FeetUp: a playful accessory to practice social skills through free-play experiences.

Andrea Rosales, Ernesto Arroyo, Josep Blat

Universitat Pompeu Fabra, Carrer de Roc Boronat 122-140
08018, Barcelona, España
andrea.rosales, Ernesto.arroyo, josep.blat @upf.edu

Abstract. In this paper we describe the design process of an interactive accessory to play anywhere and anytime while encouraging free-play and practice social skills. We explain the design process, the resulting conceptual design of FeetUp and the preliminary user's evaluation. FeetUp is a playful accessory that takes advantage of children's interest to jump, or perform body stunts. These activities generally include lifting both feet, and FeetUp gives audiovisual feedback whenever this happens to encourage free-play related with jump activities. Preliminary user's experience shows how FeetUp, encourages freeplay.

Keywords: free-play, children, playful, augmented technologies, social interaction, wearable.

1 Introduction

Children are in continuous training and their way of being will be strongly influenced by all their current experiences [12] [8]. By playing children mimic other's experiences and learn about it [10], this way they build their own values and develop new skills.

Many authors have discussed the correlation in children's life between their increased interest on screens (either television, videogames, computer, mobile phone, or others) and their lower physical activity and/or social interaction [1], [11], [14]. More interest on screens prevents them from experiencing valuable face-to-face interaction important for practicing social skills, which could be developed through free-play. Free-play can be open-ended, spontaneous, physical, collaborative, engaging, fun, pleasurable, and usually involves a pretend element [17].

Several projects have explored the use of objects to encourage free-play [1], [9], [4], [16]). Some of these objects are designed to stimulate physical play, and regard social activity as a, secondary goal. Other objects have been designed to stimulate social interaction by providing open-ended scenarios [9], [7]. However, in most cases the object to be augmented lacks well-defined selection criteria, or its interaction affordances does not add value to free-play. E.g., the interaction design proposed by Ridén for an augmented rubber ball was not useful [16]. The authors noticed that "the

interaction enabled by its flashing lights was not used at all" and they concluded "the force of affordance of balls is very strong for children".

Our approach focuses on understanding children's interest, habits and routines related to evocative objects and free-play activities. We use this knowledge as initial requirements to design and create evocative objects that encourage social interaction through free-play. In this paper we present FeepUp, an evocative object designed to encourage children's to play using their bodies to jump, roll, perform handstands or any other stunts collaboratively with their friends. We describe the design process, the resulting conceptual design of FeetUp, including the object design, its interaction rules, and the physical setup. Finally we present preliminary results indicating that FeetUp encourages free-play and discuss opportunities for future work.

2 DESIGN PROCESS

The design process started by two ethnographic studies aimed at understanding, the relationship between free-play and children's routines, in order to identify the implications for design [5]. This sets the framework for designing playful objects to promote free-play by involving children in the design process [6] through brainstorming, iterative prototyping and evaluation.

2.1 Children and free-play

In a preliminary ethnographic study, we used traditional methodologies, such as observing children in their natural play settings as observer-participants note taking, and then categorizing the collected information [2].

We followed children's between 6-9 years old while playing in Barcelona during 24 sessions in parks, school patios, and their homes. We documented children's relation with free-play, what they do, and what objects they use during free-play sessions. We registered our observations in a notebook, and then we categorized the observations, to extract relations between objects, activities, games and social interaction related with free-play.

From this process emerged that the most common object in children's activities or games is their own body. They naturally played games related with physical challenges with their body. We identified several free play challenges they typically find in their body, such as playing against gravity, aim, coordination or visibility, attention, strength, etc. Each challenge is related to many activities or games. For example, while playing with gravity, they enjoy handstands, handholding, hanging, hand walking, somersaults, tumbles, or carrying each other.

2.2 Children's routines

A second ethnographic study identified opportunities on children's routines for free-play. We documented the routines of 8, 2 to 4 members families, all of them with at

least one kid aged between 6 and 9, as participant-observers [2]. We immersed in their spare time activities and conducted unstructured interviews [2] with parents.

The study indicated that children's routines lack spare time or free time. Family routines are full of duties, and children's time has to be planned according to them. In addition to attending school, practicing sports, and doing extracurricular activities, children are also participants in many of their family's tasks, like going to the supermarket or visiting their aunt's house or following their brother's activities. However, free-play can also happen in parallel to other activities, like playing while shopping, during a family visit, or on the road.

Objects designed to stimulate free-play should be small enough to be taken along while going out, and practical enough so that children can always carry them. Objects could also be embedded into smart clothes and offer additional value as suggested by Steffen [15]. As children wear clothes all the time, they can act as playful objects to allow children to play whenever they have an opportunity, whereas at on the road, on a waiting room, or at the store.

