Profile of Frans B. M. de Waal

Not often does a book highly cited by scientists also appear on a best-read list for United States Congress members. Yet primatologist Frans B. M. de Waal's book *Chimpanzee Politics*, cited more than 600 times since its publication in 1982, was also recommended by then-U.S. Speaker of the House Newt Gingrich for freshman Representatives in 1994 (1). Embraced across many disciplines, the book detailed primate social structure and filled a gap in both the scientific literature and the public's imagination. With this book, de Waal was one of the first scientists to break long-standing scientific taboos and study animals as cognitive and emotional creatures rather than as mere learning machines.

Since that time, de Waal has become one of the most influential researchers of the social life of monkeys and apes. His six popular books (1–6) have been translated into over a dozen languages, and his research has spurred new work in animal conflict resolution and peacemaking. He was elected to the Royal Dutch Academy of Sciences in 1993 and to the National Academy of Sciences in 2004.

Now the C.H. Candler Professor in the Psychology Department at Emory University (Atlanta, GA) and director of the Living Links Center at the Emory-affiliated Yerkes National Primate Research Center (Atlanta, GA), de Waal continues to reach a multidisciplinary audience with his research. In his Inaugural Article published in this issue of PNAS (7), he presents findings on how capuchin monkeys react to their reflections in mirrors. Because mirror self-recognition is correlated with the first signs of empathy in human children, this work relates to how primates develop varying capacities for emotional connections.

Frans B. M. de Waal

Biology with a Spark of Life

Even before his career in primatology, de Waal was never far from animals. The grandson of a pet-store owner and the son of a bank director, he spent his childhood weekends in the polders (flatlands reclaimed from water) near his home in Waalwijk in The Netherlands. He was engrossed by animal projects such as breeding mice, raising jackdaws, and creating a small aquatic zoo in his backyard with buckets filled with fish and eels.

Yet in high school, de Waal's biology teacher was so uninspiring that he almost discouraged the nature-loving student from pursuing a life sciences career. Dutch students typically select a course of study before entering university, and de Waal was leaning toward mathematics or physics. Luckily, he says, his mother stepped in, pointing out that studying animals had been his long-time passion and perhaps biology would suit him better. He took her advice, and in 1966 entered a biology program at Katholieke Universiteit van Nijmegen (Catholic University of Nijmegen; now the Radboud University Nijmegen) in The Netherlands.

But biology was not a perfect fit at first for de Waal. His only interaction with animals in his coursework involved dissecting them and sketching their anatomy. Although interesting, he found it unsatisfying, and after 4 years, he was distinctly unhappy with school. To fill some time and earn extra money, de Waal began work in a psychology laboratory, performing cognitive tests on two young male chimpanzees. "All of a sudden, I thought, 'This is what I want to do. I want to work with animals,'" says de Waal.

Integrating Art and Aggression

With a renewed interest in animal behavior, de Waal began graduate studies in 1970 at the Rijksuniversiteit Groningen (University of Groningen; Groningen, The Netherlands). Groningen was the top institution for ethology, an animal behavior field that was in its heyday in The Netherlands at the time, de Waal says. Compared with traditional fields across the Atlantic, ethology had a more biological perspective on animal behavior, suiting de Waal. "I think most naturalists are basically born naturalists," he says. "It's not something that I acquired at the university." He finished his *Doctoraal* degree at Groningen in 1973.

Next, de Waal moved to Universiteit Utrecht (University of Utrecht; Utrecht, The Netherlands) for doctoral work—thereby defying, he says, the Dutch tradition of single-university education. Recruited by primatologist Jan van Hooff to work on a large study of aggression, de Waal found postaggression behavior to be highly intriguing. "I got interested in seeing these fights going on in a group of primates and then seeing that 15 minutes later everyone settled down," says de Waal. "I got puzzled by how they built aggression into their social life."

Apes Across the Water

In 1975, de Waal moved to Arnhem in the eastern part of The Netherlands to work at Burgers' Zoo, which was run by Anton van Hooff, the brother of his advisor. On an island in the zoo, the brothers had established a colony of 25 chimpanzees, which was a rare setup at the time and is still the largest such colony today. Here, while de Waal wrote his thesis on macaque aggression, he was able to watch through binoculars the unfolding Machiavellian soap opera of the colony's males.

