

# Life Centered Design: Unpacking a Post-humanistic Biodesign Process

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The current ecological crisis highlights a need for an alternative design approach to counteract the mainstream human-centered design methodologies. This pictorial aims to bridge this gap by introducing a novel design approach, Life Centered Design, and its design process. The findings from a biodesign project on bioluminescent microalgae are presented and further reflected through a panel of experts. The autoethnographical notes taken throughout the design process surfaced five design considerations, concerned with; combining perspectives, collaboration with the non-human, communication (challenges), the benefit ratio and ethical debate of human-non-human relations. These design considerations were iterated with a panel of experts to explore their applicability and generalizability across other biodesign projects. The case, the design considerations, and further discussions are organized as the body of Life Centered Design, providing both a practical guide and a reflection tool for post-human centred biodesign processes.

**Keywords:** *Life Centered Design, Biodesign, Post Humanism, Autoethnography, Design Process*

## INTRODUCTION

Designers face an urgency to alter their human-centered methods and reprioritise their goals to address the accelerating degradation of the environment. This new pressure demands recognition of nature's fragility and our responsibility to preserve it for future generations. Therefore, designers are turning to biologists for their expertise and guidance. It is necessary to support the ongoing effort to decrease the negative impact of the Industrial Revolution (Myers, 2018). A shift in mindset to decentralize the human and to capitalize on what living systems or collaboration with living systems offers in mitigating these challenges. Examples of these collaborations address fungi that help with upcycling agricultural waste (Gautum et al., 2009); bacteria that produce useful material compounds as the byproduct of their metabolic processes (Chieza and Ward, 2015), or algae that purify polluted water (Sen et al., 2013).

Over the past years, there have been many research initiatives which aimed to define the boundaries of biodesign (Myers, 2018) and raise awareness about the opportunities and challenges of incorporating living organisms in interfaces and artefacts (Pike, 2008, González, 2010, Mahecha, Driver and Bombelli, 2011). For example, Pataran et al. (2020) provide an analysis of research projects that integrate microorganisms as part of a computing system, and propose the notion of Living Bits to challenge the traditional boundaries between biological cells and computers. Merritt et al. (2020) offer a definition of Living Material Interfaces as interfaces that incorporate living organisms to enable "different forms of interaction between humans and digital systems" (p. 3) identifying different implications for designing with LMIs (p. 13-15). Karana et al. (2020) propose that: as livingness

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# ~~HUMAN CENTERED~~ → LIFE CENTERED

becomes a material quality in Living artefacts, designers need to deliberate on living aesthetics, mutualistic care and habitabilities. With habitabilities concerning the way the human body and other living and non-living entities condition the livingness of an artefact.

While a few biodesign projects take interest in a mutual relationship of cohabitation (Liu, 2018, Smith et al., 2017, Keune, 2021), biological materials are still often approached from an exploitative stance to benefit humans. This does not come as a surprise given that for decades, designers have been taught to address and prioritize human needs and only recently, the community has come to acknowledge that a design that is only good for people, without taking into account the well-being of the planet as a whole, will contribute to a climate crisis (SPACE10, 2021).

