Concerning Cattle:

Behavioral and Neuroscientific Evidence for Pain, Desire, and Self-Consciousness

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*Abstract*: Should people include beef in their diet? This chapter argues that the answer is “no” by reviewing what is known and not known about the presence in cattle of three psychological traits: pain, desire, and self-consciousness. On the basis of behavioral and neuroanatomical evidence, the chapter argues that cattle are sentient beings who have things they want to do in the proximal future, but they are not self-conscious. The piece rebuts three important objections: that cattle have injury information but not pain; that cattle have goal-directed behavior but not desire; and that the absence of evidence for bovine self-consciousness should not be taken as evidence that cattle lack self-consciousness. In sum, what is known about cattle cognition shifts the moral burden of proof on to the beef eaters.

*Keywords*: pain, desire, self-consciousness, bovine psychology, behavioral evidence, neuroanatomical evidence, cattle, moral burden of proof, beef eaters

Should people in developed countries eat beef under normal conditions, that is, the ordinary circumstances of everyday life when one is not in jeopardy of starvation? I am not concerned here with the morality of killing and eating an animal if a hiker gets lost in the woods and believes she must eat meat to survive, nor of eating the carcasses of roadkill or animals that have died of old age. Nor will I address the morality of consuming animal byproducts such as milk and blood, foods that in principle can be obtained without killing.[[1]](#footnote-1) I mean only to address the issue of whether one should, as a matter of course, consume the flesh of cattle bred and raised for the purpose of being slaughtered. And the answer to that question will turn on the answer to an even more basic one: What is it like, if anything, to be a cow?

What goes on in cattle’s minds, if they have minds? Do they actually experience the bovine contentment we so readily ascribe to them? If cattle can feel pain and pleasure, it will probably be wrong to cause them pain for anything less than a very good reason. However, if they are not sentient, if they are more like robots than like simple-minded children, then we are probably free to serve ourselves. For, if we discount the pollution costs and other environmental side effects of the cattle industry, beef lovers may maximize value when they enjoy steaks and hamburgers.[[2]](#footnote-2) Whether they do may depend upon whether cattle are sentient.

In addition to being sentient, do cattle have conscious desires? If there are things the animals want to do in the future, if they consciously care about satisfying their desires, then it is probably wrong to cut their lives short to get their meat. For even if a cow on pasture is conscious only of wanting to prolong her afternoon of reverie, our ending her life harms her by leaving her desires unsatisfied.[[3]](#footnote-3) On the other hand, if she lacks conscious desires, then we may not be able to harm her in this way. In the case that a cow has no preferences the satisfaction of which we frustrate by killing her, then we may be permitted to raise cattle for meat if we provide humane conditions, pleasant hours of (apparent) bovine “contentment,” followed by swift painless slaughter. So it matters, too, whether cattle turn out to have conscious desires, a future of their own, as it were.

In this essay, I review what is known and not known about cognition in the large domesticated ungulate, Bos taurus, the mammal whose flesh is consumed in the greatest proportions in the United States.[[4]](#footnote-4) I argue that the evidence shows cattle experience pain and desire but not self-consciousness.

Introduction

To answer the question whether we are justified in rearing and consuming cattle requires that we examine factual evidence and normative claims. Start with some facts.

Humans have killed and eaten nonhuman mammals for more than a million years.[[5]](#footnote-5) Apart from the diets prescribed by certain religions (e.g., Jainism, Mahayana Buddhism, some forms of Hinduism), virtually all of the world’s cuisines include red meat as a central element. And, as defenders of meat-eating are quick to point out, Homo sapiens is an omnivore; our teeth evolved to tear into animal flesh and our digestive systems can derive from it essential nutritional ingredients. Historically speaking, billions of humans have killed and eaten multiple billions of other mammals, a trend that shows little sign of abating. In the United States, a typical consumer ingests on average a dozen cows during one’s lifetime. Given the historical prominence and cultural ubiquity of carnivory, the burden of proof has long been on those morally opposed to eating beef.

This brings us to normative claims. Those who oppose cattle slaughter on moral grounds tend to provide either utilitarian or rights-based arguments. Utilitarians, notably Peter Singer, object to the pain and deprivation caused sentient animals by the practices of modern production agriculture.[[6]](#footnote-6) For Singer, the pain caused animals is not justified by the pleasures humans derive from meat-eating. Rights theorists, pre-eminently Tom Regan, reject utilitarianism on the grounds that the theory allows the violation of an animal’s rights if the pleasures humans get from the violation outweigh the animals’ pains. For Regan, we should not accept a theory that allows us to maximize the good of humans on the backs of animals.[[7]](#footnote-7) Regan notes that utilitarians cannot object to the killing and eating of animals if the animals have a pleasant life, a quick painless death, and quickly are replaced with new animals like them. He insists, to the contrary, that it is wrong to kill animals no matter how humanely raised and dispatched. The reason is that their lives have inherent value, value derived from the fact that animals are, like us, subjects of a life. They have conscious memories, goals, desires, interests, families, and purposes of their own. For animal rights theorists, death harms animals. Except in the rare instance when a human must kill an animal to save their own life, it is wrong to kill animals.

Singer’s and Regan’s views have been developed and adapted by themselves and others.[[8]](#footnote-8) Their views have also been the subject of important criticisms.[[9]](#footnote-9) In this essay, I do not assess the strengths and weaknesses of these arguments but take up instead a question critics on all sides must face: Are individuals of any nonhuman mammalian species capable of suffering pain, being subjects of a life, or having self-consciousness?

When they answer this question, utilitarians assume that all mammals are sentient and rights theorists assume that all mammals are subjective creatures and members of social communities. Thinkers in both traditions seem to rely on the following analogical argument to support their views.[[10]](#footnote-10) I know that I feel pain and I am the subject of my life, and I believe that other humans also feel pain and are the subjects of their lives. While I cannot get inside others’ heads or objectively measure their psychological capacities, I witness various kinds of powerful evidence that supports my belief. Behavioral evidence: when others are wounded, their bodies writhe in pain in a way analogous to the way my body writhes in pain. They wince, cry out, and withdraw the injured limb, just as I do. Physiological evidence: when others get scared their eyes get big, they breathe heavily, and they get quiet, just as I do. Anatomical evidence: in school I learn that when children are hugged and kissed, chemicals flood their brains and their neural systems are activated in the same way that my neural system is activated by physical affection. Furthermore, I have no reasons to think that others’ neuroanatomies are relevantly different from mine. By analogy, therefore, if certain kinds of stimuli cause not only physical changes but also specific feelings in me, those same kinds of physical changes caused by the same stimuli in others almost certainly cause the same feelings in others, too.

Utilitarians and rights theorists apply the argument by analogy for the existence of other human minds to other mammalian species. There is behavioral evidence: I see a calf being branded with a hot iron. I know that stimulus would cause me to yell and withdraw in pain and fear, and I see the calf bawling and kicking in evident pain and fear. There is physiological evidence: the same sort of odors from burning hair and the appearance of red, inflamed tissue at the injury site in cattle and humans. In addition, there is anatomical evidence: nociceptors in the skin and neural pathways to pain centers in the brain are active in both humans and cattle. So, argue animal defenders, we have strong reasons to think calves actually are in pain when their behavioral repertoire shows pain. The similarities in physiology and neuroanatomy between the human and the calf is simply too great to think otherwise. So goes the analogical argument.[[11]](#footnote-11)

What are the ethical implications of the analogical argument? That depends on whether one is a utilitarian or rights theorist. For utilitarians, if cattle feel pain (and pleasure) their experiences detract (and add) value to the world, and so their experiences must be taken into account in all calculations of utility. However, if cattle are not sentient—in spite of all appearances—their lives will have no traction with utilitarians. For rights theorists, if cattle have sentience and prospective beliefs and conscious desires—interests they want to satisfy as ongoing subjects of a life—their rights to life and liberty must be protected. However, if cattle lack interests and do not have things they want to do, perhaps because they lack language or a theory of mind or self-consciousness, then they lack the psychological capacities arguably necessary to have rights. In that case, animal rights theorists would be wrong to assert, as they do, that a cow has a right to life equal to a human’s right to life.

Let me insert a parenthetical remark here in the interest of clarity. While some animal rights theorists, such as Tom Regan, insist that an animal’s right to x is equal in strength to a human right to x, they typically do not claim that animals have the same rights as humans. If Kylee has a right to life, for example, she has a negative right against others that they not kill her as a means to their ends. The scope and strength of this right is the same, at least in Regan’s view, whether the rights holder is a calf or a toddler. However, having a right to life does not imply that one has other rights, such as the right to own property or to vote. One can have a right to life without having any other rights. Furthermore, Regan is clear that in cases when we must choose between honoring an ordinary human’s or an ordinary mammal’s right to life, we ought, all else equal, to honor the human’s right because the harm that death is to an ordinary healthy human is incomparably worse than the harm death is to an ordinary healthy animal.

