Playful Inspiration for a New Wave of Joyful Forest Technology

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ABSTRACT

Here we present an exploration into the playful potential of forests and how interactive tech might respond to it. Through first-person, speculative, and situated *generative* design methods, we engaged with a range of forestry activities to explore their capacity to afford experiences based on joy and care. An analysis of our 16 trips to the forest (and the reflections they motivated) revealed 13 *play potentials* [6] of human-forest interactions: 13 aspects of forestry experiences that can be intrinsically joyful. We present them clustered as 5 overarching directions that can guide the design of technology that pays more attention to nature's inherent playful character. Our work can inspire a new wave of forest technology that transcends techno-solutionism and privileges alternative values of joy and care.

CCS CONCEPTS

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

KEYWORDS

Nature, interaction design, play, joy, celebratory tech, situated play design, outdoors

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1 INTRODUCTION

The evolution of computation towards smaller, more embedded formats opens new opportunities for technology-aided experiences in contexts that have traditionally been perceived as non-technological. The forest is a clear example. Digital affordances increasingly permeate our interactions within the wilderness: we use apps like *Wikiloc* [80] to stay on track; share photos and anecdotes on social media; wear gadgets that measure our performance (e.g. the *Fitbit* [27]); or play games like *geocaching* [64] to make hiking more fun. Supporting rich human-nature interactions is a relevant concern for designers: though nature's wellbeing effects depend on many factors, there is a general consensus that "total exposure is important; all forms and quantities are helpful; and the greener the better" [59]. Overall, experiencing nature is known to have restorative effects [51] and its socio-cultural function is undeniable [47]. Yet, research indicates that current tech might be contributing [35] to a decrease in the time people spend in the forest [55]. We thus see a need to explore alternative ways for technology to support tighter human-nature interactions that are both caring, mindful, and fun.

When thinking about the human-nature interplay, one may wonder: why should we bring technology into the forest in the first place? We see this as a key question to ask when designing forest-related tech. Indeed, nature is a wonderful source of joy, in and of itself, with or without the mediation of technology. Considering that, why would we incorporate devices that may disrupt its inherent positive traits? Here we suggest there is value in exploring how computation might enrich our forestry activity. First, because it has a set of qualities that extend the affordances of analog materials: it enables asynchronous or remote communication forms that would be otherwise impossible; it allows us to digitally reproduce, manipulate, or duplicate physical objects; or it enables us to store, find, retrieve, and (literally) play with digital data. Second, on a less positive note, one might argue that, whether we like it or not, tech will increasingly be present in the nature. In fact, not only it will be—it already is. Thus, we see a need to explore how computation, if brought into the forest, might support experiences that help us to thrive in and cherish it, rather than merely utilize it in a utilitarian or even dominating sense—for the sake of our bodies, our minds, our society, and the environment.

While we see value in productive uses of tech in the nature (e.g. to navigate the forest or support our training goals), we are excited about its potential to also respond to alternative, less utilitarian agendas. We propose that, to transcend *techno-solutionistic* [60] ideas of the human-forest interplay, we may need to engage in-depth with the forest's idiosyncrasy and find meaningful ways for tech to play its part. Our work tackles that challenge by exploring how tech might support forestry experiences that are socio-emotionally meaningful. Building on the idea of *celebratory tech* [44], which helped to advance other areas of HCI, we work towards

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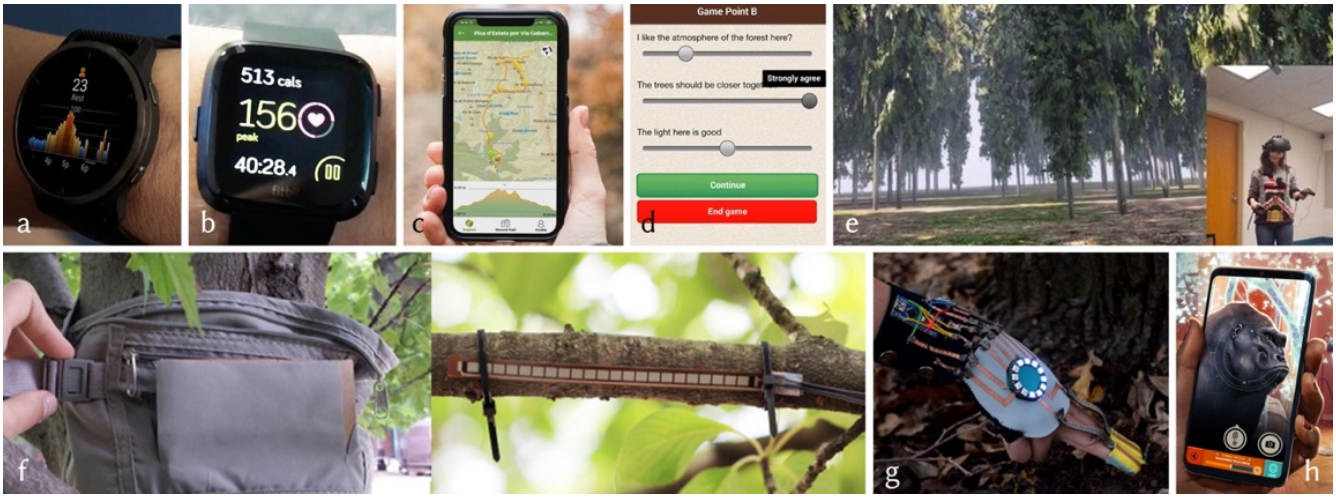


Figure 1: Existing nature tech, including: commercial products, e.g. (a) a Garmin watch [36], (b) a FitBit [27], and (c) the Wikiloc app [80]; citizen science interventions, e.g. (d) a participatory forest planning game [50]; digital nature interventions, e.g. [49]'s VR forest simulation; and sustainable HCI designs, e.g. (f) Fruit are Heavy [30], (g) the Hand-Substrate Interface [54], and (h) Wildeverse [33].

repurposing technology towards celebration of nature, hoping to reclaim it into the space of meaning in human life. We ask ourselves: *What aspects of forestry experiences are inherently joyful? And how can we design tech that helps us access and enhance (rather than disrupt) that inherent potential?*

To address those questions, here we report on a design-led study where we reflexively and generatively engaged, hands-on and in-situ, with the inherent playful potential of a range of nature activities. Through 16 trips to the forest, we (co-)explored its capacity to afford joy and fun and began to speculate as to how that potential could be supported technologically. As a result, we contribute a set of *play potentials* [6] of human-forest interactions: 13 kinds of forestry experiences that are inherently playful and might thus inspire novel and increasingly joyful types of forest-related tech. We present them structured as 5 directions for designing to support joyful human-forest-tech interplays: (1) valuing social & contextual graciousness; (2) reclaiming the aesthetic beauty of being in nature; (3) highlighting the joy of sharing the forest; (4) enabling spontaneity and silliness; and (5) fostering a sense of belonging. Our generative [39] contribution foregrounds opportunities for designing tech that privileges the joy of being in nature over other (utilitarian) agendas. It will inspire a new wave of forest technology that focuses on alternative values of joy and care.

2 BACKGROUND

2.1 Technology, human-nature interactions, and design values

Tech can contribute to distancing people from the nature when it distracts us from engaging it directly [35]. Here we argue that, if built with the right affordances, it also has the potential to help us to access, engage with, and better enjoy the forest. Technology, *per se*, is not a disabler of nature-related experiences; its effects mostly depend on how it is designed and used. Thus, we do not propose to bring technology into the nature by default. Rather, we seek to closely examine areas where it might add socio-emotional value, and to focus design agendas on responding to that.

Our perspective aligns with contemporary conversations, both in technology design and in environmental research. In HCI, overly utilitarian approaches to innovation have long been criticized due to their lack of attention on the socio-cultural, emotional, and environmental implications [60]. Researchers call for a shift towards human-tech interplays that are less bound to productivity and embrace other values like emotional fulfillment or social connection (e.g. [7, 37, 45]); they also stress the need for more sustainable [31] and caring [52] innovations. Similarly, in environmental research, there are calls for reclaiming the socio-emotional layer of the human-nature interplay, as a response to contemporary trends of approaching human-nature interactions through the lens of short-term profit and growth (e.g. [28]). We see a connection between those propositions: they all call for a shift towards non-utilitarian ideas of the interaction between people, tech, and/or the environment. Inspired by them, we suggest technology should not only support productive or efficient human-nature interactions. It should also facilitate forestry experiences that are caring, mindful, and fun.

2.2 Nature as an emergent design space within HCI

Though the design space of human-nature interaction is still underexplored in HCI, technology use in nature is by no means new. We have been using it for centuries (the compass is a great example) and technical advances (e.g. biometrics, IoT, network technology, geolocation, wearables...) only amplify this trend. For example, a plethora of commercial gadgets optimize our nature activity through data collection and processing, helping us to efficiently train [36] (Figure 1a), lose weight [27] (Figure 1b) or navigate

the forest [80] (Figure 1c). Citizen science interventions [73] persuade people (often gamefully [69]) to collect forestry data towards decision-making or scientific research, e.g. through geolocated opinions of the forests that can be used in forest planning [50] (Figure 1d). Digital nature interventions also digitalize the forest, in this case literally: through virtual simulations, they make nature more accessible to optimize its wellbeing benefits [83] or support forest management [49] (Figure 1e). Overall, the above technologies often share an instrumental agenda: they instrument the nature towards utilitarian (albeit individually and/or societally desirable) gains.

