CHAPTER 1

Human Culture in Evolutionary Perspective

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I. INTRODUCTION

Many animal species are "cultural" in the sense that individuals acquire important behaviors and skills from groupmates via social learning. Thus, whales socially learn some foraging techniques from others, capuchin monkeys socially learn some grooming-type behaviors from others, and chimpanzees acquire the use of some tools by observing the tool-use activities of others in their social group (see Laland & Galef, 2009, for an overview).

But human culture is clearly different. The challenge from an evolutionary perspective is to specify the nature of this difference. The proposal here is that nonhuman primate (and other animal) culture is essentially individualistic, or maybe even exploitative. That is to say, when a chimpanzee individual observes another using a tool and then learns something that facilitates her own use, she is simply gathering information that is useful to her—much as she might gather information from the inanimate world. The one being observed may not even know that the observer is gathering information from her actions.

In contrast, human culture and cultural transmission are fundamentally cooperative. Synchronically, humans engage in much more cooperative behavior in terms of such things as collaborative problem solving and cooperative (or even conventional) communication. Moreover, human individuals live in a world in which the group expects them to conform to its particular conventions and social norms—or else! The result is a society structured by cooperatively created and enforced conventions and norms for how to behave as one of "us," resulting ultimately in rule-governed social institutions. Diachronically, this cooperative way of living translates into established members of the group teaching things to youngsters and novitiates, who not only learn but actively conform. Teaching and conformity are main contributors to the stability of cultural practices in a group and—precisely because of this stability—to the unique ways in which human cultural practices ratchet up in complexity over historical time. The result is human artifacts and symbol systems with "histories," so-called cumulative cultural evolution (Tomasello, Kruger, & Ratner, 1993).

Underlying humans' uniquely cooperative lifeways and modes of cultural transmission are a set of species-unique social-cognitive processes, which we may refer to collectively as skills and motivations for shared intentionality (Tomasello, Carpenter, Call, Behne, & Moll, 2005). These involve such things as the ability and motivation to form shared goals and intentions with others in collaborative activities, and the ability and motivation to share experience with others via joint attention, cooperative communication, and teaching. Skills and motivations of shared intentionality arose as part of a coevolutionary process in which humans evolved species-unique ways of operating, indeed cooperating, within their own self-built cultural worlds (Richerson & Boyd, 2006).

In this chapter, we attempt to characterize human culture in evolutionary perspective. We do this, first, by specifying some of the most important ways in which human social life is more cooperatively structured than that of other primates. Second, we detail how this more cooperative mode of living transforms the process of cultural transmission across generations. And third, we look at the underlying social-cognitive skills and motivations that make it possible for developing children to come to participate in the culture into which they are born—which then leads them to construct still further, culturally specific cognitive skills. We conclude with some speculations about how this all might have come about in the process of human evolution.

II. APE AND HUMAN COOPERATION

The vast majority of primate species live in social groups and so are cooperative in a very general way. But what we are concerned with here are more specific, and arguably more complex, forms of cooperation such as collaborative problem solving; coalitions, alliances, and group defense; active food sharing; cooperative communication; conventions and social norms for cooperation;

and so forth. These are all things that characterize human cultural life, and our question here is the degree to which they are shared by other primates. To answer this question, we focus, in the case of humans, on small-scale societies, as cooperation in modern technological societies has some special properties. In the case of nonhuman primates, we focus on our nearest great ape relatives who, despite some species differences, are basically similar on the dimensions of interest here—with special attention to the species for whom most is known, chimpanzees, one of humans' two closest living relatives. We proceed by reviewing in fairly broad strokes what is known about humans and their great ape relatives in six domains of cultural life: subsistence; economy; childrearing and prosocial behavior; communication and teaching; politics; and norms and institutions.

A. Subsistence

Great apes basically forage for food individually. They may travel in groups or small bands and sit together while eating—and may even vocalize upon finding food, which attracts others (perhaps as protection against predation)—but there are almost no habitual foraging activities in which great apes actively collaborate in the acquisition of food. Upon entering a patch of fruit, for example, individuals typically take a piece of fruit and then move away a certain distance from others to eat it. (This can be observed on a daily basis in captive settings in pretty much all great apes when highly desirable food is involved.) Some great apes are more tolerant than others in feeding contexts, perhaps especially bonobos, but even they do not actively share food often (there is some exchange of food for services; see later section on "Economy").

The one major exception is the group hunting of monkeys by chimpanzees. Not all chimpanzee groups engage in this activity, and there are major differences among the groups that do. In some groups the hunt resembles a kind of helter-skelter chase in which multiple individuals attempt to capture the monkey with little if any coordination (e.g., at Gombe: Stanford, 1998; Ngogo: Watts & Mitani, 2002). In the Tai Forest, however, the canopy is continuous, and the monkeys are quite agile, and so such uncoordinated chasing will not get the job done. In the account of Boesch (e.g., Boesch, 2005; Boesch & Boesch, 1989; Boesch & Boesch-Achermann, 2000), hunting chimpanzees have a common goal and take complementary roles in the hunt. In this account, one individual chases the prey in a certain direction while others climb the surrounding trees and prevent the prey from escaping, at which point one or more individuals pounce. But a less rich characterization of this activity is the following (see Tomasello et al., 2005). One chimpanzee begins by chasing the monkey, given that others are around (which he knows is necessary for success). Each other chimpanzee then goes, in turn, to the most opportune spatial position still available at any given moment in the emerging hunt. In this process, each participant is attempting to maximize its own chances of catching the prey, without any kind of prior joint goal or joint plan or assignment of roles. This kind of hunting event clearly is a group activity of some complexity in which individuals are mutually responsive to one another's spatial position as they encircle the prey. But wolves and lions do something very similar, and most researchers do not attribute to them any kind of joint goals and/or plans (Cheney & Seyfarth, 1990; Tomasello & Call, 1997). It is perhaps also important that bonobos do not hunt in groups in the wild (nor other apes), suggesting that the chimpanzee version and the human version may have arisen independently, based on different underlying psychological processes.

This interpretation of chimpanzee hunting is supported by what happens after the kill. When a group of chimpanzees captures a monkey, the participants in the hunt typically all get meat—more than late-arriving chimpanzees who did not participate in the hunt. However, recent research by Gilby (2006) elucidates the basically individualistic mechanisms involved in this "sharing." Gilby notes, first of all, that chimpanzees who possess meat after the kill often attempt to avoid others by stealing away from the kill site, by climbing to the end of a branch to restrict the access of other chimpanzees, or by chasing beggars away. Nevertheless, meat possessors are typically surrounded by beggars. The possessor usually allows the beggars to take some of their meat, but this is a direct result of the begging and harassment: the more a beggar harasses, the more food he gets. The logic is that if the possessor actually fights the harasser for the meat actively, he will likely lose the rest of it to either the harasser or others nearby in the melee—so the best strategy is to eat quickly and allow others to take some meat to keep them happy (the so-called tolerated theft, or harassment, model of food sharing). Tomasello et al. (2005) suggest the further possibility that hunters obtain more meat than latecomers because they are the first ones immediately at the carcass and begging, whereas latecomers are relegated to the second ring.

This general account is supported by a recent experimental study. Melis, Hare, and Tomasello (2006a) presented pairs of chimpanzees with out-of-reach food that could only be obtained if they each pulled on one of the two ropes available (attached to a platform with food on it) and did so simultaneously. When there were two piles of food, one in front of each participant, there was a moderate amount of synchronized pulling. However, when there was only one pile of food in the middle of the platform, making it difficult to share at the end, coordination fell apart almost completely. Moreover, Melis et al. also found that there was more synchronized pulling from pairs of individuals previously identified as tolerant of one another than from less tolerant pairs (and generally more tolerant bonobos do better in this task as well; Hare, Melis, Woods, Hastings, & Wrangham, 2007). The point is that chimpanzees only coordinate synchronized activities when there is likely to be no squabbling over the food at the end. Thus, while it is relatively easy for hunting chimpanzees to collaborate in the "large carcass" scenario in which each individual has a reasonable probability of capturing the monkey and even unsuccessful participants can still harass the capturer and get some meat, this strategy does not generalize easily to other hunting contexts.

Humans, as compared with apes and other primates, engage in an extremely wide array of collaborative activities, many of these on a very large scale with non-kin (and many under the aegis of social norms in the context of symbols and formal institutions; see later discussion). And different cultural groups collaborate in different activities: some in hunting, some in fishing, some in house building, some in playing music, some in governing, and on and on, which testifies to the flexibility of the underlying cognitive skills involved. In foraging activities in particular, the prototypical situation is one in which a small group establishes the joint goal of capturing a certain prey or extracting a certain plant. Then they plan their various roles and how they should be coordinated ahead of time—or else those roles are already common knowledge based on a common history of the practice (see Hill & Hurtado, 1996, for a review).

