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In vegetal terms: Temporal lenses in human-plant interaction

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Abstract: This paper highlights temporality as an important more-than-human design strategy and expands multiple lenses for engaging with the temporal complexity of more-than-human. Reflecting on the dominance of anthropocentric and industrial notions of time in design, we choose plant as a paradigmatic case for otherly temporality. We take stock from interdisciplinary literatures and introduce six temporal lenses: rhythm, horizon, continuity, duration, genealogy, and incompleteness, to articulate how plants live, change, and relate through multiple overlapping temporalities. Connecting these lenses to human-plant interaction design practice, these temporal lenses enables designers to recognize temporal frictions, attend to vegetal rhythms, and cultivate responsive and situated design practices. The lenses serve as a conceptual framework for engaging with plants and other more-than-human temporalities in design processes. Ultimately, this study positions temporality as a key strategy for decentering the human in design and reimagining design as cohabitation and becoming.

Keywords: more-than-human, posthumanist design, temporality, human-plant interaction, decentering

1. Introduction

Recent design research has witnessed a decisive turn towards multispecies and posthuman perspectives that challenge anthropocentric assumptions. Within this shift, designers increasingly engage with plants, animals, and other nonhuman entities as active participants in socio-technical assemblages rather than passive objects of human use (Chang, 2022; Fell et al., 2022; Loh et al., 2024). Research in more-than-human design has significantly advanced awareness of an interconnected world of human and non-human lives, calling for a redistribution of agency, a reconfiguration of ethics, and a reimagining of design as cohabitation and mutual becoming (Akama et al., 2020; Forlano, 2017). Concepts like “noticing” (Rosén, 2022), “thingness” (Wakkary, 2024), and “sensitizing” (Hansen, 2024) expand designers’ attention beyond human users toward multispecies entanglements. These

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gestures prompt the question: how can design go beyond anthropocentric paradigms to understand other processes of life?

Although acknowledging the role time plays in shaping user experiences (Wiberg & Stolterman, 2021), designers often privilege universal and objective time measurements. In some human-plant interaction projects with utilitarian objectives, plants are trimmed off its unruliness to conform the industrial values of productivity and predictability, measured and controlled according to industrial clock and calendar times (Chang, 2022). Recent work explores diverse meanings of time and their manifestations, such as situating time within specific socio-economic contexts (Pschetz & Bastian, 2018), and through the lens of care (Oktay et al., 2024). Fuchsberger et al (2015)'s proposal of seven sensitivities regarding time in interaction design marks one of the first attempts to see the multiplicity of time, juxtaposing time as subject, context, design form, practice, and experience. More-than-human designers expand temporality to recognize more-than-human entities as active participants with their own temporalities and agencies, holding potential for ontological transformation (Oktay et al., 2024; Sanchez et al., 2024). Understanding these temporal dissonances has become key to cultivating communities of practice attentive to multiple overlapping timescales (Oogjes & Desjardins, 2024).

We argue that more-than-human temporality offers a crucial strategy for understanding nonhuman processes of becoming. Rather than confining "time" to clocks or calendars, we consider its generative role in shaping experience, change, and relation. Temporality is not only about coordinating or accommodating the different cycles but facilitating a moment of presencing (Otto, 2016) that redefines the human and more-than-human relationship in their co-emergence. Attending to multiple temporalities reveals how living entities of human and more-than-human co-exist and transform across divergent rhythms and durations

Translating this focus on temporality into practice however is often a steep learning process. Unpredictable tempos of more-than-human can frustrate design processes (Janicki, Parvin, et al., 2024; Tomico et al., 2023); even well-intentioned projects risk reproducing human-centered paradigms based on speed, efficiency, and synchrony. When researchers seek help from theories, they often find posthuman theories on time scattered and amid dense text, mingled with obscure ontologies and varied epistemological positions. A focused reading and juxtaposition of different temporal concepts, we reckon, could help design researchers to appreciate the rich and diverse ways temporality could be understood beyond linearity, providing practical assistance to manage the ontological shock and caution needs for diversifying methods. Moreover, we argue that these practical challenges are not merely tactical but reflect the deeper rupture between modern industrial time and more-than-human temporalities. Complicating this rupture may transform frustration into opportunity in which a distinct direction of more-than-human design could be pursued for interspecies flourishing

