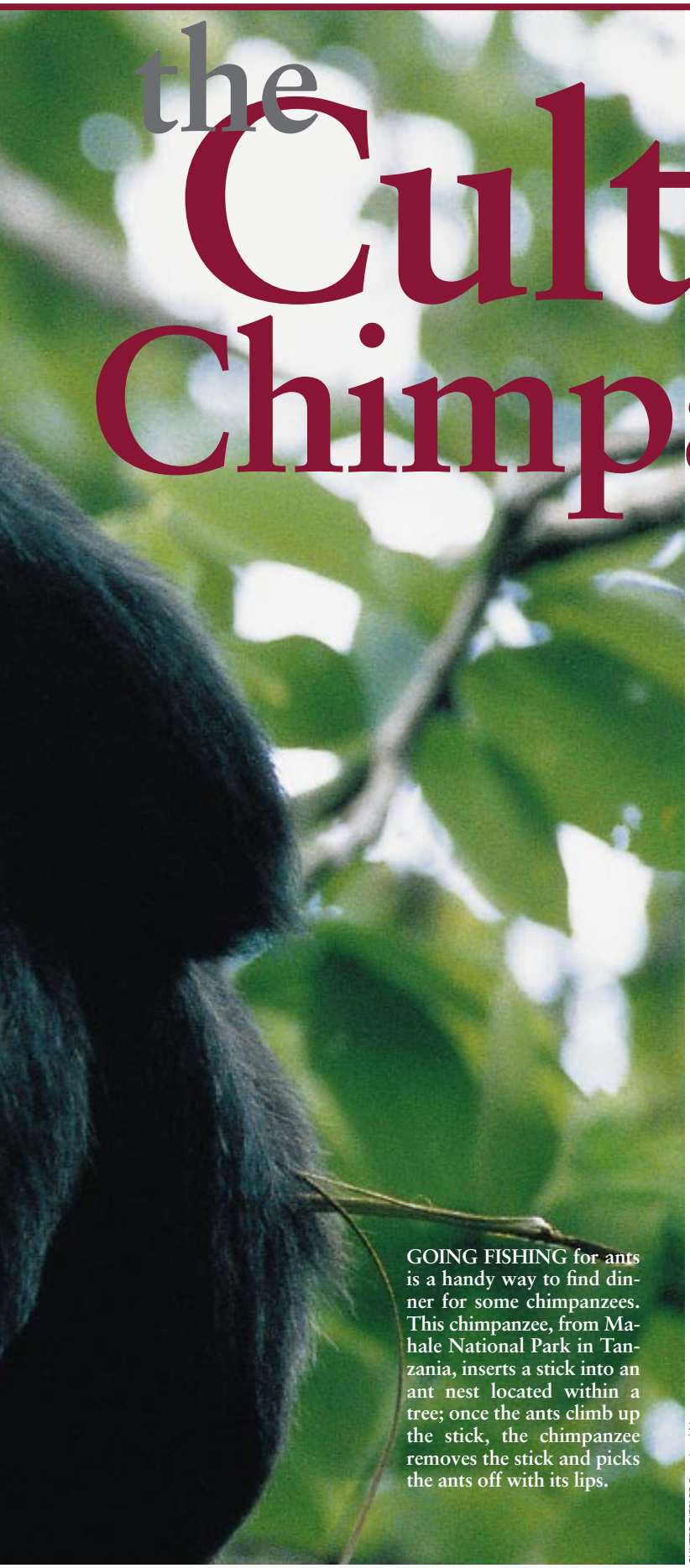
the Cultures of Chimpanzees

Humankind's nearest relative is even closer than we thought: chimpanzees display remarkable behaviors that can only be described as social customs passed on from generation to generation

by Andrew Whiten and Christophe Boesch



GOING FISHING for ants is a handy way to find dinner for some chimpanzees. This chimpanzee, from Mahale National Park in Tanzania, inserts a stick into an ant nest located within a tree; once the ants climb up the stick, the chimpanzee removes the stick and picks the ants off with its lips.

