How Can Interactive Technology Help Us to Experience Joy With(in) the Forest? Towards a Taxonomy of Tech for Joyful Human-Forest Interactions

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Abstract

This paper presents intermediate-level knowledge in the form of a taxonomy that highlights 12 different ways in which interactive tech might support forest-related experiences that are joyful for humans. It can inspire and provide direction for designs that aim to enrich the experiential texture of forests. The taxonomy stemmed from a reflexive analysis of 104 speculative ideas produced during a year-long co-design process, where we co-experienced and creatively engaged a diverse range forests and forest-related activities with 250+ forest-goers with varied backgrounds and sensitivities. Given that breadth of forests and populations involved, our work foregrounds a rich set of design directions that set an actionable early frame for creating tech that supports joyful human-forest interplays – one that we hope will be extended and consolidated in future research, ours and others'.

CCS Concepts

• **Human-centered computing** → Interaction design; Empirical studies in interaction design.

Keywords

Nature, interactive tech, play, joy, celebratory tech, speculative design, forests

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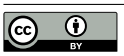

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1 Introduction

Experiencing nature is good for our body-minds [67] and socio-culturally relevant [49]. Though its effects depend on many factors, we know "total exposure is important; all forms and quantities are helpful; and the greener the better" [79]. Forests are thus relevant to HCI. In fact, technology use in forests is far from new: we have used it for centuries (e.g. the compass), and rapid advancements in computation (e.g. biometrics, wearables, geolocation, IoT...) only amplify the opportunities digitally augmented human-forest interplays. Nowadays, we use apps like *Wikiloc* [117] to stay on track, share anecdotes on social media, wear gadgets that measure our performance (e.g. the *Fitbit* [29]), or play games like *geocaching* [84], among others. Since those digitized enhancements are likely to become more present and diverse in the future, we need to mindfully weave them into the human-forest interplay in ways that are holistically valuable – for individuals, for society, and for the environment.

Here we call for a rich discussion around the values that will ground the design of technology for human-forest interactions. In recent decades, we saw how the integration of computation in new, previously analog domains was primarily *techno-solutionistic* [81]. Smart homes [80] and cities [76] are spaces where early innovations mostly sought to support humans to efficiently "get things done"; less emphasis was put on caring for socio-emotional flourishing or the flourishing of the environment. Only in retrospect we saw the risks of these overly productivistic understandings of the human-computer interplay – risks that have in part been addressed through increasingly joyful [5][22][38], caring [68], and sustainable [31][47] developments. In the emergent design space of human-forest interactions, such techno-solutionistic turn is not

only possible but plausible: the recent emergence of popular devices such as the *FitBit* [29] shows a trend of using tech to productively instrument forests (e.g. to train efficiently to get fit) while often neglecting the socio-emotional or environmental dimensions of our engagements within them. That trend portrays forests (and the many other-than-humans inhabiting them) as commodities, building on the *extractivist* [105] notion that nature is a resource for humans to exploit – an idea that has been criticized for being unrepresentative of the rich complexity of human-nature entanglements [66] and potentially harming for humans and non- [97]. As design researchers, we embrace those criticisms and call for alternatives. Learning from the above analogous design spaces, we suggest paving the way forward, from early on, by exploring how forest-related tech might respond to other values than productivity/productification. Because digitalization of forests is yet at an incipient stage, we have an invaluable (and ephemeral) opportunity for building a rich and multi-faceted foundation in this design space. Such foundational work will be much harder to do in the future when tech use is already pervasive in forests and extractivist uses and assumptions have already been built and embraced.

Our work addresses that opportunity by exploring how to position joy at the core of interactive tech design targeting forests. By *interactive tech*, we mean artifacts with digital affordances such as mobile phones, wearables, smart objects, extended reality devices, or similar. By *forests*, we mean any piece of unurbanized land where humans, vegetation, insects, fungi, and other other-than-humans co-exist. We adopt that open-ended definition as an operational frame to bypass the contentious nature of what constitutes "a forest" [25], allow the (likely diverse and often conflicting) perspectives of all participants to be included, and approach it in a way that is actionable for design. In 3.2, we describe the forests we engaged, hoping to help the reader gauge the scope of our explorations; in the Discussion, we reflect on how that scope may have influenced our research. By *joy*, we mean delightful experiences that allow us to thrive in our interactions within forests – looking at these forests (and anything within them) not as commodities from which humans might "consume" joy, but rather as complex living systems where joy can be experienced around and/or alongside other living and non-living things. We focus on joy for its known importance in human life [60] as well as its capacity to imbue meaning-making processes with coherence and equanimity [63] – both of which we see as key to rich and fulfilling interplays between humans with other species.

Our work builds on the idea that the weight of joy in tech design should match its relevance in people's lives and society. Building on that premise, we recently conducted a year-long co-design process where we invited diverse stakeholders to co-imagine joyful forest tech with us. Our work involved 5 co-design interventions of different formats and lengths where we co-experienced a broad range of forests with 250+ people from 40+ nationalities. We used those slow, situated engagements to co-create and reflexively make sense of an *annotated portfolio* [40] of 104 speculative ideas of how interactive tech might afford human experiences of joy with(in) forests. Here we share a reflexive, multi-phased analysis of those ideas and derive a taxonomy of joyful forest technology: 12 ways in which interactive tech might contribute to a more joyful human-forest interplay. We thus contribute *intermediate-level knowledge* [73] on how to design tech that adds value to human-forest interactions beyond productivity.

2 BACKGROUND

2.1 Why incorporate interactive technology to human-nature interactions?

When thinking about our interactions within forests, one may wonder: why should we populate them with digital affordances in the first place? We see this as a key question to ask when designing tech targeting more-than-human interactions. Indeed, engaging forests can be a wonderful source of joy, in and of itself, with or without the mediation of technology. By no means we see interactive tech as the only way for experiencing joy within them. Further, certain forms of technology use are known to contribute to distancing people from engaging forests directly [35]. Considering that, why would we create tech that risks disrupting forests' inherent positive traits?

Here we argue that computation, *per se*, is not a disruptor of forest experiences. Its effects depend on how it is used and designed. If built with the right affordances, tech can help us access, engage, and better enjoy the forest. Thus, we do not propose digitalizing forests by default; building on recent works within HCI [5], we seek to closely examine where and how technology might add socio-emotional value, and to design responding to that. We stress the value of that agenda, first, because of the capacity of interactive media for extending the experiential affordances of analog materials [50]: it enables communication forms that would otherwise be impossible [52]; it allows us to digitally reproduce and manipulate physical objects [53]; or it enables us to store, retrieve, and (literally) play with data [112]. Second, on a less positive note, if we look at industry trends, it is not far-fetched to assume technology will be increasingly present in forests. In fact, not only will it be – it already is. Human-nature interactions have historically been mediated by technology: in an analog form, we have long used clothes to protect us from extreme conditions, tools to set up a camp, or compasses for wayfinding; and today, tech use in forests begins to digitize, starting with commonplace devices such as phones or activity trackers that open way for a (not so distant) future where more advanced tech (e.g. companion robots [1]) will join us in forests. Our interactions with (and even our very understanding of) other-than-humans have been and continue to be influenced by technology mediation [95]. In this context, echoing exploitative notions of the human-nature interplay can be a recipe for disaster [95]. We need to explore how computation, if brought to the forest, might support experiences that help us to cherish other-than-humans, rather than merely utilize them in an extractivist sense – for the sake of our bodies, our minds, society, and the environment alike.

Our perspective aligns with ongoing conversations in tech design and environmental research. In HCI, utilitarian approaches have been criticized for a lack of attention to socio-cultural, emotional, or environmental factors [81]. There are calls for drifting away from productivity agendas and embracing other values like emotional fulfillment or social connection (e.g. [5][22][38][46]); they also stress the need for more sustainability [31][47] and care [68]. Environmental researchers extend those calls to our interplays with nature: they reclaim the socio-emotional and cultural dimensions

of human-nature interactions as a response to contemporary trends of privileging profit and growth (e.g. [10][28]). All those works embrace non-extractivist ideas of the interplay between people, tech, and the environment. Inspired by them, we suggest future tech should not only contribute to the efficiency of human-forest interactions – it should also support experiences that are joyful and holistically rich.

2.2 The design and research space of human-nature interaction

Though forest-related research is relatively new in HCI [114], people have long used technology in forests. Advances in computation only amplify this trend. Today, myriad gadgets optimize forest activity through data collection, helping to train [37], lose weight [29], or navigate forests [117]. *Citizen science* apps [99] persuade people (often gamefully [90]) to collect data for decision-making [61]. *Digital nature* also digitizes forests through virtual simulations, making their wellbeing effects more accessible [111] or supporting management [54]. These trends often share a utilitarian agenda of instrumenting forests towards productive (albeit desirable) gains.

There are also works looking at alternative, less extractivist human-nature-technology interplays. They are at odds with the *techno-solutionistic* [81] idea of using tech to commodify forests, and thus explore more-than-human interactions more critically. For example: *Fruit are Heavy* [30] is an IoT system that measures the bend of fruit tree branches to sense the ripeness of the fruit towards enabling urban foraging that attends to biorhythms; the *Hand-Substrate Interface* glove [70] enhances human-fungi interplays by inviting wearers to insert their hands into the ground to obtain digital readings, foregrounding, rather than bypassing, the sensorial qualities of engaging the soil; or *Wildeverse* [33] is an AR forest conservation game aimed at improving players' knowledge of and attitudes toward forests. We are inspired by how these works support experiences where human consciousness extends into the environment and better engages with more-than-human concerns [27][44][113], as unpacked below.

2.3 More-than-human oriented approaches to engaging nature in HCI

Human-nature interactions have been explored through myriad perspectives in HCI [114]. In the trajectory of considering nature as a critical stakeholder in design, *more-than-human design* has emerged as a promising framework for rethinking human interactions with other entities. Human-centered design traditionally positioned nature as an "other" (typically, a resource for human benefit) [72][102], assumed a (rather artificial) dominance of humans over others [114], and embraced that divide as the meaning of civilization [62]. In contrast, more-than-human design questions the dichotomy between nature and culture, advocating for an integrated perspective [44] of *natureculture* [102] that opposes separating humans from the natural world. That approach invites reimagining design practices toward acknowledging humans' interconnectedness with the environment [113]. It decentralizes us, framing us as part of shared ecosystems that entangle us with other-than-humans, living and non- [44].

More-than-human design does not operate in isolation: it builds on, shares perspectives with, and extends a rich body of research from beyond HCI, e.g. in *posthumanism* [36], *eco-centrism* [89][94], *ecological anthropocentrism* [23], or *transition design* [57]. Further, many of the concerns engaged by more-than-human designers resonate with other traditions within design research. For example, many of its critiques extend beyond species-based frameworks to address systemic inequities, recognizing how traditional human-centered methodologies often prioritize the needs of dominant groups while marginalizing others [104]; feminist perspectives further emphasize the need to share the stage not only with other species but also with traditionally underrepresented communities [59]; and all these concerns resonate with participatory practices that seek to democratize design processes and foster inclusivity [19]. Cutting across all these akin epistemologies there is a pursuit of sensitivity, respect, and mutual experiencing as both the means and the outcome of research.

Given that entangled character, an important quality of more-than-human design is its heterogeneity. First, it looks at myriad forms of natureculture, including works as diverse as e.g. Liu et al.'s exploration of sensory human-fungi relationships [70], Sondergaard et al.'s investigations more-than-human relationalities in the scope of menstrual care [103], or Odom et al.'s technologies for reflective hiking [83]. That diversity also taps into methodology: more-than-human designers embrace a plethora of approaches to multispecies care and sensitivity, including techniques such as *biophilia* [12], *forest bathing* [86], *noticing* [96], *attuning* [51], or *disconnection* [51], among many others. That heterogeneity (both methodological and in terms of object of study) leads to an equally diverse palette of ways of engaging with the notion of de-centering: while some designers/researchers take a radical stance toward de-centering humans from the design process, others explore how to foster a deeper sensitivity to the needs of other species and ecosystems, even if not fully dismantling the nature-culture divide. Given that heterogeneity, we see more-than-human design as a rich, complex continuum where design processes cannot be categorically labelled as human-centered or non-, but rather as messy multidimensional endeavors where more-than-human concerns, sensitivities, and livelihoods can be attended to in different ways and to different extents. In Section 3, we position our work within that continuum, outlining how both our research aims and our methodology were more-than-humanely sensible; in the Discussion, we engage with that positioning further to reflect on the relevance of our work to more-than-human design research and its limitations.

