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When a Tree is also a Multispecies Collective, a Photosynthesis Process, and a Carbon Cycle

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When a tree is also a multispecies collective, a photosynthesis process and a carbon cycle

A systemic typology of natural nonhuman stakeholders when designing for sustainability

Emīlija Veselova and İdil Gaziulusoy

Design research and practice is increasingly aware of the sustainability crisis. Various initiatives have started to argue for a need to acknowledge and accommodate the needs of natural entities and systems in relation to sustainability. Such more-than-human considerations have also entered collaborative and participatory design. However, there yet seems to be a lack of broad and systemic perspectives on which natural entities to consider when designing for sustainability. Therefore, we developed a systemic typology of natural nonhuman stakeholders based on empirical study in a garden and analysis rooted in the distinctions, systems, relationships, perspectives – DSRP – theoretical structure for systems thinking. Our typology suggests seven distinct types: individual organisms, single species collectives, multispecies collectives, life processes, living systems, biogeochemical cycles and processes of the atmosphere. However, our findings indicate that one living entity represents several stakeholder types simultaneously. This illuminates a tension between the simplistic and systemic view of stakeholders in collaborative design and calls for a shift towards systemic mental models and new theories, approaches, methods and tools. In this article, we present our methodology and the typology developed; then we discuss the potential implications of the typology on collaborative and participatory design and avenues for further research.

Keywords: more-than-human design, multispecies design, co-design, systems thinking, design for sustainability

Introduction

The sustainability crisis is very urgent and pressing. Design is increasingly recognizing the need for rapid further development in its theory and practice to address this crisis (Gaziulusoy & Erdoğan Öztekin, 2019). One of the areas for such development is the strive for including and accounting for the needs of more than just humans: more-than-human design. Initiatives in this category accentuate the need to rethink the currently dominant human-centric and human-exclusive design principles. Some researchers use the term more-than-human design to refer to artificial nonhuman entities and systems (e.g. see Forlano, 2016). Meanwhile others focus on the need to acknowledge and accommodate the needs of natural entities and systems (e.g. see Akama et al., 2020; Mancini, 2011; Westerlaken, 2020a). We belong to the second group. We align with perspectives from sustainability science, such as the *strong sustainability model* proposed by Neumayer (2003) and the *multispecies sustainability concept* proposed by Rupprecht et al. (2020), see Figure 1. These perspectives acknowledge the irreversible hierarchies between systems that are subjects of sustainability science: humans and human-made systems (such as economic systems and technological systems) depend on ecological systems for resources, sustenance and survival. These perspectives also underline that systems created by human society with their technological, social, political and cultural dimensions, are nested within nature and should not be viewed in separation from it. Additionally, we align with the views that human and natural systems are extensively interconnected and human systems can only be sustainable if natural systems are well functioning (Gaziulusoy, 2015). The visualizations of the strong sustainability model and the multispecies sustainability concept, however, seem to focus on visualising the dependence of humans on nature rather than the interconnectedness of all elements. They do not directly present the dynamic, interconnected nature of the human-made and natural

entities and systems. Therefore, we additionally visualize our perspectives in an interconnected manner, see Figure 1. This interconnected perspective on sustainability accentuates that humans and our societal, economic and technological entities are closely and inseparably connected to the natural, environmental entities. However, it does not equally well represent the dependence of human-made systems on natural systems. Overall, these three views on sustainability suggest that designing for sustainability requires a joint consideration of humans, human-made entities and environmental entities in a systemic manner while acknowledging the dependence of human and human-made entities on the natural entities.