As an initial and tentative step toward this direction, this study develops six temporal lenses using plants as the paradigmatic "otherness" for study. The temporal lenses first started to emerge in our ongoing research and reading on human-nature relationship and more-than-human studies. With the idea of developing an array of lenses, we conducted exploratory review spanning multispecies ethnography, human geography, and urban ecology, with guidance from latest development in the interdisciplinary field of critical plant studies (Lawrence, 2022). We place focus on human-plant relationship of the broadest definition,

from farming, gardening and forestry to urban trees and weeds. Then we formulated six temporal lenses due to their high relevance and inspiration for human-plant interaction design practice. A subsequent snowballing review of recent HPI design practices applied these lenses to identify and analyze examples that illustrate how temporal perspectives can reshape design processes and practices. The six lenses will be discussed one by one, each consisting theoretical / interdisciplinary discussion and emerging design cases. The correspondence between concepts, theoretical inspirations, plant groups and emerging design concepts are summarized in Table 1.

Table 1: Summary of six temporal lenses for human-plant interaction

	Rhythm	Horizon	Continuity	Duration	Genealogy	Incompleteness
Concept	Different cycles; uneven distribution of intensity; different speed of movement /growth	The future perspective of a plant; harvest/death avoidance; design and project horizon	(Eco/social) systems to support the existence of plant; Intergenerational continuity; inheritance /reciprocity	Showiness and performativity; significance of trivial change	Historical evolution and entanglement of socio-cultural systems	Ontological openness and freedom; articulation of milieu and time; non-teleological play
Theoretical inspiration	Urban studies (Henri Lefebvre); anthropology (Harold Conklin); phenology	Agriculture; environmental humanities	Anthropology (Ingold); ethics and practice of care (de la Bellacasa; Mol)	Process philosophy (Bergson, Deleuze); new materialism (Bennett)	Poststructuralism (Foucault); feminist posthumanism (Braidotti)	Plant philosophy (Marder, Pouteau)
Exemplary Plant group	Agriculture (phenology for crops); plant in general (speed of growth)	Agriculture (rice); Forestry	Agriculture (soil care; multi-species ecosystem); forestry (generational)	Flowering plants (showiness); grape vine (climate-sensitive flavour); plants in general (liveliness)	Urban trees (e.g., Ailanthus altissima); crops (tomato); invasive plants	Unruly plants; weeds and invasive plants
Exemplary design concepts	Noticing; negotiation; experience	Autonomy/ agency; deep time; climate change	Care	Vibrancy; performativity; presencing	Colonial history; migration; global trade	Place-based; process ontology

We treat the six temporal lenses as a conceptual provocation and the first few strokes to tease out a framework. As these lenses emerge through a contextual process of interpretation shaped by our authors' disciplinary position and theoretical commitments, the six lenses are by no means comprehensive – they represent one among many possible perspectives on plants and temporality. That is to say, the lenses do not claim authority or completeness. Rather, they serve as open, generative companions for readers to think with and, to use Barad's (2007) term, to diffract with their own design and research practices for reflection and inspiration. In this sense, the design cases we discuss in each lens serve not only as illustrative examples but also as stepping stones for this diffractive purpose, in which we amplify the temporal aspect of a design / design process, demonstrate how the case could be theorized as more-than-human temporality and, in some cases, highlight the gap that could be further explored. With this initial scoping effort, we invite other researchers to develop their own ways of attending to the pluralities of time and experience across species

to contribute to the ongoing dialogue within the diverse and evolving landscape of more-than-human design.

