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Inaugural Editorial

Animal sentience: The other-minds problem

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Abstract: The only feelings we can feel are our own. When it comes to the feelings of others, we can only *infer* them, based on their behavior — unless they tell us. This is the “[other-minds problem](#).” Within our own species, thanks to language, this problem arises only for states in which people cannot speak (infancy, aphasia, sleep, anaesthesia, coma). Our species also has a uniquely powerful empathic or “mind-reading” capacity: We can (sometimes) perceive from the behavior of others when they are in states like our own. Our inferences have also been systematized and operationalized in biobehavioral science and supplemented by cognitive neuroimaging. Together, these make the other-minds problem within our own species a relatively minor one. But we cohabit the planet with other species, most of them very different from our own, and none of them able to talk. Inferring whether and what they feel is important not only for scientific but also for ethical reasons, because where feelings are felt, they can also be hurt. As animals are at long last beginning to be accorded [legal status and protection as sentient beings](#), our new journal *Animal Sentience*, will be devoted to exploring in depth what, how and why organisms feel. Individual “target articles” (and sometimes précis of books) addressing different species’ sentient and cognitive capacities will each be accorded “[open peer commentary](#),” consisting of multiple shorter articles, both invited and freely submitted ones, by specialists from many disciplines, each elaborating, applying, supplementing or criticizing the content of the target article, along with responses from the target author(s). The members of the nonhuman species under discussion will not be able to join in the conversation, but their spokesmen and advocates, the specialists who know them best, will. The inaugural issue launches with the all-important question (for fish) of whether fish can feel pain.



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The other-minds problem. The difference between mind-reading and bird-watching is that only one of them can be done by observation alone (unless you are trying to mind-read birds). Birds can be identified and their habitats and behavior can be described on the basis of observation. But minds cannot be observed: Only their behavior can be observed. What minds are feeling and thinking can only be *inferred* from what their bodies are doing. This is the [*other-minds problem*](#) (Harnad 1991).

Is the other-minds problem unique to the biological study of organisms with minds? Or are minds just one among many examples of things in the world that we cannot observe but can only infer?

Physicists cannot observe superstrings (they are not yet even sure they exist). Until very recently they thought that although quarks are much bigger than hadrons, a hadron is a combination of multiple quarks in a “bound” state, and only the individual little hadrons themselves are observable. The big quarks of which the little hadrons are composed cannot occur as free individuals, so they are unobservable. Yet the existence and properties of quarks can be inferred from the observable behavior of hadrons. Indeed, the existence of bound quarks is *necessary* in order to explain the behavior of hadrons, according to current physical theory (Phillips 1999). Is this not like mind-reading?

The “hard problem.” Inferring quarks is like inferring minds only up to a point. Organisms really do have minds, just as hadrons really do have quarks. But there the analogy ends. It is far from true that their having minds is necessary to explain organisms’ observable behavior, in the way that their having quarks is necessary to explain hadrons’ observable behavior. Rather, explaining how and why organisms have minds remains a profound and unsolved problem — one that has lately come to be dubbed the “hard problem” (Chalmers 1995) of cognitive science (the science of the mind).

If we interpret Darwinian biology in an unbiased, non-anthropocentric way, organisms should just be *survival/reproduction machines*: robots that have the capacity — through blind genetic variation and natural selection — to evolve the structures and functions that increase their chances of surviving and reproducing (Goodwin & Dawkins 1995). Those structures and functions include not only the shapes and functions of organisms’ bodies, but also their behavioral capacities and the neural basis of those capacities, from moving, swimming, flying, hunting, foraging and mating to learning, competing, cooperating, communicating and even speaking.

