Nico's Bubbles: The Story of a Whale, Some Crows, and the Search for Sentience

by

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ABSTRACT

Humans have long been drawn to the study of nonhuman animal cognitive and emotional intelligence, but have long come up short. Cognitive scientists look for signs of a sense of self, the ability to solve problems, and the capacity for communication in a vast array of nonhuman species, from cephalopods to primates. In this particular search, science has been increasingly successful as researchers report that New Caledonian crows can use tools to solve rather complex problems; that dolphins and songbirds can identify themselves in mirrors; and that dogs can "turn off" survival drives in order to engage in play behavior. In fact, nonhuman animal intelligence research is exploding rather wildly onto the scene.

Other scientists aren't as fortunate. They have a much more difficult time identifying with any certainty that nonhuman animals experience emotion, but the answers are approaching illumination. Mice show signs of empathy. Rats laugh when they play...and when intrepid researchers tickle them. Anxious dogs respond identically to humans when fed meat-flavored Prozac. No matter what these behaviors look like, however, emotional experience is subjective and thus still just beyond of scientific reach. As long as subjective experience of nonhuman animals is brushed off by science, the search for evidence of cognitive and emotional intelligence in these creatures is at a hard-headed stand-still. Wrought with fears of anthropomorphism and crushed reputations, these research areas are perpetually at risk for withering away into scientific obscurity. A transformation of thought, a readjustment of methods is deeply needed. A revolution is likely close around the corner, and with it will come a move away from anthropocentric science, as well as some difficult ethical and moral questions.

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This work is dedicated to Nico.

Nico's Bubbles: The Story of a Whale, Some Crows, and the Search for Sentience

For a volunteer at the Georgia Aquarium, there was hardly ever a quiet moment. It was when the doors were closed for the night, when everyone had long gone home except for a handful of other volunteers and researchers, that the beauty and silence of the place appeared. The giant atrium—the first thing you see when you walk in the front doors—was quiet and vast, spidering off into the various themed exhibits. But none of the exhibits held quite the level of majesty and wonder that the Cold Water Quest section contained within its dual-level structure. And when all of the lights dimmed, after the place was emptied, some of the animals within Cold Water Quest came alive. They seemed to know that they finally had time to themselves, each swimming or lurking mysteriously on the other watery side of a thick sheet of glass.

I walked through Cold Water Quest one night to spend a moment alone with the belugas, the pale giants that everyone crowded around during the day. And with a nearly fifty feet tall viewing area, I hoped I would finally have a quiet moment with them. When I arrived before the viewing area, however, no one was there. The whales had gone to sleep, it seemed. Until Nico—the single male beluga at the Georgia Aquarium at the time—came meandering (if one can meander through water) around a corner, from a part of the massive tank hidden from view.

Nico was spectacular. The angular yet soft contours of his large white body were striking, and how gracefully he swam. I looked around, making sure no one else was near enough to ruin this intimate moment with Nico. No, we were alone. I approached the thick Plexiglas tank wall, keeping some distance so my view of him wouldn't be distorted in any way. Lazily floating at first, Nico drifted closer to where I was standing, eventually so close that I realized how tiny I was—a 120-pound mammal with a sense of self-importance inherent to my species. And Nico saw me. Slowly drifting in the water, with his big, black right eye, he looked at me. The gaze lingered for a moment, still distorted by the inches-thick glass, before he got a spring in his proverbial step and swam out into the middle of his enclosure.

I watched with close attention to see why Nico had this burst of energy, swimming with purpose out into the wide-open center. The white whale danced in the water before me, performing little loops and twirls, a smile formed by the shape of his face. I pressed my palms against the cold glass to show him that he had an audience in me, if that was what he wanted.

While dancing in the center of his tank, Nico moved his mouth in a way I hadn't seen before. His stumpy snout contorted into a great big "O," and as he positioned himself to swim downwards, Nico blew before him a bubble ring, a glassy creation that traveled in front of him as he swam down and grew in diameter the further it went. The bubble ring danced in unison with its maker.

Nico knew what he was doing. He playfully chased the bubble ring he had created, swimming right through it once it was big enough. The ring dissolved when he neared the bottom of the aquatic pen, at which point he flipped over onto his back and made the "O" shape with his lips once again. He blew another ring, forcefully toward the surface of the water. He waited until it grew in size and then swam upwards to catch up to his self-produced toy. This time, however, he manipulated the bubble ring in such a way that by touching it with his mouth, the ring twisted and twirled like a ribbon. Nico followed the ring up to the surface, where it finally dissipated after about a minute, and Nico got some air. He was not simply a whale on exhibit. Like me, he lived, breathed, had thoughts, got bored, and found solace in the company of others.

But did Nico and I really connect? Was he looking at me through that glass or just happen to slow down at that point coincidentally? I wasn't sure how distorted, how grotesque the glass might have made me look from the inside, it if allowed him to see me at all. Did he know what he was doing by blowing those bubble rings, or was I just anthropomorphizing the event? Could Nico actually think anything at all? Do nonhuman animals have anything resembling a human sense of reason and sensibility?

These questions, in some manifestation or another, have concerned humanity for as long as we've had interactions with other animals. Few who live beside animals on a daily basis—be it with pets, farm animals, working animals, or even lab animals—question that nonhuman animals think and feel. It's an intuitive belief, one that we feel rather than know with positive certainty. Science has a difficult time "proving" that nonhuman animals think, feel, reason, and emote. For human mental experiences, conclusions can be intuitively drawn because we humans can communicate with one another. Researchers can find areas of the human brain that correspond with those communicated feelings and thoughts.

The inability of animals to communicate with us doesn't stop scientists from trying. Though their approaches may differ, most researchers justify their search for sentience on a very simple notion: of course nonhuman animals think and feel. We've all evolved from some common

ancestor, however far down the evolutionary scale. Brains in the animal kingdom, especially in mammals and birds, have a similar structure with the same basic moving parts; that consciousness and the capacity for reason and emotion are unique to humans is unlikely.[1] Donald Griffin, a recently deceased professor of animal behavior at Rockefeller University, argued in his book Animal Minds that, "What little is known about the neural correlates of conscious, as opposed to non-conscious, thinking does not suggest that there is anything uniquely human about the basic neural structures and functions that give rise to human consciousness."[2]

Proposing a continuum of intellectual and emotional capacities in animal brains was by no means unique to Griffin; in fact, the idea can be traced as far back as the discovery of evolution. In his famous Descent of Man, Charles Darwin argued: "If no organic being excepting man had possessed any mental power...then we should never have been able to convince ourselves that our high faculties had been gradually developed. But it can be shown that there is no fundamental difference of this kind."[3] The idea that consciousness simply sprang into being with the arrival of homo sapiens is incompatible with the theory of evolution, Darwin argued.

The evolutionary continuum of which scientists speak is simple and elegant: all vertebrate brains share a common structure, with the differences occurring in the development of certain areas. Vertebrate brains—from fish to the great apes—and their divisions vary in size, but can all be divided into the same number of sections. These brains all have a cerebellum, an olfactory bulb, an accessory olfactory bulb, a medulla oblongata, an optic tectum, a pituitary gland, and cerebral hemispheres.[4] With these striking similarities, it's understandable why Griffin and Darwin, among many others, suggest that the emergence of cognition and emotion is a shared capacity.

When humans do find more concrete evidence of nonhuman animal cognition and emotion, we will face various ethical challenges. We humans have considered ourselves as special, outliers of the animal kingdom. We have opposable thumbs. We walk upright. We communicate with ever evolving languages and body gestures. We like to question our own existence and significance (although we rarely doubt our significance). We even domesticate other animals, take them in and teach them to live around and with us. And like Nico, we put

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[1] (Northcutt, 2002)
[2] (Griffin, 2001)
[3] (Darwin)
[4] (Northcutt)

them on display as entertainment masquerading as education. In fact, we hardly consider ourselves animals at all anymore. The tree of life branched up and out, and given our obsessively categorical nature, we labeled and sorted—and continue to do so—every nonhuman animal we could find, linking some animals and distinguishing others. And even though we placed ourselves at the top of that tree, we really tower above it, looking down with a gilded magnifying glass on a catalogue of inventory.

We now stand at the edge of a moral precipice. As I will show in the following sections, scientific research is demonstrating what many of us know intuitively—nonhuman animals do think and feel. To echo Darwin, the animal kingdom's cognitive capacities likely differ by degree, not by marked absence; with this realization comes difficult considerations. New scientific findings force us to consider what animals—both human and nonhuman—deserve, and what they don't. If humans are entitled to certain inalienable, "natural" rights, then shouldn't other sentient animals?

Recognition of nonhuman animal intelligence will affect not only the way we treat nonhuman animals, but also the way we view ourselves, our planet, and how we interact with everything and everyone around us. Our eating habits will change. Our laws will evolve. Science is finally nearing the level of sophistication required to show that nonhuman animals are thinking, feeling beings. As the glass is slowly lifted away, removing that barrier between humans and other animals, we must consider what their sentience means to us as moral, ethical, thinking, and emotional animals.