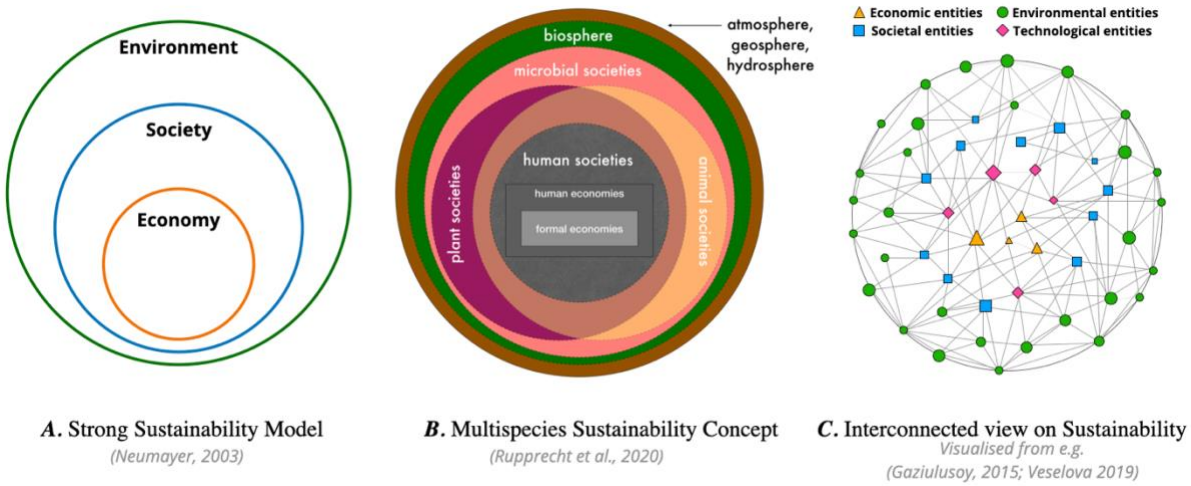

Figure 1. Three views on sustainability that highlight the importance of natural nonhuman entities when designing for sustainability

Collaborative and participatory design (C&PD) is an area of design in which designers involve varied stakeholders, for example potential users, local citizens or business representatives, as direct and active participants of design processes (Sanders & Stappers, 2008; Simonsen & Robertson, 2012). Here, we use the term stakeholder to refer to someone who is involved in creating or affected by the design process or solution (Veselova & Gaziulusoy, 2019). In C&PD, designers can involve stakeholders to jointly explore and learn about the problem; to collectively envision, design and test the solution to a problem; or both (Steen, 2013). Thus, the stakeholders have a large impact on what, how and why something is being designed. Unfortunately, the current mainstream C&PD theory and practice predominantly recognizes humans or societal, economic and technological entities as stakeholders (Veselova & Gaziulusoy, 2019). This is concerning because the acknowledged and involved stakeholders have a strong impact on the definition of the problem and exploration and creation of potential solutions. Thus, if the involved or recognized stakeholders are only human or systems and structures created by human society, it is likely that the definition of the problem and the solution is going to disregard most if not all considerations of the needs of natural entities and systems (Veselova & Gaziulusoy, 2019).

Recently, however, more-than-human considerations in C&PD has been rapidly growing. Researchers are proposing that natural entities should be viewed as important stakeholders in design projects (e.g. see Akama et al., 2020; Westerlaken, 2020a). Unfortunately, a systemic perspective on who or what should be considered as relevant stakeholders for C&PD when designing for sustainability seems to be lacking. Our earlier research indicates that designers typically consider or include mammals, such as dogs or orangutans, to co-create ways that these natural entities interact with humans and technology (Veselova & Gaziulusoy, 2019). Only a few projects, according to our findings, had considered and designed for the systemic interconnections and interrelations in the natural world (e.g. Avila, 2017) and for sustainability. Overall, there seems to be a lack of a broad, systemic perspective on which natural entities can be considered as stakeholders in C&PD processes that strive to design for sustainability. Our research aims to fill this gap by developing a systemic typology of potentially relevant natural stakeholders for C&PD for sustainability.

This paper presents and discusses this systemic typology and its potential implications for more-than-human C&PD when aiming to design for sustainability. The following section describes the research context and methodology. Then, in the *Results & Discussion* section we present the developed typology of natural nonhuman stakeholders and critically discuss the typology and its implications for C&PD and design overall. Finally, we conclude with main take-aways and avenues for further research.

Methodology

The research methodology was based on the principles of multispecies ethnography. Multispecies ethnography is an approach to ethnography which studies natural entities and, especially, their links to humans and the social world (Kirksey & Helmreich, 2010). It views that humans come into being through their interaction with nonhumans in assemblages (Ogden et al., 2013). "We use the term 'assemblage' to suggest not a mere collection of entities and things, but a complex and dynamic process whereupon the collective's properties exceed their constitutive elements" (Ogden et al., 2013, p. 7). Multispecies ethnography focuses on events and actions in which human and nonhuman worlds interact (Kirksey & Helmreich, 2010) and analyzes how these interactions shape each other and the setting (Ogden et al., 2013). It uses methods from ethnography (Ogden et al., 2013), such as participant and nonparticipant observations, interviews and visual research methods, such as photography, videography and audio recordings.