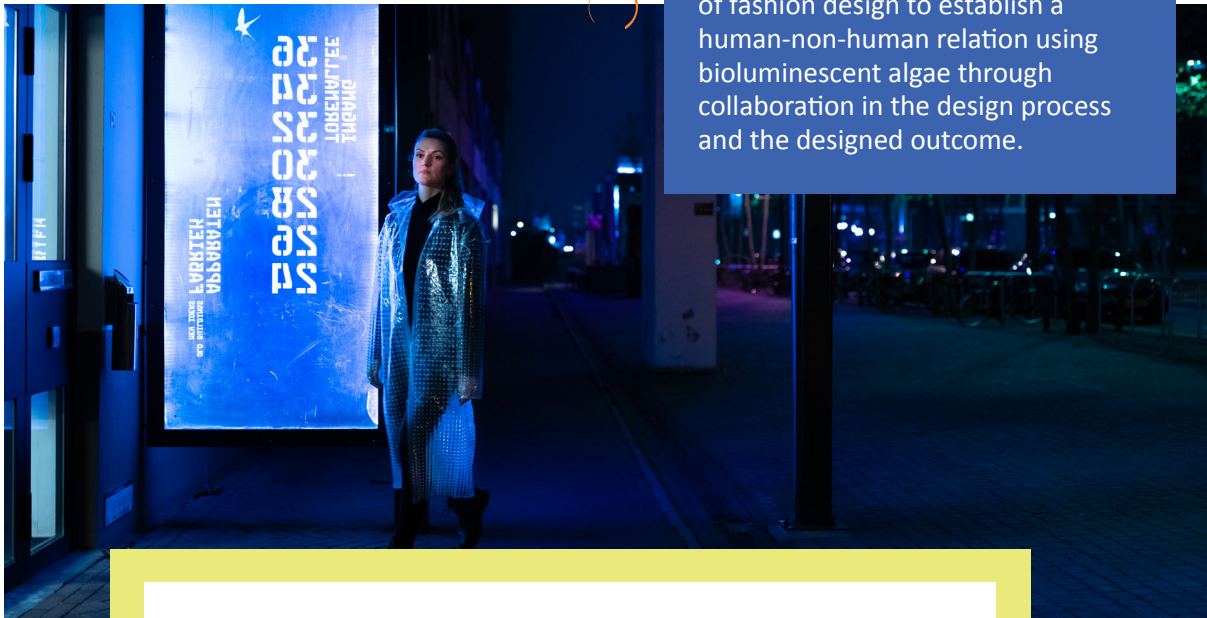
The post-humanist movement has provided an opening for designers to change the way we approach the world and broaden the perspective beyond humans (Forlano, 2017). Having its roots in philosophy, post-humanism forwards the idea that humanity can be transformed, transcended, or eliminated either by technological advances or the evolutionary process (The Oxford English Dictionary, 2021). In design literature, post-humanism is often associated with critiques on human-centered and anthropocentric practices and thinking (Forlano, 2017). In HCI there has been a call for new methods to explore post-human design, such as how noticing, seeing past dominant narratives and perspectives to see challenges in a new light, can be used as a method in design research (Liu et al., 2019). Researchers have questioned the involvement of non-humans in participatory design by suggesting we are always-participating-with-many (Akama, Light & Kamihira, 2020) or be inspired to design in response to collaborative survival, the deeply entanglement of dependency upon the health of other species to persist as the human species (Liu, Byrne & Devendorf, 2018). Others have searched to broaden the repertoire of non-anthropocentric design practices by using Donna Haraway's concept of natureculture, the blending of nature and culture, to explore how this shift in perspective might reorient our design practices (Liu, Bardzell & Bardzell, 2019). This pictorial builds on the need for guidance, tools and information for design processes in the realm of post-humanism, the nonanthropocene and the field of biodesign which has been recognized by other researchers (Gough, Ahmadpour & Tomitsch, 2021).

This pictorial presents a research-through-design journey aiming to bridge this gap through systematic reflection and interrogations of the first author's biodesign practice. It introduces the design approach, which we refer to as "Life Centered Design" (LCD) and its novel design process. We describe a design journey where a balanced human-non-human relation was aimed in both the design process and the designed outcome. Inspired by the balanced horizontal relations existing in nature, we refer to balance as a situations from which both actors can benefit e.g. a bird eating a berry benefits from the nutrients and the berry plant benefits from this situation by spreading their seeds to reproduce. In this design process the designer (first author) worked together with photosynthetic eukaryotic microorganisms, bioluminescent algae. To support reflection in and on the design process (Schön, 1991), we combine two research methods of autoethnography (Ellis, Adams & Bochner, 2010) and a panel of experts (Davis, 1992). The pictorial first defines LCD the design case of this study and introduces the non-human; bioluminescent algae. It explains the two research methods used and how these were combined. After an explanation of the design process and the designed outcome five design considerations are introduced through reflections by the designer and insights provided by the expert panel. The pictorial concludes with a proposal for future work.

