Ahead but not faster: the effect of high token frequency on sound change

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The impact of lexical frequency on phonetic implementation has been argued to support Exemplar Theory in the following way (Bybee 1998, 2002; Pierrehumbert 2001, 2002):

(a) Synchronically, high-frequency words exhibit more coarticulation and reduction than low-frequency items (e.g. Dinkin 2008, Gahl 2008, Myers & Li 2009).
(b) This is because, in diachronic processes of lenition, frequent words change at a faster rate than infrequent ones.
(c) In turn, this is because high-frequency items suffer greater exposure to phonetic biases in production and perception than low-frequency items, and the effects of this difference are directly registered in phonetically detailed lexical representations.

However, hypothesis (b) has not been corroborated by actual diachronic observations in real or apparent time; this includes Hay & Foulkes (2016), whose interpretation of the data is unconvincing. Also, (a) does not logically entail (b): as acknowledged by Hay *et al.* (2015), frequent items can be ahead of infrequent ones, and yet change at the same rate. In such a scenario, the impact of frequency gives rise to a **constant rate effect** (CRE) (Kroch 1989): when modelled as logistic functions, the curves of change for high- and low-frequency items exhibit different intercepts but equal slopes. The existence of CREs in phonology was established by Fruehwald *et al.* (2013); see also Zellou & Tamminga (2014). As regards (c), the empirical predictions of Exemplar Theory remain unclear: in the simplest models, the inertia of a large exemplar cloud cancels out the effects of more frequent exposure to phonetic bias (Sóskuthy 2014).

We challenge (b) with evidence from a CRE in /t/-glottalling in Manchester, UK. Token frequency has a strong effect on /t/-glottalling, but there is no significant difference in the diachronic growth rates of glottalling in high- and low-frequency words. We demonstrate this statistically using LOESS-smoothers, mixed-effects logistic regression, and Kauhanen & Walkden's (2015) mathematical model of the CRE. Our data come from a sociolinguistically stratified sample (62 speakers born 1926-1985; 9,187 tokens of /t/ auditorily coded). Figure 1 shows that changes in apparent time for high- and low-frequency items are not significantly different. Figure 2 shows Kauhanen & Walkden's CRE model, which uses time-invariant contextual biases to derive context-specific curves from a single logistic growth function for all contexts (i.e. all frequency bins). Fitting this more constrained model, with the CRE built in, leads to no increase in error over independent logistic curves.

Furthermore, generalized mixed-effects logistic regression shows that an interaction between Zipf-scaled frequency (SUBTLEX-UK; van Heuven *et al.* 2014) and birthyear does not improve on a model without the interaction. We conclude that the evidence favours a scenario where high- and low-frequency words change at the same rate, thus providing support for a CRE in Manchester /t/-glottalling.

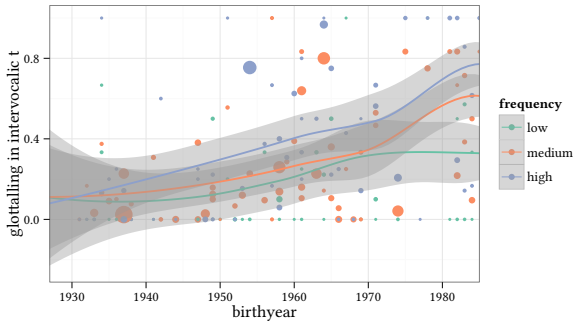

Figure 1

The absence of evidence for (b) suggests that alternatives to (c) should be considered. Frequency-driven CREs are consistent with modified versions of classical modular architectures in which neogrammarian innovation is effected through change in phonetic implementation rules referring to phonological categories in surface representations, whilst the impact of frequency is produced by orthogonal mechanisms (e.g. cascading activation, listener-modelling).

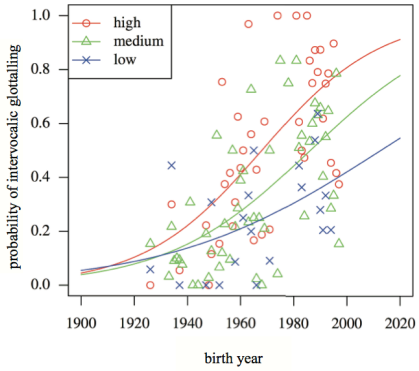

Figure 2

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