Through these observations, de Waal identified and characterized the social exchanges that allowed the chimpanzees' aggression to coexist with peaceful behavior (8, 9). It was the first time anyone had been able to study a large group of chimpanzees in captivity, and the experience remains the richest period of scientific discovery in de Waal's career. "All the issues that I'm at the moment still working on I basically saw in front of me in that colony of chimps," he says.

After one of de Waal's first talks at an international conference, he met Robert Goy, a University of Wisconsin–Madison (Madison, WI) endocrinologist, who immediately insisted that de Waal join his group in the United States "Having never been across the Atlantic, I found it a bit of a scary proposal," de Waal says. A few years later in 1981, he agreed and moved to the Wisconsin National Primate Research Center (Madison, WI), which Goy directed. Although intending to stay only a year, after 2 weeks de Waal liked the environment enough to accept a longer-term position that had just opened at the center.

This is a Profile of a recently elected member of the National Academy of Sciences to accompany the member's Inaugural Article on page 11140.

de Waal at work at Yerkes National Primate Research Center, Atlanta, GA.

The only thing missing now in de Waal's new home were apes. He studied macaques in Wisconsin but also arranged to study apes elsewhere, such as at the San Diego Zoo (San Diego, CA) and the Yerkes National Primate Research Center in Atlanta (10). Compared with monkeys, apes are more intelligent and closer to humans in development. "I was hooked on apes at that point," he says. "There's lots of good stuff you can do in monkey work, but if you're interested in questions of higher cognition and human evolution, then apes have a great advantage."

Machiavellian Chimps

Connecting human and animal behavior became more important to de Waal during this time as he developed a parallel career track in popular writing. In Arnhem, he frequently gave lectures to zoo visitors, and he appreciated their natural curiosity. Yet the hot topics in academia were the ones that set them yawning, he noticed. "What they really want to know is what kind of emotions, what kind of facial expressions, what kind of social relations the animals have," he says.

After watching political upheavals among the chimpanzees in Arnhem, de Waal decided it was the perfect subject for a general-audience book. For 2 years, he worked on *Chimpanzee Politics*, which published in London in 1982, translated from his Dutch handwritten manuscript (1). Although he initially envisioned a book that was half-scientific and half-popular, de Waal ended up writing a popular book also well received by the scientific community. In fact, it is still probably his most widely cited piece of writing, he says.

Chimpanzee Politics broke old scientific taboos by attributing traditionally human qualities to animals. At the time the book was published, academic views had begun to change, thanks in part to work by animal researchers such as Donald Griffin, Jane Goodall, and de Waal. Each took a middle-ground approach to animal cognition. Previously, comparative psychology explained animal behavior through trial-and-error learning, and, at the other extreme, ethology viewed animals as "instinct machines," de Waal says. "The time was ripe. If I had written that book 10 years earlier, probably I would have been burned at the stake. Ten years later and it would have been after the revolution."

Reaching Two Audiences

Still, de Waal had reason to be worried about his nascent academic career. Mindful of the conservative academic climate, de Waal's advisor van Hooff urged his student to be more modest with some of the book's more controversial conclusions. But de Waal felt strongly about what he saw among the chimpanzees in Arnhem and thus spoke his mind directly. "I had a bit of the attitude, which you basically find only in young people, that I had nothing to lose," he says. "I had no career, no established name or anything. So I said, 'To hell with other people who think differently.'" *Chimpanzee Politics*, popular with general readers as well as many scientists, made the then-32-year-old de Waal famous.

A willingness to be outspoken continued to be a hallmark of de Waal's career. In the late 1990s, he wanted to publish potentially controversial work on bonobo apes but found resistance from editors. "No one was talking about the sex in the bonobos," he says. "I felt that was totally ridiculous. Basically, the sex in bonobos was being worked under the table by shy people who felt embarrassed." Again, de Waal decided to present his work frankly, with an article published in *Scientific American* in 1995 (11). In 1997, he published the book *Bonobo: The Forgotten Ape*, produced with Dutch photographer Frans Lanting (3).

The ability to consistently produce general-audience writing and rigorous research sets de Waal apart from many other scientists. "I marvel at how he can do both of these things at the same time," says William McGrew, a colleague of de Waal's and a professor of anthropology and zoology at Miami University (Oxford, OH). "Frans can make statements that can be understood by the average person, but he can back it with carefully designed studies and data. He has such a high standing with his fellow scientists because he does hard work in order to get good data and form his opinions."

