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Jacob Caton
Arkansas State University, jcaton@astate.edu

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Book Review

Are We Smart Enough to Know How Smart Animals Are?

Jacob N. Caton

Arkansas State University

Are We Smart Enough to Know How Smart Animals Are?

Frans de Waal, W.W. Norton & Company, 2016, 352pp., \$16.95 (paperback)

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Correspondence: jcaton@astate.edu



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Frans de Waal's book should interest anyone who wants to seriously think about any combination of the following: minds, cognition, animals, and humans. De Waal is one of the world's leading primatologists, and he uses his vast experience in addressing questions about non-human animal intelligence. One strand of the book serves to update the reader about what we know about non-human animal (henceforth animal) intelligence and cognition. A second strand of the book concerns us, humans, and how we have and should think about animal cognition, and how we have and should go about testing animal intelligence.

The structure of the book is as follows. De Waal begins by introducing the idea of a magic well, a concept he borrows from the ethologist and bee researcher Karl von Frisch. According to von Frisch, "the life of the bee is like a magic well, the more you draw from it, the more there is to draw" (p. 11). De Waal invites us to see the recent advances in understanding animal cognition as a magic well: "...we are trying to get under the skin of other species, trying to understand them on their terms. And the more we succeed, the more we discover a natural landscape dotted with magic wells" (p. 13). De Waal next describes the decades-long ideological battle between behaviorists and ethologists (and later cognitive ethologists). (Philosophers of mind and cognitive scientists might be especially interested in this chapter. Likely, the history of behaviorism related to the study of the human mind is known, but I suspect the history related to animals is less known.) Following a rejection of behaviorism, de Waal introduces the "cognitive ripple rule", the idea that once a capacity is found in non-human primates, "the floodgates often open to include species after species" (p. 69). De Waal then proceeds to discuss the language abilities of animals, uniqueness claims about humans, social cognition by animals, animals reasoning about time, and the self-awareness of animals. De Waal closes the book by defending his favored view of cognition, "evolutionary cognition".

To get into one of the major threads of the book, begin with the following thought experiment (this is not from de Waal's book, but I think he would be sympathetic). Alien dogs from an exoplanet orbiting the star LHS 1140 visit Earth and take a human captive for intelligence testing on their ship. The alien dogs lock the human in a room with hundreds of "scent clues" (patches of olfactory information embedded in the walls) about how to escape the room. For these alien dogs, this is not a challenging test---in fact, alien puppies can solve the task in under two minutes. But the human mostly sits in the room, occasionally engaging in something that sounds like a mix of barking and whining, and occasionally "pawing" at the door. The human makes no attempt to sniff out the scent clues and makes no progress in the task. So, the alien dogs conclude that the human does not possess intelligence. Here is the question: have the alien dog researchers made a mistake?

Now consider a real experiment (this one took place on Earth and is in de Waal's book). Researchers tested gibbons, tree-dwelling apes, for tool use by dropping a banana outside their cage and providing a nearby accessible stick. Gibbons were observed not to grab the stick, so researchers concluded that they could not use tools.

Did these human researchers make a mistake? They did. These researchers failed to account for the fact that gibbons' hands lack a fully opposable thumb. Given that gibbons are tree-dwelling primates, they are unaccustomed to reaching and grabbing for things on a flat surface (their hands act more like hooks). When Benjamin Beck, in the late 1960s, redesigned the experiment to suit gibbons' physiology (he designed a string system to be at shoulder level, approximating the familiar movement of grasping branches in a tree), the gibbons used tools to solve the task, as other apes previously did (p. 13--15). Just as the fictional alien dog researchers made a mistake about human olfaction, human researchers made a mistake about gibbon physiology.

Consider a second experiment conducted in the late 1980s. Researchers were interested in whether elephants have self-awareness, so they placed body marks on the elephants and placed a 41 by 95 inch mirror outside their cage, angled up from the floor. When the elephants failed to touch their body mark, the researchers claimed that elephants lack self-awareness.

