



Population effects on languages:

*Modelling population dynamics and language transmission
from the perspective of language learning, contact and change*

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MODELLING THE DYNAMICS OF PHONOLOGICAL SYSTEMS: EVIDENCE FROM CHANGES IN RHOTICS

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Models of population ecology contribute to explain phenomena related to human language varieties. The unit of analysis in both cases is the population, which is a set (a collection) of individuals who are slightly different one from the other, as a community is by definition heterogeneous. These concepts, provided that they are parameterized with adequate phonetic variables, present a framework that might adequately model the dynamics and complexity of phonological systems. Phonological systems can be regarded as population units that change over time and incorporate many dimensions: biological, physical and cognitive. The dynamic aspects of phonological systems are highlighted by treating phonetic changes like the concept of multistationarity in physics and cellular differentiation in biology. The inherent variability of speech is the source from which sound change emerge. The formalization and the propagation of variation in phonological systems can be tackled with tools similar to those developed in the study of ecological population phenomena. The logistic equation $\frac{dN}{dt} = rN \frac{K-N}{K}$ is the basis for describing the dynamic behavior of phonological systems. This equation states that the degree of growth of a population is proportional to the product of the population and the difference between the total amount of resources used by the existing population. The equation has a very simple phonological interpretation. The amount $(K-N)/K$ is the fraction of the carrying capacity (the ability of the environment to carry the elements, that is to say, to distinguish them in the perceptual space when talking about phonological systems) that has not been taken into account by individuals who share a phonological system. This amount is the fraction of the total sound discrimination opportunities by speakers. The logistic equation is then obtained by multiplying the degree of initial increase, r , by the discriminatory possibilities of a sound. From a phonological point of view, this may be designed as the total elements of a phonological system (phonemes, gestures, features) and the difference between perceptual discrimination and items used by people sharing the same phonological system.