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Abstract

Humans learn and share information on a massive scale through the use of culture. In this paper, we will outline the mechanisms of evolutionary cultural change, evaluate their role in ecologically destructive feedback loops, and conclude by describing how we might harness the mechanisms of cultural evolution to favor ecologically and socially beneficial change. A virtue of the science of cultural evolution is that it is developed on the same basic framework of ecology and evolution that applies to the natural world, giving it a synthetic role in linking the human behavioral sciences to the natural sciences.

Keywords (separated by "-")

Cultural evolution - Cultural change - Social learning - Feedback loops - Learning bias - Sustainability

Mechanisms of Cultural Change and the Transition to Sustainability

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Abstract

Humans learn and share information on a massive scale through the use of culture. In this paper, we will outline the mechanisms of evolutionary cultural change, evaluate their role in ecologically destructive feedback loops, and conclude by describing how we might harness the mechanisms of cultural evolution to favor ecologically and socially beneficial change. A virtue of the science of cultural evolution is that it is developed on the same basic framework of ecology and evolution that applies to the natural world, giving it a synthetic role in linking the human behavioral sciences to the natural sciences.

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Cultural Evolution

Humans learn from one another on a massive scale compared to other animals. This "social learning" is the foundation of culture. Cultural evolution, in the sense we use it, refers to the change in frequency of socially learned traits in populations over time; it is a value-neutral term. Cultural evolution is driven not only by natural selection and random variation but also by individual and collective decision making (Mesoudi et al. 2006). In the context of human behavior, cultural evolutionary theory aims to explain the emergence, persistence, and decline of skills, beliefs, and institutions as they are passed down from one social learner to the next. Culture allows for faster tracking of environmental change and allows for the cumulative evolution of more complex traits than individuals could hope to invent on their own. The cultural transmission of ideas has with no doubt been critical to the radical explosion of cumulative human knowledge, technology, industry, and governance systems. However, the mechanisms of cultural evolution can, at times, lead to radically destructive feedback loops. In this paper, we will outline the mechanisms of cultural evolution, evaluate their role in ecologically destructive feedback loops, and conclude by describing how we might harness the mechanisms of cultural evolution to favor ecologically and socially beneficial change. A virtue of the science of cultural evolution is that it is developed on the same basic framework of ecology and evolution that applies to the natural world, giving it a synthetic role in linking the human behavioral sciences to the natural sciences.

A Brief Sketch of the Mechanisms of Cultural Change

Several well-studied mechanisms act as "forces" that cause cultural evolution (Boyd and Richerson 1985). We briefly sketch the most important.

Guided Variation

Over the course of an individual's lifetime, beliefs and behaviors often change via experience, due to individual learning and invention. For example, a welder may discover a more effective method of welding steel beams together, by either experimentation or accident. Neophyte welders may subsequently learn the improved technique directly from the innovator or through a chain of social learning tracing back to the innovator. In contexts such as the above example, when the strategies innovated in one time period are linked to strategies in a later time period by cultural transmission of knowledge, we say that such change is the result of guided variation.

Biasing Forces

Social transmission allows for the inheritance of acquired behaviors, values, and beliefs. Unbiased imitation is the simplest form of social transmission. The strategy in this case is simply to copy the behavior of a random individual in the population. The motivation for this learning strategy is simply to avoid the costs associated with effortful individual learning through trial-and-error experience. On the other hand, one can selectively adopt techniques that seem better by some decision-making heuristic or another, depending on context. The simplest learning bias is to try out two or more cultural variants and preferentially adopt the one that seems to work the best. This bias is based on the actual performance of the variants and is termed a content bias. This learning bias can be costly, however, if the trials are costly or hard to evaluate, much as in the case of guided variation. Several less demanding, but potentially less accurate, biases are frequently involved in social transmission. Three basic ones include:

Conformity

When individuals can sample the strategies of more than two targets, they can use the frequency of the observed strategies among the targets to guide which strategy should be adopted. Many processes in nature, including natural selection, content bias, and guided variation, will tend to produce adaptive rather than maladaptive strategies. Thus, a learning bias which favors copying the most common strategy in a population will often yield better results than random imitation. Conformity works well in adapting to spatial variation because conformist learners tend to ignore variation introduced by migrants from different ecologies or societies. On the other hand, conformity is a risky strategy in the face of temporal variation as conformists will also ignore innovators who introduce new adaptations to a changing environment (Nakahashi et al. ~~in press).~~

