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EDITORIAL

Trapped in time: Lingering with "Plantness"

1 | INTRODUCTION

In modern urban existence, the complex lives of plants are often reduced to simplistic categories, which resonate with human utility; as Jahren (2016) noted: "Human civilization has reduced the plant, a four-hundred-million-year-old life form, into three things: food, medicine and wood" (p. 279). These categories speak little of the contributions plants make to the ecological fabric of life on Earth; both on land and in the oceans, nor to the exploitation of humans by plants, for example, Darnel *Lolium temulentum* (Thomas, Archer, & Marggraf Turley, 2016); neither do they acknowledge the complex inter- and intrasystems in which plants live out their lives (Gagliano, 2015; Iverson et al., 2017). The temporal zones that plants inhabit need to be multifaceted: the "capability to sense and respond to external mechanical stimuli at various timescales is essential to many physiological aspects in plants, including self-protection, intake of nutrients and reproduction" (Guo et al., 2015). This complexity presents difficulties when the unfamiliar characteristics of "plantness" (Darley, 1990) are to be revealed to everyday spectators. Especially so when plants are popularly generalized as living in a slow lane that appears to be closed to human perception (Attenborough, 1995). This editorial draws attention to the rich time assemblages in which plants exist and highlights the need for diverse representations with which to engage human attention to the botanical world.

2 | LINGERING: BEING WITH PLANT

Charles Darwin closely attended to the movements of various plants situated around the walls of his house and in his greenhouse. In so doing, he became intertwined with plant life, both physically in his experimental work (Hustak & Myers, 2012) and intellectually through his theorizing and analysis (Darwin, 1875, 1880). In addition, he observed, and noted, multiple movements from his climbing cucumber, *Echinocystis lobata*, the plant that resided with him in his study:

> *Having the plant in my study I have been surprised to find that the uppermost part of each branch, (i.e. the stem between the two uppermost leaves, excluding the growing tip) is constantly and slowly twisting round, making a circle in from 1 and a half to 2 hr: it will sometimes go round 2 or 3 times, & then at same rate untwists & twists in opposite direction. It generally rests half an hour before it retrogrades. The stem does not become permanently twisted. The stem beneath the twisting portion does not move in the least, though not tied. The movement goes on all day & all early night— It has no relation to light for the plant stands in my window & twists from the light just as quickly as towards it.*
> (Darwin Correspondence Project Letter)

Unlike Charles Darwin, contemporary urban humans "are largely asynchronous with plants" and "have neither the patience nor the capacity to linger with them, to accompany their development and growth" (Marder, 2013, p. 19). But what if city dwellers did stay and linger with their houseplants? What might they witness? (Sanders, 2018) (Figures 1 and 2).

Is the popularized notion of slowness a case of stereotyping: "when one thinks of fast movement, plants do not usually come to mind" (Guo et al., 2015). Humans are used to "rate of living" as being inversely related to size; for example, a wren's movements and perceptions take place in a different time-frame from those of a cow and a herd of cattle changes more slowly than an individual cow. Plants are essentially what James White (1979) calls "populations of parts," and this probably contributes to their pace of change. Additionally, a key characteristic in plant survival mechanisms is their ability for tolerance in the face of attack, as noted by Farmer (2014): "No organ is as tolerant of attack as is the leaf" (p. 177). Perhaps, in recognition of this, we might add the capacity of leaves for tolerance as another aspect of temporal complexity: there is no running away because there can be no running away from insect attack.

But herein lies a challenge; how do we take popular perceptions of plant life out of the slow lane? Moreover, can we encourage human "lingering" in the presence of plants so that they might find a personal window into "Life as Plant"?

3 | FAST MOVEMENT

Plant movements are morphologically complex, temporally diverse, and sometimes invisible to human perception due to their high speed, rather than slow pace (Gou et al., 2015). A good example

FIGURE 1 *Echinocystis lobata*, commonly known as wild cucumber, prickly cucumber, or balsam apple, the movement of which so fascinated Darwin. Photograph by RA, distributed under a CC-BY-SA-3.0 licence

is the trapping mechanism of the carnivorous *Utricularia* species (Vincent et al, 2011). The traps of these plants have been recorded as conducting suction at less than a millisecond and thus "the exceptional trapping speed—far above human visual perception—impeded profound investigations until now" (Vincent et al., 2011, p. 2909). By utilizing high-speed video coupled with distinct microscopy techniques researchers, such as Vincent et al. (2011), now understand far more about the trapping mechanics of *Utricularia*, and importantly, the speed at which it takes place. Moreover, a recent study (Westermeier, 2018) on another water-based carnivorous plant *Aldrovanda vesiculose*—the Waterwheel plant—has also been documented as being extremely fast and, like *Utricularia*, the traps are very small. This combination of small scale and fast speed has pushed the scientists studying the trap mechanism of this plant to "the limits of optical resolution" (Halton, 2018). Thus, a key question for scientists and educators wishing to take this fast time plant narrative into the wider world, is how do we tell the story? Especially when it is not immediately perceptible.

4 | PLANT-TIME ANALOGIES

The use of analogy has been present in biology education for some time (Hackney & Wandersee, 2002; Harrison & Treagust, 1993) and can be useful in the context of bringing fast plant-time to human attention. An example of a physical analogy with *Utricularia* trap speed is the speed at which it is possible to click human fingers -substantially *slower* than the speed in which the plant trap functions, thus using the familiar action of finger clicking to access unfamiliar notions of plant movement. Moreover, video and animation representation can build on these initial experiences and further the narrative of plant-time complexity. Likewise, theater and mime can be useful tools, as Peleg and Baram-Tsabari (2011) have demonstrated in physics and chemistry education. In addition, there is a burgeoning videogames industry in which designers discuss complex foliage modeling (see https://video-game-foliage.tumblr.com). There are plants which do move in a time zone easily perceived by humans; a classic example being the sensitive plant, *Mimosa pudica*, which, although still considered to be fast (Guo et al., 2015), can be seen by the naked eye.

Research interest in *Mimosa pudica* spans both a broad historical range (see for example https://herbaria.plants.ox.ac.uk/bol/plants400/Profiles/MN/Mimosa) and disciplines beyond the botanical, for example, Abrahamson & Chicas-Mosier's psychology paper *Learning in Plants: Lessons from Mimosa pudica* (2016). John Evelyn writes, in his diary of 1654, of a visit to the Oxford Physic Garden (now Oxford University Botanic Garden): "The sensitive plant was shown us for a great wonder" (Evelyn, 1654, p. 289). Thus, *Mimosa pudica's* movements have drawn human attention across both historical time and academic subject.

5 | A VEGETAL VIEW

On a deeper philosophical level, what if we were to start our stories with a more plant-centric (Marder, 2016) rather than anthropocentric narrative; where might that take human views of the vegetal? Could such an approach provoke new ways of thinking about plants in the Anthropocene?

FIGURE 2 The thigmonastic movement of leaflets in *Mimosa pudica*; (a) the leaflets are open; (b) upon stimulus the leaflets close due to touch-induced changes affecting the turgor of cells within the pulvinus, a structure located at the base of each leaflet; (c) the leaflets are fully closed. The time lapse between each photograph is about 1 s. (a–c) (reproduced with permission from Scorza and Dornelas (2011)

Keywords
human perception, plant blindness, plant movement, plant speed, plant time, plant-centric, plantness

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