Towards sylvan games: Exploring playful forest-technology interactions

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Abstract

This paper presents a study based on research through design, exploring the potentials of the intersection between human play, forests, and technology. Building on the existing literature on urban games, we introduce the idea of sylvan games which focus on deepening the relations between players and natural spaces. We designed two different games, Sensor Hunt and Pathmaker, focusing on different dimensions of navigation and technologies. Fourteen participants played the games while quantitative and qualitative data was collected using pre and post gameplay surveys, open questions, and drawings. A hybrid thematic analysis approach was employed to analyse the data and four themes were identified: the game, the technologies, the forest, and the participants' emotions. The emotional influences of the games were further explored using PANAS and text analysis. We discuss these results and suggest a list of design considerations for future sylvan games based on our findings.

Keywords

Gamification, forest games, sustainability, location-based games, play in the wild

1. Introduction

The human relationship with nature is the epicentre of many of the societal challenges of our time, a key component in the struggle for building sustainable societies and in the efforts to promote human well-being. Within this context the UNITE project explores novel ways to help humans relate, preserve, and interact with natural spaces, and in particular forests. As part of this project, we present a pilot study exploring the design possibilities at the intersection between humans, technology, and nature. This pilot consists of two simple games designed to explore the potential of playful human-machine-forest interactions.

2. Methodology

This study employs research-through-design (RtD) [1], which recognises the epistemological qualities of design endeavours. Design activities have to explore and be situated in both the practical and theoretical dimension of their topic. Unlike traditional research methods following strict procedures to achieve specific results, RtD has an exploratory nature, aiming to create something new and learn from the process [2]. RtD is often used in gamification research, using game design as a focal point for exploring various socio-technical and cultural aspects associated with playfulness [3, 4].

The aim of this paper is to explore the design space intersecting games and forests, building on the design and deployment of two games focusing on human-sensor-forest interactions and of its players' feedback. Following Gaver's [2] structure, we will reconstruct our design activity through exploration of its context (section 3.1), development of its space (3.2), the refining and making of the two games (3.3), and a phase of assessment and learning, grounded on player

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responses and analysed with a mixed methods approach (4).

3. Design

3.1. Exploring context

Urban play has been a key research area within games-studies [5] and gamification [6], especially following the success of location-based games such as PokémonGo [7]. Paradigms for ludic [8] or playable [9] cities, as well as for playful citizens [10] have been proposed and developed. One key rationale behind these studies is the centrality of the urban environment for human life. Despite urbanisation, however, humans are not only urban animals. Humans inhabit extensively rural areas and engage continuously with all sorts of natural environments which can be engaged in playful ways. From countryside festivals [11] to in-the-wild sport activities [12], to geocaching [13], the list of playful practices in natural spaces is extensive. Many of them are low-tech, as such environments pose challenges: from lack of electricity to reduced connectivity [14].

There is an underexplored design space, therefore, for games focusing on the relationship between natural spaces, technology, and human play. In this study we decided to focus on forestry space and to explore it by developing *sylvan games*.

3.2. Developing a design space

Sylvan games differ from urban games because of the spatiality they face: while urban games happen in a strongly *striated space* (i.e., strictly structured environment [15] sylvan games take place in a space that is often *smooth* (i.e., naturally emerging, often amorphous for untrained human eyes [15]. Navigation emerges as a key feature of the relationships between humans and forest, but also for the involvement of technology in it. The most common technologically mediated play practice taking place in the wild is probably geocaching, using GPS technology.

In our game design, we decided to focus on the use of *sensors* in forests and on exploring play potentials [16] emerging from their use. Sensors are at the centre of bottom-up strategies of citizen sensing [17] that empower people to reappropriate data and real spaces by interacting with different sensory technologies (monitoring air quality, sound pollution, etc.) - a practice which combines well the need of communal forest monitoring [18] and the principles of punk gamification [19].

Figure 1: Temperature sensor "Sauron", a MicroBit-based interactive artefact.

