Special Section: Neuroethics and Animals

Animal Minds and Neuroimaging

Bridging the Gap between Science and Ethics?

TOM BULLER

Abstract: As Colin Allen has argued, discussions between science and ethics about the mentality and moral status of nonhuman animals often stall on account of the fact that the properties that ethics presents as evidence of animal mentality and moral status, namely consciousness and sentience, are not observable "scientifically respectable" properties. In order to further discussion between science and ethics, it seems, therefore, that we need to identify properties that would satisfy both domains.

In this article I examine the mentality and moral status of nonhuman animals from the perspective of neuroethics. By adopting this perspective, we can see how advances in neuroimaging regarding (1) research into the neurobiology of pain, (2) "brain reading," and (3) the minimally conscious state may enable us to identify properties that help bridge the gap between science and ethics, and hence help further the debate about the mentality and moral status of nonhuman animals.

Keywords: animals; neuroimaging; neuroethics; moral status

Introduction

Pet owners, farmers, zookeepers, and many others will tell us that their cats, dogs, guinea pigs, cows, sheep, horses, and more can feel happy and sad, can suffer physical and psychological pain, and even, perhaps, have hopes, fears, and beliefs. For this group of people, it is simply obvious that nonhuman animals, like their human counterparts, can think and feel and, therefore, have moral status.[1] But despite our confidence in the consciousness and sentience of animals, however, not everyone is convinced that many animals have these capacities.

Part of the problem is that those who are skeptical argue that evidence in support of animal sentience is frequently anthropomorphic and not particularly "scientific." It may be true that we can predict and explain the sheepdog's behavior by saying that she wants to get the sheep into the pen, that she believes that approaching from the front is the best approach, and that she is happy to get a reward for the successfully completed task; but perhaps we are mistaken, and the dog thinks and feels none of these things—it just appears as though she does. One way that we might attempt to satisfy the skeptic is by presenting scientific evidence indicating structural and functional similarity between humans and animals. This approach may not be successful, however, for it can always be argued that it is the differences, not the similarities, between human and nonhuman animals that are morally significant; nevertheless, it would seem that if we could present examples to show important similarities in specific contexts, we would have made some progress.

In this article I wish to consider the matter of the mentality and moral status of nonhuman animals from the perspective of neuroethics. I believe that neuroethics can contribute to this topic because the field is located at the intersection of science

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and ethics and is primarily concerned with the ethical implications that follow from neuroscientific accounts of mentality.

The Epistemic Gap

Colin Allen describes the general strategy and likely failure of the search for common ground between scientists and ethicists regarding the moral status of nonhuman animals.[2] According to Allen,

> a common structure of arguments for and against moral status in animals is as follows:
>
> (1) Argue that moral status depends on possession of properties ***M***.
> (2) Assess the scientific evidence that nonhuman animals satisfy ***M***.
> (3) Conclude accordingly for or against moral status for nonhuman animals.[3]

The problem with this structure, Allen argues, is that the types of properties often presented by ethicists in support of the moral status of animals are not the same types of properties that would satisfy scientists. Those arguing in favor of the moral status of animals tend to focus on broad, folk psychological properties that are part of our folk morality, particularly consciousness and sentience; however, as Allen points out and many have argued, there is good reason to think that these properties do not correlate with any discrete neuroscientific state, type, or property and hence are not "scientifically respectable." Rather, the types of properties that matter to scientists are discrete, observable properties that can be studied under appropriate scientific conditions. As Allen puts the matter, "but even those scientists who strongly advocate greater moral status for animals recognize that there are epistemological problems in getting from observations that pass through scientific peer review without raising eyebrows, to mental properties such as consciousness and the like that are considered so important for moral status."[4] If we are to solve some of these epistemological problems and make progress in coming to some agreement about the moral status of nonhuman animals, we need to identify properties that are both scientifically respectable, that is to say, observable, and also morally relevant. In order to do this, we need to move away from looking for the neurological correlates for consciousness and sentience and attempt to find other, more discrete and observable morally relevant properties.

According to a commonly used description of neuroethics, neuroethics is concerned with the ethics of neuroscience and the neuroscience of ethics. In regard to the former, there has been considerable discussion about the implications raised by advances in neuroscience, particularly in regard to neuroimaging. These advances are of significance because they provide a way to study brain function and to see "what is going on" in the brain while the subject performs a particular task. More colloquially and speculatively, these technologies suggest that we might be able to "read" a person's brain, to "see" inside the brain (mind?) of another and determine what the person is thinking or feeling. At first glance it would seem that neuroimaging would also be relevant in regard to the matter of animal mentality and moral status, for if neuroimaging can help us identify, for example, the neural correlates for lying and telling the truth, could it not also help

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us make progress on the question of whether some animals can feel pain or have thoughts?