2.4 Towards joyful and caring approaches to nature technology

As seen above, existing works in HCI look at forests through different lenses: instrumentalization, optimization, multispecies care... While we find all of them relevant, we see an angle of the human-forest interplay that is still underexplored: the experiential texture of forests and interactive tech's capacity to enrich it. While some gameful forest technologies exist (*Pikmin Bloom* [82], *geocaching* [84]...), they often propose autotelic experiences that are separate from ordinary forest activity and the inherent experiences it can

afford. We see potential in exploring how tech might help further enrich the experiential texture of forests, framing them not as joyful resources at human disposal but rather as rich environments where we can thrive alongside other living and non-living things. The potential of tech to support rich, playful, and contextually-meaningful experiences beyond the scope of autotelic games has been broadly discussed in HCI (e.g. [8][38]); we see an exciting opportunity for extending those conversations into forests, imagining how to realize and extend their inherent joyful potential by design.

A bit over a decade ago, *celebratory tech* was proposed as way to "celebrate the positive interactions that people have with food [...] in their everyday lives" [46]. Though it targeted food practices specifically, that provocation is also relevant in forest-related experiences, as it calls for re-orienting design toward joy in mundane (yet highly consequential) areas of life where interactive tech use is not yet widespread – areas where, as such, foundational changes can still be made. Recent works have begun to explore how to imbue forests with joy [5], echoing a tradition of playful HCI research (e.g. [8][38]). Building on that incipient body of work, we wonder how such move towards more joyful forest experiences could be supported through technology: How can we design interactive tech that helps people to thrive with(in) forests? In what different ways might it help to imbue forest experiences with joy?

3 METHOD

3.1 Study aims and approach

Driven by the questions above, we embarked on a research through design [39] inquiry into how interactive technology may help people to experience joy within forests. We chose to work with that methodology as our goal of exploring alternative paths for design practice aligned well with its *generative* [39] character. Our work unfolded as a set of five co-design interventions (each with its own format and length, described in 3.2) that took place within a year, roughly. Given our pursuit of situatedness, each intervention was different and had its own idiosyncrasy; yet they all shared a set of methodological principles that brought them together. Here we outline these principles:

- **Generative focus:** Aligning with the qualities of research through design [39], we never aimed to understand all possible ways in which interactive tech may support joyful forest experiences (would that even be possible anyway?) or flesh out all the underpinnings of such joyful entanglements. Rather, we sought to identify, foreground, and make actionable a set of alternative avenues for tech design targeting forests – focusing on *generatively* elucidating new possibilities that responded to the joy humans might experience in those forests.
- **Hetereogeneity of settings, participants, and perspectives:** Though we never sought to propose a universally applicable list of all possible joyful avenues to forest-related tech design, we tried to embrace the idiosyncrasies of different forests and human-forest interplays – our aim was to include heterogeneous perspectives of the human-forest interplay. To that end, we situated our work in different types of forests and, embracing a participatory [100] approach, involved a diverse pool of participants in our interventions.
- **Attentiveness to other-than-human livelihoods through sensible co-design within the forest:** Our work engaged with forests as ecosystems that are notably different from e.g. urban spaces. As such, we did not fully break away from the nature/culture divide. We did not fully displace humans from the center of the design process either: though we were inspired by existing research on how to move design beyond human control [4][20][71][106], we still explored how tech might cater to *human* experiences. Despite all that, we frame our work as more-than-humanly sensible: though we centered on human experiences of joy, we always did that through caring, attentive engagement with the other-than-humans that may partake in those experiences, and thus kept their livelihoods and flourishing present at all times. We were inspired by existing techniques that seek to foster kinship with and sensitivity toward non-humans, such as *ecocentrism* [89][94] or *biophilia* [12], and drew heavily from practices such as *noticing* [96] or *attuning* [51].
- **Focus on uncovering and responding to contextually-meaningful forms of joy:** Our focus on joy and playfulness introduces a distinct nuance to existing more-than-human design research: it seeks to elucidate new ways for humans to live rich, meaningful experiences within forests (a pursuit that could superficially be seen as human-centric), yet it does so by tackling the (more-than-humanely sensible) opportunity to shape those experiences in ways that escape anthropocentric ideas of human domination of everything else. While previous works have explored how to cultivate sensitivity and respect in more-than-human interactions, they have not sufficiently explored the experiential richness and emotional engagement that joy and playfulness might bring to them. These qualities are not trivial: they are known to foster meaningful human connections [8], also with(in) forests [5], and as such might support a deeper appreciation of multispecies conviviality. To attend to that potential, we coupled our use of practices akin to more-than-human design with others drawn from playful design. In particular, we drew from the *Situated Play Design* (SPD) methodology [6], which seeks to engage, hands on and skin-to-skin, with the activities taking place in specific contexts to identify latent forms of playfulness that are meaningful in those contexts and use them as starting points for design.
- **Rich lived experiences (rather than actual technologies) as starting points for ideation:** Building on the above, we did not seek to explore a particular kind of technology. As such, we never started ideating with technology in mind. Rather, building on SPD, we began by co-experiencing forests as a way of identifying interactions that could be meaningfully joyful within them – without much consideration of technology to begin with. Then, we built on our shared, embodiedly situated imaginaries of those interactions to envision how *any kind* technology (adopting a broad definition of the word) might respond to that joyful potential.
- **Speculative envisionment of alternative, anti-solutionistic futures:** We aimed to open the doors to a diverse range of possibilities that allowed us to escape the

narrow funnel of productivity-oriented, efficiency-seeking, and/or extractivist approaches that are pervasive in the technology industry nowadays. We did that through speculation [11], seeking to emancipate ourselves from technical feasibility and project exciting future scenarios in a rather unchartered design space.

Building on the above principles, all our interventions shared a similar high-level structure despite their notable differences: They all included ample opportunities for engaging, slowly and open-endedly, with one or more forests, so all those involved (including us) could sensitize themselves to the idiosyncrasies of those forests – in terms of the many livelihoods partaking in them, but also of the many joyful experiences that could be lived within them. Importantly, during those spaces of experiencing we enabled (which participants sometimes undertook alone, sometimes in group, very often in an organic fluctuation between the two), we prompted people to reflect on and discuss their experiences and observations. Then, building on those shared reflexive imaginaries, we facilitated generative conversations to produce ideas of how technology might enable human experiences of joy that might be meaningful in the forests we inhabited, during the activities we did within them. As such, the ideas we produced were heavily anchored in the experiences we had just lived in specific forests, and highly sensible to the many livelihoods (human- and non-) we engaged in those experiences. Below we describe how that overarching structure unfolded in each intervention, showing the breadth of techniques we employed to materialize the principles described above, as well as the diversity of forests we co-experienced and of participants we engaged.

3.2 Data collection through 5 situated co-design interventions

Our research involved 5 co-design interventions where we engaged different kinds of humans and forests to co-create speculative ideas of how interactive tech (present and future) might help to make human-forest interactions more joyful. We describe them below. Though the first author led the facilitation of all interventions, this study not a case of first-person research. Rather, we frame it as a collective inquiry where 250+ people from 40+ countries (spread across the 5 different continents) produced and made sense of 104 ideas of joyful forest technology, which we stored as an *annotated portfolio* [40] and reflexively analyzed. A summary of participants, interventions, and ideas can be found in Appendix 1; Figure 1 shows their look and feel.

3.2.1 Intervention 1: a series of explorations from-the-wild (October – December 2021). The first intervention unfolded as 16 trips to the forest where the first author co-experienced a range of activities to explore their experiential affordances and co-imagine how to joyfully enhance them. The trips took place in Catalonia, a Mediterranean region with both seaside and mountainy areas. They started in October, with mild climate; extended through the Fall, with occasional rains; and ended in December, when mountains were covered in snow. Trips ranged from 30' to 2 days long, depending on the activities involved (running, hiking, camping, foraging. . .), and had diverse setups: Ferran alone, with a pair, with 3-4 people, or with a larger party. 8 people participated overall, all acquaintances of Ferran. Their shared history helped him interpret their contributions. Some trips were organized by Ferran, some by others. They all had motivations besides the research (e.g. foraging mushrooms); we simply used them as opportunities for situated co-experiencing of and -ideation within the forest.

During the trips, Ferran co-experienced the forest and discussed how to joyfully enrich it. Ben documented the trips on a *visual diary*[1] [14], using voice memos, photos, videos, and written notes to synthesize the most relevant events. Though the narratives had an autobiographical tone, they also reflected other participants' experiences; participants always gave verbal consent. Ferran annotated the diary with post-session reflections, engaging in ongoing meaning making alongside data collection. Analyses of fragments of the diary have already been published, e.g. to discuss the playful potential of forests [5] or the methodological underpinnings of co-designing within them [4]. Here we focus on another slice of the data: the 29 design ideas produced by Ferran and his fellow forest-goers.

3.2.2 Intervention 2: a (gameful) conference workshop (April 2022). The second intervention was a 4h online workshop held as part of an academic conference, using Zoom and Miro[2]. The 10 participants came from India, Spain, Turkey, Finland, Germany, Greece, and South Africa; they all consented to participate in our research. The workshop began with a sensitizing activity where everyone involved (including the authors Ferran, Oz, and Juho, who acted as facilitators) created multimedia narratives to share personal forest-related experiences we deemed relevant to the workshop's agenda. Here, the lived experiences we drew upon were anchored in a rich diversity of forests, as they came from our (ours and other participants') past lived experiences situated in forests located in different countries (even continents), socio-cultural contexts, and temporalities. Following that activity, we reflected on each other's stories and discussed their inherent joyful traits. Finally, in groups, we co-imagined speculative artifacts inspired by that *playful potential* [6] and mocked them up on Miro through combinations of text, images, videos, hyperlinks, and/or drawings. Three design ideas were produced and later reflected upon in a group discussion where we examined them through the lenses of joy and multispecies care.

3.2.3 Intervention 3: a three-day retreat at a Finnish lake house (May 2022). Intervention 3 was a three-day retreat at a lake house where a group of technology researchers gathered to discuss their work through close engagement with other-than-humans. It took place in southern Finland, in Spring, when forests were still defrosting, and thus allowed us to co-experience the ecosystem surrounding the lake at a time when snow was still partially present, but Spring was starting to sprout. This intervention included a program of guided activities, as well as open-ended opportunities for engaging the surrounding ecosystem. 9 researchers (including Ferran, Oz, and Juho, who acted both as participants and facilitators) at different career stages were involved, ranging from undergraduate students to full professors. They came from Russia, Turkey, Finland, Spain,

[1]The full visual diary can be accessed at: https://bit.ly/34SJHkd
[2]The Miro board used to facilitate the workshop can be accessed at: https://bit.ly/40LIx2G

Figure 1: Photos illustrating the look and feel of our 5 co-design interventions, including examples of the landscapes we engaged, the activities we did, the materials we used (technological and non-), and the form the resulting speculative ideas took.

Germany, and Greece. They all consented to participating in our study.

As part of the retreat, we ran a *walkshop* [116] to envision joyful forest tech futures. We started by wandering around the surroundings of the lake house, to freely engage nature and reflexively document (however we pleased) our lived experiences and any relevant related memories related to them – not from our role of researchers, but rather from our positionality as forest-goers. Some did that alone, while others co-experienced things together. We gave ourselves prompts such as "*When you are in the forest, try to experiment with your movements. How does it feel?*" or "*Take a close look at the many things you experience in nature. Is there anything you find stimulating?*". Following the walkshop, we gathered to discuss the experiences we had collected (including any past memory we recalled) and identified salient forms of joyful human-forest interaction stemming from them. We then built on that *playful potential* [6] to produce 8 speculative ideas of interactive technology. We materialized these ideas through text descriptions, drawings, lo-fi prototypes made with forest materials, and/or live improvisational enactments, and later discussed them through the lenses of joy and multispecies care.

3.2.4 Intervention 4: a summer school on human-nature interaction design (July 2022). Our fourth intervention was a one-week interaction design summer school, organized by Ferran and Jordi at the design school they are affiliated with in Catalonia. It gathered 5 local students plus 10 from South Korea, all with a background in different specialties within design; they all consented to participating in our research. Through a design case, students used a range of interaction design methods and theories to envision interactive artifacts that supported joyful human-forest interactions. To do that, they engaged local forests (which, like in Intervention 1 involved Mediterranean flora and fauna, but in this case during summertime), reflected on past and present lived experiences within forests (thus also involving experiences lived by Korean students in their local forests), tinkered with different kinds of interactive technologies, and discussed existing forest-related artifacts and experiences. As a result, they produced 5 speculative ideas positing joy at the cornerstone of forest-related tech design. They materialized them through text descriptions, annotated sketches, enactments, and/or mock-ups.

