Mice in the Sink:
On the Expression of Empathy in Animals

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CeAnn Lambert, head of the Indiana Coyote Rescue Center, witnessed a small act of heroism in a sink in her garage. Two baby mice had become trapped in the sink overnight, unable to scramble up the slick sides. They were exhausted and frightened. CeAnn filled a small lid with water and placed it in the sink. One of the mice hopped over and drank, but the other seemed too exhausted to move and remained crouched in the same spot. The stronger mouse found a piece of food. He picked it up and carried it to the other. As the weaker mouse tried to nibble on the food, the stronger mouse moved the morsel closer and closer to the water until the weaker mouse could drink. CeAnn created a ramp with a piece of wood and the revived mice were soon able to scramble out of the sink.

What happened in that sink? Did one mouse actually understand that the other mouse was in trouble and find a way to help? Did the tiny creature display a kind of empathy? It is tempting to write stories of this sort off as an overexcited imagination reading far too much intention and emotion into the behavior of animals. Yet it is also possible to read too little into the animals we watch. Perhaps animals have the capacity to feel sorry for another mouse in distress, and to offer help. Indeed, there is mounting scientific evidence that animals—even rodents—have the capacity to feel empathy.

In June of 2006, researchers reported in the journal *Science* the first unequivocal evidence for empathy between adult, non-primate mammals. Dale Langford, of McGill University, and his colleagues demonstrated that mice suffer distress when they watch another mouse experience pain. Langford and his team injected one or both members of a pair of adult mice with acetic acid, which causes a severely painful burning sensation. The researchers discovered that mice who watch their peers in pain were more sensitive to pain themselves. A mouse injected with acid writhed more violently if his or her partner had also been injected and was writhing in pain. Not only did the mice who watched cage mates in distress become more sensitive to the same painful stimuli, they became generally more sensitive to pain, showing a heightened reaction, for example, to heat under their paws. The researchers speculated that mice probably used visual cues to generate the empathic response, which is interesting since mice normally rely most heavily on olfactory communication.

Frans de Waal, a world renown primatologist, said of Langford's research, "This is a highly significant finding and should open the eyes of people who think empathy is limited to our species" (Carey 2006). This data confirms that empathy is an ancient capacity, probably present in all mammals. Jaak Panksepp, an expert on animal emotion, remarked, "If it turns out that the 'empathetic' effect in mice is mediated by the same brain mechanisms as human empathy, then the evidence would be truly compelling that their model actually reflects evolutionary continuity in a pro-social mechanism among many different mammalian species" (Ganguli 2006).

De Waal and Panksepp, longtime students of animal behavior, seem unsurprised that mice show empathy. What neither says outright, but is implicit, is a more startling possibility: if animals share with humans the capacity for empathy, they have in place the

cornerstone of what in human society we know as morality. For among humans, the capacity to understand what another feels allows us to be compassionate, to avoid causing pain or suffering, and to act with an intention to improve the welfare of those around us. And if, indeed, animals share this cornerstone of morality, this may set in motion a serious reappraisal of how we understand animals, how we understand morality, and how our empathy for animals can guide our behavior toward them.

What is empathy? The lexicon of feeling

Empathy is the ability to perceive and feel the emotion of another. The word empathy was coined in the early twentieth century, to translate the German word *Einfühlung*, which means literally "feeling into" (from the Greek *em* put into + *pathos* feeling). The term empathy first appeared in the context of art, and referred to the capacity of a person to mentally identify with, and thus fully comprehend, an object of contemplation, a painting perhaps, or a piece of music. Yet the word quickly made its way into the lexicon of psychology, where it became (and remains) a concept of considerable interest as well as disagreement. In this context, the word refers to the capacity to read and understand the emotions of others and respond in a sensitive and helpful manner. The appearance of "empathy" in the literature on animals is a bit more difficult to trace; the word seems to have emerged sometime in the 1960s or 70s, but only recently has it become a subject of focused research and discussion.

The term empathy can be confusing because its meaning often shifts from one discipline to another and little effort is made to carefully define how the word is being used. Philosophers often use words like empathy and altruism differently than evolutionary biologists. Philosophers have mainly written about sympathy, while biologists have written about empathy (though Darwin himself used the term sympathy). The phenomena to which these terms refer are convergent, if not equivalent. Ultimately, it will be useful to have clear terminology that carries the same meaning in biology, ethology, human psychology, neuroscience, and other related fields; this will aid our attempts to understand evolutionary continuity of emotions and social behaviors.

