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Designing and Living with Organisms Weaving Entangled Worlds as Doing Multispecies Philosophy

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Svenja Keune obtained her PhD with “On Textile Farming” within the ArcInTexETN and recently started her position as a postdoctoral researcher at the Swedish School of Textiles at the University of Borås, Sweden. She received recently an international postdoc grant from the Swedish Research Council for “Designing and Living with Organisms (DLO)”. Her research explores textiles as mediators between people and the natural environment, for example by integrating plants into textile structures; another aspect of her research examines the perspectives open up by relating textile design to spatial design, horticulture, agriculture, permaculture and environmental philosophy.
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ABSTRACT The emergence of biodesign opens new ways for textile design and production processes by e.g. using living organisms directly for growing or dyeing textiles. Researchers and designers who engage in such practices often describe their processes as a collaboration with the living. Since maintenance or acts of caring are often fundamental for a successful result, supportive environments for the living are created. However, most of the organisms are only used to carry out a specific task given by the designers’ intention, e.g., excreting pigments to dye a piece of silk, and are killed after the successful completion of the “collaborative” project, which is one of the reasons why the anthropocentric perspective remains an integral part of the textile design process.

This research aims to challenge the anthropocentrism inherent in textile design methodologies. Drawing from the work of Donna Haraway, in this exploratory paper, I

advocate for exploring more than anthropocentric and multispecies perspectives to textile design by understanding the textile design practice as a way of being-with and staying-with, rather than as a solution-driven practice. Therefore, I revisit and reflect on three stories that derived from encounters between humans and insects in shared textile contexts. The stories on multispecies cohabitation resulted from the autobiographic research 'Textile Farming'. Weaving connections between contemporary approaches to design, this paper proposes a conceptual framework of the levels that designers can engage with the living e.g., designing with, for, or together with living organisms up to living-with and becoming-with. I found these reflections to offer valuable perspectives to reflect on, analyze, and discuss processes in which living organisms play a role. Consequently, the paper contributes to reflective practice and opens up the textile design practice towards open-ended events as a more than anthropocentric approach to designing textiles.

KEYWORDS: Artistic research, textile design, multispecies events, autobiographic design, biodesign

Introduction

Today researchers, artists and designers increasingly engage with living organisms in textile design processes. Bacteria (of different kinds) for example are explored in womens underwear to support the skin flora (Tomasello & Almeida, 2020), they are utilised to dye (Chieza & Ward, 2015), grow (Lee 2007) reinforce textiles (Beyer, 2019) and to make them move (Yao et al., 2015).

Fungi are explored to grow leather-like material (Jones et al., 2021) or to make wearables reactive (Adamatzky et al., 2021). Plants are explored to grow textiles from roots (Zhou et al., 2020), as a dynamic material for textile design (Keune, 2018) and to explore ways of living between the inside and the outside (Keune, 2019).

This paradigm shift towards biodesign reaches beyond other biology-inspired approaches to design and fabrication, since biodesign refers to the integration of living organisms as fundamental components that enhance the function of the completed work (Myers 2012: 8).

Researchers and designers who engage in such practices often describe their processes as a collaboration e.g., by Chieza and Ward (2015) whose project this paragraph draws on. The collaboration with soil bacteria in this case is established by the designer and a scientist who create a suitable environment for the living organisms to live and multiply in e.g., a petri-dish with nutrient agar and a folded piece of woven silk. After getting rid of any other living organisms that could disturb the desired outcome (by sterilizing), the targeted bacteria are inoculated and take over the available space by

responding to the designed environment and effects of e.g. temperature, moisture and light. The collaboration is thus understood by how the bacteria respond to and engage with the environment that the designer and scientist set up and maintain. One can say then that the organisms are used to carry out a task (just by their predicted metabolic response) within a framework that was created by the designer to fulfil a certain design intention, e.g. excreting pigments to dye a piece of silk. No matter if the completion of this “collaborative” project was successful or not, the bacteria are killed and the outcome (if successful) preserved.

In this way, an anthropocentric perspective remains an integral part of the textile design process. Furthermore, the potentials of the living organisms are limited to the intention and imagination of the designer (as stated by Phil Ayres in an interview study which was conducted by the author and Astrid Mody).

Inspired by the writings of feminist scholars such as Donna Haraway, Maria Puig de la Bellacasa, and Anna Tsing, amongst others, I try to imagine what an alternative approach to textile design could be.

Contextual Framework

Biomimetics and Biodesign

In biomimicry, innovation is inspired from natural biological designs or processes. Nature is seen as an example to learn from and to translate suitable aspects into other domains. Design often takes nature as inspiration for form-giving. An example is the shape changing knits, developed by Jane Scott, which have been inspired by the functional perspectives of the pinecone hygromorph and the hierarchical structure of plant materials. Translating the underlying principles to knit construction, she has been able to engineer shape change behavior into knitted fabric which is composed of 100% natural materials as a new class of smart-natural knitted textiles. Therefore, Scott could develop an alternative design approach to smart textile design which usually relies on smart synthetics and e-textile components in order to achieve shape changing behaviors (Scott, 2015; 2016). In biomimicry, nature serves as a model, not as a resource to extract something other than knowledge. In addition, it is used as a measure to validate innovations, and as a mentor for viewing and valuing nature differently (Pohlmann, 2016).

Biodesign reaches beyond other biology-inspired approaches to design and fabrication, such as Biomimetics. In the context of design, biodesign is described as “the emerging and often radical approach to design that draws on biological tenets and even incorporates the use of living materials into structures, objects and tools” (Myers, 2012: 8). In this context, living organisms serve as fundamental components that enhance the function of the completed work (Myers, 2012: 8). The cross-pollination of biology with art, architecture and design is motivated by the fascinating opportunities that

open up through co-creating with nature. The manifold expressions that can be achieved as well as the opportunity to rethink and reimagine the paradigms of design and production provide additional fertile grounds (Antonelli, 2012). Biodesign is consequently a field within which designers can act upon their responsibility to imagine and design sustainable products and habitats by directly engaging with the living.

The variety of approaches that merge biology and design have been mapped by several scholars.

