

NEWS

All Together Now—Pull!

At wildlife sanctuaries, apes demonstrate their limits of cooperation, providing clues about the evolution of sophisticated social behavior

NGAMBA ISLAND, UGANDA—Two chimpanzees, Baluku and Ndyakira, face a simple choice: Work together and reap a reward, or go it alone and get nothing. Residents of a sanctuary here, they could treat themselves to bowls of sliced bananas. But the fruit sits out of reach on a wood plank placed on the ground about a meter from their cage. To retrieve the fruit, they must each pull opposite ends of a rope rigged to the plank such that the ends are too far apart for either chimp to grab alone. Only with a coordinated tug can they reel in the reward. The chimps know the drill, but Ndyakira can't resist showing Baluku who's boss. She threatens the younger male with a cough and then attacks, chasing Baluku—now screaming—until keepers restore the peace by luring Ndyakira into a neighboring enclosure.

While Ndyakira gets a timeout, Baluku gets a second chance, this time with Okech, a male closer to his age and social rank. The two cooperate like old pros to haul in the banana bounty.

Chimpanzee cooperation depends crucially on individual relationships, says Alicia Melis, a postdoctoral researcher based at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany. Melis has been working with the chimps at the Ngamba Island Chimpanzee Sanctuary since 2004, and she knows her subjects well. Pairs of chimps who get along with each other cooperate readily on the rope-



pull task, she has found. But when a pair has a dysfunctional relationship—such as when a dominant chimp like Ndyakira insists on bullying a particular subordinate, or when a lower ranking chimp is too afraid to do its part—cooperation breaks down.

“If you can't tolerate each other, you can't work together,” says biological anthropologist Brian Hare, Melis's adviser. This idea seems obvious, but Hare thinks it may have important implications for understanding how social skills such as cooperation evolve. He proposes that reduced fear and aggression toward others is a prerequi-

site for sophisticated social behavior. His recent research on dogs and their relatives support this hypothesis: Foxes bred to be docile around people can also understand some human gestures—a social skill that eludes untamed foxes and that is key to human-canine closeness. Working mainly at sanctuaries such as this one, Hare is now examining how temperament influences social behavior in our two closest living relatives, chimpanzees and bonobos. The results feed into a larger comparative study that is yielding insights into the evolution of

◀ **A tolerant team.**

Chimps (*left*) are less able than bonobos (*below*) to cooperate to retrieve a treat of bananas from outside their cage.

human social cognition (see p. 1360).

Other researchers are watching the project with interest.

The famously hypersexual bonobos are widely considered the more tolerant of the two apes, says Joan Silk, a primatologist at the University of California, Los Angeles. If bonobos do better at collaborative tasks, when compared head-to-head with chimps, that will support the idea that tolerance is an important precondition for the evolution of social cognition, Silk says: “It will be a great insight if that's correct.”

Ape cooperation

Although chimps cooperate in the wild to attack rival groups and hunt monkeys, until recently, tests of chimp cooperation in more controlled settings have yielded largely negative results. Hare, Melis, and Max Planck Institute collaborator Michael Tomasello wondered whether a lack of “social tolerance”



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between the individuals being asked to cooperate might underlie this discrepancy. They carried out their own tests in Leipzig, paying attention to chimp-chimp dynamics. Chimp pairs with high levels of social tolerance, as gauged by their willingness to share food with one another, spontaneously figure out the rope-pull task and consistently work together to get a mutual reward, they reported in the August 2006 issue of *Animal Behaviour*.

The researchers extended those findings with experiments at Ngamba. The tests showed that chimps not only recognize when they need a collaborator to solve a problem, but, given a choice between two potential helpmates, they will also choose the one who has been most effective at helping them in the past (*Science*, 3 March 2006, p. 1297). “Chimps can do really complex things if they’re with a tolerant partner, but if they’re not with a tolerant partner they can’t do anything,” says Hare.

There are limits to cooperation even in tolerant chimps, however. When Melis repeats the test with Baluku and Okech but this time rigs the platform with one central bowl of food instead of one bowl for each of them, their collaboration falters. Okech seems to have the right idea: He runs to one end of the rope and stands by, apparently ready to do his part. But Baluku ignores his end of the rope and reaches through the bars of the enclosure, grasping at the fruit just beyond his reach. Another trial produces a similar impasse. On the third try, both chimps pull the rope, but Baluku darts to the food bowl and snatches the fruit, leaving none for Okech, who hoots softly. “He’s crying for food,” says Melis.

Okech might have had better luck if he’d been a bonobo. Bonobos have a reputation as the free-loving hippie cousins of chimpanzees. They use sex—in a seemingly endless variety of positions and combinations of partners—to defuse the tension of social interactions. Hare hypothesized that these apes, who apparently excel in social tolerance, would outperform chimpanzees in cooperating to retrieve fruit rewards.