2. Complicate human-plant temporality: six Lenses

In this section, we will introduce the six temporal lenses. In organizing these lenses, we follow a progression from more prevalent in practice (e.g., *rhythm*) to still nascent or remain theoretical (e.g., *incompleteness*). Rather than focusing on specific temporal concepts, we present a "kaleidoscope" view that highlights the breadth and richness of temporality. Each lens is illustrated with examples from human–plant interaction design to ground abstract ideas in practice.

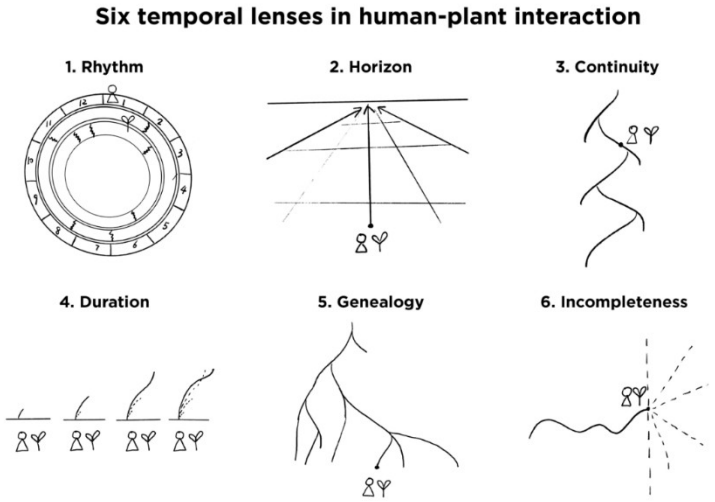


Figure 1: Illustrating six temporal lenses, adapted from multiple sources. Rhythm: from Harold Conklin's Calendar year as a set of nested activities (1980); Horizon: from one-point temporality (Gan, 2021); Continuity: from Tim Ingold's drawing on intergenerational continuity (2023); Duration: from Étienne-Jules Marey's photography titled Man Walking; Genealogy: from Maturana and Varela's illustration on structural coupling between species and their environment (1992).

2.1 Lens 1: Rhythm

Rhythm is about the different cycles of lives of both human and more-than-human, technology, organization, and society. Cycles like days and weeks consist of the basic temporal texture of our lives and embody how, since the early days, our ancestor embedded their rhythm of life in accordance with the routine movement of the sun and the moon. Industrialization since the 18th century makes clock time and calendar time the universal takt time and rhythm of globalization (Peters, 2019). Plants, however, live a rather different rhythm of time. Most remarkably vegetal life is marked by critical events of growth, from germination to blossom and fruition, which are not paced and intermitted by clock time. Rhythm can also refer to the tempo, or speed of plant changing or growing. It is almost unimaginable from our human and animal-centered perspective that plants grow both days and nights at imperceptible speed. The measurable growth of plants is merely the result of superficially spaced time durations for humans to notice (Marder, 2013).

Ethnographers have long noticed the different cycles and stages of crops. Efforts to coordinate between different cycles are captured in Harold Conklin's illustration showing a nested system across the different seasons of the year (Figure 1:1. Rhythm). The agricultural rhythm, however, is far from universal, as dictated in the lunar calendar. The cycle from pre-sowing to harvesting and storage is situated in a specific location and terroir, involving contingent decision-making based on embodied knowledge by the farmer (Head et al., 2012). This relatively stable, shared temporality is being more challenged by the increasingly unpredictable weather patterns in climate change (Brice, 2014). Furthermore, the rhythm of society and culture (e.g., loan repayment schedule and leasing schedule of harvesting machinery) plays a role in the co-production of agricultural rhythm (Head et al., 2012). Apart from agriculture, the encounters between different cycles and lifespans constitute an important aspect of our experience with the more-than-human (Tsing, 2014). For example, in Sweden, people improvise with the seasonal rhythm of the urban woods, co-creating a unique interspecies urban experience (Rosengren, 2020).

Rhythm often comes as the first thing that designers notice when working with plants. The tension between different rhythms of life (in terms of the need of artificial growing lights) is highlighted in Tomico's (2023) experimental co-living with plants for over five years. Taking care of plants means coming to the awareness of and actively accommodating different rhythms, which at the beginning often poses a challenge in HPI design projects and at the same time marks the starting point of a caring relationship between humans and plants (Angelini et al., 2016; Janicki, Parvin, et al., 2024).

