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CULTURAL EVOLUTION

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Culture involves the social transmission of novel behavior, such as gestures, songs, or tool-making skills, amongst individuals who are generally members of the same species. Elements of culture spread both vertically, from one generation to another, and horizontally amongst members of a generation. Thus two key components of culture are a means of *generating* novel behavior, and a means of *spreading* it, such as imitation and other forms of social learning.

It is widely believed that non-human species such as chimpanzees possess culture, but human culture is noteworthy because it is *cumulative*. Individuals build on each other's ideas, not in just a random manner that reflects mere copying errors, individual differences and limitations in physique, or differences in the materials at hand, but in a way that is *adaptive*. We strategically modify the ideas of others to suit our own needs and tastes, such that cultural products become more useful, expressive, or aesthetically pleasing. Anthropologists usually place the origins of human culture approximately two million years ago, during the transition from *Homo habilis* to the upright walking *Homo erectus*. Our earliest stone tools date back to this time. However, there is little evidence of *cumulative* cultural change until approximately 100 to 50 thousand years ago, during the Middle-Upper Paleolithic. This period constitutes a dramatic transition in human culture, as it marks the beginnings of many kinds of cultural artifacts including task-specific tools, art, ornamental jewelry, and indications of ritualized religion.

Thus, not only does adaptive cultural change accumulate over time, but it *diversifies*, becomes increasingly complex, and exhibits phenomena observed in biological evolution such as niches, and punctuated equilibrium. Like biological evolution, culture is *open-ended*; there is no apparent limit to the variety of new forms it can give rise to. For these reasons, it has been argued that culture constitutes a second evolutionary process, one which, though it grew out of biological evolution, exhibits an evolutionary dynamic in its own right that cannot be reduced to biology. Some of what is considered cultural behavior *can* be explained by biology. However most would probably concede that, much as principles of physics do not go far toward an explanation of, say, the vertebrate body plan (though things like gravity play some role), biology does not go far toward an explanation of, say, the form and content of a sonnet (though factors like selective pressure for intelligence play some role). Most would concede that to explain how and why such forms arise, accumulate, and adapt over time, one must look to culture. Nevertheless, the attempt to establish an evolutionary framework for culture remains a struggle.

One theory is that culture evolves through natural selection. What necessitated Darwin's theory of how species evolve through natural selection is that traits that are *acquired* by an organism over its lifetime are not transmitted to offspring, and thus not passed down through time. Thus, whereas a rock that smashes stays smashed, if a rat loses its tail the rat's offspring are *not* born tail-less; the 'bitten-off tail' trait is lost from the rat lineage. The paradox Darwin faced was: if change is not retained from parent to offspring, how does change *accumulate*? His solution was the following. He proposed that part of an organism *is* retained (the part we now call DNA). It is responsible for traits shared by relatives, and it undergoes random change from one generation to the next. Since random changes that are beneficial cause their bearers to have more offspring, or be selected, over generations, such traits proliferate at the expense of detrimental ones, and become more widely represented in a population.

John von Neuman determined the minimal algorithmic structure capable of evolving through natural selection, which he termed a *self-replicating automaton*. It consists of self-assembly instructions that are both *copied* to make offspring and *interpreted* to develop them into adults. However, it was the simpler notion of a *replicator*, something that merely makes copies of itself, that inspired the *Darwinian theory of culture*. According to this theory, culture evolves through the variation and selection of replicators sometimes referred to as *memes*. Darwinian anthropologists apply phylogenetic methods, developed for classifying biological organisms into lineages, to cultural artifacts. This works well for highly conserved assemblages, but falsely classifies similarity due to horizontal exchange of ideas as similarity originating from a common ancestor. *Dual inheritance theory* is a version of the Darwinian view that posits that humans have two inheritance systems, biological and cultural, and focuses on processes that bias the transmission of cultural information, such as the tendency to preferentially imitate high prestige individuals. However, since the theory of natural selection assumes that variation is randomly generated and acquired change is not transmitted, to the extent that transmission is biased from random, and ideas acquire change between transmission events as we contemplate them, the Darwinian approach gives a distorted model.

Another theory of cultural evolution was inspired by recent evidence that the earliest forms of life were self-organized metabolic networks that evolved through a non-Darwinian process involving transmission of acquired traits, sometimes referred to as *communal exchange*. It has been proposed that what evolves through culture is *worldviews*, the integrated webs of ideas, beliefs, and so forth, that constitute our internal models of the world, and they evolve, as did early life, not through competition and survival of the *fittest* but through communal transformation of *all*. In other words, the assemblage of human worldviews changes over time not because some replicate at the expense of others, as in natural selection, but because of ongoing mutual interaction and modification. Elements of culture such as rituals, customs, and artifacts reflect the states of the worldviews that generate them. The theory is consistent with network-based approaches to modeling trade, artifact lineages, and the social exchange of knowledge and beliefs, and with the unexpectedly high degree of cooperativity in human culture.

Further Reading

- Boyd, R., & Richerson, P. (2005). *The origin and evolution of cultures*. Oxford: Oxford University Press.
- Gabora, L. (2008). The cultural evolution of socially situated cognition. *Cognitive Systems Research*, 9(1-2), 104-113.
- Mesoudi, A., Whiten, A. & Laland, K. N. (2006). Towards a unified science of cultural evolution. *Behavioral and Brain Sciences*, 29, 329-383.