The “easy problem.” If organisms were indeed mindless, then there would only be the “easy problem” of explaining how and why organisms can do all those things they can do (swim, fly, learn, communicate) (Harnad 2012). But if organisms do have minds, the hard problem is to explain how and why such survival/reproduction machines would evolve minds: What is the *added* causal role and adaptive value of having a mind, over and above the causal role and adaptive value of just having the behavioral capacities themselves, to do whatever needs doing in order to survive and reproduce: those behavioral capacities that the slow but

growing successes of modern robotics are showing to be implementable mindlessly (Arkin 1998; Samani 2015)?

But evidently organisms do have minds, for some reason or other — or at least some species do: Which ones? Clearly our own species does. Which others? And what does it mean to “have a mind”?

Descartes’s “Cogito.” Descartes did not discover or invent the notion of a mind, but he did give it a concrete, almost operational definition: the “[Cogito](#)” (“I think, therefore I am.”)

That’s not the simplest or clearest way to put it. The question is not so much about the existence of “me” but about the existence of (at least one) *mind*: When I am thinking, *it feels like something to be thinking*. I know what it feels like to think. I don’t infer it, in my own case. I observe it directly: I *feel* it directly. I am not just a behaving (moving) machine in a certain internal state, like a robot; I am feeling something (when I am awake, and not sleep-walking, like a robot!). My internal state is a felt state.

Sentience. So Descartes might as well not have bothered to single out thinking in particular. It does feel like something to think, but it also feels like something to be in any other mental state — seeing something, hearing something, smelling something, touching something, moving something, expecting something, wanting something, imagining something — in fact, feeling anything at all: heat, cold, pain, pleasure, anger, fear, fatigue, doubt, understanding. Mental states are *felt states*, and to have a mind means to have the capacity to feel. In a word: *sentience*.

The rest is indeed about cognition (i.e., thinking): Having observed (i.e., felt) directly that I am a sentient organism and not a mindless robot (in other words, having noted, with Descartes, that I feel), *what* can I feel, think and do — and how, and why? These are things in which individuals as well as species can differ.

I know at first hand, in Descartes’s way, what *I* am feeling or thinking. Other humans can tell me in words what they are feeling or thinking, so I need not rely on reading their minds. And they can show me what they can do by doing it, and I can observe that.

Mind-reading. Hence, within our own species, the other-minds problem is a relatively minor one. It arises only when speech is not possible and behavior is absent or minimal, such as in deep sleep or coma or under anaesthesia. We are confident in our inference that preverbal children are sentient, even though they can’t tell us, and that so too are adults who have lost the ability to speak. We can also infer what other people are feeling or thinking from their behavior (and sometimes also from measuring the electrical activity in their brains). This is part of how we mind-read one another within our own species, based on behavior, on what people say, and (if we are brain scientists) on what we can measure of what is going on in other people’s brains.

But there is something more. It can be said without exaggeration that the members of our species are extraordinarily gifted at mind-reading one another (Premack & Woodruff 1978;

Krebs & Dawkins 1984; Ickes 2003; Baron-Cohen 2005; Domes et al. 2007). Our rational, observational and empathic mind-reading skills in general are far more extensive and acute than those of any other species. All mammals (at least¹) do have some degree of mind-reading ability, especially concerning the needs of their young; social species have even more of it. Some researchers have attributed organisms' mind-reading abilities to their having "mirror neurons," which are active both when an organism itself does (and, presumably, feels) something and when the organism observes another organism doing (and, presumably, feeling) the same thing (Gallese & Goldman 1998; Vogeley et al. 2001; Rizzolatti & Craighero 2005; Singer 2006). But whatever its neural basis, human beings are the planet's unrivalled champions in mind-reading one another.

Other species. What about human mind-reading of other species? When it comes to other mammals as well as birds, the other-minds problem does not arise for the question of *whether* they feel. Everyone who has had animals in the family knows that they feel, as surely as human infants feel. Our acute mind-reading ability assures us of that. But when it comes to the question of *what* it is that members of other species are feeling and thinking, the answer is not always so obvious. The problem becomes more and more challenging the more different the species' behavior and ecology is from ours, sometimes misleading² our formidable mind-reading skills (and mirror neurons) and sometimes downright stumping them (Hughes 1999; Jones 2005).