Designers have started to explore cycles of vegetal lives as the central concept of design. Researchers explore how technology brings together the slow growth of plants and microbes and the rhythm of everyday life, which is socially embedded and coordinated. For example, physio-chemical features of plants (humidity) and kombucha (opaqueness of biofilm) are translated to controlled change in the domestic environment and pitched sound for humans to sense, interact, and contemplate with directly (Bell et al., 2024; Wen & Wu, 2022). Phenology, the study of cyclic biological events of plants, animals and other living beings, has also been adopted by designers for visualization (Viégas & Wattenberg, 2014), climate-related citizen science (Johnson, 2016), and as a method for engaging with communities (Rodgers et al., 2022).

2.2 Lens 2: Horizon

The concept of horizon asks what future perspective do humans hold about plant life. In agriculture, the future perspective of crops is often oriented toward harvest and production. This "one-point temporality" (Figure 1: 2. Horizon), according to design anthropologist Elaine Gan, reduces plant life into linear growth and in isolation from other species and the environment (Gan, 2021). Apart from a linear progression toward production, this "one-point temporality" may also take another form of "doom day avoidance", surfacing the anxiety for the future apocalyptic event and orientation of everyday life as resisting or pushing away from the future disastrous moment. Best illustrating this tension is the "Doomsday Clock" which is reset once a year marking our distance from the ultimate climate apocalypse in the future (Barad, 2018).

A contrasting understanding of plant horizon is offered by Michael Marder and described as "the bad infinity of growth":

> "On the hither side of actualization, the plant and the ethical subject dovetail in becoming what they are only on the way to and for the sake of the other. Their infinite, interminable, permanently incomplete passage to the other, where "Not enough!" signals that the activities associated with being-for-the-other must go on, is ethical and vegetal time." (2013, p. 109)

Here the plant demonstrates an infinite horizon that goes way beyond our individual life as well as imagination.

Taking the perspective of a long-ranging, if not perpetual, horizon also makes the seemingly distant and gradual processes like climate change relevant. When planting long-growth cycle trees like Koa for future use, loggers have to consider the potential impact of shifting climate patterns not only on the tree itself, but the whole ecosystem - from understory vegetation, birds to patterns of wildfire. The decision to plant or not, and the actions being taken now, hinge on perspectives of a future that extends beyond one's own lifetime (Gibson & Warren, 2020). In other words, the inclusion of vegetal life into a system expands the horizon of the whole system. Comes with it is the demand for a bigger appetite for risks and a willingness to adapt and adjust. By thinking with trees of the future, questions of our own survival also come into sight.

To think of plant horizon urges designers to take an ethical consideration of plants beyond the project period (Fell et al., 2022). Spatial designers have started to leverage the ongoing-ness of the plant as one of its positive features and appeal. For example, the architectural project was extended by one year for the forest to take over the stage (Bessai et al., 2024). In the design of Alusta Research Pavilion, with a timeline extending indefinitely into the future, the growth of plants, species inhabiting with plants, and the nutrition for plants made available from the weathering of walls are all considered key parts of the regenerative design (Suomi & Mäkelä, 2024).

The dramatically different understandings of plant horizon, being it definite or indefinite, optimistic or devastating, can be attributed to the different types of plants (crops or trees) or different scale applied (an individual plant or a species/forest). Purposeful and dexterous direction of attention to these different aspects of horizon, for example, through design of practical and quantifiable evaluation or stimulating metaphorical imagination, could arouse different emotions of hope, love, indifference, and sadness.