The most careful and successful attempt so far at defining and clarifying the meaning of empathy in relation to animals can be found in the work of psychologist Stephanie Preston and primatologist Frans de Waal (2002a and 2002b). They define empathic behaviors as those in which one individual comes to perceive or understand the emotional state of another individual, through a "shared-state mechanism." Shared state means that empathy is by definition an intersubjective experience. The essence of empathy is emotional linkage. As Preston and de Waal explain,

> "The emotional state of one individual has the potential to elicit a similar state in nearby individuals. This emotional linkage has been present in primitive forms through much of the evolutionary history of chordates in the form of alarm and vicarious arousal. This basic linkage was then augmented by enhanced cognitive and emotional abilities through evolution and extended ontogeny (development of the individual), allowing individuals to experience empathy in the absence of releasing stimuli, towards more distant individuals, and without being overwhelmed by personal distress" (2002a, p. 3).

Empathy, from simple to complex

Empathy, as the quote from Preston and de Waal suggests, is not a single behavior, but a whole class of behaviors that exists across species and shows up with varying degrees of complexity. It occurs in nested levels, with the inner core a necessary foundation for the other layers. The inner core consists of relatively simple forms of empathy such as body mimicry and emotional contagion, which are largely automatic physiological responses. The next layer consists of somewhat more complex behaviors such as emotional empathy and targeted helping. More complex still is cognitive empathy, or the ability to feel another individual's emotion and understand the reasons for it. Finally, and most complex, is the capacity for attribution, in which an individual can fully adopt the other's perspective, using the imagination.

Evolution of course doesn't toss out one adaptation and replace it with another; it adds to and adapts existing structures and capacities. More complex forms of empathy such as cognitive empathy evolved from emotional contagion which, in turn, probably evolved from emotional linkage of individuals, especially emotional linkage between mother and infant. All empathy behaviors, from simple to complex, likely share many proximate mechanisms.

The notion of empathy as nested levels mirrors a more general aspect of mammalian evolution. American physician Paul MacLean hypothesized that the mammalian brain is actually three brains in one, each successive stratum having been formed on top of the layer beneath it. Each layer of the brain has its own function, though all three are interconnected and interacting. The primitive brain, which MacLean called the reptilian or R-complex, has the task of physical survival, controlling breathing and heartbeat and generating the fight or flight response. The limbic system, or paleomammalian brain, controls emotion. And the neocortex, the outer and most recent part of the brain, allows for higher cognitive functions such as language and abstract thought. The three layers function independently, but are also interconnected and interdependent in complex ways that are only partially understood. So, while emotional contagion may be in some respects simpler and more primitive, and may arise from older parts of the brain, it is most likely inextricably connected with more complex, more cognitive forms of empathy. And cognitively advanced forms of empathy are probably influenced in some measure by the more primitive and automatic impulses.

Some scientists deny that animals have empathy, despite evidence to the contrary. But they usually come to this conclusion because they have narrowly cast empathy to mean the ability to take the perspective of another. The capacity for imaginative attribution may, indeed, be found only in humans. Yet this is only one small piece of a much larger group of behaviors, many of which are certainly present in a broad range of mammals. And as de Waal and Preston argue, it is premature to pronounce animals lacking in cognitively complex forms of empathy—we still know too little about empathy in animals to make such a claim. Cognitive empathy may be found, for example, in the hominoid primates and perhaps elephants, social carnivores, and cetaceans.

Why is empathy adaptive?

Animals living in social groups benefit from being affected by the emotional states of others in the group. Emotional contagion, for example, would facilitate defensive action in light of threat. If one prairie dog gives an alarm call, all members of the group will respond immediately with evasive action. The same with birds: if you

startle one bird away from the feeder, all the birds will disperse. And not only will all the sparrows fly off, but likely so will the robins, grackles, and finches, suggesting that emotional contagion may function between species. This behavior spreads out the costs of vigilance, allowing individuals more time to forage, mate, or care for young.

Emotional linkage between individuals can lead to forms of empathic response in which the observer perceives the emotional state of another and "feels sorry for" this emotional state. Empathy may just remain a feeling state (I feel distressed to see you so distressed), but it also may motivate some action, such as trying to alleviate the source of distress or offering comfort. Empathy may be an important component of certain helping and cooperative behaviors. In particular, it may facilitate complex cooperative interactions such as reciprocal altruism. It may also function in the development of trust, since trust involves being able to assess the intentions and emotions of interaction partners. Of course, the ability to read and understand intentions also facilitates manipulation and deception, and the capacity to imagine how one's own behavior affects others can lead to the most extreme forms of cruelty.