Descartes had already answered the question of what it means to have a mind: It means to have the capacity to *feel*, to be sentient, rather than just the capacity to *do*, like a robot. However, although he was the supreme advocate of rationality — and pointed out with his *Cogito* that it would be irrational, indeed self-contradictory, for us to doubt that we are feeling when we are indeed feeling — Descartes nevertheless lapsed from rationality into arbitrary opinion when it came to the minds of members of species other than his own. He had contrasted the certainty with which we each know that we have a mind with our uncertainty not only about one another's minds, but also about the laws of science: Yes, other people probably feel too, and the laws of science are probably correct, but we can't be *sure* of that, the way we can be sure of the truth of a mathematical theorem — or of the truth of the *Cogito*.

Mindless machines. Fair enough. We can't be sure. It is good to be reminded of the fallibility of human knowledge. But we are nevertheless *sure enough* that it is true that other people, too, feel, and that the laws of science (including the theory that hadrons are composed of quarks) are true. Descartes did not deny those kinds of truths; he only pointed out that they

¹ Perhaps all R-selected animals have some mind-reading capacity for nurturing their young. R-selected species have relatively fewer young, but invest more into making sure they survive until they reach reproductive age. K-selected species invest instead in having relatively more young, but leave them to fend for themselves (Pianka 1970). Human selective breeding has probably emphasized these empathic capacities in domesticated animals, especially dogs (Yong & Ruffman 2014; Duranton & Gaunet 2015).

² A very sad recent example of failed mind-reading has been the widespread misperception of the arm-raising response of the slow loris (as seen in YouTube videos) as asking to be tickled, whereas in reality it is a frightened defensive response to a perceived attack. The result has been the brutal wresting of large numbers of the poor little creatures from their native habitat to suffer miserable fates in fulfilling the surge of demand for cute animals to tickle (Hagey et al. 2007; Nekaris et al. 2013).

are not *certain*, in the way that mathematical truths or the Cogito are certain. And yet when it came to the other-minds problem for other species, Descartes confidently asserted that, despite their behavior, animals are just feelingless machines — so we can go ahead and do whatever we like with them despite their struggles and screams (Descartes 1649/1993; Harrison 1992). Why?

Descartes assured us that animals cannot feel *on the basis of a scientific theory* — rather the way we infer that hadrons are made of quarks on the basis of a scientific theory. But Descartes's own scientific theory of mind, unlike the quark theory of hadrons, did not have the power to predict and explain the observable behavior of either humans or other species. It was in fact a quack theory, attributing the mind to the pineal gland, into which a deity had implanted the power to generate feeling — in humans, but not in any other species (Finger 1995). Apart from that, the body, in all species, is just a mindless machine according to Descartes.

Scepticism. Descartes's scientific hypotheses are of no more interest today than other inchoate hunches from the 17th century, especially in biology, and especially when tainted with theology. Descartes's persisting importance lies elsewhere: He tried to put science on a rational basis, to rescue it from the sceptics who insisted that nothing could be known to be true for sure. Descartes countered that the truth of the Cogito could indeed be known to be true for sure. Every individual knows for sure that it is true that they are thinking (when they are thinking). Yet, as we noted earlier, the only thing this really guarantees is that each of us *feels*: that *sentience* is real; that feeling really exists; that it is impossible to deny it — in our own individual case, at least. It certainly does not follow, however, from the undeniably true fact that we feel, that anything *else* that we may feel to be true really is true.