Success

Success-biased transmission of cultural traits occurs when an individual observes two or more variants of a cultural trait and preferentially adopts the trait that yields the highest returns to the people being imitated. For example, an individual in a small-scale fishing society might observe fishermen on several different trips, keeping track of the type of lures being used, and then preferentially adopt the lure that was most effective at catching fish. Success-biased transmission generates a dynamic which is very similar to that of natural selection over a broad range of conditions but can be much faster. When individuals' estimates of success are noisy or biased, this strategy is problematic.

Prestige

Prestige-biased transmission involves the copying of a diverse array of traits possessed by prestigious or culturally successful individuals. Determining who is successful in a society is much easier than determining specifically what traits have led them to success. By copying an array of traits which covary with prestige or success, one stands a chance of copying the correct traits that give rise to success. This learning bias is quite interesting in that it may allow neutral and even maladaptive traits to hitchhike along with adaptive cultural traits. When the standards of what constitutes success are themselves culturally transmitted, this mechanism can lead to quite pathological results; the consumption-based status competition of the modern world is an important example (see Chapter XXX in this section).

Differential Success

Natural selection operates on cultural variation just as it does on genetic variation. Selection on culture also operates at different levels. On the group level, if a trait of interest covaries with a group or institution, then the differential success or failure rate of groups or institutions can have an effect on the frequency of such a trait over time. For example, the beliefs of North American Anabaptists and a few other religious groups cause them to resist the demographic transition and continue to have a high birth rate. As a result, these beliefs are increasing rapidly due to differential biological and cultural reproduction. The evolution of cultural traits due to the differential success of groups or institutions can proceed due to selection (if the cultural trait gives groups an advantage in competitions with other groups) or due to drift (if the cultural trait confers no fitness costs or benefits, but other aspects of the groups cause the differential success of groups). Sometimes the rate of extinction of unsuccessful groups and the proliferation of successful ones can be

quite rapid. For example, small businesses are formed in many economies at high rates. Most of them fail, but a few succeed and grow large or spin off many daughter firms. This mechanism of cultural change can be quite relevant to ecological destruction, if the behavior that allows one company to outcompete other companies involves profit-maximizing but ecologically destructive actions, such as the illegal disposal of chemical waste.

Role of Cultural Evolution in Ecologically Destructive Feedback Loops

Cultural evolution emerges from a powerful set of mechanisms for rapidly generating complex adaptations. However, it is hardly foolproof. In this section, we will briefly detail the ways in which cultural evolution can play a role in ecologically destructive behaviors.

Cultural Evolution Often Leads to Adaptations Which Are Local in Space

In the absence of effective large-scale institutions, cultural adaptations at small scales often create the familiar tragedy of the commons. For example, intense interfirm competition will favor businesses that pollute if societies fail to establish an institutional playing field that prevents firms from profiting from environmental or social abuses. The evolution of modern lobbying techniques in the USA is an example of how intense interfirm competition can subvert the policy-making process. Global-scale problems are especially difficult to redress because global institutions are relatively weak compared to national ones.

Cultural Evolution Often Leads to Adaptations Which Are Anachronistic

In principle, we can understand something about the future, as in the case of global warming, and institute changes to respond to opportunities and threats that have not yet happened. Despite this fact, the belief systems and institutions inherited via cultural transmission are the result of evolution in past environments and frequently lead to behaviors which may be maladaptive in the present and future. Additionally, behaviors which maximize survival or profit in the short term may in fact be horrendous strategies in the long term. Conversion of rainforest to cattle pasture in Costa Rica is an example of this problem; pasturelands offered high profits in the short term but quickly became barren savannas, as limited nutrient stores rapidly leached from ~~withered~~ topsoils.

Cultural Evolution Generates Coevolutionary Pressure in Other Systems

The use of pesticides by companies or farmers often leads to increased yields and profits in the short term and manages the risk of crop failure. The strategy of pesticide use will thus be favored by innovation, by biased transmission of strategy, and by the differential success of farmers. The heavy use of pesticides, however, leads to numerous consequences including the evolution of pesticide-resistant pests, the disruption of ecosystems, and biodiversity loss. The evolution of pesticide resistance and the destruction of natural food chains may serve to exacerbate pest problems in the future.