## LIFE CENTERED DESIGN

The aim of Life Centered Design is a balanced human-non-human relation. The human designer and user are equal to all living organisms involved in the design process and design outcome. “Non-human”, “other-than-human”, and/or “more-than-human” are terms in de-centering human research and design to describe the other living being in the relation. For consistency throughout the research the term “non-human” is chosen to describe any living organism: an animal, plant, or a microorganism and is used for claims about LCD. “Algae” is used when we discuss the specific human-algae relation in the discussed project.

HUMAN NON-HUMAN



## DESIGN CASE

Create an artefact in the context of fashion design to establish a human-non-human relation using bioluminescent algae through collaboration in the design process and the designed outcome.

## NON-HUMAN; BIOLUMINESCENT ALGAE

Bioluminescent algae are photosynthetic eukaryotic microorganisms, also called dinoflagellates. This microorganism is responsible for most of the blue bioluminescence observed in the oceans' surface (Tett, 1971). Dinoflagellates use photosynthesis to produce a large amount of oxygen, influencing the concentrations of oxygen and carbon dioxide in the earth's atmosphere (Swift and Durbin, 1972). Cultures of bioluminescent dinoflagellates are regulated by a biological clock. This clock regulates the internal process for a photosynthetic period during which the organisms cannot emit any appreciable light and a corresponding luminescent or emitting period (Knaust et al., 1998, Soli, 1966). The evolutionary purpose of bioluminescence is assumed to be for defence, offence or communication (Haddock et al., 2010). Bioluminescent algae has been of interest in design for their unique flash characteristics (Barati et al., 2021).

MICROORGANISM

## METHODOLOGY

The need for guidance, tools and information for design processes in the realm of post-humanism, and the field of biodesign has been recognized by other researchers (Gough, Ahmadpour & Tomitsch, 2021). Therefore, this pictorial uses research-through-design to initiate LCD and its novel design process.

We integrate the two research methods of autoethnography (Ellis, Adams & Bochner, 2010) and a panel of experts (Davis, 1992). Through the creative practice methods of making and autoethnography the researcher was able to reflect in and on action (Schön, 1991) to help inform the LCD design process. Autoethnography is a qualitative research approach that seeks to describe and 'systematically analyse personal experience to understand cultural experience' (Ellis, Adams & Bochner, 2010). The designer (first author) used the autoethnographic method to analyse the design process, their first-person perspective and embodied experience. As HCI and design researchers Höök (2010) and Mackey et al. (2017) demonstrate, self-reflective inquiry can enable more complex and nuanced insights. The researcher documented the first-person experience through note-taking, a comprehensive examination and analysis of the samples, and videotaping the human to non-human interactions.

Five considerations regarding LCD emerged from the analysis and extraction of the collected data. A panel of experts from different research backgrounds (user-centered design, biodesign, and first-person perspective) were invited to reflect on the considerations. During this session, the researcher introduced LCD and the considerations during a sixty-minute online meeting, allowing the experts to discuss and share their perspectives. The considerations were iterated with the panel to examine/verify their applicability and generalisability across other biodesign projects. A significant advantage of this approach is the ability to gather a targeted amount of data, which helped the researcher gain insights into reactions and debates around LCD.

