The Sometimes Evitable Route to Conservatism and Persuasiveness

A Reply to Xue and Costopoulos

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In Ghirlanda, Enquist, and Nakamaru (2006) we presented a paradox. We argued that, if culture can influence people's openness to new information, then cultural evolution is likely to foster conservative individuals who are reluctant to acquire new culture. We also argued that cultural evolution would promote people's ability to persuade others. We demonstrated these predictions in a simple model in which cultural evolution created conservative and persuasive individuals. We noted, however, that the model's predictions were too extreme: people become neither completely conservative nor perfectly persuasive. We concluded that understanding the cultural dynamics of conservatism and persuasiveness requires new theoretical advances. Xue and Costopoulos (2010) have taken up this challenge, studying potential determinants of openness and persuasiveness as well as the impact of openness and persuasiveness on cultural diversity.

Xue and Costopoulos first show that allowing errors in cultural transmission, allowing individuals to change only little when imitating others, and embedding individuals in a spatial structure result in openness and persuasiveness values that lie within about 0.1 from our model's, corresponding to approximately a 10% increase in the probability of cultural transmission. Next, they introduce a new model in which individuals possess a cultural "attribute" whose transmission is influenced by openness and persuasiveness (see Xue and Costopoulos 2010 for details). They report that, when individuals change little in each social interaction, persuasiveness does not rise to high values, and a diversity of attribute values can be maintained. Stimulated by these intriguing results, we simulated both our original model and several variations of their model, varying the amount of change allowed in a social interaction (see fig. 1).

We realized that even our model does not always predict high persuasiveness. In fact, for a cultural type to replicate many times, low openness is much more important than high

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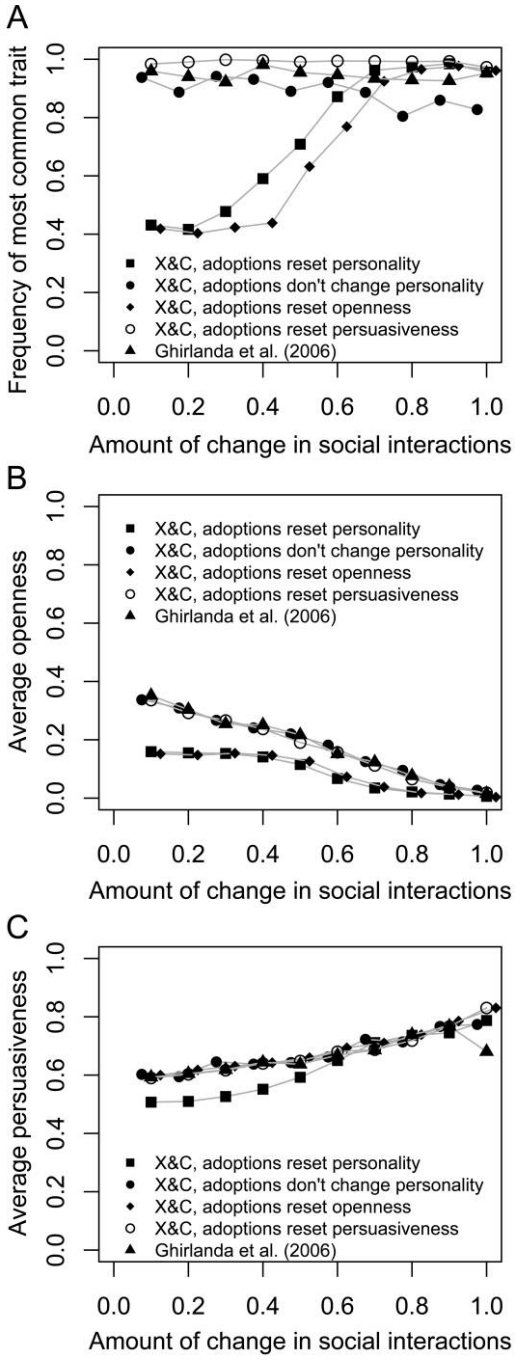

Figure 1. Evolved cultural diversity, openness, and persuasiveness as functions of the amount of change allowed in a social interaction (corresponding to 1 minus the "memory" parameter in Xue and Costopoulos 2010), in Ghirlanda, Enquist, and Nakamaru's (2006) model and in several versions of Xue and Costopoulos's model (Xue and Costopoulos 2010). All versions maintain the distinction between "imitation" and "adoption" events (see Xue and Costopoulos's text) but differ in how openness and persuasiveness change in adoptions (see text). We simulated populations of 100 individuals interacting for 5,000 time steps.

persuasiveness. Consider a cultural type with openness and persuasiveness values of p and q, respectively, in a population with average values P and Q. An individual keeps the cultural type (p, q), on average, for $1/(pQ)$ social interactions. During this time, the individual is copied by other an expected $Pq/(pQ)$ times. Thus, increasing q has a linear effect on the expected replication of a cultural type ("cultural fitness"), while decreasing p has a much stronger effect. This causes openness to decrease faster than persuasiveness increases, inhibiting the cultural evolution of persuasiveness. Thus, Xue and Costopoulos's study shows that the dynamics of Ghirlanda, Enquist, and Nakamaru's (2006) model is richer than anticipated, confirming at the same time that conservatism is strongly favored by cultural transmission dynamics.

We replicated Xue and Costopoulos's (2010) study of cultural diversity in our original model and in several versions of their model, varying the amount of change that individuals can undergo in a social interaction (fig. 1). Only in two cases is diversity in cultural attributes preserved. The first is Xue and Costopoulos's model, in which both openness and persuasiveness are reset to random values when individuals copy a model with a different attribute. The second is a variation of their model in which openness *only* is reset on such occasions. Resetting persuasiveness only, resetting neither openness nor persuasiveness, or simply adding a cultural attribute to Ghirlanda, Enquist, and Nakamaru's (2006) model does not preserve cultural diversity. Resetting openness is crucial because, on average, it decreases the openness of individuals (individuals who undergo resetting are those who copy, i.e., those with high openness). This produces, as Xue and Costopoulos note, "isolationist" individuals who are even more conservative than in our original model (fig. 1*B*). Thus diversity is maintained because cultural dynamics becomes very slow (in fact, when individuals are allowed to change a lot in a social interaction, diversity is not maintained).

Xue and Costopoulos's (2010) social learning rule construes adoption of new traits as a "traumatic" event capable of resetting individual personality. Our intuition is that this may be more appropriate for major events such as, for instance, religious conversions, than for everyday changes such as adopting someone else's clothing or food preferences. Thus, Xue and Costopoulos's study shows simultaneously the need for more empirical work on the psychology of social learning and more theoretical work on the consequences of such psychological mechanisms for cultural evolution. We are currently investigating how openness can be maintained in cultural evolution and what happens to cultural diversity in an open population. In Acerbi, Enquist, and Ghirlanda (2009), we show that openness can be preserved given that only individuals who remain open can acquire the cultural traits that are necessary to become persuasive models, and further preliminary results suggest that under such circumstances populations can be culturally diverse.

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