



# Design for Temporal Cohabitation

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Figure 1: Bird peering through the crack of a building. Image cropped from original by Eperales, licensed under CC by 2.0

## ABSTRACT

We propose the notion of Design for Temporal Cohabitation as a way to introduce a critical agenda to time in more-than-human and ecological design. Despite increased calls for HCI researchers to temporally attune to other-than-human species, overall research still tends to focus on spatial concerns, or follow assumptions that place human and more-than-human times in different realms. To redirect the discourse, we critique the nature-culture hyperseparation of temporalities and invite HCI researchers to consider what different modes of time *do* to humans and other-than-human species, and how design can help. We ask: What if we consider dominant notions to be *designed* and imposed globally through practices of capitalism and colonialism? What if we take responsibility for the ways in which such notions of time affect the times and therefore livelihoods of other species? Could we then consider

*redesigning* them in ways that are more inclusive of other species and the world?

## CCS CONCEPTS

• **Human-centered computing** → **HCI theory, concepts and models.**

## KEYWORDS

Time, More-than-Human, Other-than-Human, Design, Cohabitation, Care

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## 1 INTRODUCTION

Time and temporality are increasingly discussed in HCI in the context of designing for and with more-than-humans [38]. This includes practical investigations that identify the need to attune to times of other species in design processes (e.g. in the field of bioHCI and biodesign [23, 36, 60]), as well as ethical considerations of considering more-than-human times and rhythms in design (e.g. in the context of smart cities [20, 54, 55]). Such investigations, however,

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still often frame time away from ecological perspectives (despite considering spatial ecological concerns), and often consider the time of humans and other species as belonging to different realms. The separation echoes Western traditions that describe time of ‘humans’ as singular, universal, and detached from embodied perspectives - expressions that have evolved to distance us from natural times. More-than-human time, in contrast, is described as cyclical and changing at a much slower pace. Such distancing is often described as having been powered by industrialisation and new technologies, a discourse that is still deeply influential in HCI, particularly in the design of time management and productivity tools, and continues to resonate even within more critical discourses.

The separation between the sphere of the human and that of nature is not only a statement of difference, but also a statement of power. It promotes a view that humans are ‘outside nature,’ and can therefore ignore or deny intrinsic connections with the biosphere and non-Westernised worlds [42]. For anthropologist Kevin Birth [8], the dominance of “homogeneous empty time”, which has come to be associated with *culture* and *civilisation*, leads to a diminished capacity to perceive and envision alternative temporalities, ultimately resulting in a loss of meaning, and loss of ability to imagine the future [8, p.101]. Importantly, the inability to notice this dominance places *otherised* individuals (human and other-than-humans) in a position of subjugation where they either adapt to dominant times and rhythms, changing behavioural patterns and even their own biology, or risk extinction. As we will discuss below, such temporal adaptation may be possible, but often comes with a cost, expressed by loss of diversity, agency and reproductive capabilities.

The notion of Designing for Temporal Cohabitation comes as a way to bring entangled temporal relationships in more-than-human ecologies to the fore. Multispecies ecological interactions can be seen as ways for organisms to reinforce or redefine times (their times and of those around them), and to reinforce or challenge temporal power (a)symmetries. Based on Tsing’s [57] notion of “arts of noticing” we propose that designers and HCI sharpen their ability to notice species’ temporalities, the ever changing nature of ecological temporal relationships, and idiosyncrasies promoted by changes of agency and unexpected encounters of individuals within species. Based on Tronto’s notion of care ethics [56] we set a framework to consider design interventions within these relationships, which can help reframe temporal ecologies towards greater inclusion of other species and the world.