In 2017 Collet published a framework which is based on the three strategies “Nature as a Model”, “Nature as a Co-worker”, and “Nature as a Hackable system”. The first strategy “Nature as a Model” relates to Biomimicry and refers to the traditional designer. “Nature as a Co-worker” relates to husbandry or farming practices and expands the role of the designer to cultivation (Collet, 2017). An example for this approach is the use of living trees in architecture as vegetal technical compound structures (Ludwig et al., 2012). “Nature as a Hackable system” refers to bioengineering principles and expands the role of the designer to synthetic biology. The principle of co-working, according to Collet, is a collaboration which merges the ability of the designer with that of the organisms. The designer designs an environment for the organisms, by considering their needs as well as the designers’ intentions, and therefore balances their **nurturing and controlling**. The organisms are able to dynamically adjust to changing environments and thereby engage in a shape-forming activity (Collet, 2017). Based on Collet’s taxonomy Camere and Karana identified four main material design practices at the intersection of biology and design: “Growing Design”; “Augmented Biology”; “Digital Biofabrication”; and “Biodesign fiction” (Camere & Karana, 2018). Another taxonomy has been published just recently by Borst et al. (2020) who defined four categories within biodesign: “Design of Biology”, “Design for Biology”, and “Designing with the Product of Biology”, and speculative biodesign futures (Borst et al., 2020:10). Design of biology refers to biotechnology and the “programming” of cells for product benefits. An example is “BioPrint” by Yao et al. (2015). Design for biology refers to the manipulation of growth for product benefits. Borst et al. do not provide an example here, but one could be the work of Bastian Beyer and Daniel Suarez to reinforce a knitted framework using biocalcification by bacteria (Beyer, 2019). Designing with the product of biology refers to working with dyes or other materials that were produced by living organisms. The fourth category that is presented is speculative biodesign futures, which are projects that illustrate a certain future that is not reality today. Giulia Tomasello’s project “Future Flora” falls under this category (Tomasello, 2020).

Faber Futures can be seen as an example of a textile design practice that Chieza and Ward describe as a co-design process between them (a designer and a scientist) and the bacteria (besides the non-

living actors such as temperature and humidity). The act of folding and creasing of the textiles together with the colonisation and secretion of pigments creates a co-authorship and unique aesthetic consequences (Chieza & Ward, 2015). The collaboration is thus understood by how the bacteria respond to and engage with the environment that the designer sets up and maintains. One can say then that the organisms are used to carry out a task (just by their predicted metabolic response) within a framework that was created by the designer to fulfil a certain design intention e.g., excreting pigments to dye a piece of silk. No matter if the completion of this “collaborative” project was successful or not, the bacteria are killed, and the outcome (if successful) preserved. In this way, an anthropocentric perspective remains an integral part of the textile design process. Furthermore, the potentials of the living organisms are limited to the intention and imagination of the designer (as pointed out by Phil Ayres in the interview study “Designing and Living with Organisms” in November 2020).

The presented taxonomies on how biology and design can be merged are very similar to one another. They mainly illustrate the links to biomimetics, synthetic biology, and the use of living organisms in design and fabrication processes. Biodesign i.e., biofabrication is seen as a new industrial paradigm (Karana, 2020).

This anthropocentric approach towards the living is also very evident in the language that is used within the field. The aliveness or livingness of living organisms is referred to as a material quality in design and the living organisms as “living things” that can be collaborated with (Karana et al., 2020; Karana, 2020). Living organisms such as fungi, algae, plants, or bacteria mainly serve the production of materials that are seen as alternatives to petroleum-based materials or materials of animal origin. The main focus is therefore to control and manipulate their growth for product benefits which leaves very little space for more than anthropocentric approaches and to the inert potentials of living organisms to express themselves in diverse ways. Determining the expression and power of living organisms thus limits the potential in the design process and its outcome. Furthermore, there is a certain emotional and physical distance kept between the living organisms and the designer. The distance is created by the work environment e.g., labs and design studios, methods and protocols that minimize the physical contact with the living organisms to prevent contamination and to meet safety regulations. Additionally, it is created by the designers’ focus on specific design qualities. Moisy and Pschetz report about this duality between realizing that living materials cannot be seen as mere materials, but treating them as materials anyway, through their designerly focus on specific design qualities (2017).

Within the context of this paper a simplified categorization of how biology and design can be merged is used. *Using living organisms in a design process* summarises Designing with the Product of Biology and Growing Design. *Designing for living organisms* summarises

Nature as a Co-worker, aspects of Growing Design, Design of Biology and Design for Biology. The perspective of *designing together with living organisms* represents Nature as a Co-worker. Speculative approaches can be situated within all of the three perspectives that represent the contemporary approaches in the biodesign landscape.

Multispecies Perspectives

Haraway challenges the anthropocentric approaches evident in biodesign (as just one of many fields). Within her prominent book “Staying with the trouble” she refers to our all task as “to make kin in lines of inventive connection as a practice of learning to live and die well with each other in a thick present” (Haraway, 2016: 1). She thereby emphasizes autobiographic approaches which allow for living with (Haraway, 2016: 111) as a way of “becoming involved in one another’s lives” (Hustak & Myers, 2012: 77 as cited in Haraway, 2016). She further notes that staying with the trouble requires learning to be truly present in order to recognize the myriad of continuously changing entanglements and alternative presents and relations between places, times, matters, and meanings all of which is already there (2016). Haraway describes this as a “dance of encounters” (2007: 3) and foundational for the “making-with”, or worlding-with, in company” which she describes as Symptoiesis (Haraway, 2016: 58).

Engaging with living organisms is intrinsically connected with different levels of care. They have to be maintained or cared for in order to be used in a design process or to collaborate with them.

