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Mediating the needs of human and natural nonhuman stakeholders: Towards a design methodological framework

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Abstract: More-than-human approaches to design are one of the ways in which the design community is rethinking itself in the face of sustainability challenges. These approaches most often decenter humans from being the sole focus, stakeholder, or actant in design processes. However, currently, there is a shortage of more-than-human methods and tools that would be applicable in day-to-day design practice. In this paper, we, as one of the academic partners in a transdisciplinary consortium project, report results from our preliminary work and early insights towards developing a design methodological framework that would support the mediation of human and nonhuman needs in design. We view the concept of needs as a boundary object and, through semi-structured interviews with the consortium members, explore perspectives on 'needs' within the consortium. Then, we discuss five areas of complexity that our team needs to consider and further learn about while developing the design methodological framework.

Keywords: more-than-human design, design for sustainability, multispecies design

1. Introduction

The pressing environmental issues, such as climate change and biodiversity loss, have prompted design researchers and practitioners to rethink how design is being done (Ceschin & Gaziulusoy, 2020). More-than-human approaches to design are one of the reconsideration areas. More-than-human design strives to rethink human exceptionality and, most often, to decentre humans from being the sole focus, stakeholder, or actant in design processes (e.g. Akama et al., 2020; Fletcher et al., 2019; Forlano, 2016). More-than-human developments in design can be concerned with only artificial nonhuman entities, such as materials or technologies; with only natural nonhuman entities; or with both. In our research and in this paper, we are focusing on natural nonhuman entities. This framing of more-than-human design aims to acknowledge and consider natural nonhuman stakeholders in design processes; it



aims to design for and with natural nonhuman stakeholders. Our observations on the growing considerations of natural nonhuman stakeholders indicate that the drive seems to originate from two areas. On the one hand, some research and development are rooted in philosophical and ethical discussion (e.g. Akama et al., 2020; Rosińska & Szydlowska, 2019), such as environmental ethics, various perspectives on justice, ecofeminist and post-humanist perspectives. On the other hand, some research and development are rooted in sustainability science and systemic considerations for sustainability (e.g. Veselova, 2019; Veselova & Gaziulusoy, 2021; Wahl, 2016). Importantly, the same researchers can utilize or explore both perspectives in their work (e.g. see Veselova, 2019; Veselova & Gaziulusoy, 2019). However, overall approaches to designing for sustainability are expanding into the arena of design within socio-ecological-technical systems (Ceschin & Gaziulusoy, 2020) that requires more-than-human considerations.

While the acknowledgment and consideration of natural nonhumans in design are growing, there is a shortage of methods and tools that would be applicable in day-to-day design practice. Our observations indicate that the developments primarily seem to be theoretical, artistic, and experimental (e.g. Akama et al., 2020; Avila, 2017; Fletcher et al., 2019; Veselova & Gaziulusoy, 2019). These developments are important in advancing the area. They, however, remain insufficient to inform design practice applied in contexts where more-than-human considerations are widely relevant, for example, in our cities which host significant biodiversity and where designs impact multiple life-support systems such as water and land. There is an increasing need for methodological approaches that are workable by designers in practical contexts that take into account a more-than-human stakeholder base. This task requires stretching beyond the traditional boundary of design - a discipline arguably well-equipped theoretically and in practice to design for and with human stakeholders - to bring in expertise areas that can inform developing our understanding of how to design taking into account a more-than-human stakeholder base.

In this article, we, as one of the academic partners in an interdisciplinary consortium project, report results from our preliminary work and early insights towards developing a design methodological framework to be used in a more-than-human stakeholder context. In the following section, we describe the project, explain our task and discuss our preliminary work. In section 3, we present our methodology which is followed by reporting of our findings in section 4, discussion and reflections in section 5, and conclusions in section 6.

