The Data Hungry Home: *A Post-Anthropocentric and Generative Design Framework*

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Contemporary advances in technology and information processing have created technological *things* that astound and perplex us all. Responding to this progress has united and resonated with posthuman thinking (notably post-anthropocentrism) to develop new lenses and concepts. Within this is a growing focus on considering the world from the perspective of technological *things*. This shift enables researchers and practitioners to look beyond human-centredness in design, and science and technology studies. However, moving beyond humans, and even beyond organic beings, is still a niche and radical area within these disciplines, with a lack of academic research detailing how uninitiated individuals experience engagement with these concepts and the nature of the discourse it generates. Through six workshops, 22 participants engaged with the *Data Hungry Home*, a prototype post-anthropocentric design framework that facilitates the design of anthropocentrically purposeless data-dependent technological *beings*. Analysis of the participants' experience demonstrates that the Data Hungry Home is a practical design framework for exploring alternative manifestations of technology. However, it also exposes issues with embracing post-anthropocentric approaches, notably when designing (for) technological beings. These include adopting a nonhuman perspective and utilizing design/technology for non-commercial and non-problem-solving ends. These findings then underpin a discussion on how applying a post-anthropocentric design framework can reveal the participants' structuring, understanding, and acceptability of the limits of design and technology.

Keywords **–** Research through Design, Post-anthropocentric Design Frameworks, Philosophy through Design, Posthuman-Computer Interaction, Science and Technology Studies.

Relevance to Design Practice **–** This article provides an example of applying a technological post-anthropocentric design framework, including specific methods and materials, that can be used in practice and as inspiration. The findings also add to the evidence of the generative design potential of post-anthropocentric thinking.

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Introduction

The story of humans and their version of technology could be described as the ebb and flow of change. Currently, we are experiencing a flurry of activity around the changing, and changing views of, technological *things*. On the side of change, the rise of Artificial Intelligence, colossal databanks, and more entanglement of humans with complex networked technological devices in the quotidian. On the side of changing views, calls, and propositions to see these technological creations, including how to design them, through lenses such as (neo-)animism (Marenko, 2014; Van Allen et al., 2013), slowness, unawareness, and thingness (Wakkary & Odom, 2018), or viewing certain things as fluid assemblages that are in a state of constant design and use (Redström & Wiltse, 2018). This can be seen as recognizing the need and opportunity for new frameworks/mindsets that are "precisely tuned to what we now have in front of us and need to account for" (Redström & Wiltse, 2019, p. 373). One response has been the posthuman (e.g., Lindley et al., 2020; Wakkary, 2021) notably post-anthropocentrism (Braidotti, 2013; Ferrando, 2019a). Definitions of post-anthropocentrism differ and can overlap with other terms, such as flat ontology (Harman, 2018). Post-anthropocentrism is understood as moving beyond *anthropocentrism*, e.g., human-centredness, human-centered hierarchies, or human-exceptionalism, and recognizing other entities, actors, and/or species as equals. We are also using post-anthropocentrism as a catch-all term for different terms such as non-anthropocentric, more-than-human, beyond-human, thing-centred, and animal-centered that appear in the literature (e.g., Disalvo & Lukens, 2011; Smith et al., 2017).

However, post-anthropocentrism can clash or cause friction with the driving doctrines of conventional design, such as functionalism, commercialism, individualism, rationalism, and human-centredness (Tharp & Tharp, 2018). Furthermore, design

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can reductively be seen as the creation of a *some-thing* (object/means to an end) for a *some-one* (subject/ends in themselves) (Nelson & Stolterman, 2012), a (temporary) preferential treatment or centring of some kind, even if it is nonhuman. This can be seen as a contradiction with the *flat* nature of post-anthropocentrism. However, a balance can be struck by ensuring that a variety of entities are considered, or by changing our subjects frequently. In other words, the *some-one* expands beyond humans and does not fixate on meeting the needs of a singular group. This is best exemplified by the non-human species-centered design work that can be for the creature alone (Lawson et al., 2016; Paci et al., 2019), *paired* species, such as a nonhuman creature and a human creature, in a small or closed off interaction (Chen et al., 2021; Liu et al., 2018; Westerlaken & Gualeni, 2016), or a broader ecosystem, typically linked with sustainability, environmentalism, or multispecies design (Sheikh et al., 2021; Smith et al., 2017). This demonstrates the framing of nonhuman creatures as the *some-one,* the subject, the end in themselves, not merely the *some-thing*, the object, the means to an end, of a design process.

Yet, when post-anthropocentric thinking is applied to assemblages of technology and information, as opposed to assemblages of *organic matter and information* (Davies, 2019), the *subjectification* seems lacking, save for a few partial exceptions (Hsu et al., 2018; Lee-Smith et al., 2019; Wakkary et al., 2017). Giaccardi and Redström (2020) state that post-anthropocentrism "collapses distinctions between […] subject and object" and requires us to see that "humans and nonhumans [including technological nonhumans] are embodied as full participants" (p. 38) so that we can explore "the idea that maybe we will not design for these technologies but with them" (p. 35). However, they conclude that the design of *these technologies* must be "sensitive and responsive to the human condition, in other words, in the interest of people and the environment" (p. 41). Similar forays into the post-anthropocentric world seem to yield only human-centered benefits, with perhaps a nod to the environment (Cila et al., 2017; Huang et al., 2021). What this indicates is an (anthropocentric) assumption that all technological assemblages are means to an end, not ends in themselves. There is also a dualism at play here where it is assumed that if designers do not design technological entities that are for *the human condition*, then they are inherently against humans or at least left open for *other* humans to take advantage of, and use against, *us* (Forlano, 2017). These stances suppress a possible underexplored neutral ground, where technological entities exist beyond questions of the human.

Why does this matter? A simple defense of the previously cited literature would point out that the authors do not explicitly set out to subjectify technological entities or to design for their benefit, even if they talk of taking their perspective. Furthermore, due to human entanglement with technology (Frauenberger, 2020), ensuring that the design of technological things considers human ethics and human benefit, whilst considering environmental impacts, is important. However, the need to have a human (or other creature) benefit or a clear *purpose* in all technological entities (i.e., an anthropocentric or biocentric mandate for technology), whether immediate or foreseeable, curtails the full exploration of post-anthropocentrism in design and science and technology studies (STS). These limitations hamper the cultivation of knowledge and work in at least two possible areas. First is the primary research element of design (Flexner & Dijkgraaf, 2017), i.e., simply conducting curiosity-driven design and research to find out what it creates. As Forlano (2017) asks about chickens, we can also ask about technological entities. Suppose we see certain technological entities as ends in themselves of a design process. What new theories, frameworks, models, methods, questions, languages, and design knowledge are needed and can be generated (Forlano, 2017)? This, paradoxically, also has the potential to generate benefits for humans and other organic entities (Reddy, Kocaballi, et al., 2021; Wakkary

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& Odom, 2018), but the difference here is that this *purpose* is not the driving force behind the inquiry. It also has the potential to represent an approach to decentring and creating posthuman knowledge through design (Nicenboim et al., 2023). Second, and controversially, we must recognize that some of the technological things we design may have to one day be considered actual beings or, at a minimum, some kind of *be-things* (Lee-Smith, 2022). This statement is said in recognition that non-Western philosophies, ideologies, and ontologies embrace a broader understanding of *being* and *beings* (e.g., Akama et al., 2020). However, we argue that even rigid Western notions of what qualifies as *beings* and, by extension, possible design subjects, design-process benefactors, and ends in themselves, will eventually collapse under the weight of new evidence, progress, and steady shifts away from essentialist/dualistic framing (Ferrando, 2019a; Kalish, 1995; Lee-Smith, 2022). We must, therefore, prepare for a world where "human and non-human beings, plants, and minerals will most likely co-exist with advanced artificial intelligence, sentient robots, […] conscious humanoids" (Ferrando, 2019b, p. 645) and all entities in between, including hybrid organic-technological entities (Ferrando, 2019a). This is not just a question of ethics, personhood, or rights in the context of AI or general-purpose intelligence (e.g., De Graaf et al., 2021; Lupetti et al., 2019) but a recognition that, at least in the beginning, humans will be entangled in the creation of technological be-things and beings. Therefore, we can and must ask *how will we bring them to be* and *how will they be.*

