
Chimpanzee and Human Cultures

by Christophe Boesch and Michael Tomasello

Culture has traditionally been attributed only to human beings. Despite growing evidence of behavioral diversity in wild chimpanzee populations, most anthropologists and psychologists still deny culture to this animal species. We argue here that culture is not monolithic but a set of processes. These processes show much diversity both in the social norms and models that determine which individuals will be exposed to particular cultural variants and what cultural variants will be present in the population and in the social learning mechanisms that determine the fidelity of transmission of the variants over time. Recognition of the diversity of these processes is important because it affects cultural dissemination, cultural evolution, and the complexity of cultural artifacts. A comparison of chimpanzee and human cultures shows many deep similarities, thus suggesting that they share evolutionary roots. Two possible differences between the two species are discussed. First, thanks to indirect means of transmission such as language, cultural dissemination is possible over greater stretches of time and space in humans than in chimpanzees. Second, human cultures rely more intensively than chimpanzee cultures on cumulative cultural evolution through the ratchet effect, which allows the accumulation of modifications over time and produces more elaborate cultural artifacts.

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There is little agreement among anthropologists on precisely what is meant by the term "culture" as it is applied to human social groups (e.g., Kroeber and Kluckhohn 1952, Shore 1996). It might be supposed that looking to nonhuman primate societies for the evolutionary roots of human culture would simplify the definitional problems involved, if only because primate societies are not expected to include such ideal entities as values, attitudes, and beliefs, whose role in culture has been the main point of contention in many anthropological debates. Unfortunately, this is not the case, even though evolutionary biologists and comparative psychologists interested in culture have been primarily concerned with seemingly straightforward processes of social learning and other forms of nongenetic information transfer among members of social groups. The main problem is that the different disciplines involved approach the problem of culture with different sets of concerns. The basic dichotomy is between biological approaches, in which all information that is transmitted nongenetically among members of a group is of interest (e.g., Bonner 1980, Boyd and Richerson 1985, Dawkins 1976, Cavalli-Sforza and Feldman 1983, Mundinger 1980), and more psychological approaches, in which the main concern is the cognitive and learning mechanisms by means of which such information is transmitted (e.g., Galef 1992, 1996; Tomasello 1990, 1996).

These two approaches may be illustrated with the well-known case of the potato washing of a group of Japanese macaques (Kawamura 1959, Kawai 1965). A young female of this species discovered a new and useful food-processing technique with human-provisioned potatoes that had become sandy, and this behavior spread quickly—at least in the context of evolutionary time—to other group members, possibly as they imitated one another's behavior. The researchers documented in meticulous detail which individuals acquired the behavior and when they acquired it, establishing, among other things, that (1) the relatives and close associates of the original inventor acquired the new behavior first and (2) adult males generally did not acquire the new behavior at all. From a biological point of view, an acquired skill—and one that would seem to be at least somewhat instrumentally useful—was transmitted among individuals of a group and contributed to improved methods of foraging. On the basis of the general similarity of this process to human cultural transmission, Japanese macaque potato washing has been taken as a textbook case of cultural transmission that illustrates the deep evolutionary roots of human culture.

Recent reanalysis and reinterpretation of these observations from a more psychological perspective, however, have also highlighted some possible differences of this case from the human case. Galef (1992) reanalyzed the original data and suggested that individual Japanese macaques most likely learned to wash potatoes on their own (as had the original inventor), not by imitating their groupmates. As evidence for this view he noted

seen a change of state effected, the observer knows more about the physical nature of an object: that nuts crack, that rocks are heavy and hard, that fruit peduncles are flimsy.

3. Learning relationships among objects. Having seen an object manipulated, the observer knows more about the structural relationships that make it up or into which it meshes: that nuts are hollow and contain food, that rocks can cover food, that lids are threaded.

4. Learning what can be done with an object. Having seen an object used in a particular way, the observer knows that this functional use is possible for this sort of object: a stick can be used as a rake, the lid of a jar can be unscrewed, nuts can be smashed by striking them with rocks, a rod can be slid through a hole, fruit can be knocked down by swiping at it with sticks.