GUNTER ZIESLER *Peter Arnold, Inc.*

As researchers quietly approach a clearing in the Taï Forest of Ivory Coast, they hear a complex pattern of soft thuds and cracks. It sounds as though a small band of people are busy in the forest, applying some rudimentary technology to a routine task. On entering the clearing, the scientists observe several individuals working keenly at anvils, skillfully wielding wooden hammers. One or two juveniles have apprenticed themselves to the work and—more clumsily and with less success—are struggling to lift the best hammer they can find. All this activity is directed toward cracking rock-hard but nutritious coula nuts. Intermittently, individuals set aside their tools to gather more handfuls of nuts. An infant sits with her mother, gathering morsels of broken nuts.

In many ways, this group could indeed be a family of foraging people. The hammers and anvils they leave behind, some made of stone, would excite the imagi-

The Culture Club

How an international team of chimpanzee experts conducted the most comprehensive survey of the animals ever attempted

Scientists have been investigating chimpanzee culture for several decades, but too often their studies contained a crucial flaw. Most attempts to document cultural diversity among chimpanzees have relied solely on officially published accounts of the behaviors recorded at each research site. But this approach probably overlooks a good deal of cultural variation for three reasons.

First, scientists typically don't publish an extensive list of all the activities they do *not* see at a particular location. Yet this is exactly what we need to know—which behaviors were and were not observed at each site. Second, many reports describe chimpanzee behaviors without saying how common they are; without this information, we can't determine whether a particular action was a once-in-a-lifetime aberration or a routine event that should be considered part of the animals' culture. Finally, researchers' descriptions of potentially significant chimpanzee behaviors frequently lack sufficient detail, making it difficult for scientists working at other spots to record the presence or absence of the activities.

To remedy these problems, the two of us decided to take a new approach. We asked field researchers at each site for a list of all the behaviors they suspected were local traditions. With this information in hand, we pulled together a comprehensive list of 65 candidates for cultural behaviors.

Then we distributed our list to the team leaders at each site. In consultation with their colleagues, they classified each behavior in terms of its occurrence or absence in the chimpanzee community studied. The key categories were customary behavior (occurs in most or all of the able-bodied members of at least one age or sex class, such as all adult males), habitual (less common than customary but occurs repeatedly in several individuals), present (seen at the site but not habitual), absent (never seen), and unknown.

Our inquiry concentrated on seven sites with chimpanzees habituated to human onlookers; all told, the study compiled a total of more than 150 years of chimpanzee observation. The behavior patterns we were particularly interested in, of course, were those absent in at least one community, yet habitual or customary in at least one other; this was our criterion for denoting any behavior a cultural variant. (Certain behaviors are absent for specific local reasons, however, and we excluded them from consideration. For example, although chimpanzees at Bossou scoop tasty algae from pools of water with a stick, chimpanzees elsewhere don't do this, simply because algae are not present.)

The extensive survey turned up no fewer than 39 chimpanzee patterns of behavior that should be labeled as cultural variations, including numerous forms of tool use, grooming techniques and courtship gambits, several of which are illustrated throughout this article. This cultural richness is far in excess of anything known for any other species of animal. *—A.W. and C.B.*

nation of any anthropologist searching for signs of a primitive civilization. Yet these forest residents are not humans but chimpanzees.

The similarities between chimpanzees and humans have been studied for years, but in the past decade researchers have determined that these resemblances run much deeper than anyone first thought. For instance, the nut cracking observed in the Taï Forest is far from a simple chimpanzee behavior; rather it is a singular adaptation found only in that particular part of Africa and a trait that biologists consider to be an expression of chimpanzee culture. Scientists frequently use the term "culture" to describe elementary animal behaviors—such as the regional dialects of different populations of songbirds—but as it turns out, the rich and varied cultural traditions found among chimpanzees are second in complexity only to human traditions.

