

Biological, Cultural, and Social Evolution

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Prologue

Since the analysis of Darwin, the term “evolution” has mostly referred to the biological evolution of animal and plant species through natural selection and genetic change, as emphasized by [E. O. Wilson](#). But recent research is now showing that two further processes of evolution are significant for humans. In “cultural evolution,” [Robert Boyd and P. J. Richerson](#) show that social learning can lead to a “dual inheritance” of genetic change and individual learning. In “social evolution,” [D. T. Campbell](#) led in theorizing a parallel evolution of human social structures.

To provide a practical application of these three types of evolution, this essay traces transformations in the human household or family, as it changed first under the influence of biological evolution, then under cultural evolution, and most recently through social evolution. The essay shows how all three processes of evolution continue to influence the households of today.

Essay

Charles Darwin’s 1859 book, *The Origin of the Species*, laid the groundwork for scientific analysis of biological evolution. His theory, based on “natural selection,” laid out the process by which organisms underwent gradual change in their form and function. In 1871, Darwin published *The Descent of Man*, to emphasize that humans had emerged through the same process of natural selection, later understood to result from genetic change. But Darwin’s theory did not explain the complexity of modern human society. While social scientists sought immediately to develop parallel theories of social evolution, after a century they had little more than narratives of hierarchy and progress, without logical explanations of process. From the 1970s, other groups developed an intermediate idea, “cultural evolution,” meaning social learning, passed from brain to brain, that interacted with genetic change to expand human skills and collaboration. Their results, widely accepted by biologists, enabled cultural evolution to be understood as a second mechanism of evolution among humans. In the last few years, I have argued that the older idea of social evolution can be shown to be part of human evolution through another path, which I call “institutional evolution.” Thus, social evolution phrased as institutional evolution can be seen as the third mechanism of human evolution, alongside biological and cultural evolution.

Three Frameworks of Evolution

The essay traces the interplay of three different evolutionary mechanisms in humans. I seek to introduce details of the process of social evolution, showing its parallels and distinctions in comparison with biological and cultural evolution, and then to step back and review human evolution more generally, picturing it as the interplay of the three processes.

I describe this evolutionary interplay especially for the case of the *household*, the small residential unit centered on the nuclear or extended family. The household is the most basic of human social structures, yet it has arguably changed in the course of human history, especially under the influence of changing evolutionary processes. The three evolutionary mechanisms are “biological evolution,” based on the logic of natural selection as described by Darwin; “cultural evolution,” the dual inheritance of social learning passed from brain to brain and genetic change; and “social evolution,” in which the emergence of syntactic language and collaborative groups created social institutions and transformed them in a parallel to genetic change. The household of today relies on all three

processes—on biological evolution to sustain birth, basic nurturing, and adjustment to ecological changes; on cultural evolution for the wordless imitation and observation that enables people to learn so many of their habits; and on the speech and institutions brought by social evolution for complex communication and our large-scale society. In the remainder of this section, I provide brief descriptions of the three evolutionary processes and the times of their greatest influence on human households. In the following section, I discuss details of households as they have been influenced by each evolutionary process.

Biological evolution. The human household was governed strictly by biological evolution in earliest times, including the era of Australopithecenes, beginning over four million years ago, and including the era of *Homo erectus*, starting some two million years ago. Through natural selection, satisfactory processes were found for foraging, mating, child-rearing, and the innovations of tool-making and food-sharing.

Cultural evolution. Cultural evolution began gradually, once the growing size of human brains expanded the circuits for memory. One may mark early stages of cultural evolution with the rise of *Homo heidelbergensis* in Africa and then Europe, some 500,000 years ago. These humans supplemented processes of individual trial-and-error learning with social learning. That is, through imitation or instruction, individuals gained knowledge from other individuals, passing knowledge (or elements of individual-level culture) from brain to brain in the same generation, and then passing the same knowledge on to members of the next generation. This process of social learning was in a certain competition with the genetic inheritance of biological evolution—for this reason, cultural evolution is also known as “dual inheritance.” Overall, the process was able to bring about inheritance of greater tendencies toward collaboration and altruism, which in turn advanced the rate of social learning. In addition, the term “cultural evolution” can also be extended to other mechanisms of change that affected humans in the same era. These included advances in visual communication through gesture; the rise of “protolanguage,” in which individuals learned small numbers of words exchanged just a few at a time; a modest increase in the size of human groups; and increased precision in tools. *Homo sapiens*, in early days of our species, gained steadily in capacities through these types of cultural evolution. In a theoretical prediction of the dual inheritance model, cultural evolution is predicted to have supported the rise of ethnic groups whose members were very much like one another, with similar habits, outlooks, and cultural markers. This would have provided a basis for group biological evolution, in which the strongest and most unified groups expanded in population at the expense of others.