From the point of view of other primates, the distinguishing characteristic of these collaborative foraging activities is their highly cooperative nature. In addition to the joint planning and execution, during the foraging itself individuals help others in their roles with regularity. For example, Hill (2002) documents the following cooperative activities that take place during group foraging in the Ache of South America: cutting a trail for others to follow; making a bridge for others to cross a river; carrying another's child; climbing a tree to flush a monkey for another hunter; allowing another to shoot at a prey instead of self; allowing another to extract honey or larvae that self has found; vocalizing to locate escaping prey for others; calling the location of the resource for another to exploit while self continues searching for something else; waiting for others to join a pursuit, even when this lowers probability of success;

carrying game shot by another hunter or the palm fiber that others have gathered; climbing tree to knock down fruit for others to gather; bringing weapons and giving to others for their hunting; spending time instructing others in the best technique; lending bow or ax to other when self could use it; helping look for others' lost arrows; helping repair others' broken arrows; going back on trail to warn others of wasp nest or poisonous snake; removing dangerous obstacles from trail before others arrive; and so forth. Hill (2002) documents that the Ache spend from about 10% to 50% of their foraging time engaged in such altruistic activities—pretty much all of which would be unthinkable for nonhuman primates.

When a large prey is caught, the norm in most forager societies is that the participants carry the carcass back to some home base and share the catch with others, not only in their immediate families but also more broadly in the social group at large. Indeed, they are typically under strict social norms to do so, as those who do not share are harshly sanctioned (Hill & Hurtado, 1996). This propensity to share the fruits of collaborative labor in a "fair" way is extremely strong in humans; people in almost all cultural groups have internalized norms for sharing and fairness (see Fehr & Fischbacher, 2003, for a review). In a study similar to that reported earlier by Melis et al. (2006a), Warneken et al. (in press) found that young children cooperate just as eagerly regardless of whether the rewards are already divided for them or they must find a way to divide them themselves; they continue to cooperate in either case, trusting that they will be able to work out a satisfactory solution.

Kindly update

In general, then, great apes forage in basically the same manner as other social mammals: traveling and eating together, presumably as protection against predation, with very few collaborative foraging activities. The group hunting of chimpanzees very likely operates in the same manner as that of social carnivores, although perhaps based on more flexible cognitive mechanisms. In contrast, humans forage cooperatively, helping others as needed and sharing the spoils at the end in a "fair" manner (see Fig. 1.1). That is to say, great apes forage individualistically, whereas humans forage (and farm—but that is another story) cooperatively.

B. Economy

Like many animal species, each of the great ape species may be said to participate in a "biological market." In chimpanzees, the "commodities" exchanged are such things as grooming, support in fights, sex, and meat, with most of the activity involving males (Muller & Mitani, 2005). Many other animal species

FIGURE 1.1: Group foraging in the Hadza. (Photograph courtesy of Frank Marlowe.)

have analogous biological markets in the various social behaviors and resources important in their lives (see Noe, Van Hooff, & Hammerstein, 2001).

But human markets are different. In addition to reciprocity of various behaviors, humans trade items that they own. Although apes may have some respect for a physical possession, physical possession is not ownership. Thus, for example, if one ties a valuable object onto a string and then onto an individual macaque, others will not take it if the string is very short and so the object is close to the individual, but they will take it if the string is long so the object is far from its "possessor" (Kummer & Cords, 1991). This kind of respect for possession is presumably based on fear of retaliation for taking an object another physically holds. Human ownership of various kinds of property, on the other hand, is a fundamentally cooperative arrangement in which everyone agrees to respect others' rights. "Claims to property only makes sense in a social context where there is some level of cooperative behavior: if any given subject is to have control over any given object, others must understand the signals of ownership and acquiesce in them" (Rose, 2007, pp. 3–4). For example, when driftwood washes onto the beach after a storm, people who desire it often go and collect it and pile it in a pile, sometimes leaving a personal object beside it to mark that they have collected it and so claim ownership. Others naturally respect this and do not attempt to take that wood, but only wood not already in piles (Rose, 2007). On the other hand, when captive chimpanzees encounter large numbers of small pieces of food spread out over an area, they grab as much as they can and hold it as close as they can to their body (or perhaps sit right next to it), but there are no reported instances, to our knowledge, of them using anything like this piling strategy as a way of claiming ownership—presumably because no other chimpanzees would recognize or respect it if they did.

Another obstacle to real ownership and trade is that chimpanzees do not really trust others in the trading situation (typically with good reason). Thus, captive chimpanzees can learn to trade objects with humans—for example, tokens for food—but when they themselves have a valuable object, such as a grape, they have an extremely difficult time letting go of it in trade even for something obviously much more valuable, such as a whole bunch of grapes. Brosnan, Grady, Lambeth, Schapiro, and Beran (2008, abstract) speculate that "Chimpanzees lack ownership norms, and thus have limited opportunity to benefit from the gains of trade, and [the] risk of defection is sufficiently high that large gains must be imminent to justify the risk." In stark contrast, human foragers are often said to live in a kind of "primitive communism," in which the sharing of many things, especially food, is the norm ("no one starves unless we all starve"). In a systematic review, Gurven (2004) documents how widespread the sharing and trading of food among humans is in small-scale societies. In assessing possible hypotheses to explain this pattern of widespread food sharing, Gurven concludes that it is probably multiply determined, but he also opines that the big picture is not tit-for-tat reciprocity, but rather "more complicated social arrangements, including those whereby important social support is provided only if one adheres to socially negotiated sharing norms" (p. 559). And, of course, in many small-scale societies a large role is played by the gift (Mauss, 1954), which serves to establish and cement social bonds as well as create obligations of reciprocation.

The general conclusion is that chimpanzees and other great apes are fairly similar to many other animal species in terms of their biological markets—based mainly on kinship or some kind of close reciprocity. But in the human market reciprocity is structured by a cooperative regime in which ownership rights are cooperatively recognized and enforced by all. Food sharing is much more widespread in humans than in other primates, at least partly because there is more trust in reciprocity. One speculation is that humans' unique forms of food sharing arose originally in the context of cooperative foraging, with the “fair” division of spoils (see earlier discussion) now extended to other contexts.

C. Child Care and Prosocial Behavior

The special cooperativeness with which humans, as compared with other great apes, deal with food comes out again when we look at their prosocial behavior in general. In recent experiments it has been found that chimpanzees will help others achieve their goals when all that is required is expending a little energy. But they are not so helpful in supplying others with food.

Warneken and Tomasello (2006, 2007) had 1-year-old human infants and three human-raised chimpanzees confront a human adult needing help with 10 simple problems such as fetching an out-of-reach object or opening cabinet doors with hands full. Almost all of the infants helped at least once, and they basically did so immediately. Although they did not help in the other tasks, the chimpanzees did help humans to fetch out-of-reach objects. Because there may be many reasons that human-raised chimpanzees would help a human, in another study, Warneken, Hare, Melis, Hanus, and Tomasello (2007) gave mother-raised chimpanzees the opportunity to help humans, which they did, and then also the opportunity to help one another. The latter situation was that one chimpanzee watched while another struggled to open a door into a room. The observing ape knew from previous experience that the door could be opened by removing a pin. The surprising finding was that the chimpanzee observers did indeed remove the pin and help their groupmate gain access to the room (and there was no evidence that they expected any reward themselves).

But despite their helpful attitude in providing services for others, chimpanzees do not seem to be motivated to provide food for others—even at no cost to themselves, and even when the recipient is their child. In a recent set of experiments by Silk et al. (2005) and Jensen, Hare, Call, and Tomasello (2006), chimpanzee subjects were faced with the choice of pulling in one of two boards, on each of which was two reward trays—one tray accessible to the subject and one tray accessible to another individual in an adjoining room. In the simplest situation, one of the boards contained one piece of food for the subject and none for the partner, whereas the other board contained one piece of food for each. Thus, the energy that a subject needed to expend was identical in the two cases, and the reward for the subject (one piece of food) was identical in the two cases. And so the question was whether the chimpanzees would go ahead and pull the board that would also deliver some food to the partner—at absolutely no cost to themselves. The answer in both studies was that they did not. And in a control condition in which the other room was empty and the door to it open—so that the pulling chimp could quickly go get the food designated for the other room—the subjects in Jensen, Call, and Tomasello (2007a) demonstrated that they knew that the food was indeed going to the other room. Fehr, Bernhard, and Rockenbach (2008) have recently shown that school-age children in a very similar paradigm pull the equitable option more often than the selfish option, and Brownell, Svetlova, and Nichols (2009) found the same thing with children at 25 months of age.

Even more startling, in a recent study, Ueno and Matsuzawa (2004) looked systematically at food sharing among three chimpanzee mothers and their infants. They recorded many attempts by the infant to get food from the mother, approximately 60% of which were rejected. More active transfers of food by the mothers to the infants were rare, and when they did occur the mothers always—100% of the time—transferred to their infants the less palatable part of the food they were eating, that is, the peeling, the husk, or the shell. This is more than they would do for other adults, of course, and so there are clearly some maternal instincts at work here. But human mothers, obviously, actively provision their infants at a much higher and more generous rate (Hrdy, 2009).