3.2.5 Intervention 5: a one-month backpacking trip into the Spanish wilderness (August – September 2022). Intervention 5 took the form of a backpacking trip Ferran did along *El Camino de Santiago*, a pilgrimage trail that congregates hundreds of thousands of backpackers every year with a remarkably diverse viewpoints, origins, and socio-cultural backgrounds (see *https://oficinadelperegrino.com/en/statistics-2/*). Over 800 km+ hiked for 30 days, Ben and his fellow backpackers co-experienced a broad range of landscapes, including: mountainy trails in the *Pyrenées*, green forests in *Navarra*, vineyards in *La Rioja*, golden fields in *Castilla y León*, endless flatlands in *La Meseta*, a humid valley in *El Bierzo*, or foggy hills in *Galicia*. During his journey, Ferran interacted, in different depths and lengths, with 200+ backpackers from 35+ countries (distributed across all continents except for Antartica) to co-imagine joyful forest tech futures with them. A rich documentation of the trip can be accessed on Instagram (@wildtechresearch). Only the conversations with participants who gave consent were included in this dataset.

Building on prior works that highlight the messiness of forests as sites for co-design [4][32], Ferran avoided a rigid co-creation protocol to privilege the unexpected. He focused, first, on co-experiencing the forests he encountered along the way with other backpackers, during hikes that took between 4-8 hours every day starting early in the morning; then, he built on these situated encounters to stimulate generative [39] conversations among those he encountered. He was particularly interested in the kinds of forest experiences people found fun, joyful, or otherwise stimulating (whatever those qualifiers meant to them); their past experiences with technology use in forests; or their ethical stance towards human-nature-tech interplays. Conversations flowed organically, evolved in directions traced by the group, and yielded diverse insights, such as: rich accounts of experiences lived in forests; reflections on more-than-human interplays (though the concept of "more-than-human" was rarely referred to explicitly, as people often felt more accustomed to terms e.g. "forest", "nature", or "wilderness"); methodological discussions; or concrete tech ideas for enhancing the joys of forest-going. These diverse outputs have and will be disseminated in a range of publications (e.g. [6]). Here we focus on a specific slice of the data: the 58 design ideas created during the trip – some by Ferran, some by others, most as multi-authored amalgamations of different ideas.

3.3 Data analysis

Overall, the 5 co-design interventions yielded 104 design ideas with diverse materializations: text descriptions, narratives, mock-ups, sketches, lo-fi prototypes, enactments, storyboards... To analyze such rich dataset and identify recurrent qualities, we followed a two-step process (Figure 2). Meaning making started during the co-design interventions themselves, where we engaged participants (ourselves included) to reflexively [21] discuss the ideas we kept producing. Those conversations began to uncover recurrent ways in which people thought interactive tech might support joyful experiences within forests. That messy, emergent, and ongoing meaning-making process –which was led by Ferran but also involved the other authors and the many participants they engaged– led to a first list of 9 codes: 9 ways in which interactive tech might support joyful human-forest interplays.

Upon completing the interventions, we moved on to a second phase of analysis where we extended the insights produced during co-design. First, we digitized all design ideas on Miro[3], color-coded based on the intervention they stemmed from. Then, we used *deductive* [87] *affinity diagramming* [74] to cluster all ideas taking the preliminary codes as a starting point. At that stage, we did not pursue a definitive clustering; rather, we sought to challenge the early codes through hands-on, retrospective engagement with the data. That led to a revised list of codes: some were merged for reflecting similar phenomena; others were removed for being residual; some were kept but with nuances; and some newer ones were found, covering previously overlooked data. When consensus was achieved, Ferran did a final round of analysis: he clustered all design ideas based on the final codes, allowing ideas to belong to

[3]The Miro Board can be accessed at: https://bit.ly/4aQXIwk

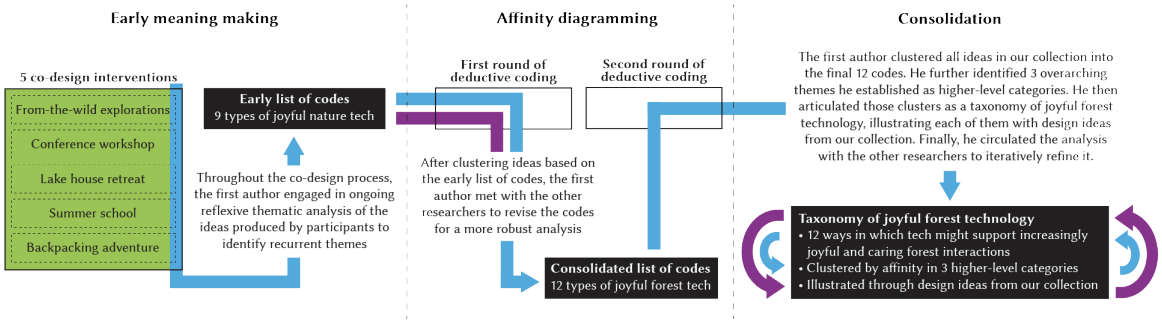


Figure 2: Synthesis of our meaning-making process, including all the phases (boxes with black outline) and outcomes (boxes with black filling). Participants are represented by color: first author (blue), co-design participants (green), and the other authors (purple).

one or more of them. The resulting clusters reflect 12 ways in which interactive tech may support joyful forest experiences. We unpack and illustrate them in Section 4, grouped into three higher-level categories, as a taxonomy of joyful forest technology that shows ways in which joy can be incorporated in forest-related design and research.

3.4 Authors' statements of positionality

Ferran is a white, able-bodied interaction designer in his early 30s whose work explores how to playfully enrich people's day-to-day. He was born and raised in Catalonia and lived in other countries within Europe and in the US. Since his childhood, Ferran is passionate about forests and visits them often to hike, run, camp, forage, or backpack. He is a casual user of forest tech for pragmatic reasons, e.g. he uses a smart watch for running; yet, he is skeptical about the capacity of existing tech to support socio-emotionally rich human-nature interactions.

Oz is a Turkish able-bodied researcher of gameful and embodied tech. He enjoys nature, though being in nature is not an integral part of his life. Since moving to Finland a few years ago, he engages forests more often and takes regular trips a cottage house. That helped him see conflicts in situating tech in forests; he tries to understand how analogue tech (e.g. fire tools, row boats) aligns better with nature's dynamics. Oz defines himself as a gamer, though not a hard-core one (competitive games are not his thing); he is fascinated by imaginative worlds and is fond of experiences of immersion and awe often induced by gameful systems. He hopes his work can help blend the peaceful joy he experiences in forests with the excitement, curiosity, and absorption induced by games.

Jordi is a white, able-bodied man in his early 40s. He was born in Catalonia and lived in other parts of Europe. He works as a lecturer at a design school and is interested in playful educational technologies. Jordi is a passionate forest-goer, and often visits the mountains with friends. As a casual user of technologies such as smart watches, he is excited about their potential to enhance people's connection(s) with(in) forests.

Juho is a white, able-male-bodied person in their early 40s. After a childhood where everyday life and play often took place in forests, Juho has primarily been interested in crafted experiences (chiefly games) and technology. Jo is holistically involved in research related to the relationship between humans and tech, especially in relation to leisure and motivational uses – he has been involved in research exploring human-nature entanglements using a variety of approaches from art and design to strictly controlled experiments.

4 RESULTS: A TAXONOMY OF JOYFUL FOREST TECHNOLOGY

Here we present the results of the reflexive analysis of our 104 speculative ideas: a taxonomy featuring 12 ways in which interactive tech might help people to find joy in their interactions with(in) forests. We illustrate them with concrete ideas from our portfolio, and group them into three higher-level ways for tech to partake in human-forest interplays: (1) making forests' inherent affordances more accessible, (2) augmenting their experiential texture, or (3) scaffolding new forms of forest-related activity. In Section 5 we reflect on the relevance of our taxonomy, arguing for its impact and potential uses, and discuss how its limitations may be addressed in future research. We frame our contribution as *intermediate-level knowledge* [73], i.e. design-oriented knowledge that is inherently in formation, sits at the intersection between theory and practice, and is, by definition, prone to change as design practice evolves. Far from a static contribution, it is an early attempt toward formalizing and making actionable the design space of joyful forest technology – one that builds on emerging conversations initiated by recent works (e.g. [5]). We hope that, however transitory, our work sets a useful frame for designing forest-related experiences that center on joy as a key component – a frame that will be enriched and evolved through future design and research.

4.1 Making the inherent affordances of forests more accessible

Our first category encompasses technologies that foreground, make accessible, or otherwise support the inherent affordances of forests rather than augmenting them with additional traits. As such, they can help identify, access, or enjoy vibrant forest-related experiences that might not need technology mediation but could be supported by it. 69 ideas from our portfolio reflect that approach. Here we build on a selection to illustrate the first 5 taxonomy items:

(a) **StepARt**
Source: intervention #2

(d) **Bring nature home**
Source: intervention #1

(b) **ApprecIT**
Source: intervention #1

(c) **The memory t-shirt**
Source: intervention #5

(e) **Bon vivant shoes**
Source: intervention #5

Figure 3: Co-design participants' visual representations of some of the ideas aimed at making the inherent affordances of forests more accessible: (a) "StepARt"; (b) "ApprecIT"; (c) the "Memory t-shirt"; (d) "Bring nature home"; and (e) the "Bon vivant shoes".

#1: Foregrounding the joyful and pleasurable character of forests (19 ideas). Forests have an inherent for affording rich experiences. Interactive tech could help to point our attention towards the many pleasures that come with them. This taxonomy item thus refers to the idea of using tech not to deliver novel experiences of its own, but to highlight and make accessible existing joys one can experience within the forest regardless of tech mediation. For example, "The art of discovery" is an app that celebrates the discovery of hidden gems of a forest. Through a database of locations that are in some way remarkable, it helps people to find new and exciting places and celebrate those findings. It thus supports two of the inherent pleasures of forest-going: it centers our attention on a forest's multisensory delights and enables us to discover new places and nature forms. Similarly, "StepARt" (Figure 3a) is a *world-as-support* [75] system that guides hikers by projecting digital footsteps on the soil, leading to aesthetically stimulating locations; or "AprecIT" (Figure 3b) is a wearable that reminds us to appreciate the beauty of our surroundings even when we are in the forest for utilitarian purposes (e.g. training) – building on the idea that any visit to the forest can be an opportunity to experience joy. Another way in which tech might help us focus on the forest's inherent pleasures is encouraging sensorial engagement, e.g. "Can you smell. . .?" is an app that challenges people to identify smells in the forest and thus helps them learn how to pay more attention to their senses.

#2: Reminding us to engage forests as rich ecosystems (5 ideas). In the face of the increasing urbanization and digitalization of contemporary life, interactive tech might help foreground the inherent affordances of forests by reminding us to engage them more and better. An example is, "Urban windows into nature", a set of screens located in the urban space that display the forests around it and provide actionable tips for accessing them. By making

nearby forests visible, they become pervasive reminders to engage them. Similarly, "Hey! Emotions! Stick to them!", is a bracelet that reminds wearers how happy they can be in the forest when they are too sedentary. By recalling a smell, the laughter of friends walking down a mountain, the cold from the first ocean dip of the year, or the warm sensation of the winter sun, it entices wearers to repeat those experiences and wholeheartedly stand up.

#3: Enabling remembrance (16 ideas). The inherent joy of forests can also be foregrounded by helping people store and recall experiences they live within them. For example, "Emotion run" tracks people's emotional state while running or hiking (moments of suffering, relief, awe…) so they can recall and (to some extent) relive it later, either at home or while repeating the activity; or the "Memory t-shirt" (Figure 3c) changes its appearance based on where it has been worn, like a wearable album of the ecosystems its owner experienced. Such digitized forms of remembrance might contribute to an increased care for the environment, e.g. "Bring the nature home" (Figure 3d) creates a multisensory bank of the things one finds in forests and then mimics them at home through IoT. As such, it makes possible a symbolic form of human-forest kinship: it allows us to playfully "bring the forest home" and intimately synchronize our day-to-day with other-than-humans, but it does so in a way that seeks to get closer to, rather than dominate, the plethora of living and non-living others we encounter outdoors.