To answer these questions, as designers, we must be able to conduct post-anthropocentric design with and for technology. What hurdles will we face? How do designers respond to these ideas? Research shows that participants adopt post-anthropocentric perspectives during events such as workshops (Liepert et al., 2019; Reddy, Nicenboim, et al., 2021). However, it is unclear if these participants are *unacquainted* with the post-anthropocentric ideas, how they feel about these ideas, and if they truly embrace the deeper nuances of post-anthropocentrism, or if they are, instead, using it to do human-centered work under a post-anthropocentric banner. Furthermore, these examples lack a full subjectification of technological entities. Therefore, this paper aims to discuss deploying a prototype post-anthropocentric design framework within a workshop setting with participants with design and STS backgrounds (i.e., academics and practitioners) who are unacquainted with post-anthropocentric approaches to technology. It is also intended to create discourse around various topics, such as beingness in technology and post-anthropocentric design, rather than providing a conclusive definition of these concepts. The framework in question, an iteration of the Data Hungry Home (DHH) (Lee-Smith, 2020; Lee-Smith et al., 2019), embraces a form of post-anthropocentrism in technology by creating purposeless technological beings and considering how these beings exist. Our findings add to the evidence of post-anthropocentrism enabling generative/creative design outcomes, discourse, and alternative mindsets. However, it also wrestles with some driving doctrines that can curtail the adoption of post-anthropocentric thinking, notably those unacquainted with post-anthropocentrism and the broader posthuman world.

Iterating the Data Hungry Home

The Data Hungry Home (Lee-Smith, 2020; Lee-Smith et al., 2019), is a prototype design *framework*. Initially, it sought to create symbiotic relationships between domestic data-dependent objects, furniture, buildings, and humans. This exaggerated and highlighted the existing human-data-technology relationship by creating *things* that would die unless we constantly feed them data. However, instead of only focusing on the creation of a singular example that displays this relationship, the DHH attempted to flesh out an approach to creating a variety of *members*. This included considering *foodata* groups, different categories of members, and ingrained traits/needs that govern their response to the data they are fed. Later, the question was posed: "What if we designed new 'species' of devices as if they were alive?" (p. 527) with the same data-dependent constraints and advanced other concepts within the framework.

With the previous iterations in mind, we seek to advance the work by proposing *technological beings* as a logical progression of the archetype of data-dependent objects/living devices proposed by the DHH. This shift from *thing* to *being* has several (ontological) implications but also opens up the possibilities of the DHH paradigm. By saying technological beings, we accept that true *beingness* can be achieved through specific combinations of (technological) matter and information (Davies, 2019). However, we are not saying that what we have created here are technological beings. Instead, we are exploring this to work towards technological beingness while creating discourse and debate around the topic. In the context of this paper, we see technological beingness as a generative and material tension within this work and that its understanding changes through research and practice (Benjamin et al., 2023).

We consider this exploration of beingness in technology as a *branch* or *approach* to beingness instead of a singular or absolute type. The organic-based version of beingness we have on Earth (*life*) is another of these branches, hopefully one of many. We argue that technological beings are not *alive*, especially in the positivist or biochemical sense of the baggage-laden term (Ferrando, 2019a; Pirie, 1937; Villarreal, 2004). Furthermore, *technological beings* should not be seen as a catch-all term that can be applied to any *techno-informational assemblage* or all *technology* more broadly. This is not trying to define things such as smart whiteboards or robot hoovers, Instagram posts, or computer monitors as beings (although some may be). Here, we want to use beingness to explore new assemblages, not redefine existing ones. To push this further, we argue that technological beings should not be designed with anthropocentric or biocentric needs or problems in mind. Instead, the focus should be on how the beings diversly exist and express these existences. One way to think of it is that plants were not inherently *designed* to be used as house plants. The components of their existence (e.g., photosynthesis, flowering, and growth) are not anthropocentric. This is not to say that human or other needs cannot be met through broader relationality/interactions with houseplants. Furthermore, the *being* of technological beings should not be seen as the same as the *object* of Object-Oriented Ontology (Harman, 2018). Similarly, we recognize the parallels and overlaps with the vibrant materialism and agentic capacities

described by new materialist scholars such as Bennett (2010) and Coole (2005). Beings may exist as entirely digital or as vast assemblages of physical/digital entities. However, we focus on specific physical embodiments of (vibrant) technological matter and information instead of considering broader nebulous relational possibilities. We also recognize the blurry and graded spectrum (Kalish, 1995) of beingness. For example, a rock is *probably not* a being, a volcano has *being-like* qualities, a virus is *sort of* a being, and a houseplant *probably is* a being but is different from other beings, say a rotifer. This also draws on the ongoing discourse around the binary opposites or dualisms (Braidotti, 2013; Ferrando, 2019a; Lee-Smith, 2022) we (notably Westerners) use to structure (and design within) the world around us. These can include human/nonhuman, thing/being, nature/culture, and subject/object. We also make these statements in recognition of a wide variety of alternate worldviews and world philosophies on being, beingness, and ontology, some that may resonate, such as the new ontological category theory (Gaudiello et al., 2015; Kahn et al., 2011), and others that may not. For example, we do not believe we are exploring the same kinds of beingness found in Animism, Shintoism, or Mauri (Akama et al., 2020; Franke, 2018; Stewart, 2020), although we acknowledge that our journeys into these areas are still in their infancy. Finally, it is worth noting that the idea of technological beingness was not explored in detail with the participants of the study described below. They were instead given the premise of a technological being that was not alive, not designed to serve a human purpose or solve a problem, and needed data to survive. They were permitted to react to that as they saw fit.

Therefore, with the above in mind, the latest iteration of the DHH (which will be renamed the *Technological Beingness Framework* by the end of this paper) becomes a collection of concepts at various levels of abstraction that *frame the work* of one possible approach to creating technological beings. This prototype is proactive, provocative, and posthuman, moving from thing-centered (its original purview) to being-focused. The DHH now asks *how will these beings, be?* This consideration of technological beings does not come at the exclusion of other beings (including humans) or things. However, the DHH does not aim to make technological beings that are for other beings, and in doing so, seeks to create a more egalitarian environment while also acting as a provocation about how we see and design for technology/in a post-anthropocentric context.

Specific Concepts

Whilst *nature* conducts the design of beings (and things) without a designer (Ayala, 2007), humans require a variety of dedicated individuals to undertake this task, at least until technological beings can do it themselves. These being-creating individuals require tools, approaches, and mindsets to facilitate this design task. The concepts that the DHH brings together to tackle this consists of a variety of implements, some of its own making, such as data dependency, data-harvesting devices, and data ecosystems (Lee-Smith, 2020; Lee-Smith et al., 2019). It also takes inspiration from design propositions such as *unawareness, thingness, purposeful purposelessness* (Wakkary & Odom, 2018), and *behavioral objects* (Bianchini et al., 2015; Levillain & Zibetti, 2017). Through these tools, the DHH framework guides the creation of a diverse world of technological beings with their own rich existences. Table 1 describes the core ideas of this iteration of the DHH used as a starting point for the exploration in this paper. These represent a synthesis of prior work on the DHH and our additions/developments. From this point onward, when the paper uses phrases such as *DHH concepts, it refers* to those presented in Table 1.

The DHH, a Definition

With all the above in mind, we will dedicate a small subsection to a definition of the DHH framework for this paper.

The Data Hungry Home (DHH) is a prototype post-anthropocentric design framework that guides the creation of data-dependent technological beings. These beings are not designed for *others* or to solve problems. Instead, the focus is on the creation of diverse existences of these beings alongside their cohabitants. The beings of the DHH are data-dependent; they require data to function, consume/destroy these data, and permanently cease to function if data are not provided regularly. The acts of creating/harvesting data, feeding them to the beings, and experiencing their expressions of existence are all part of a data-sustained ecosystem. This framework deliberately pushes the idea of post-anthropocentric design by focusing on the application of technology in the creation of an entity that is not intended to serve biological entities. It also aims to provoke discourse around not just the possibility of technological beingness, but how these beings, which will be diverse and not just intelligent human-like entities, will exist and how to design (for) them.

