

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.

Keywords

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

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.

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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.

62 Guided Variation

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

72 Biasing Forces

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

87 Conformity

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

99 **Success**

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

109 **Prestige**

110 Prestige-biased transmission involves the copying of a diverse array of traits
111 possessed by prestigious or culturally successful individuals. Determining who is
112 successful in a society is much easier than determining specifically what traits have
113 led them to success. By copying an array of traits which covary with prestige or
114 success, one stands a chance of copying the correct traits that give rise to success.
115 This learning bias is quite interesting in that it may allow neutral and even
116 maladaptive traits to hitchhike along with adaptive cultural traits. When the stan-
117 dards of what constitutes success are themselves culturally transmitted, this mech-
118 anism can lead to quite pathological results; the consumption-based status
119 competition of the modern world is an important example (see Chapter XXX in Au3
120 this section).

121 **Differential Success**

122 Natural selection operates on cultural variation just as it does on genetic variation.
123 Selection on culture also operates at different levels. On the group level, if a trait of
124 interest covaries with a group or institution, then the differential success or failure
125 rate of groups or institutions can have an effect on the frequency of such a trait over
126 time. For example, the beliefs of North American Anabaptists and a few other
127 religious groups cause them to resist the demographic transition and continue to
128 have a high birth rate. As a result, these beliefs are increasing rapidly due to
129 differential biological and cultural reproduction. The evolution of cultural traits
130 due to the differential success of groups or institutions can proceed due to selection
131 (if the cultural trait gives groups an advantage in competitions with other groups) or
132 due to drift (if the cultural trait confers no fitness costs or benefits, but other aspects
133 of the groups cause the differential success of groups). Sometimes the rate of
134 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.

169 **Cultural Evolution Generates Coevolutionary Pressure** 170 **in Other Systems**

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

179 **Cultural Systems Are Prone to Complex Dynamics Like Chaotic** 180 **Change and Runaway Processes**

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

188 **Harnessing the Mechanisms of Cultural Evolution to Manifest** 189 **Beneficial Change**

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

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

207 waste are symbols of love, and gas-guzzling SUVs with “We support our troops”
208 stickers are symbols of patriotism.
209 An integrative intervention policy, which seeks to foster positive social
210 and environmental behavior change, must aim to change both the attitudes and
211 decisions of individuals and social structures and institutions.

212 Affecting Individual Decisions

- 213 1. We need to understand the persuasion strategies that have proven useful in the
214 business and marketing worlds, for instance, using famous and prestigious
215 people to model sustainable behaviors. Also, lines of research suggest that
216 Brazilian telenovelas have played a substantial role in shifting ideas regarding
217 reproduction, gender, and family planning (Newson et al. 2005).
- 218 2. Cultural success and the components of “high status” are to be redefined. Current Au4
219 cultural trends link costly signaling and excess to prestige and success. It
220 certainly remains possible to associate sustainability with prestige and market
221 image, both in the business world and in our personal lives.
- 222 3. Sustainability needs to be framed in a nonpartisan light. Secular and
223 religious or liberal and conservative values can be interpreted in ways that
224 promote social and ecological sustainability. Secular institutions, like
225 universities, and religious institutions both have a critical role to play in
226 shaping the values of their audiences. Likewise, liberal and conservative and
227 secular and religious individuals need to hold their representatives account-
228 able for their actions and force organizations to respect the values of their
229 communities.

230 Affecting Societal Structures and Institutions

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

246 Randian capitalist and a Greenpeace environmentalist would deem morally
247 acceptable. The program acknowledges that our use of fossil fuels has
248 a negative impact on the environment of our peers and levies a tax on its
249 sale; this tax is then used to pay land owners for land-use strategies which
250 capture the carbon released by the fossil fuels. This program establishes a free-
251 market trade system which internalizes the negative externalities normally
252 associated with environmental destruction.
253 While the basic science of cultural evolution is fairly well developed, the applied
254 science of cultural evolution is in its infancy. We hope to have convinced that the
255 applied science is worth pursuing.

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