Also, the act of engaging generates sympathy and sensitivity towards them and therefore triggers thinking and acting of care. Maria Puig de la Bellacasa dedicated a book to “Matters of Care” in which she invites for a speculative exploration about care “for thinking and living in more than human worlds” (Puig de la Bellacasa, 2017: 1). For her, the term has very opposing meanings and effects, she writes: “To care can feel good; it can also feel awful. It can do good, it can oppress.” “Care means all these things and different things to different people, in different situations” (Puig de la Bellacasa, 2017). Puig de la Bellacasa describes care as an added value or concern to matters-of-fact that reaches beyond respect towards an involvement in their becoming (Puig de la Bellacasa, 2017: 66). She coins that “care is required in processes in which humans and non-humans co-train each other to live, work, and play together to construct relationships of “significant otherness”. It is required particularly if “one of the involved beings depends mostly on the other to survive (Haraway, cited in Puig de la Bellacasa, 2017: 83), which is the case in most - if not all - projects related to biodesign.

The chapter on “thinking with care” begins with Puig de la Bellacasa referring to Haraway’s situated knowledges and how it is intrinsically connected with matters of care, thinking and knowing. She states that “relations of thinking and knowing require care and affect

how we care” (Puig de la Bellacasa, 2017: 69). The chapter unfolds around three concrete moves that constitute the notion of “thinking with care” and that provide a relevant framework for engaging with living organisms as well. Thinking-with, dissenting within and thinking for.

Puig de la Bellacasa (2017) writes about “thinking with” (p. 71) as a relational way of thinking which creates new patterns of previous multiplicities, intervening by adding layers of meaning. It can be “inspirational, empowering, but mostly, not easy” (p. 79), often reveals conflicts and therefore connect to “dissenting within” (p. 78). Since designers are trained to think differently, solve problems, and develop perspectives for alternative ways of doing and living, dissenting within very well relates to Cross’ designerly ways of thinking and knowing (1982; 2001). “Thinking for” could be understood as trying to think for others who cannot engage in it themselves, and by that trying to adopt or step into their perspectives. Puig de la Bellacasa closes the chapter of thinking with care with “thinking with care as living-with” (Puig de la Bellacasa, 2017: 92), pointing out that “Thinking-with nonhumans should always be a living-with, aware of troubling relations and seeking otherness that transforms those involved in the relation and the worlds we live in” (Puig de la Bellacasa, 2017: 83).

More than Anthropocentric Approaches to Design

Discourses that re-think relations and hierarchies towards inter-dependencies and entanglements are evident in many fields, including environmental humanities, new materialism, posthumanism, feminist technoscience, and also has reached design research. Design’s reading of these discourses, especially via Donna Haraway, Karen Barad, Anna Tsing, Tim Ingold and Maria Puig de la Bellacasa, inspires new approaches in design research and practice in which a sensitization towards living beings instead of a general production of scientific knowledge alone, becomes fundamental (e.g., Haraway, 2016; Tsing, 2012, 2015; Westerlaken and Gualeni, 2016a). Examples of works include the works of Li Jönsson (2014), Michelle Westerlaken (2020), Marie Louise Juul Søndergaard (2018), Daniela Rosner (2018), and Linda Paxling (2019).

Jönsson challenges Participatory Design (PD) and the works of Haraway by proposing design events as non-anthropocentric approach to design i.e., participatory design, that “supports us in practicing ways of placing the hybrid collective in centre”. According to her, events are “designing through interlinking, infolding, and weaving together”, rather than designing for multispecies clients. Jönsson describes the design event as “not only a coming together, but constituted by a becoming together” (Jönsson, 2014: 116). Participatory Design (PD) and co-design provide methods and tools for (usually human) clients and designers to “design together”. Therefore, designers facilitate and stage design processes in which people “who have a stake in the process are invited to play the game” (Sanders, 2002: 6) and thus directly engage in the

shaping of future artefacts (Brandt, 2006). Everyday environments often serve as sites for design interventions.

Responding to Haraway's "ongoing process of world making" (Haraway, 2016: 74) Westerlaken (2020: 110) proposes "worlding as design practice". An example that illustrates how the act of engaging with other living beings generates sensitivity and sympathy, as well as types of reflections, different thoughts, alternative points of views, and previously unexperienced forms of engagement that would not be possible without the practical engagement with one another, is the designing-for-ants-workshop framed as an "Escape Rooms for Ants Game Jam" (Westerlaken, 2020).

Westerlaken concludes that the animals e.g., black garden ants in her case, that already live all around us can tell us "lots of stories about our complicated lives together" (Westerlaken, 2020: 223). She also points out that focusing on similarities rather than differences between multispecies actors (cf. Puig de la Bellacasa 2017: 77) does not necessarily lead to design work that improves their conditions, but could lead to the opposite, since scientific knowledge so far has mostly been used to exploit animals rather than to improve their livelihood (Hribal, 2007: 102 in Westerlaken, 2020). Westerlaken therefore proposes to focus on e.g., what similar activities could be carried out together such as playing, eating, and sleeping. Westerlaken and Gualeni (2016b) thus explore the notion of "becoming-with" as a conceptual framework for playful interaction design and respectful relationships with two dogs.

Another designerly approach to counter exploitation and produce knowledges that arise from increased sensitivity towards living organisms, i.e. animals is proposed by Westerlaken and Gualeni (2016). Doing multispecies philosophy, is based on the work of Driessen et al. (2014) and approaches design as a well-suited mode of thinking, tinkering with ideas and bringing them into being. Design therefore carries the potential to also think and tinker with philosophical inquiry and ethics, since these do not only happen through theory alone but have to be put into and explored in and by practice. Driessen et al. as well as Westerlaken and Gualeni propose game design as a form of doing multispecies philosophy. Westerlaken and Gualeni emphasize the approach in producing situated knowledges developed from processes of designing for and together with, in their case, ants Westerlaken and Gualeni, 2016b. They point out that the engagement with one another (participants of a workshop and the ants) was taking place in unexpected ways, leading to new experiences, thoughts, ideas, points of views, imagining worlds and accompanied forms of self-transformation. Therefore, I wonder how textile design can relate to situated knowledges, matters of care and if 'doing' multispecies philosophy could be carried out through textile design practices.

