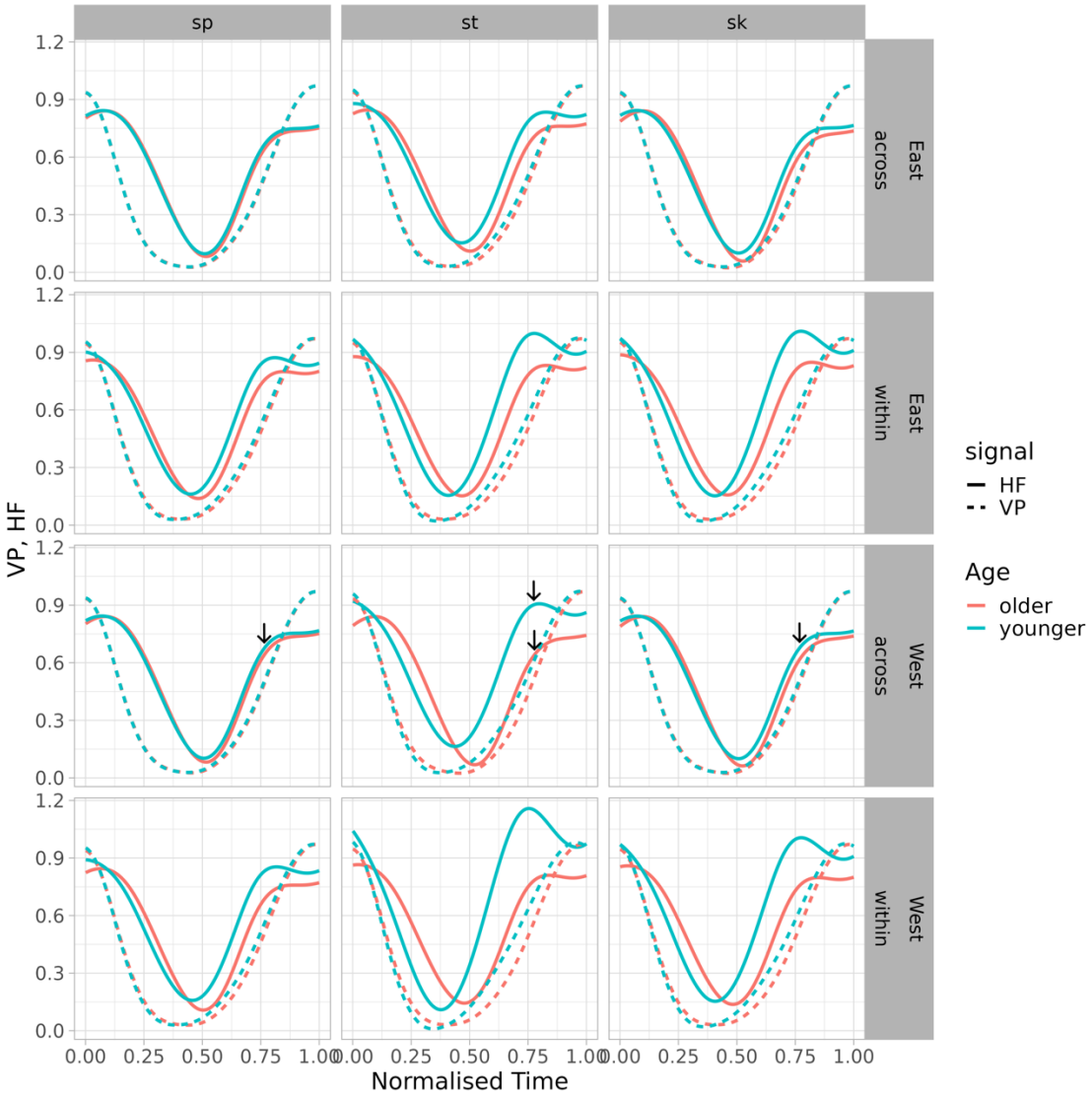
From post-lexicality to phonologization: Andalusian /s/-aspiration at the word boundary

