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Current Opinion in Behavioral Sciences

Creativity: linchpin in the quest for a viable theory of cultural evolution

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This paper outlines the implications of neural-level accounts of insight, and models of the conceptual interactions that underlie creativity, for a theory of cultural evolution. Since elements of human culture exhibit cumulative, adaptive, open-ended change, it seems reasonable to view culture as an evolutionary process, one fueled by creativity. Associative memory models of creativity and mathematical models of how concepts combine and transform through interaction with a context, support a view of creativity that is incompatible with a Darwinian (selectionist) framework for cultural evolution, but compatible with a non-Darwinian (Self-Other Reorganization) framework. A theory of cultural evolution in which creativity is centre stage could provide the kind of integrative framework for the behavioral sciences that Darwin provided for the life sciences.

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Current Opinion in Behavioral Sciences 2018, **27**:77–83

This review comes from a themed issue on **Creativity**

Edited by **Hikaru Takeuchi** and **Rex Jung**

https://doi.org/10.1016/j.cobeha.2018.09.013

Introduction

There is literature on cross-cultural differences in creativity [1–3], the adaptive value of creativity and how human creativity evolved [4–7], as well as efforts to frame creativity as a Darwinian [8,9][1] and a non Darwinian [11,12] evolutionary process. However, with some exceptions [13–15], there is a dearth of research on the implications of how the creative process works for the question of *how culture evolves*. This appears to be an outstanding gap in the literature given that creativity is what *fuels* cultural evolution, and a theory of cultural evolution could provide an integrative framework for the social sciences in much the same way that fragmentary biological knowledge was unified by Darwin's theory of natural selection (and subsequently unified further by the neo-Darwinian synthesis, and research on epigenetic processes and complex systems [16,17]). This paper outlines how creativity research can contribute to this important enterprise.

A new direction for creativity research

Creative ideas are sometimes conceived of as discreet, separate entities much like objects in the physical world that can we search for and select amongst [8,9]. However, models of the contextual aspects of higher cognition [18–22,23••], including concept combination and creativity [24•,25–27], buttressed by neural-level accounts of memory and insight [28–30], point to a different view. This research suggests that thoughts and ideas are not separate and distinct but exist as part of an interwoven matrix until the instant you think of them. Moreover, each time you think of them they are reconstructed anew and you experience them differently, depending on the context, your recent experience, and what you have done and thought about since the last time you brought them to mind. Like Schrödinger's famous cat that is neither dead nor alive, a concept or unborn idea — when you're not thinking about it — neither exists nor does it not exist. It is in a what is called a *ground state*, a state of *potentiality*, and requires a context — something that *brings it to mind* — to *actualize* it. Much as if you shine light on an object from one direction it casts one shadow, and if you shine light from a different direction it casts another, the first time you try to articulate a creative idea it manifests as one output, and after thinking about it, it may manifest as a different output. Just because these two external realizations of the idea take different physical forms, that doesn't mean there are two discrete representations in the mind. Just like two shadows cast by the same object, they may be different realizations of the same underlying idea at different phases of a creative honing process.

Extending these ideas further lead to a new conception of the creative process. While the divergent and convergent phases of the creative process are often characterized respectively as *generative* and *evaluative* [31–33], associative memory models of creativity and mathematical models of how concepts combine and transform through interaction with a context suggest that phases of the creative process instead be characterized in terms of

[1] However, previous supporters have backed away from this position, e.g. Simonton [10] has conceded that his theory's "explanatory value does not depend on any specious association with Darwin's theory of evolution".

potentiality and actualization. In this view, the creative process begins with the recognition that one's understanding of something is in a state of potentiality — that is vague, ill-defined, or engendering emotional turbulence — so one examines it from different angles to better understand it. This *may* involve the emergence of new candidate ideas, but also it may not; it may simply entail a sharpening of the originally vague idea. In this view, evaluation is not limited to the second phase but rather it is occurring throughout; the entire process of reflecting on an idea consists of interactions between your current conception of it, and contexts you throw at it, and with each 'reflection' (interaction between idea and context) you evaluate the outcome. In the *divergent* phase of the creative process one reflects on the idea by considering it from *unconventional contexts*, and the ability to do this hangs on their capacity to reform anew each time you think of them, as discussed above. In the latter *convergent* phase, the idea is refined by considering it in more *conventional contexts*, often generated through simulation of how others will receive it.