In sum, the question of animal cognition is central to food ethics because the strongest moral arguments against including beef in one’s diet—setting aside, again, arguments based on environmental considerations—depend crucially on empirical claims about animal psychology.[[12]](#footnote-12) This concludes our brief survey of some of the central normative issues relevant to moral vegetarianism. I turn now to the three psychological properties most commonly invoked to attack or defend the morality of slaughtering cattle: pain, desire, and self-consciousness.

Pain

In this section, I argue that cattle are sentient. In the first section, I survey the behavioral evidence for thinking that cattle have pleasant and unpleasant phenomenally conscious experiences. In the second section, I describe an important objection, that cattle might have pain information without the actual feelings of pain. In the third section, I rebut this objection by showing that cattle have the same neuroanatomical network that processes the emotions of pain as we do. I conclude that the analogical argument for thinking that cattle feel pain in much the way we do is as strong as philosophical arguments tend to get.

*Behavioral Evidence for Pain*

It is not easy to get a rancher, veterinarian, or a scientist who works with cattle to say the animals cannot feel pain.[[13]](#footnote-13) The reason for the overwhelming convergence of opinion has to do with the strength of an argument from analogy. When cattle are hurt, the animals act in the same way we act when we are hurt. It seems contrary to common sense to say the cows are merely acting as if they are in pain. But what does it mean to be in pain?

According to one widely accepted account, human pain is an emotional response to noxious stimuli. When our sensory receptors and nervous systems are disturbed, a negative response ensues. This response inevitably includes a feeling. Pain hurts. Indeed, we might wonder what someone means if they refer to pain that does not hurt. The feeling of pain can go away, and sometimes analgesics and anesthetics can relieve it. When we cut a finger or get a headache, our normal activities are interrupted, we grimace, focus on the injury, and try to protect it from further damage. When pain is caused by a physical insult, nociceptors in the skin transmit rapid danger signals up through the central nervous system to the hypothalamic-pituitary-adrenocortical axis, a part of the brain activated by stress.[[14]](#footnote-14) This axis works in concert with higher brain regions, notably the dorsolateral prefrontal cortex (DLPFC) and anterior cingulate cortex (ACC), to generate pain-control responses that are sent back down to one’s muscles through the spinal cord.[[15]](#footnote-15)

Cows exhibit pain behaviors. Month-old calves bawl when separated from their mothers, kick at cowboys trying to brand them, and lick injured areas after being castrated. Incisions become inflamed, plasma cortisol concentrations increase, and heart rates accelerate.[[16]](#footnote-16) Cattle subjected to noxious stimuli try to avoid those stimuli in the future, just as humans do. Cattle in pain eat less, engage in fewer social interactions, blast distress calls, just as humans do. Their respiratory and immune systems respond with quickened breathing, cardiovascular change, inflammation, and release of cortisol, just as in humans. Is there, then, any reason to doubt that cattle are sentient?

Ranchers, veterinarians, and animal scientists, as I say, have no doubts. As the Colorado State University animal science professor Temple Grandin asserts, vocalizations in a slaughterhouse are expressions of real distress. As a reason for her claim, she notes that animals make these sounds after aversive events, “such as electric prodding, slipping on the stunning box floor, missed captive bolt stuns, or excessive pressure exerted on the animal’s body by a restraining device powered by pneumatic cylinders.”[[17]](#footnote-17) Expert observers, such as Grandin, know pain when they see it. So confident are they in their ability to recognize distress that they have developed objective assessments to grade it. To communicate a steer’s pain after castration, experts devised a four-point scale: 0, for no signs of pain; 1, for flinching; 2, for kicking with the rear legs; and 3, for defensive struggling motions of the whole body. Seeing calves in pain that exceeds a 3 rating, trained assessors have quickly decided to end experiments ahead of time.[[18]](#footnote-18) For example, castration is usually accomplished with a single conventional ring. However, when an experimenter began placing three rings on calves, the animals displayed such agony that the protocol was stopped immediately on humane grounds.[[19]](#footnote-19) The observers did not have to debate whether the calves were in “real” pain.

Experts skilled in evaluating cattle health apparently have no difficulty seeing an animal’s pain.[[20]](#footnote-20) Nevertheless, experts can be fooled, and we must consider that possibility in this case.

*Objection: Cattle Have Injury Information but Not Pain, and So the Behavioral Evidence Is Inconclusive*

The behavioral evidence, as strong as it is, does not prove that cattle are feeling pain any more than your behavior would prove that you are in pain. For I could misinterpret your actions as genuine suffering when you are actually feigning pain, and observers could be seeing an animal react to information about noxious stimuli even as the animal is paying those stimuli no mind. Across the animal kingdom, entire phyla of species engage in pain-like motions but do not, as far as we know, feel anything. Descartes—or at least some of Descartes’s followers—famously held that since nonhuman animals lack language, they cannot feel pain, either.[[21]](#footnote-21) Without buying into the general Cartesian skepticism about mammals, we must acknowledge that in many species withdrawal movements are initiated by simple systems of ganglia, systems that almost certainly do not give rise to pain. For example, Gary Varner describes decapitated cockroaches that withdraw their limbs when suspended above an electrified saline bath.[[22]](#footnote-22) There is little sense in attributing pain to headless arthropods because the emotional component of pain only arises after bottom-up neural signals are processed by top-down brain centers. The higher centers include those noted above, the DLPFC and ACC. If a decapitated roach retained these or analogous structures in their bodies, say in their thoraxes, there might be some reason to wonder whether the headless roach felt pain. However, as invertebrates lack the so-called higher centers even with their heads intact, there is little anatomical basis to attribute sentiency to roaches. Perhaps all nonhuman animals have “pain” experiences that are, for all purposes of moral evaluation, essentially nonconscious.[[23]](#footnote-23) On this view, cattle would be in the curious position of exhibiting pain behaviors without ever actually being in the kind of pain that matters. One might be persuaded to think of cattle pain behaviors as false indicators if cattle lacked the higher parts of the brain responsible for signaling pain back downstream to the muscles. In that case, a calf’s bawling when branded with a hot iron would not indicate a feeling anything like what we would feel were we branded with a hot iron. But is this a plausible picture? To answer the question it will help to understand how humans process pain and to compare the results with what happens in calves.[[24]](#footnote-24)

*Response: Cattle Have Neuroanatomical Structures for Pain*

After an injury to our toe, pain signals are sent from nociceptors in the skin through ascending pathways to the spinal cord and, again, up into the cortex. It is important that the cortex is involved, and we know that it is involved for two reasons. First, functional magnetic resonance studies show increased cortical activation when subjects report being in pain. Second, clinical studies show that pain can be reduced by lesions to relevant cortical areas.[[25]](#footnote-25)

Neurally, humans have two distinct pain pathways. The first, so-called lateral, pain pathway rises through the spinothalamic tract to the periaqueductal grey matter (PAG), thalamus, and the caudal part of the parieto-insular cortex. The lateral pathway provides us with information about the injury, telling us where the damage is (e.g., the big toe) and how severe (e.g., on a scale from 1 to 10).[[26]](#footnote-26) Activation of this pathway can produce involuntary groans of misery without, as we shall see, causing the subject to report being in pain.

The second medial, pathway provides the emotional component of pain. It circumvents the PAG and connects to the brainstem reticular formation, amygdala, and cerebellum, before continuing on to the thalamus and up to the DLPFC and ACC. Activation of these structures supports the unpleasant feeling, the “ouchiness” of pain.[[27]](#footnote-27) Scientists think part of the explanation for this fact is that the medial pathway has more opiate receptors than the lateral pathway.[[28]](#footnote-28) In any case, the two pathways explain the existence of an odd phenomenon, “asymbolic” pain. On occasion, persons suffering wounds report that they think they should be in pain because they know they are hurt but, curiously, they are not in pain. In asymbolic pain, the parieto-insular cortex is actively receiving injury information but the DLPFC and ACC are dormant. While we do not fully understand the syndrome, it may be that lesions to these patients’ higher brain structures interfere either with upstream activation of the DLPFC or ACC activation by the limbic system, or disrupt downstream signals from the sensory cortices to the muscles.

It is worth examining asymbolic pain in more detail because it bears on the skeptical argument that a calf’s bawling might show that the animal has information about an injury without having any actual pain. The first reported case of asymbolic pain was a patient who had received lesions to her posterior insula. She showed no signs of withdrawal from or emotional response to stimuli that would throw most of us into agony. By her own report, she claimed to be in pain but did not mind it.[[29]](#footnote-29) How should we understand this woman’s mental condition, a condition of which there are now many reported instances? The explanation comes from seeing that the lateral and medial pathways are dissociable. The lateral pathway only tells us where and how severe is the damage. Absent the contributions of the medial pathway, the information does not hurt; it is not accompanied by unpleasant movements or aversive responses. The independence of these two structures makes it possible for patients to report unpleasant sensations emanating from the point of damage while insisting that they feel no need to do anything about it. Further evidence for this theory is found in the fact that morphine works on the medial pathway by blocking its multiple opiate receptors but it does not affect the lateral pathway with its meager number of opiate receptors.[[30]](#footnote-30)

Could all cattle pain be asymbolic? Certainly, especially if it turns out that cattle have the lateral pathway without the medial pathway. Or if, less plausibly, cattle have both pathways, but somehow the medial pathway never came online in evolutionary history. Or, even less plausibly, if the medial pathway came online in evolutionary history but then was rendered inoperable in all cattle, perhaps as a side effect of selective breeding. If any of these conditions obtained, cattle would receive injury information but not experience the accompanying objectionable feelings.[[31]](#footnote-31) Under these assumptions, questionable as they may be on scientific grounds, the following conclusion is possible. Cattle can react to pain information by withdrawing the injured area and wincing or engaging in typical pain behaviors—cattle can look to trained observers as if they are in pain—without ever having the negative feelings of pain.

