MODELING LANGUAGE CHANGE TRIGGERED BY LANGUAGE SHIFT

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Language shift is widely believed to accelerate change in the target language, an effect which is generally attributed to innovations introduced by new speakers during the second language acquisition (SLA) process (Thomason & Kaufman, 1988). If this hypothesis is correct, then the rate of contact-induced language change in a language shift context should be related to the rate at which second language (L2) speakers enter the population. Unfortunately, little diachronic data exists to test this hypothesis. The aim of the present paper is to model the mechanism that makes SLA accelerate language change on a population level and compare its predictions to a rare diachronic data set from the ongoing language shift in Maputo, Mozambique.

To model linguistic interaction, we adapted Jansson et al.'s model of creole formation (Jansson et al. 2015). At each time step, all speakers met in pairwise interactions and chose to utter one of n variants of a linguistic feature based on their probability distribution of usage. Each agent then modified their distribution of usage based on what they heard by using a linear updating rule with parameter l. After a round of interactions, population turnover occurred with some individuals dying and new L1 and L2 speakers entering the population with rates b and r, respectively. Newborn L1s chose two linguistic `parents' at random and averaged their usage distributions to initialize their own. L2 individuals started with the population mean frequencies of usage. However, with probability μ, a newly recruited L2 speaker could assign all the probability

mass to a `mutant' variant. We explored the general behavior of the model in both fixed and expanding populations for 100 years, with 365 rounds of interaction per year. We then ran a specific set of runs parameterized by demographic data (number of L1 and L2 speakers) from Maputo over a thirty-two year period (1975-2007). We compared our model runs with diachronic data on innovative preposition use and reduced verbal morphology in Maputo Portuguese from two time points (1993 & 2007), presuming that the use of the innovative forms was zero in 1975, as the spread of Portuguese through massive L2 acquisition started only after this year. The datasets comprehend 12 hours of recordings with 20 participants in similar circumstances from each time point, where variation between innovative and conservative forms is quantified.

As predicted, our results show that the rate of increase in usage of the novel variant was most strongly dependent on the rate at which L2 speakers entered the population, *r*, as well as the mutation rate, μ. In the Maputo runs, however, our data points did not fall within the 95% confidence intervals of any of our parameter groupings. We then modified the model to allow the L2 speakers to continue to introduce variation for the first five years they were in the population, to represent the fact that the SLA process occurs over time. Using the same criterion we found agreement between the simulation and the preposition data, while the verb data continued to diverge from model predictions. Importantly, our model assumed neutral evolution of the linguistic features. The departure of the verb data from our model predictions may indicate the presence of selection pressures or biases, for instance, the new verb forms being more economical.

Agent-based models have been successfully used in the field of cultural language evolution for explaining the emergence of linguistic structure (e.g. Kirby 2001), whereas change in already established structures seems to be more difficult to account for. Recent theoretical papers (Blythe & Croft, 2012; Pierrehumbert et al., 2014) have aimed at modeling the propagation of a single innovation (introduced by one speaker) in a population, thus accounting for language change with no pressure from contact. In these models, conditions such as biases and/or innovator network position, are required for the novel variant to be successful. Our simulations demonstrate how with minimal assumptions novel variants can be introduced and spread in a population, due to multiple introductions by different individuals. We thus suggest that this may be a basic typological difference between contact-induced and non-contact-induced language change, which would explain how SLA may increase language change in shift situations.

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