While these views on creativity are nascent, as we will see following a brief examination of the workings of evolutionary processes and culture in particular, *they have implications for the question of how culture evolves*, and could play a vital role in the development of a viable theory of cultural evolution.

Cultural evolution as a unifying framework for the social sciences

Darwin's theory of evolution by natural selection vastly enhanced our understanding of the organismal world by integrating scattered biological knowledge into a unified 'tree of life'. Since art, technology, languages, and customs change over time in a manner seemingly reminiscent of biological evolution, it seemed reasonable to view culture as a second evolutionary process, fueled in this case by human creativity. Although other species exhibit both creativity and imitation, humans build on each others' ideas, adapting them to our own tastes, needs, and desires, such that the process is open-ended, that is the space of possibilities cannot be pre-specified [34]. Thus, cumulative, adaptive, open-ended cultural evolution appears to be uniquely human.

There is a long history of attempts to frame cultural evolution as a Darwinian evolutionary process [35], and although highly contentious, the approach is still widespread [36,37,38•]. A Darwinian process consists of two components: the *generation* of new variants, and the differential survival or *selection* of some of those variants, such that they live long enough to produce offspring. Since Darwin's explanation focused not on the generation of variants but on the selection of some fraction of them, it can be referred to as a *selectionist* theory. Darwin posited that biological change is due to the effect of differential selection on the distribution of randomly generated heritable variation in a population over generations; in other words, 'survival of the fittest'. Organisms with adaptive traits have more offspring — that is are 'selected' for — and therefore, their traits proliferate over time. Notice that the theory operates on the timescale of generations, as it requires at a minimum a generation for change to occur. Note also that it assumes that variants are separate and distinct entities that can be selected amongst such that some survive and others do not.

Dawkins [39] proposed that natural selection requires a *replicator*, which he defined as an entity with the following characteristics: *fecundity* (it replicates), *longevity* (it survives long enough to replicate), and *fidelity* (after several generations of replication, it is still almost identical to the original). Holland [40], a pioneer in the field of complex, adaptive systems, showed that fecundity, longevity, and fidelity are necessary but not sufficient for a selectionist explanation to hold, and provided a more nuanced analysis of what is required (Table 1).

Holland's first requirement is *randomly generated variation*. A selectionist process works through

Table 1

Comparison of Dawkin's view that natural selection requires a replicator versus Holland's view that it requires a self-assembly code. Both involve self-replication with fecundity, longevity, and fidelity. Only the self-assembly code requires instructions for generating a copy of the self that are both passively copied and actively transcribed. As a result, only this view is committed with respect to (1) the sequestration of inherited information, (2) a clear distinction between genotype and phenotype, and (3) a prohibition on transmission of acquired traits. The replicator has been proposed as the central construct of an evolutionary framework for both biological and cultural evolution. Since cultural evolution lacks self-assembly instructions that are both passively copied and actively transcribed, the self-assembly code can function as the central construct for biological evolution only.

	Replicator (Dawkins)	Self-assembly Code (Holland)
Self-replication	Yes	Yes
Fecundity; longevity; fidelity	Yes	Yes
Passive copying and active transcription of self-assembly instructions	?	Yes
Sequestration of inherited information	?	Yes
Genotype / phenotype distinction	?	Yes
Transmission of acquired traits	?	No
Evolutionary processes it seeks to explain	Biological, cultural	Biological