### Expert 1

PhD candidate; Transformative Potential of Immersive Storytelling for Living Material Experiences  
University of Technology

### Expert 2

PhD candidate; Negotiating for and with Living Artefacts  
University of Technology

### Expert 3

PhD candidate; Speculative Design, Fiction, and Futuring on Monitoring Patients with Cardio-Vascular Disease  
University of Technology

### Expert 4

PhD candidate; Designing Data Enabled Ultra-Personalized Products and Services  
University of Technology

### Expert 5

Fashion-led researcher; Operating at the intersections of microbiology and fashion design research  
College of Art

Note: Quotes are slightly adjusted for fluent communication purpose only

## EXPERT PANEL



## AUTOETHNOGRAPHY



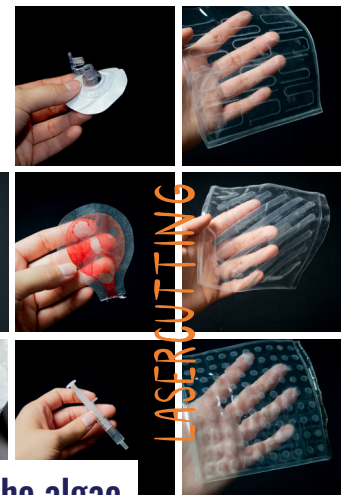
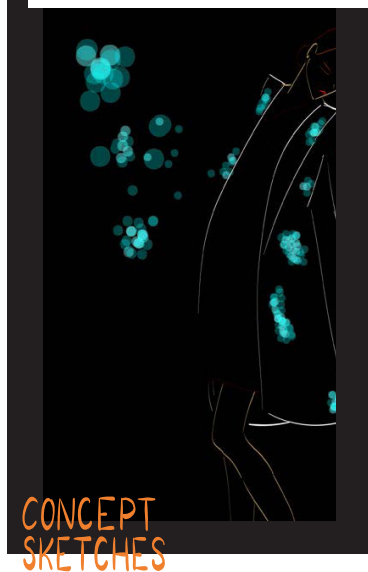
# LCD DESIGN PROCESS

Every phase of the design process is experienced by the designer in several design activities. The images give a glimpse into the activities.



take care and familiarize the algae

create a concept for the human algae relation



create a new habitat for the algae



put the human and algae in situation

## FINAL ARTEFACT; A BIOLUMINESCENT ALGAE JACKET

The bioluminescent algae had some living requirements the designer had to be aware of. The algae lives in a saltwater environment, they need sunlight for photosynthesis, a clean environment and every now and then fresh air to stay alive. The TPU material is transparent allowing sunlight to reach the algae, it is relatively easy to clean and by melting the material it is possible to create a structure to distribute the water.

For the human user this artefact is a garment, a transparent jacket with a similar fit to a raincoat. The movement of the human when wearing the jacket triggers the bioluminescent algae to glow. Due to its transparent quality, the human is able to see the bioluminescent algae and be aware of their presence. This human algae interaction enables an opportunity for a relation between both.

BIOLUMINESCENT ALGAE  
LIVING ENVIRONMENT

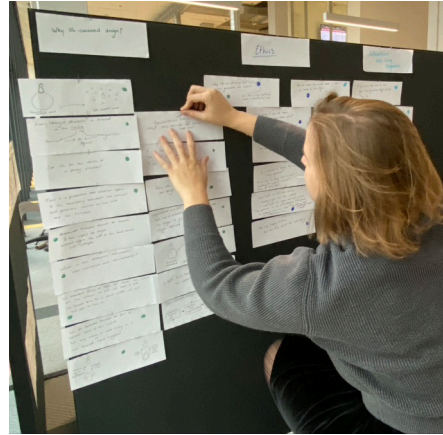


HUMAN  
FASHION ITEM



## DESIGN CONSIDERATIONS

This study introduces five design considerations which emerged from our first person analysis (autoethnography): combining perspectives, collaboration with a non-human, communication (challenges), who benefits from the human-non-human relation?, and is this an ethical relation between human and nonhuman? These design considerations were reflected on by a panel of experts. The considerations are introduced through reflections during and after specific activities in the design process, and insights given by the expert panel.