Identity and Evidence

According to the philosophical position known as solipsism, the only mind that a person can be confident exists is her own. One might hold such a view if one believes that the mind is internal and accessible only immediately and introspectively. Few people are solipsists, and we believe that there are many more minds than our own; nevertheless it seems clear that the evidence that we have for our belief in the existence of "other minds" is fundamentally different and substantially weaker than the reasons that we have for believing in the existence of our own minds. For our belief in the existence of other minds is generally taken to be based on behavior and inference, and these do not apply in our own case. In fact, it seems plausible to contend that my knowledge of my own mind is not based on any evidence at all—it is immediate.

In a recent paper, Martha Farah has argued that neuroscience is uniquely qualified to make progress on the problem of other minds and on the question of animal mentality.[5] One of the main reasons for doubts about animal mentality is that the only evidence that we have to conclude that an animal thinks or feels is the animal's behavior; however, as Farah and many others have argued, the relationship between behavior and mentality is merely "contingent," that is to say, inconclusive. For example, although we would normally regard someone crying "Ow!" to be evidence that he is in pain, it is possible that the person could be acting, or pretending, or simply trying out some new sounds. In other words, behavioral evidence is unreliable because there is no necessary connection between mind and behavior. In contrast, the relationship between mental states and brain states is "noncontingent" according to Farah.[6] Presumably, to say that mental states and brain states are related noncontingently is to say that it is impossible for one to occur without the other. Thus, to use Farah's example, if we know that the perception of pain is noncontingently related to activity in the anterior cingulate cortex (ACC), and we are able to detect through neuroimaging that there is an activity in the ACC of a human or nonhuman animal, then it must follow that the human or nonhuman animal is in pain. Neuroscience is thus uniquely qualified to make progress on resolving the problem of other minds—whether human or animal—because the relevant brain activity is both necessary and sufficient for the presence of the correlative mental activity.

The main support that Farah presents for the contention that mind and brain are related noncontingently is her claim that this is the position of the major contemporary theories of mind as they relate to the mind-body problem. According to Farah, whether one holds that the relationship between mind and brain is one of identity (type or token) or of supervenience, or whether one supports a functionalist theory of mind, one holds the view that the mind "just is" the brain or, at least, the relationship is "stronger than mere causality."[7] There are, however, a number of objections to this claim.[8] Here I wish to identify two specific problems. First, there are important differences among the major contemporary theories of mind cited by Farah—type identity, token identity, functionalism, and supervenience—and these differences relate specifically to the claimed noncontingency between mind and brain. For whereas a type identity theorist might claim that a certain type of

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mental state is identical to a certain type of brain state, a functionalist would deny this, claiming that mental states are identical to (or reducible to) functional rather than physical types. Accordingly, there can be a variety of different physical realizations of the functional type. This means that we cannot legitimately claim that a particular type of mental state is identical to a particular type of brain state, that is to say, we cannot say that the relationship between these types is noncontingent. Furthermore, if, for the sake of argument, one grants that mental states are identical to brain states and the relationship between the two is noncontingent, the basis for this conclusion is metaphysical rather empirical, because empirical investigation cannot reveal what is necessary. This is problematic because it is only through such empirical investigations that we are able to correlate the specific mental and brain states—it is only through empirical neuroscience that we are able to correlate activity in the ACC with the perception of pain.

The second problem with the aforementioned argument relates to the epistemic gap between science and ethics. In order to narrow this gap, we need to identify properties that will be both scientifically respectable and morally relevant. If the previous analysis is correct, we have not made such an identification, even if we grant, for the sake of argument, that the relationship between mental and brain states is noncontingent. For the argument for that conclusion is not itself scientifically respectable but metaphysical and thus is unlikely to satisfy those seeking scientific evidence for the mentality and moral status of animals.