During the past two years, an unprecedented scientific collaboration, involving every major research group studying chimpanzees, has documented a multitude of distinct cultural patterns extending across Africa, in actions ranging from the animals' use of tools to their forms of communication and social customs. This emerging picture of chimpanzees not only affects how we think of these amazing creatures but also alters human beings' conception of

MICHAEL NICHOLS *National Geographic Image Collection*

Today's Lesson includes a demonstration of how to crack open a coula nut. A mother chimpanzee in the Taï Forest of Ivory Coast uses a stone hammer to cleave a nut while a youngster watches. Not all chimpanzees in this area have developed this behavior: on the eastern bank of the Sassandra-N'Zo River, chimpanzees do not crack nuts even though members of the same species on the other side of the river, just a few miles away, do. All the required raw materials are available on both sides, and the nuts could be cracked using the technique habitual at Taï. The river serves as a literal cultural barrier.

our own uniqueness and hints at very ancient foundations for humankind's extraordinary capacity for culture.

Contemplating Culture

Homo sapiens and *Pan troglodytes* have coexisted for hundreds of millennia and share more than 98 percent of their genetic material, yet only 40 years ago we still knew next to nothing about chimpanzee behavior in the wild. That began to change in the 1960s, when Toshisada Nishida of Kyoto University in Japan and Jane Goodall began their studies of wild chimpanzees at two field sites in Tanzania. (Goodall's research station at Gombe—the first of its kind—is more famous, but Nishida's site at Mahale is the second-oldest chimpanzee research site in the world.)

In these initial studies, as the chimpanzees became accustomed to close observation, the remarkable discoveries began. Researchers witnessed a range of unexpected behaviors, including fashioning and using tools, hunting, meat eating, food sharing and lethal fights between members of neighboring communities. In the years that followed, other primatologists set up camp elsewhere, and, despite all the financial, political and logistical problems that can beset African fieldwork, several of these outposts became truly long-term projects. As a result, we live in an unprecedented time, when an intimate and comprehensive scientific record of chimpanzees' lives at last exists not just for one but for several communities spread across Africa.

As early as 1973, Goodall recorded 13 forms of tool use as well as eight social activities that appeared to differ between the Gombe chimpanzees and chimpanzee populations elsewhere. She ventured that some variations had what she termed a cultural origin. But what exactly did Goodall mean by "culture"? According to the *Oxford Encyclopedic English Dictionary,* culture is defined as "the customs … and achievements of a particular time or people." The diversity of human cultures extends from technological variations to marriage rituals, from culinary habits to myths and legends. Animals do not have myths and legends, of course. But they do have the capacity to pass on behavioral traits from generation to generation, not through their genes but by learning. For biologists, this is the fundamental criterion for a cultural trait: it must be something that can be learned by observing the established skills of others and thus passed on to future generations [*see box on page 66*].

By the 1990s the discovery of new behavioral differences among chimpanzees made it feasible to begin assembling comprehensive charts of cultural variations for these animals. William C. McGrew, in his 1992 book *Chimpanzee Material Cultures,* was able to list 19 different kinds of tool use in distinct communities. One of us (Boesch), along with colleague Michael Tomasello of the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, identified 25 distinct activities as potential cultural traits in wild chimpanzee populations.

The most recent catalogue of cultural variations results from a unique collaboration of nine chimpanzee experts (including the two of us) who pooled extensive field observations that, taken together, amounted to a total of 151 years of chimp watching [*see box on opposite page*]. The list cites 39 patterns of chimpanzee behavior that we believe to have a cultural origin, including such activities as using sticks to "fish" for ants, making dry seats from leaves, and a range of social grooming habits. At present, these 39 variants put chimpanzees in a class of their own, with far more elaborate customs than any other animal studied to date. Of course, chimpanzees also remain distinct from humans, for whom cultural variations are simply beyond count. (We must point out, however, that scientists are only beginning to uncover the behavioral complexity that exists among chimpanzees—and so the number 39 no doubt represents a minimum of cultural traits.)

Multicultural Chimpanzees

When describing human customs, anthropologists and sociologists often refer to "American culture" or "Chinese culture"; these terms encompass a wide spectrum of activities—language, forms of dress, eating habits, marriage rituals and so on. Among animals, however, culture has typically been established for a single behavior, such as song dialects among birds. Ornithologists haven't identified variation in courtship patterns or feeding practices, for example, to go alongside the differences in dialect.

