

ANIMAL SENTIENCE

AN INTERDISCIPLINARY JOURNAL ON ANIMAL FEELING

Struik, Paul C (2023) [Plants detect and adapt, but do not feel](#). *Animal Sentience* 33(3)

DOI: 10.51291/2377-7478.1777

Date of submission: 2023-03-25

Date of acceptance: 2023-04-04



This article has appeared in the journal *Animal Sentience*, a peer-reviewed journal on animal cognition and feeling. It has been made open access, free for all, by WellBeing International and deposited in the WBI Studies Repository. For more information, please contact wbisr-info@wellbeingintl.org.



Plants detect and adapt, but do not feel

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

P.C. Struik

Centre for Crop Systems Analysis, Wageningen University,
Netherlands

Abstract: Plant sentience is a hot topic in scientific and popular media. There are moral reasons to respect both the service of plants to humanity and their natural integrity as creatures playing their own significant role in a complex ecosystem. However, to infer that plants have certain cognitive capacities that are present also in certain human and nonhuman animals calls for scientific rigor beyond mere analogy. The unique capacities of plants identified by Segundo-Ortin & Calvo are not necessarily linked to sentience. Nor is it likely that sentience is an evolutionary trait that is present to some extent in all living organisms.

[Paul C. Struik](#) is emeritus professor of crop physiology at the Centre for Crop Systems Analysis of Wageningen University & Research. He was responsible for teaching in agronomy and crop science and led a research team focusing on C₃ and C₄ photosynthesis, crop modelling, nutrient management, and seed systems. [Website](#)



1. The debate. Segundo-Ortin & Calvo (2023) suggest it is about time for scientists to start taking the hypothesis that plants are sentient seriously. They argue that there are numerous examples showing that the behaviour of plants is not just hard-wired. They also claim that science underestimates the role of plant electrophysiology.

This debate is at least 50 years old and has diverse motivations. A philosophical debate explores how animals, plants and other life forms differ from humans. A scientific debate seeks ways to ask new research questions and test new theories. A creative debate is an exercise in scientific imagination and speculation. Here, I concentrate on the scientific debate, acknowledging that my stance is a product of my own personal world view.

2. Moral consequences. The outcomes of these debates can have considerable consequences. They can have a direct impact on how we look at plants, how we study them, how we breed and multiply them, and how we use them in agriculture. Should the moral objections against industrial animal farming also be extended to arable farming, be it organic or conventional? And should we treat our houseplants more the way we treat our family animals?

Attributing sentience to plants reflects an anthropomorphic view of plants. Taken to its extreme this could result in treating them as individual beings, as many family animal owners do with their pets. The plant's life history creates an individual with a unique level of cognition and a special phenotype because of its own unique series of experiences and decision-making processes. Moreover, each unique individual will be the result of unique parents and will pass on its accumulated expertise and knowledge to unique offspring through epigenetics. Looking at plants as individuals would influence our approach to their management and would require respecting the dignity of the individual plant.

In earlier work (Lammerts van Bueren & Struik, 2005), we argued that under organic farming crop plants deserve respect for their integrity. This integrity of crop plants concerns their inherent nature, wholeness, completeness, species-specific characteristics, and their balance with their environment as they pursue their natural aims. We suggested that this integrity has ethical value, distinguishing integrity of life, species-level integrity, genotypic integrity, and phenotypic integrity. We elaborated this ethical value in terms of human responsibility and respect for the right of crop plants to be nurtured and to express natural behaviour at all levels. We elaborated these ethical notions further by expressing the need to reconcile the natural aim of plants with their utility, recognizing that both have moral value (Struik et al., 2019). We implemented this in practice in the case of red cabbage, where plant breeding has created a plant form that disrupts the functioning of young leaves and inflorescences (Zoeteman et al., 2022).

Assuming that plants are sentient might make our moral responsibility and respect towards plants even more urgent, raising the question whether moral responsibility and respect should be accorded to them collectively, as a community, or also as individuals. Although I do wish to stress this ethical point in relation to plant sentience, the scientific debate about plant sentience and its physiological mechanisms and consequences is of a different nature.