The way that human mothers actively provision their children with food reflects a larger pattern. Humans are so-called cooperative breeders, which basically means that children are cared for not only by their mothers but also by other adults, including the father and maternal grandmother, of course, but also other mothers in cooperative arrangements. These other caretakers not only help the children in various ways but also actively provision them with food (Hrdy, 2009). Although there are some New World primate species who are also cooperative breeders, among the four species of great apes, mothers provide basically 100% of the child care themselves. In humans, across both traditional and modern industrial societies, the figure is closer to 50%. Hrdy (2009) speculates that cooperative breeding is the evolutionary context within which humans began down their distinctively cooperative way of living. A related speculation that would fit especially well with the current account is that cooperative foraging creates the need for some way of managing the children so that mothers may forage more efficiently and effectively. Help from otherwise idle grandmothers, or cooperative child-care arrangements among mothers, would clearly be beneficial for maximizing foraging efficiency as a whole.

As part of this whole complex, another unique aspect of human social life (i.e., among great apes) is of course the family in general. Male and female humans form pair bonds, sometimes exclusively, and males are partially responsible for their children's provisioning and care. One consequence of this familial pattern is that human children and fathers form strong bonds, as do siblings, which is not true in other great ape species. Chapais (2008) spells out some of the many implications of stronger familial (especially paternal) bonds, not the least of which is that when females immigrate to neighboring groups (characteristic of chimpanzees, bonobos, and humans) human males still retain ties with their sisters and daughters, and these kinship bonds serve to dampen aggression between neighboring groups (see section on "Politics").

D. Communication and Teaching

It comes so naturally to humans that we do not think of it as cooperative behavior at all, but the free exchange of information in humans is premised on the cooperative assumption that a communicative act provides useful or relevant information not for the speaker but for the listener (Grice, 1957). Thus, humans routinely inform others of things that they believe will help them, even when the speaker is just a bystander and gains no benefit at all—like giving directions or pointing to something that the other person dropped. True, the energy or cost associated with an informative communicative act is low. But that makes it all the more mysterious why, apparently, even our closest primate relatives do not seem to offer up information to others helpfully in this same way.

Virtually all animal communication, including that of great apes, involves one individual getting the other to do what he wants him to. The apparent exceptions are food calls and alarm calls. But, in recent interpretations, even these vocalizations are considered mainly self-serving. Thus, when chimpanzees find food, they call so that they can have company while eating, as protection against predators; and when they spy a predator, they vocalize as a way of recruiting allies for defense, or as a way of signaling the predator that he has been spotted (Owren & Rendall, 2001). Importantly, these vocalizations are given even when the entire group is already there and so not in need of any information about the situation; thus, their function is not to inform. Seyfarth and Cheney (2003, p. 168) say about nonhuman primates: "Listeners acquire information from signalers who do not, in the human sense, intend to provide it"; and Zuberbühler (2005, p. 126) says: "Nonhuman primates vocalize in response to important events, irrespective of how potential recipients may view the situation." Even when chimpanzees communicate with a human (e.g., by pointing), they are virtually always attempting to get him to do something for them, as are language-trained great apes (over 95% imperatives in various studies; Tomasello, 2008).

In contrast, even from their earliest, prelinguistic attempts at intentional communication, human infants inform others of things helpfully. Thus, when 12-month-old infants see an adult searching for an object, they will direct her to it with a pointing gesture, if they know where it is (Liszkowski, Carpenter, Striano, & Tomasello, 2006). Variations on this basic situation establish that the infants do not want the object for themselves (e.g., they quit pointing as soon as the adult has fetched it), and they are not just eager for the adult to perform an activity with the object (e.g., they point preferentially to objects whose location the adult is ignorant of; Liszkowski, Carpenter, & Tomasello, 2008). Cooperative informing comes naturally to even very young, prelinguistic human infants (see Fig. 1.2).

FIGURE 1.2: Human infant pointing to coordinate a collaborative activity.

Perhaps surprisingly, great apes do not even *comprehend* pointing when it is used in an informative manner. Apes follow gaze and pointing direction to visible targets, but they do not seem to understand an informative communicative intent. Thus, many different studies have found that when apes are searching for hidden food and a human points to a cup to inform them of its location, they do not understand. They do not ask themselves why the pointer wanted them to attend to the cup; they do not seek relevance (Tomasello, 2006). This makes perfect ape sense, of course, as in their everyday lives apes do not experience someone pointing out food for them helpfully—they compete with others for food—and so they do not assume an altruistic intent here. Human infants, on the other hand, understand informative pointing and make the appropriate relevance inference in such situations prelinguistically, at 12–14 months of age (Behne, Carpenter, & Tomasello, 2005). In this situation, infants appear to ask themselves the question: Why does *she* think that my attending to that cup will be helpful or relevant for *me*? This self-question is based on the cooperative assumption that others are trying to be helpful. Chimpanzees do not operate with anything like this Gricean principle of cooperation, and thus they have no basis for making the appropriate relevance inference.

A special application of this kind of cooperative communication is teaching, in which one individual, often an adult, cooperatively informs another, often a child, of how things work. Gergely and Csibra (2006) argue that teaching is especially important in the human case because the existence of relatively "opaque" cultural conventions (there is no causal structure or else it is difficult to see this structure) requires that human adults be specifically adapted for pedagogy toward children and that human children be specifically adapted for recognizing when adults are being pedagogical toward them (what Tomasello, Kruger, & Ratner 1993, called instructed learning). Though it varies greatly in form across cultures (some employing very little formal instruction beyond teaching children appropriate behavior in public and various kin relations), teaching in one form or another would seem to be universal across human cultures (Kruger & Tomasello, 1996). There have been no reported observations of chimpanzees engaged in anything resembling teaching since the two observations of Boesch (1991), and these have multiple interpretations not involving informing or teaching.

The overall point is that humans seem to have evolved a system of communication premised on cooperation, whereas other great apes have not. One possible explanation is that humans evolved this informative communicative function in the context of collaborative activities such as collaborative foraging, where helping the other typically helps us both toward our common goal, whereas chimpanzees do not engage in the appropriate kind of collaborative activities (Tomasello, 2008). The extension to situations aimed at instructing the young just contributed further to the cooperative structure of the group.

E. Politics

Politics is about social power, and the lines of social power are relatively clear for all four great ape species. In gorillas and orangutans, dominant males do whatever they want whenever they want, and they mainly stay clear of one another. In chimpanzees, multiple males live in the same group and they have a fairly clear dominance hierarchy, with all males dominating all females, though less dominant chimpanzee males may form coalitions and alliances and so increase their power. Bonobos have taken this strategy to the extreme, as bonobo females use coalitions and alliances to dominate males (who are actually individually physically stronger). Coalitions and alliances are a fairly common political strategy in various mammalian species (Harcourt & de Waal, 1992).

The main mechanism for keeping the peace among great apes is that if one individual harms another (e.g., by stealing its food or baby), the victim will quite often retaliate (within the constraints of any dominance relations at play). Indeed, the retaliation motive is so strong in chimpanzees that if one individual steals food from a victim in an experimental setting, this victim will knock that food away from the thief even if that means no one, including the victim, will get it (Jensen, Call, & Tomasello, 2007a). After conflicts are over, great ape combatants, like many mammals, quite often reconcile with various species-typical behaviors, often including touching (de Waal, 1989). De Waal (1989) has also claimed that in great apes third parties sometimes console losers in fights, but recent research suggests that the "consolers" are actually just trying to keep from being the targets of aggression themselves (Koski & Sterck, 2009). The same interpretation may also be given to so-called policing in the group by dominant individuals (e.g., Flack, Girvan, de Waal, & Krakauer, 2006), as dominants have a direct interest in keeping the peace (and breaking up emergent coalitions) as well. And so, in the group, chimpanzees and other apes retaliate against transgressors, and sometimes individuals intervene in fights in an attempt to keep themselves safer.

In terms of "foreign policy," chimpanzees are particularly hostile to individuals from neighboring groups (bonobos apparently less so). Even though chimpanzee and bonobo females immigrate to neighboring groups as adolescents (and so there is much kinship between neighboring groups), because there is no recognition of paternity, males do not know they have relatives next door. Chimpanzees in particular have violent, sometimes deadly, encounters with their neighbors, and indeed males often go on so-called border patrol to check for any foreigners that might be encroaching on their territory (Watts & Mitani, 2001). While humans clearly have an ingroup bias, and engage in intergroup conflict with some regularity, they are often more friendly with immediately neighboring groups, perhaps partly because potentially aggressive and hostile males recognize their sisters and daughters next door (Chapais, 2008). This then sometimes leads to a kind of tribal structure in which neighboring groups with high levels of kinship among one another trade goods and services with each other reciprocally and are natural allies against more distant groups (Johnson & Earle, 2000).

Internally, human forager groups have traditionally been considered highly egalitarian. Dominance plays a much less powerful role than in other great ape societies, as the group exercises a kind of cooperative power in making sure that no individual becomes too powerful (Boehm, 1999; Leach, 2003; Wrangham & Pilbeam, 2001). Indeed, in human small-scale societies the most powerful individuals often obtain and retain their power not by dominating resources directly in the manner of other great apes, but by demonstrating both their ability to control resources and their cooperative propensities by distributing resources generously to others (Mauss, 1954). In human small-scale societies peace is kept not only by retaliation for harms done, and reconciliation after fights, but also by third-party enforcement. That is, human observers punish perpetrators who victimize others, sometimes at a cost to themselves, whereas there is no solid evidence of such third-party punishment in other great apes. Third-party punishment may be thought of as a kind of cooperative enforcement of peace and well-being in the group, and it plays a critical role in the creation and maintenance of social norms in general.