Did these researchers make a mistake? Again, they did. The researchers placed the mirror *outside* the cage in such a way that the elephants mostly saw their legs and the bars of the cage, and not the mark on their face. Because the mirror was outside the cage the elephants actually saw two sets of bars, likely obscuring their view. So, it was an inappropriate test of elephant self-awareness (pp. 17--18). A later experiment, with a proper elephant-sized mirror installed *inside* the cage, showed that some elephants do indeed rub and investigate their body mark, connecting their reflection with their body, suggesting self-awareness. A more sweeping conclusion is difficult because elephants like to investigate new objects with their tusks, and this led to many destroyed mirrors in the experiment (as de Waal said, "this makes it hard to decide between poor performance and poor equipment" (p. 18)).

The central question in Frans de Waal's book is reflected in the title: are we smart enough to know how smart animals are? Throughout the book, de Waal answers this question in two ways. First, he describes and explains the inherent difficulty of designing and implementing tests for other species. Stating it simply for now, his answer is basically that we (humans) are routinely too human-centric in how we think about how other species think. I will call this the "methods" answer. Second, he addresses the human psyche and

our deep need to be thought of as “top ape”. Again, simply for now, de Waal’s claim is that our ego often gets in the way of how we think about animal cognition. I will call this the “ego” answer.

Below I will explain de Waal’s methods answer and his ego answer. But before I do that I want to make it clear that de Waal’s book is as much about us humans as it is about other species. Yes, de Waal’s book is loaded with excellent and exhilarating examples of recent experiments in animal cognition that overwhelmingly suggest that many animals are more cognitively sophisticated than we previously thought. Much of the fun of de Waal’s book is getting a whirlwind tour of our updated thinking about animal cognition, and you will likely spend the next few days after reading telling everyone you meet many of the amazing examples of animal cognition. But the persistent argument in the background of the book concerns us humans. (Okay, I cannot resist. Here is one. In the “floating peanut task” a tube is half-filled with water and a floating, but inaccessible, peanut. After initially trying to kick and shake the tube, Liza, a female chimpanzee at de Waal’s research facility, immediately went to the water fountain, filled her mouth with water, then spit the water into the tube. The water level rose and she reached the peanut with her fingers. One chimp even tried to pee into the tube to make the water level rise! Talk about a moment of insight! Other studies have shown that some orangutans and chimpanzees are able to solve the floating peanut task. Additionally, New Caledonian crows have solved a version of this puzzle (pp. 90--92)).

Elements of this argument concern the philosophical roots of human chauvinism. De Waal spends a fair amount of time on Aristotle’s *scala naturae*, the proposed linear ordering of cognition with humans at the top and insects and mollusks at the bottom. The quickest objection to this linear ordering is that Aristotle’s picture is inconsistent with the facts of evolution---evolution does not yield “higher” or “lower” forms of cognition, but forms of cognition that fit an environment. This is why scrub jays can remember the precise location of hundreds of cached food items, but humans do not have such an ability (there is also evidence they have episodic memory about *what* they have stored, *where*, and *when*) (p. 211). This may also be why Ayumu, a chimpanzee, can remember the locations of a random series of numbers from 1 to 9, after only seeing them for 210 milliseconds. On this task, Ayumu has a better photographic memory than humans. Ayumu even beat a British memory champion (p. 119--120). Or, this may be why chimps outperform humans on a version of rock-paper-scissors (p. 162).

But even though Aristotle was wrong, the idea of “higher” and “lower” cognition persists. It might be the case that our human chauvinism ultimately stemmed from a lack of evidence. How much did (and do we) we really know about the capabilities of animals? It

is only recently that we have even *started* to systematically look and test for animal intelligence. Aristotle, after all, did not have excellent evidence about the abilities of animals. He did not know about elephant self-awareness or crow episodic memory or dolphin naming systems or cockatoo tool making, for example. But it is telling that he *presumed* the absence of these abilities in the absence of evidence to the contrary. (To be fair to Aristotle, his notion of evidence and experiment are not ours. But it is still true that he did not possess good evidence for his linear ordering.)

