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LEONARDO THINKS

Opinion: The Sensorial Invisibility Of Plants: An Interdisciplinary Inquiry Through Bio Art And Plant Neurobiology

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I began my doctorate probing scientific possibilities of having living plants respond visibly to touch. Since plants, for the most part [1], do not behave in ways we recognise as sensorial, the artistic motivation was to produce interactive experiences between plants and humans – a desire born out of the intimate spaces where curiosity and touch meet.

Whilst developing a strategy to induce responsive motion in living plants using novel biomedical nanotechnology [2], I became increasingly intrigued by scientific findings revealing plants' perceptual qualities and cognitive capacities [3] and the extent these findings conflicted with our ordinary experiences of plants. The conflict between these two perceptions of plants points to the broader implications of how the arts integrate science, specifically impacting 'bio art', where this research is situated. Bio art describes itself as 'an art form, which utilizes diverse biotechnological methods as new media of expression' [4] and whose claim is to 'create not just new objects, but more tellingly, new subjects.' [5] I show how the contradistinction between the two perceptions of plants can open and problematise bio art with a new perspective. I argue that there is a need for scientific aspects to be more fully integrated into artistic processes in order to generate an understanding beyond the 'surface level' and towards epistemological insights of the living medium. The prioritisation of aesthetics in bio art practices were seen to obfuscate scientific findings and in doing so reinforce our understanding of plants as we ordinarily experience them - as 'automata-like [...] lacking active sensory-driven lifestyles.' [6]. The influential and prevailing notion of plants as devoid of cognitive or behavioural capacities can be traced back to the classical conception of plants that is deeply rooted in Aristotelian philosophy, where our ordinary and subjective observations (i.e. 'naked eye') is prioritised.

[...] for it appears that plants live, yet are not endowed with locomotion and perception [7].

Through an account of Aristotelian and post-Aristotelian thought on plants as non-sensorial, I depart from this view, or what is referred to as the 'Aristotelian trap', and relocate to more a recent view of plants as



communicative, sensorial and cognitive. Substantiating this view are the fascinating glimpses into lives of plants where the sheer sensational complexities of their behaviour are increasingly revealed through scientific findings [8]. Yet, their sensorial features frequently appear 'invisible' without the aid of an interface (i.e. imaging devices, reporter genes or electrodes). Plants' reactions to touch, for example, are not directly visible but results in gradual growth and morphological adaptations [9]. On the other hand, the existence of touch sensitive genes prevalent in plants [10] and their ability to perceive touch and wind stimuli in milliseconds [11] highlights a contradiction. Evidently, recognising plant behaviour is a time-delayed event. Our own ability to observe such changes at the level of the whole plant takes time, as genes will need to produce proteins, cells divide and so forth, slowly adding the layers that alters growth into our field of perception.

Bio art, in its integration of science, has the potential of consolidating pervasive ideas of plants as passive with the emerging cognitive view. In doing so it may offer a way of bridging a humanistic subjective experience with plants' intrinsic expressions. I provide a case study of artists within this field whose artworks attempt to elicit understandings of living plants (and cells) through a scientific context that include selective breeding, genomics and electrophysiology. However, on closer inspection we find that the scientific strategies incorporated into the artworks are frequently obfuscated and appropriated into conceptual, aesthetic, social, anthropomorphic or ethical features thereby obscuring our understanding of plant behaviour. For the scientific signification to be communicated as part of the artistic expression, aesthetics, humanistic subjectivity and narrative constructions are inadequate alone in gaining a 'deeper' understanding of the living medium.

Rather than reconcile the two understandings of plants with a broader spectrum of experiences, my findings show that we return to the 'Aristotelian' position of plants. Although bio art as an 'interaction' engages with the aliveness of the medium, genetic manipulation, ethics, biological processes and creation of subjects, it is nonetheless still caught in the 'Aristotelian trap.'



Endnotes

[1] Aside from a handful of specialised plants that exhibit elaborate, rapid and apparent touch-response behaviours such as Venus flytrap (*Dionaea muscipula*), sensitive plant (*Mimosa pudica*) or sundews (*Drosera*).

[2] Experiments undertaken as part of this research demonstrated latent features in plants (interactive motility) using biomedical magnetic nanoparticles.

[3] Anthony Trewavas, "Aspects of Plant Intelligence," *Annals of Botany* 82 (2003): 1-20.

[4] Jens Hauser, 'Biotechnology as Mediality: Strategies of organic media art', *Performance Research* 11.4 (2006): 129-136

[5] Eduardo Kac, "Introduction Art that Looks You in the Eye: Hybrids, Clones, Mutants, Synthetics, and Transgenics," *Signs of Life, Bio Art and Beyond*, ed. Eduardo Kac (Cambridge: The MIT Press, 2007) 1-27.

[6] František Baluška and Stefano Mancuso, "Plants and Animals: Convergent Evolution in Action?," *Plant-Environment Interactions: From Sensory Plant Biology to Active Plant Behavior*, ed. František Baluška, (Berlin, Heidelberg: Springer-Verlag, 2009) 285-301, 285.

[7] Aristotle, On the Soul: Book I, 350 B.C.E, 18 September 2009
<<http://classics.mit.edu/Aristotle/soul.1.i.html>>.

[8] These findings have brought together a newly focused field that addresses 'the physiological and neurobiological bases of adaptive behaviour in plants.' The Society of Plant Signaling and Behavior, Plant Signaling and Behavior, 11 January 2010, <<http://www.plantbehavior.org/>>. This nascent branch of plant biology, referred to as 'plant neurobiology' aims to understand 'how plants perceive their circumstances and respond to environmental input in an integrated fashion, taking into account the combined molecular, chemical and electrical components of intercellular plant signaling. Plant neurobiology is distinct from the various disciplines within plant biology in that the goal of plant neurobiology is to illuminate the structure of the information network that exists within plants.' E D Brenner, et al., "Plant neurobiology: an integrated view of plant signaling," *Trends in Plant Science* 11.8 (2006): 413-419.

[9] This phenomenon is known as *thigmomorphogenesis* and is used to describe the developmental responses of plants to touch.

[10] Janet Braam, "In touch: plant responses to mechanical stimuli," *New Phytologist* 165 (2005): 373-389, 384. Janet Braam and Ronald W Davis, "Rain-, wind- and touch-induced expression of calmodulin and calmodulinrelated genes in Arabidopsis," *Cell* (1990): 357-364.

[11] Marc J Knight, Steven M Smith and Anthony J Trewavas, "Wind-induced plant motion immediately increases cytosolic calcium," *Proceedings of the National Academy of Sciences* 89 (1992): 4967-4971, 4967.

Bio: Laura Cinti is an artist working with biology. She is co-founder and co-director of C-LAB, an internationally recognized interdisciplinary art platform that generates and participates in both artistic and scientific forums. The abstract for her PhD thesis was among the top-rated abstracts published in the English-language Leonardo Abstracts Service Databases (LABS) during the first half of 2011.