production Planning: Cross-word hiatus resolution in Spanish

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Production planning models account for phonological variation by predicting that sandhi phenomena occur more often when the words involved are easier to plan (e.g. Patterson and Connine 2001, Wagner 2012). This is because the phonological context required for the process will be known earlier, so flapping a word-final /t/ in English before a vowel-initial word applies more often when the following word is frequent because the speaker has retrieved the phonological structure of the second word early enough to realise a flap instead of a stop (Wagner 2012). We see the same pattern for liaison in French, where a final consonant that's only realised when the following word starts with a vowel is pronounced more often when both words are frequent (Kilbourn-Ceron et al., to appear). Though the evidence for production planning explanations of variation is increasingly robust, the cases examined all involve looking at how a first word is influenced by the structure of a second word without comparing this to a case where it's the second word that alternates (e.g. Wagner 2012, Kilbourn-Ceron et al. 2016).

We look at a case where a sandhi phenomenon could apply in the first or second word: cross-word hiatus in Spanish. In *la escuela* 'the school', /ae/ can be realised as [a] (V2 deletes), as [e] (V1 deletes), or faithfully as [ae] (e.g. Garrido 2013, Vuskovich 2006). Production planning predicts that the frequency of the first and second words can be associated with V1 deleting more (the context is more likely to be known), but it does not have clear predictions for V2 deleting (the context is always known when the vowel would be realised). In this paper, we aim to determine whether V1 and V2 are subject to the same types of frequency effects.

To test production planning, we extracted 8600 tokens /a#e/ and /e#a/ where there was no punctuation between the words in the transcription, all produced by 35 native Spanish speakers in the Nijmegen Corpus of Conversational Spanish (Torreira and Ernestus 2010). We examined the automatic classification by the PraatAlign aligner (Lubbers and Torreira 2016; with a rule for vowel deletion in hiatus contexts) using mixed-effects logistic regression with by-word and by-speaker random slopes and intercepts. In this paper, we focus on frequency and identity effects.

We find that /a/ is less likely to delete than /e/ ($p < 0.0001$) and that V2 deletes less often than V1 ($p = 0.004$), with no significant effect of vowel stress ($p = 0.392$). Deletion is significantly more likely when the words are frequent ($p < 0.0001$ for word 1, $p = 0.003$ for word 2) and V1 in a frequent first word is particularly likely to delete ($p < 0.0001$). Word 2's frequency interactions are only significant when they include the identity of the vowel, increasing the probability of deleting /e/, regardless of whether /e/ is in word 1 or word 2 ($p < 0.0001$ for both).

The vowel effects we find are consistent with those observed by Garrido (2013), who found that /a/ deletes less often than /e/. More importantly, our results are consistent with production planning predictions, since word 1's frequency increases the effect of word 2's initial vowel early in the sequence and of word 1's vowel later in the sequence. Interestingly, vowel 1 deleting is based on having planned upcoming context and so frequency effects are expected, but when deciding whether to realise vowel 2 or not the context is expected to already be planned because the other vowel in the hiatus sequence precedes vowel 2. The interaction with frequency that is found in our data suggests that deleting the second vowel is planned relatively early because otherwise the frequency of the first word might not have mattered. This implies that alternations occurring in the first or second word in sandhi processes may be sensitive to similar factors, but that there are asymmetries in the likelihood of deletion for each vowel, suggesting that vowel recoverability or other factors may play a role.

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