That hunch turned out to be right. He, Melis, and colleagues recently had bonobos housed at the Lola Ya Bonobo Sanctuary in the Democratic Republic of Congo perform the rope-pull test. Like many of the chimps, bonobos cooperated readily on the rope-pull task when the reward was separate bowls of fruit. Unlike the chimps, they also cooperated well when the food was presented in a central bowl. Moreover, the bonobo who got



SANCTUARIES AID RESEARCH AND VICE VERSA

It’s feeding time at the Ngamba Island Chimpanzee Sanctuary, and keepers are tossing chunks of pineapple, avocado, banana, and papaya to dozens of eager chimps who make a racket as they scramble for the falling fruit. Brian Hare, a biological anthropologist visiting from Germany, looks on gleefully. “Look at all those chimps!” he exclaims. “I love it!”

His work here is part of a project to compare the social behavior of chimpanzees and bonobos (see main text), in particular, cooperation—something at which he himself excels. Although currently based at the Max Planck Institute for Evolutionary Anthropology in Leipzig, it’s obvious that he’s forged strong relationships here. He exchanges animated greetings with the keepers in Luganda, a local language, and chats with them over dinner about politics—both Ugandan and chimpanzee—catching up on the latest scandals and power struggles in both realms. Hare has also recently established ties with two other African ape sanctuaries and hopes other researchers will follow his lead.

It’s a mutually beneficial arrangement, Hare says. Sanctuaries provide a home to animals orphaned by the bush-meat trade or rescued from pet traders, and they promote the conservation of wild apes in the few areas where these animals still remain. They benefit from the support and expertise of visiting scientists. And researchers get their money’s worth. Work at the sanctuaries is considerably cheaper and entails less red tape than at many zoos and primate centers, Hare says. Moreover, the sanctuaries have larger numbers of apes than many other facilities and provide more natural living conditions.

At Ngamba, for example, 42 chimpanzees have free rein over 39 hectares of rainforest on the 40-hectare island in the Ugandan section of Lake Victoria. During the day, the chimps forage, play, and interact much like chimps in the wild. They can sleep in the forest too, but most prefer the hammocks slung near the ceiling in the caged enclosure, which doubles as a behavior lab. “It’s better for us as researchers because we get to work with apes that are a little more psychologically healthy and have a much richer and [more] natural environment” than zoos or primate centers can provide, Hare says. In addition to work at Ngamba, he has begun studies at the Tchimpounga Chimpanzee Sanctuary in Congo and the Lola Ya Bonobo Sanctuary in the Democratic Republic of Congo, the only sanctuary in the world for these highly endangered apes.

The sanctuaries also stand to gain, says Ngamba director Lilly Ajarova. Hare’s research on social relationships among the Ngamba chimps, for example, has taught the keepers a great deal about how different individuals get along and how to manage them, Ajarova says. In addition, Hare’s grant money has paid to renovate the sanctuary’s kitchen and allowed one of its veterinarians to pursue Ph.D. research in microbiology in Germany.

Harvard primatologist Richard Wrangham, who helped set up the Ngamba sanctuary and encouraged Hare to pursue research there, sees “wins all around, for chimpanzees, managers, and researchers.” Like Hare, he would like to see the sanctuaries become a sharable resource for ape researchers, whose populations of subjects in developed countries may dwindle as breeding restrictions tighten (*Science*, 1 June, p. 1265). “The sanctuaries are a godsend for the future of our science,” Hare says.

—G.M.

Social Cognition

to the prize first always shared some food with its partner. (Like Baluku, most chimps adopt a winner-take-all policy in this situation.) The findings, which appeared in the 3 April issue of *Current Biology*, suggest to Hare that relative to chimps, bonobos are capable of more flexible cooperation: They are less fussy about who they will work with or what the reward is.

Still, the study presents a puzzle because field researchers have seen very little cooperation in wild bonobos. One possibility, Hare says, is that bonobos don't need to cooperate because food is so abundant in their rich rainforest habitat. Tomasello adds that although bonobos, unlike chimps, don't appear to use tools in the wild, they quickly learn to use them in captivity, suggesting they're capable of a variety of cognitive feats they don't normally perform in the wild.

Evolution of tolerance

But how did bonobos get to be so socially adept? Hare has a provocative idea, one suggested by work in canines. Domestication has honed the dog's social smarts. Dogs know when a human is pointing toward hidden food, implying complex communication between man and his best friend. Wolves and wild foxes lack this ability. But foxes bred to lack

fear or aggression toward humans can interpret these gestures just fine, Hare and his colleagues reported in 2005. "They weren't selected to do anything cognitively sophisticated," says Tomasello. Yet domestication produced social skills that wild ancestors lacked (*Science*, 23 June 2006, p. 1737).

