Changes in adaptation dynamics in systems with non-particulate inheritance

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Cultural change is mostly modelled as a competition between discontinuous particulate traits and their subsequent abundance in population. This approach is, however, insufficient as many traits transmitted through social learning are of non-particulate nature.

The non-particulate inheritance was originally simulated by Galton-Pearson model which is characterized by uniform transmission error which allows individual cultural "offspring" to differ from the mean of cultural "parents". However, the uniform transmission error is problematic as it unrealistically assumes uniform distribution of "offspring" independent of the variability of influential individuals.

Here, we present an alternative non-particulate inheritance model, where the cultural "offspring" are still distributed around "parental" average but the transmission error is a function of the difference between parental individuals. That means that higher variability of influential individuals leads to more variable cultural "offspring" and model thus approximates inheritance based on social learning more realistically.

The results of computer simulations show, that the current model, despite its simplicity, can lead to two stable states - successful adaptation and variability loss -. The process of adaptation usually contains long period of relative stasis and shorter periods of quick change in populational mean. On average 30.2% (SD=10%) of transgenerational changes in populational mean were responsible for 80% of total transition from the initial populational mean to the optimum. The average correlation between subsequent changes in populational mean was .91. This adaptation dynamics resembles a well-known pattern of punctuated equilibria. The punctuated character of the evolution was most apparent in small populations with weak selection and variable offspring.