Our research agenda is at odds with the *techno-solutionistic* [60] idea of using tech as a platform for commodifying nature towards efficiency and productivity. We shift our focus from its productive capacity towards its potential to help us to celebrate our engagements with(in) the forest, to find intrinsic joy in them, and to hopefully enrich our relationship with nature as a result. We are inspired by recent works in *sustainable HCI* [66] that explored how tech might mediate alternative, more caring and symbiotic human-nature interactions. For example: *Fruit are Heavy* [30] is an IoT system that measures the bend of tree branches as a proxy for tracking the ripeness of their fruit to enable bottom-up, collaborative urban foraging that embraces natural biorhythms (Figure 1f). The *Hand-Substrate Interface* [54] is a glove that enables tighter and more sensorial human-fungi interactions by inviting wearers to insert their hands in soil to obtain digital moisture readings—foregrounding (rather than bypassing) the embodied qualities of engaging with the soil (Figure 1g). *Wildeverse* [33] is an AR forest conservation game aimed at improving players' knowledge of and attitudes toward nature (Figure 1h). These works show how tech can support experiences where the human body and consciousness extend into the environment, increasing our capacity for noticing it and sensitizing more to the idea of environmental care. Like us, they embrace a more-than-human approach to HCI design and research [26, 42, 77].

2.3 Technology and the forest: from productivity to joyfulness and care

As shown above, existing tech looks at human-nature interactions in different ways: optimization, instrumentalization, multi-species care... While we find all of them relevant, we see a dimension of the human-nature interplay that is currently underexplored: the experiential texture of forestry activity and the potential of tech to enrich it. Though some works in HCI have explored human-nature interactions with a focus on their experiential qualities (e.g. [74, 75]), they remain exceptions. Additionally, while some gameful artifacts and activities targeting the forest exist (e.g. Pikmin Bloom [61] or geocaching [64]), they often afford autotelic experiences that are separate from ordinary nature activity. The potential of playful tech to afford rich, contextually-meaningful experiences has been broadly discussed in HCI (e.g. [7, 37]). We seek to extend those conversations into the space of human-nature interaction, studying the forest's inherent joyful potential and imagining how to realize it by design.

A bit over a decade ago, celebratory technology was proposed as way of "celebrat[ing] the positive interactions that people have with food as they eat and prepare foods in their everyday lives" [44]. Though it targeted food practices specifically, that provocation may be equally relevant to our interactions with(in) the forest: it calls for re-orienting designers towards values of joy, care, and wonder in design spaces where tech use is not widespread yet and where, as such, foundational changes can still be made. Arguably, that is the case of the emerging space of forest technology. Thus, building on prior research at the intersection of play and everyday life (e.g. ludic design [37] or technology for situated & emergent play [7]), we wonder how such a move could be supported in human-nature interaction research: How can we design tech that helps us to find joy within the forest? What kinds of experiences might it support and enhance?

3 METHOD

3.1 Approach: a first-person take on Situated Play Design

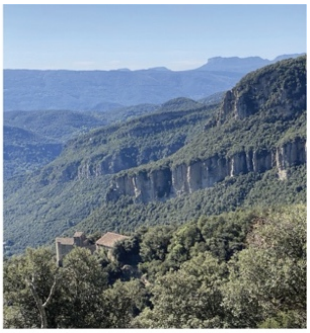
To begin to explore how tech might support joyful forestry experiences, we turned to *Situated Play Design* (SPD) [6]: a participatory, bottom-up approach to play design research that proposes to closely engage a context to identify existing forms of playful activity (i.e. *play potentials* [6]) and leverage them as inspirational material for design. Insofar as it seeks to uncover forms of existing playful activity that are contextually meaningful, SPD can help to shape novel design spaces in ways that embrace intrinsic fun and joy as guiding values [8]. We chose to follow it (and to shape our work around its underlying construct of *play potentials* [6]) for three reasons: First, because of its explicit focus on joy and playfulness [6]. Second, because of its capacity to support *generative* [39] practice in emergent design spaces where digital tech is not widespread yet and where, as such, foundational values are still being defined [6]. Third, because it proved useful in different areas of HCI, e.g. digital health [65, 84], human-food interaction [4, 8], smart cities [1], drones [68], assistive tech [34], interactive museums [21], exertion technology [57, 58], or animal-computer interaction [24].

Like other recent works in design research and design-oriented HCI (e.g. [1, 25, 34, 68]), our study specifically focused on the first stage of SPD, chasing play, wherein designers engage an activity or situation to identify play potentials: contextually grounded forms of playful engagement that can be used as inspirational material. We explored ours and other people's lived experiences of the forest to unpack underlying forms of joyful experience as generative [39] insights for forest tech design. To that end, we built on recent calls for displacing nature-related design towards the forest itself, a move that can sensitize designers towards their relationship with the environment [17] and thus give light to ideas of novel human-nature interplays that are grounded in values of joy and care [3]. We were also influenced by first-person methods [56] and their capacity to elicit rich accounts of situated phenomena. Overall, we built on a third wave perspective of HCI [45]: we embraced (rather than avoided) our own positionality as a determining factor in the research and framed our meaning-making as a "necessarily situated" [46] and hardly replicable [39] process whose outcomes are nuanced and contextual rather than universally generalizable [45]. That approach, which seeks to produce generative rather than validative knowledge [39], has been widely used and recognized in HCI [45].

#1: A 3h solo foraging walk

#2: A 2h foraging walk with a 32 year old woman

#3: A 2 day camping trip with 5 young adults in their late 20s and early 30s



#4: A 4h hike with a 38 year old man and a 32 year old woman

#5: A 1h solo trail running session

#6: A 2h solo trail running session

#7: A 3h solo foraging walk

#8: A 2h solo trail running session

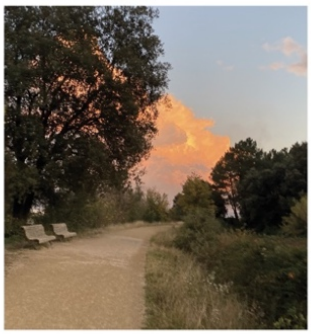
#9: A 3h trail running session with a 51 year old man

#10: A 3h solo foraging walk

#11: A 3h foraging walk with a 28 year old man and a 32 year old woman

#12: A 1h solo power walk

#13: A 1h solo running session



#14: A 1h solo trail running session

#15: A 1h solo trail running session

#16: A 2h snow walk with 4 young adults in their late 20s and early 30s

Figure 2: Summary of the forest trips, including photos of the forests and descriptions of the activities and participants involved.

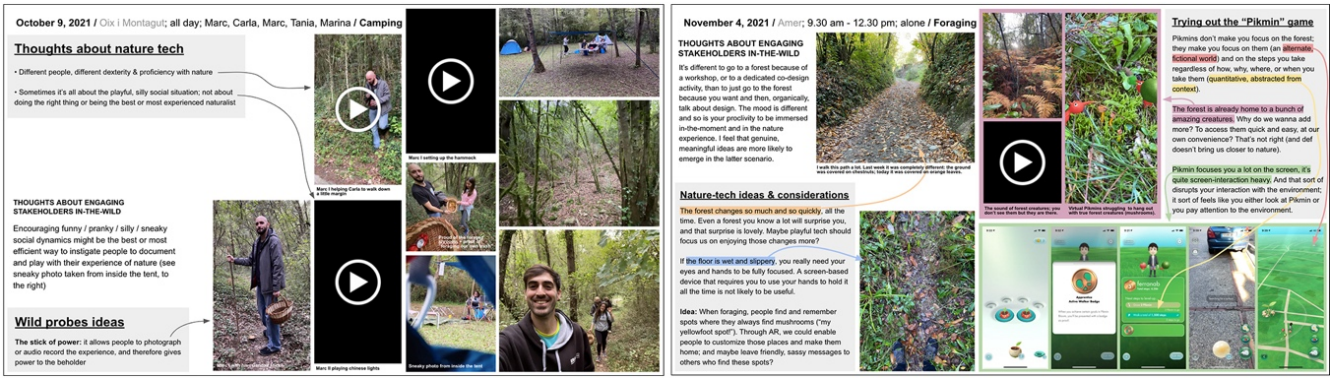


Figure 3: Slides of the visual diary used to document the forest trips. The full diary can be accessed at: https://bit.ly/fromthewild

3.2 Context: 16 trips to (co-)experience the forest

Our study began with a set of first-person *play-chasing* interventions done by Ferran, the lead author of this paper. For 3 months, Ferran did 16 trips to the forest to engage nature through running, hiking, camping, foraging, and snow walking. The trips took place in the forests of Catalonia, a Southern European region with Mediterranean flora and fauna as well as mountainy areas. They started in October 2021, when temperatures were mild and comfortable; extended into the Fall, which brought occasional rains; and ended in December, when it snowed in the mountains. Trips ranged from 30 minutes to 2 days long, depending on the activities involved, and had diverse social configurations: Ferran alone, with a pair, a small group (3-4 people), or a larger group (5+). All participants were acquaintances of Ferran; their relationship and shared history helped him access, position, and interpret their behaviors and opinions. Some trips were organized by Ferran himself, some by other participants. Importantly, all the trips had motivations besides the research (e.g. foraging mushrooms) and, as such, they took place, were structured, and scaffolded regardless of our research. We just used them as opportunities for situated co-experiencing of the forest. While in many of the trips there were no instances of technology use, participants did use digital artifacts occasionally. For example, a smart watch was used to collect biometric data while running, the *Wikiloc* app was used to navigate unknown forest areas, or the Pikmin Bloom smartphone game was used to add additional playfulness to a hike around the forest. Figure 2 summarizes the 16 trips.