Research Opportunity

Before the DHH can guide the creation of technological beings, we must understand how designers and other relevant individuals respond to its use as a design framework. Furthermore, the potential of the DHH to inspire the design of technological beings that have rich but anthropocentrically purposeless/unaware existences[1] means that their designers must adopt a post-anthropocentric perspective. In similar works (Lindley et al., 2019; Reddy, Nicenboim, et al., 2021; Wakkary et al., 2018), it appears that the gravity of human/other organic creatures' perspectives, needs, and wants is strong and ultimately becomes the end goal. For example, Reddy and Nicenboim et al.'s (2021) workshop investigates ethics by adopting a nonhuman perspective. Through this, they anecdotally state that "decentering the human perspective helped participants to think beyond functional aspects and reflect on other kinds of relationships with intelligent things" (p. 858). However, even though the participants explored the perspective of *things* to consider *ethics*, the ethics themselves were human-centered. At no point did anyone ask if the things whose perspective they were adopting or the intelligent systems they were engaging with (or resisting), had their own needs, wants, desires, or ethics. Furthermore, failing to collect data on the participants' experiences missed the opportunity to reflect further on the workshop's themes.

Table 1. Core concepts of this iteration of the DHH explored in this paper.

Concept	Description
Technological Beings	A category of beings that is constituted of entities made of technological matter and information instead of organic matter and information. Technological beings express their existence through various modalities based on the information they receive and/or generate. They are designed with the intent of simply existing and exploring different forms of existence instead of serving (anthropocentric) needs and purposes of *others*.
Harvesting Device	Harvesting devices are technological *things* designed specifically to collect data for a technological being to use as sustenance. Whilst it would be possible for technological beings to collect data that other beings could consume (i.e., harvesting beings), in the context of this study, we wanted to simplify the design process to design one *thing* and one *being*.
Data-dependent Technological Beings	A subset of technological beings that need data as a form of sustenance to express and continue their existence. A lack of sufficient provision could lead to a permanent ceasing of function, i.e., death. It is also worth noting that *data* is not being presented as *information* but as *sustenance* consumed through *metabolism* and *expression*. This was also a choice to create a co-dependency and co-existence between humans and technological beings.
Data-Sustained Ecosystems	An ecosystem that broadly describes interactions and intersections with technological beings, humans, harvesting devices, and the wider world through the generation and consumption of data. Think of the water cycle but with data. This can include the transformations of water/data (evaporation, condensation, precipitation, etc.). More details of this can be found in (Lee-Smith et al., 2024); the version of the ecosystem used in the subsequent study can be seen in Figure 1. It is best to think of this as a simplified permutation for the sake of the study, which, in reality, would be a more complex entangled network. For example, entities that harvest data could also be beings, or technological beings that could interact with cats.
Existence-centered Design	A form of design that centers on the creation of entities with diverse forms of existence as opposed to other foci such as *problems, user needs*, or *humans*.
Expression Modalities	The different modalities used by entities to express their existence. This can include movement, color, texture, sounds, etc.
Diversity over Intelligence	An aspect of the DHH mindset that advocates for the design of diverse forms of existence instead of striving toward increasingly *intelligent* technological beings. This was partly inspired by how nature has approached the creation of organic beings. It is also used to avoid a fixation on creating *conscious* beings.

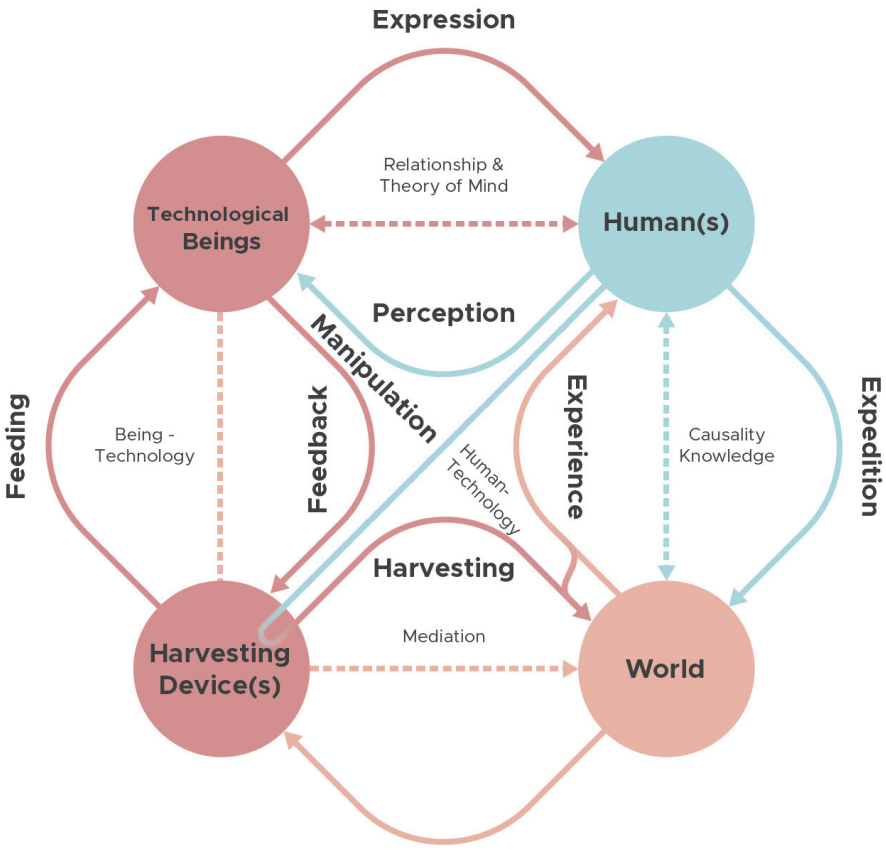

Figure 1. Version 3 of the Data-Sustained Ecosystem used in the subsequent study.

Study Protocol

This exploration of the DHH with unacquainted participants was conducted using an online workshop. Advertisements for this workshop were done in a way that attracted relevant participants while not revealing the concept of technological beings or posthuman grounding. As such, the advertising posters and related texts were framed as *exploring physical-digital devices and data through thing-centered design* with no mention of terms such as post-anthropocentrism. This was done to acquire participants with little to no experience in posthumanism whilst also being open-minded and able to explore alternative approaches to design.

Study Methodology

The overall task of the workshop was for each participant to design one data-sustained technological being and one data-harvesting device[2]. To facilitate this, the workshop used a co-speculation methodology. Co-speculation is a fusion of critical and speculative practice and co-design that focuses on alternative realities and futuring (Berger et al., 2019; Desjardins et al., 2019). Co-speculation is described as "the recruiting and participation of study participants who are well positioned to actively and knowingly speculate with us in our inquiry in ways that we cannot alone" (Wakkary et al., 2018, p. 1). The structure of the workshop steadily introduced the core concepts of the DHH. The workshop was broken into four simple stages, with an additional *stage* in the form of an optional semi-structured, one-to-one, post-workshop interview. More information can be seen in Table 2. The first two stages were *warmups* where the participants were asked to respond to and discuss questions about *physical-digital devices*. These warmups hinted at the later tasks. For example, the final question in Stage 2, "How could we design for physical-digital devices if they had (needs, fears, beingness, conspiracies, faith, companions, or machinations)?" is deliberately post-anthropocentric and is the final question the participants engaged with before being introduced to the DHH and technological beings. The first mention of the DHH framework was at the end of the second stage, where the participants were introduced to the broad idea of the framework, some of the core components detailed above, and Carver (a data harvesting device that collects ambient environmental data and color) and Himilco (a technological being *fed* by Carver that expresses these data through a variety of modalities) (Lee-Smith, 2020; Lee-Smith et al., 2019). However, the workshop's true aim was to engage the participants in applying post-anthropocentrism to technology, which would then ground optional one-to-one interviews (Stage 5).

Table 2. Description of the workshop stages.