This account of cattle psychology is increasingly untenable, for we now know that cattle have all of the physiological parts, chemical functions, and neural connections necessary to support pain. In cattle, as in humans, nociceptors respond to injuries by generating chemical signals that are relayed through a central nervous system upward to the thalamus and on to the parieto-insular cortex. In cattle, as in humans, the insula is tucked beneath the temporal and frontal lobes bilaterally, a location that creates the so-called sylvian fissure in each species.[[32]](#footnote-32) The functional role of these structures in cattle, as in humans, is affected by analgesics. Pain in all tested mammalian species is reduced by lesions to the animal’s parieto-insular cortex, just as it is in humans.[[33]](#footnote-33) While such studies have not been conducted on cattle, there is little reason to believe that lesioning the relevant regions in these animals would not reduce their pain.[[34]](#footnote-34) Furthermore, in cattle, as in humans, the medial pathway ends in the prefrontal cortex, which performs executive functions necessary to focus attention on the pain and initiate motor actions to try to inhibit it.[[35]](#footnote-35)

The modern synthesis of evolutionary biology and genetics seems to have settled the matter of the homology of pain in humans and other mammals.[[36]](#footnote-36) At the end of the nineteenth century, at least one comparative anatomist was already wondering why we should deny that homologous structures between cattle and humans do not have analogous functions in both species.[[37]](#footnote-37) Now, at the beginning of the twenty-first century, the burden of proof is on those who would treat cattle as if their expressions of pain are mere pretense.

An objective review of cattle behavior and neuroanatomy makes it nigh impossible to believe the deflationary account of cattle pain.[[38]](#footnote-38) Indeed, whereas some neo-Cartesians argue that animals lack language because they lack concepts and the animals lacking language must also lack morally relevant interests,[[39]](#footnote-39) none of them think these alleged facts render the animals insensate. And, on virtually every ethical theory, it is wrong to cause an innocent creature pain unnecessarily simply because pain is a bad thing. Since cows are sentient and since causing pain for no good reason is wrong, slaughtering cows for meat would be permissible only if they were raised and killed with no unnecessary pain. This, argue utilitarians such as Singer, is practically impossible under conditions of modern industrial agriculture. Therefore, we should not eat beef.

The question of cattle pain is central to utilitarian arguments. However, utilitarians cannot object to the raising and killing of cattle painlessly so long as each animal is replaced with another one like it. Rights theorists, on the other hand, object to painless killing and replacement by arguing that cattle consciously want to do things, have intrinsic value and, for this reason, it is seriously wrong to kill them. For killing a cow deprives her of the ability to satisfy desires she might otherwise have satisfied. Or so goes a version of the animal rights argument, an argument that appeals not to cows’ feelings but rather to their conscious desires as subjects of a life.

Desire

*Behavioral Evidence for Desire*

But are cattle subjects of a life with conscious desires? On one account, conscious desires are conations of which one is potentially aware, urges that I feel, preferences on which I can concentrate my attention. Conations are desires, mental states in which I look forward in time, anticipate what is to come, and try to organize my future activities so that coming events will go my way. We may call this sort of future an autobiographical future because it looks forward in time to events that are desirable to me in part because of my past decisions. I want to write an article because the circumstances of my life have shaped me into the kind of character who enjoys publishing and publishing brings money that I can set aside for retirement in order to take leisurely walks on the beach with my granddaughter. Such “egoistic” desires are part of my autobiographical future because I desire them, care about them, and initiate actions to bring them into being. There are other events in my future. Someday I suppose I will lose all my hair. However, that event, like my death, is not part of my autobiographical future because I do not desire it and will not initiate actions to bring it about.

Do cattle have conscious desires? Conscious desires are conations about one’s autobiographical future. They require that one be able to foresee future possible states, have preferences about which states they wish to try to bring about, and form hypotheses about how best to maximize the chances of achieving the goal. Conscious desires require that one be able rationally to form and choose among hypotheses and to change strategies midstream when the hypothesis one has chosen is not working. This kind of activity demonstrates practical rationality because when one acts on one’s first hypothesis only to find that this hypothesis is not going to succeed in reaching the goal, it is practical rationality that allows one to abandon the first strategy and switch to another. According to one common view, having egoistic ends, multiple strategies for trying to achieve them, and means-ends practical reasoning gives one a special moral status, including a basic right to life. However, this claim requires further argument.

On one of the most compelling accounts of moral rights, rights are tied to preference interests. To have a right to X you must have a valid preference interest in X. To have a right to a sum of money as your inheritance, for example, you must have a valid interest in that sum of money. There are various ways to establish such an interest, for example, by showing us your mother’s will in which she gives you the money. So, a valid preference interest in an inheritance may come along for free with the fact that you are the offspring of the person who left you the money. But neither my cat nor I have a right to your inheritance unless I can prove that I (or my cat) has some valid interest in it.

To have a right to life therefore requires that one be able to take an interest in things in one’s future. One displays such a preference interest, or conscious desire, when one strives to adjust one’s behavior in light of new knowledge. Using working memory, a consciously desiring individual can revise their beliefs about which of several hypotheses is most likely to help them reach their goal and, in light of past failures and novel circumstances, change hypotheses to maximize the chances of attaining the end.

One way to test for preference interests is called the reversal learning task. Here, subjects form hypotheses about which action will get them what they want, they assess their options with an eye on past performance, and adjust their actions in response to the consequences of prior actions. When five year-olds, for example, first learn that choosing a green cup over a red cup will bring a reward, they must not only learn the correct pattern (green = reward and red = no reward). They must further figure out how to fix errors they make in discriminating between various shades of green cups (correct) and shades of red (incorrect). “Reversal” occurs in a subsequent trial when the green cup is no longer rewarded and children must learn to choose the red cup. If they change their behavior, they demonstrate the mental flexibility needed to be conscious of their desires. They have preference interests.

Do cattle have preference interests? Everyday observation of the animals suggests a positive answer, and many controlled experiments confirm it. In one, for example, Holstein-Friesian calves had to choose between a small bucket with a feed reward and a large bucket without feed. The speed at which they learned to choose the small bucket varied, but all learned to pass the initial discrimination test within two to five days. When the buckets were replaced with black and white plastic containers and the reward was associated with “white container” rather than “small bucket,” the calves were able to learn the new correct answer more quickly than on the first trial.[[40]](#footnote-40) In another experiment, Japanese Black cows learned in one day that a plastic washtub contained the feed reward, and they retained this knowledge for up to a year without reinforcement.[[41]](#footnote-41) In another experiment, fifteen five-day-old Holstein calves were presented with either a red or a white screen. If the animal touched the screen when the right color, say, white, was presented (a “go” response), they received a reward (milk). If they touched the screen when the wrong color (red) was presented, they heard a loud noise and received a timeout punishment lasting one minute. During the first teaching session, each animal would see twenty positive stimuli and two negative stimuli. The calves successfully learned to respond appropriately to the screens. Subsequent trials increased the difficulty of the task by presenting four positive and six negative stimuli. Of the eight calves raised socially, that is, with other calves and cows, seven animals were able to learn the correct responses after the stimuli were reversed and red was changed from the “stop” to the “go” color. However, only one of the seven calves reared without social contact was able to master reversal learning.[[42]](#footnote-42) I will return to this point shortly.

In another study, fifteen--month-old heifers and cows with two calves were presented with two feeders placed at opposite sides of an experimental area. Only the left feeder contained food pellets, and animals were allowed only to approach one of the two feeders. After five days of ten-minute trials conducted twice a day, 95% of the heifers had learned to select the left feeder, and 54% of the cows were making the correct choices. (As the data suggest, younger animals outperform older animals on learning, but the older animals, as we shall see, have better long-term memory.) Similar results were obtained for reversal learning. When food was moved to the right bunker, 85% of the heifers were able to figure out the new location while only 31% of the cows were able to do so. However, six weeks later the experiment was repeated with somewhat surprising results. After more than a month of not being exposed to the experimental area, 77% of the cows remembered to select the left feeder, whereas only 46% of the calves remembered. As mentioned, calves are better at short-term learning while heifers outperform them on long-term memory.[[43]](#footnote-43) In both cases, however, the preference interests of cattle reach at least a few minutes into the future. The animals have goals that involve acting on hypotheses that will require several dozen seconds to complete. The animals see a reward at time t1, let us say. They are conscious of the fact that they cannot achieve the reward now but must initiate some action in order to achieve it at some future moment, time t3, let us say. Next, they hypothesize that if they move their bodies in this rather than that direction, they will achieve their goal, get what they want, and wind up in front of the correct feeder, at time t3. So they decide now—at time t2—to act on the hypothesis. That their desire is conscious is shown by the fact that they deliberate about the means necessary to achieve their end.