#4: Removing unnecessary unpleasantness or distractions (22 ideas). Technology can also help foreground the inherent pleasures of forests by mitigating things that might disrupt them. An example are effort and struggle: while they can contribute to the richness and depth of forest-related experiences [5], we often fail to wholeheartedly engage other-than-humans because we are too focused on certain meaningless tasks, or because certain annoying layers of the experience overwhelm us to a point that they clog our attention. Tech could mitigate unnecessary traits of forest activity that do not add to the quality of the experience nor enrich our relationship with the ecosystem, allowing us to focus more on its meaningful parts. For example, the "Bon vivant shoes" (Figure 3e), which "prefer to walk on nicer ground", use haptic signals to direct wearers towards softer ground whenever possible, thus enabling a better experience to their feet and allowing them to focus more on the joys of hiking than on the pain derived from doing it wrong. Importantly, providing human comfort does not need to be at odds with environmental care, e.g. the "Foraging basket-companion" hints at how many people have been foraging wherever you are, so you can easily avoid areas that were recently foraged – preventing both a feeling of frustration and an over-exploitation of popular forest spots. It also shows the likelihood of finding certain edibles (e.g. a specific mushroom) based on weather conditions and provides a rationale to empower people to make that judgement themselves. As such, this concept mitigates the potential risk for frustration while keeping a degree of challenge and ongoing learning, both key to foraging. It empowers us to engage with the subtleness of forests as complex networks of living things, a very different approach from e.g. commodifying these forests as easy-access resources for us to effortlessly exploit.

#5: Getting out of the way (7 ideas). Finally, interactive tech may also support the inherent affordances of forests by not being a disruption itself – a relevant consideration given how tech can on occasion detract people from nature [35]. The "Ghost of the forest" glasses exemplify how tech might take such selective steps aside: they help people navigate a forest through an AR ghost that is clearly visible when strictly needed (e.g. when approaching a confusing crossroad) but fades away otherwise. Similarly, "The lazy headlight" only works in extreme conditions (e.g. when it is pitch dark or the path is dangerous) and otherwise emits a minimal light, so wearers realize artificial light is indeed not needed and dare to walk without – thus being able to enjoy the beauty of the forest in the darkness, under the dim light of the moon and stars.

4.2 Augmenting the experiential texture of human-forest interactions

Our second grouping encompasses designs that enhance human-forest interactions with joyful qualities that would not necessarily be available without the mediation of technology. 56 ideas in our portfolio reflect that approach. We use some of them to show three ways in which interactive tech might joyfully augment forests' experiential texture:

#6: Enriching the sensorial experience (21 ideas). Though forest experiences are inherently rich, many of our ideas explored the potential of tech to enhance them sensorially – mostly, by adding additional stimuli that (carefully paired with forests' existing affordances) made for richer, more captivating experiences. For example, "Waves of nature" creates a *sonification* of forests by translating their activity (wind, water movements, colors, temperature…) into procedurally generated sounds, or by tracking people's emotions of certain spots and turning them into music for others who visit them later. Another example is "Metaground", a full-body suit that extends the soil's temperature, humidity, or texture to the wearer's skin so they can feel it with their whole body and senses.

#7: Enabling the super-natural (21 ideas). Interactive media can also augment people's capacity to do, access, or perceive when in the forest, enabling what recent works in HCI call *super-natural experiences* (e.g. [58][77][110]). For example, the "Cut-through-time glasses" (Figure 4a) use AR to allow people to scroll back and forth and see how places look at different times of year. To focus the experience on the qualities of forests rather than on the use humans make of them, instead of allowing a trip through historical moments, it allows circular transition between seasons – thereby pivoting on the cycles of nature rather than on human temporality. Another enabler of super-natural experiences is "C-Nav" (Figure 4b), a glove that signals when interesting things are around and displays holographic information on the user's palm, enhancing their capacity to access information about (and therefore interpret) their surroundings. On a more artsy level, "FlyARt" (Figure 4c) tracks the movements of flying creatures (birds, insects, airplanes. . .) and turns their traces into an ever-changing, ephemeral piece of AR art so people can enjoy through a different lens the movements of flying things, often imperceptible to the naked eye.

#8: Creating a playful disruption (14 ideas). Finally, tech might enrich forest experiences through carefully curated disruptions. The potential of the digital to spark fun and laughter has been explored widely, in and beyond HCI [8][38]. According to our work, that potential might also apply in forests. For example, the "Parrot stick" mocks the behavior of its owner to a point that is both

(a) **Cut-through-time glasses**
Source: intervention #5

(c) **FlyARt**
Source: intervention #5

(d) **Tan art**
Source: intervention #5

(b) **C-Nav**
Source: intervention #4

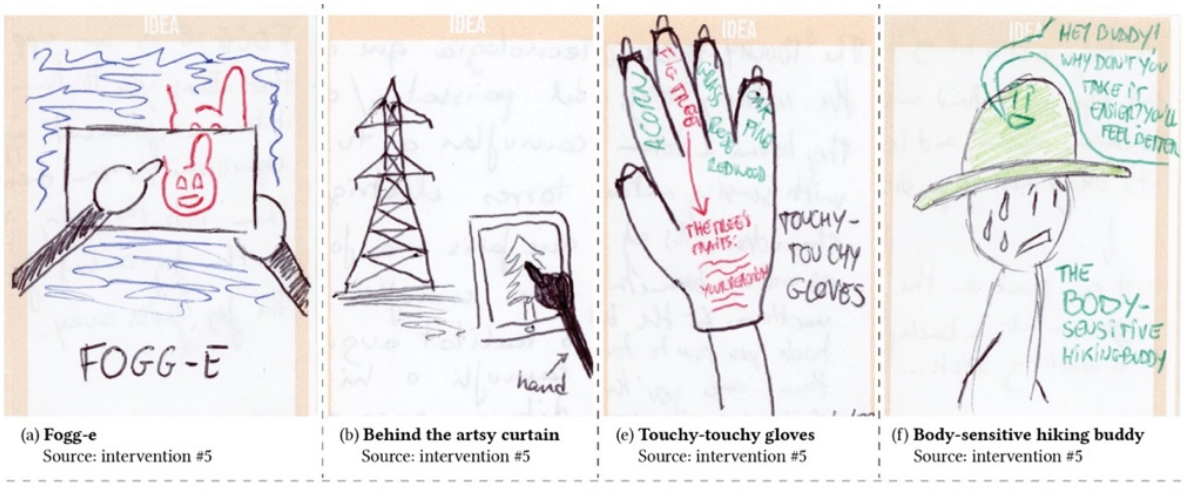
Figure 4: Participants' representations of some of the ideas aimed at augmenting the experiential texture of human-forest interactions: (a) the "Cut-through-time glasses"; (b) "C-Nav"; (b) "FlyARt; and (d) "Tan art".

funny and revealing (e.g. if the owner complains a lot about being tired, the stick acts whiny); or "Tan art" (Figure 4d) is a tiny robot that moves around uncovered parts of the body to block light from them, thereby making ephemeral artistic tan-tattoos that escape people's control or intention.

4.3 Scaffolding richer forms of forest-related activity

Our last higher-level grouping includes 80 design ideas where technology adds joy to human-forest interactions by extending their frame or structure. Here we describe 4 taxonomy items we derived from those ideas:

#9: Affording creative curation of the forest (12 ideas). Humans have long engaged forests as creative sites. Technology might augment that, enabling caring forms of creative curation that do not harm the environment. For example, "MySpot" is an XR app that allows people to customize forest spots they feel attached to by adding multimedia attire to them. Such virtual layer onto the physical space allows customization that does not harm the forest or its inhabitants; or "Fogg-e" (Figure 5a) is an AR app that turns foggy days into ephemeral opportunities for creative expression, allowing people to make doodles and stick them onto the fog for others to see until it fades away. The potential of these artistic augmentations may transcend decoration, e.g. "Behind the artsy curtain" (Figure 5b) uses AR to enable artistic drawings on top of or around unwanted human interventions (e.g. a light tower), allowing people to subtly rework damaged parts of a forests so they can be seen in another light.



(a) **Fogg-e**
Source: intervention #5

(b) **Behind the artsy curtain**
Source: intervention #5

(e) **Touchy-touchy gloves**
Source: intervention #5

(f) **Body-sensitive hiking buddy**
Source: intervention #5

(a) **Kita**
Source: intervention #4

Figure 5: Participants' representations of some ideas aimed at supporting richer forms of forest-related activity: (a) "Fogg-e"; (b) "Behind the artsy curtain"; (c) "Kita"; (d) "Co-machine"; (d) the "Touchy-touchy gloves"; and (e) the "Body-sensitive hiking buddy".

#10: Supporting sociality (31 ideas). Technology can also extend forests' affordances as spaces of conviviality, e.g. "Geo-smiling" is a socio-emotional reinterpretation of geo-catching where, instead of taking and leaving physical objects, people leave smiles. Quite similarly, the "Kita" (Figure 5c) AR googles allow people to see digital footprints of other people's presence in forests. People can leave spoken, written, or drawn messages, which will be accessible once someone steps on them. That social dimension of forest-going might also be enhanced by helping groups of people pay closer attention to each other. For example, "The hive hiking t-shirt" tells people how others are doing during a hike: how they deal with the walking pace, if they are tired or in pain… It does so in an embodied, ambiguous way, as a sort of sixth sense that centers people's attention on the wellbeing of the group so everyone's needs (bodily and emotional) are collectively taken care of. Forest tech may also enable asynchronous forms of social engagement, e.g. "Walking on an acquaintance's boots" are a pair of boots that vibrate every time you approach a place where someone you know stood before, so you can fantasize about who that was and what they were doing.

#11: Re-ambiguating forests as playgrounds (20 ideas). Game-inspired interventions can reframe forests as playgrounds and thus help people discover new sources of joy in them. For example, "Guess what this is?" extends other wildlife pedagogy apps by not providing direct information and turning queries into a guessing/betting challenges. As people hike, the app scans the surrounding ecosystem and poses relevant questions. That way, people learn through active play rather than by passively consuming facts. Another example is "Up in the clouds", an app that challenges people to find clouds that resemble certain shapes or guess what clouds look like. Those gameful re-purposings can also be social, e.g. "Punish-r" is an app for group hikes that playfully punishes and rewards people (e.g. carrying everyone's bottles for a while), in ways that seek to add spice and laughter to the adventure.

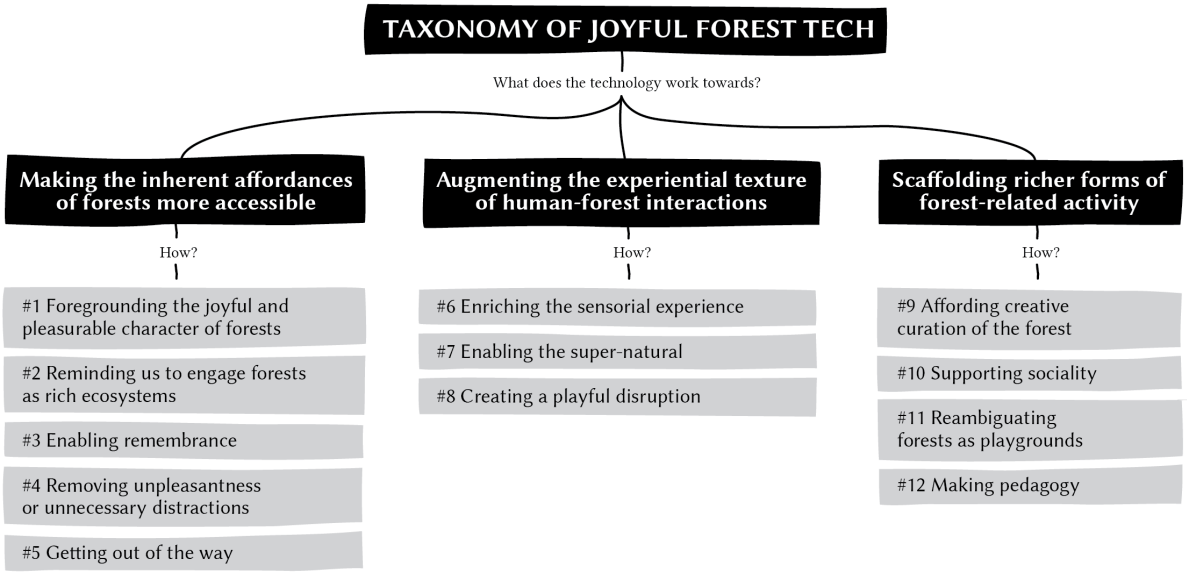


Figure 6: Synthesis of our taxonomy, featuring 12 ways for tech to support joy in forests, clustered in three higher-level groupings.

#12: Making pedagogy (17 ideas). Finally, technology-scaffolded activity may also help people learn how to find joy within forests in ways that are more-than-humanly caring. For example, the "Touchy-touchy gloves" (Figure 5d) store and display anything you touched while wearing them and thus become a token of your hands' experience with other-than-humans. Importantly, in early use, the gloves teach how to interact (or not) with different forms of wildlife in ways that are not damaging; once you are already familiar with them, they stop making active pedagogy and only intervene if needed, as reminders to act with care. Pedagogical forest tech may not only remind us to care for the environment; it may also help us better attend to our wellbeing. For example, the "Body-sensitive hiking buddy" (Figure 5e) is a wearable that helps people find and embrace their healthy walking rhythm. Some of these kinds of pedagogical artifacts may benefit from a crowd-sourced intelligence, e.g. "Wisdomer" is an app where people can leave geo-located pieces of forest-related wisdom, ready for others to find as they delve into these areas.