3.3 Data collection: a visual diary of autobiographical multimedia narratives

During the nature trips, Ferran co-experienced a range of forest activities, had conversations about their playful potential, and co-imagined how future tech might support and enrich them. To document those experiences, reflections, and ideas, he used diverse means, e.g. voice memos, photos and videos, or short phone notes. After each trip, Ferran consolidated his notes as autobiographical multimedia narratives on a *visual diary* [12] (Figure 3), synthesizing the most relevant events and reflections from the trip (his and his companions'). Using a combination of photos, videos, and annotations, he stored the key insights from each trip and unpacked them with post-session reflections—thereby engaging in an on-going meaning making in parallel with data collection. Though the narratives were primarily autobiographical—they captured Ferran's own lived experiences of and reflections around the nature trips—they also reflected the participation of his forestry companions. Since many of the forest trips were shared with other people, Ferran's experiences were inevitably influenced by theirs; and his notes often made references to his interpretation of other people's actions and opinions. As such, while the visual diary narratives were articulated by Ferran, they also reflected (1) his observation of other people's lived experiences, and (2) his interpretation of his conversations with them.

Based on the country where we situated the research, ethics approval was not required. Adhering to guidelines from the national board of research integrity, participants were told we would document the trips to later analyze and publish the data. They all gave verbal consent, and only those who also consented to being photographed and videotaped were included in the visual documentation. Participants were informed they could revoke their consent anytime during or after the trips and were invited to express their concerns anytime they felt uncomfortable with the research.

3.4 Data analysis: a multi-phased reflexive meaning making process

The visual diary that resulted from the above process includes 16 entries (see examples on Figure 3). Each entry belongs to one of the forest trips and features the most inspirational insights derived from it—illustrated with photos, videos, anecdotes, and design ideas, and extended through reflexive annotations. Those are the data this study builds on. Though meaning making started during data collection (through the narratives Ferran produced after each trip) upon completion of the trips we undertook a more in-depth analysis. Figure 4 provides a visual summary of our meaning making process.

We used reflexive thematic analysis [18] to examine the diary. All the contents were analyzed, without filtering. First, Ferran did two rounds of inductive analysis. He focused on surfacing play potentials: playful things that happened during the trips and potentially had inspirational value. After identifying a first set of

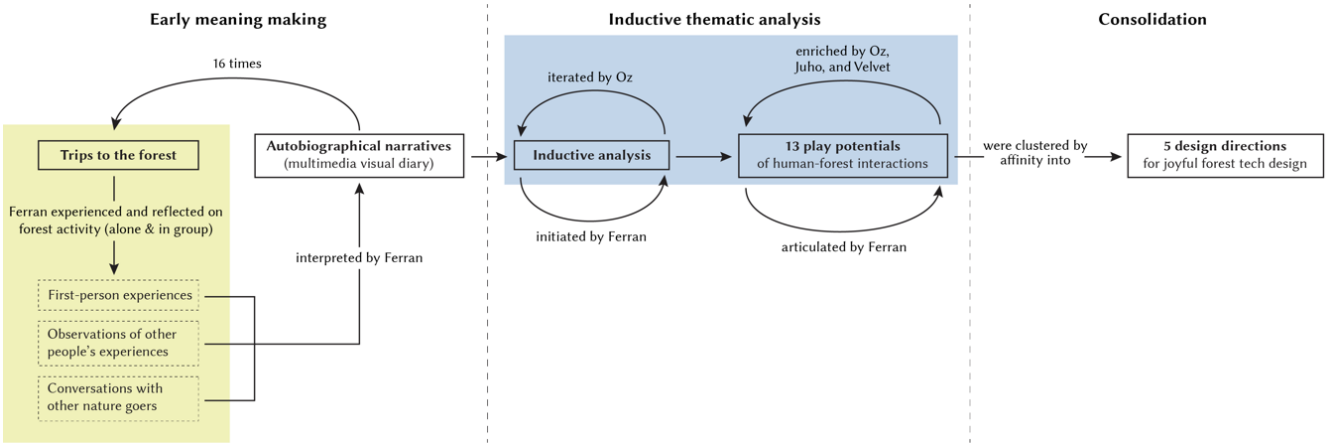


Figure 4: Summary of our reflexive [18] meaning making process, involving: *early meaning making* during the 16 forest trips through a multimedia visual diary of autobiographical narratives; an *inductive thematic analysis* [18] of the diary, leading to the articulation of 13 play potentials of human-forest interactions; and the *consolidation* of said analysis through affinity clustering [14] of the play potentials into 5 design directions for joyful forest tech design. Colored areas indicate where Ferran's first-person meaning making was enriched through other people's perspectives, including his forest trip companions (green) and the other authors (blue).

codes, Ferran began to cluster the diary contents. He then used the diary's photos, videos, and annotations to articulate the play potentials (*topics*, in reflexive thematic analysis [18]) reflected by these data clusters, and further abstract them into themes. After a first articulation of the play potentials, Ferran shared the in-progress analysis with the other authors, so they could enrich it through their different perspectives of and experience with HCI and design research. As noted in [18], "quality reflexive TA is not about following procedures correctly (or about accurate and reliable coding, or achieving consensus between coders), but about the researcher's reflective and thoughtful engagement with their data and their reflexive and thoughtful engagement with the analytic process". Thus, these researchers were involved for enriching discussions around the themes, not for inter-coder reliability. In 3.5 below, we provide a statement of positionality for each of the researchers, to help the reader to position the paper's contribution based on their backgrounds, ideas, and prior lived experiences.

In a first iteration of the analysis, Oz helped to refine the themes. He suggested ways of better fleshing out the joyful experiences depicted by the play potentials and proposed the combination of some that thought were too similar. Juho's follow-up comments helped to highlight the key inspirational aspects of the themes, with a special focus on how the play potentials might be relevant to technology innovation. In a final iteration, Velvet helped to articulate the play potentials in ways that were actionable and inspirational, making them accessible and relatable for other designers. They also created illustrations to communicate the play potentials in a visual form (see Figure 11, Section 5) Such distributed meaning making process led to the articulation of the themes in their final form: a set of 13 of play potentials that foreground intrinsic aspects of nature activity that can afford experiences of care and joy, reflecting Ferran's reflexive account of the experiences lived by himself and his companions over 16 trips to the forest enriched through the perspectives of the other authors. To consolidate and make the play potentials actionable, we decided to structure them as higher-level themes: we clustered them by affinity [14] based on their shared experiential affordances. Such second-order, higher-level clustering allowed us to foreground 5 design directions. We present them as generative and inspirational starting points for designing increasingly joyful forest technology that responds to the playful events we saw in our research.

3.5 Statements of positionality

Here we provide a statement of positionality for the researchers involved in the study. We focus on 3 items: (1) academic background, (2) experiences of and relationship with nature, and (3) perspectives regarding tech use in forests.

Ferran led the forest trips and the reflexive meaning making process. He is a white, able-bodied 32-year-old man. He was born and raised in Catalonia and lived in other countries within Europe and in the US. Ferran is an interaction designer whose research explores how people's day-to-day can be playfully enriched by design. Since his childhood, he is passionate about nature and engages it often through hiking, running, camping, backpacking, or foraging. He is a casual user of nature-related tech for pragmatic reasons, e.g. to record his running data on a smart watch. Yet, he is skeptical about the capacity of existing tech to support more casual, socio-emotionally rich human-nature interactions.

Oz is a researcher of gameful technologies with a specific focus on bodily tech. He is a Turkish able-bodied man who has been living in Finland for the last four years. He enjoys nature, although being in nature is not an integral part of his life. Since he moved to Finland, due to its culture oriented around natural environments, he is more engaged with nature and takes regular trips to cottage houses. That helped him notice conflicts from situating technology (e.g. laptops, mobile phones) in natural settings. He tries to understand

Figure 5: Situations that motivated PP#1, #2, and #3: (a) the watch alerting Ferran that he was off course; (b) the watch indicating a poor performance; and (c) a foraging trip where changing locations was key finding mushrooms.

how non-computational tech (e.g. fire tools, row boats) align more with nature's dynamics. Oz defines himself as a gamer. He is not a hard-core gamer and competitive games are not his thing, but he is fascinated by imaginative worlds and is fond of immersion and awe experiences that can be induced by gameful systems. He is hopeful that his research can help blend the peaceful joy he has experienced in nature with the excitement, curiosity, playfulness, and absorption induced by games.

Velvet is a white, able-bodied, and non-binary German person in their early thirties. They have a background in graphic design and HCI. Having grown up in a forest-dense country, being with and in nature is an important aspect of their personal self-care practice, and they make an effort to seek out nature-aligned spaces on a daily level, e.g. taking a stroll through the park. Velvet uses technology to find and navigate through nature in a more utilitarian way, e.g. identifying plants or learning about hiking trails. This orientation partially stems from their perception that nature-focused technology is focused overtly on metrics, and therefore more disruptive for them than helpful.