If cattle have egoistic interests the satisfaction of which requires deliberation about and the planning of one’s actions for the next few dozen seconds, how far into the past might bovine memories extend? In one study, six heifers were trained to search for grain in mazes. After they had learned where the grain was stored, they were given three trials to see whether they could remember where the grain was cached. The animals could remember the information for up to eight hours after the trial. Performance declined dramatically after twelve hours.[[44]](#footnote-44)

Hold on, someone may object. The egoistic interests of persons extend years, even decades into the future. That is one reason, perhaps the main reason, that it is wrong to kill people, because there is so much value in their futures. To deprive me of my future removes a vast amount of good from the world, and, given the nuanced and sensitive nature of a typical adult’s life, the good lost when an adult dies prematurely is deep, long-lasting, and complex.[[45]](#footnote-45) On the other hand, the egoistic interests of cattle are by comparison shallow, short-lived, and simple. The good lost when a cow is killed is not nuanced, complex, or significant. The conations of cattle have meager temporal extensions, reaching only a short distance into the future. A cow sees greener grass on the other side of the pasture, encounters a hedge trying to get to it, and figures out a way around it. She eats. End of story. Cattle, the critic might concede, can think about their own future—there is a good meal in it if only I can get to it—but this future is so immediate that the plans made to achieve it are easily replicable in “replacement” animals. When a twenty-three-year-old woman makes plans to retire at forty-five, the hypotheses, decisions, and resolutions required for her to achieve her goal make her life immensely valuable because the plans she has made are nuanced, sophisticated and unique to her. It would be impossible to replicable them in a “replacement” twenty-three year old woman. By comparison, the cow’s short future involves comparatively simple, common plans that very likely could be recreated were a similar cow brought into existence. The difference in the quality of human and bovine lives, continues the critic, makes it possible to replace the cow after it is slaughtered.

The response to this objection is known as the overlapping species argument; some humans only have short-term, simple, common egoistic interests and, in this limited way, their lives are cow-like. Nonetheless, it is seriously wrong to kill simple-minded humans even if we could replace them. Consider Brooke Greenberg, the severely congenitally cognitively limited twenty-year-old woman, whose temporal horizon extended no further than a few seconds into the future.[[46]](#footnote-46) Even though her egoistic interests were no more sophisticated than those of cattle, we would not countenance the thought that we were free to kill her because her temporal horizons were brief and she was “replaceable.” According to the principle that we should respond to similar cases in similar ways, we should no more embrace the killing of cattle than we should approve the killing of Ms. Greenberg.

But how do we know that cattle are conscious of their short-term conations? How do we know they are aware of their desires for more succulent grass or less cloudy water? Challenges arise here on two fronts, empirical and philosophical. The empirical challenge is that desire in humans depends crucially on certain brain structures, so we will want to know whether cattle have these structures. Second, to have conscious desires one must have beliefs about how to attain those desires. Toddlers have unconscious desires, but they do not think about how to go about satisfying them; they act without thinking.[[47]](#footnote-47) The child has concepts, mental representations of, for example, the spoon it desires to grab, but it cannot consciously desire to grab the spoon until it has the building blocks of language—words, grammatical constructions, and proto-propositions—necessary to be aware of its beliefs.

Do cattle have these linguistic building blocks, the internal words and proto-propositions necessary to have conscious desires? The objection here is not that cattle cannot talk, but rather that cattle do not have sufficiently developed linguistic resources to have conscious desires.

*Objection: Cattle Have Goal-Directed Behavior but Not Conscious Desire, and So the Behavioral Evidence Is Inconclusive*

A skeptic may not be convinced a cow is aware of anything when it rejects the sour-tasting weed and turns to enjoy sweeter grass. They might hold, rather, that the animal is simply processing information about its body position, the olfactory and gustatory features of what is being ingested, and the direction of its eyes in relation to its goal. One need not deny that animals are capable of reversal learning to hold that animals lacking language perform movements in the same unfeeling way as robots. The view I have in mind denies that cows experience the discomfort of an overfull udder in anything like the way a human mother experiences discomfort from an overfull breast. The mistake, continues the objector, is one of confusing information and awareness.

I will refer to this as the AIBO robot objection, taking the name from a mechanical dog manufactured by Sony beginning in 1999. After selling some 150,000 units, Sony admitted after fifteen years of sales that the useful life of the machines was over, and Sony stopped repairing them in March 2014.[[48]](#footnote-48) Meanwhile, owners had come to think of the dogs as real pets, with some adults thinking of the machines as their children. When the robots broke, owners mourned profoundly, as if they had lost family members. Bungen Oi, a Kofuku-hi temple priest, conducted memorial services for the robots. More than a dozen owners attended.[[49]](#footnote-49)

Now, if we know anything, it is that no AIBO had conations, despite what owners may have imagined. None of the machines wanted to get anything; none felt affection for their owners; none were conscious of what they wanted to happen in the next few dozen seconds. Information, no doubt, entered the AIBO’s central processing unit, but not through nociceptors, central nervous systems, prefrontal cortices, or medial or lateral pathways.

Is a calf like an AIBO? Does it engage in movements so sophisticated that humans close to it are fooled into thinking, mistakenly, that the calf cares about its short-term future? Skeptics who think cattle are not desiring creatures may cite two sources for their doubts. Let us examine these two objections in turn.

First, skeptics may object on empirical grounds that cattle lack the higher brain structures and connections necessary for consciousness. The structures in question support the top-down executive functions humans use consciously to process their desires. When we are thinking about how to get what we want from other people we take their perspective, simulate how they are thinking, and draw on our memories to plan our futures. This kind of cognitive work is focused on internal events in our psychology as opposed to external events in our environment, and it is supported by the same anatomical features that are active when we are resting. This is an intricate and complex set of interconnections, the so-called default mode brain network,[[50]](#footnote-50) radiating from the midline of the frontal and parietal cortices out to lateral areas of the parietal and temporal lobes. If cattle lack the hardwiring that humans use for consciousness, says the critic, we should not be surprised when we fail to observe cattle exhibiting the behaviors these structures support in humans.

The skeptic might also argue that cattle lack the kinds of neurons necessary for consciousness. According to one author, Von Economo Neurons (VENs), the so-called spindle neurons, make us uniquely human. Moreover, as recently as 2005, we were being informed that VENs are not found in cattle, “not observed in any . . . other mammalian taxa, and their volume was correlated with brain volume residuals, a measure of encephalization [intelligence].”[[51]](#footnote-51) If an animal’s brain must have VENs to have consciousness, and if cattle lack VENs, then cattle must lack conscious desires.

Second, skeptics may object on philosophical grounds that cattle lack conscious desires because they lack language. The argument goes like this. To have conscious desires one must have propositional attitudes, for being conscious of one’s desire for sweeter grass, say, requires that one be able to think, “I think I need to move across the pasture in order to find the more desirable patches.” To have propositional attitudes, one must have grammar; and to have grammar, one must have words. But cattle, lacking words and grammar, cannot form the thoughts, much less sentences, necessary to refer to themselves as “I.” Yes, they can vocalize a mental state that means “want sweeter grass,” but they are not conscious of the meaning of this vocalization. They cannot have the urge to vocalize the desire and decide, for example, not to vocalize it. Without the requisite linguistic resources, animals may engage in sophisticated movements that look like the expression of desires, but the appearance will be all illusion. Like AIBO, these animals do not consciously feel anything. Rather, their call expressions are always reliably evoked by the specific contexts. If they had language, they would be able to express beliefs and desires independently of the environmental context that causes them. So cattle vocalizations are not words and, without words, cattle cannot have propositional attitudes—or conscious desires. Or so goes this particular skeptical argument.

I turn now to my answers to these two objections.

*Response: Cattle Have Neuroanatomical Structures for Conscious Desire, and So the Behavioral Evidence Is Supported by the Anatomical Evidence*

There is little reason to believe either of the skeptics’ arguments.

First, propositional attitudes are not necessary for conscious desires if children and neurally diverse adults who lack propositional attitudes have conscious desires, as they do. There is little doubt that toddlers and the radically congenitally cognitively limited consciously want to get things. We need not have a sophisticated cognitive or linguistic superstructure to have conations because even the radically cognitively limited can picture themselves a few minutes into the future getting what they seek.[[52]](#footnote-52) Since humans do not have to have propositional attitudes to have conscious desires, the fact that cattle lack propositional attitudes is no bar to their having conscious desires.