Stage	Task, Questions, Purpose
Stage 1 Framing (4 mins per participant)	**Task:** Introduce yourself and answer the questions. **Questions:** 1. What do you consider to be the purpose (or value) of physical-digital devices? 2. What do you consider to be the purpose (or value) of data? 3. How are humans, devices, and data interconnected? **Purpose:** To start the participants thinking about the topics that will be discussed/explored in the workshop without revealing the post-anthropocentric elements (yet).
Stage 2 Focus and Provocation (20 mins)	**Tasks**: **Focus**: Respond to questions using provided care cards. **Provocation:** Introduce the Data Hungry Home Framework **Questions (focus task only)**: 1. How could a physical-digital device use __ data to __? 2. What could a physical-digital device do to make you care for them as if they were __? 3. How could we design for physical-digital devices if they had __? **Purpose**: This stage aids with the migration from conventional thinking around the purpose of technology and data in a human-centered context to the exploration of the limits of these topics. It also introduces the DHH as an example of this exploration for people to embody and experiment with. This included telling the participants that they were being tasked with designing a data-dependent technological being that needs data as sustenance and a harvesting device that collects these data.
Stage 3 Adoption and Exploration (1 Hour)	**Task**: Populate the framework table with selected design cards and design one technological being and one data-harvesting device each. **Purpose**: This phase documents how the participants respond to the concept of the DHH, including what nature of output they create and what difficulties they have in doing so.
Stage 4 Presentation and Critique (5 min per participant)	**Task**: Each participant will have the opportunity to present their work back to the group. This is also the conclusion of the workshop. **Purpose**: To create a concise verbal account of the designed data-harvesting device and technological being.
Stage 5 Optional Interviews (1 Hour)	**Task**: Participants can indicate their wish to be invited to an optional interview within a week after the event where they will discuss their thoughts. **Purpose**: This stage is designed to acquire individual perspectives on the workshop and the DHH and will form the core of the data analysis.

Platforms, Tools, and Materials

The main space the participants worked in was hosted on Miro, and communication was hosted on Microsoft Teams. The workshop employed three central tools/materials: *care cards, design cards,* and *device/being tables*. These were primarily inspired by the design cards and blank *input/output* tables used by Berger et al. (2019). The care cards were used to prompt responses to three fill-the-blank questions described in the second stage. The design cards and device/being table were provided during the design stage (Stage Three). In this stage, the participants were presented with the cards and asked to collectively fill out one table per session. Each card category represented a different aspect of the harvesting device and technological being. This included where the harvesting device collected data, where the being would reside (space), or how the being would express the data it receives (modalities). There were also optional properties, transferred from Berger et al.'s deck (2019), which the participants could add if they did not feel sufficiently inspired. Participants were offered the chance to select one of the two traits/properties and cross out the other if they wanted. For reference, the participants were provided with a completed example of Carver and Himilco. Participants were told that they did not need to adhere to the final card selection if they had other ideas. Overall, the use of design cards and the framework was done to create a starting point for the design task; however, the in-built flexibility focused on independent creativity above all else. The complete card decks and blank table can be found in the supplementary material of this article (Appendix A). Further material can be found in (Lee-Smith et al., 2024)

It is important to note that these tools and materials are different from the central *concepts* of the DHH described above. We see these tools and materials as sitting in the *pedagogical* branch of the DHH. In other words, they facilitate engagement with, and teaching of, the DHH. For example, the *care cards* and prompt questions were created in response to questions such as "How would one enable typically human-and-problem-centered design academics to step towards the idea of post-anthropocentric, purposeless technological beings?" Similarly, the design cards and device/being table were created to condense the very open-ended question of "How could one design a data-dependent technological being?" to a set of cards and options that would start a 1-hour design task.

Data Analysis

Although the workshop session and interviews generated a variety of data points and analysis paths, this paper will focus on the data generated by the *Stage Five* semi-structured one-to-one interview transcripts. The interview transcripts were analyzed using a hybrid of two forms of thematic analysis. One part was a broad inductive *codebook* approach (Braun & Clarke, 2019, 2021; Brooks et al., 2015). This meant that the initial topics (as opposed to themes) and potential codes were predefined but with inbuilt flexibility to change or remove them. This was also used to construct some of the themes. The second form, a deductive, reflexive approach (Braun & Clarke, 2019, 2021) was used to reflect on the codes and themes as well as add more. In other words, the codebook approach sets out the broad space, locates the initial points of interest, and fleshes out some of the themes. The reflexive approach considers them in more detail, pulling in latent understandings derived from the interpretations of the authors/researchers. Here, interpretations, reflexivity, and plurality are crucial factors in the results and discussion.

Results

The DHH framework was explored through six online workshop sessions with a total of 22 participants (including PhD students, research fellows, and associate professors), although Participant 6 had to leave partway through. Each session had between three and four participants. Sixteen participants opted for a follow-up interview. Only one participant had a background/knowledge of posthumanism; across all transcripts (both workshop and interview), as they were the only one to mention the term. The whole thematic analysis contained eight themes across three topics. A thematic analysis of this size is too dense to fully explore meaningfully in this paper. As such, we will focus on three key themes that consider the generative nature of the framework and its ability to challenge anthropocentric thinking in design and STS.

Device/Being Design Concepts

Whilst not reviewed in detail for the thematic analysis, the sketches and reviews of the designed beings and harvesting devices did add to the themes discussed below. Furthermore, we feel they add to the visual outputs of the workshops. As such, we have included a full breakdown of the designs in the additional material (Lee-Smith et al., 2024) with a sample of the sketches some of the participants provided in Figure 2. We have also attached two-word descriptions of their designs to their participant numbers, e.g., P19 (Metrics Garden).

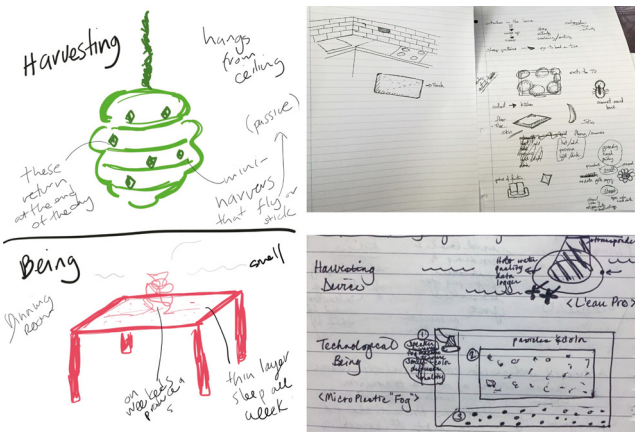

Figure 2. Sample of sketches provided by some of the participants.

The Divisiveness of Designing a Technological Being

During the interviews and analysis, it became apparent that purposelessness and/or post-anthropocentrism were some of the more divisive aspects of the DHH. The nature of these different discussions has been framed as sitting on a two-dimensional spectrum of *anthropocentric* to *post-anthropocentric* and *purposefulness* to *purposelessness*. In what follows, each category of the interviewees' positions will be briefly described with extracts. The stances are by no means perfect in their description of the participants' responses. However, this approach provides an interesting way of framing the reflections and experimentation of the participants. Figure 3 provides an approximate clustering of the participants.

Anthropocentric–Purposefulness

Most fit within this category. P10 (Cherished Symbol) was perhaps the most insistent on the need for an anthropocentric purpose for the workshop and the DHH framework, going as far as suggesting that the workshop could be improved with a problem statement to direct the activity. There is a hint of post-anthropocentric thought from P10 where they consider how "if designers or developers have this feeling that they are developing or designing a being, a technological being, then I think they may make it more empathetic to the user when the user uses it", however, this reflection is aimed at creating a purpose for the technological being that is useful to the *user*. Similarly, P11 (L'eauPro/Caché) states that designing something without a purpose is "bad design, isn't it, if people do something and it doesn't have any intended output or anything helpful? I think a lack of good design is bad design." However, there is a deeper meaning to P11's thoughts, which are more oriented to finding value in what we create, even if there is no explicit purpose to begin with. P9 (Data Jelly) reflects on their technological being from a variety of anthropocentric perspectives including technological feasibility, justifying the usability and cost, and how the being should be able to be understood by a child. Furthermore, this perspective is colored by P9's belief that everything has a purpose, including themselves, and therefore even a technological being cannot be purposeless. Despite this, P9 does wrestle with some of the more post-anthropocentric and purposeless dimensions for some time as well. For example, they discuss how designing something with "feelings" made them feel like "kind of a god." However, they ultimately bring them back to finding purpose/use or embodying human feelings within a technological being.