Juho is a white, able-male-bodied person in their late thirties. After a childhood where the main stage of everyday life and play took place in forests and nature, Juho has primarily been interested in crafted experiences (chiefly games) and technology. Juho is holistically involved in research related to the relationship between humans and tech, especially in relation to leisure and motivational uses. Currently, Juho is enthusiastic about different developments, practices, and cultures where technology and nature come together. In terms of epistemology, Juho tends towards overall skepticism in the short-term and relativism and pragmatism in the long-term (i.e. cross-disciplinary synthesis of approaches and methods leads to meaningful sense-making of reality). Juho has been involved in conducting research in relation to human-technology research representing all common approaches from art and design to strictly controlled experiments.

4 FINDINGS: THE PLAYFUL POTENTIAL OF FORESTS AND HOW TECH COULD HELP TO REALIZE IT

Here we present the findings from our reflexive analysis of Ferran's nature trips: 13 *play potentials* [6] of human-forest interactions that foreground inherently joyful aspects of forest activity and thus open exciting opportunities for technology design. We structure them as 5 overarching design directions: (1) Valuing social and contextual graciousness; (2) Reclaiming the aesthetic beauty of being in nature; (3) Highlighting the joy of sharing the forest; (4) Enabling spontaneity and silliness; and (5) Fostering a sense of belonging. Hereon, we use the conventions PP, NT, & DD to refer to play potentials, nature trips, and design directions. A summary of our findings can be found on Figure 11 (Section 5).

4.1 Valuing social and contextual graciousness

Our first design direction has to do with technology's capacity (or lack thereof) to intervene in nature in ways that are socially gracious and contextually meaningful. In many of his trips to the forest, Ferran struggled with the tech at hand, e.g. with a smartwatch that (1) measures biometric data, (2) gives feedback on performance, and (3) gives indications when following trails. However useful, those features often created tensions at a socio-emotional level: they used rich data on both Ferran's physiological state and the landscape but neglected other important factors such as his emotional state, the social situation, or the messy and rapidly changing nature of forests. As Ferran noted in his diary, forest tech "shouldn't be data-smart only; they should also be socially smart" (NT#8). This design direction unpacks some of Ferran's experiences around this tension and identifies underlying play potentials that may help designers to turn them around.

Play potential #1: Ambiguous orientation. Ferran found his watch's navigation features obtrusive, stubborn, and excessively demanding. The watch only provided information when immediately necessary, which prevented him from learning about the path and making his own choices. Instead of empowering him to orient himself better, it detached him from that responsibility (NT#8) and pushed him to constantly look at the screen. Further, the interface was too small and hard to use during intense activity. It required a lot of attention and detracted Ferran from anything else. Paying more attention to that tiny circle than to the beauty of the forest itself made Ferran feel uncomfortable. Another issue with the watch is that it did not accommodate out-of-the-box behaviors, e.g. taking short detours to approach a tree, following marks left by other hikers, or running the path backwards. Each diversion from the path

triggered an alert message (Figure 5a). As a result of those issues, interacting with the watch was detrimental to Ferran's overall experience: it framed hikes or runs as purely utilitarian activities that needed to be optimized, with no room for exploration or diversion. That was at odds with many of the reasons why the forest brought him joy. To turn that playlessness around, he thought it would be interesting to explore "analog, less dynamic strategies [that] push [people] to follow [their] gut". He also considered alternative navigation strategies (e.g. hot and cold ice-breaking games) which are "more human, present, and playful, and leave room for ambiguity and empowerment" (NT#4). From those reflections, a design idea emerged: a virtual "ghost that floats around and guides you through the forest" by playfully hiding and prompting people to find it, in ways that "it's visible whenever needed but then goes away whenever not" (NT#9). That idea could be feasibly implemented today as a sound-based mobile app, or in a near future through AR googles.

Play potential #2: The empathic training buddy. Ferran's relationship with his smartwatch eroded over time. While it proved useful to keep track of and improve his performance, he also found it socially ungracious. Though informative, it failed to appeal to him socio-emotionally and as a result it often had discouraging effects. For example, during a run where he struggled, the watch alerted that his performance was unusually low (Figure 5b)—a negative message that came at the worst possible moment and demotivated him. That made Ferran imagine more empathic kinds of tech, e.g. an AI "companion that improvises new routes based on what you need to train, so you don't repeat the same track always", and is socio-emotionally gracious "like a sassy colleague who teases you so you get better" (NT#8).

Play potential #3: A mentor rather than a guide. One day, when foraging, Ferran found a hidden spot ripe with mushrooms of a precious and rare kind. He collected them and stored the location on Google Maps. A couple weeks later, he tried to use the pin to find that spot; yet, he realized the forest had changed (bushes grew, leaves covered the paths. . .) and Google Maps was no longer useful. He "found it faster by using [his] own intuition" (NT#11)—which made him feel better, as if he had earned the mushrooms. As a result, Ferran concluded that technology might better support foraging when it "gives subtle clues, to mitigate the frustration [of not finding anything] and add a playful mystery but doesn't provide accurate information" that makes it too straightforward to find what you are looking for (NT#7). That way, "you still need to develop sensitivity towards (and knowledge about) the forest and its relationship with the things you're foraging" (NT#7). That playful turn to technology-mediated foraging led to the idea of tech as a mentor who "give[s] wisdom (i.e. the ability to build a sustainable relationship with the forest)", as opposed to a guide who indicates exactly where to go and what to look at (NT#7). Several impromptu design ideas were inspired by that play potential. For example: on a day, when Ferran went foraging and was frustrated to see that the area he chose had recently been wiped clean (NT#2, Figure 5c), he envisioned an IoT basket that uses haptics to provide unclear, mysterious information the forager can use to orient themselves around the forest and take responsibility for finding spots ripe with mushrooms; or he also imagined a "mushroom clock", a data physicalization device that people "can have at home and signals seasonality" to help them to get acquainted with the rhythms and conditions of mushrooms (NT#11).

4.2 Reclaiming the aesthetic beauty of being in nature

Our second design direction speaks to nature's aesthetic dimension. While forests can afford rich sensorial experiences, we often take that potential for granted and grow distant to its pleasures. As seen in 2.2, mainstream tech exemplifies that conundrum: it frames forest-related activity as a quest towards performance and overlooks its capacity to bring joy. The forest trips allowed Ferran to explore how to counter that trend: "How could we translate celebratory tech to the context of the forest?" (NT#7). Three play potentials emerged from those reflections. They hint at exciting ways of foregrounding the joy of ordinary forestry events such as finding mushrooms, reaching summits, or finishing a race.

Play potential #4: Reminders of nature's beauty and seasonality. One day, as he was running, Ferran stumbled upon a stunning view (Figure 6a). That day, he was in forest for training. In fact, it was a period when he was "trying harder and performing better" (NT#14), so his focus was on training rather than on finding joy. Yet, despite that agenda, stumbling upon a stunning view gave Ferran a rich, intense sensorial experience that momentarily overtook his training goals. In retrospect, that made him "think about how important it is that tech helps us to pay attention to those gems even when we are not in nature to witness them" (NT#14). That resonated with other forest trips, where he understood that nature is not only beautiful but also ever-changing: its capacity for evolving can provide seasonal experiences of novelty, beauty, and joy as one same spot of one same forest can mutate completely in a short timespan (Figure 6c). Ferran learned that quickly as he recurrently visited a forest during the 3 months of our research (Figure 6b): "The forest changes so much and so quickly, all the time. Even a forest you know a lot will surprise you, and that surprise is lovely" (NT#10). He thought that "playful tech could help us to focus on enjoying those changes more" (NT#10), which inspired a design idea that "extends existing nature-related wearables by focusing on beauty rather than on performance" (NT#14). He called it a "nature appreciation buddy": "a device that subtly points you towards the seasonal beauty of nature and hints at the lovely things it has to offer throughout the year, so you go out, explore, pay attention, and find those things yourself" (NT#12). To make that idea more tangible, Ferran envisioned a bracelet that is "aware of the biodiversity of a forest" as well as "the plants, trees, and animals the wearer is accustomed to", and uses geo-location to determine whether "the wearer is around species that are unusual for them" and send "prompts to spot them" (NT#14).