The data collection was conducted by the first author of the article in her family's garden in a small town in Latvia. She selected this location for four reasons. First, a garden is a context that includes humans, natural entities and observable processes and interactions among and between them. Second, the garden encompasses over 25 years of her contextualized experience and knowledge of the natural world previously excluded from her professional practice. She has extensively worked and lived in the garden most of her life. Third, it was a familiar environment that allowed her to avoid a language barrier and to focus on the natural entities and interactions instead of spending time on familiarizing herself with an unknown location, species and language. This enabled her to also incorporate her extensive theoretical knowledge from biology studies in basic and upper secondary school[1]. Finally, it allowed her to have unlimited access to the site while following the safety precautions related to the COVID-19 pandemic.

The first author of the article was immersed in the research context for five consecutive weeks in the summer of 2020. Data collection methods included participant observations; interviews with humans in the setting; recording of ad hoc conversations that took place while humans worked in the garden; recording of photos and short videos of the garden, its elements and nonhuman inhabitants; accounting of the plants in the garden; and recording long audio and video clips of the garden during the time when no human had been in the area. The processes in the garden and the natural entities encountered were carefully documented by taking photographs and videos to capture and preserve rich data about them. Figures 2 and 3 provide two examples of the data captured in photographs.

The collected data was analyzed using the theoretical structures of systems thinking developed by Derek and Laura Cabrera and their colleagues (see Cabrera et al., 2008, 2015, 2021; Cabrera & Colosi, 2008). This theoretical structure is based on four universal and interdependent patterns of systems thinking - distinctions, systems, relationships and perspectives - abbreviated as DSRP. ***Distinctions*** is a pattern of systems thinking in which an analyst observes a boundary between an element and 'the other' thus defining or distinguishing what the element is and what it is not (Cabrera et al., 2015; Cabrera & Cabrera, 2018). Distinction is done, for example, through naming, labelling or defining (Cabrera et al., 2015). Distinction also indicates that the defined element is part of a larger whole that encompasses the element and 'the other' (Cabrera et al., 2008). ***Systems*** is a pattern in which the analyst sees this larger whole as a system of 'two or more related parts' (Cabrera et al., 2008, p. 305). The analyst can and should mentally organize different elements in varied systems to make meaning, and the arrangement of the system changes the meaning that the analyst will draw from it (Cabrera & Cabrera, 2018). ***Relationships*** is a pattern of systems thinking in which the analyst strives to recognize the relationships between the elements in the system (Cabrera & Cabrera, 2018). "Relationships come in all types: causal, correlation, direct/indirect, etc.," (Cabrera & Cabrera, 2018). Relationships are dynamic, and there are seemingly multiple ways through which two elements can be related (Cabrera et al., 2008). ***Perspectives*** is the pattern in which the analyst recognizes that any distinctions, interpretation, relationship-making and meaning-making is done from a certain perspective or point of view (Cabrera et al., 2008; Cabrera & Cabrera, 2018). Changing a perspective through which a

[1] Emīlija Veselova has competed in and achieved high results at the state level biology olympiads of Latvia in 2006 and 2008. Results available here, http://priede.bf.lu.lv/olimpiade/gadi/, under sections Rezultāti.

Figure 2. A close-up photograph of a sweet cherry tree which showcases ripe and rotten cherries as well as dark spots on the leaves from a viral or bacterial disease.