We (laypeople) really do not know too much about the abilities of animals. Perhaps this is why de Waal provides what feels like an avalanche of examples of animal cognition throughout the book. Here are some of these examples (I will state these simply for sake of brevity): a chimp saying goodbye in anticipation of leaving, rats regretting their decisions, chimps getting bored, apes using mirrors to look inside their mouths and at their behinds, an ape jumping in a lake to save another ape, Japanese macaques with culture, chimps engaging in delayed gratification, chimps engaging in planning, chimps being altruistic, Clark's nutcrackers remembering where they stored thousands of nuts, chimps engaging in teamwork, crows recognizing individual human faces, sheep remembering other individual sheep faces, paperwasps recognizing other individual wasps, chimps with a set of tools (a "toolkit"), orangutans using tools, sea otters using tools, a crow making a tool, an octopus using a coconut shell as protection, a parrot identifying what an object is made of, a cockatoo making a tool, a parrot counting, a chimp deceiving another chimp about the location of food, a chimp saving a choking chimp's life, dolphins saving a "stunned" dolphin, capuchins having a sense of unequal food division, a crow being sensitive to their mate's preferences, jays re-caching food if observed by rival jay, a chimp starting a fashion trend, chimps inventing a game, macaques developing the trend of rubbing stones together (for no practical reason), chimps conforming to a trend, chimps trying to befriend friends of their enemies, a female chimp settling a fight by breaking a branch in two and giving each a half, capuchins recruiting friends who are dominant over their opponent, sea lions understanding transitive inference, rhesus monkeys picking out the dominant male in video of unknown monkeys, ravens having the concept of group status, a chimp standing on another chimp's shoulders to look in a window, elephants coordinating their actions, humans and wild dolphins working together to fish, elephants engaging in future-directed actions, a chimp collecting and organizing rocks in the morning to later throw at visitors at the zoo, orangutans calling to announce the direction of their next day's travel, scrub jays making strategic decisions where to cache food, dolphins realizing their own uncertainty about a task, rhesus monkeys knowing that they don't know something, elephants distinguishing between two different human languages, dogs and monkeys using a mirror as a tool to find food, magpies passing the mirror test, an orangutan using a mirror to help with wearing a

decorative hat made of lettuce, chimps taking on the accents of locals, chimps recognizing another chimp by only seeing their backside, and dolphins having whistles that act like names.

I have listed the examples above not to be tedious, but to provide a sense of what it feels like to read de Waal's book. You are confronted with hundreds of examples of animals doing sophisticated things. It does feel like an avalanche of sorts. Just try to be a skeptic about *all* of these examples. Sure, *some* of these examples might be overstated---this is absolutely possible given the inherent difficulty of interpreting behavior. Do chimps *really* take on the accents of locals? What actually happened is that chimps originally from a Dutch zoo changed the sound of their grunts to match their new Edinburgh zoo-mates. The grunting sounds chimps make can vary from group to group and the Dutch chimps changed their sounds to conform with the locals. Apparently, the media described this as "Dutch chimps learn to speak Scottish", but de Waal claims this is more like adopting an accent (p. 258). At any rate, the totality of examples should lead one to acquiesce. My sense is that de Waal knows exactly what he is doing, and it may be the only real way to combat the skeptics (de Waal adopts language from Marc Bekoff and Colin Allen and calls these people "slayers" (p. 266)). When taken in isolation, any individual study likely has *some* weak spots. But de Waal wants us to take a step back and look at the mass of examples. The only sensible conclusion is that *something sophisticated is going on*.

So, are we smart enough to know how smart animals are? One part of de Waal's answer concerns the methods we use to test for animal intelligence. De Waal uses the concept of an "umwelt", German for "surrounding world", denoting an individual species' subjective view of the world (pp. 7--13). The gibbon example above can serve as a useful example. Researchers failed to appreciate an important element of the gibbon's umwelt---a gibbon's world is about hanging in a tree, not grabbing things on the ground. In an important sense, the human researchers were not smart enough to know how smart gibbons were.

