Population dynamics in the actuation of sound change

James Kirby (University of Edinburgh) & Morgan Sonderegger (McGill University)

One of the biggest outstanding challenges in linguistics is explaining why language change occurs at some particular times, but not others. We address this problem from a computational perspective, focusing on the case of sound change. Sound change arises from the pronunciation variability ubiquitous in every speech community, but most such variability does not lead to change. Hence, an adequate model must allow for stability as well as change. Existing theories of sound change tend to emphasize factors at the level of individual learners promoting one outcome or the other, such as transmission bias (which favors change) or categoricity bias (which favors stability). Here, we consider how the interaction of these biases can lead to both stability and change in a population setting. We find that both stability and change are possible only when both types of bias are active, suggesting that it is possible to understand why sound change occurs at some times and not others as the population-level result of the interplay between forces promoting each outcome in individual speakers. In addition, if it is assumed that learners learn from two or more teachers, the transition from stability to change is marked by a phase transition, consistent with the abrupt transitions seen in many empirical cases of sound change. The predictions of multiple-teacher models thus match empirical cases of sound change better than the predictions of single-teacher models, underscoring the importance of modeling language change in a population setting.