

The scientific study of consciousness cannot, and should not, be morally neutral

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Normative decisions about moral status are strongly coupled with beliefs and assumptions about consciousness. Whether an individual is able to experience their environment, feel pain and pleasure or reflect on their own experiences, have all been judged at some point as relevant to the moral question of whether they should be protected by law. The scientific study of consciousness has advanced our understanding of some of these empirical questions by revealing the capacities and limits of these dimensions of consciousness in different states and animal species. In light of the tight link with moral status, scientific discoveries in this field have direct implications on law and ethics. Furthermore, this link with ethics may place implicit pressure on the scientific community studying consciousness to justify current societal norms, rather than challenge them. Finally, given the important role of consciousness in determining moral standing, the use of non-human animals in the scientific study of consciousness introduces a direct conflict between scientific relevance and ethics – the more scientifically valuable an animal model is for studying consciousness, the more difficult it becomes to ethically justify compromises to its well-being for consciousness research. Here we call for a discussion of the immediate ethical corollaries of the body of knowledge that has been accumulated, and for a more explicit consideration of the role of ideology and ethics in the scientific study of consciousness, including the question of animal models of consciousness.

Moral status and consciousness are coupled

Philosophical and theological writings have long debated which beings deserve moral consideration, and to what extent. Many of these accounts see *moral status*, or the degree to which an entity deserves moral consideration, as dependent on certain mental capacities, and specifically on consciousness, broadly defined here as perceptual, cognitive, and emotional states that are experienced in a particular way by a subject¹. In ancient traditions, moral obligations towards non-human animals often rested on conscious aspects of experience, such as the capacity to suffer. For instance, according to Dhārmic religions, the principle of *ahimsā* (non-violence) is applied to animals based on their capacity to suffer and to experience desire¹, and the moral priority of humans rests on unique characteristics of the human soul². In Greek natural philosophy, the Pythagorean school held that animals were capable of suffering (and were also capable of a degree of rationality), which in turn entailed a moral obligation to minimize animal suffering³. In contrast, Aristotelians, who dominated medieval philosophy, took the limited rationality of animals as evidence that they did not have a mind but only ‘locomotive souls’, and hence had no moral status⁴. This dominant view coexisted with a privileged moral standing for some working animals, such as hunting dogs, which were assumed to have rich mental lives⁵. The tight link between consciousness and moral status was not limited to non-human animals: Aristotle justified slavery by alluding to some non-Greeks as ‘not having reason’ and ‘live by perception alone, like non-human animals’⁶.

In post-medieval Western thought, different philosophical traditions identify different mental capacities as the determining factor for moral status. For Immanuel Kant, it was autonomy⁷. In contrast, utilitarian philosophers identified the origin of moral status in the capacity to experience suffering⁸, or pain and pleasure more generally⁹. More recent debates have presented conflicting views regarding the specific links between consciousness and moral status, identifying cognitive complexity as key in some views, or functional and representational aspects of the mind in others^{10–13}. Nevertheless, there is a common agreement that moral status rests, at least in part, on mental capacities, and specifically those mental capacities that contribute to conscious experience. Further supporting this dependence of ethics on consciousness, the philosophical view that posits that consciousness is merely an illusion has been challenged by philosophers for its potentially dangerous implications for ethics and society^{14,15}.

¹Our focus in this paper is on consciousness as a term used in the scientific literature, in contrast to consciousness as a mental state or capacity. As such, we do not commit to any narrow interpretation and adopt an inclusive definition that encompasses the different uses of this term in the literature.

Due to this tight link between consciousness and ethics, beliefs about the mind often mirror cultural practices and norms. If moral status depends on properties of the mind, differences in moral status between individuals can be justified based on presumed differences in consciousness or subjective experience. For example, French psychologist Ribot described savages as not capable of sustained attention, together with vagabonds, thieves, and prostitutes^{16,17}. More recently, conservative participants attributed reduced mental capacities to gay men and transgender individuals¹⁸. Similarly, white children and adults attributed reduced emotions to black compared to white people, and this was especially the case for emotions that are perceived as ‘uniquely human’¹⁹. People also ascribe lower levels of consciousness to individuals who were pushed to the margins of society: in one study, participants attributed lower levels of intention and cognition to an individual if they learned he had lost his job and could not afford to pay rent and bills²⁰.

These effects are not restricted to the attribution of mental properties to human beings. For example, participants attributed reduced mental properties to lambs and sheep after being reminded that they will later be used as food²¹. Bastian and Loughnan²² proposed that the denial of mind from certain animals resolves the cognitive dissonance between the practice of meat-eating and the belief that animals are sentient beings that are capable of suffering. More generally and related to our focus here, the denial of conscious experience can be used by individuals and societies to justify pre-existing moral attitudes and practices.