De Waal suggests that the methods we employ to test for animal intelligence should fit with the umwelt of the species. There is no "one size fits all" research paradigm. First, the methods should reflect the motivations of the particular species. So, tests for dog and cat intelligence likely will be different. Domesticated dogs typically care about social rewards from humans but cats may be motivated by different rewards, for example. Second, the methods should reflect how the species takes in information about their environment. De Waal mentions a failed experimental design where elephants were supposed to use their trunk to grab a tool. The problem is that an elephant's trunk is also a sensing organ (its nose), and grabbing a tool with their trunk blocks olfactory information. Changing

the experimental design, elephants showed they could use tools when they moved a box by kicking it until it was underneath a patch of fruit, allowing them to stand tall enough to grab it (p. 15--17). Third, the methods should (as far as possible) reflect the natural environment and social configuration of the species. De Waal gives the example of face recognition by chimpanzees. Initially, chimps were tested on human faces and did not perform as well as humans. But when Lisa Parr tested chimps on photographs of their own species they performed as well as humans (p. 19).

Now, the idea of a species' *umwelt* raises important philosophical issues. De Waal is keenly aware that we cannot simply slip on a species' subjective view of the world as we might slip on a pair of running shoes. De Waal mentions Thomas Nagel, and what it is like to be a bat. De Waal also mentions Wittgenstein's aphorism, "if a lion could talk, we could not understand him" (p. 9). Instead, de Waal suggests that we, at least, only need to enter a species' *umwelt* "imperfectly" for progress in understanding animal intelligence.

Here I am going to say a few things beyond anything de Waal mentions and I will connect my idea with a few things de Waal claims. It is important to keep in mind that Nagel and Wittgenstein are making claims about what we can know. And for much of the early- to mid-twentieth century a predominant view among epistemologists was that knowledge requires certainty. When the bar for knowledge is this high it is quite plausible that we cannot know the *umwelt* of another species (or, perhaps, even the *umwelt* of another human). But some contemporary epistemologists have argued that the bar for knowledge really is not as high as we thought. So called "fallibilists" about knowledge, these epistemologists claim that knowledge is consistent with the possibility of error. Bypassing a few technical points, the upshot is that it is possible for me to know that I am currently sitting in front of a computer (properly ignoring the possibility that I am just a brain in a vat being fed convincing sensory information). But another upshot might be that it is possible to know the *umwelt* of other species.

De Waal makes a subtle but interesting point about Nagel. He says, "in fact, Nagel could never have written his incisive reflections had he not heard of echolocation of bats, which had been discovered only because scientists did try to imagine what it is like to be a bat and did in fact succeed" (pp. 9--10). From the history of the discovery of echolocation, scientists knew that blinded bats could navigate their surroundings whereas deafened bats could not. Reportedly, some researchers initially thought that bats possessed a "sixth sense". But Donald Griffin ultimately showed otherwise, establishing the existence of echolocation as a way to sense the world.

Consider the process of this discovery. There is a puzzle: bats can navigate their sur-

roundings without eyesight. How did they do this? Addressing this question requires imagining different ways to sense the world. It requires entertaining the idea that sound and vision have structural similarities as a sense modality. It requires thinking about sound in a different way.

Returning to the “methods” answer about whether we are smart enough to know how smart animals are, de Waal proposes the “know-thy-animal rule”: “anyone who wishes to stress an alternative claim about an animal’s cognitive capacities either needs to familiarize him- or herself with the species in question or make a genuine effort to back his or her counterclaim with data” (p. 53). I am in no position to tell if either Nagel or Wittgenstein violated de Waal’s rule, but it is likely an easy mistake for a philosopher to make (I will discuss some possible philosopher blunders below). Claims about animals are almost always partly empirical claims. Philosophers rarely have the experience or evidence that ethologists possess. At the beginning of the book, de Waal describes a memorable experience with what he takes to be the first glimmers of seeing an animal’s *umwelt*. De Waal raised jackdaws, small members of the crow family, and devoted countless hours to watching their behavior. He tried “...think(ing) like a bird, mapping the environment as if looking for the perfect landing spot, judging a distant object (a branch, a balcony) with this goal in mind” (p. 9).