The Thinking Animal

"I'm sorry, I have dolphins on the brain," she laughed, correcting a trip in speech. Diana Reiss is a professor of psychology at Hunter College in New York and an eminent figure in the field of nonhuman animal cognition. With the darkest-of-brown hair carelessly thrown about at her slender shoulders, Reiss talks with the cheery demeanor of someone who sincerely loves what she does. Smiles flash frequently across her face; she seems at least twenty years younger than 61.

When I finally met Reiss in person, she was visiting Boston University to speak at a colloquium called Animal Minds. The vast room was filled wall-to-wall with a motley collection of folks: undergraduates with beatnik attire and perpetual grimaces; the penguin types in their

suits and ties, and a few older individuals in pragmatic fanny packs. Reiss' presentation seemed to fly by far more quickly than her allotted 60 minutes, and she was kind enough to field a dozen or so questions before stepping down. Even after her welcoming reception from the crowd, her enthusiasm hadn't waned when I approached her after the talk.

Reiss is one of many scientists studying nonhuman animal cognitive intelligence. Cognition, by definition, is the process of thought, how an animal digests and parses information around him. While the study of cognition in psychology and neurobiology has long been anthropocentric, or human-focused, the search for nonhuman animal cognition formally evolved out of comparative psychology in an attempt to understand how nonhumans think, solve problems, and perceive themselves. Reiss focuses primarily on the latter, trying to shed light on the self-awareness of dolphins.

She was delighted to talk about her research with mirror self-recognition, or MSR—one of the primary research methods of determining whether or not an animal (human or otherwise) has some sense of self-awareness. Developed in1970 by psychologist Gordon Gallup, MSR tests were long restricted to humans and nonhuman primates, but have since been thrust upon nearly every nonhuman animal of scientific interest: dogs, cats, birds, elephants, rats and mice, and more recently, dolphins.[5]

MSR tests are deceptively simple: put a critter before a mirror, and see how he reacts. If he fails to recognize himself or see anything at all interesting in the mirror, he fails the MSR test. If, however, he takes interest, then scientists pay a little closer attention. Researchers will then move on to a "mark test," where they place a drawn-on mark on a part of the nonhuman's body, a part that he can't see without the help of the mirror. If he responds to his own image in the mirror by touching his marked body part, he passes the mark test, and moves a rung up the cognitive intelligence ladder.

Reiss was the first to put dolphins through the MSR and mark tests. A decade after being asked by Gallup himself to test other big-brained animals (Gallup focused on nonhuman primates), she took great interest in testing the dolphins with which she worked. During her time researching at the New York Aquarium, Reiss decided to line up mirrors along one side of the dolphin pool to see how her cetacean subjects would react.

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[5] (Gallup, 1970)

Three stages typically emerge during self-recognition testing, Reiss explained, absentmindedly packing up some scattered papers and stuffing them into an attaché.

"The first stage we call 'explanatory' or social behavior, where the animals will come in front of the mirror, try and look under it, behind it, over it. They'll touch it, push it, and so on," she said, looking back at me. I caught a quick glimpse of her papers—many of them were diagrams of squiggly lines. If I hadn't seen her presentation, it would never have occurred to me that those lines were Reiss' ongoing catalogue of dolphin clicks and whistles. The papers disappeared, and she continued on with MSR stages, as if singing a favorite melody.

During the first stage, nonhuman animals will act like they're looking at another member of their species, just as the New York dolphins had done in the early parts of Reiss's experiment. When she mimed some of the mirror behavior while speaking, my mind wandered immediately to an old neighbor's Pomeranian, who would all-too-often catch her reflection in our sliding glass door and bark relentlessly at it, presumably to frighten the newcomer away with fierce shrieks. Nonhuman animals will often act aggressively or tentatively to this new, foreign entity, trying to measure if it is friend or foe.

The second stage is called "contingency testing." Instead of blatantly explaining the behavior that emerges during this stage, Reiss employed an awkwardly accurate analogy to our own behavior. When you walk into a pharmacy and notice the security surveillance monitor above the door, she said, you do a quick double take, just to make sure it's you. It doesn't look exactly like you think yourself to look, but after an imperceptible judgment call, you understand that you're looking at yourself and move on. During the contingency testing stage, nonhuman animals, including Reiss's dolphins, scrutinize the validity of what they see.

"They were like that famous Harpo Marx-Lucille Ball routine," she laughed warmly. Thanks to the years of obsessive Nick-at-Nite viewing, the scene popped instantly into my head: Harpo steps cautiously up to a mirror, sticking a leg out first like a cartoon character. When he is fully facing the mirror, Lucille Ball is dressed up the same way as he, and she mimics his every move (much to the studio audience's amusement). When the dolphins first swam past the mirrors, it appeared that they believed the reflections to be another dolphin, a sudden and unexpected visitor to their tank. But when they noticed that their movements coincided with the new visitor's, they began slowing down, stopping, slowing down...continuing this process for some time, like Lucille and Harpo in their mirror act, only with no canned laughter.

"Then comes the 'self-directed behavior' stage, the final stage," Reiss explained. This final stage is the definitive moment when scientists acknowledge that the nonhuman animals participating in the experiment indeed have some form of self-awareness, a sense of self. The New York dolphins passed this final stage with swimming colors. When they had come to terms with the fact that the mirror showed them an image of themselves, the dolphins spent a significant amount of time looking closely into their own eyes, examining their genitals, and even opening their mouths wide to peer inside—things that dolphins probably never get to do otherwise.

Given the success she had with general MSR tests, Reiss moved her flippered cohorts into the next stage of cognition studies: the mark test. After placing a large, non-toxic ink mark over the dolphins' eyes, she waited to see if and how her subjects would react. There were obvious limitations of this test, limitations that didn't exist for mark tests in nonhuman primates. When Gallup (and others since) tested the great apes with similar methods, the apes would touch their own foreheads upon seeing their new red marks. They would feel around, to see if they had been injured in some way (red ink was used to suggest a potential physiological problem).[6] Dolphins don't have hands. Their flippers can't reach any spots to touch inquisitively. Reiss explained how important it is to be incredibly familiar with an animals' typical behavior before conducting an experiment like the mark test. Knowing the behavioral patterns of your subjects is imperative in all cognition and emotion studies, she said, because researchers can't know what's different if they don't understand what's normal. Because Reiss knew how unmarked dolphins usually acted in front of a mirror, she recognized that when the marked dolphins rolled on their sides—and lingered there—to get the best view of their foreheads, they were searching.

When marks were placed on chins and underbellies, the dolphins would flip upside down and hang, suspended in the water as if posing for a photograph. They would move their heads from side to side, hindered by limited neck mobility, to try and find where they had been marked. When dolphins had been "sham marked"—when the researchers went through the motions of marking but without a marker in hand—the swimmers immediately noticed the lack of ink on their skin and moved on. But those with the real marks dawdled, curious to see what had happened to their bodies, like someone with a new tattoo who checks to see how it looks throughout the day.

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[6] (Gallup, 1970)

Reiss presented the video of her dolphins' performances with the MSR and mark tests that day, beaming with earned pride with gasp of surprise. Watching the enormous cetaceans floating and loitering before the mirrors, closely examining themselves and their bodies, I couldn't help but recognize myself in them, the way I check my teeth in the morning, the way I find blemishes on my face. I linger too, sometimes.

"We are a narcissistic bunch," Reiss responded to my tiny insight, watching her dolphins perform on camera for what must have been the umpteenth time. "We understand that the face in the mirror is ours." I'm not entirely sure she was referring only to humans.

Like the MSR test, most methods for researching cognitive intelligence in nonhuman animals operate with an ambitious underlying objective: discovering whether or not the subjects have inner lives. If a dolphin or primate can see herself in a mirror, then we can be fairly certain that she has some concept of "I," an existential knowledge, that motivates her behavior.

But what about the animals that fail the MSR test? Self-recognition is just one avenue for studying cognitive intelligence in nonhuman animals. The MSR test may unveil some level of self-awareness, but cognitive researchers, including Reiss, don't find the MSR test to be the definitive say in whether or not an animal has a sense of self. A sense of self can come in many forms—a spatial understanding of one's body in relation to the rest of the world, recognition in the mirror, an ability to plan and problem solve, an ability to communicate with other animals. While many nonhumans fail MSR tests—such as dogs, cats, most birds, and Old World monkeys (baboons, macaques, and the smaller monkeys)—researchers now understand that this failure doesn't necessarily indicate a lack of self-awareness.[7]

In fact, many of the world's most skilled nonhuman problem solvers fare quite poorly with MSR tests. Crows fail mark tests miserably, never making it past the first stage of mirror recognition. In spite of this shortfall, the shadowy corvids consistently outshine just about every other nonhuman animal in tool use, sometimes even primates.