2. NorDark project and our team's challenge

NorDark is a four-year consortium project consisting of six academic institutions in three Nordic countries. The project received funding from NordForsk Interdisciplinary Call; this call specifically required proposals based on a collaboration between at least two of the three areas of science, as categorized by the European Research Council (i.e., life sciences, physical sciences and engineering, social sciences, and humanities), to enable the development of

ground-breaking research results. The call opened in 2019 as a two-stage call, results were announced in December 2020. NorDark project started in early 2021.

The project aims to test and inform lighting designs for the Nordic urban after-dark environments in a way that takes into consideration the needs of both humans and wildlife. The lighting solutions will be tested in two field sites in Sweden (Uppsala) and Norway (Ålesund). The impact of the lighting qualities on humans and wildlife in these sites will be tracked by comparing data from existing (pre-intervention) and post-intervention studies. Digital twins of the sites will be created to support prototyping and testing of lighting concepts. NorDark is formulated as a transdisciplinary research project (Hirsch-Hadorn et al. 2008). As explained in the project proposal:

“transdisciplinarity is understood as an extended form of interdisciplinarity; while interdisciplinary research strives for integration of knowledge from different disciplines, transdisciplinary research aims for: 1) Opening up of disciplines epistemologically and methodologically to one another, thereby creating opportunities for innovation within disciplines, 2) Integration of not only disciplinary academic knowledge but also of non-academic knowledges relevant to the research context.”

Each academic partner in the consortium contributes distinct research expertise relevant to the project and complements one another in the context of the project aim. It is expected that the project will support the generation of new knowledge within each research area while the main project aim will be achieved through co-creative knowledge development across all research areas involved. There are two industry partners and two municipalities in the consortium in addition to the academic partners. Table 1 presents the list of academic partners and research areas associated.

We, the authors of this article, are the research team from AALTO. We have been invited to the consortium on the basis of our expertise in sustainable design, more-than-human design, and transdisciplinary research. We have two primary interrelated responsibilities in the project: developing a generic design methodological framework for mediating the needs of humans and nonhumans and facilitating transdisciplinary knowledge integration across the consortium. The accomplishment of the latter task is a necessary condition for the accomplishment of the former task of our team and the overall project aim. Thus, in this paper, we are focusing on the development of the design methodological framework.

Knowledge integration is acknowledged as a significant challenge of transdisciplinary research because it involves communication and understanding among people who represent different academic perspectives, work with different epistemological assumptions and use specialist language and framings that may lose their meaning and depth outside the context of a discipline (Godemann, 2008; Wickson et al., 2006). Knowledge integration in transdisciplinary research happens iteratively across different stages of a project. There is a multiplicity of methods mentioned in the literature including the development of project glossaries, project-specific theoretical models, digital or analogue prototypes, joint publications, and

epistemic objects (Bergmann et al., 2012; Pohl & Hirsch Hadorn, 2007). Epistemic objects are particularly important for achieving cognitive integration in an interdisciplinary research context. Epistemic objects are co-created by reworking loosely structured boundary objects. Boundary objects are constructs that are understood by or familiar to all researchers in a project and have sufficient adaptability and integrity for all research areas included (Star & Griesemer, 1989). For NorDark, the concept of needs seems to be a core boundary object since, with references to the project’s aim, the key indicator of success for the project will be the extent to which the needs of humans and nonhumans can be mediated in lighting design strategies. For this purpose, as our first task, we explored how this concept is used and understood within the research areas contributing to the project.

Table 1. *NorDark project academic partners.*

Project partner	Country	Research areas
Division of Lighting Design, Department of Architecture, Royal Institute of Technology (KTH)	Sweden	Lighting design, lighting design research
Environmental Psychology, Department of Architecture and Built Environment, Lund University (LU)	Sweden	Environmental psychology
Stress Research Institute, Department of Psychology Stockholm University (SU)	Sweden	Physiology; stress and sleep research
Department of Urban and Rural Development Swedish University of Agricultural Sciences (SLU)	Sweden	Urban ecology; wildlife ecology
Department of ICT and Natural Science, Norwegian University of Science and Technology (NTNU)	Norway	Computer science and engineering
Department of Design, School of Arts, Architecture and Design, Aalto University (AALTO)	Finland	sustainable design; more-than-human design; collaborative design; transdisciplinary research theory and practice