The present study is concerned with a type of metathesis found in Andalusian Spanish (AS) in which, especially for younger speakers, pre-aspiration in /sC/ sequences (C, a voiceless stop /p, t, k/) has increasingly metathesised as post-aspiration: thus e.g., *pasta*, standard Spanish /pasta/; in AS: [pa^{h}ta] → [pat^{h}a, pat^{s}a] (Torreira, 2007; Ruch & Harrington, 2014). For almost all experimental investigations of this sound change, the focus has been on isolated words (Parrell, 2012; Ruch & Harrington, 2014). The new angle in the present study is to analyse whether there is evidence of post-aspiration across word-boundaries (*las tapas* 'the tapas' → [lat^{h}apah]). The purpose of doing so is to assess the extent to which this sound change in progress has been lexicalised. Thus, according to proponents of a modular feedforward architecture (Bermúdez-Otero & Trousdale, 2012; Ramsammy, 2015; Fruehwald, 2017) and the closely related lexical phonology framework (Kiparsky, 1982; 2015), sound change proceeds strictly bottom-up from least to more abstract domains. According to these models, sound change in its initial stages is post-lexical and during its life-cycle subsequently applies in increasingly narrower domains as it is lexicalised. We sought to determine whether AS stop post-aspiration occurred word-initially i.e. following a preceding underlying /s/: if so, this would point to AS post-aspiration being post-lexical, and thus not phonologized.

We analysed 7063 phonological /VsCV/ sequences of read speech of 48 speakers from Granada and Seville separated in two age groups (20-36 and 55-79 years), i.e. 12 speakers for each region/age group combination. These involved both word-medial /sC/ clusters as well as /s#C/ clusters divided by a word boundary. Two acoustic signals were extracted for these sequences: (i) the amplitude of high-frequency energy (HF) above 3 kHz and (ii) the probability of voicing (VP). The first of these was used for detecting the aperiodic, high-frequency energy that is typical of aspiration; the second for detecting voicing during the closure. Both these signals were input to functional principal components analysis (Gubian et al., 2015) which results in (i) a set of K principal components (PC_1... PC_K) that describe the different kinds of variation in the signals' shapes across the entire data set and (ii) PC-scores that in combination with the PCs can be used to reconstruct smoothed versions of the original signals. The smoothed signals reconstructed from PC_1 are shown in Fig. 1. This PC captured the trade-off between pre- and post-aspiration due to the timing of the closure. Focusing firstly on /st/ in the central column, the reconstruction clearly shows greater post-aspiration for younger than for older speakers in all cases, as shown by the difference between the blue and red solid lines at around $t = 0.75$. This apparent-time difference confirms the sound change in progress whereby /st/ clusters are increasingly post-aspirated in Andalusian. For /sp, sk/ (left and right columns), there were also such age-dependent post-aspiration differences but only word-internally (rows 2 and 4) and not across word-boundaries (rows 1 and 3). A mixed model with PC_1-scores as the dependent variable and fixed factors for word boundary (present or not), age, region, cluster followed by *post-hoc* tests showed significant differences between young and old for /st/ and /s#t/ in the most advanced Western AS, but only for /sp/ and for /sk/ and not for /s#p/ nor /s#k/.

Compatibly with a modular feedforward architecture, these results might suggest that post-aspiration has been lexicalized in /sp, sk/ ahead of /st/ given that for /sp, sk/ there are age differences within, but not across, word boundaries. But this interpretation is incompatible with evidence showing that /st/ led this sound change (Ruch & Harrington, 2014). Alternatively, following an episodic model of speech (Pierrehumbert, 2002), post-aspiration occurs word-internally for all places of articulation in younger speakers because they have experienced and memorized word episodes containing post-aspiration in all three contexts. However, exemplar theory on its own cannot easily explain why post-aspiration should then only be manifested across word boundaries in /s#t/. Various hybrid solutions between these models will be discussed, taking into account the great perceptual salience of a /t/ release in continuous speech.

Figure 1: HF and VP signals reconstructed using PC1 and mean s1 values for each factor combination of age, region, cluster type & context (within / across word boundary).



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