Hare's Ph.D. adviser at Harvard, primatologist Richard Wrangham, had proposed in the 1990s that something analogous may have happened in bonobos after their lineage split off from that of chimpanzees about 2 million years ago. Dogs and other domesticated animals tend to have certain characteristics relative to their wild ancestors, including reduced cranial volume, smaller teeth, more gracile limbs, and lighter coloring. Wrangham argued that bonobos, and the males in particular, have these traits relative to chimpanzees. These features arose coincidentally in dogs and domestic foxes selectively bred for low aggression, and Wrangham argues that natural selection against aggression in bonobos could have produced a similar

result. Bonobos are the most peaceful of the great apes, he says. Male bonobos don't conduct raids on neighboring groups, as do chimpanzees, for example, or kill infants sired by other males, as do gorillas. (Why natural selection would have disfavored aggression in bonobos is a mystery, although Wrangham is not short on ideas.)

Hare goes a step further, proposing that, whatever the cause, selection against aggression enhanced social tolerance in bonobos, setting the stage for their ability to cooperate more flexibly than chimpanzees in some situations. "It's a racy hypothe-



Thought provoking. Comparative behavioral studies of nonhuman primates such as bonobos (above) should shed light on the roots of human social cognition.

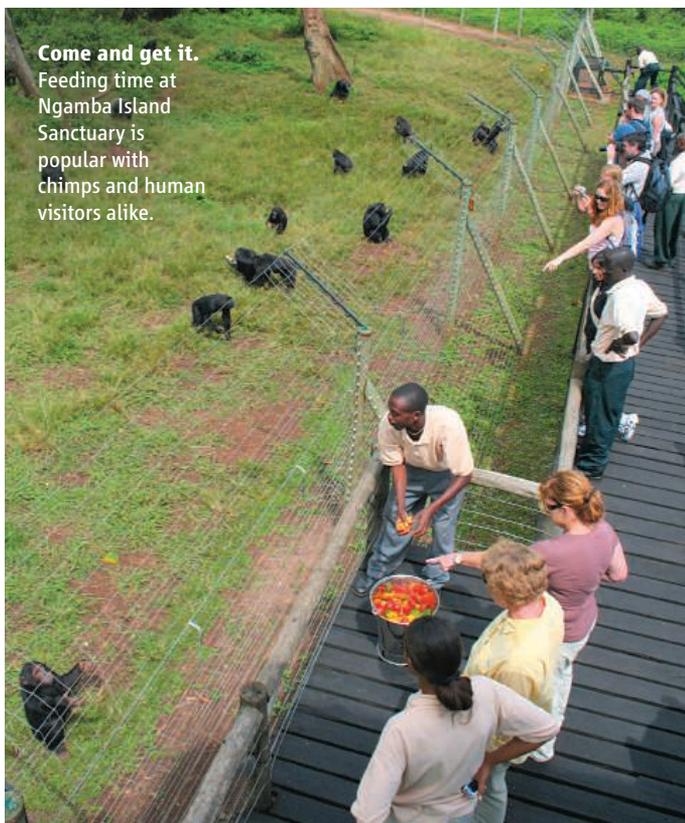
sis," Hare concedes. "It's not going to be embraced by everyone."

Primatologist Frans de Waal of Emory University in Atlanta, Georgia, is one of the unconvinced. He discounts Wrangham's assertion that bonobos arose from a chimp-like common ancestor that became less aggressive after they diverged. "It could very well be the other way around," he says. Chimpanzees could be the more aggressive offshoot of a bonobolike ancestor. "There's not a shred of evidence for one position or the other at this point," de Waal says, adding that only genetic data are likely to settle the issue.

Researchers have done very little genetic work with bonobos to date. But one study that compared variations in a gene called *avpr1a* in bonobos and chimpanzees found that the bonobo version is similar to one found in highly social prairie voles, whereas the chimp version resembles that found in socially aloof montane voles (*Science*, 10 June 2005, p. 1630). The human version is more similar to the bonobo one. The gene encodes a receptor for vasopressin, a hormone linked to aggression, sex, and other social behaviors. The findings hint at how genetic changes could produce different temperaments in chimps and bonobos, Hare says.

Hare is currently searching for additional clues by measuring heart rate and other physiological indicators in bonobos and chimps in response to social stimuli such as the recorded calls of familiar and unfamiliar individuals. "If we can figure out how those two sister species are different and how they became different, then we'll be able to make strong inferences about how we became different from them," he says. "That's the goal of the whole project."

—GREG MILLER



Come and get it. Feeding time at Ngamba Island Sanctuary is popular with chimps and human visitors alike.

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