3. Methodology

In order to develop an understanding of the perspectives on needs within the research areas included in the project, we conducted semi-structured interviews (Flick, 2009) with the key

researchers in the consortium (a total of ten). During the interviews, the concept of boundary objects was not introduced or discussed. The interviews had three key aims. First, we aimed to uncover insights on different framings of and assumptions on human and nonhuman needs in involved research areas so that these can be explicitly considered while developing joint epistemic objects and the design methodological framework. Second, we aimed to uncover insights on approaches used in these research areas to identify potential human and nonhuman stakeholders and their needs. Third, we aimed to uncover insights on concrete human and nonhuman needs that might be relevant in lighting design in the Nordic urban after-dark context. The interviews took place from April to June of 2021. Each interview lasted for about 60 minutes and was conducted via Zoom. The interviewees were informed about the aims of the interviews during the consortium meetings and in the invitation email. Participation was consent-based and consent was asked for at the beginning of each interview.

The interviews were audio-recorded and later transcribed using Temi speech-to-text software. The transcripts were thematically analysed. First, the transcripts were coded using a hybrid coding approach (Saldaña, 2015) in which we started with a set of predetermined codes and left room for the potential discovery of other relevant codes and code groups. Then we reviewed the data to identify emerging, expertise area-specific insights. Then we analysed the insights by comparing and grouping the different perspectives; visualizing and mapping them in relation to each other. We have validated our findings by presenting them to the interviewees and making adjustments in our interpretations based on the responses we received. Presenting our findings for validation marks the start of another iteration towards epistemological integration across the research areas which we plan to work on next and report in a future publication.

4. Findings

Through our analysis, we have identified four key insights in relation to the concept of needs in the NorDark project. These insights are based on the characteristics of the research areas, presented in Table 2. These insights provide a glimpse into the consortium and its relationship to needs at the very early phases of the project when various partners are at different phases of preparation and, thus, are likely to evolve over time. First, the research areas in the project can be grouped into three categories based on how they relate to the concept of needs - conceptual descriptive research, needs-based solution building, and prescriptive research - which are presented further in this section. We decided to leave out one research area - theory and practice of transdisciplinary research - from the categorization because it focuses on guiding and facilitating knowledge integration in the consortium and does not directly relate to needs that will be researched in the consortium. Second, the research areas in the project have different proximity to needs in relation to lighting. There are three research areas in the project that closely work with light and lighting: environmental psychology; physiology, stress, and sleep research; and lighting design. These research areas can identify concrete (human) needs that need to be engaged within the project. Meanwhile,

the other research areas are unrelated to lighting and the needs that are related to it. Third, the human and nonhuman stakeholder categories - the needs of whom the methodological framework is supposed to help mediate - are not uniform. Across the research areas, the term human stakeholder can refer to residents living near the study sites; municipalities; researchers of the project; lighting designers, and researchers of the project as well as potentially impacted humans in other locations and the future. Meanwhile, nonhuman stakeholders can refer to natural entities, such as animals near the study sites; relevant nonhuman stakeholders in other areas and timeframes, as well as digital nonhuman entities, such as other digital systems. Fourth, there are no formulations or theories of needs for natural nonhumans. Our consortium encompasses expertise in some human-centred theories of needs; however, several researchers, including researchers in ecology, emphasized that they are not aware of theories of needs for nonhumans. Nonhumans are rather discussed from the perspectives of their rights. Our consortium, however, does not include researchers who have expertise in disciplines that research nonhuman rights.