Autobiographic Research

Research approaches in design which are based on auto-ethnography e.g., autobiographical design (Neustaedter and Sengers 2012,

2014, 2015) allow researchers to draw on their own experiences to understand and iterate with their creations (Neustaedter et al., 2015), and open perspectives beyond the human by e.g., involving thing perspectives (Giaccardi et al., 2016), or multispecies perspectives more broadly. An example of personal engagement with textile multispecies worlds through autobiographic research is the authors work Textile Farming. The author chose to build a house and inspired by living in a prototype (Desjardins & Wakkary, 2016) explores living with (Haraway, 2016: 111) the implications and entangled worlds of the experimental work with textiles and plants (Keune, 2019).

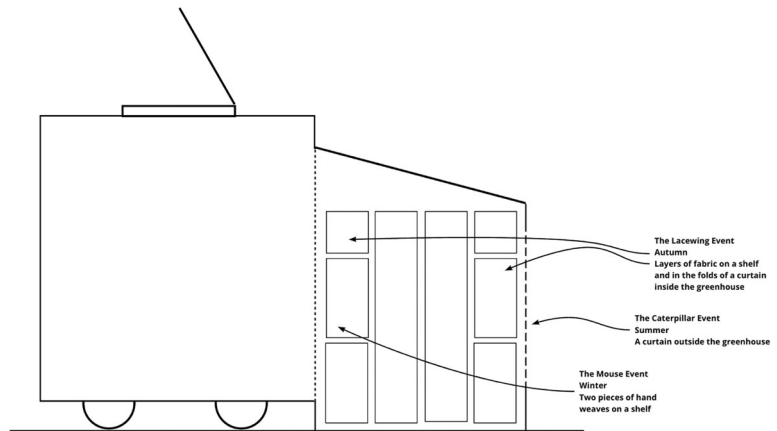
The previous sections outlined a contextual framework that connects biodesign, participatory design, autobiographic design, multispecies perspectives, and philosophy as a practice. This framework opens up a design space that embodies the potential of significantly expanding the design practice i.e., the textile design practice by adding design events/multispecies philosophy and being-with and living-with to the prevailing design perspectives in biodesign which are simplified as *using living organisms in a design process, designing for the living, and designing together with the living.*

Method

In the following I will revisit the three stories on multispecies cohabitation “Living with Lacewings”, “Pursuit of a Caterpillar”, and “The Mousemate”. The stories were composed by illustrating personal encounters mediated by the textile experiments conducted in the research project “Textile Farming” and have been published in the research journal “Living in a Prototype” (Keune, 2019). The stories were compiled based on photo documentation accompanied by brief autobiographic statements that illustrate the situation at the time, while the consequent longer textual accounts contain reflections and speculations on the situation after some time had passed and creating connections to textile design (Keune, 2019).

Within the context of this paper, the three stories are explored as textile multispecies events. The textiles have not been deliberately designed or set-up for the events that they eventually facilitated. However, reflecting back on the multispecies encounters provides valuable information about how they can be designed and set up, by either providing a specific environment for a specific encounter, or by providing a rather broad framework that invites chance and unforeseen encounters. The three stories are used for a wider reflection that is undertaken by considering the contextual framework, in particular the biodesign perspectives for designing with the living, and feminist theory i.e., “arts of noticing”, “situated knowledges”, and “matters of care”.

The reflections on the stories begin with a brief summary, followed by details about the textile structures, their set-up, and the design perspective through which they have been created. A selection of designer notes, reflections and design ideas from in the research journal are added in italics. They illustrate the auto-biographic

**Figure 1**

The graph illustrates the setup of the house prototype and situates the stories where and when they took place as well as their seasonal context.

experiences which are then discussed in relation to multispecies perspectives and the design event.

Three Stories on Multispecies Cohabitation *Living with Lacewings*

The story begins with the encounter of hundreds of insects (later identified as lacewings) in the curtains and heaps of textiles inside the greenhouse of the author, continues with a “mass-murder” through cleaning up and rearranging things, and the bad consciousness after learning that the lacewings are beneficial insects, hibernate in winter and are worth protecting (read the full story in Keune, 2019: 138-151).

The textiles in which the lacewings preferred to hide, were originally designed to explore double weave constructions as circular, square, and striped containers for seeds and substrate with another objective being to investigate dynamic aesthetic qualities by intersecting textile and biological expressions. The textiles have been woven on a jacquard loom at Svensson AB and made of the standard materials they use for interior textiles, a mix of wool and polyamide (read further Keune, 2019: 116ff) (Figure 2).

While the lady in the blog post worried about one of them, I unconsciously killed maybe one hundred.

I concluded, there was no way the lacewings enjoyed hanging out in my bed and mating. They just came to find a cozy place to sleep - and how did I greet them?

I offered her another drop and she slowly turned towards it, antennae moving almost in the same rhythm as the electronic music I was listening to.

**Figure 2**

The images show some lacewings hiding between layers of woven fabric.

© Svenja Keune.

->They can also hear the ultrasonic signals of insectivorous bats. Lacewings are not the best flyers but can move considerable distances with the help of the wind. The adults of many lacewing species are active at twilight and night, and prefer the color red; as a result, NABU painted a nesting aid.

Lacewings are similar to textiles in a number of ways: Their wings are transparent and have a lace-like net, their eggs hang on a thread-like stalk, and their larvae spin themselves into a cocoon. Consequently, the expressions of lacewings could alter the expression of a textile in a temporary or long-term way by adding biological materials to it. The textile could contain plants, which are beneficial for many insects, and so attract lacewings and keep the environment pest-free. There is also the possibility that textiles could be used as an environment for egg placement.

In order to address these ideas, the references and behaviors of these insects have to be included in the textile design process, and so the textile design practice has to be open to a perspective that includes another species as one of the main users. The textile has to create a beneficial microclimate that fits the life cycle of the critters, preferably covering the different stages of their development – egg, larvae, and adult – as well as their behavior and environment.

Through the semi-open framework of the greenhouse, the textiles were accessible to insects from the outside, in this case lacewings who were looking for a frost-free space to hibernate throughout the autumn and winter. This created the lacewing event, which started by the author noticing the lacewings and came to a climax in the massacre that was caused by the authors wish to clean up the greenhouse without realising the vulnerability of the lacewings who could not escape through the state of hibernation they were in, and without acknowledging or being conscious about the short (the suffering of the lacewings) and long term (a potential decline in lacewing populations, which are beneficial insects that live from aphids) consequences.