Chimpanzees, though, do more than display singular cultural traits: each community exhibits an entire set of behaviors that differentiates it from other groups [*see illustrations on pages 64 and 65*]. As a result, we can talk about "Gombe culture" or "Taï culture." Indeed, once we observe how a chimpanzee behaves, we can identify where the animal lives. For instance, an individual that cracks nuts, leaf-clips during drumming displays, fishes for ants with

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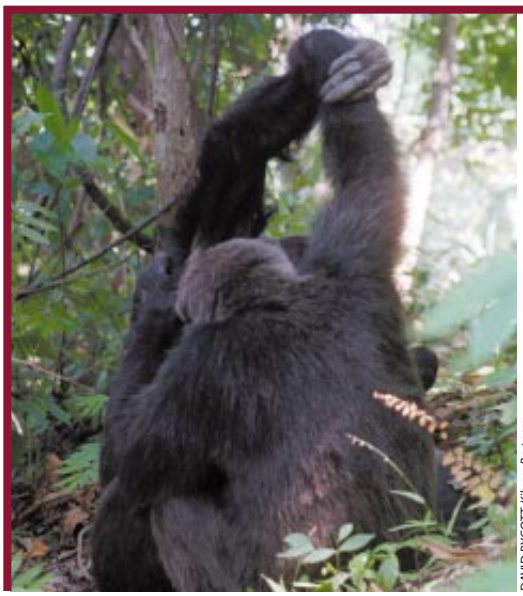


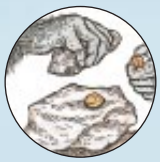
DAVID BYGOTT *Kibuyu Partners*

High Five during grooming is commonplace among chimpanzees at Taï Forest, Mahale and Kibale. Here two male chimpanzees at Mahale groom each other while clasping hands. Recent research by William C. McGrew and Linda F. Marchant, both at Miami University, suggests that the two adjacent communities at Mahale display subtle differences in how they clasp hands, with one community avoiding palm-to-palm contact, the style common among their neighbors. In 40 years of observations at Gombe, hand clasping has never been seen; chimpanzees sometimes grasp a branch overhead, but they do not hold their grooming partner's hand.

A Guide to the Cultures of Chimpanzees

In an effort to catalogue cultural variations among chimpanzees, we asked researchers working at six sites across central Africa to classify chimpanzee behaviors in terms of occurrence or absence in seven communities. (There are two communities at Mahale.) The key categories were customary behavior, which occurs in most or all members of one age or sex class; habitual, which is less common but which still occurs repeatedly; present; absent; and unknown. Certain behaviors are absent for ecological reasons (eco): for example, chimpanzees do not use hammers to open coula nuts at Budongo, because the nuts are not available. The survey turned up 39 chimpanzee rituals that are labeled as cultural variations; 18 are illustrated below. *—A.W. and C.B.*

Hammering nuts
To crack open nutritious coula nuts, chimpanzees use stones as rudimentary hammers and anvils.



Pounding with pestle
With the stalks of palm trees acting as makeshift pestles, chimpanzees can pound and deepen holes in trees.

Fishing for termites
Chimpanzees insert thin, flexible strips of bark into termite mounds to extract the insects, which they then eat.

Wiping ants off stick manually
Once the ants have swarmed almost halfway up sticks dipped into the insects' nests, chimpanzees pull the sticks through their fists and sweep the ants into their mouths.

Eating ants directly off stick
After a few ants climb onto sticks inserted into the nests, chimpanzees bring the sticks directly to their mouths and eat the ants.

Removing bone marrow
With the help of small sticks, chimpanzees eat the marrow found inside the long bones of monkeys they have killed and eaten.

Sitting on leaves
A few large leaves apparently serve as protection when chimpanzees sit on wet ground.

Fanning flies
To keep flies away, chimpanzees utilize leafy twigs as a kind of fan.

Tickling self
A large stone or stick can be used to probe especially ticklish areas on a chimpanzee's own body.