De Waal admits that this is not a perfect example of entering an animal’s *umwelt*. But it could be an approximation. Again, I am in no position to know, but how much time did Nagel spend with bats before making his claim? (I understand that the claim could be a conceptual claim. But it might not be. Conceptual claims are often packaged with empirical assumptions.) Did Wittgenstein try to talk with a lion? While at Burgers’ Zoo in the 1970s, de Waal claims that he spent an estimated ten thousand hours watching primates (this is 416 24-hour days or, if you stick to a 40 hour week, 250 weeks of animal observation) (p. 167). I can only imagine the number of hours de Waal has likely spent observing animals in the 30 years since. But if you really want to understand the *umwelt* of a species you must be prepared to log the hours. And if you want to be in a position to criticize an interpretation of a specific behavior, you must have first logged the hours getting to understand the species.

De Waal’s second answer to the question, are we smart enough to know how smart animals are, concerns the fragility of the human ego. I think the most salient example concerns Ayumu, the chimp with the world-class photographic memory (search YouTube for “Chimp vs Human Working Memory Test” and “ABC News Chimp vs Human”). As mentioned earlier, on a memory task Ayumu outperforms humans, even besting a British memory champion (p. 119--120). Apparently, Ayumu’s success was so surprising that

some humans started training on the task in an effort to beat the chimp! Virginia Morrell reports the response from Tetsuro Matsuzawa (the Japanese scientist who led the Ayumu project):

“Really, I cannot believe this. With Ayumu, as you saw, we discovered that chimpanzees are better than humans at one type of memory test. It is something a chimpanzee can do immediately, and it is one thing—one thing—that they are better at than humans. I know this has upset people. And now there are researchers who have practiced to become as good as a chimpanzee. I really don’t understand this need for us to always be superior in all domains” (p. 128).

If you have the stomach, read some of the YouTube comments to the two videos above. It is absolutely clear that this result has upset people.

De Waal’s suggestion is that our ego can get in the way of our proper search for animal intelligence. We (humans) need to be smart enough to recognize our tendency to overlook the sophistication of animals’ cognitive abilities. If we presume, from the outset, that animals cannot be intelligent, then our tests for animal intelligence will likely be insufficient. Consider the case of Chaser the border collie. Chaser knows the names of over 1,000 different items (and possibly understands some elements of grammar). But Chaser wasn’t born knowing these names. Her guardian, John Pilley, a retired psychologist, spent countless hours every day teaching her. Effectively, Pilley put Chaser through school. Now, if Pilley simply presumed that dogs had no linguistic competence for names, he would not have attempted his experiment. Pilley had to be open to the possibility that dogs had more intelligence than previously thought.

De Waal speculates that some of our insecurity about animal intelligence stems from religion and philosophy (p. 122). Philosophers, in particular, do not come off well by de Waal’s telling. I want to go over a few of these cases because I think they could be instructive. Regarding tool use, Barry Allen claimed that the rocks chimpanzees use to open nuts cannot really be thought of as tools because the chimps do not *need* them (p. 77). De Waal responds by citing the know-thy-animal rule, and alleges that Allen is in no position to claim what chimps need. Chimps, it turns out, will spend close to 20 percent of their time using twigs to fish for termites or cracking nuts with rocks. Chimps gain nine times more calories from the task than they expend (p. 77). In sum, the empirical evidence suggests “the survival of chimpanzees is quite dependent on tools” (p. 78).

Here is a second example. De Waal relates, “I recently attended a lecture by a prominent philosopher who enthralled us with his take on consciousness, until he added, almost

like an afterthought, that ‘obviously’ humans possess infinitely more of it than any other species” (p. 123). Supposedly, this philosopher had claimed that consciousness arose from the interconnectivity of the brain. But here are the empirical facts about animal brains. Dolphins, elephants, and sperm whales have larger brains (in weight) than humans. Elephant brains have three times as many neurons as human brains (p. 123--124). Further, elephant brains may have extra connectivity between “far-flung” areas of their brain (as de Waal says, this is “almost like an extra highway system”) (p. 124). So, by this philosopher’s own lights, some animals should have *more* consciousness than humans. Again, the lesson is know thy animal.

