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Taking into account the wider evolutionary context of cumulative cultural evolution

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Abstract

The target article reviews evidence showing that technological reasoning is crucial to cumulative technological culture but it fails to discuss the implications for the emergence of cumulative cultural evolution (CCE) in general. The target article supports the social view of CCE against the more ecological alternative and suggests that CCE appears when specialised individual-learning mechanisms evolve.

The target article offers a refreshing view on the question of the origin of cumulative technological culture (CTC) by providing evidence that CTC crucially depends on technological reasoning and not so much on developed social-learning capacities. However, the authors did not make explicit the wider evolutionary consequences implied by their discussion. The origin of cumulative cultural evolution (CCE) has been widely debated and the subject of renewed research efforts, leading to two broad categories of theories, namely the ecological and the social views of CCE. Let me outline them here briefly.

Under the ecological view, humans' ancestors faced strong selection pressure, potentially in the form of large and frequent climatic changes (Richerson & Boyd 2005), to adapt to diverse environments. This selection pressure resulted in the evolution of enhanced technological-reasoning skills but also in more tolerant societies based on cooperation and more developed social-learning mechanisms (e.g., imitation, teaching, and language) that were necessary to acquire the skills to survive in these environments. Crucially, although the ecological view recognises the importance of technological reasoning, the adaptation to varied environments (spatially and/or temporally variable) is realised when technologies can spread and evolve through cultural transmission (Boyd 2013). According to the ecological hypothesis, CCE evolved in order to acquire new adapted behaviour rapidly and efficiently, leading to the emergence of tools and technologies that were beyond what a single individual could produce. Under the ecological hypothesis then, CTC is the driving force behind our success as a species capable of surviving almost any environment and it is the source and the consequence of dedicated social-learning mechanisms such as our unique communication system based on language. This view receives support, in particular, from experiments showing that more complex forms of communication are essential to transmit complex technological skills (e.g., Dean et al. 2012; Derex et al. 2019; Morgan et al. 2015) and from modelling showing that cultural transmission can evolve in certain unpredictable environments (e.g., Rendell et al. 2010).

In contrast, the social view emphasises the importance and complexity of human and non-human primate social relationships (I am lumping here together the social brain hypothesis [Dunbar 1992; 2012] and the Machiavellian-social-cultural intelligence hypotheses [Byrne & Whiten 1988; Whiten & van Schaik 2007)]. According to the social view, under, maybe the same, pression from the environment, humans evolved larger groups with more relaxed social relationships based on cooperation and coordination but also more complex forms of relationships and ways of communicating about them, giving rise to theory of mind and language. Under this scenario, social learning in humans evolved for "gossiping," that is, for dealing with relationships in our large hierarchical groups. For the social view, CTC is a by-product of the evolution of social learning: technological reasoning evolved independently to solve concrete problems, and cultural transmission did not evolve to spread technological knowledge. Rather, the evolution of social-learning capacities and a more relaxed sociality evolved for social reasons and created an environment in which technology became cumulative, as did many other behaviours in other social and non-social domains. The social view stresses the complexification of social cognition and social relationships among primates and the natural continuity between communication in non-human primates, used mainly to deal with social relationships, and theory of mind and language in humans.

Is CTC the driving force behind the emergence of complex forms of social learning? Or is it a by-product of the evolution of social communication? The target article reviews evidence showing that (i) technological reasoning is critical to produce CTC, (ii) technological reasoning is a specialised cognitive mechanism in humans, and that (iii) minimal forms of social learning (such as the exposure to the products of other individuals) are sufficient to generate CTC. And although one may criticise the difficulty of the experimental tasks (e.g., building spaghetti towers, paper planes, and so on) used to test technological reasoning, it is noteworthy that these simple tasks are already well beyond what non-human primates can achieve. The target article's conclusion, that a difference in technological reasoning is at the origin of the absence of CTC in non-human primates, not a difference in social-learning mechanisms, therefore support the social view of CCE. Furthermore, the fact that complex forms of social learning do not seem to be necessary to produce CCE, combined to the observation that CCE in non-human animals are in domains in which they excel at learning (travelling routes for pigeons [Sasaki & Biro 2017], songs in birds [Feher et al. 2009], memory task of baboons [Claidière et al. 2014b], for instance), could suggest that CCE appears when specialised individual-learning mechanisms evolve.

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