BOSSOU	TAÏ FOREST	GOMBE	MAHALE M-GROUP	MAHALE K-GROUP	KIBALE	BUDONGO
customary	**customary**	absent	absent	absent	absent (eco?)	absent (eco)
customary	absent	absent	absent (eco?)	absent (eco?)	absent (eco?)	absent (eco?)
absent	absent (eco)	**customary**	absent	**customary**	absent (eco)	absent (eco?)
present	absent	**customary**	absent	absent	absent	absent
customary	**customary**	**present**	absent	absent	absent	absent
absent	**customary**	absent	absent	absent	absent	absent
present	**habitual**	absent	absent	absent	**present**	absent
absent	**habitual**	**present**	absent	absent	absent	**habitual**
absent	absent	**habitual**	absent	absent	absent	absent

ILLUSTRATIONS BY PATRICIA J. WYNNE; MAP BY SUE CARLSON

BOSSOU	TAÏ FOREST	GOMBE	MAHALE M-GROUP	MAHALE K-GROUP	KIBALE	BUDONGO
customary	customary	customary	customary	absent	present	present
absent	present	present	absent	absent	customary	absent
customary	customary	absent	customary	customary	habitual	customary
absent	absent	habitual	unknown	unknown	absent	absent
absent	absent	present	unknown	unknown	absent	customary
absent	customary	present	absent	absent	absent	absent
absent	habitual	absent	customary	customary	customary	absent
present	customary	habitual	customary	customary	absent	absent
absent	habitual	customary	customary	customary	customary	habitual

Throwing
Chimpanzees can throw objects such as stones and sticks with clear—though often inaccurate—aim.

Inspecting wounds
When injured, chimpanzees touch wounds with leaves, then examine the leaves. In some instances, chimpanzees chew the leaves first.

Clipping leaves
To attract the attention of playmates or fertile females, male chimpanzees noisily tear leaf blades into pieces without eating them.

Squashing parasites on leaves
While grooming another chimpanzee, an individual removes a parasite from its partner, places it on a leaf and then squashes it.

Inspecting parasites
Parasites removed during grooming are placed on a leaf in the chimpanzee's palm; the animal inspects the insect, then eats or discards it.

Squashing parasites with fingers
Chimpanzees remove parasites from their grooming partners and place the tiny insects on their forearms. They then hit the bugs repeatedly before eating them.

Clasping arms overhead
Two chimpanzees clasp hands above their heads while grooming each other with the opposite hand.

Knocking knuckles
To attract attention during courtship, chimpanzees rap their knuckles on trees or other hard surfaces.

Rain dancing
At the start of heavy rain, adult males perform charging displays accompanied by dragging branches, slapping the ground, beating buttress roots, and pant hooting.

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one hand using short sticks, and knuckle-knocks to attract females clearly comes from the Taï Forest. A chimp that leaf-grooms and hand-clasps during grooming can come from the Kibale Forest or the Mahale Mountains, but if you notice that he also ant-fishes, there is no doubt anymore—he comes from Mahale.

In addition, chimpanzee cultures go beyond the mere presence or absence of a particular behavior. For example, all chimpanzees dispatch parasites found during grooming a companion. But at Taï they will mash the parasites against their forearms with a finger, at Gombe they squash them onto leaves, and at Budongo they put them on a leaf to inspect before eating or discarding them. Each community has developed a unique approach for accomplishing the same goal. Alternatively, behaviors may look similar yet be used in different contexts: at Mahale, males "clip" leaves noisily with their teeth as a courtship gesture, whereas at Taï, chimpanzees incorporate leaf-clipping into drumming displays.

The implications of this new picture of chimpanzee culture are many. The information offers insight into our distinctiveness as a species. When we first published this work in the journal *Nature*, we found some people quite disturbed to realize that the characteristic that had appeared to separate us so

Do Apes Ape?

Recent studies show that chimpanzees and other apes can learn by imitation

The notion that the great apes—chimpanzees, gorillas, orangutans and gibbons—can imitate one another might seem unsurprising to anyone who has watched these animals playing at the zoo. But in scientific circles, the question of whether apes, well, *ape*, has become controversial.

Consider a young chimpanzee watching his mother crack open a coula nut, as has been observed in the Taï Forest of West Africa. In most cases, the youth will eventually take up the practice himself. Was this because he imitated his mother? Skeptics think perhaps not. They argue that the mother's attention to the nuts encouraged the youngster to focus on them as well. Once his attention had been drawn to the food, the young chimpanzee learned how to open the nut by trial and error, not by imitating his mother.