3.3. Refinement and making

We designed two games for forest spaces using different kinds of sensors. These are prototypes for more complex and carefully designed future sylvan games. For accessibility, we opted for cheap sensors that are easy to program and deploy (MicroBit 2.0), or sensors already in possession of the players (GPS tracking in smartphones) in combination with free applications. We used the games to focus on two key issues concerning navigation: wayfinding [20] and pathmaking [21].

The games were tested in a 3-day retreat in the "Uniikki lomapaikka" mökki in Jämsä, Finland with members of the Gamification Group, including the authors. The games could be played at any time, with instructions given to the group verbally and in print. Both games could be played alone or in groups, and required the use of technology (smartphone) while going out in nature.

Sensor Hunt (SH) focused on wayfinding and using a heat sensor. Players were provided with approximative coordinates to a nearby woodland

location where a slightly personified temperature sensor called "Sauron" because of the red eye on its display (Fig.1) was "hidden" (Fig. 2). Participants had to find it and record the temperature it displayed. The player that would record the highest temperature in the 3 days would win. This entailed that participants might revisit the sensor to increase their winning chances.

Pathmaker (PM) focused on pathmaking and GPS. Players were instructed to download a free app called "My Track" which uses GPS to record their path on a map. The goal of the game was to use it to produce a word or a drawing by walking in the forest. There were no winning conditions

4. Assessment and learning

Both games were played in Spring 2022, in Finland, during relatively sunny days. Participants were almost the same for both games, 8 for SH (5 male, 2 non-binary, 1 female) and 6 for PM (4 m, 1 nb, 1 f), mean age 32.57 (26-38). To assess their experience, all participants were asked to complete the PANAS 10-item questionnaire [22] before and after playing. The questionnaire had 5 items measuring positive affective traits and 5 negative. After completing each game players answered a few questions regarding their experiences with the games, technology used, and relationship with nature.

Following we present the data collected and propose an analysis leading to design considerations for creating sylvan games.

4.1. Thematic analysis

The data collected consist of text and drawings and has been analysed through a hybrid thematic analysis approach [23, 24]. The analysis was conducted following an adapted coding procedure using a combination of pen-and-paper and digitised transcribed data.

Accordingly with best practices, our analysis was articulated in 6 steps: 1) Initial data familiarisation; 2) Preliminary coding scheme based on observations; 3) To ensure reliability of the codes, both authors coded all data independently and formed two lists of possible themes; 4) Compared results and resolved conflicts through discussion, clarifying definitions of inconsistent codes and adding new codes; 5) Both authors coded the entire data using the improved themes. 6) Produced a report containing our observations based on the themes constructed. Our analysis identified four themes relating to different elements involved in the experience: the game, the technologies, the forest, and the emotions and self of the participants. Each theme is then articulated with several subthemes.

Figure 2: Temperature sensor "Sauron", a MicroBit-based interactive artefact.

Table 1
Identified themes and subthemes.

Game

Gameplay	Ease
	Difficulty
Strategy	Setting objective
	Ingenuity
	Behavioural flexibility
Additional Entertainment	Music
	Drink
	Sport
	Pretend
	Explore
Social relations	Competition
	Collaboration
	Presence
	Other

Technology

Sensor-use	Navigation

	Temperature
	Drawing
	Other
Other tech	Flashlight
	Phone
	Go Pro
	Watch
Tech challenges	Accuracy
	Misrepresentation
	Operating

Forest

Environment engagement	Description
	Relation
	Navigation
	Temporal factors
Nature challenges	Accessibility
	Anxiety & Dangers
Animals	Animals met
	Animals imagined

Emotions & Self

Emotion expression	Positive
	Negative
	Expectation
	Changes in perception
	Reflection
Forms of expression	Text
	Map
	Drawing
	Comic
	Word-art
	Humor

4.1.1. Game

The first theme focuses on what the players expressed regarding ludic aspects. Many players reported their opinions about *gameplay*, especially expressing difficulties they encountered (12 times), or the ease to accomplish tasks (6). Difficulty was often associated with challenges related to technology or the environment. Interestingly, players referred to the same situations in different ways, either because of perception of the space or atmospheric factors.