5 Discussion

5.1 Contribution and relevance

Our taxonomy highlights different ways in which interactive tech might support human-forest interactions that are experientially rich for humans. Figure 6 synthesizes them. Its focus is explicitly joyful: e.g. it suggests how, by *foregrounding forests' joyful and pleasurable character* (taxonomy item #1), we can help people identify, make sense of, and embrace the many opportunities for living rich experiences they can find in forests. By positioning joy as a central agenda in the design of forest-related artifacts and experiences, our work shows there is much more tech can do than supporting efficient and productive human-forest interactions – which (as recent works e.g. [5] have begun to suggest) better reflects the rich, multi-faceted character of human-forest interplays. However transitory (as any intermediate-level knowledge piece [73]), the value of our work lies in its generative [39] potential: it is an operational frame, with different shades of granularity, for designing forest-related technology with joyful agendas. It should be used as a starting point for envisioning tech that helps to realize the potential of forests as homes to rich lived experiences: to identify opportunities for joyful intervention, strategically determine the targeted impact, and weave the foundations of new designs that celebrate forests as joyful, convivial spaces.

We stress the societal relevance of our design research agenda of reclaiming joy as a precious thing we all should have the right to experience. Especially in the Western world, contemporary lifestyles often neglect the importance of socio-emotional flourishing under the assumption (implicit or explicit) that it is secondary to more "serious" concerns like professional or economic growth [15]. Building on a longstanding tradition of playful HCI, we see the pursuit of joy as inherently political [41], as a deliberate attempt to contest narratives positioning productivity as the ultimate pillar of human life. Taking that as a driving force, we hope our work foregrounds the idea that there is value in designing things (technological or non-) that support people to engage forests "just because" – with no other aim than experiencing rich connections with themselves and with their other co-inhabitants. Interestingly, many ideas in our portfolio show that supporting these kinds of experiences does not need to be at odds with some utilitarian activities people do in forests, e.g. "AprecIT" (tax. item #1) is a device that can help people pay attention to the beauty of their surroundings even if they are engaging in an outcome-seeking activity like training or foraging.

5.2 Breadth, depth, and representativity of perspectives and imaginaries

Our work is grounded in a rich, year-long co-design process. Through 5 co-design interventions, we involved 250+ forest-goers with diverse lived experiences with and opinions of both forests and technology (and anything in-between). They were different ages and had diverse professional, cultural, and socio-economic backgrounds; 40+ nationalities (from 6 out of the 7 continents) were reflected in the data. Participants also had diverse positionalities regarding technology use in forests (and beyond), ranging from tech enthusiasts (or even experts) and all the way to skeptics or even detractors. Regardless of their positionality, all participants could contribute to our collective processes of imagination, meaning making, and reflection. An anecdote from Intervention 5 illustrates that very well: After having backpacked with Ferran for about a week, a participant showed initiative to document a set of experiences she had lived, as well as a design idea that stemmed from them. While she was writing and drawing, she got honest: "When I first heard about your research, I thought it was bullshit. I thought it did not have anything to do with me or what I stood for. But having hiked with you, talked with you all, experienced things together... Having thought this all through, now I get it! There is something really powerful about chasing ways of experiencing joy when in nature. And why should we renounce the help of technology, if it indeed can be of help every now and then even if not always?" (Catalan–English translation by the authors). This anecdote does not only show how different perspectives are represented in our research (even those of *technophobics*, which we clearly are not); it also illustrates how our slow, situated, and experience-driven way of co-designing allowed different (and often colliding) viewpoints to come together, inform and enrich one another, and add up to a surely more interesting and representative whole. Our pursuit of choral conversations was deliberate: in all interventions we facilitated an atmosphere that was low-key, inviting, and reflexive, seeking to make diverse perspectives to feel at ease. That was possible due to the amount of time we spent with participants: sometimes through short hikes, sometimes through activities that required overnight stays, sometimes through multi-day adventures that involved sharing intimate experiences of effort or even discomfort. That skin-by-skin process of living-with helped bring together clearly different people in conversation to co-experience, make sense of, and creatively address a broad range of forests and forest-related activities. That resulted in a rich portfolio of 104 ideas of how interactive tech might help to add joy to human-forest interactions, from which we derived our taxonomy of joyful forest tech.

Despite the breadth and depth of our engagements, and the diversity of viewpoints involved, we frame our work as a useful early frame rather than a fully fleshed, universally generalizable taxonomy. In our interventions, we inevitably could not embrace all joyful experiences one could possibly live within a forest; for example, in our visits to the forest we did not involve (or even casually encounter) people with motor disabilities, or we mostly engaged forest-goers (i.e. people who *visit* the forest) rather than forest-dwellers (i.e. people who *live* in the forest). Similarly, we did not encompass all a forest might be: though we co-designed within a broad palette of forests, climates, and timeframes, our work cannot be considered complete in that regard. Future work should look at what kinds of ideas might emerge in other settings (geographical, biological, temporal...). Further, we did not explicitly account for the socio-political dimensions of forests, e.g. the regulations different communities devise for their local forests, or the cultural assumptions and beliefs different communities project on these forests. And while it is true that our pool of participants reflected 40+ nationalities from 6 out of 7 continents, the research was still situated in Europe, which likely impacted how non-European experiences and viewpoints came into play. Insofar as all forests we engaged were European, our ideation and meaning making were catalyzed by experiences lived in interaction with European geographies, flora, and fauna; even if conversations were enriched through perspectives of participants with lived experiences in other lands, such anchoring in the European context was still impactful. For all the above, we see an opportunity broaden our work to account for layers of forest experiences that may be idiosyncratic to a broader set of population types, and to examine their socio-political underpinnings more deeply. Particularly, we see a need for extending our explorations by situating them in non-European contexts, to explore better and in more depth other non-European (and also non-Western, for that matter) forest-related experiences and ways of life.

Another aspect overlooked by our analysis is the fact that our participant pool included people with a broad range of professional backgrounds; only some worked in design/IT. Though an overview of our portfolio did not reveal noticeable differences in people's ideas depending on professional background, we cannot assert a more focused analysis would not reveal them. In this study, we engaged all participants equally through their condition of forest-goers; the differences in their views based on professional background could be explored in future work. In that regard, we would also like to circle back to our positionalities as researchers and how they might have impacted this study – in particular, the first author's. Though Ferran was the lead facilitator of all the interventions, we do not see our work as autobiographic. Rather, we frame it as a rich and highly situated co-creative inquiry where a large and diverse crowd produced and made sense of ideas that we (the four authors) then systematically analyzed. Our positionalities, including Ferran's, did not privilege any particular view on how technology should partake in human-forest interplays. Throughout our study, we avoided steering conversations toward design ideas we personally felt inclined to explore or experience; we only expressed opinions and beliefs as any other participant would, and avoided imposing opinions on others or having them dominate conversations.

We only tried to influence conversations in situations where we felt certain values had to be upholded (joy, conviviality, environmental awareness...). Participants rarely drifted toward ideas that could be damaging to the environment, but in the very few instances when we felt that might be happening, we invited them to examine these ideas critically, to reflect on and discuss them, and to turn them around to better attending to more-than-human flourishing. In other words, our positionalities were reflected more in our methodology (i.e. in the ways we engaged participants and invited them to engage their surroundings) than in the ideas we

collectively produced. Even in the later phases of meaning making (which were mostly performed by us) we retrospectively *examined* (not *modified*) the portfolio of ideas aiming to reflect a diversity of perspectives beyond our own. That is reflected in the taxonomy – to a point that, in fact, many design ideas and human-forest-technology interplays they represent diverge from our personal views and experiential preferences. Thus, our contribution does not uniquely reflect our own take on how technology might joyfully partake in the human-forest interplay; it echoes a diverse, eclectic, and multi-faceted set of perspectives on how designers might imbue forest experiences with joy. We argue for its representativity: however incomplete, it reflects the idiosyncrasies of a diverse pool of forest-goers, nature forms, and forest activities. It is a first operational (albeit in-progress) conceptual structure for the design space of joyful forest tech.

5.3 Underlying values and intended non-extractivist uses

Though we are excited about the potential of our work to inspire designs that add value in forests, we stress the importance of approaching it with a certain degree of techno-skepticism. Indeed, tech is not the ultimate solution to everything [81], nor is it strictly needed to experience joy [109]. As suggested by [16], a valid outcome of design research can be realizing that tech, in fact, might sometimes be unnecessary, or even detrimental. Prior works have shown how tech, if built with the wrong affordances, can be environmentally damaging (e.g. [5][35]). It would be naïve (or even dangerous) to think of interactive tech as the one and only enabler of joyful human-forest interplays. Our study embraces and (to some extent) illustrates that idea. First, in the very results: our taxonomy items generally position tech as a secondary actor, one that seeks to highlight and reinforce the inherent joys of forests rather than propose novel experiences of its own. In fact, there is even one taxonomy item (#5) that suggests technological disconnections as a promising enabler of joyful forest experiences – speaking to how certain joys of forest going can only be accessed if tech takes a step aside, as noted by e.g. [51]. Most of the other taxonomy items focus on foregrounding (#1), enriching (#6), enabling (#3, #7) or supporting (#10) already existing but often overlooked experiential affordances of forests, and only a few suggest delving into novel experiences (#8, #9).

The capacity of forest experiences to be joyful regardless of technology was not only visible in our results, but also throughout our co-design process: our ideas stemmed from rich experiences we lived with other people as we shared time in forests, often without the mediation of technology. As described in Section 3, such participatory and situated process (arguably akin to feminist [13] and anti-solutionistic [18][81] practices gaining traction in HCI) embraced care and sensitivity as steppingstones for future-making. In those interventions, it was often clear, both to us and to our participants, that tech was not strictly needed to live joyful experiences – it simply showed promise to add value in certain ways, scenarios, and events. We thus suggest designers should carefully and critically reflect on the need for, and appropriateness of incorporating technology in any given forest activity. They should assess whether its implementation may or may not add value (and how), and only materialize it if there is promise of meaningful impact. Given the nature of our research aims, the ways in which we devised and enacted that research (as described above), and the qualities of the outcomes that derived from it (discussed in more detail below), we are confident that the conceptual structure offered by our taxonomy can help to do that.

We stress the *non-extractivist* framing of our work: it foregrounds opportunities for supporting experiences that are meaningful, joyful, and convivial, and should not be used to design things that may inflict harm upon any actor of the human-forest interplay – even if playfully. By *extractivism* [105], we mean the idea that things (in this case, forests, and anything within them) are just resources for humans to exploit. We oppose approaching forests as products for human consumption, even if that consumption is joyful; we build on the premise that they are not something we should productify. As such, we see tech as a promising enabler of joyful human-forest interplays, yes, but we stress the need to articulate those in ways that are sensible to more-than-human concerns and livelihoods. We thus reiterate that adopting the taxonomy without attending to its celebratory, convivial, and non-extractivist character may lead to undesirable effects that can be harming for people and forests alike.

5.4 Positioning within more-than-human design research

Because of the values discussed above, throughout our study we put utmost importance to enact our process (including interactions both with the humans we co-designed with and with the other-than-humans we engaged along the way) in ways that were non-extractivist. Our facilitation sought to allow conversations to emerge naturally as we naturally co-experienced things, allowing everyone to engage at their own pace, with their own perspective, and in the depth and intensity they wanted. Likewise, we made use of our privileged position as facilitators to ensure we were always mindful of the livelihoods of other-than-humans we interacted with. That is, perhaps, the way in which our own positionality as researchers was most impactful throughout the study, especially during the co-design phase – not in the kinds of ideas we produced (which reflected the views of all participants, not only ours) but in the values we imbued into our co-design process as we invited others to co-experience, -imagine, and -reflect with us. In that sense, as noted in Section 2, though our work mostly targeted humans and human experiences, we still frame it as more-than-human oriented: we engaged the plethora of other-than-humans we encountered in a humble [92], caring [85], slow [108], and embodiedly situated [48] way, all qualities that are at the core of what we understand by more-than-human design and research.