Second, cattle have the parts of the prefrontal cortex—the oribitofrontal, insula, and anterior cingulate cortice—that sponsor feelings of desire, pleasure, and reward in humans. They have the relevant parts of the mesocorticolimbic system, centering on the amygdala, nucleus accumbens, and ventral pallidum.[[53]](#footnote-53) Just as it does in humans, the central nucleus of the amygdala in cattle supports the critical transition from states of knowledge (e.g., the heifer who knows through Pavlovian conditioning that the reward button is the button on the left) to states of action (e.g., the heifer searches for the button on the left).[[54]](#footnote-54) Finally, in 2015, VENs were observed not only in cattle crown gyri but “ubiquitously distributed throughout the frontopolar cortex.”[[55]](#footnote-55)

To come to function properly in humans, the structures and networks just mentioned must be exercised in social contexts starting at a young age. This is also true of cows. Like a child raised without social contact, a veal calf tethered in a solitary crate exhibits less behavioral flexibility than one housed with conspecifics. The solitary calf’s inability to adapt to novel environmental challenges is correlated with, if not caused by, its inability to learn to play with other calves. Without social stimulation, the calf does not develop the intricate cortical connections characteristic of the PFC of socially raised animals.[[56]](#footnote-56)

In sum, a review of the available empirical evidence supports the claim that cattle have emotions, conscious desires, and egoistic plans for the short-term future. If so, cattle are subjects-of-a-life.

We have reviewed pain and desire, two of the three bovine psychological capacities invoked by those opposed to beef eating. I turn now to a third capacity.

Self-Consciousness

Some argue animals cannot have a right to life because they lack self-consciousness. This view cannot be correct, however, if younger children and elderly patients with dementia who lack self-consciousness have a right to life, as they do. That said, and in the interest of having a full picture of bovine consciousness, we may still wonder whether cattle are aware of themselves.

To be conscious of oneself is to think about oneself as a character in a story, a temporal being with a past, present, and future. It is to have what Varner calls a biographical sense of self, to understand as a narrative the actions and consequences one initiates.[[57]](#footnote-57) To understand one’s life as a narrative is to understand events unfolding in time as a plot in which various characters feel various emotions. To have an understanding of narrative, one must understand sentences. To understand sentences, one must understand grammar; and to understand grammar, one must understand words. Do cows have words? The answer may not be as obvious as one might first.

*Behavioral Evidence for Self-Consciousness*

As hard as it is to find a rancher, veterinarian, or scientist who denies cattle feel pain, it is harder yet to find one who affirms that cattle are conscious of themselves as characters in stories. A reason for this convergence of opinion has to do with the strength of another argument from analogy. So far as we know, cattle do not think about the story of their lives, think about themselves as characters engaged in dramas with other players, or recognize themselves in mirrors. Cattle do not understand that conspecifics may have false beliefs, do not work to bring their actions into line with their moral ideals, and do not feel a sense of injustice when they are treated differently from others. There is, in short, no end to the list of behavioral evidence that is lacking for bovine self-consciousness. Cattle pass no known tests for self-consciousness.

On one theory of cognitive development, consciousness of one’s own mind cannot arise apart from consciousness of the minds of others. According to this view, a theory of mind—understanding others’ behaviors as motivated by psychological beliefs and desires—is necessary to understand oneself as having a mind.[[58]](#footnote-58) To see that my own behavior is motivated by my beliefs and desires, goes the argument, I need help. I need to see that others’ minds work like mine. If this view is correct, and the evidence suggests that it is, when a toddler begins to understand that others do not see the world from the toddler’s perspective, the toddler is on the brink of understanding herself or himself as a distinct continuing psychological entity.[[59]](#footnote-59) If theory of mind is necessary for self-consciousness, individuals lacking theory of mind cannot be self-conscious.

One of the most widely used tests for theory of mind is the false beliefs test.[[60]](#footnote-60) The motivation for the test is that attributing false beliefs to others requires that one know that others use beliefs to represent the state of the world and that others make mistakes and misrepresent the state of the world.[[61]](#footnote-61) In the false beliefs test, a child is introduced to Sally, a hand puppet. The child and Sally watch as the experimenter hides a piece of candy under Sally’s stool. After Sally exits the scene, the experimenter moves the candy to a new location under Sally’s bed. The experimenter asks the child where Sally will look for the candy when Sally returns. If the child correctly says under the stool, the child passes the test. The child understands that the world looks different from Sally’s perspective and, consequently, that Sally’s beliefs differ from the child’s beliefs. If the child predicts, mistakenly, that Sally will look under the bed for the candy, the child fails the test.

Cattle, lacking the ability to understand human language, cannot pass the Sally test because they cannot take it. Were an experimenter to ask a bull “Where will Sally look?” we would question the experimenter’s intelligence, not the bull’s. However, cattle are intelligent enough to recognize faces and, as we have seen, they possess a low-level proto-language with which they can form and manipulate hypotheses about, and so become conscious of, their desires. Cattle could not pass a false beliefs test even if we knew how to pose it in their “language” because their proto-language possesses only simple tools (words) without the higher level tools (propositions and narratives) needed to understand plot twists and character perspectives. The reason bulls cannot pass the false beliefs test is not because they cannot speak, although they cannot, but because they cannot take Sally’s point of view.

We have previously examined the idea of cattle language, but it will illuminate cow consciousness to revisit the topic. Suppose cattle had their own language. Could they then pass a false beliefs test given in their language? The question is not nonsensical because cattle have their own “language.” Bovine language does not include grammar or propositions, much less narratives, but it does include concepts and words as cattle vocalizations convey information to conspecifics. Calves as young as three weeks’ old distinguish their mother’s call from others’ calls.[[62]](#footnote-62) They spend more time near speakers playing recordings of their mother’s call than recordings of strange mothers’ calls.[[63]](#footnote-63) Cattle have concepts, mental representations used to discriminate individuals (mother, friendly human) from others (strange cows, unfriendly humans).[[64]](#footnote-64) Cattle can even tell the difference between photographs of familiar and unfamiliar conspecifics. Apparently, cattle treat 2D images in the same way that we do, interpreting the images as representations of actual, “3D,” individuals.[[65]](#footnote-65)

Cattle use vocalizations to express dominance status, sex, and receptivity to reproduction.[[66]](#footnote-66) But are the sounds “words,” concepts used by a sender to represent and convey information to a receiver? Or are the noises produced simple reflexes, noises caused in a reliable and predictable way by specific environmental stimuli? For cattle do not recombine their sounds into novel strings, do not recursively embed their sounds in other sounds, and do not use auditory representations in different contexts or manipulate these symbols in flexible ways. Nor are the vocalizations “headed,” a technical term from linguistics meaning that the same sound can have different referents in different contexts. For example, the word “city” uttered in one context can generate in the heads of all those who hear it a mental picture of Chicago. However, the same sound can, in a different context, direct the eyes of all who hear it to the point on a map marked Ames. In other contexts, it will evoke a historical idea discussed in eighteenth-century political philosophy and in another context refer to a vague geographical space demarked from countryside. There are dozens, perhaps hundreds, of things city can mean. Everything depends on its context of usage, its header.

Cattle vocalizations, for all we know, are not headed, but not all of our words are headed, either. I say “male,” and nothing else, to indicate my gender, and “hey!” to assert my sense of my dominance or status. While these vocalizations lack heading, there is no impediment to understanding them as words. A cow’s “moo” often begins with a harmonic chord, proceeds through a phase of stochastic distortion, reaches a crescendo of emphasis, and resolves harmonically.[[67]](#footnote-67) The animal can use it in various ways to inform or motivate others. They do not as far as we know, use it to refer to objects outside the immediate context of utterance or combine it with others sounds grammatically. Cows do not string noises together to express propositional attitudes.[[68]](#footnote-68) However, it is not necessary to have grammar, much less narrative, in order to have words. So, while cattle lack the linguistic tools needed to understand the false beliefs test, and their vocalizations are not headed, these facts do not mean they lack words.

We have been assuming that having narrative and a theory of mind is necessary for self-consciousness. Suppose that this view is wrong; one can be self-conscious without understanding that others have minds. In that case, other empirical tests would gain in value as instruments to help determine whether a given animal was self-conscious. In the mark test, for example, an experimenter surreptitiously places a red smudge on an animal’s forehead. If a primate looking in the mirror moves its hand to the mark when looking in the mirror, this behavior suggests the animal understands the face in the mirror is its face.[[69]](#footnote-69) To the best of my knowledge, cattle have not been tested in this way, perhaps because experts hold little hope that cattle would pass it. For only a handful of the most intelligent social mammals have passed it, notably chimpanzees,[[70]](#footnote-70) bonobos,[[71]](#footnote-71) capuchin monkeys,[[72]](#footnote-72) one—of three tested—Asian elephant,[[73]](#footnote-73) bottlenose dolphins,[[74]](#footnote-74) killer whales,[[75]](#footnote-75) and orangutans.[[76]](#footnote-76) Results with gorillas, surprisingly, are inconclusive.[[77]](#footnote-77)

If cattle, as I have argued, do not possess a biographical sense of self, what evidence is there that they are self-aware in the sense required to have conscious desires? For what is required to have conscious desires is that the animal be able not only to look forward in time to the reception of a reward but that they be able to learn how to master tasks to achieve those rewards and take satisfaction in their ability to do so. Heifers evidently are not able to recognize that they are characters in stories, the sorts of individuals who can learn from their mistakes. However, heifers apparently recognize when they have learned something quickly or well, and they seem capable of taking pleasure in this knowledge. If so, cattle are self-aware even if not self-conscious.