Scientific attribution of consciousness

Cognitive science, and more specifically the scientific study of consciousness, is concerned with the study of the mind via behavioral and physiological measurement. Developments in experimental design and neuroimaging methods now bring us closer than ever to a systematic investigation of subjective experience and its neural correlates not only in adult humans, which are capable of reporting their internal states, but also in non-communicating patients, preverbal infants, as well as non-human animals. To date, all non-verbal markers of conscious states, behavioural and neural, that have been identified in humans have also been observed in other animals.

Invasive experiments on corvid birds²³, rodents²⁴, and non-human primates^{25–27} reveal percept-yoked neural activation patterns similar to what is typically interpreted as neural correlates of visual consciousness in humans²⁸. Self-awareness is also observed in other animal species: the capacity to identify one’s reflection in the mirror as ‘self’ was reported in

elephants²⁹, birds³⁰, and arguably also in some fish³¹, among other animals. Other measures are also used to document self-awareness in non-human animals with better experimental control³². Corvids were shown to organize events on a mental time line³³, a sign of mental time travel and the basis for an autobiographical self. Rats were able to monitor the accuracy of their decisions, a capacity that in humans is associated with metacognition and higher-order thinking³⁴. Insects were able to integrate information across different sensory modalities³⁵ and form egocentric representations of the world³⁶.

Inherent to the scientific study of conscious experience is a leap from observable behavior and physiological processes to conjectures about private conscious experiences. While for humans this fact does not undermine drawing associations between subjective conscious states and their measured correlates, with respect to non-human animals this consistently raises the question of “but are they *really* conscious?” Examples include debates about the interpretation of the mirror test³¹, and about the true nature of metacognitive behaviour³⁷ and emotional experiences³⁸ in non-human animals. These debates over the presence of ‘true experience’ are telling. Scientists come with strong priors regarding the presence or absence of consciousness in human and non-human agents, priors that, as we show in the previous section, may be dependent on their moral outlook and lifestyle. This way, beliefs about consciousness interact with ethics in a two-way fashion: they shape ethics, and they are constrained by it.

For example, a scientist may believe that 1) beings are conscious if and only if they can integrate information across different senses, 2) consciousness is a determinant of moral status, and 3) insects deserve no moral consideration. This scientist will need to revise at least some of their beliefs if they learn that bees can integrate information across different senses³⁵ (see Fig. 1 for a general scheme). The scientist may hold to their specific moral intuitions that bees do not possess moral status, and revise their global beliefs about a link between consciousness and moral status. For example, evidence for belief-desire psychology in bees has led philosopher Peter Carruthers to question basic axioms of utilitarian ethics on the grounds that bees cannot possibly be subjects of moral concern³⁹. Alternatively, they may update their ethical norms regarding the treatment of some entities in light of scientific evidence. An example of this second option is the change to the legal status of cephalopods (including octopuses, squids, and cuttlefish) in European law in light of evidence for a capacity to “experience pain, suffering, distress or lasting harm” in these marine creatures⁴⁰. The accumulation of scientific evidence informed a decision to provide cephalopods with the same level of protection as vertebrates in scientific experiments⁴¹. A third option is to question the validity of the theory of consciousness at hand. For example, the scientist may decide that cross-modal sensory integration cannot be a

sufficient condition for consciousness if it is evident in bees. Critically, all three courses of action involve an interaction between ethics and scientific practice.