## 2 TEMPORAL CONFLICTS

### 2.1 Temporal hyperseparation: colonialism, power asymmetries, and inability to notice diverse temporalities

Western narratives of progress tend to treat humans as apart, outside of, and “hyperseparated” from nature [42]. In terms of time and temporality, such discourses attribute the transition from nature to ‘civilization’ to the introduction of task-oriented systems, industrialization practices, and new technologies. This move is depicted as a linear progression marked by increased acceleration, with time increasingly measured independently of natural cycles [35, p.59]. Birth (2012) argues that these notions are reinforced by the widespread use of instruments to measure “universal” time,

which have worked to limit the imagination of alternative temporalities within Western cultures: “*the objects of time associated with modernity channel thought toward a distinctive temporality and the following features: uniform, homogeneous, and empty time; a combination of the cognitive processes of measuring duration with determining moments in time; and a mediation by the artifacts that hides the separation of temporal algorithms from environmental cycles*” [7, p.121]. The tendency therefore often begins in early childhood education, where children only explicitly engage with time in the process of learning to read clocks, while being disciplined by ideals of punctuality and efficiency [1, 7]. Simultaneously, the cyclicity of nature-related phenomena, as illustrated by depictions of rain cycles replenishing rivers, trees balancing levels of CO<sub>2</sub>, food chains and migratory species diagrams, and other representations of ecosystem equilibrium, is often considered distinct from inquiries into social coordination — although see [39] for ways of challenging this. McKibben [34] argues that portraying other species and the Earth as cyclical and slow may pose the risk of depicting them as offering a stable backdrop for ‘human’ progress.

The result is the expansion and naturalisation of the “unusual qualities of European temporalities” [8], a social construct that has been unevenly imposed globally through practices of colonialism [37]. Plumwood [42] argues that the separation between natural and cultural time involves more than just recognising differences, it means “*defining the dominant identity emphatically against or in opposition to the subordinated identity, by exclusion of their real or supposed qualities*” [42, p.128]. This way, uniform temporalities characterised by linear progression, and which are divorced from the influence of local solar, lunar, and ecological cycles, have been specifically associated with a limited spectrum of Western subjects. Such narratives of uniform, linear, and progressive time intentionally exclude the temporal experiences of individuals, both human and other species, who pose challenges to Western paradigms of development. In the words of Tsing: “*progress is a forward march, drawing other kinds of time into its rhythms*” [57, p.21]. The divisions between the temporalities of a universalized human culture and the natural order are strengthened by a notable absence of explicit discussion around what kind of time we wish to keep as societies [46].

Tsing [57] questions the notion of “anthropo-” employed in discourses of “Anthropocene”. She argues that, rather than belonging to humans as species, “anthropo-” in fact belongs to definitions of modern capitalism: “*imagining the human since the rise of capitalism entangles us with ideas of progress and with the spread of techniques of alienation that turn both humans and other beings into resources*” [57, p.19]. This means that it is not human or cultural time that is in disarray with other species’ times, but a particular notion of time that is considered to be uniform and external to everyday practices, a notion that serves global capitalism and, as discussed later in this paper, disservices other species and the planet. Birth [8] describes it as “homogeneous empty time,” a condition associated with what he terms “time blindness”, which denotes a diminished capacity to perceive or envision alternative temporalities, ultimately resulting in “a loss of meaning and thus to a loss of the narrative imagination of the future” [8].



**Figure 2: Clock in a Forest.** Image cropped from original by David Vega, licensed under CC by 2.0

HCI research has traditionally focused on design that attempts to support personal productivity and maximise efficiency [48], reinforcing dominant narratives of disembodied universal time [45] and what we discuss here as an inability to notice and imagine other temporalities. Increased influence of computer systems to determine times, e.g. through computer-supported flexi-time (e.g. in [33]) and further quantification of personal rhythms (through personal informatics applications e.g. [28, 47]), not only reinforces and further promotes such notions, but also removes the possibility of redefining them, as they disempower individuals by placing time outside their influence and control [44, 46]. Reframing this discourse towards new perspectives is the first step to making HCI more inclusive [9]. Opening up to discussions of more-than-human time is an opportunity to expand inclusion to other species therefore extending the discourse in environmental and ecological HCI.