Evolution is a balancing act between costs and benefits, cashed out ultimately as reproductive success. Empathy seems at first glance like a win-win behavior, particularly if the empathic response involves only an affective reaction and no particular helping response. Yet empathy can be costly in various ways. These ways have not yet been explored in much depth in the empathy literature, but might run along the following lines.

Jean Decety and Philip Jackson call attention to the "cost of an expanded self" (Decety and Jackson 2006). A self that is linked to others also shares in the emotional experiences of others. When we see someone in distress, we too feel distress and perhaps anxiety. When we see someone experiencing fear, we too feel fear. And distress, anxiety, and fear are not "free"; they demand cognitive and metabolic attention, and can divert attention and energy from important tasks. For example, fear, panic, and distress cause the brain to release cortisol, the "stress hormone." The release of cortisol in the body sets off a cascade of physiological effects: blood pressure goes up, digestion stops, pulse quickens. Too much cortisol in the body can lead to impaired cognitive function, lowered immunity, and other costly changes. This is why misplaced empathy or too much empathy might be maladaptive.

Empathy may be costly not only for the empathizer, but also for the individual who is the object of empathic response. Humans and animals alike may benefit from being able to hide emotions such as our excitement at finding a huge cache of great food or our fear during a struggle for dominance. The better those around us are at reading our facial expressions, tone of voice, body language, and olfactory messages, the less successful we will be at masking our intentions and feelings. The capacity for empathy creates in a society of animals a level of transparency and intersubjectivity that makes honest communication the norm and may explain why deception is considered more cognitively demanding than honesty.

Empathy in primates

The most robust research on empathy in animals comes from the primate literature. It may be that primates, of all the social mammals, have the most highly developed empathic abilities. Or it might simply be that the sheer abundance of primate research yields a corresponding abundance of data on empathy, and the more carefully

we look at other species, the more we'll find. At any rate, the research on primates is extremely revealing and begins to uncover many of the nuances of empathic behavior in animals.

Primate research carried out in the 1960s was suggestive, though in that era few scientists would have been willing to label any non-human behavior as truly empathic. A classic study published in 1964 showed that a hungry rhesus monkey would not take food if doing so subjected another monkey to an electric shock. The monkeys also refused to pull a chain that delivered them food if doing so gave a painful shock to a companion. One monkey refused to pull the food chain for a full 12 days, starving itself seemingly to avoid causing pain to another.

Around the same time, Harry Harlow was setting forth on his famous wire monkey experiments. Although Harlow was interested in humans, his findings on monkey love also revealed a great deal about the process of social attachment in primates—the very process that is thought to shape the neural connections that undergird empathic behavior. Working with infant rhesus monkeys who had been taken from their mothers, he showed that the desire for affection was stronger than the desire for food. Given a choice between a cold wire monkey with food and a soft cloth monkey without food, the infants clung to the soft, foodless monkey. From other studies, he concluded that baby monkeys raised without social contact with peers and without real mothers grow up to be socially incompetent. The development of social and moral intelligence is stunted when the appropriate developmental cues are not triggered. Harlow's work led to later studies on attachment and on the important connection between early nurturing of infants and children and the development of empathy.

In another study conducted in 1977 by Hal Markowitz, Diana monkeys were trained to insert a token into a slot to obtain food. A male was observed helping the oldest female who had failed to learn the task. On three occasions he picked up the tokens she had dropped, put them into the machine, and allowed her to have the food. His behavior seemed to have no benefits for him; there did not seem to be a hidden agenda.

Although many of these early studies involved monkeys, there is now a large body of research that spans the range of primate species. And having the opportunity to compare the behavior of different primates has raised interesting questions about empathic behavior. Does empathy require being able to look at the world from another's perspective? Or does it simply mean being vicariously aroused by another's emotions? Comparing empathic capacities in monkeys and apes reveals important differences, and confirms the hypothesis that empathy is a broad range of behavioral tendencies and that species will vary, perhaps considerably, in how developed these capacities are.

