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: [paθta] → [paθa, paθa] (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’ → [latθapah]). 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 (PC1... PCK) 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 PC1 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-externally (rows 2 and 4) and not across word-boundaries (rows 1 and 3). A mixed model with PC1-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-externally 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).

References