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The cultural evolution of socially situated cognition

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Abstract

Because human cognition is creative and socially situated, knowledge accumulates, diffuses, and gets applied in new contexts, generating cultural analogs of phenomena observed in population genetics such as adaptation and drift. It is therefore commonly thought that elements of culture evolve through natural selection. However, natural selection was proposed to explain how change accumulates despite lack of inheritance of acquired traits, as occurs with template-mediated replication. It cannot accommodate a process with significant retention of acquired or horizontally (e.g. socially) transmitted traits. Moreover, elements of culture cannot be treated as discrete lineages because they constantly interact and influence one another. It is proposed that what evolves through culture is the mind; ideas and artifacts are merely reflections of its current evolved state. Interacting minds transform (in part) through a non-Darwinian autopoietic process similar to that by which early life evolved, involving not survival of the fittest but actualization of their potential.
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1. Introduction

Other papers in this issue explore how cognition is shaped by the social matrix in which it is embedded. In this paper the reader is invited to take a step back and consider the dynamics that emerge when cognitive agents do not just learn from one another, but 'put their own spin on' what they learn, make sense of it in their own terms, and then express or implement their 'take' on the ideas back to others. Elements of culture start to create niches for one another. They become more complex with time, such that they might be thought of as constituting cultural lineages.

Some treat cultural change as merely a facet or dimension of biological evolution (Jablonka & Lamb, 2006).[1] Others, while not denying that culture has a dramatic impact on biological life, argue that culture constitutes a form of evolution in its own right, a second evolutionary process. On Earth the two are deeply intertwined (as illustrated by phenomena such as genetic assimilation, the Baldwin effect, and the fact that biological life had to come into being before culture could take hold). But in principle they need not be. For example, in a computer program in which artificial agents invent and imitate ideas for new gestures, but neither die nor give birth, there is still evolution (Gabora, 1995). It is not the agents' physical form that is evolving, but their ideas. Fit gestures get imitated, and spread through the artificial society, while unfit gestures do not, such that over time the distribution of gestures implemented by agents becomes fitter. Indeed, cultural traits can be said to undergo descent with modification, and on the face of it cultural change is reminiscent of natural selection. It exhibits phenomena studied by population geneticists such as adaptation, punctuated equilibrium (Orsucci, in press), and drift (Bentley, Hahn, & Shennan, 2004; Durham, 1991; Gabora, 1995), as well as features

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[1] This paper does not address the issue of the extent to which the human capacity for language and other elements of culture is genetically assimilated and/or part of the human phenotype, which is discussed at length elsewhere (e.g. Barkow, Cosmides, & Tooby, 1992; Buller, 2005; Buss, 1999/2004; Gabora, 2006a, 2006b; Pinker, 1995).

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referred to by Mesoudi, Whiten, and Laland (2004) as "key Darwinian properties", including variation, competition, and inheritance. Cultural change is also cumulative; humans have a propensity to not just generate novelty but build on it cumulatively, adapting old ideas to new circumstances (the Ratchet effect). One individual modifies the basic idea of a cup by giving it a flat enough bottom to stay put when not in use, another adds a handle, making it easier to grasp, and yet another adds a spout, making it easier to pour from. Moreover, this cumulative change is adaptive. With each instantiation, the basic idea remains the same but the details change to make it more useful with respect to the prevailing situation or need. It is also complex and open-ended; there is no limit to the cultural novelty that can be generated.

This paper attempts to answer the question of whether the transmission and transformation of information across individuals occurs through a Darwinian process, and in what sense (if any) culture can rightly be said to 'evolve'. We begin by examining why organisms do not inherit acquired characteristics, and how this impacts their evolution. This is key because acquired change *is* inherited in culture,[2] though note that here 'inherited' merely means transmitted or 'passed on' without implying genetic mediation. To the extent that not inheriting acquired characteristics is central to how organisms evolve, answers from biology will not translate to culture. Noting that current origin of life theories suggest that the earliest life forms, referred to as protocells, *also* inherited acquired characteristics, we examine the hypothesis that the mechanisms by which culture evolves are more akin to those underlying the evolution of protocells than modern-day life.

2. Is culture Darwinian?

It is often suggested that culture, or the creative ideas that propel it, evolve through a process that is Darwinian (e.g. Aunger, 2000; Campbell, 1960; Cavalli-Sforza & Feldman, 1981; Cloak, 1975; Cziko, 1997, 1998; Dawkins, 1975; Maschner, 1996; Mesoudi et al., 2004, Mesoudi, Whiten, & Laland, 2006; Plotkin, 1994; Simonton, 1998, 1999a, 1999b; Spencer, 1997). Mesoudi et al. (2004) argue that because Darwin knew nothing of genes when he proposed his theory of natural selection, rejecting a Darwinian theory of culture on the grounds that we do not know what might be the cultural equivalent of genes is to apply a criterion so strict it would have led early biologists "to reject the fundamental case made for evolution through natural selection in *The Origin*". But this is not the case, for Darwin's theory resolved a paradox that is nonexistent with respect to culture.

The paradox faced by Darwin and his contemporaries was to explain the following: how does change accumulate when acquired traits are lost? In most domains, change is retained, at least until another change overrides it. Once an asteroid has collided into a planet, for example, it does not revert back to the state of having not collided into a planet. But in biology there is a continual 'backtracking' to an earlier state. Change arising during a lifetime, for example as a result of interaction with others, is obliterated at the end of each generation. A rat whose tail is cut off does not give birth to rats with cut tails. Thus the question that Darwin's theory answered was: if new modifications keep getting discarded, how is it that the form of living things has changed over time? The ingenuity of his approach was to look for change at the level of the population rather than the individual. Individuals who are better equipped to survive in their given environment leave more offspring (are 'selected') and thus their traits are better represented in the next generation. Over generations this can lead to substantial change in the population of individuals as a whole.

The facts that inspired Darwin's theory of natural selection are unique to biology. Neither social scientists nor cognitive scientists are faced with a similar paradox. Cultural traits and artifacts *do* inherit acquired characteristics, so change resulting through creative thought processes, or interaction with peers or other elements of the environment, are retained. Once someone came along with the idea of putting a handle on a cup, cups with handles were here to stay. Inheritance of acquired traits allows for change that is orders of magnitude faster than change mediated by natural selection (for example, later today you may retell this argument in simplified form for a child). Thus we do not share the biologist's need to account for how change occurs despite a discarding of acquired traits each generation. It is therefore appropriate that Darwin's solution not be embraced in a domain where the problem that solution was designed to solve does not exist.

Even if there is not the same pressing need to come up with a population-level mechanism of change as there was for biologists in Darwin's time, might not still the evolution of culture be described in terms of natural selection?[3] This question no longer means what it would have meant in Darwin's time because the theory of natural selection has been rendered in precise mathematical terms, and for natural selection to be applicable, the following criteria must be met. First, there must be a population of self-replicating entities. Second, individuals must be lost from the population and replaced by new ones, giving rise to discreet or overlapping generations. Third, there must be competi-

[2] Culture is thus sometimes referred to as Lamarckian.

[3] It is worthwhile pointing out that neo-Darwinism, powerful though it is, does not begin to provide a comprehensive account of biology (e.g. Holliday, 1990; Kauffman, 1993; Newman & Müller, 1999; Schwartz, 1999) let alone culture. It cannot account for situations involving assortative mating, symbiosis, epigenetic or self-organized processes such as the origin of life discussed earlier, nor the appearance of new forms with new characteristics, particularly if they emerge through contextual processes such as interaction with the environment.

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