As mentioned above, there seems to be three distinct categories of research areas in relation to the concept of needs. First, there are research areas that do not explicitly discuss needs; we have called these areas contextual descriptive research. These research areas focus on uncovering and describing contextual aspects that support an entity in achieving one or several goals. They investigate how certain characteristics, elements, and processes of human-made, natural, or mixed contexts support the individual or the collective in reaching one or several goals. These research areas do not formulate their research questions around nor frame the findings as needs. It is important to note that we categorized environmental psychology into this category because of the particular perspective on needs it aims to adopt in this project. Overall, environmental psychology is rich in theories of needs as applied to humans which stem from psychology, which the researchers will review, apply and potentially adapt to this specific context. However, in this project, they do not aim to pick a specific theory of needs.

Second, there are research areas that uncover and address stakeholder needs in order to create solutions to meet those needs; we have called these areas needs-based solution building; design being among them. The solutions could include, for example, products, services, buildings, systems and could be digital, analogue, or a combination of both. In these areas, the concept of needs is omnipresent and seems to refer to the goals and aims that a stakeholder needs or wants to achieve through the use or assistance of the developed solutions. Needs are identified through self-reporting of the stakeholders, for example, via conversations and workshops, or through researcher interpretations of what has been heard or observed. Additionally, the needs list can be informed by standards, policy, regulations, guidelines, existing project examples, and experience and input from research.

Table 2. Characteristics of the research areas in relation to needs in the broader research area (BRA) and NorDark project specifically (ND). When talking about the NorDark project we include only perceived stakeholders, needs and approaches used to identify needs related to light.

Research area	Use of explicit theories on needs	Whose needs are researched/ Considered (perceived stakeholders)?	What kind of needs are considered?	Approaches used to identify or work with needs?
Environmental psychology Contextual descriptive research	<i>BRA</i> : YES: human, various <i>ND</i> : NO	<i>BRA</i> : Humans <i>ND</i> : Residents living near study sites	<i>BRA</i> : N/A <i>ND</i> : 'Needs' related to the urban outdoor environment	<i>BRA</i> : N/A <i>ND</i> : Structured Walks; Focus Group discussions
Physiology; stress and sleep research Contextual descriptive research	NO	<i>BRA</i> : Humans; Society <i>ND</i> : Residents living near study sites	<i>BRA</i> : N/A <i>ND</i> : 'Needs' related to the urban outdoor environment; 'needs' related to maintenance and promotion of health	<i>BRA</i> : N/A <i>ND</i> : Questionnaires; Measurements of light exposure; Subject diaries with sensitive variables and scales; Motion loggers
Urban ecology Contextual descriptive research	NO	<i>BRA</i> : Nonhumans; Humans <i>ND</i> : N/A	<i>BRA</i> : N/A <i>ND</i> : N/A	<i>BRA</i> : Inventories of (species in) a particular context; Observations/sightings of species <i>ND</i> : N/A
Wildlife ecology Contextual descriptive research	NO	<i>BRA</i> : Nonhumans <i>ND</i> : N/A	<i>BRA</i> : N/A <i>ND</i> : N/A	<i>BRA</i> : Observations/sightings of species; citizen science <i>ND</i> : N/A
Research area	Use of explicit theories on needs	Whose needs are researched/ Considered (perceived	What kind of needs are considered?	Approaches used to identify or work with needs?

Research area	Use of explicit theories on needs	Whose needs are researched/ Considered (perceived stakeholders)?	What kind of needs are considered?	Approaches used to identify or work with needs?
Computer science and engineering Needs-based solution building	NO	<i>BRA</i> : Humans; Other digital systems <i>ND</i> : Lighting designers of the project	<i>BRA</i> : Needs in relation to the functionality of the system; Needs in relation to performance of the system <i>ND</i> : Needs related to simulating lighting solutions	<i>BRA</i> : Soft Engineering approach; Conversations with stakeholders <i>ND</i> : Conversations with researchers
Lighting Design (research) Needs-based solution building	NO	<i>BRA</i> : Humans <i>ND</i> : Residents living near study sites; Municipalities of the study sites; Animals near study sites	<i>BRA</i> : Needs related to the lighting in the urban outdoor environment <i>ND</i> : Needs related to the lighting of the urban outdoor environment; Decreasing impact on nonhumans	<i>BRA</i> : Conversations with stakeholders; Community workshops; Use of standards, guidelines, rules, regulations, policy <i>ND</i> : Integration of transdisciplinary knowledge; Digital simulations
Collaborative Design Needs-based solution building	NO	<i>BRA</i> : Humans <i>ND</i> : N/A	<i>BRA</i> : Varied self-reported or identified needs of the stakeholders <i>ND</i> : N/A	<i>BRA</i> : Stakeholder workshops; interviews with and observations stakeholders <i>ND</i> : N/A