Because of their intelligence and ingenuity, crows (especially New Caledonian crows) are hot research subjects for cognitive experiments. There doesn't seem to be a month that goes by without news of crows performing unbelievable feats of problem solving. For instance, in the middle of 2010, a BBC video circulated around the Web of a new type of wild crow behavior in

[7] (Allen & Bekoff, 2002)

Japan. In order to break open stubbornly shelled nuts, crows were letting the traffic do the work for them. They position themselves near pedestrian crosswalks and drop hard nuts into traffic to be cracked by oncoming cars. They then wait for the traffic light to turn red, and walk casually out into the street to collect their treasures. [8] Not only do the birds do this regularly, they also seem to have a better grasp of crosswalk etiquette than many human pedestrians.

This is one example in many dozens. Clever behavior in the wild is common for crows, but researchers also see similar crafty behavior within laboratory settings. Joanna Wimpenny at the University of Oxford's Behavioral Ecology Research Group is one such person. She has studied New Caledonian crow tool use and problem solving for nearly a decade. In one of Wimpenny's most recent studies (as of 2011), she discovered something previously thought to be limited to large mammals such as humans, apes, and elephants: sequential tool use, or using tools in a multi-step process.[9] This ability is thought to be indicative of high-level cognition, as it suggests analysis and planning.

The experiment, which took several shapes, aimed to test crows' abilities for using one tool to get another. In one manifestation, the set-up was all tubes and sticks. On a flat surface, Wimpenny and her team laid out five transparent tubes, about the size of hamster tunnels. They were organized like spokes radiating out in a wheel, and when viewed from above appeared almost as a bird footprint in the sand, with four "toes" fanning outward and one "toe" pointed in the opposite direction. In the wide-open center of this arrangement were a freely available short stick and room enough for a crow to move about and examine the setting.

Within the first four tubes, Wimpenny placed sticks, one long and the other three of medium length. The reward tube, the rear toe of the footprint, contained a treat. None of the tube materials were accessible by beak, and only the tubes with the medium-length sticks were accessible by the freebie short stick. The crows were left to figure out the puzzle: they would have to use the short stick to fetch out a medium stick, use that to reach the single long stick, and finally use the long stick to reach the food in the reward tube.

Betty, one of the more experienced tool-using crows in the experiment, figured it out almost immediately. She stepped into the center of the tube arena, looked and pecked around for a bit before working out what needed to be done. Another, arguably cleverer crow named Pierre

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[8] (Davies)

[9] (Wimpenny, Weir, Clayton, Rutz, & Kacelink, 2009)

decided to leave the puzzle altogether and fetch his own twig, one that was long enough to reach the food without doing all the work (in order to keep stress levels low, Wimpenny allowed the birds to come and leave the experiment at will). A couple of the other crows—Uek and Barry—made it to the second round, getting the medium stick through use of the short one, but never made it to the longest.[10]

Betty and the other crows in Wimpenny's experiment are not unique. Corvids perform exceptionally well in most studies involving tool use and problem solving. In one 2009 experiment, rooks lent truth to the famous Aesop's fable, "The Crow and the Pitcher," written sometime around the 5th century BCE. The story goes:

> In a spell of dry weather, when the Birds could find very little to drink, a thirsty Crow found a pitcher with a little water in it. But the pitcher was high and had a narrow neck, and no matter how he tried, the Crow could not reach the water. The poor thing felt as if he must die of thirst. Then an idea came to him. Picking up some small pebbles, he dropped them into the pitcher one by one. With each pebble the water rose a little higher until at last it was near enough so he could drink.[11]

Comparative psychologists from Queen Mary's and Cambridge Universities, Nathan Emery and Christopher Bird, decided to take a closer look at rook (a close crow cousin) behavior. The experiment echoed the fable, replacing the pitcher with a tall, skinny, cylinder of water and a few differently sized stones in reach. Since the rooks in the study weren't desperate to quench their thirsts, a mealworm was dropped into the water, floating at its surface, an enticing target for any creature with a palate for invertebrates. Like in the fable, the water in the tube was far too low for the crows to reach. One by one, each of the four crow subjects picked up stones and plopped them into the cylinder until the water level rose to within beak-reach. Two rooks, Fry and Cook, scored on the first try. The others, Monroe and Connelly, figured it out by their second

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[10] *Ibid.*

[11] (Aesop)

attempt. With the water came the mealworm treat.[12] Like a feathered homage to Archimedes, every crow gobbled down a mealworm.

Tool use and other behavior signifying cognitive processing is seen rather widely across the vertebrate—and sometimes, invertebrate—spectrum. Nonhuman primates are well documented as tool users, washing their food in rivers or using rocks to smash open hard-shelled foods.[13] The famous ethologist Jane Goodall was the first to observe, in 1960, chimpanzees digging into termite mounds with blades of grass, thus changing humanity's views on our primate relatives indefinitely.[14] For a good while after Goodall's discovery, the vast majority of nonhuman animal cognition research was primate-centric. That oversight, however, has since been corrected.

Nonhuman animals as alien to us as octopi have been recorded unscrewing caps and lids to reach food within bottles and jars, as well as using coconut shells as hiding spots that they carry with them, like portable hideaways. While they carry the shells, the octopi walk awkwardly along the sea floor, holding the shells beneath them. They use the shells as defensive shields only when needed, a process that suggests to researchers that the cephalopods can plan and anticipate in their own mollusk way.[15]

Our pets have also been shown to be rather capable at solving problems. Like my neighbor's Pomeranian, dogs consistently and magnificently fail MSR and mark tests, but they exhibit other types of self-awareness through their abilities to think on-the-spot and plan ahead. In a widely discussed NOVA special on animal intelligence, a border collie named Chaser blew her viewers' collective mind as she, without fail, identified and retrieved dozens of stuffed animals out of a pile of a thousand toys on verbal command. As published by Wofford College psychologist John Pilley, Chaser can successfully distinguish 1,022 stuffed toys by name.[16] Not only does she know all of those toys, but Chaser also showed her experimenters that she was capable of what researchers call "exclusion learning," the ability to figure out which object doesn't belong. When Chaser's researchers asked her to find a mysteriously named toy that she hadn't seen before amidst a pile of familiar toys, the border collie could pick it out through deductive reasoning.

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[12] (Bird & Emery, 2009)
[13] (Shanor & Kanwal)
[14] (Goodall, 1999)
[15] (Finn, Tregenza, & Norman, 2009)
[16] (Pilley, 2011)

Chaser isn't unique in this ability, either—in 2004, a study was published in the journal Science that profiled another border collie named Rico who could do the same thing (though with fewer toys).[17]

Scientists may agree that the abilities to solve problems and use tools are indicative of some form of cognitive intelligence, but it can't yet be considered conclusive proof. The reductionist, Cartesian model of thinking about nonhuman animals still saturates the minds of some researchers—the abilities discussed above could simply be the emergent properties of a series of basic, thoughtless biological and neurological interactions.

Before Rene Descartes hit the philosophy scene with his new ideas, the world seemed basically satisfied with an Aristotelian concept of consciousness. For Aristotle, the physical body and the consciousness of mind (or "soul") were inseparable. Neither one can exist without the other, he argued, and he employed a rather poignant analogue to drive in the point: "If the eye were a living creature, its soul would be its sight." From this perspective, it's impossible to imagine an eye functioning without sight, and, tautologically, the sight wouldn't exist without the eye.[18]

And then came Descartes, shattering this philosophy with his own dualist conception of body and mind. To Descartes, the two principles are separate entities. A former professor of philosophy at the University of Massachusetts, Gareth Matthews says in the book Nature of Minds that Descartes boldly "rejected the traditional connection between being conscious and being alive, as well as the traditional separation of living things and mechanisms." It was from this new philosophy—one to which science still adheres—that a scientific prejudice about the concept of consciousness was set in stone: nonhuman animals, in spite of any neurological similarities to humans, were biological machines, without consciousness, and as it follows, cognition.[19]

The prejudice toward considering nonhuman animals as intelligent or conscious lives on, though the flame burns a little less brightly. The skeptics' arguments vary in several ways, but their point is united: the subjective experience of other beings are impossible to understand, to know for certain, and therefore cannot be proven as true "experience." Not by the scientific

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[17] (Bloom, 2004)
[18] (Aristotle, 350 B.C.E)

method, anyway. Rather than finding the concept of nonhuman minds impossible, it's the scientific pursuit of this issue that modern skeptics find the most unreasonable.