A Neuroethical Perspective

A different approach that we might adopt to help narrow the epistemic gap is to look at this issue from the perspective of neuroethics. Since its emergence a dozen or so years ago, neuroethics has addressed a variety of issues relating to advances in neuroscience to "monitor and manipulate" the brain, and to the legal and moral implications that are raised by neuroscientific explanations of action and behavior. Although neuroethics has had little to say directly about animal mentality and moral status, there are reasons to think that the field might help us narrow the epistemic gap. First, although a fair amount of discussion within the neuroethics field might be regarded as theoretical (speculative) rather than practical, much of the discussion is empirically informed and focused directly on specific examples and types of neuroscientific research. Second, and relatedly, although there has been considerable discussion about the implications of neuroscience on broad, macro-level folk notions like agency and responsibility, discussion has also focused on more specific mental operations that have discrete and observable neurophysical correlates, for example, lie detection, face recognition, and the minimally conscious state.

Neuroimaging and Pain

When one considers the question of the moral status of animals, there is good reason to follow Bentham and think that the fundamental question to ask is whether animals can suffer.[9] This question can be taken as equivalent to asking whether or not animals are sentient; however if the question is understood this way, then we would run into the aforementioned problems described by Allen regarding the lack of scientific respectability of the notion of sentience. A better approach is to frame the question in terms of whether animals can feel pain. An advantage to

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framing the question this way is that in broad terms we tend to think of pain and suffering as intrinsically bad, and hence the fact that a being is in pain, or has the capacity to feel pain, we consider to be morally relevant, other things being equal. Additionally, framing the matter this way in principle provides us with a way of narrowing the epistemic gap between science and ethics. For if we can (1) identify the structural and functional aspects of the brain that underlie pain perception in humans, and (2) identify structural and functional similarities in the brains of animals, then it would seem that we would have identified properties relevant to the moral status of animals that would satisfy both scientists and ethicists.

In "Minding Animals" Adam Shriver presents a detailed account of recent empirical research on pain and offers a strong case in support of the view that some animals can feel pain. In brief, Shriver discusses evidence to show the crucial role of the ACC in pain perception, and he argues that structural and functional similarities between humans and animals place the burden of proof on those who are skeptical of animal pain. As Shriver says,

> all mammals have an ACC and research has suggested that it plays a similar role in other mammals as it does in humans. . . . Thus at least one important theoretical step has been taken to strengthen the argument by analogy for the moral significance of nonhuman animals. Past critics have suggested that mere processing of information and reflexive withdrawal behavior are not enough to prove the conscious experience of pain; research has confirmed their suggestion is right but also indicated that other animals possess both those parts of the pain pathway that can be dissociated from the conscious "minding" of pain and those parts of the brain that appear to be integral to the "minding."[10]

Shriver concludes, "Research on the lateral and medial pain pathways has provided some additional evidence to support the claim that it is reasonable to believe that animals feel pain similar to that categorized as suffering in humans."[11]

As Shriver states, the arguments that he presents and the evidence that he describes may not be persuasive to the "pain skeptic." For arguments from analogy are always vulnerable to the objection that the analogy is not quite close enough, and thus the pain skeptic can claim that the inferences from human to animals regarding the experience of pain are questionable. However, as Shriver suggests, it seems fair to suggest that, as additional evidence is presented of the similarities between human and nonhuman animals in this regard, the burden of proof rests more heavily on the pain skeptic to explain just why this evidence is of little value.

In a number of recent studies, researchers have used neuroimaging to study the functional representation of brain activity to painful or unpleasant stimuli in animals ("animal models").[12,13,14] As Borsook and Becerra write,

> animal imaging of brain systems offers exciting opportunities to better understand the neurobiology of pain and analgesia. Overall functional studies have lagged behind human studies as a result of technical issues including the use of anesthesia. Now that many of these issues have been overcome including the possibility of imaging awake animals, there are new opportunities to study whole brain systems neurobiology of acute and chronic pain as well as analgesic effects on brain systems de novo (using pharmacological MRI) or testing in animal models of pain.[15]

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One of the challenges with the use of animals in these studies is that it is common practice to anesthetize the animal in order to sedate or decrease mobility, for it is important that the animal be immobile in order for the neuroimaging to work. The anesthesia may, however, have an effect on brain activity. As Borsook and Becerra note, "there are marked differences in the BOLD response in awake vs. anesthetized rats. . . . Thus anesthesia may complicate the data sets either because of a diminished signal or as a result of drug-drug interactions on brain systems."[16] Accordingly, there is reason to conduct research on awake (conscious) animals, and techniques have been designed to help conduct the research in a way to minimize stress to the animals.[17]

One can legitimately suppose that there are two main reasons for using nonhuman rather human animals in these research studies: first, the translatability and application of the data to humans and, second, the common belief that for ethical reasons it is better to conduct the research on nonhuman animals. As Mogil points out, there are problems with translation;[18] however, it seems reasonable to believe that the neuroimaging research conducted on animals has the potential to substantially increase our understanding of the neurobiology of pain in humans, and this is because of the structural and functional similarity of the brains of humans and animals regarding pain. Furthermore, the advantage that functional neuroimaging has over prior studies of brain structure is that we can gain some idea of what is going on when the subject is experiencing the painful or noxious stimuli, for if this were not the case, there would be little advantage in using awake as opposed to anesthetized animals.