Here is a third example. Philip Kitcher has called chimpanzees “wantons”, animals at the mercy of whichever impulse strikes them in the moment (p. 223). But, just as in the examples above, such a claim is not supported by the empirical facts. The well-known “marshmallow test” is a test of delayed gratification---do you choose to eat one marshmallow now or choose to wait some period of time to receive a second marshmallow (during which the first marshmallow sits, beckoning, in front of you)? Apes, it turns out, perform about as well as children on the task (p. 225). Some chimps will delay gratification for up to 18 minutes. And perhaps Kitcher would be surprised about the findings for birds. Crows and ravens will delay gratification for up to ten minutes for a larger reward. Griffin, an African gray parrot, could wait even longer (p. 225).

Philosophers can easily get into trouble when they make empirical claims. De Waal’s book serves as a reminder of this. Before making an empirical claim about animals, make sure you “know thy animal”. The book is filled with examples of someone claiming “oh, but animals don’t do *this*”, only to find out that yes, there are cases of animals doing *this*.

I also want to mention another collection of issues from the book that is relevant to philosophy. De Waal ultimately supports a view called “evolutionary cognition”, which purports to study “all cognition, human and animal, from an evolutionary perspective” (pp. 21--22, 320). Evolutionary cognition is at odds with behaviorism, and another thread of the book is a sustained attack on behaviorism. But evolutionary cognition is also at odds with elements of comparative psychology, traditional ethology, and some traditional views in cognitive science. On this last possible disagreement, de Waal suggests that “adding animals to the mix is bound to stimulate the up-and-coming field of ‘embodied cognition.’” (p. 159). De Waal also makes the case for moderate skepticism about many studies that attempt to compare young children with non-human primates.

Lastly, I want to mention a few criticisms. De Waal's avalanche of examples come at the expense of a detailed presentation. In several cases de Waal will mention a feat of animal intelligence in one sentence. Understandably, a more detailed presentation would necessitate that the book be at least three times longer. As a partial remedy, de Waal gives citations for most of his claims, so the interested reader is able to get a more complete picture of the cited research.

This next point is somewhat minor to the overall purpose of the book, but I suspect a philosopher of mind would appreciate it. De Waal is often unclear in his discussion of consciousness (but he only spends about eight pages in total on the issue). He does not differentiate between different notions such as phenomenal consciousness, self-consciousness, or conscious awareness (though I think it is clear that he is mostly discussing something like conscious awareness). In some places he seems happy to discuss self-awareness ("some Asian elephants recognize themselves in the mirror" (p. 18)) but in other places he says things like "no one seems to know what it [consciousness] is" (p. 23).

Finally, I wish de Waal included some information from anthropology. When discussing "animals vs. humans" the focus is usually something like chimps vs. modern-day freshmen psychology students (or children from industrialized countries). But when talking about *humans* and *human abilities* we must include what we know about people from modern-day, small-scale societies and what we know about *Homo sapiens* living 100,000 years ago.

I suspect that this book will be useful, perhaps inspiring, for those that do research in the philosophy of mind or cognitive science. If you are interested in animal ethics, de Waal gives examples of how some animal research paradigms systematically treat animals: "many labs keep their animals at 85 percent of typical body weight to ensure food motivation" (p. 35). De Waal asks: "no one has ever proposed permanent food deprivation for university students. Why would it be any different for animals?" You'll also read about the Morris Water Maze test and the Columbia Obstruction Method, both of which place an animal in duress for testing. And if you are interested in human nature, de Waal's book will be informative. After all, the term 'ethology' comes from the Greek word 'ethos', meaning character. It is a bit clichéd to say, but also still a bit true, that de Waal's book can help us think about what it is to be human.