2.3 Lens 3: Continuity

Continuity is about the sustained existence of an individual or a lineage. Thinking about the individual vegetal life as a living process in need of care and support expands the matters of concern from the plant itself to the conditions required to sustain the vegetal life. This brings our attention from the physical structure to the broader ecological and social systems that maintain the plant's survival and wellbeing. These systems can be various elements of an ecosystem that the plant is coupled with, from soil (Puig de la Bellacasa, 2017), worm and microbe, to climate patterns and elemental agents (Papadopoulos, 2021). They can also be the social infrastructures that create a condition for such ecosystem to exist in the first place, from time available for gardening (Hitchings, 2021), institutional funding for the breeding program (Richardson-Ngwenya, 2012), and economic and logistic systems for soil care (Wernli, 2024).

A second notion of continuity depicts an inter-generation, inter-species reciprocity over extended time. According to Tim Ingold, plant life does not come to a definitive end at the point of dying or being cut but becomes a node in a reciprocal human-plant relationship (2022, p. 330) (Figure 1: 3. Continuity). Using traditional forestry in Japan as an example, trees enter their second lives as timber and provide reciprocal care to foresters and their families who have nurtured the trees for years. In Gibson and Warren's study (2020), loggers whose lives depend on cutting down trees for economic benefit voluntarily decided to plant trees for "their grandkids". A delicate sense of balance and continuation makes them a member who contributes to the survival of this multi-species ecology. Urban ecology scholars pay increasing attention to the insects, lichens and mycelium that depend their lives on the dead wood as a habitat, breeding site or food source. The death of the tree in this sense does not conclude liveliness, rather marks the start of a diversified community of species with intricate relationships (Rosengren, 2020).

To think of plant life as continuation makes a great difference in the emotions aroused, between fear and hope, in the event of life-ending. To hope, according to Ingold, "denotes a process that does not begin here and end there but carries on through" (2022, p. 332). It also sees life and the passing of time beyond one's individual body. Forests with arboreal cycles longer than human lifetime clashes with the capitalist rhythm, leading to reduced diversity and prevalence of monoculture plantation. But when people decide to let go own short-term return and almost dissolve themselves within the arboreal cycle which is certainly exceeding their lifetime, it creates a soothing and comforting sentiment that life continues (Gibson & Warren, 2020).

In the context of digital technology, soil care is a stationary topic in digital farming. Recent practice, informed by care studies, has shifted the focus from soil fertility management to soil health and the well-being of other beings. Despite the availability of comprehensive data, research shows embodied and experiential knowledge situated in specific socio-technical systems is crucial in making sense and acting with such data. One such example looks at how patch-specific visualization can only be useful when combined with situated and embodied knowledge of the farmer (Lundström & Lindblom, 2018). Designers also start to explore how scientific data, e.g., elementary composition of soil, when translated to senses other than visual, activates different ways of perception, interaction, and connection by humans (Rosén, 2024). In the metaphorical sense, the continuity of plant time entangles with the intergenerational sociality of humans. In their speculative design probe of an electricity-generating plant, Ciobanu and Jublin (2022) acutely capture the symbolic role played by plants in human's intergenerational relationality and memory. The line between plant and human is blurred within the caring relationship, which smoothly passes through generations and species.

2.4 Lens 4: Duration

Drawing from process philosophy, the concept of duration highlights the subjective experience of time constantly changing in quality and the uniqueness of the present moment (Bergson, 2001) (Figure 1: 4. Duration). When it comes to plants, durational thinking is best manifested by Michael Marder, who observes the repetitively falling and regeneration of leaves and writes: "Each leaf is a repeated expression, a reiteration of the difference that 'is' nature, a reaffirmation of the finite, material sense of existence it epitomizes." (p. 115).

Seemingly identical leaves are each the expression of the unruly life and the inscription of time (Marder, 2013).

Other authors, if not subscribing to the same philosophy, are attracted by the performative quality of plants and immerse themselves in the very present moment. Luce Irigaray insists a non-mechanic and non-dissecting way of looking at vegetal life is necessary, as "motion is not at the service of a finality external to it; … the flower or the fruit are not the end of a plant, but a moment of its growth, which cannot be separated from the complete motion…" (Gagliano et al., 2017, p. 129). Plant studies scholar also reminds us that the showiness and eventfulness of plant performance, like when blossoming, not only serves the goal of reproduction but also forms a reciprocal relationship with humans on the basis of fulfilling certain human desires (Gibson & Sandilands, 2021; Pollan, 2002).