Social evolution. As of about 70,000 years ago, certain communities of *Homo sapiens* arguably launched social evolution with a crucial pair of innovations, initiating the great expansion and migration of human populations from that time. The innovations were “syntactic language” (permitting the construction of full and precise sentences) and “collective intentionality” (conscious formation of groups to perform a chosen task). Each was necessary for the other. Language became the first social institution, and language communities rose to the size of 150 members. As members of the speaking community identified new tasks to complete, they created institutions to carry them out (early examples included migration, marriage, workshops, and religion). Each institution needs to be reproduced after a generation, to replace missing members and in order to preserve information on functioning of the institution. The value of each institution was assessed in terms of its benefits to the overall community and to individual beneficiaries of institution. Nevertheless, there were debates about social institutions, as the various beneficiaries had differing priorities for them. Overall, the processes of social evolution encouraged diversity within communities, while the processes of cultural evolution encouraged similarity within communities.

Evolution of Human Households

Household and biological evolution. The household, created through biological evolution, included relations among parents, offspring, and other group members. Households facilitated sharing of food, caring for offspring, foraging and hunting. In one example of biological change, births became more difficult for mothers as the brains of infants expanded. Births took place earlier and the time of early nurturing was extended.

Household and cultural evolution. As social learning developed, individuals in households came to have new capabilities, including more collaboration and interaction, visual communication, and relying on protolanguage especially for emergencies. Household groups may have become larger, more efficient in their foraging, and more closely linked to other households.

Household and social evolution. The household remained a biological structure, even after the rise of speech and social evolution. Speech presumably developed outside of the household, in communication among young and imaginative people from different households. Syntactic speech also created a larger community—growing after a couple generations to an optimum size of 150. In these new circumstances, households became constituent groups within a speech community. With time, speech came to be used in the household, households took on the task of teaching language to infants, and relations among household members changed because of the addition of verbal communication. With the passage of the millennia, household members became involved in additional institutions of steadily greater complexity. But the household could still provide the comforts of home.

Conclusion: Households at Present

Households have continued to exist throughout the millennia of human history. Households today are families, but they include others not born into family (this was doubtless true in earlier times). Households today vary greatly in size—from individuals and nuclear families, but up to the size of extended, co-resident families. Today, as long ago, households are mostly monogamous but sometimes polygamous.

People today leave the household for school and work to a far greater degree than in earlier times when so many were farmers. Some still spend most of their time in the household, though certain of their household tasks may be performed by employees who visit. The household is still central for sleep, dress, and personal hygiene. Preparation and consumption of food center in the household, though restaurants and cafeterias are cutting into that space. Marriages link couples within households; they also link the couple's household to households of their relatives.

Households play a central though often-neglected role in the national societies of today. Households can be considered as the source of the labor force for the full range of economic activities; households are centers of the ethnic and religious identity that is expressed in the larger society; households can be seen as the bases from which voters cast their ballots in cases where there are elections. The costs of child care, cooking, and home maintenance are generally borne by the household, but tend not to be accounted as part of the national or regional economy. The full range of household activities and responsibilities can be seen to rely, even today, on the three processes of biological, cultural, and social evolution.

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INSPIRATION FOR THIS ESSAY:

E. O. Wilson, *Human Nature*

Edward O. Wilson, *On Human Nature, with a New Preface* (Cambridge, MA: Harvard University Press, 1974, 2004), 17, 32–35.

Sociobiology is a subject based largely on comparisons of social species. Each living form can be viewed as an evolutionary experiment, a product of millions of years of interaction between genes and environment. By examining many such experiments closely, we have begun to construct and test the first general principles of genetic social evolution. It is now within our reach to apply this broad knowledge to the study of human beings. . . .

