Ekō: a Smart Toy for Fun and Active Learning during Outdoor Experiences

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Abstract

The pervasive use of technology, especially screens, is often blamed for children not leaving home. The prevalence of intrusive gameplay paradigms hinders social interaction as well as interest in the natural environment, leading to children's alienation from nature. Ekō is a smart toy that fits into this context by transforming screen-time into an active, educational, and fun outdoor experience. The system is meant for children from 6 to 10 years old and it is designed to stimulate their interest in the natural environment through a slower sensorial activity. Ekō consists of five recorders (see Figure 1), designed to collect natural sounds and an integrated tablet-based system to produce audiovisual content. In this case, technology becomes a solution to encourage children to go out in the open air and explore, without interfering with the central experience and indeed promoting a connection with the natural world.

Keywords

Smart toys; outdoor learning; outdoor exploration; pervasive games; smart object design; unobtrusive interaction design

Figure 1: Ekō's recorders and logo.

1. Introduction

As many studies conducted in the last decades have stated, children spend less and less time outdoors [5, 23, 31]. Indoor habits not only increase the appearance of medical conditions such as asthma, obesity and vitamin D deficiency, but they also affect children's mental wellbeing. This condition has been worryingly described as "nature deficit disorder" by Richard Louv [20]. Although this definition is certainly not scientifically compelling, studies such as those conducted by McCurdy & Co [22] and Clayton [4], give value to this concern by proving that spending time in a natural environment could lead to improvement of children's mental and physical health. Despite that, children are spending less and less time outdoors due to different factors such as structured school activities, difficulty in accessing outdoor spaces in urban areas, or safety concerns [16, 17]. In addition to that, technology is frequently addressed as one of the causes of this disconnection between nature and children [29], as they easily become addicted to screens, and increasingly spend their free time indoors instead of going outside. At the same time, it must be noted that technology and nature are not mutually exclusive. It was indeed claimed that both traditional methods and digital tools can be widely effective in connecting children to nature in a spontaneous and genuine way [2, 6, 12].

Therefore, technology can be leveraged to stimulate children's interest in the natural environment and contrast their growing distance from nature. Ekō stems from the need to contribute to this area, as a result of user-based research. Ekō is an integrated product-service system that offers a playful, creative and educational outdoor experience, by providing a slower game rhythm for children from 6 to 10 years old. Ekō is composed of a set of recorders to capture the sounds of nature and an integrated system that enables children to manipulate recordings to create audiovisual content. The system is made of a tablet app and a base that is necessary to connect the recorders. Ekō aims at placing itself at the service of children in their discovery of nature, acting as a go-between nature and their creative spirits.

2. Background and user research

Technology use is becoming more pervasive even in outdoor settings. As of now, children too have access to digital devices that they can use to interact with the environment. Various studies have explored how ubiquitous computing technologies can be used as a tool to enhance nature exploration with children [7, 13, 15, 23]. Such technologies can be used to foster social interaction among children [10, 11, 14] but also to design of playful educational outdoor activities that can also involve indoor activities as a follow-up [1, 8, 29, 25, 26]. Activities such as these are designed to be part of school programs or to be used to enhance field trips, but technology can also become a tool to motivate children to go outdoors in their free time. In particular, in natural settings, Heads Up Games [27], such as Hearbit [21] or the prototyping platform RaPIDO[28], provide an unobtrusive interaction paradigm that can foster social interaction and play by not requiring players to interact with a screen. In the following section, a preliminary study will be presented. The study was conducted to gain insights on the opportunities that can be offered by a HUG that could integrate both outdoor activities and indoor ones, to stimulate kids' interest in the natural environment.

The study involved 8 kids aged between 6 and 10 years old. In the first place, the investigation was conducted to assess the degree of familiarity with the natural environment; and secondly, to understand what kind of feelings and impressions the kids had regarding the outdoors compared to technological devices. To collect data, the kids participated in three different activities: a sensory quiz; a sorting card game, and a brief structured interview. The sensory quiz was designed to evaluate kids' familiarity with nature. Furthermore, considering that many devices for nature exploration are based on the sense of sight [8, 13, 14], we decided to focus this quiz on touch, smell, and hearing to understand if they could be viable design channels. During the quiz, kids were blindfolded and had to guess what the sample they were presented with was, either by smelling it, touching it or by listening to an audio track. The results of the quiz highlighted that sounds are more easily recognized by children, while smells were recognized the least.

During the sorting card game, instead, we asked them to associate different ideas and feelings with natural elements and artificial ones, so as to collect qualitative information about their relationship with the natural world with respect to artificial objects. Lastly, the interview was structured to gather information on how they prefer to spend their free time, in particular when they are outdoors. Data collected during these two phases highlighted that kids have a mixed view of the outdoors. When associating words with outdoor concepts, for example, the most used word was "curious", but some regarded the outdoor concepts as "boring", with one kid commenting that "I do not like it, when there is nothing to do." Moreover, during the interview, it emerged that children tend to prefer outdoor activities, such as biking or going to a playground, to exploring nature itself. Instead, regarding technology, the sorting card game highlighted that kids view digital devices favourably, associating to their usage mostly positive concepts, such as "fun." The interview showed also that while playing video games is a sought-after activity, when outside they are not compelled to play them, provided that they have friends or other things to play with.