## 2.2 Tensions in temporal cohabitation

In contrast to the hyperseparation [42] proposed between cultural and ecological times, we put forward the importance of engaging with the temporalities of cohabitation that interlock human and more-than-human temporalities. Ecologists have demonstrated various instances of species adapting their rhythms in response to growing urbanisation and industrialisation of their environments, with some species of birds serving as particularly well-documented examples. Within urban centres, these birds have adjusted communication methods to navigate acoustic disruptions caused by traffic and other ambient noises [18]. In European urban areas, for example, robins seem to increase their nocturnal singing activity [17], while in city parks of Bogota, Colombia, sparrows initiate their dawn chorus earlier in the morning [15]. Furthermore, frogs and insects, such as grasshoppers, residing near noisy highways, have demonstrated adaptations that alter the timing, pitch, or types of sounds used for communication [11, 21, 27, 40]. Similarly, the cycles of various species are influenced by artificial light. Exposure to artificial light at night (ALAN) from human-made sources has been

shown to disrupt physiological functions, impact health and circadian rhythms in nocturnal species, and compromise their foraging behaviors, navigation, and communication, while also elevating the risk of predation [4, 22]. Crucially, these impacts are not confined solely to urban environments, as might be anticipated, but extend broadly, even influencing marine ecosystems. For instance, the synchronicity of coral spawning, the daily movements of zooplankton, and turtle migration are profoundly affected by ALAN [31] and it is possible to say that its impacts can be observed across entire ecosystems [51].

Although certain species are adjusting to anthropogenic impacts on their temporal cues, these adaptations are not without consequences. Some adapted species may be perceived as less appealing to potential mates, consequently impacting their reproductive success. Additionally, if species lack flexibility in generating or perceiving relevant cues, their inability to communicate effectively could lead to their exclusion from habitats, potentially resulting in significant ecological implications [43].

Anthropogenic action has further impacted the temporality of various species through habitat clearance, which increases travel times between habitats and food sources and decreases safe routes to migrate or escape from predators. For example, the clearance of forests leads to isolated pockets of habitat, which demands behavioural adaptations that are unlikely to be sustainable in the long term [16]. In Australian woodlands, the reduction of forested areas has increased travel time between food sources for flying foxes, leading to a significant decline in their populations [50]. In the UK, some species were still able to migrate from pockets of wilderness through preservation of hedgerow corridors in rural areas. However, the use of larger agricultural machinery resulted in a decrease in the number of hedgerows, affecting the connectivity between these areas [19], which impacted on the ability of butterflies [2], birds [10], and other species to find optimal conditions for times of hibernation and reproduction.

Climate change is leading to even greater shifts in temporal coordination by changing conventional environmental cues like seasonal temperatures, weather patterns, rainfall, and wildfire seasons, with extensive impacts on ecosystems. Research in phenology, the study of seasonal life cycles, has strongly warned about disturbed ecological temporalities that could lead to significant mismatches and asynchronies. As discussed by scholar of environmental cultures Sarah Dimick [14], “*environmental time [...] proceeds according to phenological coordinates such as the air’s temperature, the particular scent of foliage, the tenor and intensity of insect noise, and a host of other sensory data,*” all these phenomena propel as well as mark environmental time. However, as highlighted by evolutionary ecologist Marcel Visser [59] in a review of various phenological studies, warming of the climate presents challenges to species with interconnected temporalities because not all species within a given ecosystem undergo shifts in the same direction or at the same rate. Each organism is sensitive to distinct factors or exhibits varying degrees of sensitivity to similar environmental factors. Often, it is the convergence of multiple environmental changes, such as temperature, photoperiod, and precipitation, that plants and animals use to coordinate behavioural patterns. Consequently, numerous instances of temporal mismatches between species are increasingly being observed. For instance, in warmer circumstances, female arctic ground squirrels finish hibernation earlier than their male counterparts [12], the arrival date of barnacle geese does not align with advancing changes in their food sources in breeding grounds [26], and certain bee species have been documented as initiating flight before the onset of flowering seasons [49].