Benefit of the doubt. Thanks to Descartes, I cannot be sceptical about the fact that I feel — but I can certainly still be sceptical about whether *anyone else* feels. That's the other-minds problem yet again. The reasons we nevertheless give one another the benefit of the doubt have already been mentioned: Language is perhaps the first and most prominent reason: People can tell us they feel, just as they can tell us other things, including things we can confirm to be true by observation; so we tend to believe what people say. Second, we infer from people's nonverbal behavior that they feel, much the way we infer that there are quarks from the observable behavior of hadrons. Inferring feelings helps us to predict what people do and to explain why they do it. The third and perhaps most palpable reason we believe other people have minds is that our acute mind-reading powers (sometimes) make us *feel* as if other people feel.

None of these beliefs about other minds, however, inherits the certainty of Descartes's Cogito: they could all have been wrong even though they felt as if they were true. And for every uncertain hypothesis, its opposite is likewise uncertain: I can't be sure that others feel, because of the other-minds problem, but, for the very same reason, I can't be sure that others *don't* feel either. So what is at stake? Is this just like saying that we can't be sure there are quarks, but we can't be sure there aren't quarks either? so we just provisionally accept the more probable option — the option that has more evidence supporting it?

Consequences of error. Picking the more likely option is partly the answer; but in the case of feelings, there is something far more important at stake than just the truth, namely, the *consequences of being wrong*: There is incomparably more at stake *for others* if we assume that they don't feel, yet they do, than if we assume that they do feel, yet they don't.³ For feelings, if they are indeed being felt, can be hurt. Yet we cannot feel another organism's hurt: Only the other organism — the one we are wrongly assuming to be mindless — can feel the hurt.

The other members of our own species are not at risk from our scepticism, because we have already accepted the overwhelming evidence that other humans feel.⁴ But what about other species? Descartes theorized that no other species than our own is sentient, whereas most rational people today agree that mammals and birds, at least, do feel, and hence that it would be monstrous to go ahead — as Descartes had advised, based on his theory — and do whatever we like with them despite their struggles and screams, confident that they are merely mindless machines.

Whose other-minds problem? But what about species like fishes, who cannot scream? Or invertebrates, like worms or clams, some of whom can hardly even struggle? We cannot feel their pain — if they feel — any more than we can feel one another's pain. Thanks to our acute mind-reading abilities, we grant the benefit of the doubt — to some degree — to mammals and birds, because they and their young resemble us (and especially resemble our young) (Paul 2000; Decety & Jackson 2004; Panksepp & Panksepp 2013).

But even with mammals and birds, the dictates of our mind-reading abilities are easily dismissed as “anthropomorphic” illusions when there is a financial, personal or even a scientific interest in being able to do whatever we like with them, hence in seeing and treating them more like feelingless machines than as sentient organisms. Fish, reptiles, amphibians and invertebrates, if they feel, are further handicapped by the fact that even to our acute mind-reading sense, they look robotic.⁵

So it turns out that the other-minds problem is not *our* problem: It's the problem of other species, if they do have minds — if they do indeed feel, yet have the misfortune that our species does not *know* they feel, or does not *believe* it. Pain is the negative feeling that comes to mind first: The other-minds problem is a catastrophe for any sentient species that we are hurting because we are sceptical about whether they feel pain. But there is far more to negative feeling — let us frankly call it suffering — than just the infliction of brute pain. There is also stress and fear and loneliness — and being deprived of the other things a species may

³ The underlying issue here is the “cost” of false positives versus false negatives. It also arises in medicine and law (Menikoff 2001).

⁴ Andrew Rowan (personal communication) has pointed out that it was not until recently that it was universally accepted that infants feel pain (Fletcher 1987; Morris 1991; Page 2004). (See also Segner 2016.)

⁵ As Balcombe (2016) notes, fishes have the further disadvantage that they do not blink. (They don't need to, because their environments constantly bathe their eyes.) Blinks are among the important anthropomorphic cues engaging our mind-reading ability, as roboticists know (Yoshikawa 2006).

need: the habitat for which they have evolved; the possibility of seeing, hearing, tasting, touching and doing the things for which their sensory and motor systems are adapted and that they are designed to expect; and of course being deprived of freedom — and of their lives, which, if they feel, may feel every bit as precious to them as ours feel to us.