David McFarland is one such skeptic. McFarland, a former professor of animal behavior at Oxford, discusses his thoughts in a 2008 book called Guilty Robots, Happy Dogs: The Question of Alien Minds. As can be gleaned from the title, McFarland's "alien minds" include not only nonhuman animals, but also robots and machines. He argues that, at the end of the day, any construct humans conceive for "alien" consciousness or experience will be purely human in nature, nothing else.[20] Because he keeps wholly separate the concepts of the living body and consciousness, McFarland denies nonhuman animals their minds. In an earlier book, Problems of Animal Behavior, he thoroughly sums up his problems with the scientific search for cognition: "A scientist's hunch is acceptable as a start, provided that it leads to a theory that can be rejected in the face of evidence. This has not been achieved in the field of animal cognition."[21]

While McFarland is not alone in his skepticism, not all take a philosophical approach to their criticisms. Cecilia Heyes, a professor of psychology at Oxford, actively attempts to silence the pursuits of cognitive ethology—a field that focuses strictly on behavior in order to search for cognitive and emotional intelligence. In a paper on the subject of animal minds, Heyes talks about the pursuit as "more lively, more heated, and apparently more tantalisingly close to resolution, than at any other time." But while she personally believes that nonhuman animals experience some form of self-sense, a consciousness and awareness of the world around them, she's compelled to conclude that the demands of scientific rigor are "too great, and therefore [she] doubt[s] that animal consciousness is currently the subject of scientific investigation."[22]

While engaged in a journal-battle with a few notable cognitive ethologists (Marc Bekoff—whom we'll meet momentarily—and his colleague, Colin Allen), Heyes remarked that the budding field is troublesome, sentimental, and has an unfortunate "sticky staying power." The challenge, she wrote, is "to make it go away." Clearly in a more objective, strictly reductionist approach to the matter, she offers cognitive ethologists a way out: "It is perhaps at this moment that the

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[19] (Matthews, 1991)
[20] (McFarland, 2008)
[21] (McFarland, Problems of Animal Behavior, 1989)
[22] (Heyes, 2006)

cognitive ethologist decides to hang up his field glasses, become a cognitive psychologist, and have nothing further to do with talk about consciousness or intention." [23]

Eminent cognitive ethologist Marc Bekoff won't be giving up so easily. "It's very lazy thinking," he laughed one morning over the phone from his home in Denver, Colorado. Thoroughly down-to-earth, the former professor of Ecology and evolutionary biology at the University of Colorado, Denver is well known for his contributions to the study of nonhuman animal behavior. When asked for his thoughts on the skeptics of nonhuman animal cognition, I could almost hear him shaking his head, his shoulder-length ponytail swinging across his neck. The lack of replicable results was the best argument that skeptics could muster, he told me. It's like religion for them, Bekoff explained. Skeptics are so convinced with the way they've learned hard reductionist science that no matter the evidence, they will find subjectivity in results and turn blind eye after eye. Their Cartesian prejudice inhibits them from seeing anything they would dare label "intelligence" in a nonhuman animal subject. That, Bekoff said, would be their equivalent of blasphemy.

"Often skeptics raise the ante so high that most humans wouldn't qualify as sentient beings," he added, listing very young human children, the autistic, the mentally handicapped, and some elderly as examples. Indeed, human psychology frequently suffers with similar problems of subjectivity, since much research depends heavily on human verbal response to stimuli, qualitative at best. If we were to hold human psychology to the same severe scrutiny as we do cognitive ethology, Bekoff said, the entire field would fall apart as a science.

Bekoff is a kind man, with whispers of hippy and two decades of research into nonhuman animal cognition under his belt. But even he is skeptical about some of the research methods used in his field; he's not the biggest fan of MSR and mark tests when it comes to determining whether or not a being is self-aware. Bekoff and other nonhuman animal researchers are now quick to call these methods into question. The tests were long considered as fail-proof signifiers of self-awareness, but now, no one's sure. Unexpected performers like elephants, porpoises, pigs, and even small-brained songbirds pass mark tests, while most smaller, nonhuman primates fail miserably. Scientists are confused. Perhaps their assumptions about self-awareness have been wrong all along.[24]

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[23] (Allen & Beckoff, Cognitive Ethology: Slayers, Skeptics and Proponents, 1997)
[24] (Allen & Bekoff, The Cognitive Animal, 2002)

Bekoff raised a good point that morning on the phone. Maybe some nonhuman animals simply don't care about their reflections. It's a subjective answer to a complex question, but a possibility nonetheless. To get around this problem, Bekoff beseeches scientists to look at the way animals react to and around one another, and not judge the interactions based on human experience, on what humans consider important. Social behavior may very well clue us in on their self-awareness. After all, animals—humans included--can't function in a social manner without at least having some form of self-awareness.

Play is a particularly fascinating way to gauge self-awareness in nonhuman animals. And almost all animals play. Other than biologically motivated behavior, play is one of the most universal behaviors in the vertebrate branches of the animal kingdom, and it necessitates a sense of self in all participants—which Bekoff and many other scientists now argue.[25] Bekoff focuses much of his research these days on play, especially amongst dogs, both wild and domestic.

But couldn't play just be an emergent activity brought forth by eons of evolution, in order to teach young animals how to survive in the wild? Couldn't it be an autonomous behavior? I asked Bekoff. I didn't believe that personally—I've seen my own dogs play, my birds chase squeaky toys—but I knew that was the ongoing argument from skeptics. Bekoff expelled a bit of air in a huff, and then audibly sipped a drink, mumbling that he was about to reply.

"Yes, it certainly could. In that case, so it could be with human children," he replied. We can't expect to truly understand the goings-on of another creature's mind, Bekoff continued; when it comes to subjective observations, we can only base what we see on what we know. In the case of nonhuman animal intelligence (and, as we'll see later, emotion), we must draw comparisons to our own behaviors, adjusting accordingly for species-specific issues that may arise (like the MSR test with Reiss' handless dolphins). I laughed over the phone, and I could hear a dog barking in the background—Bekoff's favorite subject.

In his book Wild Justice, Bekoff explores the world of dog play with bridled attention to detail. Playtime opens up a whole new world of rules and regulations that transcend any type of survival or mechanistic behaviors, a system that Bekoff refers to as "imaginative constructions." While engaging in play, two or more animals (humans included) set aside instinct and participate in a voluntary activity that requires an acceptance of terms. These terms are quite noticeable in dog language, Bekoff explains.

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[25] (Brown, 2009)

Before a play session, dogs will express their intent to do no willing harm through what Bekoff calls a "play bow." All dog owners will understand what this means: the dog, with tail in the air, will bow down on his front paws to let his play opponent know that this session will be for fun only. Bekoff says that this behavior serves as an apology of sorts, just in case anything injurious happens during play. Once terms are accepted, dogs will go about their business by biting, tackling, head shaking, and growling—all behaviors that would, in other circumstances, be considered aggressive. But they don't bite to harm, don't tackle to dominate, and don't growl to intimidate. These "self-handicaps," Bekoff argues, imply a level of self-awareness that enables them to consciously modify the intensity of their actions. And while play functions to practice fighting, to get exercise, and to strengthen social ties, the actual act of play serves no immediate purpose. At the end of a play session, there are no winners, and nothing is materially gained.[26]

But again, the hardwired skeptics will stomp their feet and declare this anthropomorphism, the many-headed beast lurking in the shadows of cognitive ethology. As Bekoff and I discussed, although they're decreasing quickly in numbers, the most vocal skeptics (or "slayers," as he calls the most impetuous of the bunch) cite subjectivity as the biggest argument against the search for nonhuman sentience. These slayers often use as much anecdotal evidence as the scientists they're trying to debunk, Bekoff said.

"Some of the arguments, in my view, are pretty lame," he told me. Somewhere in the background, a dog continued to bark playfully. The skeptic arguments are "lame" because of the notion of evolutionary continuity. To suggest that humans alone maintain the capacity for thought, for problem-solving, and so forth is to ignore the makings of our wiring, the structure of the vertebrate brain. As discussed earlier, vertebrate brains evolved a good long while ago from a common ancestor or ancestors, which is one possible reason so many manifestations of cognitive intelligence pop up in a wide array of species. The term is "convergent evolution," and it explains how two very distantly related creatures, like dolphins and humans, might evolve with a similar capacity for self-recognition. Convergent evolution is proposed to explain how a tree-dwelling chameleon can camouflage itself much the same way an invertebrate cephalopod can; it explains how a sea turtle and a goose can navigate the world by sensing magnetic fields.[27] Based on the theory of convergent evolution, coupled with similar brain structures, it only makes sense that

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[26] (Bekoff)

[27] (Morris, 2003)

humans aren't so unique in our cognitive abilities. We may technically be smarter, better adapted for our environments, but this shouldn't disqualify other animal intelligence.

By determining that animals other than humans have some form of self-awareness, we acknowledge that their inner lives, their subjective experiences, are indeed valid, however different they may be from human experience. If (or when, Bekoff argues) cognition is accepted as a veritable aspect of nonhuman animal lives, then the way we approach our relationships with them may require deeper scrutiny. But more on that later.

Intuitively obvious or not, our scientific knowledge of nonhuman animal cognition is still limited. Because of the wall of subjectivity and experience, we're stuck observing animal behavior through a thick and dark sheet of glass, hoping to glean fragmented shards of their inner lives through inference. We can see it on the other side, but we can't yet touch it. Science seems forever in pursuit of empirical data; whether empiricism and objectivity are within our reach in this search is uncertain. What is certain, however, is that there exists an extreme prejudice among some researchers, the slayers. Humans have a history of finding themselves at the center of existence, whether it's by divine assignment or simply a Faustian arrogance. Historically, anthropocentrism has been repeatedly torn down by ambitious discovery, and we have no reason to think the case for nonhuman animal intelligence will be any different. Someone, or a series of someones, always happens along to shatter the glass, to tear the house down.