Evidence for cattle self-awareness comes from a 2004 study at Cambridge University.[[78]](#footnote-78) Researchers taught one-year-old heifers in a control group to hit a button to let them into a long chute at the end of which was a reward. The animals learned which button to push, but they had no control over when the gate would open to let them get the reward. Their behavior as they moved down the chute showed they were interested in the reward but their movements were otherwise unremarkable. In a second experimental group, other heifers were put through the same training procedure but were allowed to exercise control over when the gate would open. As the animal got faster and faster at mastering novel test patterns and hit the right button more and more quickly, the gate would open more and more quickly. Each of the animals in the second group, therefore, had control over its learning environment, control animals in the first group lacked.

When heifers are in control of their environment and can see that improving their performance on a learning task leads to faster access to the reward, they respond with signs of pleasure. They are more agitated as they go through the gate; their hearts beat faster, they jump or kick, buck and gallop.[[79]](#footnote-79) They seem to take pleasure in their agency, by which I mean their ability to exercise control over their environment by concentrating their attention on their cognitive performance. I make this controversial suggestion for the following reason. The behavioral evidence suggests that the relevant animals not only understood but also took pride in their causal role in a very short story. The short story concerned their being an effective agent able narratively to connect three temporally-indexed and self-referenced events: near-term past events (a standing desire to eat), with proximal behavioral events in current working memory (my having hit the right button even quicker than I have come to hit it in the past) and causal reasoning about the means necessary to achieve short-term goals (I get to eat sooner as I get better at solving these puzzles).

If I am right, the work of the Cambridge researchers, Kristin Hagen and Donald Broom, suggests both that cows can look at least a few minutes into the past (e.g., comparing their earlier slow trials with their more recent fast trials) and a few dozen seconds into the future (e.g., getting down the race and into position in front of the feeder). This is my basis for the claim that cows are self-aware. Cows can exercise practical reason (e.g., solve the novel challenge about the means required to achieve their ends in reversal trials), can hypothesize about ways to achieve their goals (try this new combination of responses), and can understand that their decisions have causal influence on their environment. If so, then heifers can: (1) differentiate occasions when their choices are causally efficacious and when they are not, (2) be aware of the fact that sometimes they are in control of their circumstances and sometimes they are not, and (3) take pleasure in their role in mastering a new task.

Given the Hagen and Broom results, one might be tempted to think cows are conscious of themselves. But this would be a mistake. The results just reported show that calves are self-aware, meaning that they have proprioceptive abilities to understand where their bodies are, how long it is taking them to finish a task, to exercise control over their movements, and to understand themselves as causes of effects. Cattle can be aware of themselves as agents in narrative chains linking a short-term past and future, although they would not, of course, be able to express themselves using such concepts. These claims are also true of normally developing twelve-month-old human infants. Like cattle, one-year-old babies are not self-conscious, do not recognize themselves in a mirror, and do not have a biographical sense of self. However, they are self-aware. They understand where their bodies are, what their limbs are doing, which of several hypotheses is the most likely to get the result they desire, and how to right and spatially reorient themselves if acting on their favorite hypothesis ends in failure.

*Objection: Absence of Evidence Is Not Evidence of Absence*

Critics may respond as follows. The fact that we have not yet found reason to believe cattle are self-conscious does not mean that cattle are not self-conscious. The mirror test, continues the critic, should not be trusted because it requires a powerful visual sense, which cattle lack. A “smell” test, as Marc Bekoff has suggested, might be a more reliable measure for species with strong olfactory senses. If cattle use scent to recognize themselves, the fact that they fail the mirror test might tell us nothing about their self-consciousness. Failing to find evidence for some trait is not finding evidence that the trait is not there.

*Response: Promises of Discoveries Are Not Discoveries of Promise*

The fact that we can imagine alternative universes in which cattle—with behaviors no different from the behaviors we see in our cattle—nonetheless are having internal monologues with themselves, is not a reason to think that such cattle exist. Nor is it a reason to think we simply have failed to discover the truth about bovine psychology. For there is a simpler explanation, an explanation that coheres with the performance of most animals on the mark test. Animals of most species observed fail the mark test, including Hamadryas baboons,[[80]](#footnote-80) sea lions,[[81]](#footnote-81) giant pandas,[[82]](#footnote-82) gibbons,[[83]](#footnote-83) capuchin monkeys,[[84]](#footnote-84) stump-tailed macaques,[[85]](#footnote-85) and crab-eating macaques.[[86]](#footnote-86) Pigs can use mirrors to locate food hidden behind objects, but no record exists of a pig passing the mark test.[[87]](#footnote-87) It is rare for animals other than the Great Apes to exhibit self-consciousness, a result one might predict on evolutionary grounds insofar as self-consciousness seems to be a trait that has appeared only recently.

Skepticism, it bears saying, works both ways. If one responds to the lack of evidence for some trait by insisting that the trait may still be there, one must also grant that passing a particular test does not prove the existence of the trait. A particular behavior, such as moving one’s hand to a mark on one’s face, does not prove one possesses the concept of self. If the events causing the movement are not integrated with other experiences of the individual, if the movement is in fact nothing more than the result of a computer program responding to selected stimuli by putting into motion a series of mechanical gears, then the signs that purportedly indicate self-consciousness may be simple illusions. For example, Qbo, a robot, has “learned” to pass the mirror test, but we should not attribute self-consciousness to Qbo.[[88]](#footnote-88) For Qbo does not have a biographical sense of self, no unified memories, or anticipations. Skepticism of the “absence of evidence is not evidence of absence” sort is certainly valuable, but skepticism must be kept within its proper bounds. If not regulated, skeptical slogans can become excuses for anti-scientific attitudes and, eventually, blindness to evidence.

There is to date no evidence for thinking cattle are conscious of themselves. Unless the experts are wildly wrong in reading the behavioral evidence, cattle cannot be harmed by—because they cannot have—thoughts about what is happening to their mental lives or their reputations in the herd. However, the ethical implications of this fact are negligible for, as the argument from overlapping species shows, it is not necessary to have self-consciousness to have a moral right to life.

Conclusion

What are the practical implications of cattle cognition for food ethics? The analogical argument for thinking cattle are sentient is virtually unassailable given the behavioral and anatomical evidence. Cattle have behaviors, neuroanatomical physiologies, and brain structures similar to those of humans. In each species, the structures likely evolved in response to similar environmental challenges. In individuals of both species, the same foreign chemicals introduced into wounds cause nociception, which in turn cause physiological changes in the dorsal column of the neural system, the medial and lateral pathways, culminating in increased blood flow in the anterior cingulate cortex. In cattle, the sensory pathway leads upstream to the same caudal part of the ACC as it does in humans. In cattle as in humans, the ACC is in turn networked downstream to subcortical regions, including the amygdala, cerebellum, and striatum, that play a role in pain responses. As do humans, cattle learn from past pain experiences to avoid situations that may lead to pain. These facts may not convince the most hardened neo-Cartesian critic or the died-in-the-wool skeptic-about-other-minds, but, to the rest of us, there is little reason to deny that cattle not only get information about pain but also that they mind it. The question of whether cattle feel pain is as settled as such philosophical questions are likely to get. Furthermore, we are on solid ground in taking cattle pains into account in the moral calculus. Agricultural practices involving cattle should avoid causing them unnecessary pain and frustration.

The case that cattle are subjects of a life with conscious desires is similarly strong. It is not true that cattle live entirely “in the moment.” To the contrary, as we have seen, cattle have objectives they want to achieve in the near-term. They have memories stretching back dozens of minutes if not hours. They have futures of their own and can try different strategies to get what they want to get. Nor is it true that cattle have no cares about the future; they can egoistically desire to perform better than they have performed in the past on an upcoming challenge, such as getting quickly through a gate. Moreover, they can feel good or bad about their ability to learn new skills and overcome novel puzzles. Consequently, it is not true that cattle have no conscious desires that are frustrated when the animal is killed.