Research area	Use of explicit theories on needs	Whose needs are researched/ Considered (perceived stakeholders)?	What kind of needs are considered?	Approaches used to identify or work with needs?
Sustainable design Prescriptive research	YES: human, Max-Neef's theory of human needs	<i>BRA</i> : Humans; Nonhumans <i>ND</i> : site-specific human and nonhuman stakeholders; other relevant human and nonhuman stakeholders at different time and space locations; designers in the project	<i>BRA</i> : N/A <i>ND</i> : Needs of humans and nonhumans in relation to lighting; Needs related to mediation process	<i>BRA</i> : N/A <i>ND</i> : Integration of transdisciplinary knowledge
More-than-human design Prescriptive research	YES and NO: human; depending on the researcher; Maslow's hierarchy of needs; Max-Neef's theory of human needs	<i>BRA</i> : Humans; Nonhumans <i>ND</i> : site-specific human and nonhuman stakeholders; other relevant human and nonhuman stakeholders at different time and space locations; designers in the project	<i>BRA</i> : N/A <i>ND</i> : Needs of humans and nonhumans in relation to lighting; Needs related to mediation process	<i>BRA</i> : N/A <i>ND</i> : Integration of transdisciplinary knowledge

Third, there are research areas that strive to differentiate between needs and wants to distinguish which stakeholder needs should be addressed and which stakeholder wants can and should remain unaddressed; we have called these areas prescriptive research. From a human rights perspective, humans have the right to have their needs met. At the same time, from a sustainable development perspective, overconsumption is driven by wants and leads to inequality and injustice. To address the overconsumption of resources we have to differentiate human needs from human wants in our decision-making processes. Design-related disciplines seem to be more prone to use Maslow's hierarchy of needs (Maslow, 1943); meanwhile, sustainability science and, in turn, design for sustainability is more aligned with Max-Neef's theory of needs (Max-Neef, 1989). The prescriptive expertise areas are informed by varied perspectives on rights and justice: intergenerational justice, interspecies justice, justice between global north vs south justice, justice between the wealthy and the poor, and justice between the classes. They are also informed by discussions from philosophy, anthropology, animal welfare, posthumanism, and de-colonialism. It seems that the boundary between needs and wants is seen as blurry and contextual, especially when the inquiry lies beyond the basic functioning of humans as biological entities. Thus, while these expertise areas advocate for differentiation of needs and wants, they do not necessarily have a clear rubric of how to do so.

5. Discussion

Our exploration of the concept of needs within the consortium surfaced three distinct perspectives on needs that should be considered during the development of the methodological framework. First, we will discuss the potential implications of the three perspectives on the concept of needs for the methodological framework. Second, we will consider potential complexities related to non-uniform human and nonhuman categories of stakeholders. Third, we will reflect on the lack of theories of nonhuman needs. Fourth, we will reflect on the relationships between our two project goals: the development of a generic design methodological framework and the facilitation of transdisciplinary knowledge integration. Finally, we will explore the relationship between the NorDark case specifics and the generic framing of the methodological framework.