Figure 3. A photograph of the same sweet cherry tree (see Figure 2) which showcases lichens on the tree trunk, the soil in which the tree grows, a human and animal which consume the cherries and a green plastic net used to protect the ripe cherries from birds which live in the adjacent forest and eat them.

system is viewed and interpreted can "instantly transform whole systems, rearrange distinctions, and cause relationships to appear or disappear" (Cabrera et al., 2008, p. 305). The perspective can be informed by many aspects, such as disciplinary training, social norms or personal experience (Cabrera & Colosi, 2008), and can be attributed both to humans and more-than-human elements, including natural nonhuman entities and systems. However, we find it important to highlight that a human, at their core, can only have a human perspective on systems: "one concept (subject) cannot literally 'see' another's point of view, but instead interprets and attributes a particular perspective of the other (object)" (Cabrera et al., 2008, p. 305). The four DSRP patterns of this theoretical structure for systems thinking are inseparable from each other and operate concurrently in the analyst's mind (Cabrera et al., 2008, 2021; Cabrera & Cabrera, 2018; Cabrera & Colosi, 2008). "Even though four patterns are simple, the result of their interactions can be wildly complex" (Cabrera & Colosi, 2008, p. 312). These four patterns served as guiding principles for data analysis.

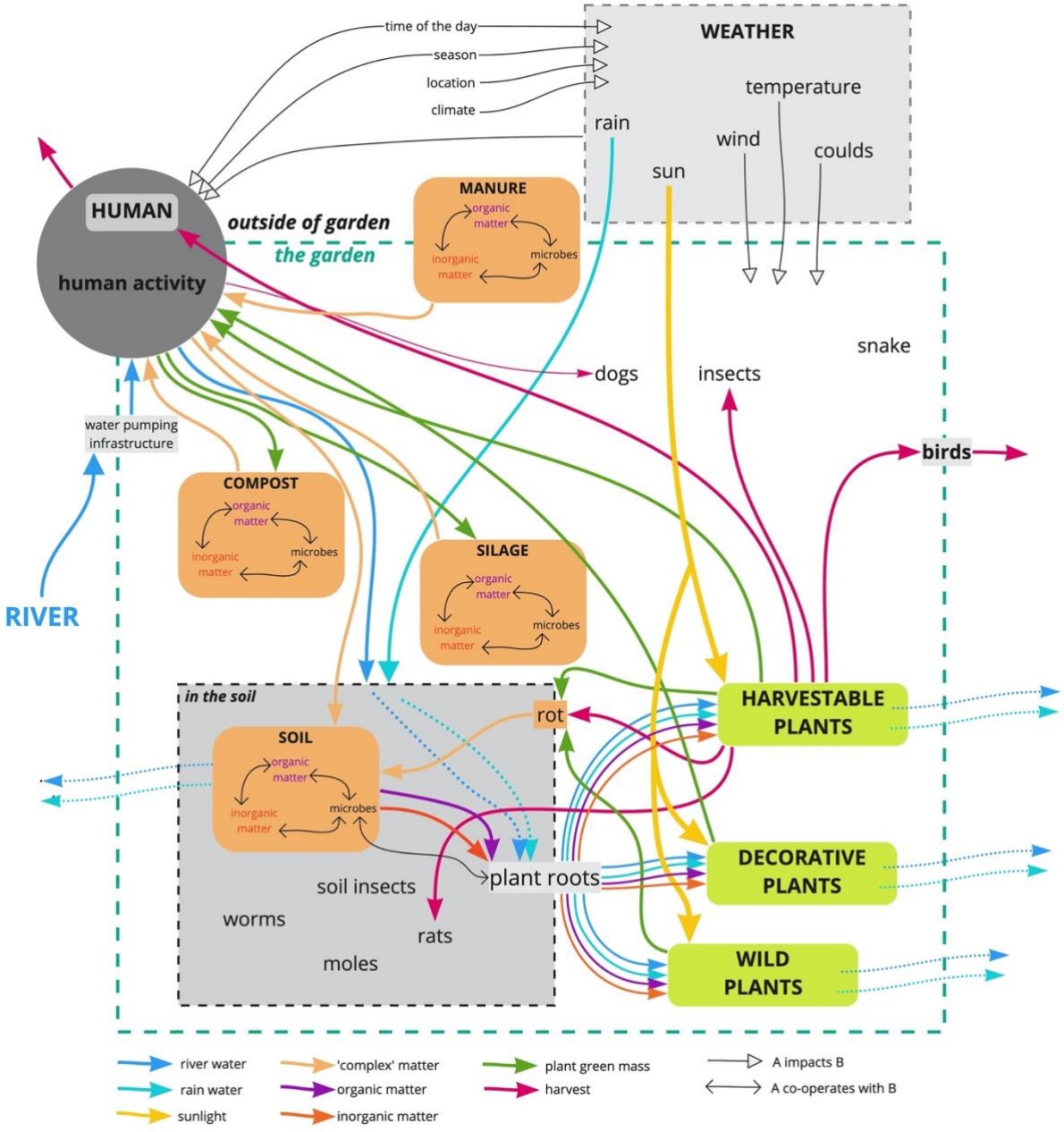

Figure 4. A systems model of the garden developed during data analysis.