In fact, probably due to all the above, most ideas in our portfolio project a sense of multi-species conviviality. For example, the "Foraging basket-companion" (tax. item #5) helps to subtly "read" a forest so one can learn to better forage within it – "better" meaning "better for all parties involved". Rather than enabling easy-access, effort-free collection of fungi, the basket empowers us to understand the current state of the forest where we are sitting: Does it present the right conditions for mushroom growth? Has it been foraged recently? That discourages practices that are known to

be damaging (e.g. overexploitation or floor trampling [34]) while supporting foraging in spots where mushrooms are at full bloom – which is known to contribute both to the flourishing of mycelia [91] and to people's sense connection with forests [24]. That non-extractivist, more-than-humanly sensitive orientation permeates into the taxonomy we derived, for example: taxonomy items #1 and #5 call for noticing [107] other-than-humans and delving into convivial experiences with them; items #6 and #7 explore how to make the influence of those other-than-humans more perceptible to humans, both aesthetically and sensorially, thus facilitating attunement [78] and trans human/species [55] understanding; or item #12 paves the way for multisensorial pedagogy of how to interact with other-than-humans in equally joyful and caring ways, thus emphasizing ecological respect and preservation.

We recognize, however, that some of our taxonomy items are less explicit in their non-extractivist ambitions – and that, as such, they may risk being interpreted otherwise. For example, if approached without the context provided in Section 4, the idea of "Reambiguating forests as playgrounds" (tax. item #11) might spur designs that exploit forests as yet another human entertainment product; or, if read superficially, the idea of "Removing unpleasantness or unnecessary distraction" (item #4) might wrongfully be seen as a call for designing tech that removes the (rather lovely) messiness of forests and turns them into sterile sites for easy-access human joy. Aligning with other works in more-than-human design (e.g. [26]), we would find that problematic. There is always a chance that our work is misused (as happens with any form of generative knowledge), e.g. to create games privileging economic revenue over genuinely joyful experience, as is known to be common in mobile games [9][45], or to support joyful experiences that, though beneficial for humans, cause a harm to other things around them. Though the taxonomy does not call for these practices (nor does our way of bringing it forth), in future research we aim to deepen our understanding of the opportunities the taxonomy items give rise to and, in doing so, more confidently steer designers in directions that support (or at least respect) the flourishing of all, human- and non-.

When examining our work from a more-than-human stance, we also acknowledge another limitation: the design ideas, and the taxonomy they yielded, target human experiences only. They were created by humans, looking at joy from a human point of view. Our situated co-design encounters were indeed influenced by our interactions with other-than-humans, living and non-; being physically and mentally close to them helped us embrace an empathic perspective of co-existence. However, even if we dearly engaged other beings throughout the process, we (as human designers) inevitably projected our own (human) perspectives onto our designs. And even if some of the resulting ideas show promise of also catering explicitly to more-than-human flourishing (we unpack that potential below, in 5.5), in its current form the taxonomy does not directly account for non-human joyfulness. Given that, at this stage, we humbly frame our contribution as one that mostly caters to experiences that are joyful for humans. As also noted in Section 2, that does not mean our work is not akin to more-than-human concerns: it aligns with more-than-human perspectives modestly, not by fully displacing humans from the design process but by catering to human experiences in ways that attend to the livelihoods of other beings as well, living and non-. We take the limitations of our work from a more-than-human perspective as an opportunity rather than a drawback: in future research, we will engage non-humans more actively to also attend to the joys that might be experienced by them. Taking fully non-anthropocentric views is not easy [115] and requires deliberate attention and humbleness [56]; as some have noted before, any type of joy that we project on non-humans might be from our human perspective after all [43], and that in and of itself challenges engaging designerly with such phenomena. However difficult that may be, though, we are excited about the prospect enriching our taxonomy by also encompassing the joys that might be experienced by other-than-humans. We look forward to seeing other more-than-human design researchers join us in our efforts, broadening the scope of their work towards designing for celebration and joy.

5.5 What if "joyfully human" could also mean "more-than-humanely caring"?

As noted in 5.4, though our study mostly looked at joyful forest experiences from human perspectives, we argue that both our process and the resulting ideas reflect a deliberate attention to more-than-human flourishing. Throughout, from the very first co-design intervention and all the way to the last analytic discussion, we avoided approaching forests as resources for humans to exploit. We engaged them deeply and empathically, to observe, understand, and even experience how interacting within them might bring us joy. As a result of our deliberate focus on *being with* [106] and *(co-)designing within* [4] forests, the ideas we produced shed light on human-forest interactions that (let it be explicitly or implicitly) project a sense of care toward other-than-humans. Interestingly, as our meaning-making evolved alongside our co-design efforts, we (us, our participants) began to see an exciting overlap between those two notions in the context of forests: joy and care. We realized many ideas in our portfolio supported experiences that were implicitly caring. The "Cut-through-time glasses" (tax. item #7) illustrate that: they allow the wearer to scroll back and forth through time and see how a forest looks like at different times of the year. As such, they support richer, more nuanced ways of relating with forests (as a complex living systems) and their different temporalities. They enable experiencing and sense-making through a temporal frame (the cyclic flow of seasons) that is inherently more-than-human and escapes human-centric mental models, e.g. the hour-, year-, century-based model we often use to deal with time. Another example is "Bring the nature home" (tax. item #3), which allows people to create sound or color banks of their forest experiences and then see their house mimic it through IoT. By metaphorically (rather than materially) collecting parts of forests and bringing them home, people can symbolically synchronize their day-to-day with the ecosystem and connect more with, rather than dominate, the plethora of living and non-living others they encounter out there.

This and other ideas show ways in which supporting human joy within forests might in turn nurture an increasingly caring and empathic relationship with forests, as well as a deeper engagement with more-than-human concerns. Hence, we bring forth the (still incipient) idea that by purposefully designing for certain forms of

human joy within forests we may be able to foster increasingly caring human-forest interplays – ones where humans empathically position themselves (and flourish) alongside other beings, see them as "play partners", and avoid narratives of "us versus them". As prior works began to hint, the value of being able to play and enjoy together the world we live in with non-human species might be a promising a pathway towards diminishing the nature/culture divide and adopting *natureculture* perspectives [102]. We are excited by that promise and, building on the early insights from our work, we look forward to further exploring if and how supporting joyful human experiences within forests might in turn help nurture more-than-human entanglements that are more resilient and caring.

5.6 Future work

Given the transitory nature of our intermediate-level contribution, our future efforts will be put to consolidating it. We will do that in different ways. First, we will extend the taxonomy by broadening the palette of joyful experiences embraced: we will engage other kinds of forests, and we will do so with other stakeholders. We hope that helps to make the taxonomy more representative and open it up more explicitly to more-than-human concerns. Second, we will deepen our understanding of all taxonomy items to explore how they might spur designs that are holistically valuable. We are excited about the potential of research through design as a platform for doing that: exploring the taxonomy items in designerly ways, hands-on and in practice, will create the right conditions for anticipating their potential impacts and projecting non-extractivistic ways of realizing them. We seek to extend conversations in more-than-human design research (which have to date been more conceptual than tangible [42]) into a hands-on design practice. Third, we will build upon the early findings from this study to further inquire into the relationships between "joy" and "care" – in particular, to explore how supporting joyful human-forest interactions might help, in turn, to make those interactions more caring. Our aim is to shed light on how, by fostering celebration of human-forest interplays and the inherent joy they can provide, we might help people grow increasingly empathic to anyone and anything involved in them. Furthering our understanding of the dynamics between joy and care might allow us to incorporate the latter (as defined by e.g. [93]) as an explicit dimension of our taxonomy, rather than as a suggestion for how to use it as happens now. We are positive that such a move would enhance the potential impact of the taxonomy when it comes to designing tech that is holistically beneficial, also in more-than-human terms.

Once the above future work plans are consolidated, we will begin to use the taxonomy to design, prototype, and evaluate joyful forest technologies for specific use cases. Through those case studies, we hope to explore more in depth the different taxonomy items and expand our understanding of how they can be designed for, leading to a comprehensive framework for designing joyful (and caring) forest technology. While we create that framework, we would also like to identify, further unpack, and creatively experiment with aspects of our dataset that emerged in our analysis but were not explicitly reflected in the taxonomy. For example, we found several ideas involving playful or gameful interactions with the sky; we wonder whether that could give rise to "sky games" as a new genre of more-than-humanely oriented playable media. In the future, we would like to pay closer attention to such kinds of interesting themes emerging in the data and explore their potential to inspire forest-related experience design.

Finally, it was out of the scope of this paper to discuss how the ideas in our portfolio might be translated from research concepts to commercial designs, or to what extent the joy these ideas may enable would justify the introduction of new technology. We see those as important matters. In fact, in many conversations we had with other forest-goers, that question came up quite often: "It would be great to have these kinds of tech, but will the tech industry pick up on the idea of privileging joy and care over productivity and revenue?". Arguably, it is not far-fetched to believe some of the ideas in our portfolio might easily be adopted by the industry. For example, "Hey! Emotions! Stick to them!" (tax. item #2), reminds people about the joys of visiting the forest so they decide to do it more often, a functionality existing wearables e.g. the *Fitbit* could use. However, many of our ideas build quite heavily on the premise of privileging joy (and, in many cases, also care) over productivity or profit. How these kinds of non-extractivist concepts may (or may not) be adopted by the industry is a relevant concern – one the interaction design community has not been able to successfully answer yet. Further, we acknowledge that the production of new technology is often subject to extractivist practices (e.g. through the use of limited materials, the emission of polluting residue, the questionable work conditions imposed upon unprivileged communities...). We are aware of and highlight the problematics derived from that. We thus suggest that future work (ours and others, likely in multi-disciplinary collaboration with scholars from other fields like sociology, economics, or STS) should explore how these kinds of anti-solutionist futures might be pragmatically and realized, even if that means transcending current dominant modes of production and consumption. In HCI, there are works that have explored how tech design and consumption might be enacted through other forces than those currently driving the tech industry (e.g. works on *DIY cultures* [64], on *degrowth* [101], or on the ideal of *anarCHI* [69]). Building on these, we argue future research should investigate how the idea of creating joyful and caring forest technology might evolve from an academic ideal to a real-world, palpable change.

6 Conclusion

In this paper, we presented intermediate-level knowledge [73] in the form of a taxonomy of joyful forest technology highlighting 12 ways in which interactive tech might help people find joy in their interactions with(in) forests. The taxonomy stemmed from a reflexive analysis of 104 speculative ideas produced through 5 co-design interventions involving 250+ participants. To make it manageable and actionable, we clustered the 12 joyful forest tech types as three higher-level categories that reflect different ways in which interactive tech may joyfully intervene in the human-forest interplay: (1) making the inherent affordances of forests more accessible, (2) augmenting their experiential texture, or (3) scaffolding new forms of forest activity. Our contribution provides an early operational frame for designing tech that supports joyful human-forest interactions. It can support the design of experiences that

are also more-than-humanly caring and, by extension, holistically beneficial – for humans and beyond.

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References

[1] Eshtiak Ahmed, Oğuz 'Oz' Buruk and Juho Hamari. 2024. Human-Robot Companionship: Current Trends and Future Agenda. *International Journal of Social Robotics*, 1-52. https://doi.org/10.1007/s12369-024-01160-y

[2] Yoko Akama, Ann Light, and Takahito Kamihira. 2020. Expanding Participation to Design with More-Than-Human Concerns. In *Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 1* (PDC '20). Association for Computing Machinery, New York, NY, USA, 1–11. https://doi-org.libproxy.tuni.fi/10.1145/3385010.3385016

[3] Andreas Almqvist, Anders Hedman, Adrian K Clear, and Rob Comber. 2023. Different Together: Design for Radical Placemaking. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 599, 1–16. https://doi.org/10.1145/3544548.3581080

[4] Ferran Altarriba Bertran, Oğuz 'Oz' Buruk, and Juho Hamari. 2022. From-The-Wild: Towards Co-Designing For and From Nature. In Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems (CHI EA '22). Association for Computing Machinery, New York, NY, USA, Article 315, 1–7. https://doi.org/10.1145/3491101.3519811

[5] Ferran Altarriba Bertran, Oğuz 'Oz' Buruk, Velvet Spors and Juho Hamari. 2023. Playful Inspiration for a New Wave of Joyful Forest Technology. In Designing Interactive Systems Conference (DIS '23), July 10-14, 2023, Pittsburgh, PA, USA. ACM, New York, NY, USA, 24 pages. https://doi.org/10.1145/3563657.3596015

[6] Ferran Altarriba Bertran, Jordi Márquez Puig, Maria Llop Cirera, Eva Forest Illas, Joan Planas Bertran, Ernest Forts Plana, Oğuz 'Oz' Buruk, Çağlar Genç, Mattia Thibault, and Juho Hamari. 2023. Designing and Using the Wild Probes Toolkit (v1) to Co-Design From-the-Wild. In Proceedings of the 2023 ACM Designing Interactive Systems Conference (DIS '23). Association for Computing Machinery, New York, NY, USA, 765–778. https://doi.org/10.1145/3563657.3596102

[7] Ferran Altarriba Bertran, Elena Márquez Segura, Jared Duval and Katherine Isbister. 2019. Chasing Play Potentials: Towards an Increasingly Situated and Emergent Approach to Everyday Play Design. In *Proceedings of the 2019 on Designing Interactive Systems Conference* (DIS '19). ACM, New York, NY, USA, 1001-1015. DOI: https://doi.org/10.1145/3322276.3322325

[8] Ferran Altarriba Bertran, Elena Márquez Segura and Katherine Isbister. 2020. Technology for Situated and Emergent Play: A Bridging Concept and Design Agenda. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (CHI '20). Association for Computing Machinery, New York, NY, USA, 1–14. DOI:https://doi.org/10.1145/3313831.3376859

[9] Fernando R. H. Andrade, Riichiro Mizoguchi, & Seiji Isotani. 2016. The bright and dark sides of gamification. In *International conference on intelligent tutoring systems* (pp. 176-186). Springer, Cham.