F. Norms and Institutions

In many ways the most distinctive feature of human social organization is its normative structure. Human beings do not just have statistical expectations about what others *will* do—which all apes have—they also have normative expectations about what others *should* do. These vary across different cultures, of course, and form a continuum from moral norms (typically concerning harm to others) to mere conventions. Social expectations gain normative force from the fact that they are shared, mutual expectations in the group. Thus, we all know and expect that people in our society should dress sedately for a funeral, and so anyone who wears a red shirt cannot plead ignorance and thus may be thought of as flaunting our norm for his own individual purposes. We may reasonably respond to this flaunting with disapproval, gossip, and, in egregious cases, by social ostracism—which means that individuals must be ever vigilant about their reputations as norm followers (leading to various impression management strategies; Goffman, 1959). If the glue of primate societies is individual social relationships, the super glue of human societies is generalized social norms.

In great apes, as noted earlier, dominant individuals sometimes intervene in fights to break them up—and this has sometimes been called "policing" (Flack et al., 2006)—but nondominant individuals do not do this, and dominants do not do it for behaviors other than aggression which threatens to escalate. These interventions may thus be evolutionary precursors of third-party punishment and social norms, but they do not, by all appearances, involve mutual expectations and cooperative enforcement. With respect to norms of fairness, Brosnan, Schiff, and de Waal (2005) claimed that some nonhuman primates, including chimpanzees, have a normative sense of fairness, for example, in food distribution. In their study, chimpanzees rejected food they otherwise would have accepted if they observed others receiving better rewards. But subsequent research has shown that what is at work here is a simple contrast effect in which seeing a better food makes the one I have now appear less palatable. There is no social comparison here, only food comparison, and so there is nothing in the direction of norms of fairness either (Bräuer, Call, & Tomasello, 2006, 2008). Moreover, in experimental studies using, for example, the ultimatum game, humans in all cultures show some kinds of social norms in distributing resources (Henrich et al., 2005), whereas chimpanzees in an ultimatum game behave in an almost totally self-centered manner (Jensen, Call, & Tomasello, 2007b).

Humans live in a sea of social norms that govern pretty much all aspects of their lives. Just to take the cases of most direct interest to biologists, individual humans living in a society cannot just take food or have sex whenever and wherever they wish. In human small-scale societies the distribution of food is governed by strict social norms, and basically all human societies have some form of marriage contract, or something similar, that regulates who can mate with whom and when. In terms of the psychology of social norms, people respect and follow norms for two basic reasons (Tomasello, 2009). The first is that it is prudent to do so, because breaking social norms often leads to one or another kind of sanction, ranging from physical punishment to disapproval with gossip to social ostracism. The second is that social norms are part of the social identity of the group: This is the way we dress; this is the way we behave at weddings or at funerals. If you do not follow these norms, you are in an important sense not one of us. Humans have also evolved social emotions of guilt and shame to self-punish for norm violations—perhaps to forestall punishment by others and also to signal to others in the group that the violator knows the norm, and so is one of us, even if he did not follow it on this particular occasion.

The group mindedness of social norms is most clearly displayed not in conformity to them—which is typically in the individual's self-interest—but in their enforcement. As many theorists have noted, punishing others, even by simply gossiping about them, is either costly or risky, and others in the group benefit as much as the punisher (thus making it a kind of collective action problem). This is especially true when the norm violation does not involve a moral norm concerning harm, but merely a convention. Nevertheless, even young children go to some trouble to admonish others that they are doing something the "wrong" way if they do not conform. For example, Rakoczy, Warneken, and Tomasello (2008) showed 3-year-old children how to play a game. When a puppet then entered later and announced it would play the game also, but then did so in a different way, most of the children objected, sometimes vociferously. Importantly, the children's language when they objected demonstrated clearly that they were not just expressing their personal displeasure at a deviation; they said generic, normative things like "It doesn't work like that," "One can't do that," and so forth. It is not just that they do not like the puppet's playing the game in his own way; he is playing it the *wrong* way. Importantly, this is not a moral wrongness—it's only a game after all—but simply not doing it like "we" do it. The motivation for enforcing such nonconsequential norms in this way presumably stems from some kind of identity with the group and its constitutive norms.

The ultimate outcome of social norms in human groups is the creation of social institutions, whose existence is constituted by the collective agreement of all group members that things should be done in a particular way. Institutions create both joint goals and individual social roles (for both persons and objects). Searle (1995) refers to the creation of these roles as the creation of status functions, because as individual people and objects assumed these roles they acquire deontic powers. For example, in the process of trade, some objects (e.g., pieces of gold, special pieces of paper) have acquired in some societies the status of money and so play a special role in the trading process. And while nonhuman primates have some understanding of familial relatedness, humans assign special status to social roles such as “spouse” and “parent,” which everyone recognizes and which create certain entitlements and obligations. The main point here is that human social institutions represent both a unique form of collaborative activity and also a unique form of cooperative agreement in which we, together, normatively stipulate the way particular roles are to be played and the kinds of deontic powers that each role should be granted.

G. Summary

Thus, while most primates live in complex social groups, humans live in cultures premised on normative expectations that they will participate in many different collaborative activities. Distinctively, human collaboration involves shared goals and a division of labor (often organized via cooperative communication), with contributions by all participants and a sharing of spoils at the end. And human cooperation has a distinctly normative structure in which individuals do not just cooperate themselves; they expect others to cooperate and sanction those who do not. People are expected to do their share in cooperative foraging, to divide the spoils fairly at the end, to respect others’ property, to participate in child care and teaching, to communicate truthfully, to help control bullies and norm violators, and to play their roles in institutions. Many of these forms of collaborative activity, and the norms that govern them, very likely either evolved or were culturally constructed in the context of foraging for food.

By way of summarizing this overall account of ape and human cooperation, Table 1.1 characterizes the chimpanzee version (as generally representative of nonhuman great apes) and the human version (especially in small-scale societies) of social participation in the various domains of activity reviewed in this section.

III. APE AND HUMAN CULTURAL TRANSMISSION

Behavioral biologists tend to think of culture as the social (rather than genetic) transmission of information across generations. In earlier work, I and others have claimed that this transmission is more powerful in the case of humans, as compared with other primates, mainly because humans are much better imitators than other great apes, and humans intentionally teach their young

TABLE 1.1: **Chimpanzee and Human Social Participations**

	Chimpanzees	**Human Small-Scale Societies**
Subsistence	• Individual foraging • Sharing under harassment	• Cooperative foraging • Sharing spoils "fairly"
Economy	• Biological markets • Individual possession	• Cooperative markets • Cooperative property
Child care and prosocial	• Maternal child care • Reciprocal food sharing	• Cooperative child care • Cooperative food sharing
Communication and teaching	• Intentional communication • No intentional teaching	• Cooperative communication • Intentional teaching
Politics	• Dominance • No third-party punishment	• Cooperative power • Cooperative enforcement
Norms and institutions	• No mutual expectations • No institutions	• Social norms • Institution + status functions

(e.g., Tomasello, Kruger, & Ratner, 1993; Tomasello, 1999). This perspective is still valid, although it may be that the gap between great apes and humans in skills of imitation is not as great as it once seemed (e.g., Whiten & van Schaik, 2007). A perspective that was underplayed in this earlier work is the role that cooperation plays in human cultural transmission. Teaching is obviously a cooperative activity, and it can even be normative if parents expect their children to learn or be sanctioned. In turn, children not only learn from teaching and normative expectations, but they actively conform to them. Teaching and normative conformity play a critically important role in generating the so-called ratchet effect, which leads to cumulative cultural evolution in human but not other primate societies.

A. Chimpanzee Behavioral Traditions

Whiten et al. (1999) report the results of discussions among the major chimpanzee fieldworkers relevant to the question of chimpanzee culture. These fieldworkers reported observations of interesting chimpanzee behaviors and checked whether they occurred at other field sites. Based on these discussions, and some systematic published data, several dozen population-specific behavioral traditions were identified as "cultural"—meaning that they were used by most members of a population, not used by most other populations, and most likely due to social learning (because not due to ecological factors). Van Schaik et al. (2003) report a very similar set of observations for orangutans, though based on less data and fewer populations.

Perhaps the most difficult issue in these data is how to deal with behaviors that are widespread in some but not all populations, with these populations being widely dispersed so that there seem to be multiple origins for the behavior. This turns out to be characteristic of two of the best-known and best-studied chimpanzee traditions. First, the so-called grooming hand clasp (McGrew & Tutin, 1978) has arisen in several populations independently, including at least one in captivity not even on the African continent (de Waal & Seres, 1997). Second, nut cracking was always thought to occur only in West Africa on the west side of the Sassandra River, but it has recently been found 1700 kilometers to the east, with many non-nut-cracking populations in between (Morgan & Abwe, 2006). The most plausible explanation is that we are dealing here with behaviors that are inventable by individuals, and they spread within groups by some form of social learning—with the within-group spreading being facilitated in some way by the ease of individual invention (see Tennie, Call, & Tomasello, 2009, on the "zone of latent solutions" for explaining such patterns).

