An operationalization of causal factors in vowel shifts

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Ample phonetic literature has tried to determine causality behind sound change, oftentimes in vowel shifts. Proposed causes may be divided into *internal* factors (e.g. push chains maintaining margins of security, drag chains maintaining symmetry; [1]) and *external* ones (gender, social network, etc.; [2]). The usual approach to establishing such effects (e.g. [3]) is to demonstrate that such factors significantly correlate with change progression over time. However, such a *correlation* is insufficient to establish *causation*. Thus, do internal and external factors really *cause* change, or are they simply along for the ride?

We present a method to answering this question based on natural selection in biology. We operationalize causality as a deterministic pressure driving language change ('directional selection'), which contrasts with the cumulative effect of random variation ('stochastic drift'). [4] demonstrated that this distinction makes it possible to disambiguate *caused* changes from historical accidents, based on results from English do-support (Fig. 1). We present ongoing work adapting this model from discrete syntactic features to continuous measures in F1/F2 space. We use this to infer selection pressure within the vowels in the Philadelphia Neighborhood Corpus, a corpus full of vowel changes spanning a course of ~100 years ([5]).

Preliminary results demonstrate that some of the known ongoing changes in Philadelphia, such as pre-fortis [aɪ]>[ʌɪ], are the result of selection pressure, while others are historical accidents. We furthermore present in-progress quantitative analyses of internal and external factors that drive those changes that were subject to selection pressure. We discuss these findings in light of current theories of sound change.

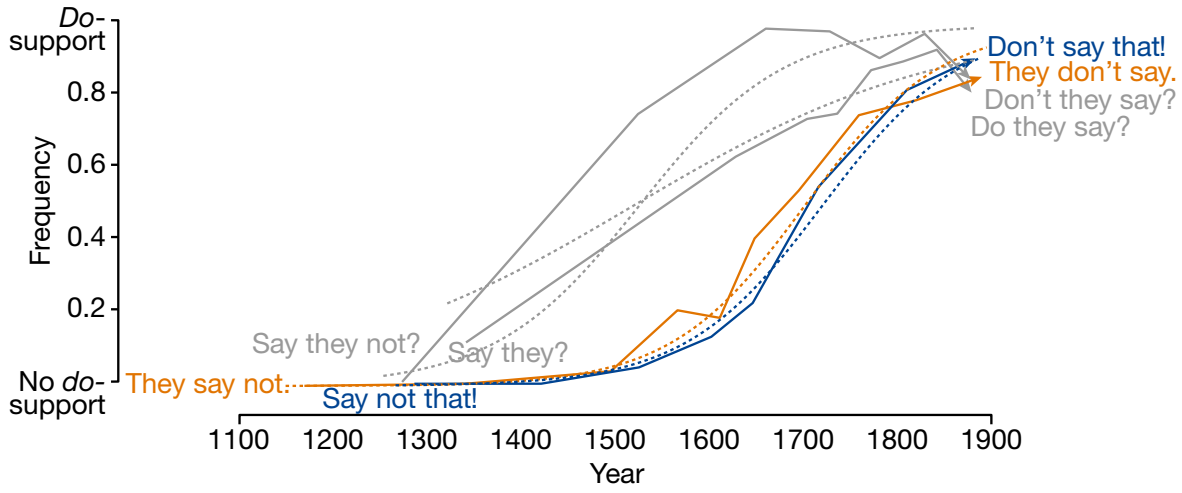

Figure 1: English do-support ([4]). All four changes show significant trends with time, but only two (orange & blue) were driven by selection; the other two (gray) were historical accidents.

References

[1] Labov, W. (1994). *Principles of linguistic change.* Vol. I: internal factors. Blackwell.

[2] Labov, W. (2001). *Principles of linguistic change.* Vol. II: social factors. Blackwell.

[3] Kroch, A. S. (1989). Reflexes of grammar in patterns of language change. *Language Variation and Change*, 1(3), 199-244.

[4] Newberry, M. G., Ahern, C. A., Clark, R., & Plotkin, J. B. (2017). Detecting evolutionary forces in language change. *Nature*, 551(7679), 223-226.

[5] Labov, W., Rosenfelder, I., & Fruehwald, J. (2013). One hundred years of sound change in Philadelphia: Linear incrementation, reversal, and reanalysis. *Language*, 89(1), 30-65.