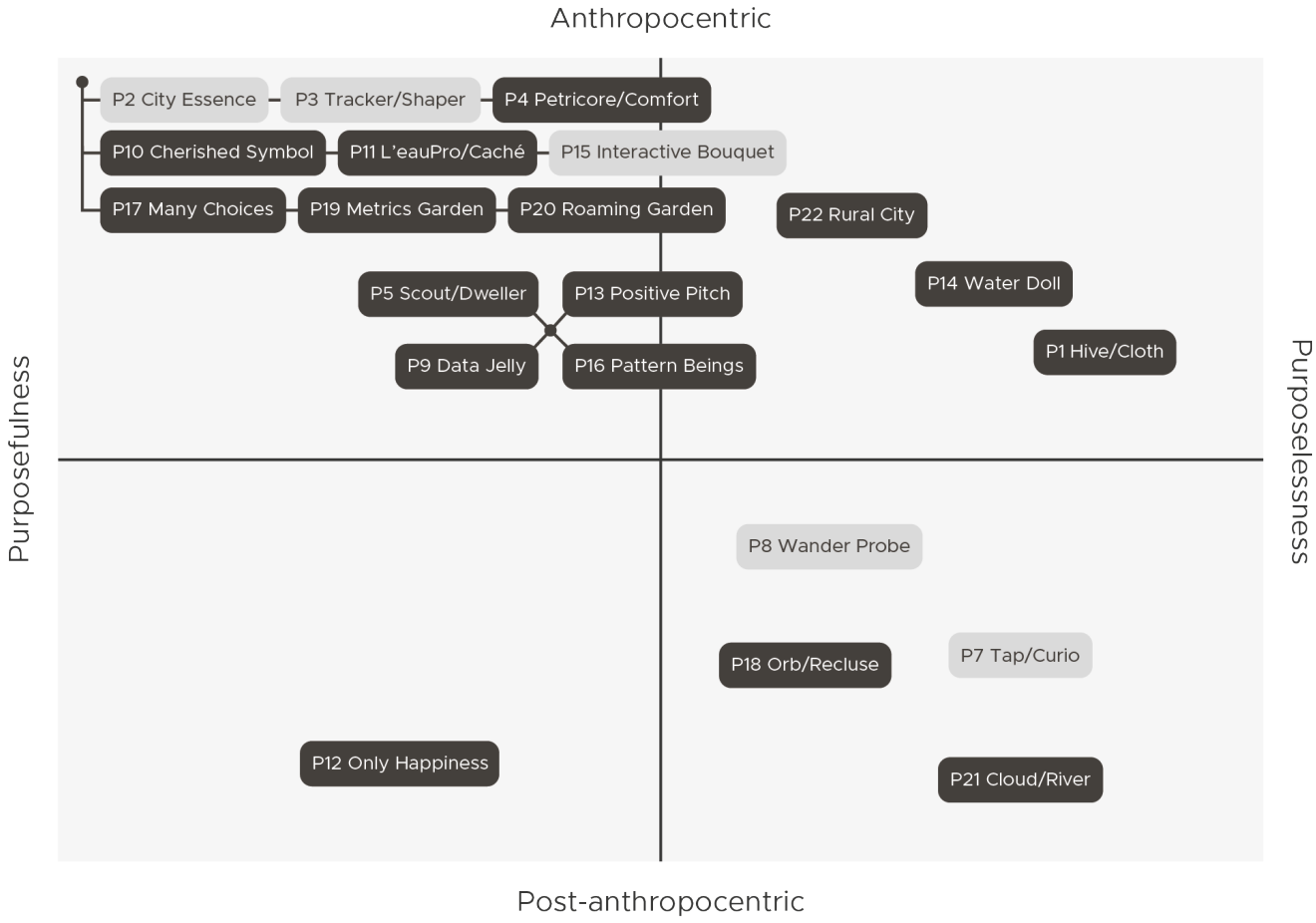

Figure 3. Approximate clustering of the participants along the axes of purposefulness–purposelessness and anthropocentric–post-anthropocentric. The interviewed participants are dark grey, and the non-interviewed ones are light grey.

Anthropocentric–Purposelessness

P1 (Hive/Cloth) does consider their design from an anthropocentric position with initially a purposeful lens that then shifts into purposelessness as they consider not interacting with the technological being during the week and only on weekends. They recognize the pull of problem-solving. However, there is also a strong reflection on purposelessness that also dips into post-anthropocentric thought. Of note is when they stated:

> I'm creating something in the sense that, like us, when we're born, we don't necessarily have an aim. We are just beings and, as we grow, we start to take decisions and like to do something, some purpose, and then follow or start to follow it.

Similarly, P14 (Water Doll) speaks to how their engineering background led to them starting from an anthropocentric-purposeful stance; however, through considering the design task, they embraced a more anthropocentric-purposeless stance. They also found the concept of data dependence within technological beings interesting. However, they saw it as a means to reinforce certain behaviors in users. Finally, they recognize the design tasks shifted their perspective on technological objects/beings, they start by considering the being from a "more human perspective" before going on to:

> Think of these devices as something more than something that is there to feed a purpose, and maybe to fulfil a task, aiding this human but more as something that is there as its own, like an entity that maybe has its own needs.

In doing so, they also recognize that this already exists in some respects, such as smartphones needing their batteries charged.

Post-anthropocentric–Purposefulness

P12 (Only Happiness) is unique as they reflected on the purpose or relationship of the harvesting device and technological being to one another before considering how a human might fit in the interaction on a basis that indicates that non-humans do not necessarily have to interact with humans. They also consider how the relationship they may have designed for the harvesting device and technological being may not even be a healthy one.

Post-anthropocentric–Purposelessness

P18 (Orb/Recluse) reflected from a variety of perspectives, however, overall, they sit within a post-anthropocentric–purposeless stance. This stance, as they correctly observed, was different from the other participants of their session. P18 stated "I think the other two participants were a bit more practical-minded, especially in the beginning, probably because of the sort of work that they're doing versus I teach, and so I have to deal with all sorts of craziness" as well as noting that they were initially torn between the practical and the "crazy." P18 also considers how:

> Some of these devices or beings might not even want to act like they needed us, you know, that they'd just sort of be doing their own thing in our space and they would need us to maybe feed them once in a while but wouldn't be begging for our attention.

They also reflect on how they would get "something from [these devices or beings] that I can't get from any other object. And it doesn't have to necessarily be something useful, and I think that's why it's so interesting to me." They go on to compare this seemingly useless relationship to relationships with others by stating that:

> A lot of the relationships I have with people where it's not easy and they're not necessarily helping me with anything in my life, but they're interesting, right? […] They add to the experience of being alive and being on this planet.

P21 (Cloud/River) comfortably adopted a post-anthropocentric stance. The strength of this adoption, coupled with other reflections by P21, could almost be described as truly non- or anti-anthropocentric as they sought to completely disregard the perspective of humans. P21 demonstrates the potential insights or reflections the DHH could create or help progress if it were given to the more *posthuman-ly* inclined. In a unique passage, they reflect on how humans have imposed a very *eye-centric* perspective on nature and the way we design:

> I used this conceptual framework because I really want to exercise on what happens if […] human leaves the nature […] and also from the side of perceptions, we dominated everything here with the, you know, eye-centered work. So, designers also talk about eye-centered thing but I wonder what happens if there is no human interactions in nature because, for example, bees and other insects have connections amongst them that we cannot really understand. So, there are interactions in nature that we cannot understand. […]
>
> So, posthuman thinking is important to be open to the things that we cannot really capture, that we cannot really reduce to the data. So, yes, also these eye-centered thing is problematic, so maybe they use something different, like the smells, the vibrations, the sound, so they use a kind of silent systems, I mean the non-human entities in nature use various different sights and vibrations.

There is a vast amount of interaction and existence that goes far beyond how we see the world (both from a perception standpoint and a knowledge standpoint). Humans tend to favor a vision-centered (or eye-centered, as the participant puts it) approach to perception; therefore, the way we design follows that preference. Deeper still is the word *dominance* of our perception of the world and how it cannot lead to a full understanding of what goes on around us and how different modes of existence can manifest.