The heart of the genetic hypothesis is the proposition, derived in a straight line from neo-Darwinian evolutionary theory, that the traits of human nature were adaptive during the time that the human species evolved and that genes consequently spread through the population that predisposed their carriers to develop those traits. Adaptiveness means simply that if an individual displayed the traits, he stood a greater chance of having his genes represented in the next generation than if he did not display the traits. The differential advantage among individuals in this strictest sense is called genetic fitness. There are three basic components of genetic fitness: increased personal survival, increased personal reproduction, and the enhanced survival and reproduction of close relatives who share the same genes by common descent. An improvement in any one of the factors or in any combination of them results in greater genetic fitness. The process, which Darwin called natural selection, describes a tight circle of causation. . . .

It is nevertheless a curious fact, which enlarges the difficulty of the analysis, that sociobiological theory can be obeyed by purely cultural behavior as well as by genetically constrained behavior. . . . Consequently, an auxiliary goal of human sociobiology is to learn whether the evolution of human nature conforms to conventional evolutionary theory. . . .

We can be fairly certain that most of the genetic evolution of human social behavior occurred over the five million years prior to civilization, when the species consisted of sparse, relatively immobile populations of hunter-gatherers. On the other hand, by far the greater part of cultural evolution has occurred since the origin of agriculture and cities approximately 10,000 years ago. Although genetic evolution of some kind continued during this latter, historical period, it cannot have fashioned more than a tiny fraction of the traits of human nature. Otherwise surviving hunter-gatherer people would differ genetically to a significant degree from people in advanced industrial nations, but this is demonstrably not the case. . . .

In the case of the theory of the genetic evolution of human nature, if it is ever to be made part of real science, we should be able to select some of the best principles from ecology and genetics, which are themselves based on the theory, and adapt them in detail to human social organization.

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INSPIRATION FOR THIS ESSAY:

Boyd and Richerson, “The Evolution of Ethnic Markers”

Robert Boyd and Peter J. Richerson, *The Origin and Evolution of Cultures* (Oxford: Oxford University Press, 2005), 105, 107, 115.

We define culture as information—skills, attitudes, beliefs, values—capable of affecting individuals’ behavior, which they acquire from others by teaching, imitation, and other forms of social learning. A particular member of a set of attitudes, beliefs, and values will be referred to as a cultural variant. . . . We have adopted this definition because it focuses attention on the means by which cultural traditions are perpetuated. Culture is acquired by individuals by teaching, imitation, and other forms of social learning from other individuals, stored in individual brains, and transmitted by teaching and imitation to others.

Individual behavior depends in part on the cultural variation in the population from which individuals acquire cultural variants. At the same time, which cultural variants are available in the population to be acquired depends on what happened to individuals with different variants in the population in the past. For example, in every generation some individuals will invent or learn new behaviors, modifying the variants they originally imitated and transmitting the new variants to others in the process of enculturation. Cultural evolution can be viewed as a complex of sampling and modifying processes that operate iteratively on a population of variable culture-bearing individuals. That there is a very general analogy between genes and culture is a commonplace observation; what is new is the reworking of methods of analysis developed by evolutionary biologists to build a useful theory from the old analogy. . . .

The existence of ethnic groups and similarly marked social units suggests two evolutionary questions: (1) What are the processes that would cause a human population to split into two groups distinguished by cultural marker traits? (2) Could such processes give rise to cultural variation that is biologically adaptive in the sense of increasing reproductive success?

The model presented here suggests that the modes of cultural transmission that give rise to ethnically subdivided populations are adaptive because they allow populations to more accurately track a heterogeneous environment. Similar processes may favor the development of symbolically marked caste, class, occupational, and professional subgroups within complex societies. The process of imitating people like oneself sets up a self-reinforcing process that causes subpopulations occupying different habitats, or pursuing different economic strategies in the same environment, to become culturally isolated. Thus, the mean value of the adaptive trait in each habitat converges to the optimum. . . .

Unlike other mammals, humans acquire massive amounts of adaptive information culturally. Perhaps it is not coincidental that symbol-using humans of the late Pleistocene epoch became very widely distributed for a biological species. The processes modeled here, by allowing the protection of culturally transmitted adaptations to local conditions without genetic isolation, can be considered a cultural substitute for speciation. Undoubtedly many aspects of cultural transmission allow adaptation to a wide range of habitats. However, it does seem plausible that the fact that the human species is divided into distinct groups that are culturally isolated from each other may play a role in allowing humans to be culturally polymorphic and thus to occupy such a wide range of ecological niches.