P4: *"There were many trees around the sensor, so it took time to find it".*

P6 *"It was easy to find the sensor, because it was shiny bright at night."*

Another subtheme was the *strategy* players adopted. One of the key elements that emerged was the use of ingenious solutions (5 occurrences) including using body heat to achieve a higher temperature (SH), looking for shortcuts, and exploiting GPS drift (PM).

P3 *"I used my body to heat up the sensor for a higher number"*

Several players set up their own objectives, especially in PM, which had no clear goals. Players decided what to draw or what style to adopt (a tree, a spiral, a circle, inorganic shapes contrasting the forest…), and some connected gameplay to other objectives, such as supporting a running routine or preserving memories.

P12 *"it is good to record the trip in the forest and save it as a souvenir* 😊 *"*

Other themes related to strategic thinking were evident by behavioural flexibility (players adapting their strategy to, e.g., the terrain or mistakes they made) and reflections on learning through practice (P10 mentions "mastering the tool" in PM).

Many players made use of *additional forms of entertainment* while playing, including music, drinking alcoholic beverages, working-out, exploring the forest, and even instances of pretend play that accompanied, and enhanced, their playful experience.

P13 *"I listened to good music and walked in beautiful nature."*

P14 "*I had a go-pro and I was talking to it."*

These additional layers of play were more present in the free-form PM, but several were also mentioned for SH (notably music and drinks). Finally, players reported their *social relations* with other players. Two cooperated in SH, going to look for the sensor late at night, and two others mentioned spotting other players and having to wait for them to leave. Competition emerged only hypothetically in one of the responses about SH:

P3 "*I think if I was more incentivized by competition (I am not) I would try to learn everybody else's numbers to calculate if I need to go back."*