Such a distinction has important implications for any discussion of chimpanzee cultures. Some scientists define a cultural trait as one that is passed down not by genetic inheritance but instead when the younger generation copies adult behavior. If cracking open a coula is something that chimpanzees can simply figure out how to do on their own once they hold a hammer stone, then it can't be considered part of their culture. Furthermore, if these animals learn exclusively by trial and error, then chimpanzees must, in a sense, reinvent the wheel each time they tackle a new skill. No cumulative culture can ever develop.

The clearest way to establish how chimpanzees learn is through laboratory experiments. One of us (Whiten), in collaboration with Deborah M. Custance of Goldsmiths College, University of London, constructed artificial fruits to serve as analogues of those the animals must deal with in the wild (*right*). In a typical experiment, one group of chimpanzees watched a complex technique for opening one of the fruits, while a second group observed a very different method; we then recorded the extent to which the chimpanzees had been influenced by the method they observed. We also conducted similar experiments with three-year-old human children as subjects. Our results demonstrate that six-year-old chimpanzees show imitative behavior that is markedly like that seen in the children, although the fidelity of their copying tends to be poorer.

SARAH MARSHALL AND ANDREW WHITEN *Ngamba, UWEX Uganda*

PRACTICE MAKES PERFECT as a juvenile chimpanzee experiments with an artificial fruit it has been given to "peel" after watching others do so. Such studies help scientists determine how chimpanzees learn by imitating others.

In a different kind of experiment, one of us (Boesch), along with some co-workers, gave chimpanzees in the Zurich Zoo in Switzerland hammers and nuts similar to those available in the wild. We then monitored the repertoire of behaviors displayed by the captive chimpanzees. As it turned out, the chimpanzees in the zoo exhibited a greater range of activities than the more limited and focused set of actions we had seen in the wild. We interpreted this to mean that a wild chimpanzee's cultural environment channeled the behavior of youngsters, steering them in the direction of the most useful skills. In the zoo, without benefit of existing traditions, the chimpanzees experimented with a host of less useful actions.

Interestingly, some of the results from the experiments involving the artificial fruits converge with this idea. In one study, chimpanzees copied an entire sequence of actions they had witnessed, but did so only after several viewings and after trying some alternatives. In other words, they tended to imitate what they had observed others doing at the expense of their own trial-and-error discoveries.

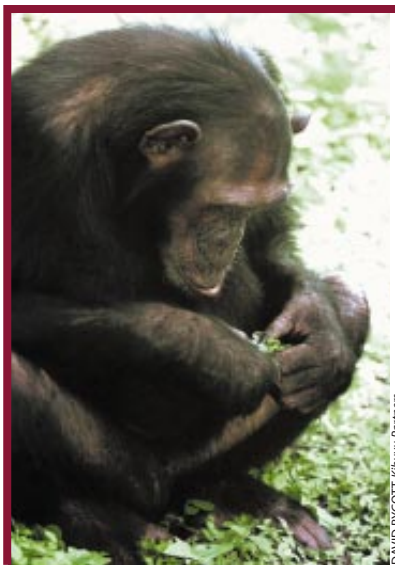
In our view, these findings taken together suggest that apes do ape and that this ability forms one strand in cultural transmission. Indeed, it is difficult to imagine how chimpanzees could develop certain geographic variations in activities such as ant-dipping and parasite-handling without copying established traditions. They must be imitating other members of their group.

We should note, however, that—just as is the case with humans—certain cultural traits are no doubt passed on by a combination of imitation and simpler kinds of social learning, such as having one's attention drawn to useful tools. Either way, learning from elders is crucial to growing up as a competent wild chimpanzee.

—A.W. and C.B.

starkly from the animal world—our capacity for cultural development—is not such an absolute difference after all.

But this seems a rather misdirected response. The differences between human customs and traditions, enriched and mediated by language as they are, are vast in contrast with what we see in the chimpanzee. The story of chimpanzee cultures sharpens our understanding of our uniqueness, rather than threatening it in any way that need worry us.