5.1. Implications of the three perspectives on the concept of needs for the methodological framework

One of the goals of our team in this project is to develop a generic design methodological framework to be used by practicing designers who want to take into account more-than-human stakeholders and their needs. In our categorization, these designers would, most likely, be positioned in the needs-based solution building category. This means that they are experienced in identifying human stakeholders, sourcing their needs, and they likely view that identifying needs is essential to build a solution that satisfies these needs. Currently, we are unsure whether they are familiar with the other two perspectives on needs that we have identified: research areas that do not explicitly research nor frame findings around needs

and research areas that strongly advocate for differentiation between needs and wants. Thus, the methodological framework we are developing needs to present all three perspectives on needs and, ideally, provide approaches or methods for designers to engage with information, insights, suggestions that are built on differing perspectives on needs.

In the context of the NorDark project, the methodological framework would need to support lighting designers in engaging with researchers and findings from environmental psychology and physiology, stress, and sleep research to understand the light and lighting-related needs of humans. This engagement might be strengthened by the fact that all three of these research areas are strongly linked to research on light. There is more likely to be a shared understanding of the context, issues and possibilities among the three. Meanwhile, the engagement with researchers and findings from urban and wildlife ecology might be more challenging as not only the perspectives on needs differ between the areas but also a shared topic of research is lacking. However, collaborations between environmental psychologists and wildlife ecologists already exist outside of the particular NorDark context; thus, there are likely existing collaborations we can learn from. Similarly, it might be harder to engage with the necessity to differentiate between needs and wants coming from the prescriptive research areas which do not relate to the topic of light or lighting in any way. As we develop the design methodological framework, we could attempt to facilitate the exchanges between the disciplines where the perspectives on needs differ and research areas are unfamiliar with light. In this case, a two-way engagement might help in which lighting design researchers can share what information they are looking for while the researchers learn and explore the relationship of their research and findings to light. Additionally, we can investigate whether and what type of engagement between the contextual descriptive research areas and prescriptive research areas is needed.

Meanwhile, when developing the generic design methodological framework, we need to anticipate the potential ways of designers to engage with insights that come from differing perspectives on needs while, potentially, not having direct access to the researchers working on the topics. Experience of and insights from the NorDark project could serve as a starting point to approaches, methods, or practical suggestions on how to source or differentiate needs in relation to natural nonhumans. This development likely requires engagement with various design practitioners to identify how they source their insights and how they formulate needs based on gathered information.

5.2. Complexities related to nonuniform human and nonhuman categories of stakeholders

The key goal of the design methodological framework we aim to develop is mediating human and nonhuman needs. As we explore the concept of needs, it also seems necessary to briefly reflect on the 'holders' of those needs. In our exploration - and also in our previous experience with practicing designers and design researchers - it is evident that neither humans nor nonhumans are uniform, monolith groups. Each encompasses varied sub-categories. Our interviews showcased that in the NorDark project, in relation to lighting, the human

stakeholders are residents living near the study sites and municipalities. This means that human stakeholders can be both individuals, but they can also be organizations. This, of course, correlates to the idea that each design project has many types of individuals and groups, collectives, institutions, organizations, companies, etc., with stakes, interests, and needs which may or may not be similar (Simonsen & Robertson, 2012). Design for sustainability also adds another relevant human stakeholder category: future generations. The diversity of and nuances within the human category of stakeholders should not be forgotten when developing the design methodological framework, and it requires reflection on whether and to what extent the design methodological framework should include approaches to mediate differing human needs.