Play potential #5: The lovely divide between suffering and reward. In trips involving strenuous activities like trail running, Ferran experienced a source of aesthetic gratification other than beauty: the tension between physical effort and embodied well-being. "While trail running, you'll likely experience a mix of intense suffering (bodily pain, labored breath, exhaustion. . .) and thrilling reward (finding unusual spots, connecting with nature, reaching goals. . .)" (NT#6). Experiencing those tensions between suffering and reward—which Ferran often found oddly pleasurable (Figure

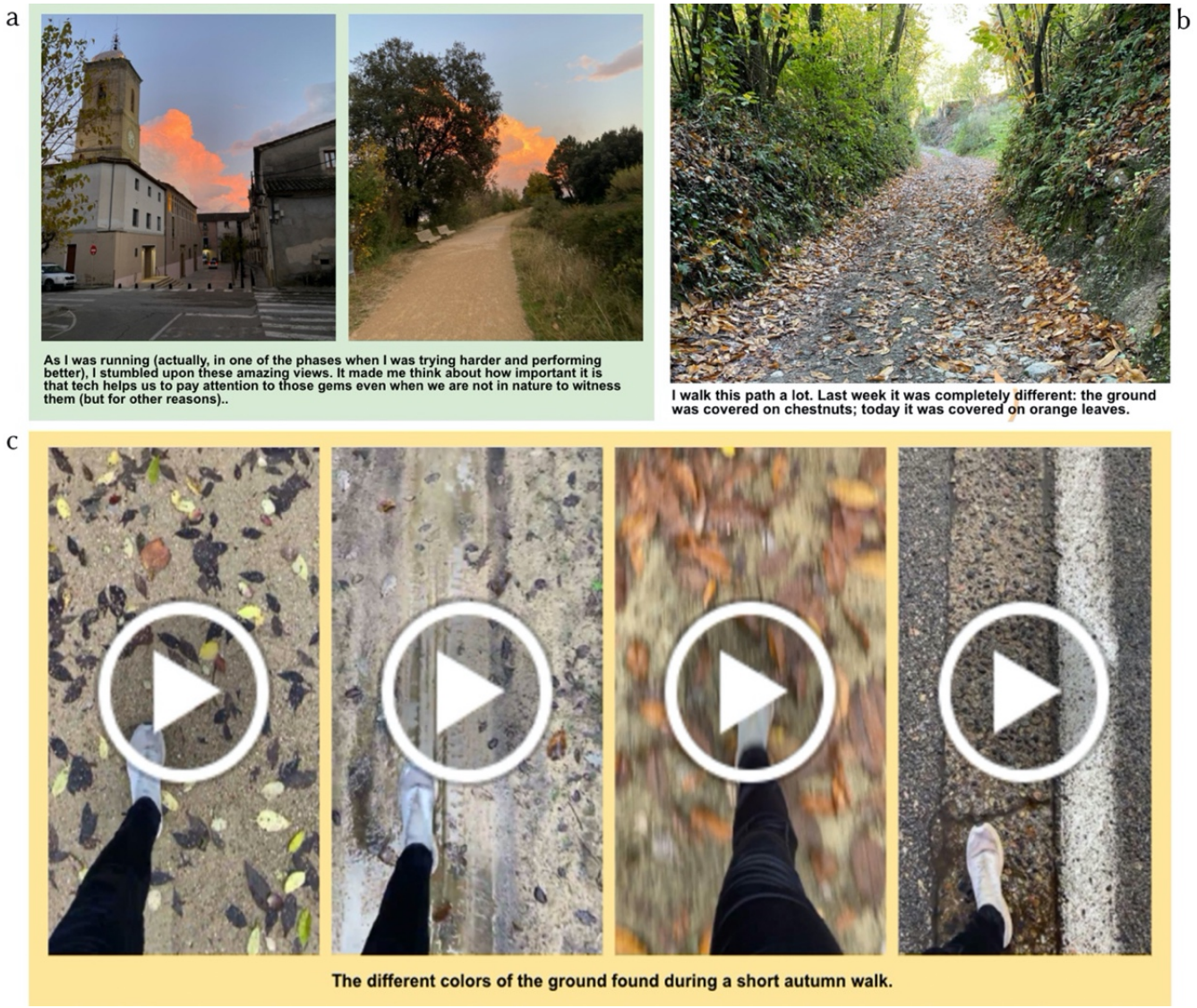


Figure 6: Situations that helped Ferran to reflect on the potential of tech to support experiences of aesthetic beauty: (a) a stunning view he stumbled upon while running; (b) a photo that shows how the forest changes over time; (c) a sequence of videos showing autumn's color variations due to the different kinds of fallen leaves. Videos of (c) can be accessed on p. 12 of the visual diary.

7)—motivated a reflection on their playful potential: "Maybe tech could amplify those intense suffering moments in fun, emotionally positive ways?" (NT#6). Inspired by those thoughts, Ferran speculated with a celebratory tech idea for moments of both suffering (to joyfully reframe them) and reward (to amplify them): a "system that tracks your emotional state (e.g. relief, suffering...) in each trail you run so you can relive the experience afterward when running it again" (NT#8). Interestingly, he realized that such technology could be fruitful in both socio-emotional and utilitarian terms: past experiences "can be fun to relive [...] (e.g. 'Ha-ha! Remember when I almost died here?'), but that can also help to perform better" (NT#8).

4.3 Highlighting the joy of sharing the forest

Our third design direction explores the potential of nature activity to be a source of shared joy and laughter. In many of the nature trips, Ferran experienced the forest in group. Those shared forestry encounters surfaced opportunities for playful intervention: situations and ways of relating to one another that are common in nature-related activity and that could potentially be enhanced through technology. Here we describe three of those play potentials, hoping they will inspire the design of tech that supports rich playful and social experiences within the forest.

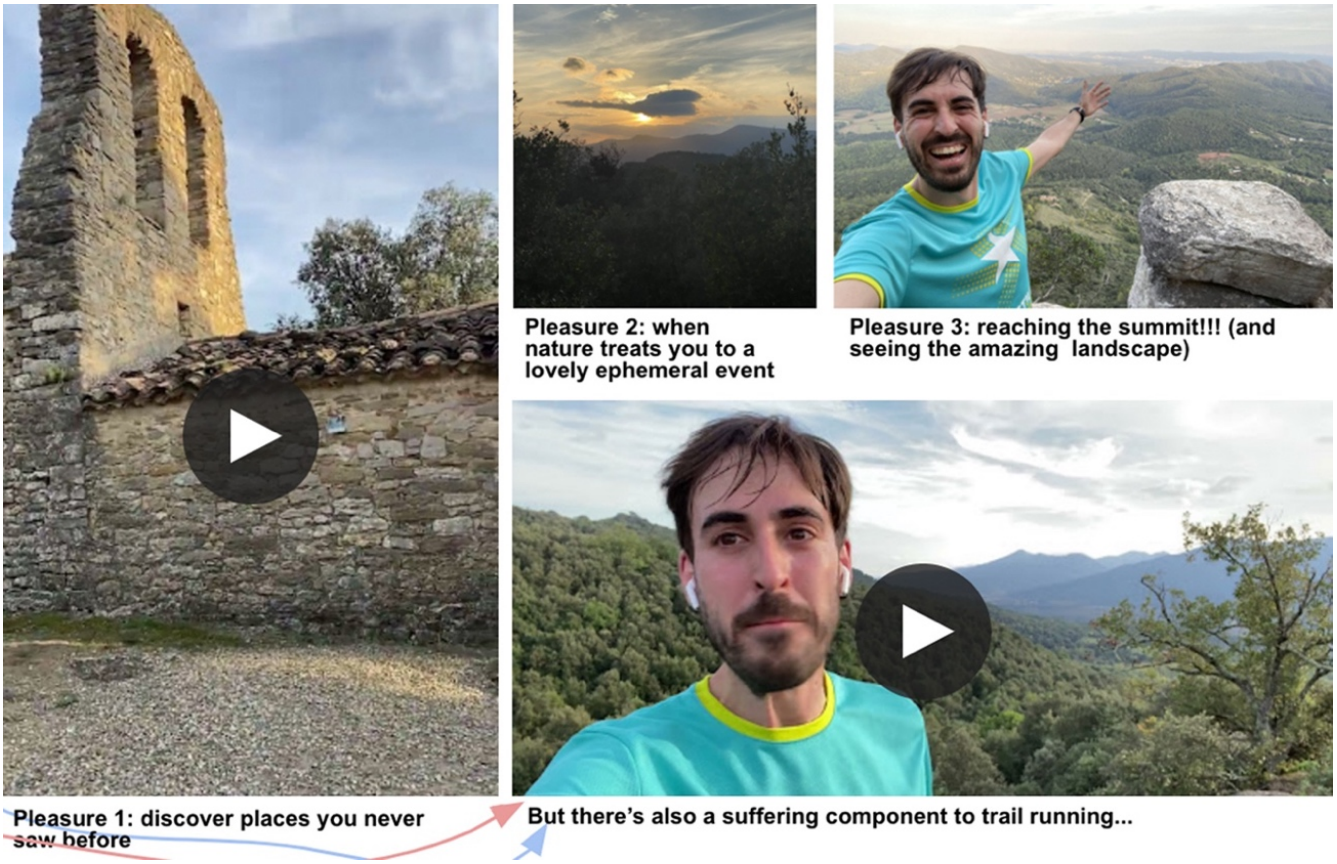


Figure 7: Screenshot from Ferran's diary providing a visual account of the pleasures and struggles he experienced when trail running in the forest, which motivated PP#5. Videos can be accessed on p. 6 of the visual diary.