A very telling study in this connection is that of Humle and Matsusawa (2002) on ant dipping in a community of chimpanzees in Bossou. Ant dipping was at one time used by many fieldworkers as the best example of chimpanzee "culture" because it involved different groups engaging in the same basic foraging activity—poking sticks into ant nests to capture and eat ants—but done differently. Chimpanzees at Tai and at Gombe, for example, dip for the same species of ant using different techniques: At Tai they use shorter wands and bite the ants off the wand directly (Boesch & Boesch, 1990), whereas at Gombe they use longer wands and typically (though not always) pull the ants off it with their other hand before eating them (McGrew, 1974). Humle and Matsusawa observed that the chimpanzees at Bossou sometimes used both techniques. The choice of technique was driven in the first instance by the length of the wand: biting from shorter ones, and pulling ants off with longer ones. In turn, the length of the wand was driven mainly by the aggressiveness of the ants—with different species of ants being differentially aggressive, and all ants being more aggressive at the nest than when on the move—such that longer tools were used (to avoid being bitten) when the ants were more aggressive. What seemed originally to be cultural transmission, then, would seem also to have a large component of individual learning about the behavior of ants and how best to avoid painful bites. Further support for this interpretation comes from the fact that when investigators compared the ant-dipping techniques used by three mother–infant pairs in different situations at Bossou, no relationship was found.

Another important method for characterizing the nature and source of chimpanzee behavioral traditions is exposing captive individuals to materials from the wild and seeing what they do with them. Thus, Huffman and Hirata (2004) found that giving medicinal leaves, whose use was thought to be socially transmitted in the wild, to naive individuals in captivity resulted in their using them in ways similar to wild chimpanzees, thus undermining the social transmission hypothesis. Tennie, Hedwig, Call, and Tomasello (2008) did something very similar for gorillas and their supposedly culturally transmitted nettle-feeding behaviors and found that again the captive animals—some with almost no relevant experience—used techniques very similar to those in the wild. And so, again, individual learning (or even "prepared learning") would seem to be at work.

It is also interesting and important that behavioral traditions of this same general type have now been reported by fieldworkers investigating many other animal species, both primate and nonprimate, for example, capuchin monkeys (Perry et al., 2003), whales and dolphins (Rendell & Whitehead, 2001), among others. This raises the question of how the naturally occurring behavioral traditions of chimpanzees compare with these others, and whether the chimpanzee and orangutan versions are any closer to human cultural traditions than are those of other mammalian species.[1]

B. Chimpanzee Social Learning

Another source of information to help characterize the nature of chimpanzee behavioral traditions is experimental work on their social learning. The most systematic program of research over the past dozen years or so is that of

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[1] The textbook example of nonhuman primate culture is the potato washing of a group of human-provisioned Japanese macaques (Imanishi, 1965). But this is a poor example for myriad reasons that have been amply documented. For example, the human provisioning may have influenced the behavior, the spread in the group was relatively slow (and did not accelerate exponentially as would be expected if individuals were socially learning from one another), new individuals may have learned the behavior by following others into the water and discovering it themselves, the behavior was isolated and died out after a few years, and so on (Galef, 1992; Tomasello, 1990.

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Whiten and colleagues. Whiten, Custance, Gomez, Teixidor, and Bard (1996) showed that chimpanzees will choose the way of opening a box they observe, rather than some other plausible way of opening it, and Whiten, Horner, and de Waal (2005) even showed that other observing chimpanzees will follow the original learner in a "transmission chain" across individuals (see also Horner, Whiten, Flynn, & de Waal, 2006). These studies thus demonstrate the social transmission of behavioral traditions in captive chimpanzee populations. But two facts about these experiments are important. The first is that they leave open the possibility that individuals are learning about how the box works—perhaps supplemented by an understanding of the demonstrator's goal—without attending much or at all to the behavioral techniques used (so-called emulation learning). Indeed, in the Whiten et al. (1996) study, clear results emerged only when investigators looked at the demonstrator's and learner's behavior in terms of the result it produced on the box, not in terms of particular modeled actions. It is thus an open question whether the apes would have learned the same thing if they had simply observed the box opening itself in a particular way without any demonstrator, and indeed Tennie, Call, and Tomasello (2006) found no difference in learning between individuals exposed to this so-called ghost control and those exposed to a full demonstration (although see Hopper, Lambeth, Schapiro, & Whiten 2008, for some different results).

The second important fact is that the Whiten et al. (1996) study also had a comparison group of 3-year-old human children, and they produced the demonstrated actions much more faithfully than did the chimpanzees. This result was corroborated by Call, Carpenter, and Tomasello (2005), who found that chimpanzees preferentially focused on the outcomes of problem-solving activities, whereas human children preferentially focused on the actions of the demonstrator. Most importantly, Horner and Whiten (2005) found that observer chimpanzees tended to ignore irrelevant actions on a box when their causal ineffectiveness was clear, but they tended to produce them when their causal effectiveness was unclear. Again, this suggests that chimpanzees are focused mainly on the desired outcome (the goal) of the demonstrator in assessing what they themselves should do to solve the problem. But in this study, as well as in Nagell, Olguin, and Tomasello (1993), the human children paid much more attention to the actions of the demonstrator, even ignoring the apparent causal relations governing the problem to imitate the adult—not an intelligent strategy, perhaps, but simply one more focused on demonstrator actions. In all of the studies in which chimpanzees and human children have been compared, the clear result is that the human children are much more focused on the actual actions of the demonstrator, whereas the chimpanzees are much more focused on the outcome of her actions—either the actual outcome (the result) or the desired outcome (her goal). As an important addendum, Tomasello and Carpenter (2005) found that young, enculturated chimpanzees reproduce only intended and not accidental actions, and they produce a demonstrator's desired outcome even when the demonstration was of a failed attempt. Being raised by humans may facilitate chimpanzees' skills of social learning.

Help in interpreting these results comes from studies in another behavioral domain, namely, gestures. Tomasello et al. (1997) systematically compared the gestures of two different groups of captive chimpanzees (with extensive longitudinal data on one group available as well). In brief, there was no evidence for the social transmission of gestures within groups, as there were just as many differences among individuals within each group as between the two groups. In addition, Tomasello et al. (1997) reported an experiment in which one chimpanzee was taught a novel gesture and put back in the group to demonstrate it (on two different occasions using two different gestures and demonstrators). The other members of the group did not acquire this gesture, suggesting that chimpanzees do not socially transmit their gestures, but rather they learn them individually via ritualization. It is possible that individuals raised or trained by humans might imitate gestural actions, as Custance, Whiten, and Bard (1995) were able to train individuals over a several-month period to reproduce some demonstrated actions in the so-called do-as-I-do paradigm, and Tomasello, Savage-Rumbaugh, and Kruger (1993) found that enculturated apes were better at following demonstrations of actions on objects than were unenculturated apes.

A reasonable hypothesis is thus that chimpanzees are able to understand to some degree the goal of a demonstrator's action, and as observers they tend to focus on that goal, or else the actual outcome, with little attention to the actions designed to achieve that goal. Being raised and/or trained by humans can lead chimpanzees to focus more on actions, but human children naturally focus much more readily on the actions involved. It is important to note, however, that children also focus quite a bit on outcomes in concrete problem-solving situations (Call et al., 2005; Nagell et al., 1993), and so one might actually say it this way. In observing instrumental actions, apes in general, including humans, tend to focus on the outcome, either produced or intended, but in some cases they analyze the action backward to the behavioral technique used to see how that outcome was achieved; human children engage in such analysis more naturally and perhaps more skillfully than do chimpanzees.

C. Human Cultural Learning and Cumulative Culture

In addition to their special focus on actions in social learning situations involving concrete instrumental goals, human children also imitate for purely social reasons: to be like others (Uzgiris, 1981). The tendency of humans to follow fads and fashions and to conform are well known and well documented, and indeed Carpenter (2006) argues that this represents a different and important motivation for social learning that may produce qualitatively different behaviors. For example, human infants have a greater tendency than do chimpanzees for copying the unnecessary "style" of an instrumental action (Tomasello & Carpenter 2005), and of course human children naturally acquire linguistic symbols and other cultural conventions whose use cannot be discovered on one's own. This analysis would also explain why children in the studies cited earlier sometimes tended to imitate poor demonstrators when it would have been to their advantage to ignore them, and, in general, why children copy the actual actions of others more readily than do other apes. This so-called social function of imitation—simply to be like others—is clearly an important part of human culture and cultural transmission, including language acquisition (Tomasello, 2003).

Moreover, as already noted, human cultural learning is different because humans also engage in teaching, whereas there is no evidence for systematic teaching in any great ape species (Hoppitt et al., 2008). Teaching is especially important in the human case because of cultural conventions that cannot be invented on one's own but only imitated (Gergely & Csibra, 2006; see earlier discussion). Teaching is a key manifestation of the cooperative way in which humans transmit information across generations, and it contributes to the faithfulness with which such information transmission occurs in human societies.

Finally, as also noted earlier, human culture persists and has the character it does not just because human children do what others do but also because adults expect and even demand that they behave in a certain way. Children understand that this is not just the way that something *is* done but rather the way it *should* be done. This normative dimension to human cultural traditions serves to further guarantee their faithful transmission across generations. Nothing like normative learning has been observed in any nonhuman primate species.