It seems plausible to contend that advances in neuroimaging are providing us with greater understanding of the neural mechanisms of pain, and they are permitting us to gain some idea of the specific brain activity when the subject is experiencing painful stimuli. These advances will not convince the pain skeptic, for he or she can legitimately argue that neuroimaging provides no further knowledge of the animal's experiences nor evidence to suggest that animals are capable of the type of mental activity believed to be necessary for pain to matter. But these advances do appear to be dependent on the view that animals can experience painful and noxious stimuli and that these experiences are relevantly similar to those of humans.

Lie Detection and Brain Reading

The notion that one can use neuroimaging to determine whether a person is telling the truth or lying depends on the possibility of being able to find specific types of neurophysical correlates for particular types of mental state. If we look at what might be termed the "rhetoric" of brain reading, we can see that it is often described as a "window" into another person's mind—a way to "see inside" the brain, to find out what is "really going on" in the person's head. As Wolpe states, "for the first time, using modern neuroscience techniques, a third-party can bypass the peripheral nervous system—the usual way we communicate information—and gain direct access to the person's thoughts, feelings, intention or knowledge."[19]

As this statement indicates, the rhetoric of brain reading suggests that neuroimaging presents a unique and qualitatively different kind of access to the mind of another person than behavioral evidence does. Customarily we think that behavioral evidence provides us with third-person access to another person's mind, rather

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than the first-person access that only the person herself has. Perhaps we should conclude, therefore, that brain reading through neuroimaging grants us first-person access to another person's mind. This is not how brain reading has been thought of in neuroethics. Although it might be described as providing a window into the mind of another, there is little suggestion that we have adopted the person's subjective point of view, that we would, therefore, know what it is like to be that person under these specific conditions; rather, what is suggested is that we can draw accurate conclusions about the specific type (and perhaps content) of mental activity in which the person is currently engaged from an objective, third-person perspective. Clearly, there are those who argue that the notion that we could read another person's thought by studying her brain is absurd, precisely because such objective, third-person reading leaves out the subjective element; however the point that I wish to emphasize here is that this subjective element and the phenomenal aspect of our mental states plays little or no role within the discussion of brain reading in neuroethics.

Let us now turn to the matter of animal mentality and moral status: many regard the question, "What it is like to be . . . ?" to be important. The sentiment is that if we were able to know what it is like to be a pig or a cow or some other animal, we would be better able to evaluate its welfare. Thus the pain skeptic may be dismissive of the neuroscientific evidence precisely because it does not provide us with this privileged subjective perspective: for all we know, and despite behavioral evidence to the contrary, the cat might think or feel that having its fur brushed is unpleasant. If we apply the framework of neuroethics described previously, however, it would seem that, in principle, one would be able to read the brain of an animal without having to adopt the first-person perspective: we could learn that the animal was in pain or, if we are more fanciful, thinking about hiding bones, from neural evidence alone. In other words, neuroimaging would enable us to determine that an animal was experiencing pain, or feeling anxious or scared, on the basis of the identification of the relevant neural correlates and without having to know what it is like to be that (type of) animal.

The Minimally Conscious State

Another instance of neuroimaging that may have some relevance to the moral status of animals pertains to the detection of brain activity in patients diagnosed as being in a minimally conscious state (MCS). Research by Laureys has revealed cognitive activity in the brains of individuals diagnosed as being in a MCS, activity that is not present in individuals diagnosed as being permanently comatose or vegetative.[20] This research has generated a considerable amount of interest, and one might conjecture that one of the reasons for this interest is that it leads us to reevaluate our prior judgments about the mental lives of minimally conscious patients, and other patients who are comatose or "locked in." Whereas previously we might have concluded that the MCS patient no longer responds to anything that is said to her, we might now conclude that the patient's differential neurological reaction to meaningful as opposed to meaningless sounds constitutes a response.