This vibrant, at times hard-to-control performativity does not always translate to positive experience when interacted with. Russel Hitchings (2007) highlights how garden owners are likely to apply expectations of static aesthetics on the garden instead of seeing it as a collection of lively lives. The unruliness and messiness of gardens at times conflict and challenge the cultural mainstream insistence on order and control, making gardening a "challenging, upsetting and unsettling activity" (Hitchings, 2021, p. 101) . This dilemma between liveliness and control, associated with the ethical decision taken by designers to highlight or make invisible plant agencies, may also resonate with designers working on human-plant interaction.

To think of the time experienced with vegetal beings as durational and performative also reminds us of the responsivity required to care for the plants. Describing the temporal and performative quality of care, John Law refers to the choreography of care as the "materiality, structural constraint, performativity, discipline, co-dependence of setting and performers, and movement" (Cussins, 1996). As demonstrated in caring for the grapevine (Krzywoszynska, 2016), a set of heterogeneous practices respond to the performativity of the plant and the relational factors (e.g., weather and farmers themselves). Choreography of care therefore is always situated and "cannot be planned and orchestrated beforehand" (Law, 2010, p. 68).

Highlighting the vibrancy and responsivity of plants, designers cast attention to the very moment of encounter between humans and plants. In the eco-digital exploration by Wright and Howden (2023), plants' instant responses to human presence and bodily gestures in the form of electro-chemical processes are translated to sound and rhythm, which further elicit human improvisation. These unplanned and performative responses (plants) and improvisational moves (humans) are incorporated as part of the human-plant co-compositional process.

One real-world example focusing on the concept of "real-time" is the machine deforestation monitoring system by Rainforest Connection (Rainforest Connection, 2023). Near real-time capture of acoustics from the overstory in forest feeds into machine learning models to identify noise generated by illegal logging and notify forest management on the ground for responsive action. Each passing moment is filled with the possibility of destruction and tension. The slow growth of trees, the institutional timeframe of state forestry management, and the swift activities of illegal loggers driven by short-term profit are bridged by the attentiveness to each moment as "happening now".

Attention to the present moment shared with plants can also cultivate ecological sensitivity. In the case of Plant Radio, intangible and hidden signals of plants (e.g., bioelectrical signals) are translated into sensory stimuli that humans could receive (e.g., sound, light, and graph), exposing their inner liveliness. In Plant Sensorium, versatile sound is produced based on the real-time quality (e.g., intensity and duration) of human touch on plants. These designs bring sharp focus to a mindful contemplation of the plant as a living being of its own worth at the very present moment, laying the foundation for reworking the affective and ethical relationship between humans and plants (Hansen, 2024).

2.5 Lens 5: Genealogy

Genealogy looks at the history of plants and asks how it becomes what it is now. With this concept, plant, a scientific object, cultural/relational object and place-based object all at the same time, is not taken for granted, but understood as the result of a long history of structural coupling with the environment and relational beings around it (Maturana & Varela, 1992) (Figure 1: 5. Genealogy). This perspective brings together the evolutionary lineage and the cultural genealogy together and puts plants on the blurry boundary between nature and culture.

For post-humanist philosopher Rosi Braidotti (2011), this act of tracing back consists of the practice of cartography. A cartography "is a theoretically based and politically informed reading of the present" (p. 4) that responds to both the specificity of one's location and the historical and genealogical dimension of time. The Foucauldian, genealogical tracing of time-beings not only makes alternative imagination of the present and affirmative engagement for future making possible, but reconstitutes the identity, the "self" of the being (Barad, 2018). "The past", as Karen Barad argues, "was never simply there to begin with and the future is not simply what will unfold; the 'past' and the 'future' are iteratively reworked and enfolded through the iterative practices of spacetimemattering" (2013, p. 28). Understanding the genealogy of plants allows a re-reading of the past with concerns of the present which opens up possibilities for worlding differently.