Sensitizing to sentience. *Animal Sentience* (*ASent*) is a journal devoted to sensitizing the members of our own species — scientists, scholars, ethicists, veterinarians, attorneys, policy-makers and concerned citizens — to the sentience, and hence the needs, of other sentient species. The objective is to help us understand *what* other species feel — *how* and *why* — and of course *whether*. To put it another way: the goal is to further enhance our species' already powerful mind-reading abilities, across species. This means that some articles will also explore the boundaries of sentient life. The assumption, of course, is that it is the nervous system that generates feeling. But some articles will also consider simpler animals, lacking neurons, all the way down to unicellular organisms, and even across the frontier of the animal kingdom to plants: not on the expectation that all living organisms are sentient, but in order to get a clearer idea of what sentience is and what it is not. For this reason, there will also be some articles about robotics. Articles will also explore feeling worlds very unlike those of our own species, to extend our mind-reading ability even to the point of trying to answer questions like “What does it feel like to be a bat?” (Nagel 1974; Hughes 1999; Jones 2005).

Open peer commentary. Because of the subject matter of *ASent*, the topic of every article will be controversial in one way or another, with potential implications for many fields. After articles have been refereed and accepted for publication, *ASent* will invite “[open peer commentary](#)” from the leading specialists on the topic of each “target” article, across disciplines and around the world. This peer commentary will consist of multiple shorter articles by experts from different fields and perspectives, elaborating, applying, supplementing and criticizing the content of the target article, along with responses from the target author. Commentaries can also be submitted for consideration without invitation. All target articles will be peer-reviewed, and all commentaries will be editorially reviewed.

As the editor-in-chief of *Animal Sentience*, I am not new to open peer commentary. I founded and for over twenty years edited the journal [Behavioral and Brain Sciences](#) (BBS), published by Cambridge University Press. BBS, too, was an open-peer-commentary journal. After I had stepped down from its helm, I had no intention of editing a journal ever again. But when long-time BBS Associate and commentator Andrew Rowan (1990), President of the [Humane Society International](#), approached me to ask whether I would agree to edit a journal on animal sentience, it took me exactly 10 milliseconds to look into my heart and know I would do it — that I had to do it, in fact (Bekoff & Harnad 2015). Nonhuman animals, after incalculable and unpardonable suffering at the hands of our species, may now be beginning to have some hope of being accorded [legal status and protection as sentient beings](#)⁶ (D'Silva & Turner 2012;

⁶ [Projet de loi no 54](#) (adopted 4 December 2015): “[D]orénavant, au Québec, les animaux ne seront plus considérés comme des « bien meubles », mais comme des êtres doués de sensibilité ayant des impératifs biologiques.” [“Henceforth, in Quebec, animals will no longer be considered as property but as sentient beings with biological imperatives.”]

Wise 2014). This is hence the historic time to build a clear and full understanding of what sentience is, species by species, and what is needed to understand and protect it. I hope fervently that *Animal Sentience* will make significant, substantive and lasting contributions to that vital and urgent scientific and humanitarian goal.

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UQÀM/ISC Cognitive Science Summer School June 26 - July 6 2018, Montreal, Canada

The Other Minds Problem: Animal Sentience and Cognition

Overview. Since Descartes, philosophers know there is no way to know for sure what — or whether — others feel (not even if they tell you). Science, however, is not about certainty but about probability and evidence. The 7.5 billion individual members of the human species can tell us what they are feeling. But there are 9 million other species on the planet (20 quintillion individuals), from elephants to jellyfish, with which humans share biological and cognitive ancestry, but not one other species can speak: Which of them can feel — and *what* do they feel? Their human spokespersons — the comparative psychologists, ethologists, evolutionists, and cognitive neurobiologists who are the world's leading experts in "mind-reading" other species -- will provide a sweeping panorama of what it feels like to be an elephant, ape, whale, cow, pig, dog, bat, chicken, fish, lizard, lobster, snail: This growing body of facts about nonhuman sentience has profound implications not only for our understanding of human cognition, but for our treatment of other sentient species.