We analyzed the data iteratively and collaboratively. Jointly we developed and discussed the analysis strategy. Then, the first author of the article qualitatively coded (Saldaña, 2015) her fieldnotes to start identifying the elements in the garden and interaction or interrelations between these elements. Then, she coded the data in videos and pictures. Throughout the coding, she supplemented empirical data with scientific and other expert knowledge, for example, on farming or gardening via scientific and professional publications, the online edition of Encyclopedia Britannica and species collections. The online edition of Encyclopedia Britannica was selected as a resource because its entries are regularly updated by prominent scholars from the fields that relate to the entry (*Britannica Knowledge Experts*, n.d.). During the coding, the first author utilized the *distinctions* pattern of systems (Cabrera et al., 2015; Cabrera & Cabrera, 2018): she distinguished various elements in the garden by acknowledging how she had called/named them in her field notes or by naming what she saw in the videos and pictures. At the same time, she utilized the *relationships* pattern of systems thinking (Cabrera et al., 2008, Cabrera & Cabrera, 2018) when identifying what relationships between the elements she had described or were visible in visual data. Based on identified elements and relationships, she used the *systems* pattern of system thinking and mentally arranged them into a systems and iteratively visualized this system in a systems model.

She developed four iterations of this systems model; Figure 4 present the fourth and final developed systems model. Throughout this process she retained the perspective of a human and a C&PD researcher and practitioner which aligned with the aim of developing a typology of natural nonhuman stakeholders for C&PD. Thus, the first author of the article continuously utilized the *perspective* structure of systems thinking (Cabrera et al., 2008; Cabrera & Cabrera, 2018). Furthermore, we jointly discussed the elements, relationships, systems models to interpret them through the perspective of the second author. The data, systems models and discussions between the authors about theory and practice of C&PD, design for sustainability and systems thinking informed several iterations of the stakeholder typology and reflections on its implications, future research avenues and limitations. The systemic typology and the reflections are presented in the next section.

Results & Discussion

Table 1. A systemic typology of natural nonhuman stakeholders when designing for sustainability.

Type	Examples
Individual Organism An organism typically seen as an independent living entity	Plants Animals, incl. mammals, birds, reptiles, insects, amphibians, crustaceans, mollusks
Single species collective A collective of organisms from a single species that live together and might have a special organization of their life	Social insect colonies Bryophytes, incl. mosses and hornworts Algae Fungi
Multispecies collective A collective of living organisms, such as microorganisms, insects, worms, and gases, organic and inorganic matter that jointly partake in life processes	Bacterial collectives Lichens Soil Compost Animal manure
Life Processe A flows of elements between living and nonliving parts of the biosphere	Photosynthesis Decomposition of organic matter Respiration Nitrogen Fixation
Living system A location-tied system of living organisms, collectives and the organic and inorganic matter and gasses that jointly partake in life processes ("Ecosystem," 2020)	Garden Lawn Greenhouse Forest River
Biogeochemical Cycle A cyclical flow of an elements between the living and nonliving parts of the biosphere ("Biogeochemical Cycle," 2020)	Carbon cycle Nitrogen cycle Phosphorus cycle Water cycle
Processe of the atmosphere A short-, mid-, or long-term processe in the atmosphere that determines presence of elements and energetic resources for life processes (Waggoner, 2020)	Weather Season Climate