Testing the Good Nature of Primates

After a decade of research in Wisconsin, de Waal began to miss another sort of animal: graduate students. As a research faculty member, he concentrated on research but could not easily mentor students. "I was missing the fact that I had no legacy," he says. In 1990, de Waal moved to Emory University, where he had been involved with ape studies at the Yerkes National Primate Research Center.

"You have monkeys who have friends and enemies in their groups, and you can use that in your experiments."

At the same time, de Waal shifted his research emphasis. His work had been mainly observational until that point, but he had become interested in doing more experimental research. At Yerkes, he set up a laboratory focused on capuchin monkeys, designed for experimentation and based on a concept by primatologist Hans Krummer in Switzerland. The

monkeys live in indoor/outdoor social groups but are trained to leave the group for experiments in a special facility (12, 13). "You have monkeys who have friends and enemies in their groups, and you can use that in your experiments," de Waal says.

Although de Waal initially concentrated on experiments on cooperation and reciprocity in primates, he has also been interested in empathy (14). In 1996, he wrote the book *Good Natured*, in which he discusses the capacity of primates to have empathy (2). "For example, if one chimpanzee is distressed, another one will come over and put an arm around them and calm them down," de Waal says.

In human children, these higher forms of empathy appear only when they are old enough to recognize themselves in the mirror, de Waal says. Interestingly, apes can recognize themselves in the mirror, whereas monkeys cannot. Similarly, apes are capable of more complex expressions of empathy than monkeys are, and de Waal has argued that a connection exists between empathy and mirror self-recognition.

Strange Reflections

In his Inaugural Article in this issue of PNAS (7), de Waal presents results of an experiment to test the assumption that monkeys looking into a mirror mistake the image they see for a real monkey. Although it has been documented that monkeys do not recognize their own reflection, de Waal wondered whether they believed their image was that of a strange monkey.

In the experiment, capuchin monkeys from the Yerkes experimental habitat were observed in front of both familiar and unfamiliar monkeys and in front of a mirror. Their reactions to the mirror were markedly different from their reactions to real monkeys, especially ones from another social group, de Waal says. "The monkeys, at first glance already, seem to immediately see that this is not a stranger. We don't know what they see. They don't see themselves. But they also don't see a stranger. Basically, they fall somewhere in between."

Developmental researchers make similar claims about children, de Waal says. Before the age of 18 months, humans do not recognize their reflection, but they develop a certain understanding of the mirror and understand they are not looking at a real child. This behavior contrasts with some theories in animal science literature that claim a black-and-white distinction in mirror self-recognition. "[These theories] say you either see a stranger or you see yourself. There's nothing in between," de Waal says. In his Inaugural Article, he argues that capuchin monkeys fall into a gray area shared by human infants.

A Mixed Moral Heritage

Although the study of animal emotions remains a controversial area, de Waal's work is enjoying a boost from the field of neuroscience. With neuroscientists' quantification of emotional centers through brain scans, the study of emotions in animals has gained legitimacy. "Neuroscientists are not shy about empathy and emotions in research on people," de Waal says. "When I started writing about empathy in animals, there was far more interest from neuroscientists than from traditional behavioral scientists."

This work on animal empathy and its relationship to human empathy has also led de Waal into territory where few scientists venture: philosophy. Are humans naturally moral creatures, or do we learn morality only through hard work? Is goodness artificial? In answer, de Waal says he mostly agrees with Charles Darwin, who called morality an outgrowth of social instincts and viewed it as an evolutionary product. "It's an old debate within philosophy. And it's a debate within biology," de Waal says. "That's where the interface between my work and philosophy occurs."

In the future, de Waal plans to continue his research on empathy, hoping to test empathy responses in primates. In October of this year, his newest book, titled *Our Inner Ape*, is slated to publish (15). It is more focused on human behavior than any of his previous popular works. "In this book I'm arguing that we have two sides," he says, each of which corresponds to the stereotypical characteristics of the human's closest ape cousins, the chimpanzees and bonobos. "We're really a bipolar ape. We have a very nasty side to us, and when we are nasty, we are nastier than almost any other animal that you can imagine. But we also have a very nice, altruistic side to us. And when we're nice, we're actually much nicer than almost any animal you can imagine."

Regina Nuzzo, *Science Writer*

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