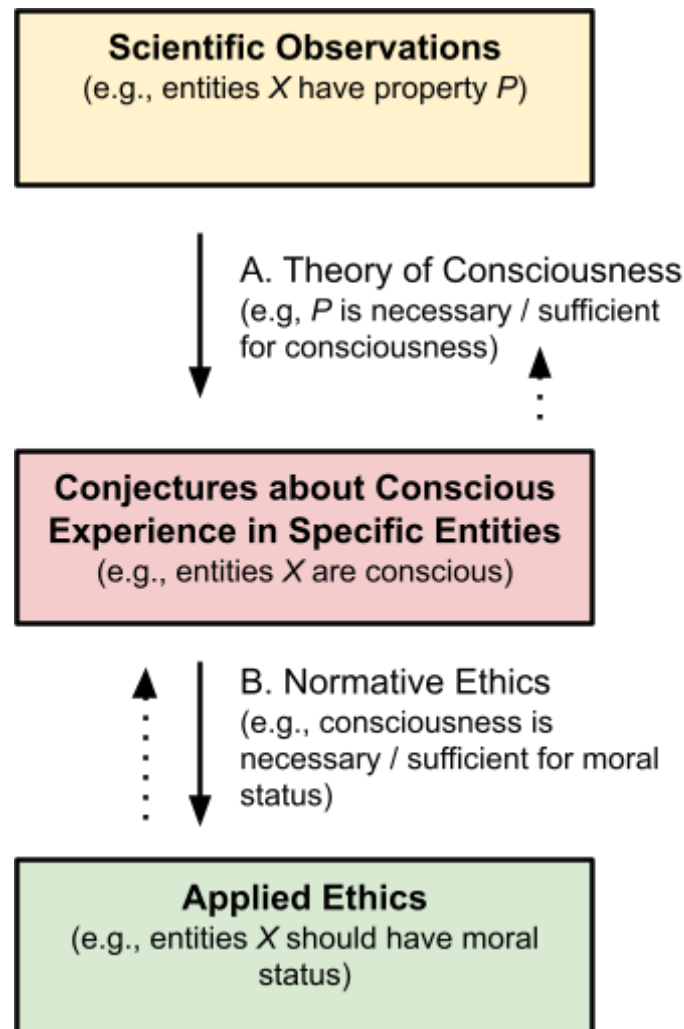


Fig. 1: A schematic description of the link between scientific observations, conjectures about conscious experience, and applied ethics. Scientific observations are translated into conjectures about conscious experience in specific entities via a theory of consciousness. These conjectures then go on to affect applied ethics via general beliefs about the relation between consciousness and ethics. At the same time, applied ethics shapes conjectures about conscious experience: entities that do not hold moral status are less likely to be perceived as conscious. This in turn puts pressure on theories of consciousness to align with current intuitions about the attribution of consciousness to specific entities.

The animal-models-of-consciousness paradox

An instance where the scientific community has failed to acknowledge the intimate link between consciousness and ethics is in the use of animal models of consciousness. Our focus here is on the use of animals that are assumed to be conscious as an opportunity to probe the underlying mechanisms of consciousness in ways that would not be ethically acceptable with human subjects. In such studies, animals are often captive, deprived of basic needs, and undergo invasive procedures. At the same time, for these animals to be appropriate models for the study of consciousness, it has to be assumed that they are conscious. As conscious capacities play a pivotal role in the attribution of moral status to animals, in these experiments scientific validity and moral justification are in direct conflict. This conflict is particularly acute in the study of consciousness and subjective experience: that an animal is an adequate model for the study of consciousness makes it more likely to be capable of suffering, and its life more valuable, much more than being an appropriate model for the study of the immune system does.

In a recent study of the Neural Correlates of Consciousness, researchers contrasted brain activation in awake, sleeping, and anesthetized macaque monkeys⁴². For this study, two monkeys were kept in captivity, implanted with brain electrodes, and were immobilized by sticking rods in a head implant during electrophysiological recordings. In another study from 2021, a behavioral measure of conscious awareness was reported in four caged rhesus monkeys⁴³. Scientists surgically implanted subjects with a metal extension to their skull for the purpose of restraining movement during experimental sessions, and restricted subjects' access to water at testing so that they are motivated to participate in the task for juice droplets. In a study from 2019 on the neural basis of introspection, researchers abolished parts of the prefrontal cortex of six caged macaque monkeys, which were killed at the end of the study⁴⁴. In another study published in *Science* in 2020²³, a neural correlate of sensory consciousness was demonstrated in the brains of two male crows by implanting electrodes in their brains. These are mere examples of typical research practice in the field of invasive electrophysiology, and conform with current ethical guidelines in place at a national level and which are commonplace in many fields of study. Yet, common to these studies is that their scientific relevance rests on the animal being conscious, but at the same time, their ethical justification rests on the animal not deserving the same protection from suffering as a human subject.

Similarly, animal models of psychopathologies induce behaviors that in humans are interpreted as indicating a mental illness or distress. For example, non-human animals show behavioral markers such as passivity and anhedonia when exposed to long periods of social⁴⁵ or

physiological stress⁴⁶, or to stress inducers that cannot be avoided⁴⁷. The ethical justification for such experiments is in their clinical potential for suffering patients. However, for most psychiatric disorders such as major depression, schizophrenia, and post-traumatic stress disorder, conscious suffering is central, defining even, of the disorder⁴⁸. For example, according to the Diagnostic and Statistical Manual of Mental Disorders, a diagnosis of depression depends on the patient having a depressed mood or a loss of interest or pleasure in activities. Without at least one of these experiential symptoms, they should not be diagnosed with depression, even if they walk slowly, lose their appetite, and show signs of tiredness. Do animal models of psychiatric disorders induce the same kind of experiential suffering in non-human animals? An affirmative answer to this question would call into question the morality of such experiments, and a negative answer their scientific validity and clinical utility⁴⁹.