The Emotional Animal

I finally met with Marc Bekoff at Boston University at the Animal Minds colloquium. During his saga of research, he's seen some amazing things, some of which he recounted to me. He spoke of wimpy penguins in Antarctica, mourning elephants, and empathic mice, painting vibrant images in my mind of each.

As we talked, my mind involuntarily flashed back to Nico, the beluga who blew bubble rings. He was a massive mammal, and I remembered him only through an impenetrable pane of glass. It was now difficult to see him as an animal. Like a piece of fine art, like something created and harnessed by man, Nico was contained. He was an object, our object, at the Georgia

Aquarium, where his bubble dance amused and touched me. I wondered how captivity affected Nico psychologically.

Emotion in humans is difficult to gauge empirically and often depends on subjective rating systems. A psychologist can ask her patient outright what he is feeling, and he can tell her about his depression or anxiety. She can then compare her patient's response with established diagnostic criteria. In nonhuman animals, science is forced into a world of inference. Dogs respond similarly to humans when taking psychiatric medicine; rats emit high-pitched chirps when tickled; an experiment can show that lab mice appear to exhibit empathy when their cage-mates are subjected to painful injections, judging by basic stress responses and reactions to future pain. But whether or not they are responding with conscious emotions or simply with unconscious and automatic survival mechanisms is a mystery to scientists everywhere, no matter what their intuitions tell them. Instead, all that can be done is to interpret abnormal behaviors that coincide with either high levels of stress or pleasure. In this realm, scientists tend to operate in the extremes.

But what if there existed some standardization for identifying nonhuman animal emotion? What if, like with psychiatry's Diagnostic and Statistic Manual of Mental Disorders (DSM), some general criteria were collected and used in observation for cognitive scientists who wish to see which animals are feeling, and which may not be? Such a test would have to be based upon human experience, as understanding a radically different concept of emotion is, as of yet, beyond our scientific reach. The test and the criteria might resemble something of an emotional Turing test, with a crow, elephant, or dog, for instance, in place of the machine.

In some scientific cases, more credence seems to be given to machine capabilities than to those of nonhuman animals. For machine behavior, the Turing test has been used for nearly six decades. Developed by British mathematician and computer pioneer Alan Turing, the test arose out of a simple question: can machines think? Turing developed a method to attempt to answer his question. In its most basic manifestation, a Turing test involves two humans and a computer. Person A sits before a computer screen; person B and the computer sit behind a barrier, out of Person A's view. Once this is all set up, Person A types questions into a computer, and both Person B and the computer respond. This exchange continues for a while as a casual conversation, and in the end, Person A is left to figure out which of her correspondents is human, and which is

computer. If the computer tricks Person A into thinking it's human, then that computer "passes" the test and is considered potentially intelligent.[28]

Though it has evolved into many variations, each type of Turing test runs on the basic principle of judging artificial intelligence based against human intelligence. In other words, if it communicates intelligently, as judged by a human being, then the machine is granted the title of "artificially intelligent." The search for AI has been long and the Turing test has yet to be successfully satisfied—however, that's not to say scientists aren't trying.[29]

Adapted and applied into nonhuman animal cognition research, an emotional "Turing test" would take a third-person approach to what has long been a first-person problem; in other words, it would increase objectivity in an otherwise subjective experience. The first step in developing such a test would require that a set of basic, standardized criteria be developed; if measures for emotionally or consciously motivated behavioral responses are standardized, then judging behavior against those criteria becomes possible. If a dog cries when pricked and his bodily responses (cortisol levels and skin temperature, as well as other clear indicators of stress in the mammalian central nervous system) correspond, then that dog can be said to be experiencing pain. If the dog develops skittish behavior around needles, he can be said to remember and feel fear.

Tufts University professor and eminent theorizer of consciousness Daniel Dennett has proposed something similar for use with humans, a practice he refers to as "heterophenomenology." This practice, he argues, is "the sound way to take the first-person account as seriously as it can be taken." In a nutshell, Dennett says that if the researcher both listens to a subject's inner account of a situation, and then observes the environmental factors, an objective conclusion can be reached about the inner-workings of the subject's conscious processes. He writes in an article on the subject: "a more constructive approach recognizes the neutrality of heterophenomenology and accepts the challenge of demonstrating, empirically, in its terms, that there are marvels of consciousness that cannot be captured by conservative theories." The conservative theories Dennett refers to hold back the study of consciousness in general, in humans and nonhumans alike. And though his proposal is meant for human consciousness, the principles could easily be applied to nonhuman animal emotion (Dennett, who

[28] (Turing, 1950)

is also a cognitive scientist, sometimes turns to the discussion of nonhuman animal consciousness).[30]

It's a bold proposal, one that some may argue requires too great a leap of assumption. But analogues based on rather sweeping generalizations are common throughout many areas of human psychology. Consider a hypothetical therapy session between Jane Doe and Dr. Z. A set of criteria for emotion (in disorder form) is already accepted in the psychiatric field—the DSM—and judging by these formally laid out, generalized criteria, Dr. Z can determine by Jane Doe's verbal explanation of her experience whether or not his patient is experiencing anxiety. If she is, Dr. Z makes a leap to believe her, thereby prescribing a medication for her that will take the edge off.

Now, let's replace Jane Doe with a neurotic dog.

Tosh is a 3-year old golden retriever rescue with a fluffy melon of a forehead and a fanning tail that can't seem to wag fast enough. His 27-year-old receptionist companion, Andrea (who asked I refrain from using her last name), loves him to death. When she can, she takes him everywhere. They go to the grocery store together, take evening strolls to the Peachtree City, Georgia dog park, and sleep in the same bed. Andrea and Tosh are inseparable, but Andrea has to work a nine-to-five during the week. Because of his larger-than-life devotion to Andrea, Tosh experiences what appears to be extreme separation anxiety when his human companion leaves for work in the morning. The frantic pup chews up doorframes, eats curtains, and occasionally vomits with strategic precision near Andrea's bed when he's left alone for more than a half an hour. She tried crating him a few times, but he destroyed the crate by triumphantly chewing right out of it. In a desperate frustration, Andrea gave up on the crate and sought out psychiatric help for her troubled canine friend. Tosh was Reconciled.

Reconcile is meat-flavored Prozac, and the pharmaceutical goliath, Eli Lilly, produces them both. The active ingredient, fluoxetine hydrochloride, is the same in each version of the drug; it treats anxiety and depression in humans, and now, in dogs. Since Andrea put Tosh on Reconcile, his compulsive destruction has all but dissipated. Every now and then, Andrea will

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[29] Check out the annual Loebner Prize competition, in which computer researchers all compete to have their machines pass Turing tests.

come home to a gnawed-on couch corner, but this behavior is now easily fixed with rawhide. Tosh is a whole new dog.

Medications that have long been intended for human use only are now frequently distributed to nonhuman animals, especially dogs and cats. The drugs work with incredible efficacy. Reconcile, one of many psychiatric treatments marketed for nonhumans, has been extensively tested and approved for use in canines by the US Food and Drug Administration. According to an FDA-backed study, Reconcile was tested on a number of problem behaviors, including inappropriate urination, inappropriate defecation, excessive salivation, excessive licking and grooming, shaking and shivering, and depression. 73 percent of the 112 medicated dogs studied showed significant improvement, compared with only 51 percent of the other 112 dogs treated with behavior modification (basic training) alone.[31]

If human psychiatric medication affects dogs in a similar—if not identical—way, what does that say about the emotions being experienced? Some argue that it says absolutely nothing at all. In a 2008 New York Times Magazine article on pill-popping dogs, writer James Vlahos gets Dr. Ian Dunbar's input on the matter.[32]

"We're confusing behavior problems, which are observable and quantifiable, with terms like 'anxiety,' which describe the dog's internal mental state, for which we have absolutely zero proof," Dunbar told Vlahos. Dunbar, rigorously scientific in his approach to the matter, is a veterinarian from the Royal Veterinary College at London University, as well as the owner of a northern California training clinic for dogs and their keepers. While Dunbar goes on to explain to Vlahos that he does personally believe that the dogs he sees are experiencing thoughts and emotions, he can't professionally suggest this to be the case.[33]

The confusion Dunbar decries would be all but nixed if an emotional Turing test could be applied to these medicated dogs. If researchers could agree on a set of criteria, then the dogs' behavior, environment, and bodily responses could be measured and determined to be either indicative of an emotional response, or not. Without this standard, the scientists hard at work to unravel the mysteries of nonhuman animal emotion find themselves at a subjective impasse.