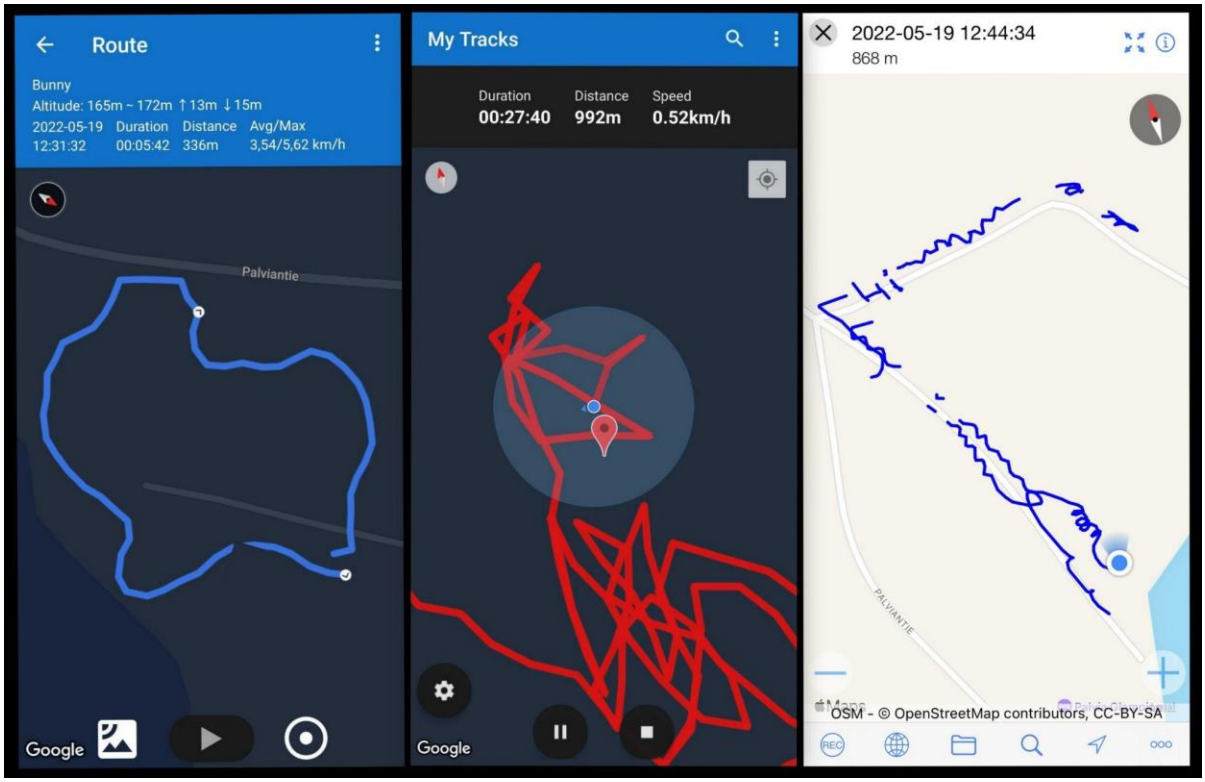

Figure 2: Drawings made by PM players. From left to right: a bunny, inorganic shapes, and a humoristic path.

4.1.2. Technology

The second theme focuses on the relations between players and technology. Most players reported *using or interacting with sensors* in different ways. Many used them for navigation with *Google Maps* being abundantly mentioned for SH and *MyTrack* for PM. Only one player mentioned the use of *MyTrack* to record and conserve the path, others focused instead on the act of drawing with it. Several players reported their interactions with "Sauron" when finding the sensor, operating it and, in two cases, warming it up. *Other tech* was also mentioned by several players, including: Flashlight, Phone (video, pictures), GoPro, and Smart Watch.

P6 *"We used a phone (navigation), a flashlight and a glass of gin-tonic."*

Finally, players mentioned several *technological challenges* while playing the games, notably: GPS accuracy (P5 "*It did not point me first to exactly the right place*"), misrepresentation of their path in *MyTrack* (P9 "*it made an ugly line that did not even show up in the final drawing*") and difficulties in operating (P5 "*Filming and clicking without shaking the thing (sensor) was annoyingly hard*"). Technical challenges were generally associated with playing difficulties and often generated negative emotions.

4.1.3. Forest

A This theme is related to the natural environment of the game. Most players described different kinds of *engagement* they experienced with the woodland. Their personal relations with the environment were the most cited (15 times), including both positive and negative perceptions. Some players mentioned their relationship changed because of the game.

P8 *"I did feel a positive familiarity when I returned."*

P4 *"I had too much expectation about this experience so when the experience failed to meet my high expectation, that caused some negative emotions, which reflect on the area [sic] of the forest (my relationship with the place)."*

Several (7) descriptions of the environment were presented, generally mentioning the presence of many trees, wet moss, and pathways.

P1 *"There is no path towards it, so you need to walk between trees, between the trees on the soft soil covered with moss."*

The role of the environment in *navigation* also emerged strongly (6) with a strong focus on a car-road passing through the forest, and on existing paths:

P1 *"I am glad it was not too far away from the road"*
P2 *"I liked that it was not on this road, but I had to explore a bit"*

Interestingly, no other environmental elements emerged as landmarks in the players responses. Temporal effects were also mentioned twice, by players that played at night and indicated darkness as part of their experience. Two players mentioned the possible presence of animals, but never actual encounters. This possibility was always considered threatening:

P1 *"I immediately imagined snakes under my feet. The most unpleasant experience was when I (...) touched sticks because they are home for ticks and mites."*

Players also mentioned forest *challenges*, both related to accessibility in relation to wet soil and to possible dangers.

P9 *"I was attentive of the ground not to hurt myself"*

4.1.4. Forest

The final theme focuses on the players, and in particular on their emotions and self-reflections. Players *expressed* both positive (niceness, familiarity, enjoyment, happiness, fun, excitement, inspiration, comfort, soothingness, safety, activity, amazement, pride, awe, generic "good" feelings) and negative (annoyance, fear, disappointment, stress, pressure, dislike, unpleasantness, and frustration) emotions. Positive emotions were often connected to playful activities and to natural spaces. Negative emotions were often connected to technological or natural challenges and possible dangers. As part of the analysis, both authors individually marked all expressions of emotions indicating clear negative or positive valence through all reports. Then the authors compared notes and agreed on a total of 10 negative expressions, and 28 positive ones.