DAVID BYGOTT *Kibuyu Partners*

Grooming one another is a source of fascination to chimpanzees in all known populations, but exactly how they deal with nuisances such as ticks and lice differs. Those in East Africa, such as the Gombe chimpanzee shown here, will sometimes turn from grooming a companion's coat to "grooming" leaves. When Gombe chimpanzees find parasites, they may put them on top of a stack of leaves and then carefully, using their thumbnails, squash the insects before eating them. At Budongo they will instead place the insects on leaves and inspect them before eating or discarding them. In the Taï Forest, however, chimpanzees do not use leaves; they place parasites on their forearms and hit them repeatedly with their forefingers until the insects have been smashed. All East African communities incorporate leaves in their grooming habits, suggesting a common eastern origin to the practice.

Human achievements have made enormous cumulative progress over the generations, a phenomenon Boesch and Tomasello have dubbed the "ratchet effect." The idea of a hammer—once simply a crude stone cobble—has been modified and improved on countless times until now we have electronically controlled robot hammers in our factories. Chimpanzees may show the beginnings of the ratchet effect—some that use stone anvils, for example, have gone a step further, as at Bossou, where they wedge a stone beneath their anvil when it needs leveling on bumpy ground—but such behavior has not become customary and is rudimentary indeed beside human advancements.

The cultural capacity we share with chimpanzees also suggests an ancient ancestry for the mentality that must underlie it. Our cultural nature did not emerge out of the blue but evolved from simpler beginnings. Social learning similar to that of chimpanzees would appear capable of sustaining the earliest stone-tool cultures of human ancestors living two million years ago.

Whether chimpanzees are the sole species on the planet that shares humankind's capacity for culture is too early to judge: nobody has undertaken the comprehensive research necessary to test the idea. Early evidence hints that other creatures should be included in these discussions, however. Carel P. van Schaik and his colleagues at Duke University have found orangutans in Sumatra that habitually use at least two different kinds of tools. Orangutans monitored for years elsewhere have never been seen to do this.

And Hal Whitehead of Dalhousie University and his colleagues have begun to document the ways in which populations of whales that sing in different dialects also hunt in different ways. We hope that our comprehensive approach to documenting chimpanzee cultures may provide a template for the study of these other promising species.

What of the implications for chimpanzees themselves? We must highlight the tragic loss of chimpanzees, whose populations are being decimated just when we are at last coming to appreciate these astonishing animals more completely. Populations have plummeted in the past century and continue to fall as a result of illegal trapping, logging and, most recently, the bushmeat trade. The latter is particularly alarming: logging has driven roadways into the forest that are now used to ship wild-animal meat—including chimpanzee meat—to consumers as far afield as Europe. Such destruction threatens not only the animals themselves but also a host of fascinatingly different ape cultures.

Perhaps the cultural richness of the ape may yet help in its salvation, however. Some conservation efforts have already altered the attitudes of some local people. A few organizations have begun to show videotapes illustrating the cognitive prowess of chimpanzees. One Zairian viewer was heard to exclaim, "Ah, this ape is so like me, I can no longer eat him." SA

The Authors

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Further Information

CHIMPANZEE MATERIAL CULTURE. William C. McGrew. Cambridge University Press, 1992.

CULTURES IN CHIMPANZEES. A. Whiten, J. Goodall, W. C. McGrew, T. Nishida, V. Reynolds, Y. Sugiyama, C.E.G. Tutin, R. W. Wrangham and C. Boesch in *Nature,* Vol. 399, pages 682–685; 1999.

CHIMPANZEES OF THE TAÏ FOREST: BEHAVIORAL ECOLOGY AND EVOLUTION. Christophe Boesch and Hedwige Boesch-Aschermann. Oxford University Press, 2000.

PRIMATE CULTURE AND SOCIAL LEARNING. Andrew Whiten in *Cognitive Science*. Special issue on primate cognition, Vol. 24, pages 477–508; 2000.

Chimpanzee Cultures Web site: http://chimp.st-and.ac.uk/cultures/

Wild Chimpanzee Foundation Web site: http://www.wildchimps.org