The event caused several emotional reactions. Disgust, discomfort, and pity were felt during the killing, shame, anger, remorse, and sadness arose with the process of contextualising the event. This was caused by increasing knowledge that resulted from reading and learning about lacewings, and especially how some other humans treat them. The “situated knowledges” stay and travel with the author until today, since she notices the peculiar pattern of their flight from a distance, and shares her home with the ones who come to hibernate inside. The aftermath of the event is therefore still with the author and is triggered by whenever a lacewing is noticed. One could say that the textiles, through which the event has taken place, supported an “arts of noticing”. This is probably due to the intimate connection between the author, as a textile design researcher, and the textile creations. However, since textiles have qualities that mediate between people and food (e.g., Heinzel et al., 2016), space (e.g., Ramsgaard Thomsen & Bech, 2015), and people and living organisms as illustrated in the contextual framework, it seems valuable to further investigate textile multi-species relationships, which is what the author will focus on for the postdoctoral project “Designing and Living with Organisms”. The reflections on lacewings and textiles illustrate that the textile multi-species event has led to what Puig de la Bellacasa describes as “thinking-with, dissenting-within and thinking for”. This series of concrete moves articulates what Puig de la Bellacasa defines as “thinking with care”.

Pursuit of a Caterpillar

The story begins with the encounter of a caterpillar climbing up on one of the textiles suspended on the outside of the greenhouse. The author describes how she climbs up after the caterpillar to the top to observe what he or she might be doing and follows on the way down. After the caterpillar moved on, she does some research in order to find out more about the insect.

The Organic Shapes fabric made from wool and polyamide was woven industrially and explored double weave constructions as containers for water in the top of the textile, and some for soil and seeds in the bottom (cf. Keune, 2018: 246-252). Two of either side were connected in order to guide the water from the upper one down to the other. The stripes and balloon like envelopes exhibited a strong contrast, dark grey and white.

Similar to the previous story, the textile has been designed for another reason and after proven unsuccessful was used to shade the greenhouse from the summer sun. It gained a totally different meaning with the caterpillar event (Figure 3).

He crept very purposefully up my grey and white curtain. I moved the ladder and followed, observing him for a while.

**Figure 3**

The images show the goat-moth caterpillar climbing up the Organic Shapes fabric which has been filled with soil and seeds in the bottom enclosure and suspended outside the greenhouse. © Svenja Keune.

They also smell of vinegar, and this allows infected plants to be identified. I decided to have a sniff around.

I think about the dedication with which the caterpillar climbed up my curtain. What was he looking for?

Too bad no bird found the orange and black critter in this exposed position. The Romans apparently ate red goat moth caterpillars, but as a vegan I would prefer to give my winged friends priority.

Instead of wondering why butterflies and bees follow us when we are wearing colourful dresses, simply trying to have a drink, we could finally learn about graphic design for insects in order to help them where they can find a rest, a nest, and the next seat at the insect bar.

My relationship with flowers is not half as romantic as that which some bees have with them. If they are big enough, bees can sleep there, holding each other's legs when the flower closes at night and so sleeping in a colourful, safe, and cozy bedroom.

-> Trees can die as a result of the feeding, particularly with an infestation of multiple caterpillars. Older caterpillars smell strongly of vinegar, which can be noticed in the area around the infected plant as well. This 'goaty' smell is where the name comes from.

Consequently, the textile could be an agent of pest control, mediating between pest and predator.

The textile provided an environment to notice and for situated knowledges to unfold. The event, like the previous one, reveals the relational ethics that come with scientific and cultural knowledge. The innocent, naive meeting of designer and lacewing, or designer and caterpillar is shaped by the designers pre-condition and existing knowledge. If there is no pre-existing knowledge and no pre-

condition, just unconditional curiosity, then species can meet on a similar level, which means without a filter that alters their meeting.

The scientific knowledge about the behaviour and way of life of the insects open up to knowledges about the environment and its inhabitants, but they also have ethical implications as becomes apparent when the author speculates about a textile that attracts the caterpillars for people and birds to harvest and eat in order to prevent them from damaging trees, which would an intervention from an anthropocentric point of view. The aftermath of the event thus prompted the author to take sides for the injured trees and against the caterpillars right to live and thrive.

However, the event enabled textile design ideas beyond what could have been imagined without it. It even led to generalisations to a wider context of insects and textile design e.g., relating textiles and their potentials for communicating patterns and graphics to insect communities and imagining relationships resulting from the visual multispecies communication. The event also had a sensitising effect towards the visual and olfactory dimensions that insects can be identified with.

The Mousemate

The Mousemate is a story about encounters with mice in the greenhouse of the author, especially about two hand weaves which have been altered by them, but also about the challenges of cohabitation which include noticing one another's traces, smells and noises.

The two textiles are hand weaves, one was woven with a very soft and fluffy weft from carded wool, and the other with a bean-tube weft, which is a knitted tube filled with black eyed beans. Both textiles have been stored in the greenhouse over winter and were randomly placed on a shelf.

The textiles were initially woven to explore the integration of seeds into textile structures and how their presence alters the textile expression. The mice however decided to use them for other purposes, the fluffy one became a home, and the other one served as a source for several meals. Since both textiles have been altered by the mice according to their new use, one could say that there was some kind of unconscious co-design happening, or that the mice were attracted by the textiles and altered them according to their needs (Figure 4).

While cleaning the Greenhouse I met my secret mousemate.

I talked to her to make myself and her more comfortable.

I came across two of my fabrics spotted with mouse poo. One of them – a doubleweave with thick strands of carded wool – had been used as a bedroom, I suppose, whereas the other – a single-cloth woven with a yarn filled with beans – had been torn and bitten, the beans eaten.