The kids' parents, aged between 35 and 63, were also interviewed to gain insights on their perspective regarding kids' attitude towards technology and their daily routine. Interviews with parents highlighted that they are trying to limit the time their kids spend using digital devices, but also that kids have few opportunities to explore nature, as children follow various after school activities and it is sometimes difficult for parents to organize outdoor playtime. The insights collected led us to conceive Ekō as a system that could motivate children to spend time exploring the outdoors' sounds, but that could also double as an indoor educational toy able to stimulate children's curiosity for the outdoors.

3. Design of Ekō and system architecture

Following the results of the preliminary study, we designed Ekō as a system focused on the collection of natural sounds that could be used both indoor and outdoor. In fact, since opportunities to be outside seemed to be limited, we intended to design a toy that could entice their curiosity for the natural soundscape even at home, by means of a playful and educational experience.

The architecture system (see Figure 2) consists of a smart toy that includes five recorders that enable users to collect natural sounds, as well as an integrated tablet-based system for the production of audiovisual content, composed of a control base to connect the recorders and a tablet app.

Figure 2: Ekō's system architecture.

3.1. Smart Object Design

Ekō offers four main functions: natural sounds recording, sounds reproducing, visual feedback and transmission of data to the tablet app. Natural sounds are collected through five portable recorders (see Figure 3a) characterized by an essential interface: a START/STOP recording button, a PLAY/STOP replay button and an intermittent LED light that provides visual feedback on the activity of each recorder. Transmission of the collected data to the tablet app is made possible through a control base (see Figure 3b) that allows each recorder to be inserted in one of its five slots. Each slot is associated with different graphics elements in the composition screen in the app, and the positioning of the

recorders on the base is arbitrary and left completely to the child's free creativity. In other words, the board serves as a playful dashboard for the composition of audio-visual content.
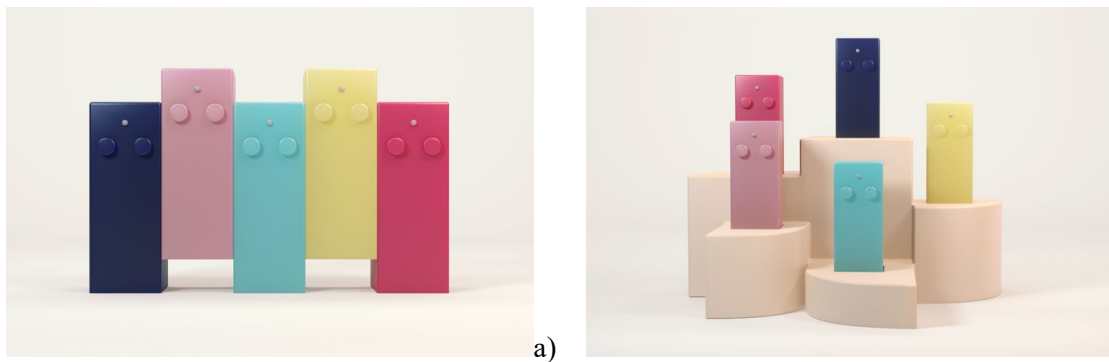

Figure 3: The smart object a) Ekō recorders; b) The control base for mashing-up audio-visual content.