Another reason why the research has provoked such discussion is because, for many, the difference between vegetative and minimally conscious states matters morally: other things being equal, we believe that we have a greater responsibility to care for the welfare of the MCS patient than for the vegetative patient. This view

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could be defended on the grounds that there is good reason to think that the present and future quality of life of the MCS patient is superior to that of the vegetative patient. If this is correct, then one can see that the neuroimaging data revealing preserved cognitive ability in MCS patients are of considerable importance, for these data are sufficient to accord the patient greater moral status.

The previous conclusion can be applied to animals in the following way. For most people there is little doubt that animals are conscious, if by this we mean that nonhuman beings are aware of their environments and can behave selectively to different situations. Although there may be very good reason to doubt that animals have anything like the sophisticated type of consciousness and self-consciousness typical of humans, even those who doubt that animal pain is morally significant do not generally think that animals are devoid of consciousness, like robots or zombies. A very difficult task is to gain anything like a meaningful idea of the level of consciousness possessed by even one type of animal, for a host of practical and theoretical reasons, but the research indicating preserved cognitive ability in MCS patients suggests another way to approach the matter. For if we believe that the level of cognitive ability preserved in MCS patients matters morally, and if we have good reason to suppose that the level of cognitive ability of many animals is equal to, or greater than, the level of MCS patients, then it seems that the appropriate conclusion to draw is that many animals matter morally.

This conclusion could be rejected as being both too strong and too weak: it is too strong because we have no neuroimaging evidence of the cognitive ability of animals—perhaps it will be revealed that there is far less activity in the brains of chimps than in MCS patients—and it is too weak because there is far stronger evidence, namely behavioral evidence, to already show conclusively that many animals have a high degree of cognitive ability. These are legitimate responses, but they fail to see that the main issue is not the identification of the specific degree of consciousness possessed by animals but rather the identification of a potentially scientifically respectable way to inform our judgments about the mental and moral status of a human or animal.

Conclusion

The main aim of this article has not been to provide further evidence or argument for one or the other side of the debate about the moral status of animals but rather to show how neuroethics might be able to make a contribution to this debate. In the article I have tried to present a number of reasons to think that advances in neuroimaging and a neuroethics perspective can help us identify properties that might help narrow the epistemic gap between science and ethics. Up until now, neuroethics has tended to be very human centered in its focus, and consequently has had little to say about the mentality and moral status of animals. I hope that this article has shown that advances in neuroscience have broader implications than have been previously acknowledged, and that neuroethics can make a significant contribution to existing debates pertaining to animal cognition and animal welfare.

Notes

1. For brevity's sake I refer to human animals as "humans" and nonhuman animals as "animals."
2. Allen C. Ethics and the science of animal minds. *Theoretical Medicine and Bioethics* 2006;27:375–94.
3. See note 2, Allen 2006, at 376.

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4. See note 2, Allen 2006, at 378.
5. Farah M. Neuroethics and the problem of other minds: Implications of neuroscience for the moral status of brain-damaged patients and nonhuman animals. *Neuroethics* 2008;1:14.
6. "Noncontingent" is generally understood to mean "necessary," although Farah prefers the former term.
7. See note 5, Farah 2008, at 14.
8. Fenton A. Neuroscience and the problem of other minds: Why it may not matter so much for neuroethics. *The Monist* 2012;95:464–85.
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10. Shriver A. Minding animals. *Philosophical Psychology* 2006;19:438.
11. See note 10, Shriver 2006, at 440.
12. Chen LM, Dillenburger BC, Wang F, Friedman RM, Avison MJ. High-resolution functional magnetic resonance imaging mapping of noxious heat and tactile activations along the central sulcus in New World monkeys. *Pain* 2011;152:522–32.
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15. Borsook D, Becerra L. CNS animal fMRI in pain and analgesia. *Neuroscience and Behavioral Reviews* 2011;35:1125–43, at 1125.
16. See note 15, Borsook, Becerra 2011, at 1129.
17. Murnane KS, Howell LL. Development of an apparatus and methodology for conducting functional magnetic resonance imaging (fMRI) with pharmacological stimuli in conscious rhesus monkeys. *Journal of Neuroscience Methods* 2010;191:11–20.
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20. Laureys S, Owen A, Schiff N. Brain function in coma, vegetative state, and related disorders. *The Lancet Neurology* 2004;3:537–46.

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