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From animal to plant sentience: Is there credible evidence?

Commentary on **Segundo-Ortin & Calvo** on *Plant Sentience*

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Abstract: Segundo-Ortin & Calvo argue that plants have a surprisingly varied and complex behavioral repertoire. Which of these behavioral capacities are credible indicators of sentience? If we use the standards of evidence common in discussions of animal sentience, the behavioral capacities reviewed are insufficient evidence of sentience. Even if some putative indicators of animal sentience are present in plants, it is not clear whether what we should conclude is that plants are sentient or that those indicators are inadequate.

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1. Introduction. Drawing on a growing literature, Segundo-Ortin & Calvo (2023) review evidence of surprisingly sophisticated behavioral capacities and electrochemical activity in plants. They conclude that we should "take seriously the hypothesis that plants, too, might be sentient". With the term 'sentience', they refer to the property of having states which subjectively *feel like something* (what philosophers call 'phenomenal consciousness'.).

In this commentary, I sketch some issues relevant to evaluating the authors' behavioral evidence of plant sentience in the light of what is currently regarded as credible evidence of animal sentience. If plants do not meet the criteria for attributing sentience to animals, it is hard to see how attributing sentience to plants can be justified.

2. Assessing animals and plants consistently. The two main questions are: Is there strong evidence that some plants have behavioral capacities that researchers count as credible indicators of sentience in animals? And if plants have these capacities, should we actually infer that they are sentient? Segundo-Ortin & Calvo mention ten types of capacities we seem to find in plants: (1) communication, (2) kin and species recognition, (3) decision-making, (4) risk sensitivity, (5) anticipatory behavior, (6) learning and memory, (7) foraging and competition, (8) mimicry, (9) numerosity, and (10) swarm intelligence.

All ten capacities are relevant to the complexity and sophistication of plant cognition. Shevlin (2020) has argued that, with respect to *artificial* sentience, general intelligence is a useful heuristic for ascribing sentience. If the same is true in this context, all ten of these capacities seem at least somewhat relevant to questions of plant sentience.

Nevertheless, to make a strong case for plant sentience, one needs evidence which speaks directly to the question of sentience, not just general cognitive complexity. A strong case for

plant sentience could be made if plants had many of the capacities which are typically regarded as credible evidence of animal sentience.

Five recent comprehensive overviews classifying indicators of animal sentience are: Sneddon et al. (2014), Birch et al. (2020), Dung (2022), Crump et al. (2022) and Dung and Newen (2023). In considering the indicators of sentience that these five papers propose, two putative pieces of evidence of plant sentience particularly stand out: First, as Segundo-Ortin & Calvo (2023, section 2.3 and 2.4) point out, there is evidence that "plants can engage in complex decision-making, integrating and weighting information from different parameters and trade-offs, and prioritizing responses to improve the chance of survival". Second, they argue that plants learn via habituation and perhaps classical conditioning.

In the animal sentience literature, motivational trade-off behavior, i.e., behavior which flexibly trades off between rewards and punishments and their respective strengths (e.g., the strength of an electric shock and a food reward), is standardly seen as credible evidence of sentience (Appel and Elwood 2009; Gibbons et al. 2022; Millsopp and Laming 2008). In fact, all five of the overview papers listed above mention this paradigm explicitly. Segundo-Ortin's & Calvo's review of plant decision-making and risk sensitivity shows that there is evidence of similar kinds of trade-offs in plants.

In the five overviews as well as in many other works (Allen 2013; Birch 2022; Ginsburg and Jablonka 2019), learning capacities are regarded as important indicators of sentience. Thus, Segundo-Ortin's & Calvo's discussion of learning and memory seems relevant to questions of plant sentience. However, it is noteworthy that the orthodox view in the animal sentience literature, supported by considerable empirical evidence (Clark and Squire 1998; Droege et al. 2021; Greenwald and De Houwer 2017; Mason and Lavery 2022), is that simple forms of learning, including some forms of classical conditioning, do not require sentience. Thus, even if findings of classical conditioning in plants could be replicated, this would not do much to support the view that plants are sentient.

To take stock, when we evaluate plants by the same standards that have been proposed for assessing animal sentience, we get a mixed picture. One may argue that the evidence of decision-making by plants appealed to by Segundo-Ortin & Calvo is indeed credible evidence of sentience. By contrast, the known learning abilities of plants are insufficient to speak to the question of sentience. For the other behavioral capacities reviewed by Segundo-Ortin & Calvo, it would be instructive to spell out the rationale for why they might count as evidence of sentience. Which specific features implicated in sentience are they supposed to indicate?

3. Should we trust the methods of animal sentience research? There is a further complication, however, in treating behavioral capacities known from the animal literature as evidence of plant sentience. Suppose you learn that plants possess a certain behavioral capacity you thought was too sophisticated for them. There are two types of reactions you might have: First, you might think that plant cognition is more complex and sophisticated than you thought. Second, you might think that the capacity in question requires less complex and sophisticated cognition than you thought. It is not clear which option to prefer in any given case. [1] Consider motivational trade-off: Irvine (2020) takes the fact that *C. elegans*, a worm whose nervous system comprises only 302 neurons, displays motivational trade-off behavior

[1] In probabilistic terms, where you update your degree of belief in accordance with new evidence, you should have both reactions simultaneously, to some extent.

as evidence that motivational trade-off is not sufficient for sentience. In the same vein, Mason and Lavery (2022) argue that because certain organisms not considered sentient (including plants) nevertheless have certain capacities, these capacities are not sufficient indicators of sentience.

Perhaps in response to these concerns, Gibbons et al.'s (2022) study on bumblebees supplemented the motivational trade-off (between noxious heat and a rewarding sucrose solution) task with a memory component. Since the trade-offs depend on associative memory, this study increases the demand for information integration. I know of no evidence that trade-offs that rely on associative memory can be performed by *C. elegans*, let alone plants. Hence, if we decide that passing this version of the trade-off paradigm is actually what credible evidence of sentience requires, then trade-off paradigms provide insufficient evidence of plant sentience.

In conclusion: To make a strong case for plant sentience, it is necessary to show that plants have behavioral capacities that count as credible evidence of sentience when they occur in animals. Currently, this criterion has not been met. Moreover, there is a methodological issue. When plants have a particular behavioral capacity, we often take that as evidence that that behavioral capacity does not require sentience, rather than as evidence that plants are sentient. This methodological issue would benefit from explicit discussion in the future.

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