De Waal asserts that empathy is more cognitively complex and more highly developed in great apes (chimpanzees, bonobos, and humans) than in monkeys. He argues, as a case in point, that consolation behavior, in which one animal (a bystander) consoles another after a fight, is indicative of cognitive empathy. Consolation behavior has been demonstrated in great apes only, not monkeys. De Waal's thesis is that cognitive empathy, including consolation behavior, is connected with mirror self-recognition. Great apes have mirror self-recognition; monkeys do not. Mirror self-recognition indicates a certain level of self-awareness, and self-awareness is correlated with cognitive empathy, particularly in the ability to distinguish self from other. De

Waal has documented many instances of cognitive empathy in chimpanzees and bonobos.

Empathy in cetaceans

The cetacea includes some 90 species of whale, dolphin, and porpoise. These are thought to be some of the most intelligent animals on earth, and also some of the most socially sensitive. Relatively little is known about cetacean social behavior because social networks among marine animals are notoriously hard to study. Cetaceans tend to be fast-moving, wide-ranging, and some are very deep-diving. What we observe on the surface of the water may be only a small fraction of their behavior; it is difficult and expensive to observe behavior in the depths. What little data there is on cetaceans, though, suggests a significant capacity for empathy.

Mark Simmonds, an expert on toothed whales, tells of a pod of false killer whales that remained with an injured member of their group for three long days, in water so shallow that they were exposed to sunburn and risked becoming stranded. The pod stayed with the injured whale until it finally died. Simmonds also tells the story of two male orcas who appeared to be grieving over the death of their mother. After their mother died, the two males swam together, apart from other orcas in their pod, retracing their mother's movements on the last few days of her life. Naomi Rose, the cetacean researcher who witnessed this event, interpreted this as grieving. Orcas also known to grieve for lost calves (Simmonds 2006). There are also many anecdotal accounts of dolphins showing empathy for other dolphins.

Cetacean researchers were surprised recently by the discovery of spindle cells, which were long thought to exist only in humans and other great apes, in humpback whales, fin whales, killer whales, and sperm whales in the same area of their brains as spindle cells in human brains. Spindle neurons are important in processing emotions and appear to play a role in empathy and in feelings of love. Researchers believe that spindle cells may have existed in the toothed whales for at least twice as long as in humans. It may turn out that other cetaceans—including the baleen whales, which are of a different suborder than dolphins, porpoises, and toothed whales—also have spindle cells, which would suggest that empathy is widespread among this order of animals.

Empathy in elephants

Elephants seem to be uniquely empathic. They are known for the tenderness they show to each other, and for their close-knit societies. There are countless anecdotal accounts of elephants showing empathy toward sick and dying animals, both kin and non-kin.

Joyce Poole, who has studied African elephants for decades, relates the story of an adolescent female who was suffering from a withered leg on which she could put no weight. When a young male from another group began attacking the injured female, a large adult female chased the attacking male, returned to the young female, and touched her crippled leg with her trunk. Poole considers that the adult female was showing empathy (Poole 1998).

Elephant expert Iian Douglas-Hamilton describes how one elephant—Grace, of the Virtues family—attended to Eleanor, matriarch of the First Ladies family. Eleanor was ailing, unable to stand steadily. When she fell, Grace gently touched Eleanor with

her trunk and foot and then lifted her back to her feet. As Douglas-Hamilton writes in his field observation: “Grace tried to get Eleanor to walk by pushing her, but Eleanor fell again. . . Grace appeared to be very stressed, vocalizing, and continuing to nudge and push Eleanor with her tusks. . . Grace stayed with her for at least another hour as night fell.” After Eleanor died, a number of elephants visited the body, some touching, some just standing for a time near the dead matriarch. A female named Maui “extended her trunk, sniffed the body, touched it, and then tasted [Eleanor’s] trunk. She hovered her right foot over the body, nudged the body, and then stepped over, pulling the body with her left foot and trunk, before standing over the body and rocking to and fro” (Douglas-Hamilton et al. 2006).

Elephants grieve openly for their dead. One story related in the Sunday Times told of a baby elephant killed by a lioness; over the course of the day, elephants from the herd gathered in a rough circle around the remains of the baby. Many of them touched the body with their trunks. Elephants also show a pronounced interest in corpses and bones—a behavior thought to exist only in elephants and humans. As Douglas-Hamilton says, with the understatement of a seasoned scientist, “the question of whether or not there might be compassion or suffering among surviving elephants who interact with ailing or dead ones remains so far unanswered.” But, he continues, “observations suggest that this could be the case.”

Social breakdown in elephant society

What shapes behavior—what allows empathy to flourish in a person and also in other animals—is social environment and early development, particularly maternal nurturing. Nature may plant the seeds of empathy—the neural circuitry that can develop from emotional linkage and attachment into empathy, but if the seeds are not nourished, development can go wrong.