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[30] (Dennett, 2003)
[31] Gathered from Drugs.com FDA information on Reconcile
[32] (Vlahos, 2008)
[33] *Ibid.*

"The taboo against considering subjective experiences of nonhuman animals has become such a serious impediment to scientific investigation that it is time to lay it aside and begin the difficult task of investigating the subjective experiences of nonhuman animals," wrote Donald Griffin in Animal Minds.[34] And he is not alone in his criticism of strict objectivity.

Even if reductionist reasoning can't yet prove that Tosh was feeling anxious, his response to Reconcile is irrefutable, and he would likely pass any emotional test developed. The nervous golden retriever isn't alone in his response to medications, either. Most nonhuman animals show a preference for medications that are geared toward alleviating pain, anxiety, or any other unpleasant state. This inclination is especially well documented in farm animals, due in part to the rising public awareness of their poor treatment in factory farming conditions. Lame chickens (birds who are injured from close quartering or repetitive behavior) show a clear penchant for medicated feed, as do pigs, cows, and sheep. When injured, chickens will choose feed laced with analgesics significantly more often than non-injured animals.[35] Chimpanzees exhibit similar tendencies. In her book Wild Health, environmental scientist Cindy Engel describes a chimp practice where the primates seek out a positively unappetizing shrub in order to ease stomach ache (the shrub was later analyzed to have stomach-settling properties. At the time, no one understood why the chimps were eating the shrubs).[36] Most researchers looking for evidence of nonhuman animal emotion find the predilection to seek out pain relief as a good sign that the animals want to alleviate their pain. If the want exists, then so must the capacity for suffering—or an ability to reflect on pain—they argue. The desire to palliate suffering also suggests a capacity to feel something that is not pain—happiness or joy, for instance. Sometimes triggered by behaviors from unlikely subjects, like Nico's playful bubble blowing to alleviate boredom, some researchers have set their sights on the happy side of nonhuman animal emotion. In one particular case, it was the giggling of laboratory rodents.

In the early nineties, professor of psychology at Bowling Green State University Jaak Panksepp and his PhD student Jeff Burgdorf (now a biomedical engineering professor at Northwestern) decided to take a closer look at their lab rats.[37] It was obvious to both researchers that the rats in their labs were playing—so much so that in their paper detailing the study, they

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[34] (Griffin, 2001)
[35] (Danbury, Weeks, Chambers, Waterman- Pearson, & Kestin, 2000)
[36] (Engel, 2002)
[37] (Panksepp, 2003)

left out the usual quotation marks when explaining "play." What they wanted to find out was whether or not their little subjects expressed their feelings in an auditory fashion—were the rats giggling when they played?

Rat laughter isn't audible to humans, so the experiment required special circumstances. In order to gauge if and how squeaks and rat-giggles affected playtime, Panksepp and Burgdorf deafened a group of rats and set them off to play with each other. Compared to rats with intact hearing, the deaf rats played with less frequency and for shorter periods of time. With an apparent correlation between hearing and the desire to play, the two neuroscientists then set to sensing the sounds the non-deaf rats were making. With the help of ultrasound equipment, they could finally hear what was happening amidst the rats. The chirping going on during rat playtime was occurring at about 50 kilohertz, far too high to be sensed by the human ear (we can hear sounds up to about 20 kilohertz). And it was abundant. The rats' play area was bursting with chirps that the researchers couldn't help but compare to laughter. Of course, they also knew they couldn't respectably call this behavior laughter, so they tagged it as a "laughter-type response" and took their research a step further.

In 1997, Panksepp approached Bergdorf with an interesting proposition: "Let's go tickle some rats," he told his partner. And tickle rats they did, all the while measuring the auditory response with the ultrasound equipment. What they discovered was that the rats were emitting the "laughter-type response" twice as much as during playtime alone. The two also discovered that the rats would then seek out tickling after the experience was over. However obvious it might have been to Panksepp and Burgdorf that their rats were laughing to express enjoyment, they ultimately knew their conclusions must be careful. They stated that it would be best, simply, to "remain open to the possibility that there was some type of ancestral relationship between this response, and the primitive laughter that most members of the human species exhibit in rudimentary form by the time they are three months old." The two scientists went on to study response vocalizations in a number of nonhuman animals, from chickens to puppies, and of course, more rats. Continuing with these studies, they have stated outright that the "laughter-type response" is, in fact, the "sound of social joy."[38]

Other nonhuman animals laugh, too. It comes as no surprise to those who live or have lived around dogs that canines appear to have a marvelous sense of humor. Although their laughs

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[38] *Ibid.*

sound more like pants and grunts, perhaps a bit like Muttley from the old Hanna-Barbara cartoons, dog laughter has a way of initiating playtime and alleviating stress. When these pant-type sounds are played in a room full of dogs at favorable frequencies, not only does anxious behavior (such as nervous panting, drooling, compulsive barking, and pacing) diminish, but play behaviors (such as those Bekoff discussed earlier—play bows and increased tail wagging, for instance) show up with greater frequency.[39]

Like dogs and rats, chimpanzees, orangutans, gorillas, and bonobos all laugh too. They laugh in response to social behavior; when the primates wrestle, tickle one another, or chase each other playfully, their vocalizations change. Of course, this laughter sounds nothing like human laughter; nonhuman primates sound like they're panting heavily or wheezing. The prevalence of laughter across the mammalian branch of the animal kingdom provides a strong case for an evolutionary commonality.[40] Or as Darwin might say, "We're not as unique as we think we are."

As we've seen in the previously discussed research, this laughing and playing behavior of ours likely extends to some degree all throughout the vertebrate animal kingdom at least, potentially even further. But what about our most cherished human qualities, such as compassion or empathy? The ability to empathize—to imagine and feel what another is feeling—is often seen as counter to the survival-of-the-fittest theory, a step far outside the idea of a dog-eat-dog world. As it turns out, though, we're not alone in that ability either. Dale Langford has dedicated much of her up-and-coming scientific career to studying the expressions and reactions of lab mice to pain. As a graduate student of the Pain Genetics lab at McGill University, she shook things up with her dissertation, which went on to be published in the prestigious Science. In the culmination of her graduate work, she showed the world that the mice in her lab expressed empathy—a vicarious experiencing of the feelings of another.[41]

Langford and the research team carefully arranged the experiment, intent on eliminating any possible contributing factors to the way the mice reacted to her methods. A number of scenarios were established: in some Plexiglas cylinders, the scientists placed a single mouse. In others, there were pairs. Some of the pairs knew each other (they had been cage-mates for some time), and others were strangers to one another. After arranging the mice, some were injected in

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[39] (Simonet, Murphy, & Lance, 2001)
[40] (Johnson, 2001)

the belly with a nociceptive assay—a pain-inducing, acetic-acid-based concoction that would cause the subjects to writhe in agony. The lone mice presented the expected "writhing behavior," as the paper describes: they would extend their back legs repeatedly, which Jeffrey Mogil (the head of the Pain Genetics Lab at McGill and co-author on the paper) argues is simply "stretching." When cage-mates were paired together in one cylinder and injected at the same time, their writhing lasted for a significantly extended period of time. In the presence of a familiar mouse also experiencing pain, mice appeared to feel the effects of the acetic acid far more intensely than the single mice, or even mice paired with strangers.

The team also wanted to see if mice were more receptive to other types of pain when witnessing a cage-mate writhing from the injection. In another trial, researchers injected only one mouse with acetic acid. The other mouse, the one watching on, was placed over hot spots in his or her cylinder. When the mice could see their cage mates struggling from the injection, they would withdraw their paws from the heat far more quickly than those who couldn't see another mouse in pain. This portion of the experiment was the most important, as it showed that the mice weren't simply mimicking the writhing behavior (as was seen in both cage-mates when injected with the acetic acid), but truly more receptive to pain exposure. In other words, these mice were showing clear signs of empathy. It wasn't so much "empathy" in the way humans tend to think about it—"feeling" for a friend who has just lost his job, for instance. In fact, some feel that this demonstration of empathy can't be considered empathy at all. In true Cartesian reluctance, they explain it away as a simple mechanistic response.

"What we have here is modulation of a reflex response during observation ... of the reflex responses of other animals," responded Charles Vierck, a neurobiologist at the University of Florida Gainesville. Broken down as a "modulation of reflex response," the experiment seems to lose all its significance, and the emotional responses of the mice trivialized.[42] Still, Mogil argued in Science that his and Langford's findings truly demonstrate that the mice have what they call "emotional contagion," or a very basic type of empathy.

Empathy has long been considered to be unique to humans and, some suggest, nonhuman primates. However, that empathy only appeared in primates was unlikely. As Langford reasoned in her dissertation, the phenomenon is likely evolutionarily continuous, and well within the

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[41] (Langford, et al., 2006)
[42] (Miller, 2006)

reach of all mammals. And it stands to reason that empathy—for both physical and emotional responses—is beneficial to any animal with even vague social tendencies. Empathy not only can heighten senses for danger (as with Langford's mice: empathy in their case made them more sensitive to pain, thus more likely to avoid injury if possible), but also foster harmonious interactions with other animals in the group. The well-known ethologist and Emory psychologist Frans de Waal calls this particular empathic behavior "community concern." Such a concern can lead to lower rates of aggression between social animals, and therefore poses an evolutionary advantage.[43] In these senses, empathy gives us—all animals—a clear leg-up.