This last would seem to be what Tomasello (1990) intended; certainly, if a chimpanzee could learn tool function by observation, it would account for the results of Tomasello et al. (1987), and his more recent definitions mention "dynamic affordances." The trouble is that this is intrinsically about doing something with an object: raking, screwing, striking, swiping, sliding, etc. These are actions, and therefore emulation learning of this sort means associating a particular action with an object. For some this simply is imitation (e.g., Heyes 1994). In any case, this phenomenon is going to be hard to distinguish from imitation, and indeed the data Tomasello et al. (1987) describe as emulation have been suggested instead to show imitation of one act from a sequence (Whiten and Ham 1992) or imitation at an inappropriately general level of hierarchical organization (Byrne and Russon n.d.). There is no fully convincing evidence yet that chimpanzees can learn by observation what actions can be performed with an object (relational emulation) instead of how to perform them (imitation).

The two other senses of emulation learning—observational learning of physical properties and of relationships—are worth further investigation. In these cases, it should prove possible experimentally to divorce the crucial revelations from the actions that typically produce them. Problems may arise in distinguishing relationship learning from much simpler, associative explanations: for instance, linking the taste of nut meat with the sight of the unopened nut rather than appreciating notions of containment and hollowness. However, the more elaborated representations should generalize to other tasks involving containment and hollowness, whereas associative linking would remain specific to nut cracking.

The challenge is worth some effort, for it is about understanding not merely how animals learn to deal with physical problems but how they understand and represent the world. Is this a matter of relational operators like "under," "inside," and "through," material descriptors like "brittle," "tough," "heavy," "flimsy," or just an undifferentiated mass of associations as animal-learning theorists would suppose?

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The authors of this article are to be congratulated for providing both a comprehensive account of current evidence of tradition in chimpanzees and a useful framework for comparing traditions in humans and apes. I am, however, concerned that the article does not address some fundamental conceptual and evidential problems in the search for "the evolutionary roots of human culture." Three such problems (discussed in greater detail in Galef 1992) are as follows:

1. Is culture a trait open to selection and consequent evolution? Culture is not a characteristic of individuals, and therefore culture per se cannot, in the biological sense, evolve. Individuals may have cognitive processes enabling them to develop traditions; such cognitive processes are characteristics of individuals, open to selection and to elaboration by evolution, and possibly increase the ability of individuals to acquire socially and transmit patterns of behavior. However, evolution of cognitive processes supporting culture is not at all the same thing as evolution of culture itself.

2. Are the "cultures" of chimpanzees and humans homologous? If culture is not an evolving characteristic of populations and increasing complexity in culture reflects the evolution of cognitive processes underlying the ability to acquire socially and transmit behavior, then only those chimpanzee traditions that express social-learning processes homologous to those that support human culture should be discussed as possible antecedents of human culture. It follows that unless one believes, for example, that local enhancement somehow evolved into active teaching, language, imitation, or some other process important in the maintenance of human culture, chimpanzee traditions resulting from local enhancement are not relevant to discussion of the roots of human culture.

Unfortunately, in free-living chimpanzees, traditions that reflect cognitive processes such as imitation and active teaching are difficult to discriminate from traditions resting on cognitive processes such as local enhancement that are not true antecedents of human culture.

3. If chimpanzees have culture like that of humans, why is evidence of active teaching or imitation and of ratcheting so weak in wild chimpanzees? It is generally agreed that social transmission processes that simply call the attention of an observer to aspects of the environment that others are exploiting (e.g., local enhancement, passive teaching, emulation) cannot provide a basis for cumulative cultural change (ratcheting). Once these forms of social learning have focussed attention on some aspect of the environment, individuals must learn for themselves how to manipulate that portion of the environment. No individual can copy behavioral innovations of its predecessors, and, almost by definition, no cumulative cultural change can occur.

The characteristic of human culture that makes it so central to human life is its cumulative potential. Each generation can inherit intact the innovations of preceding generations, improve upon that inheritance, and pass on improved behavioral variants. Over generations, patterns of behavior develop that no individual could acquire as a result of his/her asocial interaction with the physical environment.