2.3 Brainstorming with children

The Current design trends suggest that children should be part of the design team in order to voice their opinions and inform the design with their own interest, emotions and feelings [6]. For the design of FeetUp, children collaborated with researchers, providing ideas for interaction and providing useful information about adequate ways to stimulate free-play. At the beginning of the process we presented children with sketches of 5 imaginary powerful accessories. (See Figure 1).

Fig. 1. Children were presented with 5 inspiring sketches of imaginary powerful accessories: a fanny pack, a belt, a brooch, gloves and shoes.

We explained to children that these objects were powerful ("magical", and "limitless"). In order to evoke children's imagination, we asked them to describe and explain the sketches: what the pictured kids where doing, and how the pictured devices would work.

This process provided many interaction design ideas for many playful accessories, and also provided valuable insights to identify the most adequate accessories to stimulate body challenges in diverse playful situations. For the final selection, we considered only playful accessories that could be developed with existing hardware. We selected three playful accessories that elicit numerous opportunities to practice social skills and allow them to imagine several situations and evoke possibilities for play making use of body challenges. The selected projects include FeetUp, Statue, and Gloves The two other projects were developed at later time.

2.4 Wizard-of-Oz and Imaginary Experience

We started the iterative design process with early prototypes, to validate the concept, and verify if the prototype could be used for what it was designed for. Several sessions allowed children to test every new improvement, and re-arrange the pieces to fit their bodies and interests. The first iterations demonstrated the ideas with a combination of wizard-of-oz and partially functional prototypes to test and validate the initial concepts. At the beginning, part of the functionality was implemented and the rest was operated manually activated sensors. This method was used to illustrate how some of the accessories would work, facilitating the user to imagine experiencing and playing with each accessory. This gave us important insights to evolve the design according to how users imagine this will be working and what for.

2.5 Iterative Prototyping

We improved the original design according to users' feedback and introduced several new functionalities that emerged from interacting with the objects themselves. For every test we invited a new user to a playground to play with the prototypical accessories and drew conclusions about how to improve the design, considering how users spontaneously used the device? What for? And how users expected the device to work?
The results of every new test guided the following iteration in the design. This process finished when the prototype was fully implemented and the concept was validated with individual users. Trough validation, users confirmed that they managed to practice diverse activities with the accessory and imagined games where they could use it. Important improvements emerged from user's ideas about how to arrange sensor to properly detect jumping, how to arrange the actuators for visibility, or the kind of feedback they expect to have in the games they where imaginary playing.

3 CONCEPTUAL DESIGN

FeetUp is a playful accessory embedded in a pair of children's shoes that provides audiovisual feedback whenever the user jumps or is off the ground. (See Figure 2). FeetUp is similar to popular shoes that light while walking, but FeetUp demands additional effort as kids have to jump to get the feedback. Since games and playful

activities have to have some degree of challenge [3] [13], increasing the difficulty to get the feedback opens a gap to make more interesting plays around it.

Fig. 2. FeetUp

FeetUp stimulates children to play against gravity, one of their most frequent activities related to free-play. Giving feedback while jumping lets each child share his jumping achievements with his colleagues, and when several children have the same accessory, they have the same interest in common and they can have shared goals. While sharing goals they must explain ideas, argue, negotiate, and make agreements, thus they are practicing quite important social skills.

There is no digital network between users, but the common interest is the excuse for them to create a network of shared goals, represented as simple activities or more complex games. They have to propose how to use this shared feedback to play together with this new shoes. The system incorporates a simple rules system so that children have the opportunity to create their own system of rules, challenges and goals based on the basic, but consistent information they receive.

3.1 Object Design

For the object design we considered the use of an existing object children already wear and have with them all the time. Thus we choose a pair of shoes that can be used anywhere, and offer limitless opportunities to play. The audiovisual feedback is directly embedded in the shoes themselves to maximize its visibility.

3.2 Interaction rules

The interaction system reacts to only one factor; children jumping. The shoes rules give feedback when children are jumping; they blink and play sounds when both feet are not touching any surface.

3.3 Physical Setup

The setup includes 4 touch sensors, 2 microcontrollers, and 2 emitter and receiver radios, 2 LED arrays, and 2 piezo speakers. The setup includes two pressure sensors placed on the insole inside each shoe (one in the base of the heel and another on the sole), thus allowing us to detect when each foot had been completely lifted from the floor. A microcontroller in each foot reads sensor data, validates that both sensors have been de-activated, and sends a radio frequency signal read by the other device. When both microcontrollers confirm that all pressure sensors have been de-activated, they trigger the LEDs in the surface of the shoe and make a sound alert with a piezo speaker.