**Figure 4**

The images show the two types of hand-weaving that attracted mice. The first row of images shows a hand that was woven with a weft from carded wool and due to it being a double weave could be opened and placed upright, creating a vertical tube. This one was used as a shelter by a mouse. The mouse created an entrance into the tubular arrangement and was hiding from the cold. The second row of images present the weft material and the resulting hand-weaving of the piece of cloth that a mouse used to eat. The mouse ate the black-eyed beans that were organized in a tubular knitted weft material and therefore altered its aesthetic and tactile qualities. © Svenja Keune.

At first, I was sad about this invasive destruction, but also happy that the weave had been of use and appreciated by another species. The acoustics of the Greenhouse and the box amplified the sound in a way that meant that the mouse filled the entire house with its nocturnal attempt. I never saw her.

Several days went by while I thought about how to deal with this situation. I imagined a large family of mice falling on my head while I was trying to find their nest in order to relocate them. Maybe they felt my stress and the approaching danger; I never saw or heard them again.

Would they eat their home if it was edible? Would they consume everything, or just nibble some holes to use as doors or windows?

-> They were especially attracted by two textile pieces; one was used as a shelter and one was eaten, presumably because of the integrated beans.

This experience triggered a range of thoughts relating to how to react when other species live in the immediate vicinity, and how to make use of the benefits that our surroundings offer.

Living with mice and lacewings was a challenging but interesting experience which might recur in the coming winter. Until then, there is time to think about how a temporary cohabitation could be better planned for both sides, such as by building a lacewing-home. The experience pushed me to reflect on my house and how it could be customised to accommodate not only myself but plants and certain wildlife, and to do so by acknowledging the privacy of all involved and thinking about which textiles could be useful and how to design, fabricate and arrange them.

The mouse event, like the other textile multispecies events, asked for ways of caring for the present situation. Especially the lacewing event and the mouse event called for reactions and were not small enough to be ignored, since they happened within or close to the private living space of the author. Both events illustrate the challenges of multispecies cohabitation and the complex meetings of stakeholders with something at stake, precarious as living and dying, or just about levels of privacy.

The autobiographic annotations illustrate that imagination can make situations appear very dramatic, but that in reality, the situations of the lacewings or mice is far more dramatic than the imagination of the author. Many of the lacewings died, one mouse drowned as she fell into a watering can, their reality is thus about living and dying whereas the authors reality is very much about comfort and discomfort, which is also very subjective and relative. However, the events make visible some of the already existing forms of multispecies cohabitation and open up for questions of negotiating space and resources.

Conceptual Framework

This paper proposes a conceptual framework for engaging with nature i.e., the living, in design processes beyond approaches inspired by nature or based on what is commonly understood as biodesign. The framework adds multispecies perspectives and autobiographic approaches to biodesign as a deeper level to engaging with living organisms (or nature in general) in design.

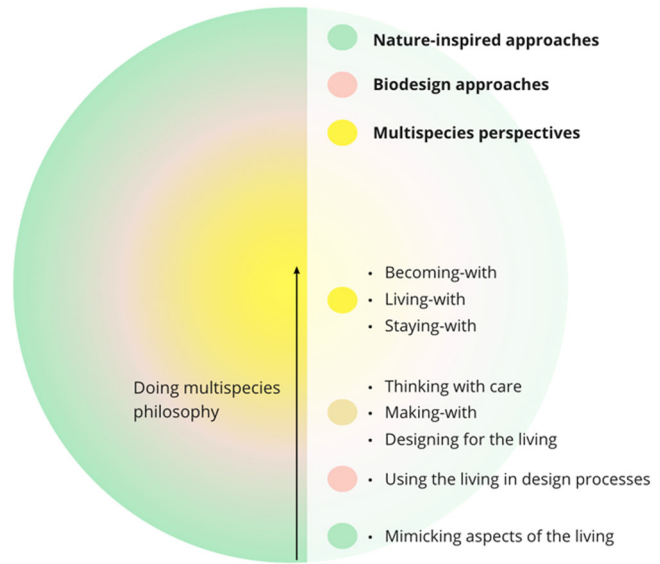
Figure 1 illustrates a 3-coloured gradient that starts at the outer edge of the circle with green and turns towards the inside of the circle first in pink and then in yellow. Approaches inspired by nature which e.g. mimmick aspects of the living are situated within the green outer ring and fade into biodesign approaches, which make use of the living in design processes and which is represented by pink. Further towards the center of the circle, the pink slowly fades into yellow. Where pink and yellow meet and turn into beige, the concept of “designing for the living” is situated, followed by “making-with” and “thinking with care”. The three concepts represent a more intense engagement with the living in the context of design that is nurtured by multispecies perspectives. “Staying-with”, “becoming-with” and “living-with” are located closer towards the centre and therefore

represent multispecies perspectives more fully. The usage of the term multispecies in the context of this paper and especially the conceptual framework that is proposed here, refers to the intensity and inclusivity by which designers and other living beings engage with one another. The highest level that one can reach, according to this framework is a “becoming-with”, a process in which all actors involved shape and are shaped with and by one another and thus engage in alternative ways of knowing and collaborative world-making through which alternative multi species assemblages emerge.

Discussion

The three stories described in this paper challenge the design event approach that Jönsson proposes in several ways. The described events have not been designed for lacewings, mice, or caterpillars. Initially the textiles have been designed to integrate and invite plants in order to co-create dynamic expressions (a combination of designing for an designing together with). When the encounters with mice, lacewings, and a caterpillar took place the three textiles were not set-up for any experimentation. The organic stripes fabric had already proven to be unsuccessful in relation to plant growth and simply served as a protection from the sun to prevent the greenhouse from over-heating. The two hand-weaves and the textiles in which the lacewings were encountered were just stored in the greenhouse over winter and randomly stuffed into the shelves. The events as described have therefore randomly occurred without having been designed intentionally. The living-with experience allowed the encounters to take place and therefore proved as a fundamental aspect. Another fundamental aspect was the staying with the trouble, the openness to stay with the situation at hand and to care for it with an open and curious mindset. Consequently, unplanned entanglements could lead to new worldings which open up for reflections and insights, potentially leading to another iteration of a design event with a more deliberate design intent, addressing the situation through which it was motivated and by which it was informed initially. Practices of designing and living with are therefore interwoven and are continuously challenged by one another, leading to new situated knowledges.