[10] Arts, I., Fischer, A., Duckett, D., & Van Der Wal, R. (2021). Information technology and the optimisation of experience–The role of mobile devices and social media in human-nature interactions. *Geoforum*, *122*, 55-62.

[11] James Auger. 2013. Speculative design: crafting the speculation. *Digital Creativity*, *24*(1), 11-35.

[12] Barbiero, G., & Berto, R. 2021. Biophilia as evolutionary adaptation: An onto-and phylogenetic framework for biophilic design. *Frontiers in psychology*, *12*, 700709.

[13] Shaowen Bardzell. 2010. Feminist HCI: taking stock and outlining an agenda for design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '10). Association for Computing Machinery, New York, NY, USA, 1301–1310. https://doi.org/10.1145/1753326.1753521

[14] Ruth Bartlett & Christine Milligan. 2015. *What is diary method*?. Bloomsbury Publishing.

[15] Miguel Basáñez. 2016. *A world of three cultures: honor, achievement and joy*. Oxford University Press.

[16] Eric P. S. Baumer and M. Six Silberman. 2011. When the implication is not to design (technology). In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI'11). Association for Computing Machinery, New York, USA, 2271–2274. https://doi.org/10.1145/1978942.1979275

[17] Howard Berenbaum. 2002. Varieties of joy-related pleasurable activities and feelings. *Cognition & Emotion*, *16*(4), 473-494.

[18] Mark Blythe, Kristina Andersen, Rachel Clarke, and Peter Wright. 2016. Anti-Solutionist Strategies: Seriously Silly Design Fiction. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (CHI '16). Association for Computing Machinery, New York, NY, USA, 4968–4978. https://doi.org/10.1145/2858036.2858482

[19] Bødker, S., Dindler, C., Iversen, O. S., & Smith, R. C. 2004. What is participatory design?. In *Participatory design* (pp. 5-13). Cham: Springer International Publishing.

[20] Andrea Botero Cabrera, Markéta Dolejšová, Jaz Hee-jeong Choi, and Cristina Ampatzidou. 2022. Open forest: walking with forests, stories, data, and other creatures. interactions 29, 1 (January - February 2022), 48–53. https://doi.org/10.1145/3501766

[21] Virginia Braun & Victoria Clarke. 2019. Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11(4), 589-597.

[22] Barry Brown & Oskar Juhlin. 2015. *Enjoying machines*. MIT Press.

[23] Burchett, K. 2014. Anthropocentrism and nature. *Attempt Reconcil. Teor*, *34*, 119-137.

[24] Butler, A., Ångman, E., Sang, Å. O., Sarlöv-Herlin, I., Åkerskog, A., & Knez, I. (2021). "There will be mushrooms again"–Foraging, landscape and forest fire. *Journal of Outdoor Recreation and Tourism*, *33*, 100358.

[25] Robin L. Chazdon, Pedro H. S. Brancalion, Lars Laestadius, Aoife Bennett-Curry, Kathleen Buckingham, Chetan Kumar, Julian Moll-Rocek, Ima Célia Guimarães Vieira & Sarah Jane Wilson. (2016). When is a forest a forest? Forest concepts and definitions in the era of forest and landscape restoration. *Ambio*, *45*(5), 538-550.

[26] Patricia Ciobanu and Oskar Juhlin. 2022. Me, the Hill and My Browser – Investigating the Role of Time in Posthuman Interaction. In *Nordic Human-Computer Interaction Conference* (NordiCHI '22). Association for Computing Machinery, New York, NY, USA, Article 71, 1–12. https://doi.org/10.1145/3546155.3546651

[27] Paul Coulton & Joseph Galen Lindley. 2019. More-than human centred design: Considering other things. *The Design Journal*, *22*(4), 463-481.

[28] S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). 2019. *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. IPBES secretariat, Bonn, Germany. 56 pages. https://doi.org/10.5281/zenodo.3553579

[29] Keith M. Diaz, David J. Krupka, Melinda J Chang, James Peacock, Yao Ma, Jeff Goldsmith, Joseph E. Schwartz, and Karina W. Davidson. 2015. Fitbit®: An accurate and reliable device for wireless physical activity tracking. *International journal of cardiology*, 185, 138.

[30] Carl DiSalvo and Tom Jenkins. 2017. Fruit Are Heavy: A Prototype Public IoT System to Support Urban Foraging. In *Proceedings of the 2017 Conference on Designing Interactive Systems* (DIS '17). Association for Computing Machinery, New York, NY, USA, 541–553. DOI:https://doi.org/10.1145/3064663.3064748

[31] Carl DiSalvo, Phoebe Sengers, & Hrönn Brynjarsdóttir. 2010. Mapping the landscape of sustainable HCI. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 1975-1984).

[32] Marketa Dolejsova, Jaz Hee-jeong Choi, Andrea Botero, and Cristina Ampatzidou. 2022. Open Forest: Data, Stories, and Walking-With. In *Proceedings of the Participatory Design Conference 2022 - Volume 2* (PDC '22). Association for Computing Machinery, New York, NY, USA, 309–312. https://doi.org/10.1145/3537797.3537864

[33] Mathilda E. Dunn, Gautam Shah, & Diogo Veríssimo. 2021. Stepping into the Wildeverse: Evaluating the impact of augmented reality mobile gaming on pro-conservation behaviours. *People and Nature*, *3*(6), 1205-1217.

[34] Egli, S., Peter, M., Buser, C., Stahel, W., & Ayer, F. (2006). Mushroom picking does not impair future harvests–results of a long-term study in Switzerland. *Biological conservation*, *129*(2), 271-276.

[35] Robert Fletcher. 2017. Gaming conservation: Nature 2.0 confronts nature-deficit disorder. *Geoforum*, *79*, 153-162.

[36] Forlano, L. (2017). Posthumanism and design. *She Ji: The Journal of Design, Economics, and Innovation*, *3*(1), 16-29.

[37] Garmin. n.d. *Garmin*. Accessed on January 25, 2022 at https://www.garmin.com/

[38] William Gaver. 2002. Designing for homo ludens. *I3 Magazine*, *12*(June), 2-6.

[39] William Gaver. 2012. What should we expect from research through design?. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 937-946).

[40] Bill Gaver & John Bowers. 2012. Annotated portfolios. *interactions*, *19*(4), 40-49.

[41] William Gaver. 2015. Homo ludens (subspecies politikos). *The gameful world: Approaches, issues, applications*. Sebastian Deterding and Steffen P. Walz (Eds.). MIT Press Cambridge, MA.

[42] Çağlar Genç, Ferran Altarriba Bertran, Linas Gabrielaitis, Esthiak Ahmed and Velvet Spors. 2024. Designing Our Way Through Abstractions: Calling for More Practice-based More-than-Human Design Research. In *Halfway to the Future (HTTF '24), October 21–23, 2024, Santa Cruz, CA, USA. ACM, New York, NY, USA, 10* pages. https://doi.org/10.1145/3686169.3686195

[43] Çağlar Genç, Ferran Altarriba Bertran, Oğuz 'Oz Buruk, Sangwon Jung, Velvet Spors, and Juho Hamari. 2024. Shroom Cards: Playful Exploration of Human Positionalities for More-than-Human Design. In *Companion Proceedings of the 2024 Annual Symposium on Computer-Human Interaction in Play* (CHI PLAY Companion '24). Association for Computing Machinery, New York, NY, USA, 97–103. https://doi.org/10.1145/3665463.3678784

[44] Elisa Giaccardi & Johan Redström. 2020. Technology and more-than-human design. *Design Issues*, *36*(4), 33-44.

[45] Ole Goethe. 2020. Gamification for Good: Addressing Dark Patterns in Gamified UX Design. In *The Digital Gaming Handbook* (pp. 53-62). CRC Press.

[46] Andrea Grimes & Richard Harper. 2008. Celebratory technology: new directions for food research in HCI. *In Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 467-476).

[47] Lon Åke Erni Johannes Hansson, Teresa Cerratto Pargman, & Daniel Pargman. 2021. A decade of sustainable HCI: Connecting SHCI to the sustainable development goals. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (pp. 1-19).

[48] Donna Haraway. 2013. Situated knowledges: The science question in feminism and the privilege of partial perspective 1. In *Women, science, and technology* (pp. 455-472). Routledge.

[49] Terry Hartig, Agnes E. van den Berg, Caroline M. Hagerhall, Marek Tomalak, Nicole Bauer, Ralf Hansmann, Ann Ojala, Efi Syngollitou, Giuseppe Carrus, Ann van Herzele, Simon Bell, Marie Therese Camilleri Podesta & Grete Waaseth. 2011. Health benefits of nature experience: Psychological, social and cultural processes. In *Forests, trees and human health* (pp. 127-168). Springer, Dordrecht.

[50] Marc Hassenzahl. 2010. Experience design: Technology for all the right reasons. *Synthesis lectures on human-centered informatics*, *3*(1), 1-95.

[51] Karey Helms, Pedro Ferreira, Barry Brown, and Airi Lampinen. 2019. Away and (Dis)connection: Reconsidering the Use of Digital Technologies in Light of Long-term Outdoor Activities. *Proc. ACM Hum.-Comput. Interact. 3*, GROUP, Article 230 (December 2019), 20 pages. https://doi.org/10.1145/3361111

[52] Susan C. Herring. 2015. New frontiers in interactive multimodal communication. In *The Routledge handbook of language and digital communication* (pp. 412-416). Routledge.

[53] Zhanpeng Huang, Weikai Li, and Pan Hui. 2015. Ubii: Towards Seamless Interaction between Digital and Physical Worlds. In *Proceedings of the 23rd ACM international conference on Multimedia* (MM '15). Association for Computing Machinery, New York, NY, USA, 341–350. https://doi.org/10.1145/2733373.2806266

[54] Huang, J., Lucash, M. S., Scheller, R. M., & Klippel, A. 2021. Walking through the forests of the future: using data-driven virtual reality to visualize forests under climate change. *International Journal of Geographical Information Science*, *35*(6), 1155-1178.

[55] Jenny Huberman. 2024. Activating the senses: the aesthetics and politics of the transpecies society. *The Senses and Society*, *19*(2), 205-217.

[56] Tisha Hupkes & Anders Hedman. 2022. Shifting towards non-anthropocentrism: In dialogue with speculative design futures. *Futures*, *140*, 102950.

[57] Irwin, T. 2015. Transition design: A proposal for a new area of design practice, study, and research. *Design and Culture*, *7*(2), 229-246.

[58] Katherine Isbister. 2019. Toward 'Suprahuman' Technology. In *Proceedings of the Halfway to the Future Symposium 2019* (HTTF 2019). Association for Computing Machinery, New York, NY, USA, Article 24, 1–4. https://doi-org.libproxy.tuni.fi/10.1145/3363384.3363468

[59] Irr, C. 2023. The Multispecies We: Democracy and Pronouns in the Environmental Novel. *American literary history*, 35(1), 276-289.

[60] Matthew K. Johnson. 2020. Joy: A review of the literature and suggestions for future directions. *The Journal of Positive Psychology*, 15(1), 5-24.

[61] Annika Kangas, Jussi Rasinmäki, Kyle Eyvindson, & Phillip Chambers. 2015. A mobile phone application for the collection of opinion data for forest planning purposes. *Environmental management*, 55(4), 961-971.

[62] Stephen R. Kellert. 2012. *Building for life: Designing and understanding the human-nature connection*. Island press.

[63] Pamela E. King & Frederic Defoy. 2020. Joy as a virtue: The means and ends of joy. *Journal of psychology and theology*, *48*(4), 308-331.

[64] Stacey Kuznetsov & Eric Paulos. 2010. Rise of the expert amateur: DIY projects, communities, and cultures. In *Proceedings of the 6th Nordic conference on human-computer interaction: extending boundaries* (pp. 295-304).