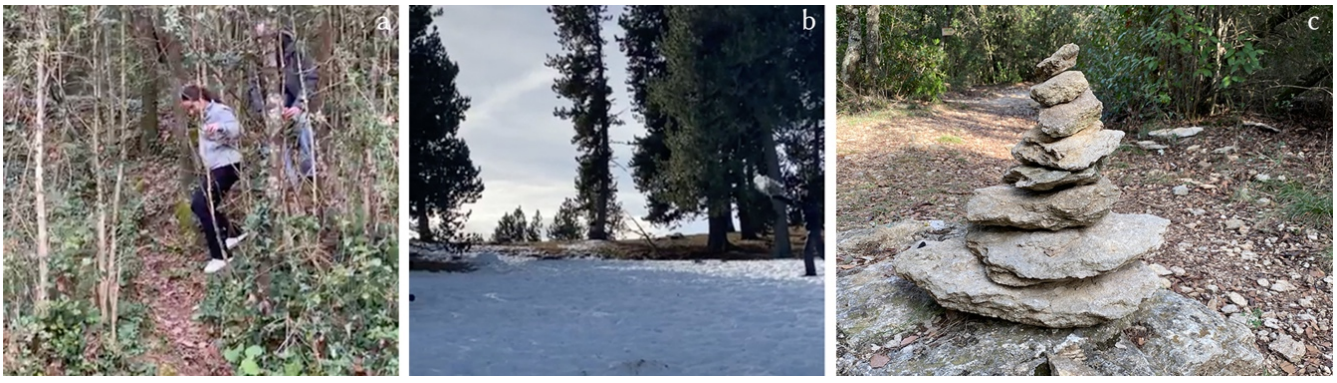


Figure 8: Situations where Ferran and other forest goers found joy in sharing nature-related activity: (a) a hiker helping another to walk down a slippery hill; (b) two participants engaging in a snowball fight; and (c) a carefully crafted sculpture, created (probably over time and by multiple hikers) to signal a forest path. Videos of (a) and (b) be accessed on p. 3 and 16 of the visual diary.

Play potential #6: Role taking and distributed responsibilities. When engaging the forest in group, distributing aspects of the activity at hand can enrich the collective experience. An important quality of these shared experiences is the difference in expertise between forest goers. During many of the trips, Ferran realized that people's clearly different experience with (and dexterity within) the forest plays an important role in the unfolding of the events. For example, one day, when hiking a trail with steep and slippery hills,

some members of the party needed help to feel safe to continue walking (see Figure 8a) (NT#3); something similar happened during a snow walk (NT#16). Similarly, when foraging, experienced folks helped others decide which mushrooms to pick (NT#11). The quality of those experiences hinged on people's capacity for making everyone feel accepted and recognized for what they contributed to the activity, regardless of skill. In Ferran's nature trips, that was achieved by distributing tasks and responsibilities. For example, when camping, different people took responsibility for different tasks: those who were good at manual tasks set up the tents or hung a hammock; those who liked cooking prepared the food; those who were musicians played the guitar; or those who were avid hikers led a morning walk (NT#3). When hiking, people also took care of different needs: checking the map; taking photos; carrying food and water; or entertaining the party with jokes and such (NT#4). In all those cases, distributing tasks had a dual positive effect: (1) it contributed to an optimal functioning of the activity, making sure that all necessary tasks were taken care of; and (2) it made everyone feel useful and recognized, regardless of their skill. Participants of NT#9 came up with a design idea building on that play potential: "a multi-device system that playfully distributes digital information (and associated tasks) among a group of people who go to nature together, [...] so that each person takes pride, in a role-playing fashion, about caring for one aspect of human-nature interaction" like "knowing what time it is, keeping on track, controlling pace, taking care of the activity's ambience, entertaining the group..." (NT#9). According to those who envisioned the idea, the system should "focus [people] on the team rather than the technology", in ways that privilege the recognition of people's effort rather than tech's capacity for providing quick-fix solutions.

Play potential #7: The forest as a site for playful disputation. While smooth and well-distributed activity can contribute to the experiential quality of shared nature activities, fun can also derive from disputation. In his group visits to the forest, Ferran experienced several situations where joy emerged in different forms of playful and lightweight confrontation between people. An example is spontaneous snowball fight that took place during a snow walk Ferran did with a group of friends. At some point, while taking a break, one of them surprised the group by throwing a snowball at them. That triggered a hilarious battle that lasted over 15 minutes and led to intense laughter and fun (see Figure 8b), both for those involved and others in the audience. That made Ferran think about the potential of disputation to stimulate fun experiences within the forest: "There's something super compelling about tricking and teasing others in nature e.g. to win a race, or throw snowballs, or... How could technology support that?" (NT#16).

Play potential #8: Pathfinding and signaling. Forest experiences can also be shared asynchronously, in ways that shape large, loose-knit-yet-still-valuable communities of forest goers. A clear example is the act of marking trails, i.e. putting up signs or making marks on paths so others can follow them. That activity is often performed by average forest goers in bottom-up and non-institutionalized ways. During many of his visits to nature, Ferran found those asynchronous sharing events to be an interesting opportunity for playfully re-ambiguating the forest. They "can be seen as a creative act of care" that could be computationally enhanced as to "be used as a sensitizing activity" that entices people to care more for the environment by "feel[ing] they are the 'keepers of the forest"'. A design idea emerged from those reflections: an AR system that allows "creative ways of signaling paths", extending with multimedia affordances people's existing signaling practices such as making rock-based sculptures to indicate a turn (NT#8, Figure 8c).

4.4 Enabling spontaneity and silliness

Another form of joy one can find in nature is silliness. Imbuing forestry activity with an element of carefree fun and laughter can help to make it memorable. During his trips, Ferran experienced countless instances of that potential: "Sometimes it's all about the playful, silly social situation, not about doing the right thing or being the best or most experienced" (NT#3). Here we highlight three play potentials that relate strongly to that notion of silliness, motivated by a set of hilarious lived experiences documented by Ferran and his forestry peers. We hope that they inspire designers to imagine future nature technologies that encourage people to let go and elicit the emergence of carefree joy.

Play potential #9: Bloopers and spontaneous laughter. One of the most obvious sources of laughter in nature are bloopers. An example is NT#11 where, while deeply focused on finding mushrooms, a participant suddenly yelled and started laughing. In response, another said: "Did you fall? Don't do this to me!". He regretted missing on the opportunity of seeing his friend fall on her butt. Everyone involved, Ferran included, laughed about it. Then, they talked about the importance of these events when it came to the experiential quality of nature activities: so long as they do not risk serious harm, they can be a lovely source of laughter (for both those involved and those around them) that supports bonding through playful teasing. Ferran synthesized that conversation as follows: "When going to nature with friends, bloopers are likely to happen (e.g. someone slipping, a branch hitting someone's face...). It's super funny to witness them, and it sucks to miss out on those moments. Maybe technology could help to store them and make them accessible for the whole party, so no one misses them?" Following up on that reflection, Ferran and his peers speculated how tech might enhance the underlying experience: On the one hand, it could help to document these events so people do not have to stay vigilant. Motivated by a situation where a hiker's fall was accidentally caught by someone else on video (Figure 9a), a participant of NT#4 proposed a tech that "anticipates when someone is going to fall and documents it"; another extended it with "a filter that interprets whether the fall is harmless, to share it on social media, or harmful, to call for medical support". Participants of a snow walk, where people struggled not to slip and fall (NT#16, Figure 9b), had a similar idea: by anticipating a fall, an audio mechanism could play a sound to magnify it (e.g. a "mickey-mousing" effect[1] [16]). Existing smart watches are equipped with fall detection and could support such kinds of experiences; yet, these capabilities are only used for emergency response. The above ideas begin to hint at how that infrastructure could also be used towards joy and celebration, and better respond to people's desire for shared fun and laughter.

[1]"Mickey mousing" is a film technique that synchronizes music with the movie's actions to amplify them. It originated in the early Disney films, where music mostly focused on mimicking the characters' actions. It is known to be a useful technique for creating humor and parody.

Figure 9: Silly forestry events: (a) an accidental slip; (b) people struggling with ice walking; (c) a selfie of Ferran struggling during a run; (d) Ferran walking up a margin, chasing mushrooms; and (e) photo sneakily taken by a camper from inside their tent. Videos of (a), (b), (c), and (d) can be accessed on p. 4, 16, 6, and 2 of the visual diary.

Play potential #10: Suffering together. Bloopers are not the only source of silliness supported by the nature. Witnessing and dealing with exhaustion (one's and others') can also be hilarious. During a group hike (NT#4), while walking down a hill they had previously climbed with a fair share of suffering, someone graciously said: "Here's where I almost got a heart attack!". That led to intense laughter and inspired the "No-breath cam": a set of heartrate sensors and 360° cameras people can use when hiking in group so "when someone is exhausted, cameras take a photo to catch their funny face" and a photo album is produced for them to re-live the funny moments. Interestingly, Ferran also found exhaustion to be a potential source of shared silliness when walking alone. He noticed he was often able to amuse his non-present acquaintances by sending selfies while engaging in strenuous activity, e.g. when reaching a summit during a trail run (Figure 9c, NT#6). Nature tech could enhance the silly sharing of exhausting events in ways that amplify the experience of remote audiences (e.g. through multi-sensory stimuli) or even afford novel ways for them to answer back.