Emotional influences were also explored using a quantitative comparison using PANAS [22], to determine if there was a statistically significant difference between the negative and positive participants' emotions before and after playing. The 5 positive and 5 negative items from PANAS were used to form the two groups respectively. The two groups were used to test if there was a statistically significant difference between pre and post scores. Due to our small sample ($N=14$) a non-parametric Wilcoxon signed rank test was run using SPSS. There was no statistical difference found between the positive traits felt before and after the playful experience ($p=0.8$), and no difference between the negative feelings experienced before and after ($p=0.5$). The PANAS average scores were higher for the positive items compared to the negative ones.

Additionally, some players voiced their *expectations*, especially when not met, regarding the game or their own performance:

P9 *"I did not know whether I should blame it or myself when the drawing did not go as expected."*

Others reported playing helped them obtain a new perspective on the technology or the environment.

P 11 "*It made me map the environment/ reflect on GPS +phone (how it works/ways) to exploit it)- different context than "normal" google maps/GPS use!"*
P 13 *"Helped me obtain a new perspective."*

Some players also shared their *reflections* during the playful activity:

P11 *"I reflected on inorganic shapes and tried to create non-foresty shapes"*
P12 *"I was thinking about the beauty of nature, magic of nature"*

Lastly, our analysis individuated several different *forms of expression* the players adopted to express their experience. In particular: written text (majority of answers), maps (5), drawings (7), use of humour (5), one comic and one "word-art" (reading "*DARK*"). We found the use of such creative forms highly relevant, but their analysis will be the object of another study.

5. Discussion and design implications

The analysis of the data collected by the players prompted a discussion between the game designers, which led to several design considerations. These considerations can be the base for future projects involving both the creation of sylvan games and the study of forest design space. Due to the exploratory nature of this study, the following considerations are preliminary steps, illustrating possible resources for future designs and refinement.

- While the PANAS test did not produce any significant result in the emotional state of participants before or after the game, the players' answers report many strong emotional responses, possibly confined during the game experience. This suggests the potential of sylvan games to provide visceral experiences to players.
- The emotions reported by the players, while often positive, varied greatly. The strong dislike and fear of forest spaces from some of the participants suggests that different layers will respond in significantly different ways to games that take place in woodland. Designers can cautiously use this as a resource, realising games that aim to invoke different emotional responses, including fear and discomfort, that can still be appreciated by players [25].
- From the responses, it appears that spatial navigation relied heavily on different technological means and the only spatial features players used to navigate were human-made (roads, paths). Similarly, fauna was mentioned only as an imagined possible threat. While this might be due to the types of players involved (urbanites without a deep knowledge of the flora and fauna) it also indicates a possible design direction: games that require a more close engagement with the natural space. Offering natural landmarks alongside coordinates in the game instructions, for example, might increase the connection with nature and even present learning occasions (e.g. if players need to spot an Oak tree near certain coordinates, they will have to first learn its features).
- Many players reported encountering natural challenges, often related to the difficulty of reaching a specific location due to obstacles or moistness of the terrain. While urban games cater for a space that is generally stable, sylvan games happen in continuously changing environments. A couple of days of rain, a coat of snow, or a wet season could significantly alter the accessibility of several locations. Sylvan game designers must keep this in consideration, both as a limitation, but also as a possible resource for seasonal or otherwise situation-dependent opportunities.
- Players also reported frustration towards malfunctioning inaccuracies of the technologies used, especially the GPS. While malfunctions can hinder enjoyment, we also argue that inaccuracy could be used as a resource to indicate the "off-the-grid" nature characterising sylvan games. Inaccurate GPS might require longer searching to find specific coordinates, or longer paths to be able to draw some specific shape in PM. This increased need of time or distance is metaphorically well connected with the features of natural spaces, which are more rarefied than urban spaces.

In conclusion, our preliminary and exploratory study was able to inspire several design implications that can help guide the development of sylvan games as an area of design and research. The current study is limited in scope, as it included a restricted number of participants and two relatively simple games. Additional data including psychophysiological measures during play (Empatica), and maps realised by the players were collected and will be explored in future studies aiming to establish a more concrete framework for safe and influential sylvan games.

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