The typology strives to represent the key distinct variations of natural nonhuman stakeholders observed during the case study rather than precise, definite, mutually exclusive or universal categories. However, it can also be seen as a mental model for making sense of the complexity when working with natural nonhuman stakeholders. While the typology seems to indicate clear-cut boundaries between the types, the reality is, of course, more complex. For example, an apple tree is an individual organism, yet it also likely hosts lichens, fungi and insects. It needs pollinators to bear fruit, and it needs microbes to draw nutrients from the soil (Montgomery & Biklé, 2015). It breathes and goes through the process of photosynthesis; thus, it takes part in the cycles of water, oxygen, carbon and other elements. This same tree could and should be seen as an individual organism, a multispecies collective, a living system and a representation of life processes and biogeochemical cycles, all at the same time. In essence, the same living entity is several stakeholder types simultaneously. Figure 5 schematically presents these complex relationships between observable entities and the systemic types of stakeholders. When identifying natural nonhuman stakeholders for C&PD projects it is vital to concurrently view the same entity as different stakeholders. The entity should be viewed through a systemic mental model. Cabrera et al. (2021) suggest a similar notion with an example of the same object being used both as a desk and as a barricade. "*A being a desk* OR *A being a barricade* refers to our mental model of A (our epistemological or cognitive reality)" (Cabrera et al.,

2021, p. 14). This challenges the currently dominant perspective on stakeholders in C&PD which views one natural nonhuman entity as one type of stakeholder.

In this research, we deliberately chose to exclude humans from our categorization. Meanwhile, humans could be seen as one of the individual organisms that is included in or related to other natural nonhuman stakeholder types. For example, humans breathe; thus, they are part of the oxygen and carbon cycles. Moreover, human creations and their activity also are linked to the natural nonhuman stakeholders. For example, a mobile app is powered by electrical energy and, therefore, via the energy system is linked to the carbon cycle. This highlights that even projects that seem to have no visible natural nonhuman stakeholders, when viewed through a systemic perspective, have them. Further research is needed to more clearly outline how humans and their activity are interlinked with the natural nonhuman stakeholders, particularly when using a socio-technical systems lens within which they generally are disregarded. This also correlated to our previous research that every design project is linked to ecological systems and sustainability (Veselova, 2019).

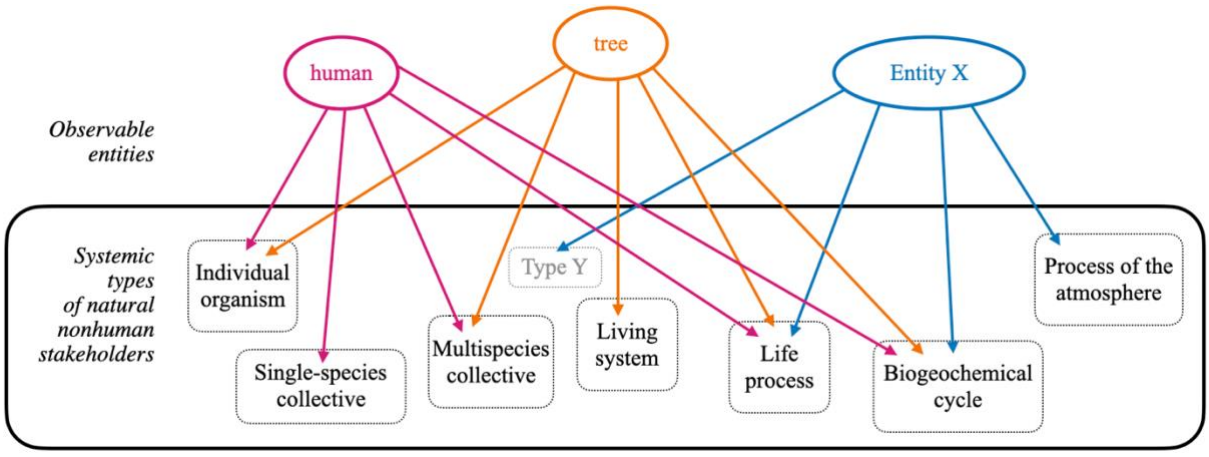

Figure 5. Schematic representation of the relationship between observable entities and the systemic types of natural nonhuman stakeholders.