With a study like Langford's, one of the greatest booby-traps of studying nonhuman animal emotion materializes with clarity: anthropomorphism. The problems that accompany anthropomorphism are two-fold. On the one hand, due to our own subjectivity, humans risk jumping to premature conclusions about nonhuman animal emotions. While reading about the suffering mice, I am inclined to empathize with them. I feel a kind of horror for them, imagining how terrible an acetic acid injection might feel. I imagine looking on at my own cage-mate writhing in pain, and how that would affect my own experience. It's then easy to project those feelings onto the mice in Langford's experiment, but it's also unjust. Mouse experience and human experience are undoubtedly distinctive. And herein lies the second problem with anthropomorphizing: projecting human experience onto nonhuman animals does them injustice. By seeking out analogues of our own behavior, we underestimate—if we estimate at all—the uniqueness of a nonhuman animal's experience. We see them as parodies of ourselves, as lesser versions.

But we may be limited to judging all other animals against our own, subjective knowledge of consciousness, of emotion. This needn't hinder our scientific exploration nonhuman animal emotion; by establishing the previously discussed emotional Turing test, we might overcome such difficulties. If researchers can glean that a machine is "thinking" based on its ability to interact with a human, then it seems like a major scientific oversight that a similar method doesn't yet exist for nonhuman animals.

If such a test is developed for nonhuman emotion, it could easily be run on the same principles as its machine-based counterpart. In this case, however, the nonhuman animal brain would act as the computer, and a human would observe the creature's behavior in several

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[43] (de Waal, 1996)

situations. Consider Langford's empathic mice in this hypothetical Turing test: are the mice behaving as if they are experiencing heightened suffering? Are they behaving in a similar way as a human might in the same situation? To make it personal, would you feel uncomfortable if you saw a close friend injected with acetic acid?

The science is there. Expressions of social joy, anxiety, depression, and empathy abound in nonhuman animals, comparable yet different from our own feelings and stemming from similar neural structures. Fading away are the days that these considerations are reserved for activists and the naïve. Whether an enlightened view of nonhuman animal emotion stems out of a yet undeveloped Turing test of sorts or by some other illuminating discovery that pacifies skeptics, widespread acceptance is likely near on the horizon. Now all that's left to do is consider what this means to us—the self-proclaimed "moral animal," the watcher and keeper of all earthly beings. Opening now are some uncomfortably narrow doorways through which we must pass if we wish to live up to our own imposed significance as reasoning, moral animals.

The Moral Animal

Most people will never spend any meaningful time with a beluga whale like Nico. We have our dogs, cats, sometimes parrots and fish, but we don't often come into close contact with crows, dolphins, mice, rats, elephants, nonhuman primates, or many of the other animals mentioned thus far. This proximity (or lack thereof) is a good indicator of why the animal welfare laws that do exist serve to protect only the nonhuman animals that we've decided we like—beings that we use, on the other hand, don't fare so well.

Farm animals are perhaps the clearest example of the "used." They are bred and raised as product, capital in a highly mechanized system. Finding survivors from concentrated animal feeding operations (CAFOs, or factory-farms) isn't too common. CAFOs are well-oiled machines that raise animals at an impossible rate, cage them in unsanitary and tight conditions, and process them without hesitation.

The conditions of a CAFO depend on the animals that the CAFO processes. Operations that "finish" cattle for meat crowd the bovines in feedlots naked of grass, where they stand knee-deep in their own feces. The cows are fed corn, which their stomachs aren't evolved to digest. Because

of their high-caloric intake, these animals grow quickly—so quickly that their bones often give out due to malnutrition and accelerated weight gain. If an animal's bones give out, he is called a "downer" and thrown out.

Pigs face similar conditions. Gestating pigs, for instance, are confined to small crates that force them into a single position, unable to move. In these crates, the pregnant pigs develop obsessive behaviors that cause them to inflict bodily damage upon themselves, such as repetitive chewing on bars or head-banging. When the pigs give birth in the confines of their crates, the piglets can easily be crushed by their mothers.

Chickens are labeled as either "layers" or "broilers," and depending on which type they are, experience life very differently. Layers—chickens that are raised for egg production—are placed 6-to-a-cage, each cage about the size of an industrial-sized microwave. These battery cages, as they're called, are mesh wire and often cut into chicken feet. Occasionally, chickens are found with their feet fused to the wires. In such close quarters, hens can turn to cannibalism—a behavior that very, very rarely occurs when left to roam freely. To curb this behavior, all chickens' beaks are "trimmed" when they are chicks. The trimming consists of cutting off about a quarter of the bird's beak, an appendage with nerve endings that the animal would otherwise use to preen and forage.

Broiler chickens, or chickens raised for meat, aren't usually caged. Instead, they are crowded into large chicken houses where they have no room to extend their wings. There are no perches in CAFO broiler houses (chickens tend to perch). These animals have been bred to be giant-breasted echoes of what they once were—flying, perching, foraging birds that actively seek out sunlight and social interaction. It is not uncommon to find dozens of dead birds carpeting the floor of a broiler house; because they grow so quickly, their enormous chests fracture their bones, and when they can no longer walk, they are trampled by the thousands of other birds in their house. People who tend to the chickens have to wear masks when entering one of these houses, else they face rather rapid onset of respiratory illnesses.[44]

This alienating treatment of farm animals is the norm, rather than the exception. Organizations like People for the Ethical Treatment of Animals (PETA) and one of their affiliates, Farm Sanctuary, do a lot of outreach and fight for legislation for the protection of the animals we eat, to some avail. But as billions of animals are kept and slaughtered in these types of conditions

[44] (Kirby, 2010; Farm Sanctuary)

every year (in the United States alone), the organizations fighting desperately and passionately for animal rights are gaining in number and in influence.

The pursuit of animal rights, in some fashion or another, has existed at least since the philosopher Jean-Jacques Rousseau's time. In his 1754 Discourse on Inequality, Rousseau states that nonhuman animals should be considered a part of natural law (which grants humans a universal free pass to basic natural rights) because they are sentient beings. He doesn't make the jump to argue that they can reason, but grants them at least a sense of self, and argues that this is reason enough to include them on the natural rights list. "As [nonhuman animals] partake, however, in some measure of our nature, in consequence of the sensibility with which they are endowed, they ought to partake of natural right, so that mankind is subjected to a kind of obligation even toward the brutes," he writes. [45]

German philosopher Immanuel Kant opposed the "obligation" of which Rousseau spoke. Kant didn't believe we have any obligation toward nonhuman animals, but that by treating them poorly, we detriment ourselves as humans. By abusing animals, he argued, we deaden the feeling of sympathy not only for the animal, but also for other humans. By Kant's argument, we are weaker beings through apathy.[46] Whether they stem from a sense of obligation to nonhumans or to oneself, animal rights have long been considered the next necessary step in the development of humanity, of the moral animal.

While philosophers continue to argue about animal rights, organizations like PETA took to the streets. And in response to early activist efforts, the U.S. government initiated the Animal Welfare Act in 1966, presumably in hopes to oil the squeakiest wheels. This Act, even in its 2010 modifications, is effectively useless for the nonhuman animals that we use for our purposes. It sounds hopeful in its scope and goals—to promote humane treatment and handling in nonhuman animals. However, there's a big, fat asterisk by the term "animal." The asterisk explains:

> "...such term excludes (1) birds, rats of the genus Rattus, and mice of the genus Mus, bred for use in research, (2) horses not used for research purposes, and (3) other farm animals, such as, but not limited to livestock or poultry, used or intended for use as food or fiber, or livestock or poultry used

[45] (Rousseau, 1754)
[46] (Kant 1797)

> or intended for use for improving animal nutrition, breeding, management, or production efficiency, or for improving the quality of food or fiber."[47]

By the Animal Welfare Act, a dead dog has more right to humane treatment than a living chicken, cow, pig, rat, or mouse. The Act protects shockingly few: dogs, both living and dead, cats, nonhuman primates, and other mammals...only if they're not being used for research or food production. In research, all bets are off and the nonhuman's welfare is left up to the discretion of the institution performing the experiments. In farm animals, there are few protections on a federal level. And considering that some estimates place the yearly number of animals slaughtered for food in the U.S. somewhere between 600 million and 1 billion,[48] that lack of welfare becomes unsettling.

The prospect of granting rights to animals other than humans understandably makes some people uncomfortable on a number of levels. To some, increased animal rights could mean a full stop in medical advancement and a severe change in dietary habits. Questions fuelled by fear spawn like wildfire: if we grant animals rights, then are we putting nonhuman animals on a level equal to or higher than humans? And when we do that, are we putting ourselves and our loved ones, at potential risk?