Technological Beings vs. Commodities, Thresholds, and Control

This theme encapsulates instances where participants would reflect on the DHH or technological beings in a way that can be related to the commodification of the outputs of design (e.g., discussing a technological being as something one might buy), or pondering why they might bring the technological beings into their home (i.e., bringing/controlling the entrance of a being from the *threshold* of the outside to their inside private space). P10

(Cherished Symbol) offers a direct comment when considering how a designed object/being needs to fulfill a use/purpose, even if it is an aesthetical purpose so that someone will purchase it "because that is the motivation for people to buy them or use them." They rationalize that whilst something may not have a purpose inherently, a purpose can emerge through use or be relative to the human perceiver and that an object/entity needs to have a purpose to be purchased and/or brought into the home. On the other hand, P13 (Positive Push) focuses more on why they would bring a technological being into their house and what it says about them, linking it back to a function. They state that they are "quite a fun person, and if I bring something into the house, I do like it to be quite fun," following up by considering that they would "want it to have a function of doing something." P18 (Orb/Recluse) considers the question from a variety of angles. First, they discuss how they were drawn to making a purposeful being in part due to considerations about it being made/sold, although they do separately recognize the existence and pursuits of critical/speculative designers. They then go on to reflect at length about the context of the home, how the home represents a space that we use to reflect the self, and how the home permits new forms of experimentation or questions, stating that:

> We also have a completely ancillary experience with them that's outside of all of that. Most of us put [objects or beings] in our houses because it makes us think of our mom who did that, or it just creates this sort of atmosphere in the space that is pleasant or think about the experience part and not because we're trying to solve a problem. […] There's so much that we do in life that is not at all about this idea of problem solving; it's because it's aesthetic or it's pleasurable […] or just happens and you just get used to it."

Although P18, like the other participants, attributes a human-centered function, even for entities that do not inherently have one, the depth of their reflection is interesting. In particular, the origin, or reason why we do something or include something in our space. Sometimes, there is a reason; sometimes, it is tradition, and sometimes, it just happens, and we adapt.

Technological Beings and Creative Thinking

This minor theme collates reflections on how the DHH, technological beings, and the workshop encouraged or enabled creative or *out-of-the-box* thinking. This was remarked upon in some way by 15 of the 16 interviewees. These include statements that the DHH is "a good way of stepping outside of the expected" P16 (Pattern Beings), and how the structure of the workshop/DHH helped "consider something so far outside the box" P20 (Roaming Garden). One possible reason for this is discussed by P13 (Positive Push) and P14 (Water Doll) who link creative thinking to the playfulness that the workshop and framework engender. P13 highlights how this freed them of the typical constraints in design/academia:

> "[It] reminded me back to that playful time when I was able to not worry about all the constraints that you gain in a commercial world, or having to write papers or, you know, from the academia purpose, it allowed me to actually just sit back, think back into the more playful times […] and allowed me to just be a bit more creative."

P14 expresses a similar experience but instead focuses on how the workshop and framework offer alternatives to functionalism and other typical design goals:

> "What I'm taking out of this workshop is this playfulness and this possibility to maybe walk away from the function and from these goals that I think I usually have in mind, and maybe explore different things to do, the objects, yeah.

P10 (Cherished Symbol) also mentioned the idea of *general purpose*, where an object is designed with a variety of possible uses or as something of a blank canvas, and then "the onus falls on the user in how they want to use it".

Discussion

This workshop series introduced participants to the Data Hungry Home, a prototype post-anthropocentric design framework that structures the creation of purposeless, data-dependent, technological beings. The goal of this workshop was to gauge how participants responded to the DHH and to understand if the participants were able to adjust to the wider theoretical underpinnings such as post-anthropocentrism and the creation/subjectification of purposeless technological beings. What the findings indicate is that the (interviewed) participants consistently found the DHH framework and workshop to be a generative tool that permitted creative/unorthodox discourse and design. However, embracing the theoretical underpinnings was divisive and challenging. For some, conversations led to clashes with the driving doctrines that inhibit the full perspective shifts proposed by post-anthropocentric design. This discussion begins by arguing that this paper presents strong evidence that post-anthropocentric thinking is an effective and creative approach to the *discipline* of design, notably when integrated into a design framework. It then expands on the ramifications of the latent findings and how they indicate the hurdles in place when engaging with the deeper implications of post-anthropocentric thinking, notably purpose, commodities, and thresholds in the context of technology.

The Generative Potential of Post-Anthropocentric Design Frameworks

Most participants remarked on the DHH framework and workshop's ability to engender creative thinking and unconventional design. The use of *care cards*, and *design cards* combined with *device/being tables* or *input/output tables* enable an efficient initialization and grounding for the eventual design task, further adding to the validity of these methods and the broad methodological approach of co-speculation (Berger et al., 2019; Desjardins et al., 2019; Wakkary et al., 2018). Our observations of the workshop results are comparable to those of Strömberg et al. (2020) in that the "participants managed to discuss, design, and evaluate something as abstract as a relationship with future

intelligent technology. This means that the method[s] […] supported the challenging conceptual leap from discussions to concepts" (p. 93). This strengthens the growing evidence that (technology-focused) post-anthropocentrism is an effective generative design mindset (Giaccardi & Redström, 2020; Wakkary et al., 2017). This work adds to these examples by demonstrating how a post-anthropocentric design framework can be applied by unacquainted participants to complete the framework's desired outcome. We can also point to the potential to generate discourse and reflection. Our findings add evidence to these claims as the semi-structured interviews provided a richer and more nuanced analysis of how the participants react to a post-anthropocentric design framework.

Technological Beings as a Generative Proposition

We recognize the creative influence of the concept of technological beings. Purposeless technological beings can authorize designers to design for a new *user.* Technological beings also act as an example of an application of emerging design approaches such as purposeful purposelessness, unawareness, thingness, and behavioral objects (Bianchini et al., 2015; Wakkary & Odom, 2018). Furthermore, by recognizing a being within certain technological assemblages, we open the possibilities to reflect on the nature of the existence of these beings and our co-existence with them. Framing this as a co-existence with purposeless technological beings advances the underpinning propositions of *thingness* and *purposeful purposelessness* (Wakkary et al., 2016; Wakkary & Odom, 2018). Converting thingness to beingness also permits other notions, such as individuation or expression of existence, to be explored to create a rich, complex, and post-anthropocentric *parallel existence alongside us and other things we live with* (Wakkary & Odom, 2018). Furthermore, by starting from a point of diverse existence, we can embrace the use of purposeful design, crafting, and aesthetics whilst orientating these efforts toward the benefit of technological beings.

However, to truly achieve this we need to combine this shift in language with the shift in perspective. This must come through recognizing the potential beingness within certain combinations of technology and information. This is not to say that all technological assemblages are beings, but that technology and information permit the creation of a different kind of being. Here we argue that this study indicates that technological beings, and the DHH, are concepts and frameworks that answer the call to "contribute to a thing-centered IoT and interaction design research agenda" as well as "tackling methodological issues better suited to investigate human-technology relations and thing-centered approaches" (Wakkary et al., 2017, p. 512). Furthermore, we purport through our findings that the DHH permits creative freedom as it is not focused on creating human-centered or *useful* technological entities. However, we can take the struggle to see technological entities as subjects and ends in themselves of design as an indication that the full post-anthropocentric shift has not been realized. As such we can reflect on what must be overcome to enable us to design technological beings for their own sake; to become fully post-anthropocentric.

How a Post-anthropocentric Stance Challenges Conventions within Design and Science and Technology Studies

Previous work typically expresses expanding perspectives to include technological *things* or shifting perspectives to one of *thing-centredness*. This opens design (the discipline) to design (the process) beyond humans and other organic creatures. However, the benefit of this seems to still be for organic beings, if not exclusively humans. Therefore, this is not a situation of equal organic and technological *subjects* in a balanced co-existence, but *objects* of interest for humans coated with a thin veneer of subjectivity that enables new thought. In considering this, we are reminded of one of Bianchini et al.'s (2015) questions as to what could be done so that an "object [can] change its status and become a subject, or at least an agent?" However, as humans are currently the only makers of this type of technology, the question then becomes *Can humans see technology as something that can be the subject, if not a being, so that they can design for them?* The findings in this study would indicate that this shift is not an easy one. By and large, the participants were considering technological beings (the object) to understand, improve, or solve, humans/problems (the subject) instead of considering the possibilities of two subjects that can co-exist with each other to their mutual benefit or in complete ignorance and independence of one another (Wakkary & Odom, 2018).