The potential of an open-ended design event is to invite the not-yet-known, to reach beyond exploring what can be already known, expected, assumed, or can be imagined. The textiles in the context of this work have a mediating agency. They invite e.g., a mouse through the potential that the woolen weave unfolds and what is recognized and needed by the mouse in the wider context of the environment, the location and the season. The textiles furthermore allow encounters that would otherwise go unnoticed, provide the opportunity to respond to the encounter e.g., a mass-murder, learning about lacewings as beneficial insects, and a chance to reflect and conceptualise the experience e.g., recognizing a false behavior,

**Figure 5**

A graphical representation of the conceptual framework that relates nature inspired approaches with biodesign and multispecies perspectives.

thinking about how to co-create with a mouse in the design of a textile.

Inspired by Jönsson, Gualeni and Westerlaken, Haraway and Puig de la Bellacasa this paper explores the idea of multispecies philosophy through textile multispecies events and resulted in a conceptual framework of how biodesign approaches can be expanded and enriched by multispecies perspectives. The textiles, originally designed for other purposes, served as a mediator between the author and the multispecies local context of the immediate environment, plants, and insects. They call for ways of caring for the situation as described in the research journal (Keune, 2019), when the author unintentionally kills hundreds of lacewings or when she has to negotiate with a mouse that finds a meal and a home in some of the textiles. The textiles, as mediators, thus become a framework for design events and support an art of, a cultivation of awareness of diverse actors to see “the divergent, layered, and conjoined projects that make up worlds”. These lead to “situated knowledges”, knowledges that arise from local entanglements. The textile multispecies events also encouraged to engage in alternative ways of knowing through e.g. auto-biographic and embodied practices, which led to questions about “what is and what can be” (Blevis, 2018) concerning textile design but also a wider context. In order to reflect on the complexities of care and ethics, I would like to refer to Westerlaken again, she states that care is not equal empathy and that it can be practised without being concerned with what is ‘right’ or ‘wrong’, or any ethical answers. Instead of focusing on consequences of actions or inactions, it could become a “doing ethics-in-practice”, which promote

fluid processes of adding diversity rather than restricting the possibilities by focusing on one universal way of how to do things right (cf. Westerlaken, 2020: 149).

The conceptual framework that expands biodesign towards multi-species perspectives is proposed in order to foster diversity in textile design research, practice and beyond. It is a framework through which existing works and new works can be contextualized. However, the ideal design work doesn't make use of just the multi-species perspectives and the "becoming-with" as a call for design 'doings', for example, instead it seeks to include as many approaches as possible, which might be as post-anthropocentric as design can become.

Consequently, the designer is challenged to fluidly take on the perspectives of all actors involved, which subsequently turns the design of products and services into the design of eco-systems, which is a new level of design entirely and needs to be approached with the utmost care.

Within the postdoctoral project "Title" I aim to gradually explore what could be understood as "textile ecosystems" by introducing multispecies perspectives (e.g. that of spiders, solitary bees, and certain plants) in the processes of designing and making textile structures and setting them up as an event by approaching the processes as doing situated ethics in practice and multispecies philosophy.

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References

- Adamatzky, A., Nikolaidou, A., Gandia, A., Chiolerio, A., & Dehshibi, M. M. 2021. Reactive fungal wearable. *Biosystems*, 199, 104304. <https://doi.org/https://doi.org/10.1016/j.biosystems.2020.104304>
- Antonelli, P. 2012. Foreword. In: Myers, W. *Bio Design: Nature • Science • Creativity* (first edition). London: Thames and Hudson, pp.6–7.
- Beyer, B. 2019. 'Between Duck and Tree. Metabolism-informed composite tectonics'. PhD Thesis. Royal College of Art, London.

- Blevis, E. 2018. Seeing What Is and What Can Be: On Sustainability, Respect for Work, and Design for Respect. In CHI '18, Paper No. 370.
- Borst, C., Congdon, A., Lee, S. and Parker, G. 2020. "Understanding "bio" material innovations: a primer for the fashion industry," *Biofabricate & Fashion for Good*, <https://fashionforgood.com/wp-content/uploads/2020/12/Understanding-Bio-Material-Innovations-Report.pdf>
- Brandt, E. 2006. Designing exploratory design games: a framework for participation in Participatory Design? (1). PDC '06: Expanding boundaries in design, ACM Press.
- Camere, S., & Karana, E. 2018. Fabricating materials from living organisms: An emerging design practice. *Journal of Cleaner Production*, 186: 570–584.
- Chiezza, N.A. and Ward, J. 2015. "Design in the age of living technology," *Research through Design (March) 2* : 25–27. <http://doi.org/10.6084/m9.figshare.1327971>.
- Collet, C. (2017). 'Grow-made' textiles. *Alive. Active. Adaptive: International Conference on Experiential Knowledge and Emerging Materials*, EKSIG 2017, pp. 24–37.
- Cross, N. 1982. Designerly ways of knowing. *Design Studies*, 3(4), 221–227. [https://doi.org/10.1016/0142-694X\(82\)90040-0](https://doi.org/10.1016/0142-694X(82)90040-0)
- Cross, N. 2001. "Designerly Ways of Knowing: Design Discipline Versus Design Science." *Design Issues* 17(3): 49–55.
- Desjardins, A. and Wakkary, R. 2016. Living in a prototype: A reconfigured space. Conference on Human Factors in Computing Systems - Proceedings.
- Driessen, C.P.G., Alfrink, K., Copier, M. and Lagerweij, H. 2014. "What could playing with pigs do to us? Game design as multi-species philosophy," *Antennae: The Journal of Nature in Visual Culture*, 30: 81–104.
- Giaccardi, E., Cila, N., Speed, C. and Caldwell, M. 2016. 'Thing ethnography: Doing design research with non-humans'. In *DIS 2016 - Proceedings of the 2016 ACM Conference on Designing Interactive Systems*, 377–387.
- Haraway, D.J. 2007. *When species meet*. Minneapolis: University of Minnesota Press.
- Haraway, D.J. 2016. The companion species manifesto. In *Manifestly Haraway*. Minneapolis: University of Minnesota Press.
- Heinzel, T., Keune, S., Walker, S. and Peciulyte, J. Al Dente Textiles. Notes on edible textiles as economic and ecological intermediality, 2016. *Proceedings 6th STS Italia Conference | Sociotechnical Environments*, Trento, November 24–26,
- Hribal, J. 2007. "Animals, agency, and class: Writing the history of animals from below," *Human Ecology Review*, 14(1): 101–112.
- Hustak, C. and Myers, N. 2012. "Involutionary momentum: Affective ecologies and the sciences of plant/insect encounters" *Differences*, 23 (3): 74–118.

