To err is human – Rich memory language models and *t*-glottalisation in English

The aim of this paper is to compare rich memory and minimal memory models in the description of *t*-glottalisation. It will be argued that rich memory models are able to provide a more elegant and parsimonious account of it.

The process of *t*-glottalisation is a complex diachronic change in the South of England, resulting in the (variable) loss of place of the fortis coronal stop in all environments except word-medially, before a stressed vowel. Both diachronic and apparent time studies (Altendorf, 2003; Fabricius, 2000) suggest that it started word-medially before a consonant, and subsequently spread to word-final pre-consonantal and then word-final pre-vocalic environments. Given the prevalence of fortis stop pre-glottalisation in the relevant dialects and the relative weakness of the coronal stop, pre-consonantal loss of place is phonetically motivated (Harris, 1994). Its occurrence before vowels, however, is not. An analysis of the phenomenon has to account for its presence there, as well as for the fact that in apparent time studies, word-final pre-consonantal *t*-glottalisation is always larger in extent than word-final pre-vocalic, and never *vice versa*.

A minimal memory model – operating with abstract underlying representations and a set of rules or constraints deriving the output forms – would be at pains to describe such a pattern. Variation in itself can be accommodated into partial constraint ranking in Stochastic Optimality Theory (Boersma, 1998). Difficulties lie in defining the constraints themselves. A markedness constraint referring to pre-consonantal position can derive loss of coronal place in this position, but not before a vowel. A constraint referring to the word-final position can account for loss of place in this position even before a following vowel-initial word, but it is unable to explain why a larger extent of word-final stops lose place before consonant-initial words. A possible combination of the two could, theoretically, do both, however, it would arbitrarily split a process into two, justified only by the need to re-create the observed patterns. It would also be at odds with the more general picture of *t*-glottalisation, including the primacy of word-medial pre-consonantal environments.

A rich memory model can regard *t*-glottalisation as a categorisation problem, if we assume a detailed memory of *t*-final words, consisting of the previous recorded instances, and a phonetic bias favouring *t*-glottalisation before consonants. Using a k-nearest neighbour based classifier (Aha & Kibler, 1991) on a dataset sampled from a corpus of adolescent speech recorded in London (Cheshire et al., 2008), it can be found that, on the one hand, following phonetic environment presents a robust, learnable pattern of glottalisation. The model predicts glottalised word-final stops pre-consonantally, and non-glottalised coronal stops before a vowel. On the other hand, loss of information in the recorded instances leads to categorisation noise, giving us occurrences of glottalised stops before vowels – the observed pattern. If we assume that the basis of categorisation is the word (Bybee, 2001) and production is based on previous instances (Pierrehumbert, 2001), the information most likely to be lost is the environment of the instance. Imperfect learners will then try to predict whether the final stop is glottalised or not based on similar instances, in which case they are bound to fail – at least in certain cases. That is to say, an imperfect learner will not use all the information on the phonetic environment, since they are more likely to recall the word, the basis of categorisation. In such a case, categorisation will extend the majority pattern to the minority environments. Since words in the corpus are more likely to be followed by a consonant-initial word, the glottalisation pattern will be extended.

Therefore, a rich memory model allows us to regard word-final pre-vocalic *t*-glottalisation as a case of mis-categorisation, caused by the overlap of the word-final and the pre-vocalic environments, and by the learners' tendency of imperfect recall of the environments themselves. It gives a streamlined account of the phenomenon based only on instance-based representations, phonetic bias, and memory decay.

References

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