Also, the nonhuman stakeholder category is not uniform. In our research, the term nonhuman stakeholder identifies natural entities. As presented in Table 1, the category of nonhuman stakeholders had remained abstract in the early months of the research, and further clarification of the term in relation to the project and each involved discipline is necessary. At the time of the interviews, the term nonhuman seemed to predominantly refer to wildlife. An ecologist in our consortium defined the term wildlife as the naturally occurring species of mammals and birds and highlighted bats as an important, protected category of wildlife. The project is framed around investigating the impact of urban outdoor lighting solutions on wildlife species in the study sites. However, these are not the only naturally occurring species in the study sites; various amphibians, insects, plants, mosses, lichens are also present. From a systemic perspective, single organisms or species are only some types of systemic natural nonhuman stakeholders that designers can consider. Other types may also include single-species and multispecies collectives, living systems, life processes, biogeochemical cycles, and processes of the atmosphere (Veselova & Gaziulusoy, 2021). Thus, wildlife is only a small portion of the potentially relevant nonhuman stakeholders at the sites. Furthermore, from the perspectives of design for sustainability and more-than-human design, not only immediate nonhuman stakeholders at the sites but also other relevant stakeholders in other time and space scales likely need to be considered. For example, there might be a need to consider nonhuman stakeholders throughout the whole lifecycle of an object, such as a lighting solution, to grasp the (full) spectrum of stakeholders a designed solution can affect. We have visualized the time and space terrain of nonhuman stakeholders in Figure 1. Though we use it here to identify the terrain of nonhuman stakeholders it likely also can be used to identify human stakeholders. The methodological framework should illuminate these variations to the designers and guide them in explicitly identifying which nonhumans they consider, which they leave out and why. Furthermore, the needs of nonhuman stakeholders might be conflicting, so there might be a need to not only mediate between human and nonhuman needs but also between contradicting needs of several nonhumans.

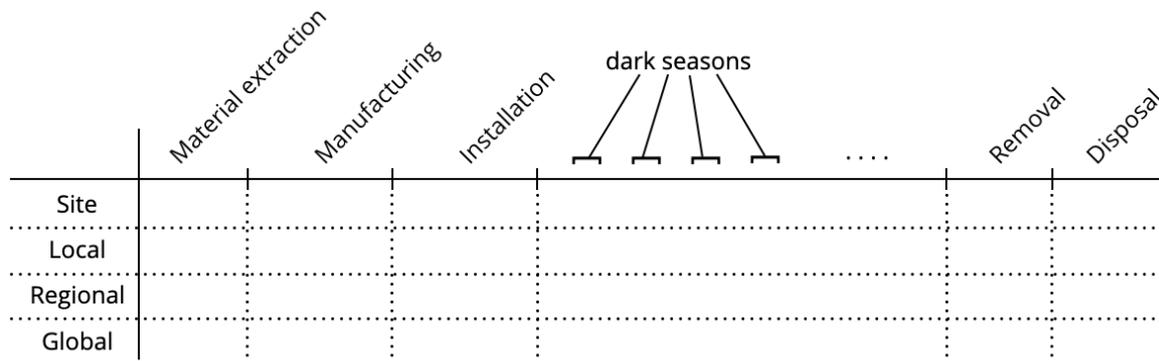


Figure 1. Schematic representation of the terrain for identification of natural nonhuman stakeholders over the lifecycle of a lighting solution.

5.3. Lack of theories of nonhuman needs

One of the key conceptual challenges when developing a design methodological framework that mediates human and nonhuman needs is the lack of theories on nonhuman needs. Thus far, we have found only one attempt at extending a theory of nonhuman needs to include also nonhuman actants (Jolibert et al., 2011). This research applied Max-Neef's theory of needs to otters and used biologists to represent the otters and formulate otters' needs (Jolibert et al., 2011). As we develop the methodological framework, we can examine this attempt further and identify whether it is a relevant addition. Otherwise, the concept of rights is more prominent in relation to nonhumans. The concept of rights is based on discussions on interspecies justice which are informed by perspectives and ongoing research in philosophy, anthropology, animal welfare, posthumanism, and de-colonialism. Unfortunately, the NorDark consortium does not include researchers with such expertise. Therefore, as we develop the methodological framework, we need to devise a strategy to include researchers or insights from normative areas, for example, through an expert workshop. Additionally, there might be a need to explore whether adoption of a particular normative perspective has implications on the differentiation between needs and wants: is the line between needs and wants different if a designer adopts lenses of sustainability versus interspecies justice versus justice between the global south and global north. Furthermore, we feel that conceptually needs and rights are different things. Therefore, further development of the design methodological framework likely requires exploration of the similarities and differences of these concepts and potential ways to bridge the gap between the two.