A report published in *Nature* in 2005 by Gay Bradshaw and colleagues on what they call elephant breakdown gives us a window into the connection between early experiences—especially maternal nurturing—and the development of empathy. The attachment bonding process between mother and infant facilitates the development of neurophysiological structures that underlie normal social behaviors such as empathy. We know that in humans a disruption of this bonding process can result in reduced capacity for empathy and an increased propensity toward violence. Early trauma has permanent effects on the brain, and thus on behavior. Trauma such as separation of the infant from its mother, or abuse or neglect by the mother, can lead to a permanent impairment in empathic social interaction.

Bradshaw and colleagues hypothesize that social disruption in animal societies—in this case wild elephants—has interfered with the normal development of young elephants, particularly by depriving them of appropriate maternal care and teaching. This early trauma can lead to empathic impairment in elephants, just as it can in humans. Elephants live in very tightly bonded matriarchal societies, with layers of extended family who participate in caring for and rearing young. In the early 1990s, there were an estimated 10 million wild elephants; these populations have been decimated by poaching, culls, and habitat loss, and only about a half a million elephants now survive in the wild. The complex social structures of elephant society are collapsing under the weight of loss and fragmentation. Infants have been orphaned, often after witnessing their parents being

brutally killed. Some of the remaining elephants—particularly young males—are displaying symptoms very much like human post traumatic stress disorder: depression, abnormal startle response, unpredictable social behavior, and violent aggression.

Matriarchs are repositories of social knowledge, and the loss of a matriarch can have wide ranging impacts on elephant society. As Bradshaw and Allen Schore report, "infants are largely reared by inexperienced, highly-stressed, single mothers without the socio-ecological knowledge, leadership, and support that a matriarch and allomothers provide" (Bradshaw and Shore 2007, p. 429). Most astonishing to researchers has been the killing of white and black rhinoceroses by young male elephants. These young males were cull orphans, or were born to mothers who had witnessed a cull, or were reared within socially disrupted herds. Not only has the normal process of maternal care been derailed, but the larger social structure of elephant society has been disrupted.

When human societies disintegrate and the social fabric becomes damaged, people often lose their moral bearings. This may be equally true for animal societies held together by normative standards of behavior. This suggests, among other things, that in planning for conservation, we need to pay particular attention to conserving intact and functioning societies, not just saving individual animals.

Empathy, building block of morality

Let us take stock of what we know about empathy in animals. We know that the capacity for empathy has evolved in mammals that live in complex social groups and that it helps foster and maintain social cohesion. There is good evidence for empathy in primates, pachyderms, cetaceans, social carnivores, and rodents. The capacity for more nuanced and complex empathic behavior seems to be correlated with both social complexity and intelligence. Because empathy is grounded in the same neurological architecture as other prosocial behaviors such as trust, reciprocity, cooperation, and fairness, it seems likely that a whole suite of interlinked behaviors have co-evolved in social mammals. Empathy is possibly among the most basic of these prosocial behaviors, having evolved out one of nature's earliest experiments in social attachment: the mother-infant bond.

Here we arrive, then, at the startling implication of Langford's study of mouse empathy: humans may not be the only species with morality. Indeed, it is likely that morality has evolved in a number of species, as an adjunct to sociality. The difference between the moral behavior of animals and that of humans is, as Charles Darwin suggested, a difference in degree, not kind.

Feeling beyond species boundaries

It will not escape your notice that Langford's study of empathy involved the deliberate infliction of pain on mice. Other empirical studies of empathy in animals have relied, similarly, on eliciting a pain or distress response. This, of course, is only one of many ironies in animal research. Harry Harlow showed us the importance of love and nurturing in the developing child by tearing infant monkeys from their mother's breast. Curt Richter gave us fascinating insight into the nature of hope by placing rats in utterly hopeless situations and watching them struggle for survival hour after hour after hour as they swam in a tiny tank with steep sides and no escape. Jack Panksepp offered

pioneering insights into rat joy by making rats laugh and, as they squeaked with pleasure, killing them and slicing open their brains to observe physiological changes.

Is the irony too painful to bear? Does the presence of empathy in animals mean that we should discontinue our studies of empathy, where these involve pain and suffering? Does it suggest anything concrete in the way of ethics? The uncomfortable answer is: yes and no.