Before we parted ways at the Animal Minds colloquium, Bekoff offered his thoughts to me on the subject of nonhuman animal rights. "Lazy thinking is a big problem with this world," he told me. "Caring for animals doesn't mean caring less for humans." Like Kant, Bekoff argues that with increased compassion toward animals comes increased compassion toward other humans. Of course, any further legislation regarding animal rights would require changes to be made in a number of arenas: food production would have to change; medical testing would become more careful, with animal suffering as a prioritized concern; entertainment featuring animals might decline or disappear completely. This kind of change should happen, though, Bekoff thinks. "Whether they're sentient or not," he said, "they're still not objects."

Many philosophers and researchers have proposed basic sets of rights for nonhuman animals, rights that are lesser than human rights, but rights just the same. First proposed by the

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[47] (USDA 2011)

[48] (National Agriculture Statistics Service, 2011)

UK Farm Animal Welfare Council in 1965 and amended in 1993 (with the help of Bristol University scientists) is a list of Five Freedoms, basic components of life that should be granted to all thinking, feeling animals.[49] While this list is clearly geared towards farm animals, it seems reasonable to extend the freedoms to all nonhuman animals that show even the most basic forms of sentience, be it self-recognition, intelligent behavior, the ability to play, or the capacity for empathy. The Five Freedoms are as follows:

1: Freedom from thirst, hunger, and malnutrition
2:Freedom from discomfort
3: Freedom from pain, injury, and disease
4: Freedom to express normal behavior
5: Freedom from fear and distress

Idealistic rights activists propose that all nonhuman animal research be put to an end, that all humans cease to wear fur, and, most of all, that everyone becomes vegan. This policy is wholly unrealistic, and about as useful as suggesting that humans simply stop fighting wars or that we all stop using oil in order to combat climate change. Our relationships with nonhuman animals are complex, and require careful attention to alleviate the unnecessary distress they experience. That said, we should examine with a scrutinizing lens how the beings we use for food, clothing, and research can be treated more humanely, and with as little industry lobbying as possible.

If the Five Freedoms mentioned above were adopted in the U.S. and extended to all nonhuman animals, most of the required changes would fall in the court of industry and academia. Institutions would have to better justify a great deal of animal testing—injecting mice with acetic acid, for instance.[50] CAFOs as we know them today would all but cease to exist; by their very nature, they violate each and every Freedom listed above. More attention would have to be paid to the welfare of farm animals, approaching their sentience from a scientific rather than sentimental perspective.

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[49] (Animal Ethics UK)

[50] There is of course the fact that we would know little about mouse empathy without subjecting them to these experiments. This logic goes for much of what scientists know about nonhuman animal intelligence—without the testing, it's difficult to form conclusions.

But to which animals should those Freedoms apply? A lot of research done in laboratories is conducted with water fleas, mosquitos, and fruit flies, to name a few of the invertebrate subjects. And what of fish? We eat and conduct research on them, too. Mammals and birds are much easier for humans to identify with, perhaps because our proximity to them, both geographically and evolutionarily. Fish, on the other hand, are alien; they can't communicate or interact with us the way dolphins can, and they don't demonstrate the same kind of cognitive or emotional capacities as obviously as other vertebrates. Where can we draw the line?

Animal behavior scientist Lesley Rogers of the University of New England in Australia doesn't think we can draw a line just yet. "This important decision cannot be made lightly, and the deeper we look at it, the more we realize that drawing the line accurately is bedeviled by gaps in the relevant scientific knowledge about most species and the inaccuracies of attempting to rate species according to a single criterion, or even a small set of criteria," she writes in an essay on defining animal rights.[51] Many others agree with her sentiments, considering it ethically dangerous to judiciously grant one group of nonhuman animals rights, but not another.

If that line isn't possible yet, there is clearly research that needs to be done. Most importantly, neurological research into emotion and reasoning must leap forward in order to more clearly define where and how these faculties act and within what brain structures. Assuming for now that a human will never truly experience what another animal experiences, be it a neighbor or that neighbor's Pomeranian, neurobiology is perhaps key to nonhuman animal freedoms. Adhering to the fact that all vertebrate brains share fundamentally common elements, discovering the true neurological seat of emotion and cognition would very likely signal the end of this ongoing debate.

Whether we can draw a line or not, it is ethically irresponsible to neglect nonhuman animal rights because of the present incapacities of researchers. Consider the Green movement. There are many mechanisms of climate change that we don't yet understand, not to mention a great deal of American citizens who simply don't believe that anything's happening. What's lost in the Green movement? Our dependency on oil might decrease. We might drive less often, or at least change the way we drive. We might try to use less water and electricity. All of these things are beneficial, whether we understand all the mechanisms or not. The same goes for more

[51] (Rogers & Kaplan, 2004)

nonhuman animal protection: what do we really stand to lose by treating nonhuman animals with more respect and consideration?

After Bekoff left with his ethologist posse, I sat down in one of the many empty chairs in the conference room at Boston University. There were a few lingerers, a dozen or so people standing around talking with their cold coffee and hardening pastries. I wondered what kind of shared existence we would hope for, if any, between humans and our nonhuman cohabitants—not the wishy-washy, Love-is-all-around kind of peace, but a pragmatic, calm sort of peace. A coexistence rather than an exploitative tyranny.

Not that the tyranny could have been avoided. Human civilization is long founded in the idea that the earth is ours to shepherd, to dominate. Our history as homo sapiens is characterized particularly with a dialogue of supremacy, an anthropocentrism that reinforces our position in the world's driver's seat. Major world religions inform their followers that humans have domain over all the Earth, including the other animals that inhabit it. In the Christian Bible's Book of Genesis, it is explained to readers that humans were entrusted with the care of other animals, that they are ours to watch and reign over. Nonhuman animals are not our equals, as humans are divine, special, made in God's image. That view has held strong throughout the years, even when the shattering contributions of Copernicus exploded onto the scene in the 1500s.

When Copernicus ventured forth and proclaimed that our home planet was, in fact, not the center of the universe, it fractured the sense of human superiority. Around then, the idea began to spread that perhaps our significance wasn't central to the workings of all things. We were somehow smaller, less important in an ever-increasing universe. In spite of our smallness, it remained clear that at least on Earth, we reigned supreme. We were still kings, separate from the animal kingdom by virtue of reason and divine appointment. But that wouldn't hold much longer, either.

Charles Darwin and the other early evolutionists yanked from us our uniqueness, explaining that we were a part of a constantly changing and adapting continuum of life. In this continuum, nature guides all animals through a wonderful process of trial and error, selecting out some and favoring others. Rather than creations of the divine, humans—just as mice, pigs, lizards, octopi, and parrots—came from a long line of evolving ancestors, a line of life billions of years old in which we were all connected. This continues to be a difficult concept for some to grasp, still clinging to their imposing significance. Some are convinced that this fundamental

evolutionary force culminated with Man, as if we were an end goal all along. Over 200 years later, it's still difficult to hear that, even given our obvious consciousness, our capacity for reason, judgment, and emotion, we share much in common with all other life on Earth. And that we are no end-goal.

We may be on the cusp of another anthropocentric paradigm shift. Admittance of nonhuman animal sentience may be it. Eventually, we must come to terms with the idea that *homo sapiens* is part of a continuum of emotional and cognitive intelligence in all life on earth (and perhaps beyond).

I found peace as I watched a captive beluga whale blowing bubble rings. A thinking and emotional animal like me, Nico danced gracefully behind his thick sheet of glass, darkened and obscured by his containment. He didn't see the world as I do, didn't have the same insecurities, anxieties, or religious beliefs. Beluga happiness is undoubtedly different than my own, distinctive perhaps to his own kind. No other creatures (not even human physicists) can blow a bubble ring quite Nico and his toothy dolphin and whale relatives.

When I last stood watching Nico dance with his bubbly hula-hoop, he twirled for almost thirty minutes. I felt like I danced with him, hypnotized by his creation. I hadn't been told how sick he was, how his faithful veterinarian called his remaining life "borrowed time." No one told me how Nico came to the Georgia Aquarium because no one else wanted the liability of a dying beluga. His days there were numbered. Another year passed, full of swimming idly for the thousands of spectators, meeting daily with his trainers and lady beluga tank-mates, Maris and Natasha. By November of 2008, Nico had been temporarily moved to the San Antonio Sea World while his Georgia home tank underwent renovations. Before his keepers could bring him home, Nico died suddenly on October 31, 2009.

An old volunteer friend of mine called to tell me a week later. I had been in the shower, and learned of Nico's death by voicemail. I wondered what he thought, what he felt, before he died.

I can still see the bubble rings sometimes when I close my eyes. They waltz and wiggle and writhe through my thoughts like whispered dreams, the memory of an impossibly elegant and playful Nico occasionally weaving through. To question his thoughts, his presence of mind, is impossible to me. The science may be catching up, but it's catching up to something many of us—

if not all—simply know. Nico saw the world, and he saw you. Peace ultimately comes when you look the white whale in the eye, and you both realize that you're not alone.

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