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Cognition is not evidence of sentience

Commentary on [Segundo-Ortin & Calvo](#) on *Plant Sentience*

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Abstract: The ability of plants to detect their environment, including other organisms within that environment, is unquestioned. The ability of plants to differentially process, integrate and respond to complex combinations of environmental information could perhaps be described as cognition. But no amount of evidence for cognitive abilities in plants equates to evidence for plant sentience. Nor is plant sentience required to understand or interpret the behaviour of plants in their environment.

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1. Plant cognition? Even among plant scientists, there has long been a tendency to view plants as rather passive actors in their environment, merely reacting to stresses through hard-wired response mechanisms. This is perhaps best illustrated by classical physiological models in which changes in plant growth are explained as a response to starvation (see Walker & Bennett, 2018). However, as summarised by Segundo-Ortin & Calvo (2023) (S&C), a wealth of studies over the last two decades have shown that plants can change their growth and physiology pro-actively in response to environmental information. They can anticipate future events (such as starvation) by monitoring the environment and adjusting their behaviour to avoid stress altogether or to deal with it as effectively as possible. One can describe this ability as “cognition,” as S&C do, but the term is controversial here, as highlighted by both Ten Cate (2023) and Mallatt et al (2023) in their commentaries. The pro-active processes might still be hard-wired responses to *predictive* cues in the environment rather than direct responses to stressful stimuli. However, we do not yet fully understand plant information processing. Plant bodies are pseudo-colonial, with no “central processor”, and each organ processes information locally (Leyser, 2011). In such distributed computing systems, there could certainly be scope for something akin to cognition to arise as an emergent, whole-system property of the hard-wired responses of individual organs to the environment.

2. The plant neurobiology debate. The recent evidence for plants as pro-active agents, undergoing complex interactions with their environment, including with other organisms, has led to a vigorous and rather polarized debate among plant scientists. There are some very active proponents of “plant neurobiology” (and, by extension, “plant intelligence”) and a larger number of plant scientists who instinctively and automatically react against such claims. This is evident in the commentaries evoked by the target article by S&C, who are also strong proponents of plant neurobiology. For the record, I am very much “on the fence” regarding this debate; I certainly recognise the potential for plants to have some form of complex information processing (akin to cognition), but I do not think current evidence allows any firm conclusions to be drawn. For me, there is enough fascination in understanding the

incredible ability of plants to adapt pro-actively to their environment; it does not matter to me whether this counts as “cognition” or not.

3. Cognition is not evidence for sentience. S&C summarise current evidence for plant cognition, as well as for electrophysiological signalling that could act like the nervous system of animals. These capabilities are then used to argue that plants could even be sentient, i.e., able to “feel” sensations rather than just respond to stimuli.

I disagree with the arguments advanced by S&C, on two major counts. First, as well-summarised by Gutfreund’s (2023) commentary, this is largely an empty debate about a cultural construct. The idea of sentience is hard enough to define in humans, let alone animals, and certainly impossible in the context of plants. But even if we could define what plant sentience would amount to, we can never know whether plants have it.

My second objection relates to the line of argument advanced by S&C. They seem to rely on very weak reasoning, which essentially amounts to: “because X exists, we cannot rule out that Y exists,” S&C do not present any evidence for the existence of plant sentience *per se*, only speculation based on incompletely understood phenomena: e.g., “*It is possible that anesthetics not only disrupt plant behavior but shut down plant sentience or awareness altogether.*” S&C rely ultimately on the argument that because plants (may) have cognitive abilities that are unanticipated, we cannot rule out that they are also sentient: “*Thus, since plants turn out to exhibit many of the cognitive abilities formerly assumed to be exclusive to animals, there is no reason to assume that they are incapable of sentience too.*” But cognition would not be positive evidence for plant sentience in itself, and indeed, no amount of evidence for plant cognition would ever be evidence for sentience, which is something fundamentally different. In this sense, I concur with Struik (2023), that S&C do not link cognition to sentience in a scientifically principled or rigorous way.

4. Concluding remarks. Whereas I join the other commentators in recognising the stimulating contribution of Segundo-Ortin & Calvo (2023) and the vigorous debate that it provokes, my personal belief is that discussions about plant sentience are an unnecessary distraction from understanding the amazing ability of plants to adapt to their environment. We should aim to understand plants on their own merits, rather than trying to fit them to zoomorphic frameworks.

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