Thus, designers should view each living entity, including humans, as a collection of several systemic stakeholder types rather than one individual stakeholder. This requires a paradigmatic shift from a fragmented, reductionist view of stakeholders in design processes to one which acknowledges and works with systemic complexity. Such shift seems to challenge the currently dominant perspective that a stakeholder is a separate, independent entity. Our systemic typology suggests one mental model through which a designer could approach viewing natural nonhuman entities. It also accentuates and provides solutions to the often-ignored tension between isolated C&PD projects and systemic world they operate it. This mental model should be further integrated into C&PD theory, approaches, methods and tools to stimulate and support expansion of the mental models of researchers, theorists and practitioners working in the field. For example, when making stakeholder maps for C&PD projects, the designers could first identify the visible entities and beings in the project and then, with the help of the typology, trace back other relevant systemic stakeholders. Currently, such thinking does not seem to be prominent in more-than-human C&PD projects. Typically, such projects view a natural nonhuman stakeholder only as an individual organism (e.g. see Jönsson & Lenskjold, 2014; Robinson & Torjussen, 2020; Webber et al., 2020; Westerlaken, 2020b). However, there have been some projects that take a more complex and systemic outlook. For example, Avila (2017) has identified a plant as a part of feeding and pollination processes of bees. Thus, further research is needed to problematize currently dominant framing of stakeholder in C&PD through a systemic perspective.

The variety of natural nonhuman stakeholder types also raises questions about the current definition of participation in C&PD. It seems that C&PD typically views participation as a direct input of a human being often through the means of verbal or visual communication (Simonsen & Robertson, 2012). However, neither a tree, process of photosynthesis nor carbon cycle can engage in such forms of participations. Overall, none of the types of natural nonhuman stakeholders can directly participate in the co-design process. Nevertheless, all or some of them are still stakeholders of the process that have to be considered and accounted for. Additionally, most often participation seems to be viewed in relation to the design project timeframe; meanwhile, natural entities live according to their timeframes. Therefore, there seems to be a need to re-question what participation is and how

to conceptualize it for natural nonhuman entities. This re-conceptualization of participation would have a direct impact on how natural nonhuman stakeholders are considered, included and represented in the projects. The current C&PD tools, methods and approaches have been developed for direct human participation. Therefore, it is crucial to evaluate their relevance when representing complex natural nonhuman stakeholders and to develop novel tools for the purpose.

Additionally, we view our typology as a starting point for an exploration of systemic perspectives on natural nonhuman stakeholders in C&PD and design for sustainability. Our typology should be developed further to represent and accommodate various design contexts. Currently, our typology is based on one case study of a particular outdoor setting. Meanwhile, C&PD is applied in many fields, settings, contexts, both indoors and outdoors. All of these contexts include at least some types of the natural nonhuman stakeholders. However, not all contexts will include the same elements and processes that led to the creation of our typology. Thus, it is necessary to apply this typology in varied arrangements to identify whether it represents the natural nonhuman entities in that setting and how the typology might need to be adapted or expanded. This would also allow the design community to identify which types of natural stakeholders are relevant in particular types of co-design projects and in which ways. Such research would contribute to shaping this typology to be robust and flexible for different locations, contexts, projects, aims and stakeholder configurations.

Furthermore, the research to further develop the typology needs to include direct input of varied scientific and applied disciplines. Currently, our typology encompasses scientific knowledge that we have gathered from secondary scientific sources. Such an approach allowed us to rapidly access verified, up-to-date scientific knowledge from various domains and disciplines. However, it limited the depth and breadth of knowledge that we could access and likely excluded critical disciplinary and interdisciplinary discussions. Moreover, our typology encompasses local, practice-based knowledge of humans in the garden about various processes, cycles and history of the location. Therefore, it seems that the further development of this and creation of similar typologies would highly benefit from transdisciplinary knowledge building. Here, we use the term transdisciplinary to indicate knowledge building that integrates knowledge from varied scientific disciplines and non-academic actors (Hirsch Hadorn et al., 2008). Our work indicates that input from the natural sciences, such as biology, ecology and various branches of Earth science, life sciences would be especially relevant in further development of the framework. Input from sustainability science would be necessary, to include the emerging natural nonhuman frameworks of sustainability, such as the recent multispecies sustainability framework (Rupprecht et al., 2020). Additionally, practitioners in the design community and practitioners working closely with natural entities can support the development of the framework by providing insights on contextual needs, processes and specifications.