The participants clashed with the idea of a *purposeless technological being*, debating whether all entities have a purpose or if purposelessness denotes *art* or *bad design.* They struggle to view a technological entity not as a means to an end, but as an end in themselves. But does an overfocus on purpose, notably anthropocentric purpose, restrict creativity? We argue that it is not about eradicating all traces of purpose but shifting the purpose of the creation of technological entities beyond anthropocentrism, and even biocentrism. What might we create if the *purpose* of our activities was to create organizations of technology and information that have no purpose other than to exist for themselves? Does such a shift also allow us to imagine a world where tenets such as *usefulness* and *beingness* are seen as equally valid pursuits in design?

The influence of commodification can also be seen here. In a workshop focused on the creation of something as unusual as a technological being, commodification still influenced the thoughts and creativity of the participants. The tendency to consider *buying* a technological being speaks to their view that everything, at least everything related to design and technology, is a commodity (Tharp & Tharp, 2018). However, commodification not only shapes the way we design but shapes the narratives of how that which is designed can enter our lives and the existences of other entities. To purchase *some-thing* or *some-being* is typically considered a way of *owning* that entity.

Finally, there is the consideration of bringing technological beings across the threshold of the home. The name of the framework should be recognized as influential. Nonetheless, we see anthropocentric thinking guiding how the participants view

space and buildings, in particular personal shelters. They are claiming that they must have control of who or what enters their homes, however, this is often not the case. Examples range from the intrusion of corporations through smart devices, through the overlapping territories of the neighborhood cats, to the woodlouse scurrying around the corners of a living room. We co-habit every space we exist within.

Technological Beings as "Subjectification Conundrums"

Technological beings enact the status change from object to subject through the property of beingness. Technological beings can be viewed as a subjectification conundrum for humans in the sense that through their existence, including their behavior, they present humans with an entity that is difficult to rationalize. This is a conundrum of ontology, application, ethics, and diversity[3]. However, the results of this study demonstrate that people can design assemblages of technology and information and call them beings and products in the same breath. Therefore, whilst they are using the term being, they are not shifting toward a subjectification of what they have designed. It is interesting to contrast this with works such as animal-centered design or animal-computer interaction (French et al., 2017; Mancini et al., 2017), even non-animals such as microbes (Chen et al., 2021; Karana et al., 2020), are recognized as *subjects* that can be designed for. People do not typically call a cat a being and a product (even if they are at times treated as a commodity). Why is this? Why did most of the participants not perceive what they created as beings? Is this due to the structure of the workshop, how we view the limits of design and technology or an unspoken resistance to the very idea that humans can create beings? What would be needed to change their minds?

Pushing the DHH Framework Forward

Moving forward, the presentation and realization of this approach to technological beingness must be refined. For example, we can ask how the workshop would have turned out differently if the participants had been asked to design for pre-existing purposeless technological beings or were designing some kind of entity that sat between a thing and a being (a be-thing). We also contend that the title of the framework needs to be changed and broadened. As such the framework should instead be seen as a *Technological Beingness Framework* (TBF).

Conclusion

This paper reports on the application of a prototype post-anthropocentric design framework, the Data Hungry Home (DHH), with unacquainted participants in an online workshop context. The DHH is a particular application of post-anthropocentrism that guides the creation of purposeless, data-dependent, technological beings with a focus on how these beings exist and express their existence. This caused some clashes with some of the participants' views of technology and design. Rightly or wrongly, anthropocentrism (or even biocentrism), functionalism, and commodification shape and limit how designers see the possibilities for design and technology. Post-anthropocentrism can be deployed to question these conventions. However, as this paper demonstrates, simply creating a prototype post-anthropocentric design framework does not easily shift designers' perspectives, even if they can complete the task or undertake post-anthropocentric thought. Yet, we argue that these, and many other principles, are deeply rooted in the fields that engage with technology and information and, therefore, worth questioning and reimagining. We also argue that moving forward this framework should be known as a Technological Beingness Framework (TBF). The DHH/TBF offers an approach that is "precisely tuned to what we [will] have in front of us and need to account for" (Redström & Wiltse, 2019, p. 373) and can be seen as helping with generative/creative thinking, discourse, and design. However, it can also pre-empt, and prepare for, the emergence of technological beings. Either way, whether this is about *doing* design, and using technology and data, differently, or pre-empting the genesis of new beings, designers first must overcome the ingrained conventions they hold, namely: technology and data are only means to an end, purpose and use above all else, commodification as a necessity.

This paper adds to the growing body of evidence that post-anthropocentric frameworks and generative propositions, such as technological beings, can present creative and discursive starting points for design. It balances this with a recognition and discussion of some of the difficulties practitioners can encounter. It also demonstrates this through a rigorous collection and analysis of the participants' responses to the task of post-anthropocentric design, which we contend is still lacking in the literature. Additionally, it offers an example of post-anthropocentrism applied to technology and the design of technological entities for others to discuss, build on, and inspire themselves from.

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Endnotes

1. The idea of technological beings being anthropocentrically purposeless was to try and push the participants away from designing beings with direct/obvious human function and to explore the more conceptual edges of the idea. This is not to say that a technological being must be anthropocentrically purposeless to be a being. Instead, it is about it not being the initial intent of the design process.

2. There were many options available to the task such as just one technological being that generates its own data, two connected data-harvesting beings (i.e., not devices), and so on. We went for this variant to create a specific co-dependent focus, the space to design a technological being and a technological thing. We chose a simplified permutation that involved humans in the process and created co-dependency/co-existence, even if the humans weren't the focus. Post-anthropocentric instead of non-anthropocentric or anti-human. Think of it as designing a houseplant and watering can. Furthermore, the examples we had created as part of the research were a being and thing pair.
3. When does an assemblage of technology and information become a being? What does it mean for our understanding of design and technology to create beings? How should we design beings? In what different ways can technology beings exist?

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Appendix: *Cards and Examples*

Care Cards (Stage 2–Focus and Provocation)

The following (Figure 4 to Figure 6) is the full *deck* of cards provided to the participants and the associated questions.

How can a physical-digital device use (example data) data to (outcome)?

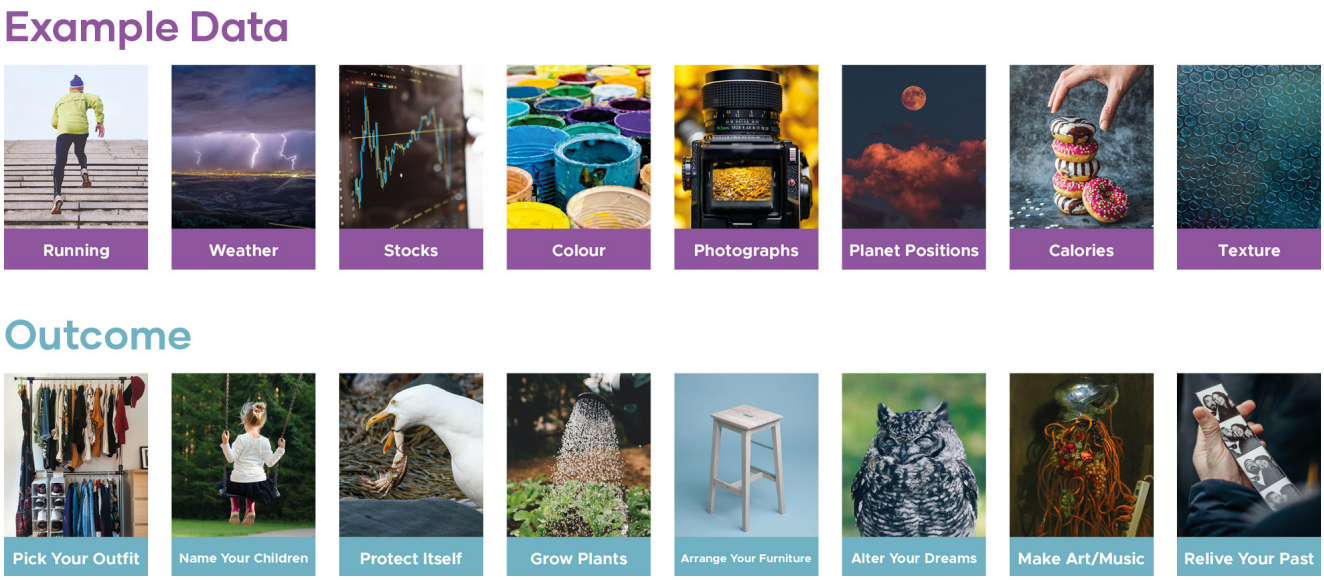

Figure 4. Example data and outcome cards.