Dimick [14] states that “*while climate change has been most frequently measured and symbolized through increases in atmospheric carbon dioxide and rising sea levels, scientists working with contemporary phenological data have recently described [it...] as the effective manipulation of time by humans.*” Some even claim that while environmental damage is often associated with toxicity or extinction, climate change should be gauged through ecological asynchronies. She further remarks that, while early naturalists recorded seasonal changes as a means of “*intuiting the environment’s temporal order*”, that is, to find the regularity of nature and seasons, and therefore have a greater sense of order and meaning; nowadays such recordings are done as a way to track environmental events to intuit change, and with the intention to show irregularities. Bringing visibility to these shifting multiple temporalities and (a)synchronies is an important way for design to draw attention to the ways we cohabit in deeply problematic ways with all those Earth others we share our worlds with. This way, we can start reimagining temporal cohabitation in ways that are more cognisant of the effects our times have on more-than-human others.

### 3 RELATED WORK

As mentioned, time and temporality are increasingly discussed in HCI in the context of designing for and with the more-than-human [38]. In attempts to closely investigate processes of designing with other-than-human living organisms, researchers have started to reflect on issues of time particularly in the sense of slowing down, e.g. to match the pace [6, 36] or attune to the temporalities [23] of the organisms at hand. For instance, Zhou et al. [60] investigated ways

of making the temporality of microbes more perceptible to humans, attempting to reveal states of development that are only perceptible to humans after a period of time, and Bell et al. [5] created a calendar to attune to the slowness of Kombucha SCOBY. By reframing the controlled space of designer-to-organism relationship, these projects promote the need to observe and understand how other beings may experience time, respecting and incorporating these experiences in the design process — although often still reflecting the general slow nature vs fast culture division.

Similarly, in environmental and sustainable design, there has been increasing interest in exploring how design processes might be made less anthropocentric and more inclusive of other-than-human species (see [52]). Such efforts are expressed through attempts to include other species in urban [20] and smart cities design [55], providing multisensory technologies that support ways of noticing and becoming more “compassionately concerned” with other beings [29], and explicitly designing for cohabitation based on data on other-than-human beings in cities [54]. In discussing possibilities for human-animal cohabitation, Smith et al. [54] use two design projects in urban informatics as case-studies to discuss the changing perspective of nature in the cities and how animals adapt to networked life in urban spaces. One of the projects, the Phenology Clock, by Natalie Jeremijenko et al. [24] depicts webs of temporal relations in cities through visualisations of phenology data; the second focuses on behavioural tracking of big cats which also depict the rhythms of these animals. Their intention is to reveal other ways of understanding “urban wild things”, which can help to design systems that can support such complex urban entanglements. Furthermore, Livio and Devendorf [30] introduce and explore the concept of “eco-technical interface” to describe and investigate the “*increasingly complex boundary between humans, the more-than-human world, and human-designed technologies*”. These investigations draw attention to the significance of attuning to local ecological temporalities because deeper, more-than-human understanding of other-than-human life around us, is seen as supporting more sustainable design outcomes. Time, therefore, is crucial to designing in this context of polycrisis, it allows us to understand how humans and other species can continue to change and adapt with changing climate, biodiversity loss, environmental injustice.

By extending the notion of cohabitation to time and inviting designers to consider how we might temporally cohabit with other-than-human beings (not only in cities but across the planet) we invite designers to also consider climate change as the ultimate “manipulation of time”. We explicitly stress that designing for cohabitation requires understanding the temporal connections on different scales, how human and other-than-human lives are linked and entangled, and that design can have a key role in surfacing these diverse temporalities as well as the effects of different notions of time on more-than-human species, suggesting ways in which they could be reframed to support more sustainable ways of living.

### 4 DESIGN FOR TEMPORAL COHABITATION

Design for temporal cohabitation begins by acknowledging that everything we do, which includes the designed and the act of designing, are intentionally or unintentionally affecting the timings of other species and thereby entire ecologies. The key is to recognise,

understand and account for different temporal modes, scales and scopes. For this to take place, it is necessary to first expand notions of ecologies, beyond spatial concerns and dominant narratives of time. Paying attention to the plurality and entangled nature of temporal ecologies, as well as acknowledging power asymmetries that benefit certain times in detriment of others, would help us improve our ability to consider and imagine other expressions of time and be better equipped to design artefacts, interventions and systems that can support temporal cohabitation, and ultimately help (re)design temporal ecologies.