While evidence of traditions in both free-living chimpanzees and other wild animals is overwhelming, evidence in any nonhuman species of free-living animal of teaching, imitation, or cumulative culture is not strong. For example, Boesch, after ten years of field observation, reports two incidents that he interprets as instances of active teaching by chimpanzees. Others who have watched wild chimpanzees for hundreds of man years report active teaching by chimpanzees even less frequently than Boesch. If active teaching exists in chimpanzees and is adaptive, it is surprising that it is expressed so rarely. Similar arguments can be made on the basis of observed failures of chimpanzees (e.g., Goodall 1986: 426; Kitahara-Frisch and Norikoshi 1982) or other free-living primates (see Tomasello and Call 1997: 282–84 for review) to imitate adaptive behaviors after watching others repeatedly exhibit them.

We know of nothing that wild chimpanzees do that an individual chimpanzee could not learn for itself (Goodall 1970). We can, therefore, tentatively conclude that in the millions of years that *Pan troglodytes* has existed, chimpanzees have not ratcheted any behavior to a level where the cumulative effects of culture are obvious. By contrast, I suspect that one would not have to observe even the most technologically or socially primitive of human social groups for 30 hours, never mind 30 years, to see examples of behavior that were obviously the product of cumulative culture.

In summary, it is not my position that chimpanzees do not actively teach, imitate, or exhibit cumulative cultural change homologous to human culture. Perhaps they do. However, "culture," like "adaptation," is an onerous concept (Williams 1966). The burden of proof lies with those who would argue for the existence of human-like culture in any nonhuman species. I do not believe that proof has yet been provided.

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It is certainly true, as Boesch and Tomasello remark, that the several disciplines involved with the phenomena of culture approach them with very different concerns and that this puts formidable obstacles in the way of interdisciplinary synthesis. The basic dichotomy, they say, is between biological approaches, which focus on culture as a corpus of information transmitted by other-than-genetic means, and psychological approaches, which focus on the mechanisms of transmis-

sion themselves. There is no incompatibility here; rather, the two sets of approaches are perfectly complementary. It stands to reason that if information is to be transmitted across the generations so as to form a cultural tradition, then mechanisms must be in place to enable such transmission to occur. Furthermore, this complementarity of approach is underwritten by a complex of shared assumptions which are implicit in the metaphor of transmission, in the notion of "cultural variants" as particles of transmissible information, and in the idea of behaviour as their observable expression.

These assumptions, however, which remain pervasive in biological and psychological circles, have long since been abandoned by the majority of social and cultural anthropologists—albeit with notable exceptions (Sperber 1996). Yet, paradoxically, in addressing the quintessentially anthropological "problem of culture," Boesch and Tomasello completely bypass recent and contemporary approaches in social and cultural anthropology. These approaches, admittedly, are many and varied, as indeed are the approaches to be found in the current literatures of biology and psychology. Fortunately, not all biologists are committed to a reductionist view of the organism as a vehicle for the propagation of form-and-behaviour-specifying information, nor are all psychologists committed to what could be called the Xerox model of behaviour, according to which every exemplar of a traditional practice is run off from a master copy installed within the mind of the individual.

These, nevertheless, are the theoretical commitments that Boesch and Tomasello bring to their work. And if there is a fundamental and intractable dichotomy, it is between the kind of approach they adopt, with its emphasis on the distribution and transmission of information, and more developmentally and ecologically oriented approaches in biology and psychology (e.g., Oyama 1985, Dent-Read and Zukow-Goldring 1997) which ground the activities of organisms in an ongoing and mutually constitutive engagement with their environments. These latter approaches chime with much recent work in anthropology which has stressed the inseparability of knowledge and practice and the embodied character of cultural skills (e.g., Bourdieu 1990, Csordas 1990, Lave 1990, Lave and Wenger 1991). They also resonate with the position I have taken in my own work (Ingold 1996a, b).

In comparing the ways in which human beings and chimpanzees learn, the important thing, according to Boesch and Tomasello, is whether novices realise from watching others that a certain operation is possible but are left to their own devices to figure out how to do it or whether they precisely copy the bodily routines of their mentors so that the technique is literally reproduced across generations. Depending on the answer, Boesch and Tomasello would describe the learning situation as one of either emulation or imitation. For them the distinction is absolutely critical, for only in the latter case can one speak of the *transmission* of technique, and only if it is transmitted can the technique form part of a cultural tradition.