3. What is the reasoning of proponents of plant sentience? Papers on plant sentience usually describe the ability of plants to perceive signals, to communicate these signals internally, to interpret and respond to them, to do so in a highly organized or even calculated manner, to learn from this, and to adjust their future behaviour accordingly. Plants also communicate to other plants (kin or not) and to other life forms, either for their own good or out of “altruism.” In the way plants behave, the proponents of plant sentience recognize cognition, including capacities such as communication, kin- and species-recognition, decision-making, risk sensitivity, anticipatory behaviour, learning, memory, foraging, competition, mimicry, numerosity and swarm intelligence. Segundo-Ortin & Calvo suggest that these capacities require informational integration of the plant body as a whole and serve to maximize fitness and decision-making efficiency. One could call that “consciousness,” and they indeed use that word. They also suggest that these capacities are only possible through a form of neurobiology, plant electrophysiology or electrical activity in plant cells. As one of the major proofs of plant neurobiology, they describe experiments with anaesthesia that indeed disrupts plant functioning when administered to plants. [See Segundo-Ortin & Calvo’s target article for references.]

4. My objections. My first objection to the reasoning in this target article and other such papers is that it is based on reasoning by analogy. First, definitions and concepts that are commonly used in work on human cognition and sentience are stretched to make them broad enough to also include plant phenomena. Then proponents argue that it is acceptable to apply these definitions and concepts to plants on the basis of widely known (but not ubiquitous) phenomena in the plant kingdom. The case is then built from there, mainly from indirect and weak evidence (or no evidence at all), speculating mainly from further analogy. These narratives are certainly entertaining and thought-provoking, but they call for rigorous evidence. Nor does it help science to use metaphors without a basic understanding of the mechanisms underlying certain phenomena, or to copy definitions and use them *ad libitum* in debates where there cannot be direct evidence of who is right and who is wrong. The result is that there is a set of slightly distorted definitions and concepts that together create a new reality, its main advantage being to provide room for new hypotheses and innovative ways of

thinking. But reasoning by analogy should only be applied when there is a balanced use of similarities and differences between the distinct types of organisms. When this is not done, pseudoscience is around the corner.

My second objection is that the capacities suggestive of cognition are not linked to plant sentience in a principled way. These capacities probably exist in plants (although some are still debatable) but they do not require sentience; they require detection and processing of signals, followed by a coordinated response, based on the intrinsic characteristics of the species, cell-to-cell and organ-to-organ communication, internal patterning, homeostasis, and – where possible – changes in epigenetics to transfer the acquired traits to offspring. Comparing behaviours and assuming similar triggers based on similar behaviours simply does not pass the test for scientific rigor. Even the term “behaviour” is often considered inappropriate for plants.

My third objection is to the inference that all biological taxa are to some extent sentient. This inference comes from a bottom-up, evolutionary view based on the premise that adaptive functioning requires sentience (Reber 2019). This is circular reasoning. The premise is again pushing reasoning by analogy too far. I prefer to acknowledge the tremendous progress made in developmental and evolutionary biology during the last 50 years. This body of knowledge cannot be replaced by a theory built loosely on a weak foundation of notions and metaphors; it can only be replaced by constructing a new body of knowledge built on solid evidence for plant sentience.

5. Closing statement. Thanks are due to Segundo-Ortin & Calvo for stimulating our imaginations and rethinking our attitudes towards these marvellous, complex, and very resourceful organisms. I do love plants; however, I do not expect any feelings in return.

References

- Lammerts van Bueren, Edith T. & Struik, Paul C. (2005). Integrity and rights of plants: ethical notions in organic plant breeding and propagation. *Journal of Agricultural and Environmental Ethics* 18, 479-493.
- Reber, A. S. (2019). *The First Minds: Caterpillars, Karyotes, and Consciousness*. Oxford University Press.
- Segundo-Ortin, M., & Calvo, P. (2023). [Plant sentience? Between romanticism and denial: Science](#). *Animal Sentience* 33(1), 455.
- Struik, P.C., Bos, A., Van Mansvelt, J.D., Sprangers, D., & Zoeteman, K. (2019). Handling tensions between natural and utility purpose of farm animals and crop plants. *Sustainability* 2019, 11(4), 1019
- Zoeteman, Kees, Van Zon, Astrid, & Struik, Paul (2022). Werken vanuit de telos. Eigenheid van organisaties, mensen, dieren en planten. *Motief* 267, November 2022, 14-16.