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Unconscious humans, autonomous machines and the difficulty of knowing which animals are sentient

Commentary on **Crump et al.** on *Decapod Sentience*

Marian Stamp Dawkins
Department of Biology, University of Oxford

Abstract: The framework proposed by Crump et al. still leaves much doubt about whether invertebrates such as crabs are sentient. For example, many complex behaviours - even in humans - occur without sentience. Also, simple machines could easily meet all of Crump et al.'s eight proposed criteria for sentience. Acknowledging the limitations of what we currently know about sentience is important both for formulating legislation correctly and for advancing scientific understanding of this most puzzling of biological phenomena.

Marian Stamp Dawkins is Professor of Animal Behaviour at the University of Oxford and has a long history of research in animal welfare with a particular focus on the animal's own point of view. Her books include *Animal Suffering* (1980), *Why Animals Matter* (2012) and *The Science of Animal Welfare* (2021). **Website**

The question of which non-human animals are sentient can currently, depending on which authors are cited, be given almost every possible answer from none (MacPhail, 1987), to only apes (Bermond, 2001), to all mammals (Boly et al., 2013), to mammals and birds (Seth et al., 2005), to mammals, birds and reptiles but not fish or amphibia (Cabanac et al., 2009), to all vertebrates including fish (Denton et al., 2009; Mashour and Alkire, 2013; Braithwaite, 2010; Sneddon, 2019) to all vertebrates and a few invertebrates such as octopuses, (Tye, 2017), to many invertebrates, especially insects & crustacea (Barron and Klein, 2016; Bronfman et al., 2016), and even to all living things, including plants and bacteria (Margulis, 2001; Reber et al., 2022).

Crump et al. (2022) have now applied a set of eight criteria to decapod crustacea as a way of deciding which of them are sentient. The authors start by acknowledging the difficulty of this task but then go on to argue that, for ethical reasons, it may be necessary to take action to protect animals based on evidence that is less than certain (Birch, 2017). Their proposed framework, however, gives the impression that it can provide much stronger evidence for animal sentience than it in fact does. Given the weight already given to their criteria in the UK's recent Animal Welfare (Sentience) Act 2022, it is important that the limitations of the framework are acknowledged and discussed. Three of these are listed here.

1. Much complex behaviour occurs without sentience

Crump et al. state "We accept that any set of behavioural, cognitive, and neuroscientific patterns could conceivably be achieved without sentience" (p.3). But the phrase "could conceivably" appears to dismiss a growing volume of evidence that many highly complex processes not only could, but actually do, occur without sentience.

For example, people who take certain so-called fear-reducing drugs can appear calmer on the outside and even show a reduction in heart rate and other physiological indicators of fear but they say they still feel just as anxious and fearful as ever (LeDoux, 2014; LeDoux and Hofmann, 2018). The drugs target the amygdala, which controls the behavioural and physiological response to threat, whereas conscious feelings of fear arise from a different brain circuit, one that does not require the amygdala (Anderson and Phelps, 2002), and are unaffected by the medication (LeDoux and Pine, 2016; LeDoux and Hofmann, 2018). These changes in behaviour/physiology clearly occur without a corresponding change in sentience.

Many behaviours and cognitive tasks such as playing a musical instrument or driving a car also have multiple routes to action (Rolls, 2016) - that is, they can be performed using alternative brain circuits, only some of which involve consciousness. Our brains enable us to recognize faces, recognize emotions, detect errors, learn the rules of a game, read, and even do mathematics, all without being conscious *that* we doing it, or *how* (Colman et al., 2010; Dehaene, 2014; Axelrod, et al., 2015; Schelonka et al., 2017). "Most of the brain's operations are unconscious" Dehaene (2014) concludes "We are unaware of most of what we do and know" (p.191).

These findings on human consciousness should make us careful when evaluating the question of sentience in other species. They show that, even in humans, behaviour and cognitive abilities are not necessarily tied to conscious experiences in any simple way. The argument that other species are like us in their behaviour and so, by analogy, must be like us in being sentient when they perform similar behaviour is therefore weaker than it might appear. There is always the possibility that many animals could still be like us, but like us when we are in unconscious mode. This means that until we understand a great deal more about what a brain does when it gives rise to sentience, claims about sentience in invertebrates should emphasize how little we currently understand about what makes the difference between a sentient and a non-sentient brain.