#### 4.1 Sharpening ability to notice more-than-human temporalities

We look at reorienting attention towards other-than-human temporalities based on Tsing's [57] notion of "arts of noticing", that is, the ability to notice the ontological capacities of living organisms and of their environmental encounters: "Each living thing remakes the world through seasonal pulses of growth, lifetime reproductive patterns, and geographies of expansion. Within a given species, too, there are multiple time-making projects, as organisms enlist each other and coordinate in making landscapes. [...] World-making projects emerge from practical activities of making lives; in the process, these projects alter our planet. To see them, in the shadow of the Anthropocene's "anthropo-," we must reorient our attention" [57, p.21]. Reorienting our attention, away from generalised perspectives, and towards the intricacies of more-than-human temporalities, their assemblages and encounters, is therefore key to understanding how we might co-create time with other beings and support temporal cohabitation. A renewed ability to see could thus be interpreted as: a) ability to notice species' ontological abilities and their networks and "assemblages" of times b) ability to notice such assemblages as in-flux, changing over time, and c) ability to observe nuances in the temporalities of same species individuals, observing how unexpected encounters can lead to new ontologies.

**4.1.1 Ability to notice species and assemblages of times.** Species evolved to have different levels of adaptation to their specific environments and therefore different needs and rhythms. Something that could come in the way of seeing such richness is treating a group of similar-looking individuals as the same. Plant species, for instance, have different levels of sensitivity to changes in photoperiods, variation of insects, temperature and precipitation. However, we can walk in a forest without seeing this variation and what is around us, simply generalising "trees as trees". According to Marder [32] while names and definitions assign an exact place for species, "swallowing up" their singularity and uniqueness, the actual individual "turns into an example of the genus, tribe, and so forth, to which it belongs and is nothing in itself outside the intricate net of classifications wherein it is caught up" [32, p.4].

**4.1.2 Ability to notice more-than-human temporalities in-flux.** We learn early on in formal education that particular species have specific behaviours and depend on other species. Such relationships are often depicted in ecology and food chain diagrams. As useful as these learnings might be for introducing notions of interconnectedness, they may also render species within a closed loop of dependency, tied to food and reproduction as the only reasons for

other species survival. However, as Tsing puts it: "the question of how the varied species in a species assemblage influence each other—if at all—is never settled: some thwart (or eat) each other; others work together to make life possible; still others just happen to find themselves in the same place. Assemblages are open-ended gatherings." [57, p.23]. It is therefore important that HCI and design take into account, but move beyond, technical definitions of species.

**4.1.3 Ability to notice temporal idiosyncrasies of individuals within species.** There might be a tendency to think about temporal patterns that would apply to all individuals of a species. However, individuals can create times through unexpected encounters, and agential changes. Species might meet other species or be faced with environmental changes that diminish or create needs (e.g. a pavement may change the shape and ecosystem of the roots of a tree). Therefore, there are subtle differences in patterns: "patterns of unintentional coordination develop in assemblages. To notice such patterns means watching the interplay of temporal rhythms and scales in the divergent lifeways that gather" [57, p.23]. This means that even when observing species that are familiar to us, we might notice differences: "ways of being are emergent effects of encounters. Thinking about humans makes this clear. Foraging for mushrooms is a way of life—but not a common characteristic of all humans. The issue is the same for other species" [57, p.23]. Although understanding design processes in this context could expand perspectives it is also important not to be too prescriptive regarding behaviours and responses.