Play potential #11: Performative documentation. Both PP#9 and #10 used documentation as the enabler of joyful experiences. By storing bloopers and other silly events, nature goers can indeed relive those exhilarating events. But the potential of forestry documentation transcends remembrance: it can be, in and of itself, a standalone source of fun. In several of his trips to nature, Ferran experienced how documentation can "add some spice" to forestry activity (NT#16). For example, while taking a panoramic photo of the group during a snow walk (NT#16), two participants moved their faces and bodies as to mess with the photographer (Figure 10). The resulting photo was as bizarre as it was fun, and it led to laughter by everyone in the party. Similarly, during a camping trip (NT#3), a participant sneakily photographed others' sleepy faces in the morning, from inside his tent, and shared the pictures as friendly pranks on *WhatsApp* (see Figure 9e). Another example of how documentation can be a standalone source of social silliness is a situation Ferran experienced during a foraging trip: At some point during the foray, he climbed up a margin where he thought he might find a particular kind of mushroom. His companion leveraged that as an opportunity for social play: she started filming his actions on video while role-playing the making of a documentary voice over, pretending that Ferran was a gorilla and narrating his actions as such (Figure 9d). Watching the video afterward was a highlight of the trip and led to a design idea involving silly documentation: "some kind of speaker device that invites people to narrate, in performative, silly, epic, or otherwise funny ways the actions of their peers" (NT#2).

4.5 Fostering a sense of belonging

Our last set of play potentials have to do with the experience of forming bonds of familiarity with and through nature. The lived experiences captured in Ferran's diary—which reflect his and his nature companions' different ways of engaging nature—revealed several ways in which the forest can contribute to developing a sense of belonging. Here we unpack two that might inspire the design of tech that helps people to create and strengthen bonds with a natural space.

Play potential #12: Becoming an expert of the forest. The forest is not only a site for social bonding; it can also help people to strengthen their emotional connection with the land. Spending quality time in a particular forest can create a sense of belonging: by mastering it, one becomes a part of it and its surroundings (sociocultural and geographical). Ferran experienced that as he recurrently engaged the forests around the town he had recently moved to: "It's an amazing feeling when you begin to know a particular forest well enough so you can find your way in it comfortably, without paying too much attention" (NT#11). Such familiarity brought "pleasure[s of] proficiency, sense of ownership, and sense of belonging" (NT#11). During a trail run (NT#12), Ferran envisioned a tech to afford experiences of territorial belonging: "an AR app that [displays] an overlay of the paths you've walked or run when you observe a landscape", and thus reflects one's engagement with the forest over time so they can remember and share it with others.

Play potential #13: Symbolic kinship. Humans have long strived to own the forest (among other things). While that can contribute to people's sense of attachment to a place, claiming ownership over nature is problematic for many reasons. During his trips to the forest, Ferran identified two opportunities for alternative, more symbiotic human-nature interaction that, rather than allowing people to claim the forest as theirs, invite them to relate to it as a home they share with others (humans and beyond). The first opportunity emerged from the mushroom forays. From his vast experience as a forager, Ferran knew that "people often remember spots where they always find mushrooms" and playfully claim them as their own (NT#10). Ferran himself had "his yellowfoot spot" where he often found that mushroom in abundance. While foragers often take great pride in those spots, they hardly see them as exclusively theirs. Not only they accept that anyone might eventually

Figure 10: A hijacked panoramic photo. Left: the original photo. Right: close-up of the glitch the hijackers produced.

find them—and thus do not oppose resistance by fencing or otherwise making them inaccessible—but they often share the location as an act of fellowship, love, or trust. The complex social dynamics behind that phenomenon reveal an interesting form of kinship; one where humans take pride and feel attached to a place but do not claim exclusivity or attempt any form of domination. Unpacking that symbolic form of kinship sparked an idea: "through AR, we could enable people to customize those places and make them home, [. . .] and maybe leave friendly, sassy messages to others who may find [them]" (NT#10). That might be an exciting approach even beyond the context of foraging: it would allow anyone to create their own hybrid spaces of belonging within the wilderness, in ways that do not damage or dominate the forest yet still support the emergence of emotionally rich connections. The second form of symbolic kinship that emerged in the nature trips related to the idea of bringing the forest home. Humans have long done that: collecting flowers, leaves, rocks, branches, or even whole plants and trees, and bringing them home to decorate. That can be seen as problematic: it damages the environment and undeniably frames it as an object of domination. A solo walk in the forest (NT#12) sparked a design idea that supports alternative, unharmful ways of bringing the forest into the household: While admiring the autumn colors and listening to the sounds of the birds and the wind, Ferran imagined an "app for creating a sound bank of one's nature activities, or for storing the color palette of the forests they visit, and then see the house mimic them" through a multisensory IoT ambiance system. That idea shows how tech might support symbolic forms of kinship that allow us to playfully bring the forest home and synchronize our day-to-day more intimately with nature—in ways that seek to get closer to, rather than dominate, the wilderness.

5 DISCUSSION

5.1 The generative value of our play potentials

Our hands-on engagement within nature revealed playful events that can enrich forestry experiences. They shed light on aspects of forest activity have intrinsic joy, and thus direct our attention towards areas of the human-nature interplay where tech could make a positive impact. By articulating these observed experiences as *play potentials*—contextually-grounded, joy-oriented design material [6]—we hope to inspire a new wave of forest tech that helps us to better connect with and care for nature, to cherish it and the many pleasures it can afford. Figure 11 summarizes our play potentials and design directions. We present them as starting points for joyful and caring forest tech innovation.

The early ideas that came up in our forest trips show how our play potentials may materialize into concrete designs: NT#2 gave rise to an IoT device that signals mushrooms' seasonality so people grow aware of when/where they might find them (PP#3); during NT#14, Ferran imagined a device that prompts wearers to pay attention to, spot, and mindfully learn about forms of wildlife that are unusual for them (PP#4); or during NT#8, he devised an AR app for creatively signaling forest paths in ways that are both functional and aesthetic (PP#8). These ideas share a focus on supporting experiences where people can thrive in their interactions within the forest and cherish the multifaceted beauty of nature—and, often, the joy of sharing it with others. Rather than framing the forest as an object of domination, they embrace it as a companion to care for and flourish with. These ideas thus extend existing designs (see 2.2) by focusing explicitly on surfacing the inherent joy of human-nature interactions. For example, some provide inspirational starting points for diversifying the palette of joyful experiences environmental awareness interventions, e.g. the Wildeverse game [35]. They also propose joyful ways of supporting positive affordances of nature demonstrated by previous literature (see 2.1) by supporting tighter human-nature interplays. For example, through a device that anticipates possible slips or falls and creates musical soundtracks to magnify them, thus enriching the quality of the social experience around nature going; or through an IoT system that uses the sounds and colors people find in the forest and to create a multi-sensory ambiance back home, blurring the boundaries of forestry experiences by extending them into the urban space. These ideas hint at how tech might help to encourage people to engage the forest more and more often (which is known to be desirable for human wellbeing [51, 59, 67, 79]) in ways that also care for the wellbeing of the environment.

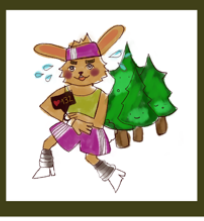
Importantly, our play potentials relate to aspects of human experience that have been discussed before in and beyond HCI. For example: our call for valuing social and contextual graciousness (DD#1, PP#1-3) is shared by research on human-food interaction [8] and computational social agents [11]; the idea of supporting experiences of wandering (DD#, PP#1 & #3) aligns with existing works around exploratory information search [81] and technology-mediated drifting [38]; the idea of using tech as a reminder of nature's aesthetics (PP#4) relates to a rich body of work on multisensory experiences [63]; our thoughts around the playful potential of role-taking (PP#6) extend into the nature a longstanding tradition of work around group-oriented experiences, both in computer supported collaborative work research [19] and in game(ful) design

PLAY POTENTIALS OF HUMAN-FOREST INTERACTIONS

A printable deck of cards featuring all the play potentials on this list can be downloaded at **https://bit.ly/wildtechcards** or by scanning the QR code to the left.

DESIGN DIRECTION 1
VALUING SOCIAL & CONTEXTUAL GRACIOUSNESS

#1 Ambiguous orientation
Wandering around the forest without clear indications enables exploration and creates space for emergent social situations. How might technology provide people with ambiguous information about their whereabouts or direction so they can figure things out themselves?



#2 The empathic training buddy
When training in nature, feeling cared for and guided in empathic ways can enrich the experience of exercising. How could we use tech to support people in training by caring for its emotional (rather than productive) dimension?

#3 A mentor rather than a guide
Rather than teaching or instructing, tech could act as a sensei: sharing just enough so it empowers us to figure things out ourselves. What if nature tech did not teach or instruct us on how to do things in nature (e.g. foraging), and instead empowered us to learn through experimentation?

DESIGN DIRECTION 2
RECLAIMING THE AESTHETIC BEAUTY OF BEING IN NATURE

#4 Reminders of nature's beauty & seasonality
Nature is both beautiful and dynamic: its capacity for mutating holds potential for providing seasonal experiences of novelty. How could technology subtly point us towards the seasonal beauty of nature so we are compelled to go out and explore?

#5 The lovely reward between suffering & reward
The suffering derived from intense activity within nature can be a source pleasure, especially if coupled with an intrinsic reward.How could tech afford experiences of gratification that operate at the intersection between exhaustion & pleasure?

DESIGN DIRECTION 3
HIGHLIGHTING THE JOY OF SHARING THE FOREST

#6 Role taking and distributed responsibilities
People have remarkably different experience with (and dexterity within) the forest. Giving people roles that suit their ability can help to enrich the quality of the shared experience.How could we scaffold group activity so everyone's role suits their abilities and makes them feel seen and recognized?