- Jönsson, L. 2014. Design Events: On explorations of a nonanthropocentric framework in design.
- Jones, M., Gandia, A., John, S., & Bismarck, A. 2021. "Leather-like material biofabrication using fungi," *Nature Sustainability* 4: 9–16. <https://doi.org/10.1038/s41893-020-00606-1>
- Judge, T.K., and Neustaedter, C. 2014. *Studying and Designing Technology Lessons from Home*. San Francisco, CA: Morgan Kaufmann.
- Juul Søndergaard, M.L. 2018. Staying with the Trouble through Design. Critical-feminist Design of Intimate Technology. PhD thesis, School of Communication and Culture, Aarhus.
- Karana, E. 2020. "Still alive: livingness as a material quality in design". *Breda, Avans University of Applied Sciences*, ISBN: 978-90-76861-61-6.
- Karana, E., Barati, B. and Giaccardi, E. 2020. "Living artefacts: Conceptualizing livingness as a material quality in everyday artefacts," *International Journal of Design*, 14 (3): 37–53.
- Keune, S. 2018. *On Textile Farming: Seeds as a Material for Textile Design*. Borås: The Swedish School of Textiles.
- Keune, S. 2019. *On Textile Farming: Living Indoors*. Borås: The Swedish School of Textiles.
- Lee, S. 2007. *Fashioning the Future: Tomorrow's Wardrobe*. London: Thames & Hudson.
- Lindström, K., & Ståhl, A. 2016. Becoming response-able stakeholders—Participatory design in times of uncertainties. In *PDC '16: Proceedings of the 14th Participatory Design Conference: Short Papers, Interactive Exhibitions, Workshops* – Volume 2, 15–19 August 2016. Aalborg University, Denmark: ACM Digital Library, pp.41–44.
- Ludwig, F., Schwertfeger, H. and Storz, O. 2012. "Living systems: Designing growth in baubotanik," *Architectural Design*, 82(2): 82–87.
- Myers, W. 2012. *BioDesign. Nature, Science, Creativity*. High Holborn: Thames & Hudson.
- Neustaedter, C. and Sengers, P. 2012. "Autobiographical design: what you can learn from designing for yourself," *Interactions*, 19(6): 28–33.
- Neustaedter, C., Judge, T.K. and Sengers, P. 2015. Autobiographical design in the home. In *Studying and Designing Technology for Domestic Life: Lessons from Home*. Burlington, MA: Morgan Kaufmann.
- Paxling, L. 2019. Transforming Technocultures: Feminist technoscience, Critical Design Practices and Caring Imaginaries. PhD thesis, Blekinge Institute of Technology.
- Pohlmann, L.D. 2016. "The Benyus Effect: Rapidly Growing Interest in Biomimicry," *INSIGHT* 19 (1): 10–11. doi:[10.1002/inst.12065](https://doi.org/10.1002/inst.12065).
- Puig de la Bellacasa, M. 2017. *Matters of Care: Speculative Ethics in More than Human Worlds*. Minneapolis: University of Minnesota Press.

- Ramsgaard Thomsen, M. and Bech, K. 2015. "The textile interior – imagining a transformative architecture," *Design Ecologies*, 5(1): 48–87.
- Rosner, D.K. 2018. *Critical Fabulations: Reworking the Methods and Margins of Design*. Cambridge, MA: MIT Press.
- Sanders, E.B.N. 2002. "From user-centered to participatory design approaches," *Design and the Social Sciences: Making Connections*: 1–8.
- Scott, J. 2015. Mutate : The Evolution of a Responsive Knit Design System. *Proceedings of the 2nd Biennial Research Through Design Conference | RTD 2015*, Proc. 2nd Bienn. Res. Through Des. Conf. | RTD 2015.
- Scott, J. 2016. Programmable Knitting. Acadia 2016: Posthuman Frontiers - Projects Catalog of the 36th Annual Conference of the Association for Computer Aided Design in Architecture.
- Tsing, A. 2012. "Unruly edges: mushrooms as companion species," *Environmental Humanities*, 1: 141–54.
- Tsing, A.L. 2015. *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton, NJ: Princeton University Press.
- Tomasello, G., & Almeida, T. 2020. Empowerment and Self-Care: Designing for the Female Body. In K. Townsend, R. Solomon & A. Briggs-Goode (Eds.). *Crafting Anatomies: Archives, Dialogues, Fabrications* (pp. 171–188). London: Bloomsbury Visual Arts. Retrieved April 13, 2021, from <http://dx.doi.org/10.5040/9781350075504.ch-009>
- Westerlaken, M. 2020. Imagining Multispecies Worlds (PhD dissertation). Malmö universitet, Malmö.
- Westerlaken, M. and Gualeni, S. 2016a. Becoming with: Towards the inclusion of animals as participants in design processes. ACM International Conference Proceeding Series.
- Westerlaken, M. and Gualeni, S. 2016b. Situated Knowledges through Game Design: A Transformative Exercise with Ants. *Proceedings of the Philosophy of Computer Games Conference*.
- Yao, L., Ou, J., Wang, G., Cheng, C.-Y., Wang, W., Steiner, H. and Ishii, H. 2015. "BioPrint: A liquid deposition printing system for natural actuators." *3D Printing and Additive Manufacturing*, 2(4): 168–179.
- Zhou, J., Barati, B., Wu, J., Scherer, D. and Karana, E. 2020. "Digital biofabrication to realize the potentials of plant roots for product design." *Bio-Design and Manufacturing*, 4:111–122.