The result of all this is that human cultural traditions are qualitatively different from those of other primates in readily observable ways. Most importantly, virtually all of humans' complex cognitive practices and products have arisen not instantaneously; rather, they are cumulative products that have arisen gradually across generations, ratcheting up in complexity as individuals work to improve on what they have inherited from their forebears to meet current needs (Tomasello Kruger, & Ratner, 1993). A critical component of this ratcheting effect is the faithful transmission of traditions across generations, which keeps the tradition stable until further improvements come along. Human social imitation, teaching, and normativity—for all the reasons listed earlier—are mainly responsible for this extraordinary stability and cumulativity over historical time. Importantly, social imitation, teaching, and normativity are not just three unrelated human behaviors, but rather they are all manifestations of humans' uniquely cooperative way of life. And so, humans are not only more cooperative in their daily interactions, but their cooperative way of life also leads to different forms of cultural transmission across generations, leading to humans' unique version of culture in the form of cumulative cultural evolution.

IV. APE AND HUMAN SOCIAL COGNITION

To cooperate with one another in all of the ways just elaborated, human beings must be born with a certain set of social-cognitive skills and motivations, or at least have the ability to construct such skills and motivations during early ontogeny. They must be capable and motivated to do such things as understand the intentional actions of others in terms of its underlying goals and intentions; form with others shared goals and intentions; locate and identify the attentional focus of others; direct and even share others' attention to outside entities; and learn or create shared conventions and symbols. We will argue that while humans share many social-cognitive capacities with other apes, the unique skills and motivations that enable their unique form of culture all fall under the general rubric of what we may call shared intentionality.

A. The Human Adaptation for Culture

Evidence for the general hypothesis that humans are specially adapted for cultural life comes from a large-scale study comparing a wide range of cognitive abilities in human children and two great ape species. Herrmann, Call, Lloreda, Hare, and Tomasello (2007) administered a comprehensive battery of cognitive tests to large numbers of chimpanzees (*n* = 106), orangutans (*n* = 32), and 2.5-year-old human children (*n* = 105). The test battery consisted of 16 different nonverbal tasks assessing all kinds of cognitive abilities involving both physical and social problems relevant to primates in their natural environment. The tests relating to the physical world consisted of problems concerning space, quantities, tools, and causality. The tests relating to the social world consisted of problems requiring subjects to imitate another's solution to a problem, communicate nonverbally with others, and read the intentions of others from their behavior. If the difference between human and ape cognition is a difference in something like "general intelligence," then the children should have differed from the apes uniformly across all the different tasks. But this was not the case. The finding was that the children and apes had very similar cognitive skills for dealing with the physical world; but the children—old enough to use some language but still years away from reading, counting, or going to school—already had more sophisticated cognitive skills than either ape species for dealing with the social world.

Examining the correlational structure of individual differences in this large range of cognitive tasks, neither the children nor the chimpanzees showed a factor structure including a factor of general intelligence (Herrmann, Hernandez-Lloreda, Call, Hare, & Tomasello, 2010). This means that individual differences in the species' cognitive performance on the various physical and social-cognitive tasks cannot be explained by one underlying general factor for either species. The main specific commonality was that for both species a similar factor of spatial cognition was found. But the main difference was that for the chimpanzees there was only one additional factor comprising various physical and social-cognitive tasks, whereas the children showed distinct, separate factors for physical cognition and social cognition. The suggestion is that this species-unique adaptation for social cognition then enables children to culturally learn from others in ways that then "bootstrap" their understanding of the physical world—in its spatial, causal, and quantitative structure—through language, instruction, and other cultural and educational interactions, so that as adults they will have more cognitive skills than other apes across the board.

Together, these findings suggest that the differences between human and ape cognition are not based on humans being generally more intelligent. Instead, they suggest that humans share many cognitive skills with their closest living relatives, especially for dealing with the physical world, but in addition they have evolved some specialized and more integrated social-cognitive skills. One hypothesis is that humans have evolved a kind of species-specific cultural intelligence for living and exchanging information in cultural groups, and this then bootstraps their cognitive skills in all other domains as well. This very general study does not help us to specify in detail, however, the nature of this species-specific cultural intelligence. For that we need more targeted experimental investigations.

B. Understanding Intentions and Attention

One obvious candidate for a uniquely human social-cognitive skill is the understanding of others as intentional agents, which is clearly necessary for human cultural learning and cognition (Tomasello, 1999). But recent research has demonstrated beyond a reasonable doubt that great apes also understand much about how others work as intentional, perceiving agents. Specifically, recent research has demonstrated that great apes understand something of the goals and perceptions of others and how these work together in individual intentional action—in ways very similar to young human children (see Call & Tomasello, 2008, for a review; see Povinelli & Vonk, 2006, for a different view).

First, great apes (most of the research is with chimpanzees) understand that others have goals. Evidence is as follows:

- When a human passes food to a chimpanzee and then fails to do so, the ape reacts in a frustrated manner if the human is doing this for no good reason (i.e., is unwilling), whereas she waits patiently if the human is making good-faith attempts to give the object but failing or having accidents (i.e., is unable) (Call, Hare, Carpenter, & Tomasello, 2004; see Behne, Carpenter, Call, & Tomasello, 2005, for similar findings with human infants).
- When a human or conspecific needs help reaching an out-of-reach object or location, chimpanzees help them in a way very similar to human infants—which requires an understanding of the other's goal (Warneken & Tomasello, 2006; Warneken et al., 2007).
- When a human shows a human-raised chimpanzee an action on an object that is marked in various ways as a failed attempt to change that object's state, the ape, in her turn, actually executes the intended action (and not the action actually demonstrated, e.g., hands slipping off the object) (Tomasello & Carpenter, 2005; based on Meltzoff's 1995 study with human infants).
- When a human shows a human-raised chimpanzee a series of two actions on an object, one of which is marked in various ways as

accidental, the ape, in her turn, usually executes only the intended action (Tomasello & Carpenter, 2005; based on Carpenter, Akhtar, & Tomasello's 1998 study with human infants; see also Call & Tomasello, 1998, for further evidence).

The conclusion is thus that apes and young human children both understand in the same basic way (in simple situations) that individuals pursue a goal in a persistent manner until they have reached it. Furthermore, they understand the goal not as the result produced in the external environment, but rather as the actor's internal representation of the state of the world she wishes to bring about.

Second, great apes (most of the research is again with chimpanzees) also understand that others have perceptions. Evidence is as follows:

- When a human peers behind a barrier, apes move over to get a better viewing angle to look behind it as well (Bräuer et al., 2006; Tomasello, Hare, & Agnetta, 1999; see Moll & Tomasello, 2004, for a similar study with human infants).
- When a human's gaze direction is toward a barrier and there is also an object further in that same direction, apes look only to the barrier and not to the object—unless the barrier has a window in it, in which case they look to the object (Okamoto-Barth, Call, & Tomasello, 2007; see Caron, Butler, & Brooks, 2002, for similar findings with human infants.)
- When apes beg a human for food, they take into account whether the human can see their gesture (Kaminski, Call, & Tomasello, 2004; Liebal, Pika, Call, & Tomasello, 2004).
- When chimpanzees compete with one another for food, they take into account whether their competitor can see the contested food (Hare, Call, Agnetta, & Tomasello, 2000, Hare, Call, & Tomasello, 2001), and even on occasion attempt to conceal their approach from a competitor (Hare, Call, & Tomasello, 2006; Melis, Hare, & Tomasello, 2006b).

The conclusion is thus that apes and young human children both understand in the same basic way (in simple situations) that individuals perceive things in the world and react to them, and they understand that the content of the other's perception is something different from their own.

Understanding others as intentional agents is almost certainly a necessary condition for participating in a human-like culture. But it is not sufficient.

Current research demonstrates that chimpanzees and other great apes understand much about intentional action, but they still have not created cultural artifacts, practices, and symbols of the human kind. Something else is needed.

C. Sharing Intentions and Attention

Tomasello et al. (2005) proposed that this something else is skills and motivations for shared intentionality. Beyond just understanding others as intentional agents and responding to them—often in competition—humans also understand others as potential cooperative agents, and this requires some additional skills and motivations.

According to a number of philosophers of action, shared intentionality refers to behavioral phenomena that are both intentional and irreducibly social, in the sense that the agent of the intentions and actions is the plural subject "we." For example, Gilbert (1989) looks at extremely simple collaborative activities such as taking a walk together—as opposed to walking down a sidewalk in parallel to an unknown person—and concludes that the agent of the social activity is "we." The difference can be clearly seen if one person simply veers off in another direction unannounced. If we just happen to be walking in parallel, this deviation means nothing; but if we are walking *together*, my veering off is some kind of breach and you may rebuke me for it (since we have made a joint commitment to take a walk together and so certain social norms now apply). Scaled up, we may even get to phenomena in which "we" intend things together in such a way that they take on new powers—such as when pieces of paper become money, and ordinary people are transformed into presidents within institutional realities (Searle, 1995). The proposal is that because humans are able to engage with one another in acts of shared intentionality—everything from a joint walk together to joint participation in transforming people into institutional officials—their social interactions take on new qualities.