Finally, the argument for thinking cattle have selves and are conscious of the selves of others is weak. Cattle very likely do not entertain propositional attitudes, have theory of mind, or experience self-consciousness. If my reading of the empirical evidence is correct, the argument from species overlap becomes compelling. Since we would not kill for food human “far-persons” (that is, sentient humans with desires who lack propositional attitudes, theory of mind, and self-consciousness), justice demands that we not kill animals with similar mental states.[[89]](#footnote-89) Whether other kinds of animals, such as birds, fish, reptiles, and amphibians, have mental states similar to cows is not a matter we have space to explore here.[[90]](#footnote-90) Nor is there time to decide whether we are ethically required to be vegans and not use milk, blood, and other cattle byproducts.[[91]](#footnote-91)

Perhaps it is too simple to say we should not eat beef, full stop. Given the variety of circumstances in which we find ourselves, other factors will have to be taken into account in an all things considered judgment about the matter. However, to the extent that one lives in a developed agricultural economy and takes scientific facts seriously, the shoe is now firmly on the other foot. Eating beef requires a defense that either refutes the data presented here or gathers new data to undermine it. Cattle bring value into the world by acting on their desires. We deprive the world of value by killing these animals for their flesh. The arguments are simply too strong to continue to think otherwise.[[92]](#footnote-92)