Cultural Systems Are Prone to Complex Dynamics Like Chaotic Change and Runaway Processes

We have already mentioned how cultural evolution of prestige can result in runaway status competitions. American consumerism is a classic example; advertising campaigns and social norms link love, friendship, and prestige with gifting large quantities of mass-produced goods. Thus, the behaviors necessary to maintain social relationships, attract mates and business partners, or improve one's status are often linked to large ecologically destructive externalities and unnecessary waste.

Harnessing the Mechanisms of Cultural Evolution to Manifest Beneficial Change

Cultural evolution is frequently a powerful process, and our policy tools to influence it are often feeble. Adding evolutionary theory to the policy analysis toolkit should help to improve policy recommendations (Richerson et al. 2006). Given that we desire to prevent environmental and social harms that we have good reason to know exist or will come to pass, how might practical tools derive from cultural evolutionary theory? Several major issues should be addressed to foster socially and environmentally beneficial policy:

1. Time scales must be reevaluated. Current policy tends to focus on short-term effects, and long-term-term effects are marginalized.
2. The scope of outcomes from policy must be reevaluated. Policy and law often have come to protect the interests of the wealthy and powerful over the interests of the public and the environment.
3. Institutional incentives and constraints must be reevaluated. Current corporate, political, and legal structures and institutions motivate unsustainable choices.
4. Linkages (often irrational) between various activities, roles, beliefs, motivations, constraints, and outcomes must be reevaluated. Blood diamonds and plastic

waste are symbols of love, and gas-guzzling SUVs with "We support our troops" stickers are symbols of patriotism.

An integrative intervention policy, which seeks to foster positive social and environmental behavior change, must aim to change both the attitudes and decisions of individuals and social structures and institutions.

Affecting Individual Decisions

1. We need to understand the persuasion strategies that have proven useful in the business and marketing worlds, for instance, using famous and prestigious people to model sustainable behaviors. Also, ~~lines of~~ research suggest that Brazilian telenovelas have played a substantial role in shifting ideas regarding reproduction, gender, and family planning (Newson et al. 2005).
2. Cultural success and the components of "high status" are to be redefined. Current cultural trends link costly signaling and excess to prestige and success. It certainly remains possible to associate sustainability with prestige and market image, both in the business world and in our personal lives.
3. Sustainability needs to be framed in a nonpartisan light. Secular and religious or liberal and conservative values can be interpreted in ways that promote social and ecological sustainability. Secular institutions, like universities, and religious institutions both have a critical role to play in shaping the values of their audiences. Likewise, liberal and conservative and secular and religious individuals need to hold their representatives accountable for their actions and force organizations to respect the values of their communities.

Affecting Societal Structures and Institutions

1. The time scale of concern need to be reevaluated in policy discussions. Our current dialogue surrounding elections and our methods of evaluating politicians is often based on incredibly short-sighted performance. In such a context, borrowing against the future to gain popularity in the present is an effective career strategy for a politician or business executive, albeit one with horrendous long-term consequences.
2. Externalized costs (e.g., environmental and social harms) need to be accounted for in the price of products and services. These negative externalities do not normally end up represented in the prices of products because the associated costs are normally passed off into the community due to weak laws and powerful corporate lobbying. The price of conventionally farmed food does not include the environmental costs associated with ground water pollution, since there is no real mechanism by which the affected community can challenge such practices. The Pagos por Servicios Ambientales program in Costa Rica is a program which seeks to do this, in a way that both an Ayn

Randian capitalist and a Greenpeace environmentalist would deem morally acceptable. The program acknowledges that our use of fossil fuels has a negative impact on the environment of our peers and levies a tax on its sale; this tax is then used to pay land owners for land-use strategies which capture the carbon released by the fossil fuels. This program establishes a free-market trade system which internalizes the negative externalities normally associated with environmental destruction.

While the basic science of cultural evolution is fairly well developed, the applied science of cultural evolution is in its infancy. We hope to have convinced that the applied science is worth pursuing.

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