3.2. App design

The tablet app is structured in four areas: landscape, card, composition, and archive area. The landscape area (see Figure 4a) acts also as the landing page of the app and depends on the geolocation system. Its function is to show what natural scenery and sounds children can find near their location. The interaction with clickable animated elements offered in this section leads to access in-depth cards (see Figure 4b), where the selected natural element is introduced by a brief description and a sound sample, that acts as a cue and stimulus for the exploration. The child's interaction with these first two areas of the tablet app is fundamental because it acts as a phase of pre-discovery and has a preparatory function for the real outdoor experience. The composition and archive areas are instead intended for the post-outdoor experience phase. To access the composition area, sounds recorded must be first uploaded to the app. To do so, recorders need to be connected to the base. The app, which is synchronized with the smart object via a Bluetooth connection and RFID tags, detects collected sounds and uploads them automatically. After this step, in the composition area (see Figure 4c), the user can interact with a visual scenario made of geometrical elements whose movements are determined by the parameters of the various natural sounds uploaded. The result of the audiovisual composition is influenced both by the position of the recorders in the slots and by parameters that can be manipulated thanks to a very simple interface present in the composition area. Each slot directly controls a category of graphic elements, such as shapes and colors. By changing the positioning of the recorder, and through the manipulation of the different parameters, the child obtains a personal and unique composition. Finally, the archive area (see Figure 4d) is used to store both the collected sounds and the audiovisual compositions generated. The app is organized around a system of rewards and creative sections aimed at stimulating the child to leave the home environment and devote time to a slower and more natural listening experience. Although central to the project, the interaction between the child and the interface is deliberately limited to certain phases of the experience, acting so as an enhancement of the relationship between the real world and the digital one.
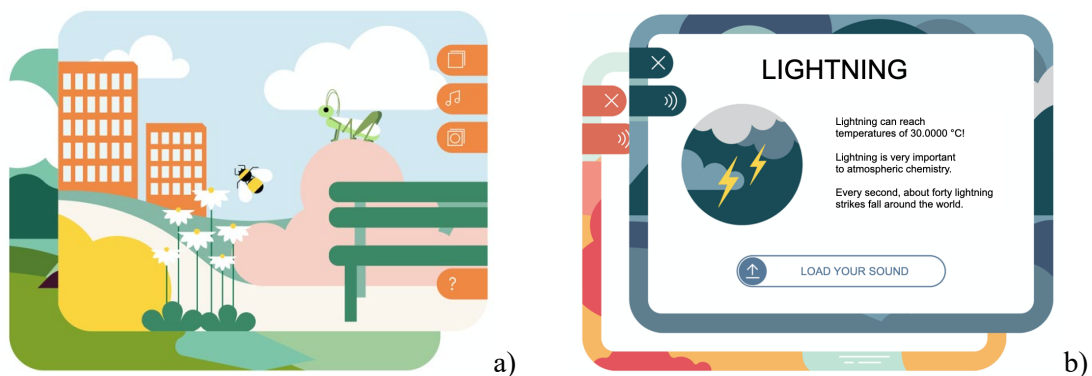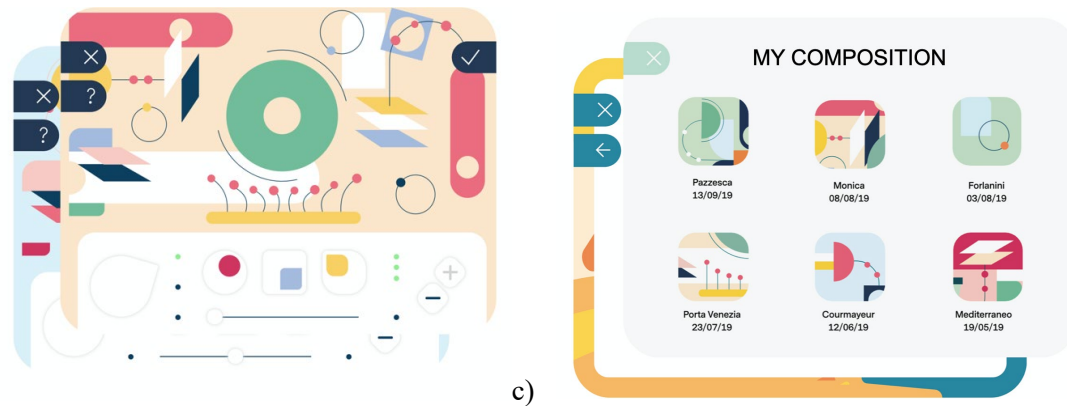
Figure 4: The tablet app: a) The landscape area; b) The in-depth card; c) Screenshot of the composition area; d) the archive area.

4. Comparison with other works

In recent years a lot of research has focused on technology as a mean to enhance the natural experience, triggering the birth of products adding "intelligence" through electronics or digital devices to provide companionship and educational involvement [18].

For example, Nature Passport [24] encourages children to explore, document what they see, share it, and make memories in nature thanks to activities designed by experts in outdoor play. Instead, Animal Explorer [3] is a collection of animal sounds, photographs and educational modules. Similar to Ekō, they promote learning through mobile technologies. However, while the applications use smartphones and tablets as intermediaries, Ekō purposely distinguishes between the physical experience and the digital content and aims to make children concentrate only on natural elements while they play outdoors. Other works, such as DisneyNature Explore App [9], go for augmented reality with 3D-animated animals materialising in the live camera view. The HCI literature contains other recent examples of studies that opt for augmented reality and nature combined in education. This prototype [1] is an application running on a tablet computer that uses natural markers such as leaves and pinecones in a game-like nature quiz. Similarly, Yilmaz [30] presents educational magic toys (EMT) developed with AR technology, including puzzles, flashcards, and match cards to teach children to recognize animals, fruits, and vegetables. To shape children's experience and to enhance their imagination, Ekō refrains from using scripted and semi-structured adventures. Instead, it focuses on supporting a form of curiosity-driven learning and involves exploration without the imposition of rigid plans: in fact, hypothetically, any existing sound could be recorded.

5. Conclusion

This article introduces Ekō as a smart toy that turns screen-time into an active, playful, and fun outdoor experience using technology as a leverage to motivate kids to explore and learn in a smart and educational environment. However, the use of digital devices is limited to a previous and subsequent phase that remains central to the project, but that does not interfere with the main focus: the opportunity to stimulate them through the direct interaction with natural elements, as highlighted by this studio [7].

The project was developed in an academic setting with the purpose of focusing on the design of the interactive service built on preliminary user research. Therefore, Ekō is still in a prototype version. We are considering future interventions such as full technical implementations and the evaluation of functionality by children. Additionally, further investigation will corroborate the impact of the project on persuading children to go outside and discover the nature soundtrack.

6. Acknowledgements

7. References

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