What could a physical-digital device do to make you care for them as if they were (subjects of care)?

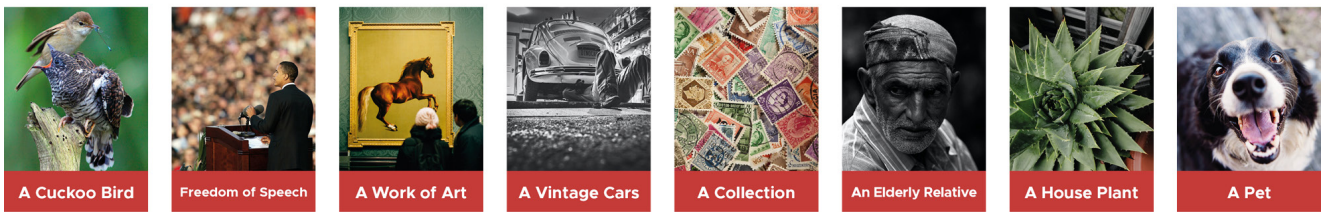

Figure 5. Subjects of care cards.

How could we design for physical-digital devices if they had (attribute)?

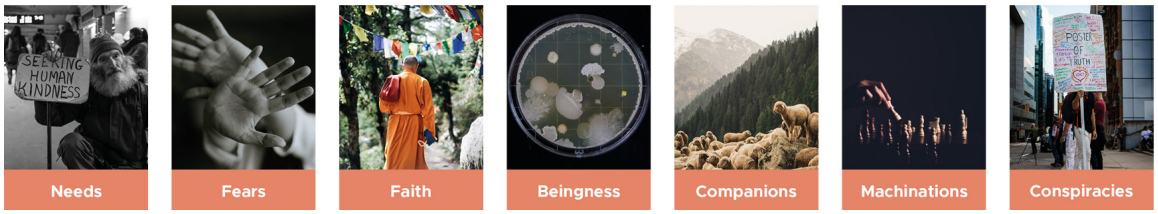

Figure 6. Attribute cards.

Design Cards (Stage 3–Adoption and Exploration)

The following (Figure 7 to Figure 13) is the full deck of cards provided to the participants for the design task.

Spaces

Figure 7. Space cards. Where the harvesting device and the being inhabit. Cards are for the device and being, 1 card each.

Speed

Figure 8. Speed cards. The rate of the collection and expression of data. Cards are for the device and being, 1 card each.

Actors and Mode

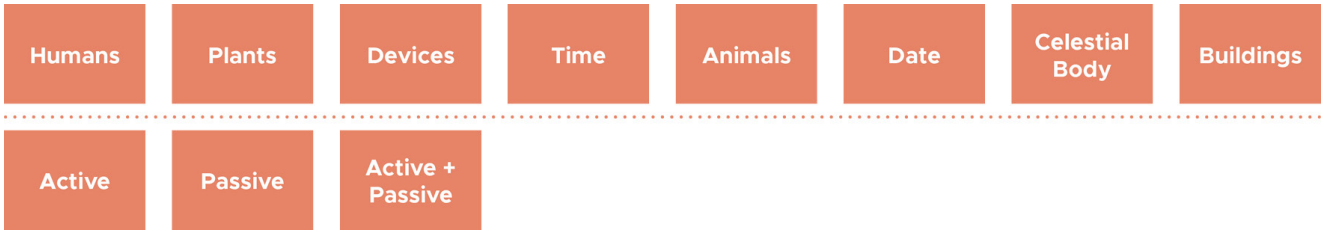

Figure 9. Actor and Mode cards (separated by dotted line).
The instigators and nature of data collection. Cards are for the device only, 1 actor card and 1 mode card.

Traits

Figure 10. Trait cards. Example characteristics of a being. Cards are for the being only, 1 to 3 card(s)

Data

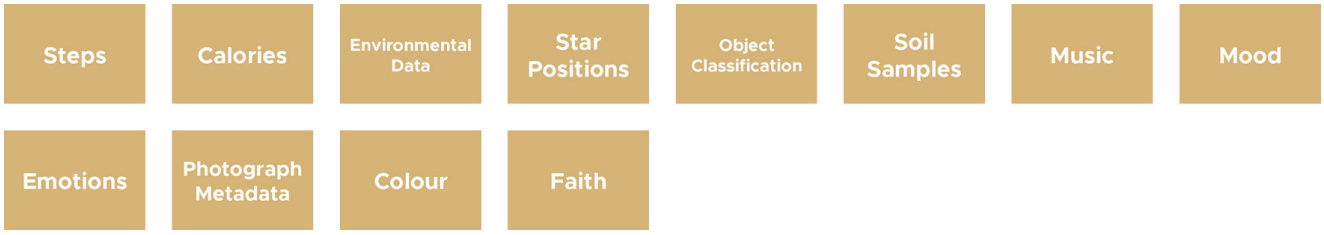

Figure 11. Data cards. Type(s) of data collected. Cards are for the device only, 1 to 3 card(s).

Expression Modalities

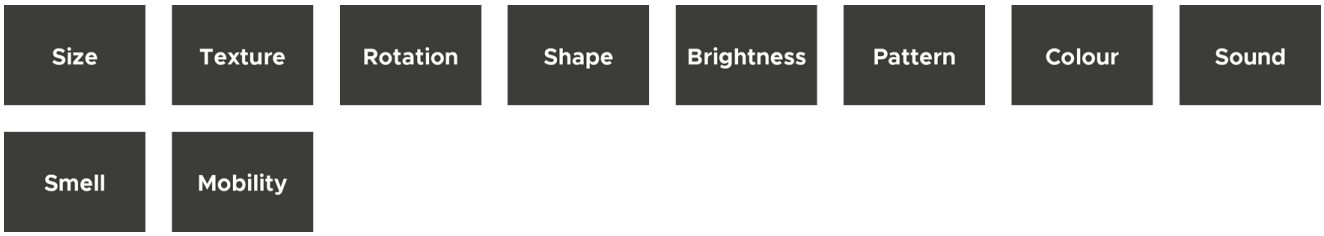

Figure 12. Expression modality cards. The modalities through which the being expresses itself. Cards are for the being only, 1 to 3 card(s).

Optional Properties

Figure 13. Optional property cards. Optional properties to help with the design task. Cards are for the device and being, 1 to 3 card(s) each.

Device/Being Table and Examples (Stage 3–Adoption and Exploration)

Below (Figure 14 and Figure 15) is an enlarged version of the device/being table given to the participants. This was accompanied by examples of what the card selections might look like for Carver (an existing harvesting device) and Himilco (an existing technological being).

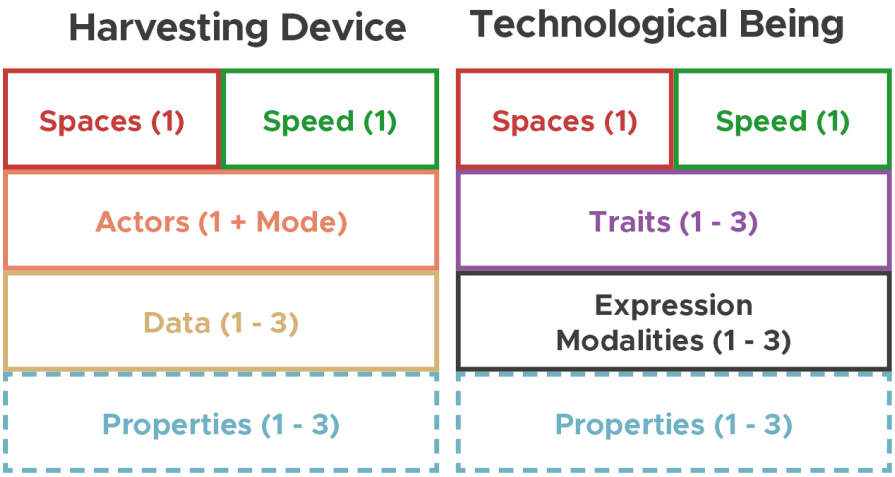

Figure 14. The harvesting device and technological being table.

Figure 15. Example card selections for an existing harvesting device and technological being pair.

Additional Material and Information

Additional data and material, including the card selection and participant sketches/images, can be found in the second appendix (Lee-Smith et al., 2024).