## COMBINING PERSPECTIVES

*As a designer, I am trained to combine multiple disciplines relating to e.g. aesthetics, business, society and technology, in my design processes. An important step in LCD is to understand and work with the non-human; the algae. The introduction of a non-human team member and user in the design process requires an understanding of life-sciences. This new discipline presented me with an overload of biological information and challenged me in getting familiar with this unknown scientific language. In my first encounter with LCD, I experienced difficulties in handling the information overload and when positioning myself in relation to life-science experts. I soon realised that I needed their expertise to help me understand the world of micro-organisms. But, what could I offer them in exchange for helping me? How can designers create a connection if their position in the connection is not yet defined? Why did I feel lost and in completely unknown terrain if biodesign is an upcoming and important design discipline?*

The panel recognized the unknownness of working with different perspectives but cherishes the benefits of the unknown.

*"Put yourself in that situation where you have no idea what is going on." - Expert 5*

*"Our work was depending on each other, we constantly were in need of each other's expertise." - Expert 4*

*"It is hard to learn another field, but at the same time it is super inspiring." - Expert 1*

*"Design has the ability to combine different fields." - Expert 1*

*"I was reading some scientific papers and the terminology is completely different. It was another challenge. To combine this scientific knowledge and how I can use that knowledge in my design process." - Expert 1*

INFORMATION  
OVERLOAD

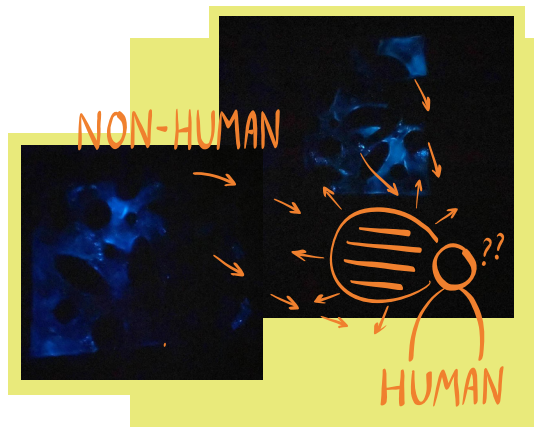


## COLLABORATION WITH NON-HUMAN

*In LCD a human-non-human collaboration is essential. Within my design education, I collaborated with human team members and users. In modern society humans are actors with their own agency, and equal collaboration between two or multiple humans is common. I considered the algae as team members and was aware of their presence. I referred to the algae as “them” or “they”, attributing human-like characteristics to them. But it remains hard to specify the algae’s agency in a human non-human collaboration. Does the algae has agency when it did not decide to take part in the collaboration? In our collaboration I experienced the essence of making concessions. I must release my control and base decisions on the algae’s life requirements. The algae were forced to live in a new and unknown habitat. Does human awareness about concessions increase the non-human agency? Does human agency decrease when its sole purpose is serving another being in its needs?*

*“It is not about us doing everything for them, but about trying to create a negotiation between the human and the living organism. How do they negotiate when their needs are in conflict?” - Expert 2*

*“Is there any collaboration? Are they collaborating with us? Or do we just need to do everything they need.” - Expert 1*



There is a need for external forces to improve communication and a wish for increased understanding from both sides.

*“Help them to express what would be meaningful for them. I am looking for tools and mechanisms to allow them to communicate what they need.” - Expert 4*

*“How do we let them speak for themselves really loudly?” - Expert 2*

*“Help them to express what would be meaningful for them. I am looking for tools and mechanisms to allow them to communicate what they need.” - Expert 2*