[65] Samuli Laato, Daniel Fernández Galeote, Ferran Altarriba Bertran, Konstantinos Papangelis, and Juho Hamari. 2023. How Location-Based Games Incentivize Moving About: A Study in the Context of Nature-Going. *Proc. ACM Hum.-Comput. Interact.* 7, CHI PLAY, Article 398 (November 2023), 23 pages. https://doi.org/10.1145/3611044

[66] Bruno Latour. 2004. *Politics of nature*. Harvard University Press.

[67] Qing Li. 2010. Effect of forest bathing trips on human immune function. *Environmental health and preventive medicine* 15, 1 (2010), 9–17.

[68] Ann Light. 2022. Ecologies of subversion: troubling interaction design for climate care. *Interactions*, *29*(1), 34-38.

[69] Conor Linehan & Ben Kirman. 2014. Never mind the bollocks, i wanna be anarCHI: a manifesto for punk HCI. In *CHI'14 Extended Abstracts on Human Factors in Computing Systems* (pp. 741-748).

[70] Jen Liu, Daragh Byrne, and Laura Devendorf. 2018. Design for Collaborative Survival: An Inquiry into Human-Fungi Relationships. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, Paper 40, 1–13. DOI:https://doi.org/10.1145/3173574.3173614

[71] Szu-Yu (Cyn) Liu. 2019. Designing with, through, and for Human-Nature Interaction. In Companion Publication of the 2019 on Designing Interactive Systems Conference 2019. https://doi.org/10.1145/3301019.3324874

[72] Susan Loh, Marcus Foth, and Yasu Santo. 2024. The more-than-human turn in human-plant interaction design: From utilitarian object to living co-inhabitant. *Int. J. Hum.-Comput. Stud.* 181, C (Jan 2024). https://doi.org/10.1016/j.ijhcs.2023.103128

[73] Jonas Löwgren. 2013. Annotated portfolios and other forms of intermediate-level knowledge. *interactions* 20, 1 (January + February 2013), 30–34.

[74] Andrés Lucero. 2015. Using affinity diagrams to evaluate interactive prototypes. In Human-Computer Interaction–INTERACT 2015: 15th IFIP TC 13 International Conference, Bamberg, Germany, September 14-18, 2015, Proceedings, Part II 15 (pp. 231-248). Springer International Publishing.

[75] Malinverni, L., Maya, J., Schaper, M. M., & Pares, N. 2017. The world-as-support: Embodied exploration, understanding and meaning-making of the augmented world. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 5132-5144).

[76] Shannon Mattern. 2021. *A city is not a computer: Other urban intelligences* (Vol. 2). Princeton University Press.

[77] Joshua McVeigh-Schultz and Katherine Isbister. 2021. The Case for "Weird Social" in VR/XR: A Vision of Social Superpowers Beyond Meatspace. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems* (CHI EA '21). Association for Computing Machinery, New York, NY, USA, Article 17, 1–10. https://doi-org.libproxy.tuni.fi/10.1145/3411763.3450377

[78] Milstein, T., Tate, J. M., Miller, G., Thomas, M. O., & Yildiz, D. 2024. The more-than-human world in environmental communication: Attunement for transformation. *Environmental Communication*, 31, 323.

[79] Frances E. "Ming" Kuo. 2013. Nature-deficit disorder: evidence, dosage, and treatment. *Journal of Policy Research in Tourism, Leisure and Events*, *5*(2), 172-186.

[80] Samantha Jane Mitchell Finnigan. 2020. *Human-Centred Smart Buildings: Reframing Smartness Through the Lens of Human-Building Interaction* (Doctoral dissertation, Newcastle University).

[81] Evgeny Morozov. 2013. *To save everything, click here: The folly of technological solutionism*. Public Affairs.

[82] Niantic. n.d. *Pikmin Bloom*. Accessed on January 25, 2022 at https://pikminbloom.com/

[83] William Odom, Jordan White, Samuel Barnett, Nico Brand, Henry Lin, Minyoung Yoo, and Tal Amram. 2024. Capra: Making Use of Multiple Perspectives for Capturing, Noticing and Revisiting Hiking Experiences Over Time. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (CHI '24). Association for Computing Machinery, New York, NY, USA, Article 804, 1–27. https://doi.org/10.1145/3613904.3642284

[84] Kenton O'Hara. 2008. Understanding geocaching practices and motivations. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 1177-1186).

[85] Marysol Ortega Pallanez. 2024. Healing our Designing: Practices of Care for Human and More-than-Human Relations.

[86] Paletto, A., Notaro, S., & Cristian, P. 2024. Forest bathing: a quantitative exploration of emerging trends, patterns, and growth areas. *Journal of Forest Research*, 1-7.

[87] Noel Pearse. 2019. An illustration of deductive analysis in qualitative research. In *18th European conference on research methodology for business and management studies* (p. 264).

[88] James Pierce, Yolande Strengers, Phoebe Sengers, and Susanne Bødker. 2013. Introduction to the special issue on practice-oriented approaches to sustainable HCI. *ACM Trans. Comput.-Hum. Interact.* 20, 4, Article 20 (September 2013), 8 pages. DOI:https://doi.org/10.1145/2494260

[89] Pierre, L. S. 2015. Ecocentric Design: We Are Deeply Connected. *The International Journal of Design in Society*, *9*(1), 13.

[90] Marisa Ponti, Thomas Hillman, Cristopher Kullenberg, & Dick Kasperowski. 2018. Getting it right or being top rank: Games in citizen science. *Citizen Science: Theory and Practice*, 3(1).

[91] Pouliot, A., & May, T. 2021. *Wild mushrooming: a guide for foragers*. Csiro Publishing.

[92] Price, C., & Chao, S. 2023. Multispecies, more-than-human, nonhuman, other-than-human: Reimagining idioms of animacy in an age of planetary unmaking. *Exchanges: The Interdisciplinary Research Journal*, *10*(2), 177-193.

[93] Maria Puig de La Bellacasa. 2017. Matters of care: Speculative ethics in more than human worlds (Vol. 41). U of Minnesota Press.

[94] Purser, R. E., Park, C., & Montuori, A. 1995. Limits to anthropocentrism: Toward an ecocentric organization paradigm?. *Academy of management review*, *20*(4), 1053-1089.

[95] Reyes Benavides, P. D. 2024. Technologically mediated encounters with 'nature'. *Ethics and Information Technology*, *26*(3), 51.

[96] Richardson, M., Hamlin, I., Butler, C. W., Thomas, R., & Hunt, A. 2022. Actively noticing nature (not just time in nature) helps promote nature connectedness. *Ecopsychology*, *14*(1), 8-16.

[97] P. W. Schultz. 2002. Inclusion with nature: The psychology of human-nature relations. In *Psychology of sustainable development* (pp. 61-78). Boston, MA: Springer US.

[98] Miguel Sicart. 2015. Participatory Republics: Play and the Political. In *FDG*.

[99] Jonathan Silvertown. 2009. A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

[100] Douglas Schuler & Aki Namioka. 1993. *Participatory design: Principles and practices*. CRC Press.

[101] Vishal Sharma, Neha Kumar, and Bonnie Nardi. 2023. Post-growth Human–Computer Interaction. ACM Trans. Comput.-Hum. Interact. 31, 1, Article 9 (February 2024), 37 pages. https://doi-org.libproxy.tuni.fi/10.1145/3624981

[102] Nancy Smith, Shaowen Bardzell, and Jeffrey Bardzell. 2017. Designing for Cohabitation: Naturecultures, Hybrids, and Decentering the Human in Design. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (CHI '17). Association for Computing Machinery, New York, NY, USA, 1714–1725. https://doi.org/10.1145/3025453.3025948

[103] Marie Louise Juul Søndergaard and Nadia Campo Woytuk. 2023. Feminist Posthumanist Design of Menstrual Care for More-than-Human Bodies. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 38, 1–18. https://doi.org/10.1145/3544548.3581083

[104] Soni, S., Mason, J., & Sherman, J. (2022). Beyond Human-centered Design. *Child Welfare*, *100*(1), 81-110.

[105] Imre Szeman & Jennifer Wenzel. 2021. What do we talk about when we talk about extractivism?. *Textual Practice*, *35*(3), 505-523.

[106] Oscar Tomico, Ron Wakkary, and Kristina Andersen. 2023. Living-with and Designing-with Plants. interactions 30, 1 (January - February 2023), 30–34. https://doi.org/10.1145/3571589

[107] Anna Tsing. 2010. Arts of inclusion, or how to love a mushroom. *Manoa*, *22*(2), 191-203.

[108] Turner, J. & Morrison, A. 2020. Designing slow cities for more than human enrichment: Dog tales—Using narrative methods to understand co-performative place-making. *Multimodal Technologies and Interaction*, *5*(1), 1.

[109] Jean M. Twenge. 2019. More time on technology, less happiness? Associations between digital-media use and psychological well-being. *Current Directions in Psychological Science*, *28*(4), 372-379.

[110] Velasco, C., Barbosa Escobar, F., Petit, O., & Wang, Q. J. (2021). Impossible (food) experiences in extended reality. *Frontiers in Computer Science*, *3*, 716846.

[111] Chia-Pin Yu, Hsiao-Yun Lee, & Xiang-Yi Luo. 2018. The effect of virtual reality forest and urban environments on physiological and psychological responses. *Urban forestry & urban greening*, *35*, 106-114.

[112] Eliane Zambon Victorelli, Julio Cesar Dos Reis, Heiko Hornung, & Alysson Bolognesi Prado. 2020. Understanding human-data interaction: Literature review and recommendations for design. *International Journal of Human-Computer Studies*, *134*, 13-32.

[113] Ron Wakkary. 2021. *Things we could design: For more than human-centered worlds*. MIT Press.

[114] Sarah Webber, Ryan M. Kelly, Greg Wadley, and Wally Smith. 2023. Engaging with Nature through Technology: A Scoping Review of HCI Research. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (CHI '23). Association for Computing Machinery, New York, NY, USA, Article 521, 1–18. https://doi.org /10.1145/3544548.3581534

[115] Weston, A. 1991. Non-anthropocentrism in a thoroughly anthropocentrized world. *The trumpeter*, *8*(3).

[116] Fern Wickson, Roger Strand, & Kamilla Lein Kjølberg. 2015. The walkshop approach to science and technology ethics. *Science and engineering ethics*, *21*, 241-264.

[117] Wikiloc. n.d. Wikiloc: trails of the worls. Accessed on January 25, 2022 at https://www.wikiloc.com/

A APPENDICES

A.1 Summary of interventions, participants, and resulting ideas

Table 1: Summary of interventions, participants, and resulting ideas

Intervention	Format	Participants	Resulting design ideas
#1:From-the-wild explorations (October – December 2021)	16 short trips to the forest where the first author co-experienced and reflected on forest-related activities such as hiking, running, foraging, camping, or snow walking.	8 adults (ranging from 24 to 53 years old) from Spain and Denmark, not professionally related to design- or IT-related fields	29 speculative ideas in the form of annotations on a visual diary.
#2: Conference workshop (April 2022)	Four-hour online workshop held as part of an academic conference. Participants shared, reflected upon, and ideated based on their past experiences within the nature.	10 researchers in IT- or design-related fields, from India, Spain, Greece, Turkey, Finland, Germany & South Africa.	3 speculative ideas in the form of quick multimedia mockups on a Miro board.
#3: Lake house retreat (May 2022)	Three-day retreat at a Finnish lake house where participants co-experienced the surrounding nature and envisioned increasingly joyful nature technology futures.	9 researchers, including all career stages from undergrad students to professors, originally from Russia, Turkey, Finland, Spain, Catalonia, Germany, and Greece.	8 speculative ideas in the form of text-based descriptions, drawings, enactments, and lo-fi prototypes made with materials sourced in the forest.
#4: Summer school (July 2022)	One-week interaction design summer school where undergraduate and masters students worked on a design case focused on enhancing nature-related experiences through technology	15 design students from Spain and Korea	5 speculative ideas in the form of multimedia mockups on a Miro board.
#5: Backpacking adventure (August – September 2022)	One-month backpacking trip where the lead author engaged other backpackers to co-imagine joyful nature technology futures from the forest itself.	200+ backpackers, not professionally related to design- or IT, from 35+ nationalities, including: Spain, Peru, Honduras, Chile, Mexico, Guatemala, Cuba, US, Canada, Argentina, Brazil, Uruguay, Colombia, Russia, Philippines, South Korea, Japan, England, Scotland, Ireland France, Italy, Greece, Germany, Poland, Slovakia, Czech Republic, Croatia, Denmark, Finland, Norway, Sweden, Switzerland, the Netherlands, Belgium, Catalonia, and Euskadi.	59 speculative ideas in the form of quick drawings and text-based descriptions on little snapshot cards.