#7 The forest as a site for playful disputation
Tricking or teasing others in nature can be a source of collective joy, e.g. unexpectedly throwing a snowball. Tech could support those kinds of disputation forms in playful ways.How might we enable forms of playful disputation that make people's experience of nature activity?

#8 Pathfinding and signaling
Pathfinding and signaling offer opportunities for asynchronous communication between forest goers, e.g. through creative signs.How can we help nature goers feel like "carers of the forest", e.g. inviting them to contribute to signaling & taking care of trails and paths?

#9 Bloopers and spontaneous laughter
It can be really fun to be a part of (or see someone go through) an epic fail within nature, e.g. slipping and falling on one's butt. How can we help people to find joy in the bloopers and moments of epic fail that sometimes take place in nature?

DESIGN DIRECTION 4
ENABLING SPONTANEITY & SILLINESS

#10 Suffering together
Experiencing exhaustion in group can be a source of social fun, either by bringing people together or by enabling an occasional tease. How can we help people to cherish those parts of nature activity that are intense, strenuous, or otherwise effortful?

#11 Performative documentation
Ordinary nature-related events can become memorable if documented in fun, creative ways that add extra meaning to them.How can we help people to turn ordinary nature activities into a fun and memorable ones through creative documentation?

DESIGN DIRECTION 5
FOSTERING A SENSE OF BELONGING

#12 Becoming an expert of the forest
One can find a lot of joy in learning the intricacies of a specific forest as to become acquainted with it feel they belong in it. How can we help people to experience the pleasure of becoming acquainted enough with a forest as to be able to (intuitively) act within it?

#13 Symbolic kinship
We should seek alternative, environmentally sensitive forms of kinship that, rather than claiming the forest as ours, invite us to relate to it as a home we share with others. How might technology allow people to customize the forest and/or bring it home without making an environmentally negative impact on it?

Illustrations by Velvet Spors

Figure 11: Summary of our list of play potentials. An accessible version be found at https://bit.ly/playpotentialsnature

[71]; the idea of framing the forest as a site for playful confrontation (PP#7) has strong ties to gameful design research around the pleasures of disputation [82]; our reflections on the playful dimension of suffering (PP#9) relate to works around the ambivalent (and sometimes enticing) nature of experiences of thrill and pain [13]; or the idea of symbolic kinship (PP#13) aligns with the human-nature entanglements often proposed by sustainable [66] and more-than-human [26] oriented HCI. We speak to that rich body of works by providing a glimpse of how these experiences might be relevant in forests, and contribute actionable directions and exemplar design concepts that could induce these experiences. Future work should investigate how to translate relevant knowledge in each of those areas to the idiosyncratic space of human-forest interaction through hands-on design, development, and evaluation practices. Our contribution is a first step in that direction: it highlights exciting design avenues for re-centering people's attention towards the joy (rather than the productivity) of being in the forest.

5.2 Towards designing to cherish (rather than use) the forest

Our work aligns with contemporary calls for embracing sustainable [31] and caring [52] values in HCI. Rather than designing tech to optimize and make productive use of our interactions within the forest, we seek to inspire designs that help us to cherish nature more, to care for it and for all it has to offer. We look at forests not as commodities at our disposal but as a spaces for conviviality we should love and respect. Thus, we do not see tech as a cure to a "nature deficit disorder" [55], or as a tool to otherwise instrument nature; rather, we highlight its capacity to support sustainable and caring human-forest interplays. We embrace the idea of *working with* rather than *controlling* nature [54]: by reclaiming the relevance of joy (which, as our findings indicate, is inherent to nature) we hope to challenge current ideas of the role of tech in human life and work towards de-colonializing human-centric ideas of the human-forest interplay.

Works in play studies and play design posit the act of caring for joy as a relevant form of political resistance against hyper-capitalistic world views [40, 72]. Excited by that potential, we hope to support a playful transition towards increasingly caring forms of forest tech design. To achieve that, we believe it is crucial to draw our attention back to the earlier question: if forests are inherently joyful, why would we digitalize them in the first place? Indeed, tech is not the ultimate solution to everything [60], nor is it needed to experience joy [76]; as suggested by [15], a valid outcome of design research can be the realization that tech may, in fact, be unnecessary (or even detrimental). We suggest that, in the design space of human-forest interactions, that can both be and not be the case. While tech can on occasion hinder the quality of our forestry experiences (or even worse, pose environmental threats), there are also scenarios where the affordances of digital media may add value. We see an opportunity for exploring those opportunities further and present our contribution as an early starting point. We acknowledge the risk that our study is perceived as a call for designing tech that, by delivering an enjoyable user experience, reinforces forest-related behaviors that pose risks to individuals and/or the environment. Though our generative contribution does not endorse manipulative patterns (e.g. those often associated with gameful designs leading to addiction or unnecessary competition [9, 43]), we feel the need to remind designers that adopting our play potentials without putting enough attention to their celebratory, caring, and sustainable character may lead to undesirable effects that can be harming to people and the environment alike.

We thus stress the moral framing of our contribution: it foregrounds opportunities for weaving forestry experiences that are holistically caring and should not be used to playfully reinforce human-centric understandings of the human-nature interplay. Our study highlights 13 aspects of forest experiences that can be both fun and environmentally caring. Some of the speculative ideas that emerged during our trips begin to hint at how that playful potential might be responded to by tech design. For example, the "symbolic kinship" play potential (PP#13) builds on the idea that, to feel connected to a forest, we do not need to claim exclusivity over it—or, even worse, to remove some of its parts and bring them home. Such kinds of ideas begin to hint at the opportunity of using joyful forest tech to create hybrid spaces for human-forest interaction that afford symbolic and caring forms of kinship—ones that do not damage the environment yet still provide a(n arguably lovely) sense of attachment to a place. Future works should investigate the implementation of those principles in practice, in concrete design scenarios, and explore whether and how that desired impact can be met. By (co-)designing, implementing, and evaluating the performance of designs inspired by our play potentials, we will better understand how technology might help to realize them and to what extent.

5.3 Limitations and future work

Our study builds on a researcher's (primarily autobiographical) account of 16 trips to the forest. That comes with limitations: the events discussed in this paper were experienced by a limited amount of people, reported through the lens of a single one of them, and analyzed by that same person with the suggestions of three other researchers. Further, the study was anchored in a specific geographical setting, with its own socio-cultural and environmental idiosyncrasy. That inevitably influenced the kinds of playful situations our work built upon. Engaging other forests with different audiences would likely reveal additional play potentials. As a result, our work does not portray all possible ways in which the forest can be joyful; nor all our play potentials will bring joy to any forest-goer in any possible context. Rather than a universal, comprehensive guide to understanding the joyful character of forests, our work should be seen as a contextually grounded provocation that can help designers to embrace fun and joy as core values in their forestry work. It proposes starting points for envisioning tech that responds to nature's inherent joyful potential, which we claim is much needed considering the productivity-oriented trends that dominate contemporary tech design. Designers should adapt our play potentials to concrete contexts and audiences, mapping them out to each design scenario at hand.

Further, we reiterate the *generative* rather than *validative* value [39] of our contribution: it can help to carve the foundations of the rather novel design space of forest tech, in ways that privilege values of joy, fun, care, and celebration over those of productivity

and efficiency. We hope it gives rise to a new wave of forest tech that steers away from utilitarian human-nature interactions, and instead reclaims forests as spaces to cherish and celebrate. In future work, we will broaden the palette of experiences and sensitivities embraced by this study. To enhance our list of play potentials, we will engage with a more diverse pool of forest activities, e.g. biking, climbing, backpacking, or skiing, and situate those engagements in other socio-cultural and geographical settings. We will also contrast the experiences reported in this paper with the views of other people, and open up our explorations to other forms of nature to explore how our current findings may apply beyond forests. Inspired by [1, 8, 20], we will also work on implementing the second and third stages of the SPD approach [6], which propose to *enhance the play* (i.e. design tech and experiences that respond to our play potentials) and then *deploy* it (i.e. assess the impact of our designs in naturalistic settings). To that end, we will use speculative co-design methods to involve a diversity of stakeholders in co-imagining how the above (and other) play potentials could give rise to future forest tech that responds to people's need for joy, social connection, and emotional stimulation. We hope that the outcomes of that process will lead to the development of diverse joyful forest tech artifacts, which we will deploy and evaluate in naturalistic settings. In turn, we hope it will help us to discern if and how technology might contribute to realizing the different play potentials on our list, which as noted in 5.2 this paper only tackles through speculation. We hope other designers will also pick up on our work to follow a similar process: the inspirational material we present here can give rise to the development of design exemplars that build up to a new generation of technology that helps people to reclaim the joy of experiencing the forest, and thus begin to foster a shift from utilitarian to socio-emotionally and environmentally sensitive forest technology.

6 CONCLUSION

In this paper, we presented our generative insights from a series of reflexive trips to the forest. Through a combination of first-person, speculative, and situated methods, we engaged first-hand with a range of forest activities and used ours and other people's lived experiences as a platform for reflecting on the potential of nature to afford experiences of joy. A reflexive thematic analysis of those trips revealed 13 play potentials [4] of human-forest interactions, which we clustered in 5 design directions. We present them as inspirational material that can give rise to novel designs that support the celebration of nature and its positive socio-emotional affordances. We hope our work inspires a new wave of joyful forest technology that transcends techno-solutionism and focuses on alternative values of joy and care.

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