We note that this tension between ethics and scientific relevance in the case of consciousness studies is not resolved by cost-benefit considerations such as “it is better to cause some suffering now in order to prevent a lot of suffering in the future”. Modern societies consider it unacceptable for scientists to confine non-consenting humans and compromise their well-being for science, even if such research may have great promise for future generations by facilitating scientific discovery. One still needs to explain why such cost-benefit considerations can justify suffering in some cases, but not in others. Similarly, speciesist arguments such as “it is acceptable to cause suffering in animals in order to prevent human suffering” beg the question. What is it that makes human suffering more important or bad, and how? Without necessarily taking a stand on this matter, we believe consciousness scientists should acknowledge this tension and address it.

What steps should we take?

As we have shown, the scientific study of consciousness is not ethically neutral in that a) it informs ethical decisions, b) it is particularly susceptible to societal and normative biases, and c) in some cases it introduces a conflict between scientific validity and morality, as in the case of non-human models of consciousness. By this we do not mean to imply that scientists should leave consciousness in the hands of philosophers and theologians. Instead, we believe this link between the study of the mind and ethics should become more explicit in the way the scientific study of consciousness is practiced, and in how it is communicated to non-scientific audiences.

As a first step, the field should prioritize conceptual clarity with respect to the words ‘consciousness’ and ‘awareness’ in scientific writing. We suspect that different scientists mean

vastly different things when claiming that one is conscious or aware, and that these differences further translate to different attitudes toward what consciousness means for ethics. What do we mean when we say of an animal that it is capable of ‘conscious experience’ or ‘visual consciousness’? What do we mean by the definition of a ‘minimally conscious’ patient or by saying that a fetus at some gestational age is ‘aware’ of sounds? Being more explicit about the ethical connotations of the words we use will not only make for a more responsible science, but would also facilitate better communication in this jargon-laden field.

Second, it is essential to have an open scientific discussion about the relation between consciousness and the capacity to suffer, and by that, to ethics. Perhaps surprisingly, current leading scientific theories of consciousness have fairly little to say about the relation between consciousness and suffering. An open discussion would bring to the surface hidden preconceptions and their effect on theorizing and interpretation of finding. For example, a recent theoretical paper introduced a classification of dimensions of animal consciousness, with independent dimensions such as selfhood and the richness of visual experience⁵⁰. According to the authors, creatures can independently vary on each of those dimensions, giving rise to different consciousness profiles. Which of these dimensions matters for ethics is a question not only for ethicists, but also for cognitive scientists.

To facilitate an open discussion, we envision a requirement for research papers that make claims about consciousness, awareness, or introspection in model organisms to include a short statement, explaining 1) the degree to which the choice of the model organism rests on aspects of their conscious awareness, 2) the degree to which the study’s results shed light on whether the animal is indeed conscious (and if so, in what ways), and 3) the way the first two statements interact with the ethics of the methods used. For example, a statement for a study on neural markers of consciousness in crows may read *“We chose crows as our model organism for demonstrating sophisticated perceptual and cognitive behaviors that suggest conscious experiences. Our finding of stimulus-evoked activity in crows increases the likelihood that their visual awareness resembles that of primates. We do not think the presence of conscious experience by itself should matter for moral standing, and for the ethics of keeping such animals in captivity and performing invasive experiments on them. This study would not have been ethically defensible if crows were shown to have self-consciousness or metacognition.”* This hypothetical statement entails a qualitative distinction between perceptual consciousness and other forms of consciousness - an important distinction that should be open to scientific and societal criticism.

Finally, we believe consciousness researchers, also those working with consenting humans only, should take an active role in the ethical discussion about these issues, including the use of animal models for the study of consciousness. Studying consciousness, our field has the responsibility of leading the way on these ethical questions, and making strong definite statements where such statements are justified by empirical findings. Recent examples include discussions of ethical ramifications of neuronal signs of fetal consciousness⁵¹ and a consolidation of evidence for consciousness in vertebrate animals, with a focus on livestock species, ordered by the European Food and Safety Authority⁵². In these cases, the science of consciousness provided empirical evidence to weigh on whether a fetus or a livestock animal is conscious or not. The question of animal models of consciousness is simpler, as the presence of consciousness is a prerequisite for the model to be valid. Here we can skip the difficult question of whether the entity is indeed conscious or not, and directly ask: do we believe that consciousness, or some specific form or dimension of consciousness, entails moral status?

It is useful to remind ourselves that ethics is dynamic: things that were acceptable in the past are no longer acceptable today. A relatively recent change is that to the status of non-human great apes (gorillas, bonobos, chimpanzees, and orangutans), such that research on great apes is completely banned in some countries today, including all European Union member states and New Zealand. In these countries, drilling a hole in the head of a chimpanzee, keeping them in isolation, or restricting their access to drinking water, are forbidden by law. What are the critical differences that make some practices acceptable with respect to some animals, but not others, is a fundamental question of the utmost importance. If consciousness is a determinant of moral status, consciousness researchers have a responsibility in taking an active part in this discussion - either by providing scientific observations to justify current ethical standards or by revising these standards given current scientific knowledge.

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