In urban ecology, the entanglement between the lives of plants in the urban environment and colonial history has been explored. At the planetary level, plants from grain to grass themselves constitute geological force and are stickily entangled with the history of civilization and the formation of cities (Clark, 2020). Entanglement between colonial histories and plants keep surfacing in the postcolonial botanical gardens (Ernstson, 2020; Gibson et al., 2024). History-laden plants carefully planned in urban parks and along streets, despite their quietness, keep participating in the rather political issues of migration, race, poverty, and colonial power in unexpected ways (Stoetzer, 2020).

The exploration of the historical becoming of plants marks an important step in shifting from an anthropocentric and managerial viewpoint by wading into the lifeworld of other species, including plants. In Lee et al.'s work (2024), tracing the evolution, migration, and culture-specific meaning of tomato starts to delineate paths that could change our way of connecting to tomatoes and the socio-economically situated production system. Their reframing of pheno-data is a first step to capturing the many embodied and experiential aspects of the liveliness of the often-neglected plants that afford diversified ways of meaning-making and connection in the digital representation of the world.

The entanglement with sociocultural histories can play a powerful role in meaningful human-plant interaction. In the sensing body project, historical plantation plants like tobacco, indigo and rice are selected because of their special role played in colonial and slavery history. By extending the temporal frame back in the dark history, the acts of getting closer to plants, feeling with touch, and breathing with plants, facilitated by various sensors, become the starting point of forming a new, intimate relationship not only with plants as innocent beings but with the whole colonial history saturated in these plants (Janicki, Riggs, et al., 2024). In another example, designers incorporate the embodied knowledge and gestures of past human-plant interaction from indigenous people into the digital composition process (Wright & Howden, 2023).

2.6 Lens 6: Incompleteness

The concept of time as open and perpetually incomplete gives us a glimpse of how alien plants can be when considered ontologically different from humans. While often read as passive and lacking mobility, plant ethics scholar Silvie Pouteau (2018) points out that plants adopts a radically different way of being. Transforming sunlight into energy and creating the fundamental condition for all lives to exist on earth, this unique energy-acquiring mechanism of photosynthesis also means plants do not need to acquire energy by predating other forms of life, devouring other bodies and transform them to become part of self. In fact, their lives can be seen as having no definitive boundaries between inside and outside, self and other. According to Pouteau, a plant's body "center is already 'around'" (p. 87).

This non-self quality, while difficult enough to get our (human) head around, invalidates the self-preservation strategy held by human and animal as the only feasibility of life. From tulip flowers that do not yield to reproduction to seeds that are more often than not carelessly spread and wasted, plant life is a form of "non-teleological play" that is open to randomness and contingency (Marder, 2013, p. 89) (Figure 1: 6. Incompleteness). As an "open being", plants are ultimately hospitable to their milieu. Think of how wine made from grapes speaks the meticulous differences on terroirs hundreds of meters away from each other, we start to grasp how plant life is not a fixed "self" as genetics dictates, but an articulation and expression of their environment and their experienced time (Marder, 2017).

Contrary on every end to time of definitive goal of production, this time is perpetually "in the making, evolving, emerging, open, unfinished, overflowing into a 'to come', unlimited, ready to transform and metamorphose without losing coherence and integrity" (Pouteau, 2018). This openness to contingency and forever incompleteness generate frictions with the commodity economy that holds the normative value of productivity, efficiency, and control (Hitchings, 2007) and, in the case of invasive plants, are often dealt with brutal violence, even eradication (Atchison & Head, 2013).

Among all the concepts of temporalities, the last temporal lens of incompleteness is the most radical. It still appears weird to designers and empirical examples do not emerge on our radar. However, we believe it bears a lot of potential for theoretical and practical exploration. Comparing this contingent, playful being of plant with the nomadic idea of becoming, Ponteau sees the potential link we could build between plant and human's psycho-spiritual inner life "as a form of open life in its own right" (2018). From there, an affective or even spiritual human-plant connection may not be too far-fetching. This resonates with Lawrence's take on the non-instrumental logic of plants that serves as an

counterpoint that puts our own utilitarian relations with other forms of life into question (2022).