Finally, our research also indicates that, when working in the natural nonhuman arena, there is a need for C&PD designers to have an understanding of (1) the natural world, (2) systems thinking and (3) transdisciplinary work. First, when starting to consider natural entities in design, it is necessary to have knowledge about organisms, life processes and the principles under which nature operates. Such knowledge allows the designer to rapidly grasp the basic natural organisms and systems and then creatively engage with them. For example, the research work of the first author was extensively supported by and would be much harder without her previous extensive training in biology and decades of practical experience in gardening. This insight resonates with many researchers working with more-than-human design and on intersections of design and nature (for examples see Fletcher et al., 2019), biomimicry (Benyus, 1998) and regenerative design (Lyle, 1996). Second, more-than-human C&PD designers should have an understanding of and skills working with systems thinking. Nature operates in systems, and sustainability is a systemic property. Therefore, there is a deep need to educate designers that are able to work with these issues with appropriate, systemic mental models and tools. This notion also resonates with designers working in areas of design for sustainability (Ceschin & Gaziulusoy, 2020), urban design (e.g. Yang & Yamagata, 2020) and systemic design (Jones & Kijima, 2018). The DSRP theoretical structure for systems thinking served as a simple entry point to such thinking; however, particular approaches, methodologies, such as systems dynamics, soft systems methodology, critical systems heuristics, systems science (see Cabrera et al., 2021 for overview) could provide further depth and breadth to the exploration and theoretical and practical development. Lastly, designers need to be able to work in a transdisciplinary manner. Research into the natural world is ongoing, and design projects will likely always also include varied human stakeholders. Thus, it is important for designers to be competent in effectively engaging with academic and nonacademic experts and partners and integrating these varied perspectives into design processes and solutions.

Conclusion

In this research, we aimed to develop a systemic typology of natural nonhuman stakeholders that would outline which natural entities should be viewed as stakeholders in collaborative and participatory design projects that strive to contribute to systemic sustainability. Based on empirical research in a garden and analysis of the data using the DSRP theoretical structure for systems thinking, we propose that there are seven key types of natural nonhuman stakeholders: individual organisms, single species collectives, multispecies collectives, life processes, living systems, biogeochemical cycles and processes of the atmosphere. While the seven outlined types are distinctly different, our research indicates that a single natural entity represents several stakeholder types simultaneously. For example, an apple tree is an individual organism, a multispecies collective, a part of life processes and biogeochemical cycles. Additionally, a human could also be seen as an individual organism that is part of several natural nonhuman stakeholder types. Therefore, C&PD should start viewing each living entity, including a human, as a collection of several systemic stakeholders. This suggests a necessity for a potential need to shift towards a systemic, multidimensional mental model about who and what is considered a stakeholder. The systemic perspectives also indicate a potential need for reconceptualization of what participation in C&PD means. Almost none of the natural nonhuman stakeholder types can participate in co-design through direct and deliberate communication, which is currently often seen as the main and only form of participation in C&PD. Thus, a systemic mental model and theory for C&PD and, consequently, tools, methods and approaches for participation in such C&PD are needed. These shifts will also require designers to develop knowledge of the natural world and its processes as well as systems thinking and working with varied scientific disciplines. The typology presented in this paper should be seen as a first step in the long journey towards developing a robust, scientifically sound systemic typology of natural nonhuman stakeholders applicable in most design projects.

Our research indicates that the following future research directions could support development of such typology:

- Further developing the typology to (1) include multidisciplinary and systemic scientific knowledge of the natural world and (2) accommodate various design contexts, locations, projects, aims and stakeholder configurations;
- Building understanding on the ways in which humans and their activities are interlinked with the natural nonhuman stakeholder concept;
- Identifying how C&PD currently perceives and defines a stakeholder and participation and relating that to the systemic natural nonhuman perspectives;
- Identifying whether and how C&PD could adopt the thinking models and tools from systems thinking approaches and systemic design;
- Re-conceptualizing participation in C&PD to be inclusive of natural nonhuman participation and development of tools, methods, approaches that support it.

These developments are likely to contribute to development of C&PD practice that develops projects and solutions that support systemic transitions towards sustainability.

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