For current purposes, the key expression of shared, or "we," intentionality is collaborative activities in which the participants have both a joint goal and individual roles (Bratman, 1992). This dual-level structure is apparent even in the early collaborative interactions of young children. As evidence of a joint goal, to which both participants are jointly committed, Warneken, Chen, and Tomasello (2006) found that if an adult partner suddenly stopped interacting with a young child in the middle of a collaborative activity, the child quite often made active attempts to reengage the adult. Human-raised chimpanzees tested in a similar situation never, not once, attempted to reengage their human partner. Graefenhain, Behne, Carpenter, and Tomasello (2009) found that human children attempted to reengage even when they could easily continue the activity successfully to the goal on their own. Moreover, from about 3 years of age if the child herself wanted to opt out of the activity, she engaged in some kind of "leave taking" as a direct acknowledgment that she wished to break her commitment to the joint goal. And Hamann et al. (in press) even found that when a peer partner needed help in the middle of a collaborative activity—like that supplied by human foragers in the observations of Hill (2002)–many 3-year-old children stopped and helped their partner, including after they had already retrieved their part of the spoils. And they helped the partner much more in the context of this collaborative activity than they did in more neutral contexts—which was not true of chimpanzees in a similar study—suggesting a normative commitment to the joint goal.

Kindly update

In addition to a joint goal, a fully collaborative activity requires that there be some division of labor and that each partner understand the other's role. In another study, Carpenter, Tomasello, and Striano (2005) engaged in a collaborative activity with very young children, around 18 months of age, and then took over their role on the next turn—forcing them into a role they had never before played. Even these very young children readily adapted to the new role, suggesting that in their initial joint activity with the adult they had somehow processed her perspective and role. Three young, human-raised chimpanzees did not reverse roles in the same way (Tomasello & Carpenter, 2005). One interpretation is that this role reversal signals that the human infants understood the joint activity from a "bird's-eye view," with the joint goal and complementary roles all in a single representational format (similar to Nagel's [1986] "view from nowhere"). In contrast, the chimpanzees understood their own action from a first-person perspective and that of the partner from a third-person perspective, but they did not have a bird's-eye view of the activity and its roles. Human collaborative activities thus have in them, from the perspective of both participants, generalized roles potentially fillable by anyone, including the self, what some philosophers call agent-neutral roles.

As individuals coordinate their actions with one another in collaborative activities with agent-neutral roles, they also coordinate their attention to things relevant to their joint goal—so-called joint attention (Bakeman & Adamson, 1984). Children thus monitor the adult and her attention, who is of course monitoring them and their attention. No one is certain how best to characterize this potentially infinite loop of me monitoring the other, who is monitoring my monitoring of her, and so forth (called recursive mindreading by Tomasello, 2008), but it seems to be part of infants' experience—in some nascent form—from before the first birthday. In addition to this shared attention on things, participants in these interactions each have their own perspective on things as well. Indeed, Moll and Tomasello (2007) argue that the whole notion of perspective depends on us first having a joint attentional focus, as topic, that we may then view differently (otherwise we just see completely different things). This dual-level attentional structure—shared focus of attention at a higher level, differentiated into perspectives at a lower level—is of course directly parallel to the dual-level intentional structure of the collaborative activity itself—joint goal with individual roles—and ultimately derives from it.

To coordinate their complex collaborative and joint attentional activities, humans have evolved some species-unique forms of communication. Most obvious is of course language, but even before this complex form of conventional communication humans engage in species-unique forms of gestural communication, specifically, pointing and pantomiming. Pointing and pantomiming express communicative intentions to refer others' attention to something in the external world. For pointing and pantomiming to communicate in the complex ways that they do, the communicator needs to use them in the context of joint attention with the recipient, and the recipient needs to be capable of comprehending communicative intentions (i.e., intentions about the other's intentional states). Comprehending communicative intentions requires complex inferencing (Sperber & Wilson, 1986), what Tomasello (2008) calls cooperative reasoning in which each participant attempts to infer what the other is intending toward him or her recursively (recursive mindreading).

Collaborative activities with joint goals and joint attention take place within the context of prosocial motives for helping and sharing with others. From early in ontogeny, human infants seem motivated to share psychological states with others, first just in emotion sharing episodes (often called protoconversations; Trevarthen, 1979), but then more actively in cooperative communication involving pointing, pantomiming, and language. Beginning at around their first birthdays infants communicate not just to get what they want (imperatives) but also to provide others with information that is useful to them (informative declaratives) and to simply share attention with them to interesting phenomena (expressive declaratives) (Tomasello, Carpenter, & Liszkowski, 2007). Human communication is thus cooperative to the core, and it helps in coordinating collaborative activities as well.

The most sophisticated outcome of all this, as noted earlier, is creation of and participation in social institutions, whose existence is constituted by—and only by—the collective agreement of all group members that things should be done in a particular way. Institutions create both joint goals and individual social roles with deontic powers. Perhaps surprisingly, we can even see this kind of thinking and acting in children's early pretend play. For example, when two children agree to treat this stick as a horse, this is the assignment of a status function (Wyman, Rakoczy, & Tomasello, 2009). Stipulations of deontic status—in either pretense or institutional reality—go beyond normal social norms governing overt social behavior in that they begin with a conventionally created symbolic reality—the pretend or institutional scenario—and then collectively assign deontic powers to the relevant roles and entities within that symbolic scenario.

Overall, then, human children from very early in ontogeny collaborate with others in unique ways. They participate with adults and one another in interactions in which they commit themselves to a joint goal and each takes his or her agent-neutral role. In the process, they also share attention with the other to things and take unique perspectives (while still understanding the other's perspective) as well. Young children's communication is also a cooperative activity—both participants collaborating to get the message across for prosocial reasons—and the cooperative inferencing involved enables unique forms of communicative activity. They also create in their pretense the forerunners of institutional reality in the form of joint agreements to confer special deontic status to otherwise ordinary people and entities. And so from fairly early in ontogeny young children socially engage with others in unique ways—involving skills and motivations for shared intentionality—and this enables them to participate in unique forms of collaboration, communication, and social learning.

D. Cross-Cultural Differences

An obvious question in all of this is whether these skills and motivations of shared intentionality are universal in the children of all human cultures, and at the same age. Despite much research on the role of different cultural settings on cognitive development in school-age and older children, very little is known about how different parenting and socialization practices in different cultures might affect the kinds of early emerging social-cognitive skills and motivations of concern here. To our knowledge, there is only one relevant large-scale study.

Callaghan et al. (unpublished data) report a series of eight studies in which they systematically assessed the social-cognitive skills of 1- to 3-year-old children in three different cultural settings. One group of children was from a typical Western, middle-class cultural setting, while the other two were from more traditional, small-scale cultures in rural Peru and India. In a first group of studies they assessed 1-year-old children's most basic social-cognitive skills for understanding the intentions and attention of others: imitation, helping, gaze following, and communicative pointing. Children's performance in these tasks was mostly similar across cultural settings. In a second two studies, they assessed 1-year-old children's skills in participating in interactive episodes of collaboration and joint attention. Again in these studies the general finding was one of cross-cultural similarity. In a third pair of studies, they assessed 2- to 3-year-old children's skills with pretense and graphic symbols. Here they found that the Western children, who had had much more experience with such symbols, showed skills at a significantly earlier age.

The overall conclusion was that young children in all cultural settings get sufficient amounts of the right kinds of social experience to develop their most basic social-cognitive skills for interacting with others and participating in culture at around the same age. In contrast, young children's acquisition of more culturally specific skills for use in culturally specific practices involving culturally specific artifacts and symbols is more dependent on particular learning experiences.

E. The Ontogeny of Cultural Cognition

Humans are thus clearly biologically adapted for culture. Another piece of evidence for this claim is children with autism. Children with autism are born with a biological deficit for some aspects of shared intentionality (along with other things), and so they cannot take advantage of the cultural world into which they are born and do not develop normal social-cognitive skills (Hobson, 1993). However, it is also clear that no human could do any of the complex things he or she does with a biological predisposition alone; that is to say, no human could invent any of the complex cognitive practices and products of the species without a preexisting cultural world within which to grow and learn. A biologically intact human child born outside of any human culture—with no one to imitate, no one to teach him or her things, no language, no preexisting tools and practices, no symbol systems, no institutions, and so forth—also would not develop normal social-cognitive skills. Both biology and culture are necessary parts of the process.

Since organisms inherit their environments as much as they inherit their genes (albeit in different ways), perhaps it is most appropriate to say that human beings biologically inherit the cognitive skills necessary for developing in a cultural environment. Obviously some kind of social environment is also important in the ontogeny of other primate species for developing species-typical behaviors of all kinds, and cultural transmission may even play some role as well. But for humans the species-typical social-cultural environment is an absolute necessity for youngsters to develop the cognitive skills required for survival in the many very different, and sometimes harsh, environments that humans inhabit. And so the point is simply that ontogeny plays an especially large and important role in the cognitive development of *Homo sapiens* as compared with other primates.