3. Discussion

3.1 Understanding multiplicity through six lenses

With the six lenses and their design relevancy laid out, questions may arise regarding their relation to each other. Do they overlap like categories, interact like forces, or diverge like paths? Indeed, the six concepts seem not to conform to categorical thinking, nor do they follow a consistent logic. Some has more distant standpoint than others (e.g., “Rhythm”); some are forward-looking (“horizon” and “incompleteness”) or history-tracing (“genealogy”), yet others are more present. Instead of seeing this incongruence as lacking rigor, we argue that this demonstrates the versality of the concept of time. In choosing the word “lens” we think all plants as multiple: they can be analyzed with one lens on, performing certain qualities, and with changed lens perform another set of qualities. It is the multiplicity of plant time and plant life that makes them best partners to think with to challenges our own confined human thinking in late capitalism.

3.2 Design implications

Having presented the conceptual framework of six lenses, we now discuss several practical implications for design practice, illustrating how designers could concretely incorporate plants in their design process. First, the friction caused by temporal incompatibility presents a persistent challenge in design, for instance, the tension between vegetal time and project deadlines, grant cycles, or caregiving routines. Temporal lens serves as a reminder of the inherent difference between industrial, institutional time, and the plant time that is continuous and responsive to environmental factors. The acquisition of temporal lenses could enhance designers’ sensibility and provide them with the vocabularies to articulate temporal related frictions experienced in the process, as well as account for the temporal features of plants, for example, choosing between a “horizon plant” like cherry tomato which is suitable for scheduled interactions toward material harvesting versus a “duration plant” like devil’s vine for observing feral growth.

Secondly, the temporal lenses enable designers to expand methods of observing and representing plants beyond an objectifying measurement treating them as static object. For instance, a rhythmic lens supports documenting recurring patterns such as daily leaf movements or seasonal flowering through time-lapse or sensor data, while a horizon lens focuses on developmental milestones like germination and fruiting. A duration lens invites close observation of subtle morphological changes, treating unexpected developments as meaningful rather than erroneous. A continuity lens extends this view over longer timescales, tracking cycles or generations of growth. Meanwhile, a genealogical lens situates plants within cultural and historical contexts through archival or oral history research, and an incompleteness lens attends to resilience and adaptation, interpreting irregular growth or stress responses as sources of insight for future reflection or design speculation. And these practices could open up richer and more human-plant interactions as design outcomes, offering insights for future analysis or speculation.

Finally, rethinking design through vegetal temporality allows the rhythms, delays, and anomalies of plant life (e.g., shifting flowering or fruiting patterns under changing climates) to surface as sites of knowledge production rather than noise to be erased for their unfittedness for human agendas. These temporal irregularities reveal how living systems register environmental change and adaptation, offering designers empirical and affective cues for reflection and response. Attuning to these temporal cues cultivates a practice of mutual adaptation between design artefacts, environmental conditions, and living systems.

4. Conclusion

This paper introduces “temporal lenses” as a design strategy for advancing human–plant interaction and more-than-human design. The six proposed lenses of *rhythm, horizon, continuity, duration, genealogy,* and *incompleteness* offer designers a conceptual framework for engaging with the temporal complexity of living systems. They deepen understanding of more-than-human beings as agents that live, grow, and transform according to their own temporalities. This paper serves as an invitation to designers to accept, expect, and inquire into temporal differences, to consider their own position in mediating between institutional/industrial time and vegetal time, to expand methods that are attuned to more-than-human temporalities, and to produce knowledge at the heated contact zone with temporal frictions. and invite designers to attend to these rhythms as part of their design process. In doing so, this study offers a working conceptual framework for developing a more temporally responsive design practice, which evolves alongside the living systems it engages and acknowledges design as a temporal act of cohabitation and becoming.

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