5.4. Relationship between the design methodological framework and transdisciplinary knowledge integration

In this project, our team has two interdependent goals: the development of a generic design methodological framework and the facilitation of transdisciplinary knowledge integration in the consortium. Currently, the relationship between the two remains unclear. On the one hand, the two goals seem to differ in targeted outcome, 'end-users' and scope. On the other hand, the development of the methodological framework will benefit from the integration

of knowledge from the consortium members. Currently, however, it remains unclear integration of which insights, from which research areas, at which part of the project, and for what reasons should happen. As we develop the methodological framework, we need to continuously reflect on whether and how the integration activities we are facilitating within the consortium. Likely not all consortium activities will be relevant for the development of the methodological framework and vice versa.

The NorDark project, thus, can serve as a platform for and case study of design being informed by various research and practice areas. Furthermore, the theory and practice of transdisciplinary research can provide insights into potentially useful approaches, methods, and tools for transdisciplinary knowledge integration. Integration can be also understood as “interrelating epistemological, conceptual and practical elements that were not related before” (Pohl et al., 2010, pp. 271–272). For example, some researchers in transdisciplinary research suggest the use of systems thinking and systems mapping to explore and account for complex “social, natural, technical, legal, etc. factors” that relate to a life-world problem (Pohl & Hirsch Hadorn, 2008, pp. 113–114). On the other hand, integrating knowledge from various research and practice areas is challenging, as it requires explicit opening up of epistemological and methodological nuances. The ability to work in such a manner is a skill that needs to be developed (Felt et al., 2013; Pohl & Hirsch Hadorn, 2007). In our team, we have theoretical understanding and some practical experience with that. Nevertheless, how such skills are relevant for designers and can be effectively supported by the design methodological framework needs to be further investigated. For example, we might need to establish whether and how designers striving to mediate the needs of humans and nonhumans engage with transdisciplinary knowledge integration; how they can develop the skill without access to transdisciplinary research literature and practical training in it; and whether there are boundaries for using transdisciplinary integration in design.

5.5. Relationship between the NorDark case specifics and the generic framing of the methodological framework

Finally, the relation between the case-specific and the aims of developing a generic design methodological framework is worth reflecting on. We aim to develop a methodological framework that is useful in day-to-day design projects. As we come forward, we likely need to further define what type of practitioners are our target users. Then, we need to build an understanding of how the methodological framework can be useful for them. For example, the projects of these practitioners are likely not part of consortium projects that include relevant scientific expertise. We need to engage with our target practitioners to seek answers to many questions about them. What do they already know about the mediation of human and nonhuman needs? What do they know about and, potentially, how do they already practice more-than-human approaches to design? How, if at all, do they differentiate between needs and wants? How do they engage with research findings and academic experts? What guidance do they see as useful? What makes designers adopt and stick to a particular

design method? Answers to these questions are critical to shaping the generic version of the methodological framework to be actually useful to the practitioners.

6. Conclusion

In this article, we presented and discussed the preliminary work towards developing a design methodological framework to be used in mediating human and nonhuman needs. Our research indicated that there are complexities surrounding the development that need to be further addressed. There is no uniform perspective of needs within our consortium; neither would there be in similar projects which tap into diverse expertise bases to guide more-than-human design. The human and nonhuman stakeholders of design are categories that include diverse actors and groups with, potentially, contradicting needs. As researchers in a consortium project, we need to balance participation in and support of consortium activities and the development of a generic design methodological framework. These complexities require further exploration with our consortium, academic and non-academic experts outside of the consortium, and design practitioners. Such exploration can lead to the development of a theoretical and methodological base for strengthening more-than-human considerations in the design and making them workable by designers in practical contexts.

7. References

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