Indeed, Tomasello (2009) argues that participating in collaborative activities with joint goals, joint attention, and normative structuring creates new and species-unique forms of cognitive representation. Specifically, participating in joint attention leads to the taking of perspectives, and consequently to perspectival cognitive representations in which the same entity can be construed in different ways depending on one's perspective. Using conventionally created symbols—that can be used either correctly or incorrectly from the point of view of the group—leads to normative cognitive representations. The argument is that perspectival, symbolic, and normative cognitive representations are only possible for individuals growing up in a cultural world interacting with others who are symbolically communicating different perspectives on things—indeed, the "correct" perspective on things—to them in the first place. These perspectival and normative cognitive representations will then be used by children in different cultures to acquire the particular skills of cultural cognition characteristic of their group.

F. Summary

Great apes function in social groups—perhaps we could call them cultural groups—that have some behavioral traditions. But these result basically from one individual exploiting the experience and hard work of others by observing their successes in instrumental situations and trying to profit from them. In contrast, groups of human individuals cooperate together to create cultural artifacts and practices that accumulate improvements (rachet up in complexity) over time, thus creating ever-new cognitive niches, including even complex social institutions with normatively defined roles. Children must be equipped to participate during ontogeny in this huge groupthink process by means of species-unique cognitive skills for collaboration, communication, and cultural learning, which coevolved with human cultural organization during relatively recent evolutionary history. These basic skills are universal across all cultural settings, and indeed, in an important sense, make human culture possible in the first place.

V. AN EVOLUTIONARY FAIRY TALE

Where did humans' ultra-cooperativeness come from? Although we are a long way from a full account, one hypothesis is that somewhere along the line, for some reason (changing climactic conditions, new competitor species, new prey species, etc.), humans were forced to become cooperative foragers or perish (see Sterelny, 2008). There had to have been, in our view, three basic steps along this road to obligate cooperative foraging (Hare & Tomasello, 2005; Tomasello, 2009).

First, for humans to become truly cooperative foragers, there must have been an initial step that broke them out of the great ape pattern of strong food competition, low tolerance for food sharing, and almost no food offering at all. This great ape pattern may be clearly seen in the experiment of Melis et al. (2006a) in which pairs of chimpanzees had trouble collaborating if the food reward was not predivided for them (whereas human children had no such trouble). Relatedly, on another dimension of primate temperament, when human children were directly compared with chimpanzees and orangutans on their response to novelty, children were found to be especially uncertain when encountering novel people and objects. This quite often led to their seeking reassurance from parents and peers in ways that might often provide opportunities for social referencing, social learning, teaching, and coordinating activities (Herrmann et al., 2007). The proposal is thus that changes in human temperament—toward greater tolerance and social comfort seeking, among other things—were prerequisite for humans beginning down their ultra-cooperative pathway (Hare, 2007; Hare & Tomasello, 2005).

The temperamental change in humans may have occurred in any one of several possible ways (or in some combination). One possibility is that humans evolved an especially tolerant and prosocial temperament through a process of self-domestication in which aggressive and despotic individuals within a group were systematically punished or shunned—a pattern commonly seen in small-scale societies (Boehm, 1999). Another possibility is that changes in human temperament in a prosocial direction were brought about by cooperative breeding (Hrdy, 2009). In humans, unlike other apes, mothers get the support of alloparents who contribute to basic child-care activities and also engage in a variety of active prosocial behaviors such as active food provisioning of the infant and teaching of the child as well. In this context, selection presumably favored more tolerant and prosocial individuals for playing the role of helper (who presumably benefits in many ways, from kin selection to direct and indirect reciprocity). It is of course possible that both of these factors—self-domestication and cooperative breeding—may have played a role. The important point is that there was some initial step in human evolution away from great apes involving the emotional and motivational side of things that propelled humans into a new adaptive space in which complex skills and motivations for collaborative activities and shared intentionality could be selected.

The second step toward humans' ultra-cooperativeness was that in this new social context, these tolerant and prosocial individuals would be more likely to be doing the kinds of things together in which cognitive skills for forming joint goals, joint attention, cooperative communication, and social learning and teaching would be especially beneficial—such things as hunting animals together, gathering embedded plants together, and so forth. As Alvard (2001) argues, obligate cooperative foraging poses a basic coordination problem in which individuals have to negotiate a shared goal and somehow communicate about their respective roles. Tomasello (2008) argues that humans' unique skills of cooperative communication (including language) evolved originally to coordinate collaborative foraging activities. And so a more tolerant disposition led to the possibility of individuals acting together with one another in new ways, which set the conditions for selection for ever more complex cognitive skills of shared intentionality for collaborating and communicating in ever more complex ways.

The third step involved group-level processes, including the creation of group-enforced norms and group-constituted social institutions. These required significant social-cognitive skills of coordination for forming both mutual expectations and normative rules with others in the group (Tomasello, 2009). Then, in addition, human groups began to compete with one another, leading to processes of cultural group selection. That is, as Richerson and Boyd (2005) have argued, human groups at some point possessed different traditions—and even norms and institutions—for engaging in various activities, including for subsistence. Those groups that passed along culturally "better" traditions, norms, and institutions did better in competition with other groups. And in the new context of obligate cooperative foraging, "better" could easily mean more cooperative. This could then lead to a kind of runaway selection involving a new process of coevolution between culture and cognition: Cultural artifacts, norms, and institutions create a new environment to which individuals must adapt. Thus, individuals who could most quickly learn to participate in various collaborative cultural practices and use various cultural artifacts and symbols—through special skills of communication and social learning supported by more sophisticated ways of reading and sharing the intentions of others—were at a selective advantage. Also advantaged were individuals who could most quickly identify with their group and negotiate its various social norms (expectations of judging and punishing groupmates) for how one interacts peaceably in the group (and so avoids being shunned).

Human evolution is thus characterized to an inordinate degree by niche construction, in the form of cultural practices and products (Odling-Smee, Laland, & Feldman, 2003), and gene–culture coevolution, as the species has evolved cognitive skills and motivations enabling them to function effectively in any one of their many different self-built cultural worlds (Richerson & Boyd, 2005). No one knows, but it is possible that these skills of cultural cognition were still absent in *Homo erectus* 1–2 million years ago. First of all, their relatively rapid brain growth during ontogeny resembled more closely that of modern apes than that of modern humans, and overall modern humans have significantly larger brains than *Homo erectus* (Coqueugniot, Hublin, Veillonm, Houët, & Jacob, 2004). In addition, most evidence suggests that at that time there were very likely not extensive cultural differences between different human groups (Klein, 1999). One hypothesis, then, is that humans' special skills of cooperation and shared intentionality—leading to all kinds of specialized cultural practices and products—arose for the first time in modern humans (or their immediate predecessors) in the last 100,000–200,000 years.

Interestingly, humans also have a species-unique physiological adaptation that might have emerged along with the emergence of their ultra-cooperativeness. Unlike other primates, humans have eyes with large white sclera, making it especially easy to follow their looking direction (Kobayashi & Kohshima, 1997). Indeed, whereas other great apes typically follow the head direction of other individuals when they are gazing somewhere, human children typically follow specifically their eye direction (Tomasello, Hare. Lehmann, & Call, 2007). A morphological adaptation such as this could only have evolved in cooperative social groups in which groupmates did not too often exploit the gaze direction of others for their own benefit, but rather more often used it in coordinating collaborative and communicative interactions involving joint attention. When this cooperative physical trait evolved in the species is currently unknown.

VI. CONCLUSION

As compared with their nearest great ape relatives, who all live in the vicinity of the equator, humans occupy an incredibly wide range of environmental niches covering almost the entire planet. To deal with everything from the Arctic to the Tropics, humans have evolved a highly flexible suite of cognitive skills and motivations for modifying the environments in adaptive ways. But these are not individual cognitive skills that enable them to survive alone in the tundra or rain forest, but rather they are cooperatively based social-cognitive skills and motivations that enable them to develop, in concert with others in their cultural groups, creative ways of coping with whatever challenges may arise. Humans have evolved not only skills of individual intentional action and cognition but also skills and motivations for sharing intentions and cognition with others in collaborative activities of all kinds.

As always, there are still many unanswered questions. With regard to apes, negative findings are of course never final, and so it may be that at some point we will find new methods that reveal skills in great apes that I have denied them here—in social cognition, communication, cooperation, and/or social learning. And the ways apes differ from human children in these different domains have not been specified as precisely as we might like. With regard to children, exactly how they acquire their various social norms is not totally clear, nor is it clear why they choose to enforce these norms on others when it would seem that they gain nothing concrete by doing this. Finally, in the context of the current volume we must note the most glaring lacuna of all in the data relevant to the evolutionary origins of human culture, and that is the almost complete lack of cross-cultural data on young children's early skills and motivations for social interaction, social learning, cooperation, teaching, and norm enforcement. In particular, one might expect that children who grow up in cultures in which they are socialized more through peer than adult interaction might have some special skills of cooperation and norm creation and enforcement. This would be an especially important question for future cross-cultural research.

It must be emphasized in closing that the evolutionary dimension of culture highlighted here is clearly only one aspect of the process. The specific cultural practices and products generated by individuals interacting with one another in cultural groups—everything from specific linguistic constructions to techniques for building kayaks or skyscrapers—can in no way be reduced to biology. Human cognitive and motivational adaptations for culture are simply psychological enabling conditions for the generation and maintenance of the specific cultural artifacts and practices created by specific cultural groups—which, by all appearances, are endlessly creative.

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