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INSPIRATION FOR THIS ESSAY:

Campbell, “Ultrasociality”

Donald T. Campbell, “Two Distinct Routes beyond Kin Selection to Ultrasociality: Implications for the Humanities and Social Sciences,” in Diane L. Bridgeman, ed., *The Nature of Prosocial Development: Interdisciplinary Theories and Strategies*, 11–41 (New York: Academic Press, 1983), 11, 16, 35, 37.

The theory of kin selection is successfully providing a unifying core to a wide range of sociobiological studies. Its relevance to humans may be even greater than for other animals because of the human capacity for reckoning kin beyond the associative contiguity of mother and sibling. In the enthusiasm engendered by this success, anthropologists, sociologists, and biologists doing human sociobiology are apt to claim too much, are apt to claim that kin selection can explain all the basic forms of social behavior, and are apt to end up with the conclusion that ultrasociality, the division-of-labor social systems found only in the social insects and urban humankind, are in both instances to be explained by the same evolutionary mechanism, namely, kin selection. Instead, neither kin selection nor structured demes theory can explain degrees of sociality beyond the semisocial wasps and baboons. Additional mechanisms are required to explain the ultrasocial forms. . . .

By *ultrasociality* I refer to that high level of sociality in which full-time division of labor occurs, with specialized roles whose occupants do no food gathering and are fed by others. Usually there are stored foodstuffs. A soldier role may have evolved to protect such granaries. Often there are compact apartment-house-like residential arrangements. Always there is extreme effectiveness in communicating relevant information. Complex multi-individual cooperative acts are achieved. Self-sacrificial, even suicidal, bravery in collective defense occurs. . . . Such ultrasociality is found in the social insects (termites, ants, bees, and some wasps) and in urban humankind. It is absent in all vertebrates except humans. Baboons, chimpanzees, wolves, marmots, scrub jays, jackdaws, etc., achieve at best a lower level of sociality.

To get to the stage of self-sacrificial heroism in warfare or to procreational abstinence on the part of custodians of the tribal wisdom and to get into full-time division-of-labor societies made up of numerous primary groups, some of the beliefs transmitted to enculturated individuals must predispose behavior that is counter to any single individual’s inclusive fitness (even though increasing the group’s collective or average inclusive fitness). At this point the new model of social evolution of Boyd and Richerson (1982) becomes of particular value. It attributes a variation-generating function to the human capacity for belief conformity and to the human tendencies to force belief conformity on in-group fellows.

Boyd and Richerson (1982) start with the mathematical models of biological evolution. A first modification is to permit multiple parents and cross-familial parenting in the transmission of beliefs, customs, skills, etc., to a younger generation. . . . I anticipate that in the long run such a system would *not* work to produce complex social coordination, even though it would end up with the altruistic preachings heard by the offspring generation being many times more numerous than the selfish ones.

In Boyd and Richerson’s nonlinear version of social transmission, the offspring are influenced to adopt the majority position of the parent generation. Under these conditions, groups move rapidly toward internal uniformity in the social transmission. With small groups, chance pluralities would occur in different directions from group to group, and thus the model predicts both internal homogeneity within groups and large group-to-group differences. This is the condition that permits group selection to be effective and, thus, the selection of beliefs and culturally induced behavioral tendencies that are beneficial to the group but costly to the individual. . . .

Ultrasociality refers to the most social of animal organizations, with full-time division of labor, specialists who gather no food being fed by others, effective information sharing on sources of food and danger, self-sacrificial

action in collective defense, and other forms of absolute or hard-core altruism. This level has been achieved by ants, termites, and humans in several scattered archaic city states. The currently standard concepts of evolutionary theory used in sociobiology, such as kin selection and structured deme theory, adequately explain only moderately social forms such as semisocial wasps and baboons. In the social insects, the further route to ultrasociality has been made possible by caste sterility, which almost entirely removes genetic competition among the cooperators. This route has *not* been available for human societies. Instead, the development has been through mutual monitoring, forcing altruism on fellow group members who cannot survive without cooperative group membership, and a cultural evolution of norms and beliefs at least partially inhibiting a biological model of tendencies toward self-serving and nepotistic behavior. Attending to the details of these two distinct routes to ultrasociality provides a portrait of human nature compatible with traditional religious, literary, sociological and psychological views of human nature. Light is thrown on human ambivalence, honesty, deceit, bravery, and cowardice; the specific contests of lists of sins and commandments; human intuitions of justice, equity, and equality; the dynamics of ethnocentrism; and self-seeking and nepotistic distortions of collective bureaucratic rationality.