Gregory Berns: Decoding the Dog's Mind with Awake Neuroimaging
Gordon Burghardt: Probing the Umwelt of Reptiles
Jon Sakata: Audience Effects on Communication Signals
PANEL 1: Reptiles, Birds and Mammals
WORKSHOP 1: Kristin Andrews: The "Other" Problems: Mind, Behavior, and Agency
Sarah Brosnan: How Do Primates Feel About Their Social Partners?
Alexander Ophir: The Cognitive Ecology of Monogamy
Michael Hendricks: Integrating Action and Perception in a Small Nervous System
PANEL 2: Primates, Voles and Worms
WORKSHOP 2: Jonathan Birch: Animal Sentience and the Precautionary Principle
Malcolm MacIver: How Sentience Changed After Fish Invaded Land 385 Million Years Ago
Sarah Woolley: Neural Mechanisms of Preference in Female Songbird
Simon Reader: Animal Social Learning: Implications for Understanding Others
PANEL 3: Sea to Land to Air
WORKSHOP 3: Steven M. Wise: Nonhuman Personhood
Tomoko Ohyama: Action Selection in a Small Brain (Drosophila Maggot)
Mike Ryan: "Crazy Love": Nonlinearity and Irrationality in Mate Choice
Louis Lefebvre: Animal Innovation: From Ecology to Neurotransmitters
PANEL 4: Maggots, Frogs and Birds: Flexibility Evolving
SPECIAL EVENT: Mario Cyr: Polar Bears
Colin Chapman: Why Do We Want to Think People Are Different?
Vladimir Pradosudov: Chickadee Spatial Cognition
Jonathan Balcombe: The Sentient World of Fishes
PANEL 5: Like-Mindedness and Unlike-Mindedness
WORKSHOP 5 (part 1): Gary Comstock: A Cow's Concept of Her Future
WORKSHOP 5 (part 2): Jean-Jacques Kona-Boun: Physical and Mental Risks to Cattle and Horses in Rodeos
Joshua Plotnik: Thoughtful Trunks: Application of Elephant Cognition for Elephant Conservation

Lori Marino: Who Are Dolphins?
PANEL 6: Mammals All, Great and Small
Larry Young: The Neurobiology of Social Bonding, Empathy and Social Loss in Monogamous Voles
WORKSHOP 6: Lori Marino: The Inconvenient Truth About Thinking Chickens
Andrew Adamatzky: Slime Mould: Cognition Through Computation
Frantisek Baluska & Stefano Mancuso: What a Plant Knows and Perceives
Arthur Reber: A Novel Theory of the Origin of Mind: Conversations With a Caterpillar and a Bacterium
PANEL 7: Microbes, Molds and Plants
WORKSHOP 7: Suzanne Held & Michael Mendl: Pig Cognition and Why It Matters
James Simmons: What Is It Like To Be A Bat?
Debbie Kelly: Spatial Cognition in Food-Storing
Steve Phelps: Social Cognition Across Species
PANEL 8: Social Space
WORKSHOP 8: To be announced
Lars Chittka: The Mind of the Bee
Reuven Dukas: Insect Emotions: Mechanisms and Evolutionary Biology
Adam Shriver: Do Human Lesion Studies Tell Us the Cortex is Required for Pain Experiences?
PANEL 9: The Invertebrate Mind
WORKSHOP 9: Delcianna Winders: Nonhuman Animals in Sport and Entertainment
Carel ten Cate: Avian Capacity for Categorization and Abstraction
Jennifer Mather: Do Squid Have a Sense of Self?
Steve Chang: Neurobiology of Monkeys Thinking About Other Monkeys
PANEL 10: Others in Mind
WORKSHOP 10: The Legal Status of Sentient Nonhuman Species