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1. For evidence that dairy products are not obtained without killing, see Varner, “What’s Wrong with Animal By-Products?” [↑](#footnote-ref-1)
2. The argument against meat-eating on environmental grounds is a formidable one and not only because of the well-known devastating effects of razing rainforests to create pastures. The atmospheric contributions to climate change of methane-producing cattle raised in industrialized agricultural systems are similarly profound. Raising cattle contributes twice as many greenhouse gases as raising pigs, and thirteen times as many gases as raising vegetable protein sources (Hamerschlag, Meat Eater’s Guide to Climate Change + Health). [↑](#footnote-ref-2)
3. While the word “cattle” refers to male and female animals, I occasionally follow colloquial usage and use cow, which technically refers only to females, as a substitute for cattle. I allow the context to indicate my meaning. [↑](#footnote-ref-3)
4. Davis and Lin, “Factors Affecting U.S. Pork Consumption.” [↑](#footnote-ref-4)
5. Domínguez-Rodrigo et al., “Earliest Porotic Hyperostosis on a 1.5-Million-Year-Old Hominin, Olduvai Gorge, Tanzania.” [↑](#footnote-ref-5)
6. Singer, Practical Ethics. [↑](#footnote-ref-6)
7. Regan, The Case for Animal Rights. [↑](#footnote-ref-7)
8. Rachels, Created from Animals; Dombrowski, Babies and Beasts; Varner, In Nature’s Interests?; McMahan, The Ethics of Killing; Steiner, Animals and the Moral Community; Rowlands, Animal Rights. [↑](#footnote-ref-8)
9. McCloskey, “Moral Rights and Animals”; Frey, Interests and Rights; Cohen, “The Case for the Use of Animals in Biomedical Research”; Carruthers, The Animals Issue; Cockburn, “Human Beings and Giant Squids.” [↑](#footnote-ref-9)
10. Perrett, “The Analogical Argument for Animal Pain.” [↑](#footnote-ref-10)
11. Singer, Practical Ethics. [↑](#footnote-ref-11)
12. While cattle, pigs, goats, and sheep are all used extensively in food production, I focus here on cows, calves, steers, and bulls because cattle are typically thought to be less intelligent than, for example, hogs. If an animal’s intelligence matters in food ethics, as it does, then the case against eating beef would appear to be more difficult to establish than the case against eating pork. [↑](#footnote-ref-12)
13. Rollin, The Unheeded Cry; Grandin and Johnson, Animals Make Us Human. [↑](#footnote-ref-13)
14. Manteuffel, Puppe, and Schön, “Vocalization of Farm Animals as a Measure of Welfare.” [↑](#footnote-ref-14)
15. Purves et al., Neuroscience. [↑](#footnote-ref-15)
16. Bateson, “Assessment of Pain in Animals.” [↑](#footnote-ref-16)
17. Grandin, “The Feasibility of Using Vocalization Scoring as an Indicator of Poor Welfare during Cattle Slaughter.” [↑](#footnote-ref-17)
18. However, assessments of the degree to which cattle feel pain varies among veterinarians between younger and older practitioners (Thomsen et al., “Scandinavian Bovine Practitioners’ Attitudes to the Use of Analgesics in Cattle”) and, perhaps, between men and women (Huxley and Whay, “Current Attitudes of Cattle Practitioners to Pain and the Use of Analgesics in Cattle,” and Raekallio et al., “Pain Alleviation in Animals”—but cf. Thomsen et al., “Scandinavian Bovine Practitioners’ Attitudes to the Use of Analgesics in Cattle”). [↑](#footnote-ref-18)
19. Becker et al., “Acute and Chronic Pain in Calves after Different Methods of Rubber-Ring Castration.” [↑](#footnote-ref-19)
20. Jamieson, “Science, Knowledge, and Animal Minds.” [↑](#footnote-ref-20)
21. MacPhail thinks language is necessary for true consciousness (MacPhail, The Evolution of Consciousness). Donald Davidson and the early Peter Carruthers argue in a similar vein but none of these authors thinks a lack of language or thought entails a lack of sentience. [↑](#footnote-ref-21)
22. Varner, In Nature’s Interests? [↑](#footnote-ref-22)
23. Carruthers, “Brute Experience.” [↑](#footnote-ref-23)
24. Although one might be skeptical about the relevance of scientific evidence. Thomas Nagel argues that objective third-person empirical investigations cannot inform us about what it is like to have the subjective perspective of a member of another species (Nagel, “What Is It Like to Be a Bat?”). I am not convinced. There is no good reason not to think that if the firing of certain neural networks in humans causes certain kinds of feelings in humans that the firing of those same neural networks in other species, if they have the networks, causes the same feelings in other species (cf. Allen 1995). [↑](#footnote-ref-24)
25. Craig, “Mapping Pain in the Brain.” [↑](#footnote-ref-25)
26. For the curious, the median weight of the adult cattle brain is around 450 grams. For purposes of comparison, the adult human brain is around 1,400g; a two-year-old human around 1,100g. Sperm whale = 7,800g; elephant = 4,700g; gorilla = 500g; chimp = 420g; pig = 180g; sheep = 140g; rhesus monkey = 90g; dog = 72g; cat = 30g; and rat = 2g (Chudler, “Brain Facts and Figures”). [↑](#footnote-ref-26)
27. Craig, “Mapping Pain in the Brain.” [↑](#footnote-ref-27)
28. Talbot et al., “Multiple Representations of Pain in Human Cerebral Cortex”; Jones et al., “Localization of Responses to Pain in Human Cerebral Cortex.” [↑](#footnote-ref-28)
29. Berthier, Starkstein, and Leiguarda, “Asymbolia for Pain”; Klein, “What Pain Asymbolia Really Shows.” [↑](#footnote-ref-29)
30. Shriver, “Minding Mammals.” [↑](#footnote-ref-30)
31. For an assessment of the likelihood of pain in species other than mammals, see Smith and Boyd, Lives in the Balance; Varner, In Nature’s Interests? [↑](#footnote-ref-31)
32. Schmidt et al., “A Study of the Comparative Anatomy of the Brain of Domestic Ruminants Using Magnetic Resonance Imaging.” [↑](#footnote-ref-32)
33. Coffeen et al., “Insular Cortex Lesion Diminishes Neuropathic and Inflammatory Pain-Like Behaviours.” [↑](#footnote-ref-33)
34. Grandin, “Distress in Animals: Is It Fear, Pain or Physical Stress?” [↑](#footnote-ref-34)
35. Ibid. [↑](#footnote-ref-35)
36. Some question the capacity of fish to have pain but there is not much debate about birds. Some now claim that pain is found in the other two non-mammalian classes of phylum chordata, amphibians and reptiles, but these are all questions for another day. [↑](#footnote-ref-36)
37. In 1898, Wallace Wood obtained thirty American cattle brains from a New York slaughterhouse. Following the “dry-process” method pioneered by his teacher, Broca, he prepared them for study, noting that if the ox brain is prepared with medicated glycerin and the human brain with dilute nitric acid, the resulting “two pieces of brain sculpture [are] of about equal size” (italics in original). After his study, he noted that two structures “the ligula and the fusiformis in Homo and Bos taurus are unmistakable homologues.” His questions at the end of the nineteenth century are instructive. “That such homologies are found need not indeed be a cause of surprise. Hath not an ox eyes and ears? Hath he not a nose and tongue and a manus and pes? Why, then, should he not have an eye gyrus, an ear gyrus, a paracentral lobule, and a Rolandic vortex? That these lines of psychical action will be found upon the bovine brain and every gyrus and lobule identified it appears to me one may reasonably presuppose. Wood closes his little essay by asking, “Do not homologous forms imply analogous functions?” [↑](#footnote-ref-37)
38. Examination of bovine neural structures also reveals important differences in morphology and cytoarchitecture of parts of the brain shared by mammalian species. For example, one study of the insula shows “substantial variability in shape, extent, and gyral and sulcal patterns, as well as differences in laminar organization, cellular specialization, and structural association with the claustrum. Our observations reveal that the insular cortex is extremely variable among mammals” (Butti and Hof, “The Insular Cortex”). While we should not neglect the fact of these differences, neither should we overestimate their importance. Given the different evolutionary histories of the species, we should expect some differences. The question relevant to ethics is whether the anatomical differences are so great that cattle do not feel pain. The evidence thus far does not support such a claim. [↑](#footnote-ref-38)
39. Davidson, “Rational Animals”; Frey, Interests and Rights; Carruthers, The Animals Issue. [↑](#footnote-ref-39)
40. Schaeffer and Sikes, “Discrimination Learning in Dairy Calves.” [↑](#footnote-ref-40)
41. Hirata and Takeno, “Do Cattle (Bos taurus) Retain an Association of a Visual Cue with a Food Reward for a Year?” [↑](#footnote-ref-41)
42. Daros et al., “Individual Housing Impairs Reversal Learning in Dairy Calves.” [↑](#footnote-ref-42)
43. Kovalčik and Kovalčik, “Learning Ability and Memory Testing in Cattle of Different Ages.” [↑](#footnote-ref-43)
44. Bailey et al., “Characteristics of Spatial Memory in Cattle.” [↑](#footnote-ref-44)
45. See Jeff McMahan’s idea that our lives have lesser or greater value based on where we are in the narrative arc of our lifetime and what McMahan calls our time-relative interests, the strength of the psychological connections of our present selves to our earlier and future selves McMahan, The Ethics of Killing. [↑](#footnote-ref-45)
46. Comstock, “Far-Persons”; Comstock, “The Cattle in the long Cedar Springs Draw.” [↑](#footnote-ref-46)
47. Bermudez, Thinking without Words. [↑](#footnote-ref-47)
48. “In Japan, Robot Dogs Are for Life—and Death.” [↑](#footnote-ref-48)
49. Tamblyn, “The AIBO Dog Is Dead and Japan Is in Mourning.” [↑](#footnote-ref-49)
50. Buckner, Andrews-Hanna, and Schacter, “The Brain’s Default Network.” [↑](#footnote-ref-50)
51. Roth and Dicke, “Evolution of the Brain and Intelligence.” [↑](#footnote-ref-51)
52. Blind movement becomes intentional behavior when an agent understands the movement as an attempt to connect two temporally discrete events; a concurrent recent desire (one that started within the last few seconds or minutes) and a proximal state of affairs in which the agent believes it will have satisfied that desire. When desires are for proximal objects not involving other minds, such as moving to that patch of grass to eat those shoots, the agent need only understand its role as protagonist in a story that connects events separated by as little as milliseconds, and perhaps, at most, a few hours. When desires are for distant subject objects, such as being satisfied with the reputation one has made with one’s peers in the grass-choosing skill department, the agent must understand a story that connects events that may be decades apart, or at least many months, and which involve integrating into one’s own narrative the intentional behaviors and perspectives of other agents. If the temporoparietal juncture (TPJ) is required to have multi-year and multi-perspective desires (Lerner et al., “Topographic Mapping of a Hierarchy of Temporal Receptive Windows Using a Narrated Story”; Mantini et al., “Interspecies Activity Correlations Reveal Functional Correspondence between Monkey and Human Brain Areas”), and if a network of structures is necessary to process sentences about oneself and others consisting of the medial prefrontal cortex, the right TPJ, and the precuneus (Knobe, “Do Corporations Have Minds?”), then cattle, lacking this hardware, almost surely do not have such sophisticated desires. And, given the lack of any behavioral evidence that cattle have a theory of mind, there is little reason to hedge one’s bets; cattle lack self-consciousness. [↑](#footnote-ref-52)
53. Berridge and Kringelbach, “Pleasure Systems in the Brain.” [↑](#footnote-ref-53)
54. Mahler and Berridge, “Which Cue to “Want?” [↑](#footnote-ref-54)
55. Raghanti et al., “Von Economo Neurons.” [↑](#footnote-ref-55)
56. Gaillard et al., “Social Housing Improves Dairy Calves’ Performance in Two Cognitive Tests.” [↑](#footnote-ref-56)
57. Varner, Personhood, Ethics, and Animal Cognition: Situating Animals in Hare’s Two-Level Utilitarianism; Comstock, “Far-Persons.” [↑](#footnote-ref-57)
58. Carruthers, The Opacity of Mind. [↑](#footnote-ref-58)
59. Carruthers, “Knowledge of Our Own Thoughts Is Just as Interpretive as Knowledge of the Thoughts of Others.” [↑](#footnote-ref-59)
60. Suddendorf and Whiten, “Mental Evolution and Development.” [↑](#footnote-ref-60)
61. Bennett, “Some Remarks about Concepts”; Dennett, “Beliefs about Beliefs”; Harman, “Studying the Chimpanzee’s Theory of Mind.” [↑](#footnote-ref-61)
62. We do not know whether cows can similarly recognize their calves’ vocalizations. <IBT>Barfield, Tang-Martinez, and Trainer, “Domestic Calves (Bos taurus) Recognize Their Own Mothers by Auditory Cues.”</IBT> [↑](#footnote-ref-62)
63. Ibid. [↑](#footnote-ref-63)
64. de Passillé et al., “Dairy Calves’ Discrimination of People Based on Previous Handling.” [↑](#footnote-ref-64)
65. Coulon et al., “Cattle Discriminate between Familiar and Unfamiliar Conspecifics by Using Only Head Visual Cues.” [↑](#footnote-ref-65)
66. Kiley, “The Vocalizations of Ungulates, Their Causation and Function”; Watts and Stookey, “Vocal Behaviour in Cattle”; Schön et al., “Altered Vocalization Rate during the Estrous Cycle in Dairy Cattle.” [↑](#footnote-ref-66)
67. Schön et al., “Altered Vocalization Rate during the Estrous Cycle in Dairy Cattle”; Padilla de la Torre et al., “Acoustic Analysis of Cattle (Bos taurus) Mother–offspring Contact Calls from a Source–Filter Theory Perspective.” [↑](#footnote-ref-67)
68. Watts and Stookey, “Vocal Behaviour in Cattle.” [↑](#footnote-ref-68)
69. <IBT>Gallup, “Chimpanzees: Self-Recognition.”</IBT> [↑](#footnote-ref-69)
70. Ibid., 1970; Suarez and Gallup, “Self-Recognition in Chimpanzees and Orangutans, but Not Gorillas”; de Veer et al., “An 8-Year Longitudinal Study of Mirror Self-Recognition in Chimpanzees (Pan Troglodytes).” [↑](#footnote-ref-70)
71. Westergaard and Hyatt, “The Responses of Bonobos (Pan Paniscus) to Their Mirror Images.” [↑](#footnote-ref-71)
72. Roma et al., “Mark Tests for Mirror Self-Recognition in Capuchin Monkeys (Cebus Apella) Trained to Touch Marks.” [↑](#footnote-ref-72)
73. Plotnik, Waal, and Reiss, “Self-Recognition in an Asian Elephant.” [↑](#footnote-ref-73)
74. Reiss and Marino, “Mirror Self-Recognition in the Bottlenose Dolphin.” [↑](#footnote-ref-74)
75. Delfour and Marten, “Mirror Image Processing in Three Marine Mammal Species.” [↑](#footnote-ref-75)
76. Gallup and Povinelli, “Mirror, Mirror on the Wall Which Is the Most Heuristic Theory of Them All? A Response to Mitchell.” [↑](#footnote-ref-76)
77. Suarez and Gallup, “Self-Recognition in Chimpanzees and Orangutans, but Not Gorillas.” However, for positives results, see Posada and Colell, “Another Gorilla (Gorilla Gorilla Gorilla) Recognizes Himself in a Mirror”; Allen and Schwartz, “Mirror Self-Recognition in a Gorilla (Gorilla Gorilla Gorilla).” [↑](#footnote-ref-77)
78. <IBT>Hagen and Broom, “Emotional Reactions to Learning in Cattle.”</IBT> [↑](#footnote-ref-78)
79. Ibid. [↑](#footnote-ref-79)
80. Ma et al., “Giant Pandas Failed to Show Mirror Self-Recognition.” [↑](#footnote-ref-80)
81. Hill et al., “Can Sea Lions’ (Zalophus Californianus) Use Mirrors to Locate an Object?” [↑](#footnote-ref-81)
82. Ma et al., “Giant Pandas Failed to Show Mirror Self-Recognition.” [↑](#footnote-ref-82)
83. Hyatt, “Responses of Gibbons (Hylobates Lar) to Their Mirror Images.” [↑](#footnote-ref-83)
84. <IBT>Roma et al., “Mark Tests for Mirror Self-Recognition in Capuchin Monkeys (Cebus Apella) Trained to Touch Marks.”</IBT> [↑](#footnote-ref-84)
85. Ibid. [↑](#footnote-ref-85)
86. Ma et al., “Giant Pandas Failed to Show Mirror Self-Recognition.” [↑](#footnote-ref-86)
87. Broom, Sena, and Moynihan, “Pigs Learn What a Mirror Image Represents and Use It to Obtain Information.” [↑](#footnote-ref-87)
88. Ackerman, “Qbo Robot Passes Mirror Test, Is Therefore Self-Aware.” [↑](#footnote-ref-88)
89. Comstock, “Far-Persons.” [↑](#footnote-ref-89)
90. For this, see Varner, In Nature’s Interests? [↑](#footnote-ref-90)
91. Varner, “What’s Wrong with Animal by-Products?” [↑](#footnote-ref-91)
92. It may be permissible to use animal by-products obtained by means that do not cause pain or frustration, but current milk- and egg-production techniques do not satisfy these criteria. Novel agricultural biotechnologies may result in byproducts that are humanely obtained—and even in in vitro meat—but whether the new methods will be economically beneficial for today’s farmers is an open question. [↑](#footnote-ref-92)