Based on these three points, we could consider that every living organism designs time, times that are, however, hidden by layers of narratives of linear time and accelerated progress. Through acknowledging, delving deeper, showcasing, mapping, designers can then help bring more visibility to these times. It also involves revealing not only interconnections, but also increasingly broken connections and mismatches that result from reductive perspectives. This way, pluralised perspectives of time emerge by observing the struggles of interdependent species, e.g. the struggle of bees who, with the advancement of spring season, start flying too early to find flowers to pollinate, and of flowers aiming to survive without pollinators, as well as the effort of meeting each other in time, e.g. the effort of some bee species that have been shown to be able to force plant species to flower earlier, in a true example of the more-than-human ability to redesign time [41].

**4.1.4 Acknowledging and attempting to challenge temporal power asymmetries.** Progressive narratives of human time that are placed as detached from natural times, as discussed, are a way to impose a temporal order and neglect temporalities that can be key for species survival. In other words, it is a way to threaten cohabitation. We therefore invite HCI researchers and designers not only to attend to and reveal the plurality of times in the world, but to do so with special attention to imbalances and asymmetries that may emerge through actions of and encounters between humans and other than humans species, technologies and other species and between individuals within species and their environments.

While attuning to the temporalities of an organism might be an important first step to pluralising perspectives, we still need to question the power dynamics of designers choosing and restricting organisms to their own times and agendas. How are we hindering

or facilitating “time-making projects” of other species? Are we leaving space for them to express their agency, to act, to choose not to follow our temporal agendas?

Looking beyond the design practice itself, we may ask what is the impact of new technologies, products or services on the ways we perceive the times of other beings. What does it mean to continue to frame the time of other species as slow and cyclical? Are we depicting some as more important than others? For instance, there has been enough discussion on how climate change can be difficult to grasp due to effects taking place at a much slower pace than “human” time [25, 34]. There is, however, increasing research, and indeed media coverage that demonstrates accelerated impacts of warming climates all over the world. Phenology research has been particularly critical in translating what was once seen as a hyper, distributed, intangible subject into observable, tangible and actionable issues [3]. The litany of slowness also reflects a privileged position of Global North voices, as issues associated with climate change are more rapidly felt in the Global South.

Rather than staying with our narratives of universal accelerated times and working for species to adapt to them, can we look at ways of changing what humans do to reduce impact and promote temporal re-attunements in broader ecologies? This starts by asking what kind of and whose times we want to prioritise in our research and everyday and how we can look for alternatives.

## 4.2 Designing to reduce impacts and promote temporal reattunements

With ability to see, and to critically analyse temporalities, we move to considering the best ways of designing artefacts, interventions and systems that can support temporal cohabitation, reducing impact while potentially promoting temporal reattunements. Within narratives of universal disembodied time and timesaving, relationships to people, things and other beings tend to adopt the same disembodied logic of production, simplifying entangled relationships or making them invisible to fit a system of production. In order to counteract these perspectives, we need to go through the points above and take a new perspective to design itself. Here we suggest the incorporation of renewed notions of care and care ethics which we closely align with the discussion of plurality, interconnection and agency. Designing with care in a context of temporal optimisation translates into unidirectional act of “caring for”, an act that also implies a power asymmetry between the giver and receiver of care. However, when we expand awareness to other temporal modes and ontologies, and give greater prominence to them in our interactions with the world (as well as in our research and practice) we start to open up space to reinterpret care and therefore what would mean to do “care-full” design.

Looking at the perspective of feminist care ethics, which is becoming increasingly influential in HCI and elsewhere, we find tools to define parameters to understand what good could mean in design for cohabitation. In her *Ethics of Care* [56], Tronto proposes that care is “a species activity that includes everything that we do to maintain, continue, and repair our ‘world’ so that we can live in it as well as possible [...] all of which we seek to interweave in a complex, life-sustaining web” [56, p.103]. Puig de la Bellacasa [13] conceptualises

