
Bursts of rapid change in the adaptiveness of the cultural system may be partly explained by the connectivity dynamic

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Abstract

The evolution of cultural systems is shaped by neutral dynamics (Real, & Griffiths, 2010; Blythe, 2011), cognitive biases (Boyd & Richerson, 1985; Tamariz, Ellison, Barr, & Fay, 2014) and demographic factors such as population size (Shennan, 2001; Kline & Boyd, 2010; Henrich, 2004) and the degree of contact (Powell, Shennan & Thomas, 2009; Muthukrishna, Shulman, Vasilescu & Henrich, 2014). In particular, a number of studies on cultural evolution have developed models that link demography and cultural adaptiveness, using a variety of mathematical approaches (Mesoudi, 2011, Shennan, 2001). While macroscopic models are useful, agent-based models are more realistic to keep track of individual's knowledge (Mesoudi, 2011). In this study, our goal is to analyze how adaptiveness changes globally when we manipulate microscopically the organization of turn taking in pairwise interactive microsocieties (termed connectivity dynamic). We constructed an agent-based model that, for each round and agent, yields the probability distribution of cultural variants for a given history of agent's interactions. We systematically manipulated content bias, coordination bias, memory, innovation and two levels of the connectivity dynamic (early connectivity and late connectivity). Our results suggest that, in some scenarios, bursts of change in the cultural system may be partly explained by the order in which individuals interact over time (Fig. 1). These computational results extend a number of studies that, under a variety of assumptions, have proposed punctuational or rapid bursts of change as a feature of cultural and language evolution (Atkinson, Meade, Venditti, Greenhill & Pagel, 2008; Fitch, 2008; Janda & Joseph, 2003). Furthermore, we suggest that research in the field would benefit from experimental designs that control the probability of occurrence of each possible connectivity dynamic.

Keywords: Cultural evolution, agent based models, punctuated equilibrium, contact, population size, cognitive biases, connectivity, adaptiveness

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