2. All eight criteria can be met by simple machines

Crump et al. (2022) point out that the neural structures associated with sentience in humans may be very different from those potentially present in invertebrates because the same functions may be carried out by very different structures. However, the same functional argument would also lead logically to the conclusion that it is not even necessary to have a nervous system at all to be sentient and that a man-made machine could also be sentient, provided that it can perform the relevant functions.

To see how easy it would be for even a relatively simple machine to meet all eight criteria defined in functional terms, imagine an autonomous robot designed to operate for long periods in a complex environment (such as another planet), where any guidance from humans was limited or subject to significant time delays. To keep going for any length of time, an efficient robot would have to have ways of detecting damage to itself (criterion 1) and of integrating information to determine the source of damage (2 & 3). It would then need to be able to repair itself and/or modify what it could do in the light of damage (4 & 6). It would also need to have a mechanism for managing motivational trade-offs (5) such as deciding priorities for different tasks, repairing, itself or dropping everything to go and recharge its batteries. The advantages of anticipating or avoiding damage altogether could be gained by using already advanced techniques of machine learning (7); and since the robot would also need to have a mechanism for knowing whether the steps it was taking to avoid, alleviate or repair damage to itself were working, it might also show the equivalent of our response to

analgesics and anaesthetics (8). We judge whether our injured limb is healing by whether the pain signal is getting less and find anything that reduces that signal rewarding, even when the pain signal has been artificially reduced by a pain-killer. Similarly, a machine that used progressive reduction in a damage signal as evidence that its repair of surface damage was working could also be more likely to seek out situations that reduced the damage signal. The point is that all eight criteria proposed by Crump et al. could easily be met (and in many cases are already met) by machines programmed with simple algorithms.

Accepting the eight criteria as evidence for sentience in crustacea and other invertebrates would thus allow a whole army of damage-detecting, self-repairing, self-training machines into the sentience club. I am not arguing here either for or against sentience in machines. I am simply pointing out that the Crump et al., criteria for sentience in crustacea could make it difficult to say that some quite simple machines were not also sentient.

3. The grading system confuses meeting a 'sentience criterion' with whether that criterion correctly indicates sentience

Crump et al. propose a grading system for judging the overall strength of evidence that crustacea (and other animals) are sentient that looks at first sight as though it does provide the necessary provisos and disclaimers. On page 8, a grade of "very high confidence" is defined as "when the weight of scientific evidence leaves no scope for reasonable doubt" that an animal satisfies or fails one of their criteria for sentience. However, on page 9, high or very high confidence is stated to be when there is very strong evidence for sentience itself, with "No urgent need for further research into sentience in this taxon." Very high confidence that an animal fulfils most of their criteria for sentience has been subtly transformed into very high confidence that their sentience criteria do actually detect sentience. This could mislead the unwary reader (or legislator) into believing that the scientific evidence for sentience in some crustacea is so strong as not to require more research. But evidence that a 'sentience criterion' has been met is not evidence that the criterion correctly indicates sentience. As argued above, the criteria themselves are highly uncertain indicators of sentience so even 100% compliance with all of them would not guarantee certainty of sentience.

4. Conclusions.

If less than certain evidence is, on ethical grounds, used to decide which animals are sentient as Crump et al. recommend, then it is important that the weaknesses and objections to that evidence are stated explicitly, for two reasons: First, it is important as guidance for legislators so that they can evaluate explicitly the possible risks and side-effects such as failing to protect the welfare of a genuinely sentient animal *versus* needlessly legislating to protect the welfare of an insentient organism or machine.

Second, it is important on scientific grounds. Sentience – in any brain, human or otherwise – remains one of the biggest unsolved puzzles in the whole of biology. We should not give up saying so just because legislators have decided that there is enough evidence to pass laws and regulations (Dawkins et al., 2022). Highly complex behaviour can and does occur without sentience. The fallibility of the neural, behavioral and cognitive evidence we currently have needs to be spelled out so that everyone can see just how much we still do not know about which animals – or machines - are sentient.

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