thinking with care as a thick, non-innocent act of living in interdependent worlds. Care-full design would therefore emerge from deep observations of everyday relationships of species, that result from habitual negotiation of actions in time. It would result from an awareness of interdependence and the ability to acknowledge temporal power dynamics without overwhelming the rhythms of species that one is deeply connected to. “Repair” would not come from designers who, despite good intentions, still see themselves as outside the context they are working on. Instead, it would come from those who see themselves as deeply implicated in the relationships with other things and beings, beyond the “anthropo” cage that Tsing refers to. Van Dooren [58] calls for a need to “understand how particular human communities, as well as those of other living beings, are entangled and how these entanglements are implicated in the production of both extinctions and their accompanying patterns of amplified death.” Acknowledging such entanglements includes acknowledging that “we are complicit, implicated, tied in to things we abjure” [53]. By noticing this implication we are able to reframe the object of design too. For instance, rather than simply designing a shelter for a species whose migration pattern has been affected by the removal of hedgerows, we might look into reframing agriculture or consumer habits. This way, we can place temporality and indeed the points above within the different “Elements of an Ethic of Care” that define parameters to judge quality of care, that is: attentiveness, responsibility, competence and responsiveness, as defined by Tronto [56]:

**Attentiveness** is in direct opposition to ignorance. “*Since care requires the recognition of a need and that there is a need that be cared about, the first moral aspect of caring is attentiveness [...] By this standard, the ethic of care would treat ignoring others - ignorance - as a form of moral evil*” [56, p.127]. The inability to notice other things in this case becomes the biggest issue within a framework of “careful temporal design”.

**Responsibility** is discussed in contrast to lack of responsibility and indeed obligation. By placing time within an entangled web of temporalities that invariably includes human time we take responsibility for potential issues. Responsibility here comes not from a predefined social standard (obligation) but to a sense of connection. While keeping a pristine park speaks to a level of social obligation, more-than-human care through a park might mean keeping it messy, implying a sense of connection and responsibility to insects and other species that live there. In the words of Tronto [56, p.133]: “*we are better served by focusing on a flexible notion of responsibility than we are by continuing to use obligation as the basis for understanding what people should do for each other.*”

**Competence** “*making certain that the caring work is done competently must be a moral aspect of care, if the adequacy of the care given is to be a measure of the success of care*” [56, p.133]. There is indeed a need to acknowledge limitations of one’s own competence as well as trying to expand competences to tell time in complex and context dependent ways, through interdisciplinary partnerships, for example.

**Responsiveness** “*signals an important moral problem within care: by its nature, care is concerned with conditions of vulnerability and inequality*” [56, p.134]. The renewed ability to notice may lead humans to become more aware of the vulnerability, inequality and

therefore ability to respond to other beings, but there is still a level of practice involved in “care-full” temporal design.

## 5 CONCLUSION

Through the notion of Temporal Cohabitation, we draw attention to the need to reframe temporalities from a hyper-separation between ‘human’ and ‘natural’ times towards emergent, plural and entangled temporalities. We note the risks of dwelling in dominant notions and neglecting such interconnections, which can translate into promoting temporal asymmetries and unequal forms of adaptation and even extinction of species. We propose Design for Temporal Cohabitation as a way to draw attention to the multiple ways in which species and individuals within species affect and can indeed define the times of others, through matches, mismatches and unexpected encounters. We also acknowledge the different levels of temporal agency and control among different species which can place humans in a position of greater responsibility in increasing scenarios of environmental injustice.

Systematically, Designing for Temporal Cohabitation requires us to first sharpen our ability to notice more-than-human temporalities, which includes the ability to notice species and their assemblages of times, the ever changing nature of temporal relationships in ecologies, and the temporal idiosyncrasies promoted by unexpected encounters (and agential changes) of individuals within species. It then requires us to acknowledge and potentially challenge power asymmetries, including what it means to define times of humans and other species in particular ways (e.g. as fast vs slow). With awareness and critical understanding, we are finally better equipped to develop interventions that focus, not on particular times, but on the complex webs of temporal relationships that are created, maintained and repaired by species and individuals who are striving to sustain life. This way, we can start to re-frame and, dare we say, *redesign* temporal ecologies in ways that can be more inclusive of other species and the planet.

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