How individuals change culture

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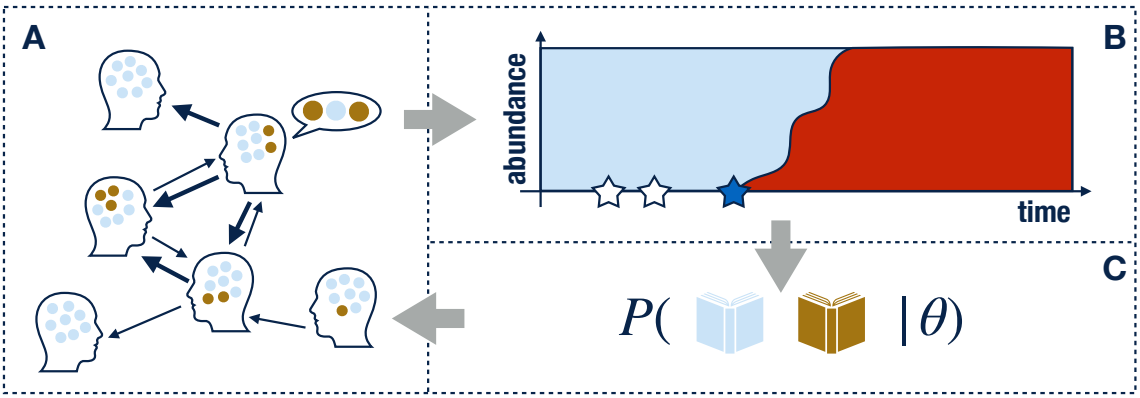
Culture is the product of social interactions between potentially many individuals over potentially long timescales. A key question is how the manner in which behaviour is socially learnt by individuals determines the emergence and change in cultural norms at the community level. A further goal is to infer the behaviour of individuals from datasets that document cultural norms and their changes over time.

In this work, we review a case study of a language change that has occurred in many of the world's languages over historical time, namely the way that definite and indefinite articles are expressed [1]. We show that models of biological evolution, featuring replication, innovation and selection, can be used to predict the probability of observing a specific sequence of changes in the population, given assumptions on how quickly individuals can change their behaviour and the structure of the social network that connects them. We then appeal to statistical inference to identify the process that generated the empirical data (see Figure).

Our main finding is that historical corpus data is best described by a model in which speakers change continuously across the lifespan (not just in childhood) and social networks are heterogeneous. This latter property proves important in reproducing a surprising feature of the empirical data, which is a weak dependence of change timescales on the population size.

An important aspect of the analysis is that it does not require either the cultural variation or the social interactions to be specifically linguistic. We thus also discuss the potential for generalising to other domains of cultural evolution.

[1] R A Blythe and W Croft (2021) How individuals change language. PLOS ONE 16 e0252582



Cycle of inference in cultural evolutionary modelling. A: In an explicit agent-based model of cultural behaviour, each agent maintains an internal representation of the frequency of cultural variants, and exposes this behaviour when interacting with other members of the community (shown here as a speech bubble). Different members of the community may exert more or less influence on the internal states of others (shown as arrows of various thickness). B: At the population scale, one can find periods where one variant dominates. Innovations are introduced by individuals, which may fail (open stars) or propagate through the community (filled star). C: Aggregating over trajectories of change that are compatible with historical records (e.g., written corpora) allows the likelihood P of the empirical data to be assessed for given agent-based model parameters θ. Maximising this likelihood with respect to θ allows for the properties of individual agents, their internal representations and social interactions to be inferred.