The scientific data on empathy doesn't lead ineluctably to a particular conclusion about how we should treat animals or what our relationship to them should be. We could easily say "animals have empathy" and go on treating them just the way we do. A scientific description cannot, according to the rules of logic, generate a moral imperative.

It is nonetheless worth noting that modern scientific research on animals, as well as industrial farming of animals, has traditionally been justified by a scientific description of what animals are like. It has long been asserted as scientific fact that animals do not have rich emotional lives or complex thoughts; it is therefore, the fallacious logic goes, morally acceptable to use them as raw material to test the potency of our antacids and toilet cleaners. As it turns out, of course, the scientific description has all along been wrong. If morality were guided by logic and reality, it would be a happy day for animals around the world. Unfortunately, logic and morality are rarely woven together into a seamless garment.

On the other hand, a scientifically accurate description can alter our perception of reality, and can thus also alter our moral responses. Martin Hoffman, a psychologist who devoted his life to the study of empathy, believes that the empathic predisposition gains maturity and depth, as well as stability and breadth of scope, through veridical perception and deep discernment (Gibbs 2003, p. 89). In other words, the more cognitively sophisticated our perception of reality, the more deeply and accurately empathic we become. Conversely, research has suggested that empathic understanding leads to enhanced critical and moral reasoning (Gallo 1989). More careful and scientifically accurate description of the lives of animals may lead to increased sensitivity to their needs. If we understand animals to have rich emotional and social lives—to deeply feel many of the same emotions that we do, and to be as connected emotionally with family and friends as we are—it may increase our capacity to empathize with them and feel more "ruth" for the suffering they experience.

If we were to take seriously the capacity for empathy in animals, and use this as a motivation to improve the conditions under which animals live and die in service to us, at least five specific goals might emerge from the empathy research.

1. Paul MacLean, who proposed the triune brain, argued that all mammals have three interdependent requirements for successful development and survival. He called these the family triad of needs: audiovisual communication, nurturing, and play. Failure to provide for any of these three needs will disrupt social and intellectual development. Adequate provision of these three needs should become a baseline requirement for humane housing, care, and use of laboratory and farm animals.

2. An awareness of how empathy functions in animals might suggest specific changes in protocol, in the lab and at the slaughterhouse. Jonathan Balcombe, author of *Pleasurable Kingdom*, notes in a response to Langford's research the phenomenon of "witnessing

effects" which arise out of the capacity for empathy. He cites numerous studies indicating that rats show increased heart rate and blood pressure (both stress responses) when watching other rats being decapitated, and when a paper towel with dried blood from a decapitated rat is placed atop their cage. Witnessing effects have also been documented in mice, monkeys, and of course humans, and are likely to be present in all animals with a capacity for empathy.

Protocols for slaughter, decapitation, or painful procedures should be sensitive to the needs not only of the animal at hand, but also the needs of those animals who are watching.

3. At present, mice and rats are not protected under the Animal Welfare Act. But evidence for empathy in these animals suggests the need to extend protections to these species. Langford's work on mouse empathy confirmed earlier studies on empathy in another rodent: rats. In one study, for example, rats were unwilling to press a lever to receive a food reward if doing so inflicted pain on a rat in a neighboring cage. Like Markowitz's monkeys, the rats were willing to starve themselves to avoid inflicting pain on another rat. The presence of empathy in rats and mice—two of the most common research subjects —should lead to increased protections for these animals.

4. Social animals need to be housed with their family and friends. Isolation is unnatural and causes emotional suffering. On the other hand, housing social animals together makes emotional linkage stronger, makes empathy among the animals stronger, and thus makes separation more painful and increases the seriousness of witnessing effects. In Langford's study, mice showed an increased empathic to response to mice with whom they had shared a cage than to unfamiliar mice. This seems to pose an intractable dilemma about humane treatment in a research or industrial setting.

5. One possible approach to research on empathic animals is to create a sort of moral calculus. We have done something of this sort with sentience, which is loosely understood as a capacity for rich experience (for experience that seems to mirror human-like experience). So, chimpanzees are protected quite carefully, and painful or fatal experiments must be strongly justified by significant potential for useful information. Nematodes are pretty much fair game.

We could apply this same kind of calculus with empathy: the more empathic an animal, the more moral value we accord to it. But this kind of calculative approach to morality has limitations. We already know from past mistakes that science tends to grossly underestimate the emotional and cognitive capacities of animals, so basing moral decisions on current knowledge is a tricky business. Furthermore, how we treat an animal should perhaps not be a measure not of how much empathy they have, but how much *we* have.

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