## COMMUNICATION (CHALLENGES)

*As a designer, I am trained to communicate my vision, identity, and concepts. I communicate using words, images, and materials. User-centered design education is focused on the human and therefore it comes down to human-focused communication. In LCD it is vital to understand the non-human “language” and communicate in this matter. In the anthropocentric world, humans have a loud dominant voice. Other living beings, especially microorganisms, use subtle communication methods. In this project, the algae communicates its well-being with a subtle glow at night. By exploring human-algae communication, we can debate if the human terminology fits. Can we laybear this with an experience-based communication? Is it possible to create more than human terminology? Are we ever able to understand the non-human the same way we understand our own species?*

*“How do we cope with these different voices? I think there is a need for tools to help us communicate with microorganisms or living organisms.” - Expert 2*



## WHO BENEFITS FROM THE HUMAN NON-HUMAN RELATION

*In this project, I established a human-non-human relation with the algae, both in the process and the final artefact. Looking back, I can conclude that I, the human designer, benefited from the relationship. The designer-algae collaboration considerably influenced this LCD study. Without the algae, I could not experience a LCD process and could not become familiar with a microorganism. On a macro scale, humans need microorganisms and biodiversity to sustain a living on our shared planet. If humans build these human-non-human relations it can lead to appreciation of microorganisms and possibly increase biodiversity, which would positively impact climate change. In this scenario, the human species benefits from a human-algae relation. We can debate if the algae benefits from sharing the earth with the human species and their anthropocentric lifestyle.*



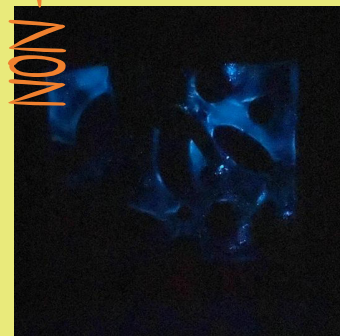
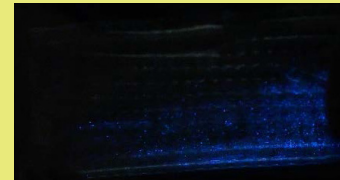
*"I am a human designer/researcher but the decisions that we are making are all in favour of the organism and its needs." - Expert 5*

*"I think it could also be a way to act as a vehicle to form a discussion and start the relationship. Which maybe puts the algae at a disadvantage to start off with, but it is a way to introduce it into our known world?" - Expert 3*

*"I think it is hard to say because we can argue that we perpetuate this living natural environment. Because in nature they actually cannot live that long." - Expert 2*

*"I don't know, we are obviously benefiting from them. That is why we want to have them in our lives. But from the microorganisms perspective, we are providing things to keep them alive. I am not sure what they are benefiting from." - Expert 1*

OR



# IS A HUMAN NON-HUMAN RELATION ETHICAL?

A recurring theme in LCD is the ethical debate of human non-human relationships. This LCD study took part at a University of Technology, and to pursue a study at this University accepted ethical review form is mandatory (University, 2021). In this form the researcher answers questions concerning (human) ethics in the study. None of these questions addressed the non-human; an animal, plant, or microorganism. It did not include the algae I was collaborating with. Designers are educated to think about the welfare of their human participants, but the question is should we only care about human welfare? Below you can see the ethics questions, in this study the participant is the algae. Would this form be accepted with the corresponding answers in line with the conducted study?

## LIVING

“Does the study involve ~~human~~ material (such as surgery waste material derived from non-commercial organizations such as hospitals)?” (TU/e, 2021)

*Yes, it does. A microorganism was used in the study.*

Based on the expert panel it is clear that there is a lot of doubt how we should approach the topic of ethics in these new human non-human relations.

“Will the participants give their explicit consent – on a voluntary basis – either digitally or on paper?” (TU/e, 2021)

*No, the algae cannot give their consent neither digitally nor on paper.*

*“They have senses so ethically the relation should be equal. They (the microorganisms) are living. They are sensing things.” - Expert 1*

“Does the study involve participants who are particularly vulnerable or unable to give informed consent?” (TU/e, 2021)

*Yes, compared to humans the algae are particularly vulnerable and unable to give informed consent.*

*“How should we treat this kind of “don’t know”? We can’t say because we don’t know, we don’t care. We should care more, because we don’t know.” - Expert 2*

“May the research procedure cause harm or discomfort to the participant in any way?” (TU/e, 2021)

*Yes, there is a possibility for the algae to die during the research procedure.*

*“We don’t know how ethical it is if we are benefiting.” - Expert 5*

“Is the study invasive (i.e. it affects the body such as puncturing the skin; taking blood or other body material (such as DNA) from the participant)?” (TU/e, 2021)

*Yes, the study is invasive.*

*“Being in control is not a mutual relationship. It is not a collaboration. It is like working with a voiceless subject.” - Expert 5*

The introduction of a non-human requires an understanding of life-sciences and presents difficulties in handling the information overload and positioning oneself in relation to life-science experts. In a human-non-human collaboration it remains hard to specify the non-human agency. In the collaboration the designer must release control and base decisions on the non-human. It is vital to understand the non-human “language” and we can debate if the human terminology fits. Although the designer benefited from this relation, we can debate if the non-human benefits from sharing the earth with the human species and their anthropocentric lifestyle.

## CONCLUSION AND FUTURE WORK

In this pictorial we introduce a Life Centered Design approach and its novel design process through a biodesign case study of a jacket that provides a living environment for bioluminescent microalgae where a balanced human-non-human relation was aimed. The first-person perspective in the design process departed from an introduction to the microorganism and resulted in nuanced insights into understanding more tacit aspects of making with another being.

With this work we expanded the boundaries of biodesign (Myers, 2018), by not just incorporating living organisms into our artefacts and interfaces (Pataran et al. 2020, Merritt et al, 2020), but by being more inclusive towards co-designing with the algae in the design of a raincoat. Despite an increasing awareness regarding the welfare and cohabitation with animals in our designed environments (Smith et al., 2017), our interactions with microorganisms are mostly addressed from an exploitative stance. We unpacked the processes of designing “Living artefacts” (Karana et al. 2020) and the challenges that the designers might face while addressing “living aesthetics”, “mutualistic care” and “habitabilities”. Through our reflections we propose a set of considerations that can support designers in becoming more respectful towards these new “materials”.

Life Centered Design provides a set of design considerations to practically guide and inform designers and industry practitioners to acquire specific sensitivities and know-how in multispecies relations between human and non-human. The considerations focused on (1) combining perspectives in the design process, (2) collaboration with the non-human, (3) communication and its challenges, (4) the benefit ratio in a human-non-human relation and (5) the ethical discussion emerging from working with a non-human. The findings verify a necessity for combining perspectives through cross-disciplinary practice and put forward the debate if there is and can be a collaboration between species. Our study outlined a need for design tools to help communicate, understand and develop empathy with microorganisms.

The introduction of a non-human requires an understanding of life-sciences and presents difficulties in handling the information overload and positioning oneself in relation to life-science experts. In a human-non-human collaboration it remains difficult to specify the non-human agency as the designer must release control and base decisions on the non-human. Therefore, it is vital to understand the non-human “language” as well as discussing to what extent the human terminology fits its purpose.

For the LCD approach to become a viable alternative to human-centered approaches, a shift in mindset is required, as designers should start thinking of microorganisms as participants or co-designers in the process. Taking a first step towards the LCD approach, further iterations on the concept of LCD and its design process will be necessary. The next step, therefore, will be to apply the approach in other biodesign projects and reflect upon its applicability as used by designers and in relation with other microorganisms.

Our future work will include different and/or multiple organisms in the design process to gain more insights in balanced human-non-human relations and collaborations. In line with the experts’ view, we believe that including various species can teach us how the process and approach differs if another living being is involved. Beyond fashion, we see opportunities for applying our process in many other design contexts where a more respectful interaction between humans and their living environment is needed, e.g., interior, vehicle and service design.



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