4 EVALUATION

A pair of children tested the final prototypes playing with the shoes in a playground during 30 minutes, in a preliminary evaluation of the project. Researchers did structured observations, to identify how the FeetUp accessory yielded the characteristics commonly present in free-play. Observers took notes during the session, and at the end of it, answered some open questions.

Observers described 7 concepts related with free-play behavior [17], including spontaneous, voluntary, collaborative, open-ended and engaging play, being physically active and with a pretended element. Some observations are described in the following list:

- They enjoyed discovering the accessory and understanding how it worked; they discovered that it blinked when jumping. They *spontaneously* started to play challenges related on how to cheat the shoes and discovered how to cheat it by making it blink without jumping; moving their feet while sitting, or tiptoeing.
- They exchanged their discoveries, and motivated each other to start new challenges. They paid attention to their partner activities and made comments about them, while *collaboratively* helping each other.
- They were free to do whatever they wanted in the park. However, they *voluntarily* moved-on to other jump related activities, and got involved in making the lights blink by dancing, hanging, sliding, or jumping.
- They played games using simple goals, games they were used to. Later they started to adapt the activities to better see the lights of the shoes, to keep the lights blinking longer, or to make the activity more and more difficult in an *open-ended* encouraging game.
- They *engaged* in the experience, preferring to play with the accessory rather than playing with games in the park where the testing took place, and the activity occupied all the time they usually spend in the park.
- They were active and had continuous *physical* activity during the test.
- They described the accessory as “magical shoes” and they imagined that the shoes could give the super-powers and allow them to control others shoes, or other people. However, the accessory was no used as a *pretend element*.

Fun and pleasure values, also fundamental in free-play [17] were not considered, as they will be observed using an extended framework in future work.

Children used verbal and non-verbal communication while discovering the accessory, while imagine what they could do with the powerful shoes, and finally while playing. With verbal communication they described their hypothesis about the shoes, described their achievements, express satisfaction or frustration, and give support to his friend. Non-verbal communication challenged them to imitate each other, or establish new challenges. This indicates that they where practicing social skills.

Some inadequate ergonomics of the design generated frustration and disappointing experiences in children. This was due to the size and intrusiveness of the devices' hardware, as is also mentioned by Steffen [15].

5 CONCLUSIONS AND FUTURE WORK

We have presented the design process of a playful accessory to practice social skills through free-play. FeetUp is a playful accessory to play against gravity; it encourages children to perform jumping challenges.

The ethnographic studies gave us important insights to create a conceptual framework which argued that children could benefit with playful clothes, playful bags or playful accessories and that these objects can support their innate need for playing.

The participatory design process, and the activities proposed to involve children in the design process, allow us to involve children's insights, during the entire process and make informed design decisions to fit their interest and preferences.

Future work includes, testing the prototypes with larger groups of children, and evaluating the accessory using a specific framework to identify how FeetUp encourage fun and pleasure. Future work will also consider 1) Developing conceptual designs and prototypes for other physical activities often performed by children in their games. 2) Comparing the results of the evaluation of each design. 3) Define guidelines to design objects to stimulate practicing social skill.

Acknowledgments

This work has been partially funded by the Learn 3 project, (TIN2008-05163/TSI). The authors would like to thank the cultural and technical partners of the C3I2 workgroup for their support and ideas.

References

1. Bekker, T., Sturm, T., Eggen, B.: Designing playful interactions for social interaction and physical play. In: Personal and Ubiquitous Computing, 14, 385 – 396 (2010)

2. Blomberg, J., Burrel, M., Guest, G.: An ethnographic approach to design, The Human-computer interaction handbook. Lawrence Erlbaum Associates, New Jersey, USA (2003)
3. Costello, B., Edmonds, E.: A study in play, pleasure and interaction design. In: Conference on Designing Pleasurable Products and Interfaces, pp. 76 -- 91. ACM, Helsinki, Finland (2007)
4. Creighton, E.: jogo An Explorative Design for Free Play. In: 9th International Conference on Interaction Design and Children, pp. 178 -- 181. ACM Press, Barcelona (2010)
5. Dourish, P.: Implications for design. In: Conference on Human Factors in Computing Systems, pp. 541-- 550. ACM, Montréal, Québec (2006)
6. Druin, A.: The Role of Children in the Design of New Technology. Behaviour and Information Technology 21(1), 1 -- 25 (2002)
7. Ferris, K., Bannon, L.: ...a load of ould boxology! In: 4th Conference on Designing Interactive Systems, pp. 41 -- 49. ACM London, England (2002)
8. Ginsburg, K.: The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds. Pediatrics. American Academy of Pediatrics, (2006)
9. Iguchi, K., Inakage, M.: Morel. In: Conference on Advances in Computer Entertainment Technology. Hollywood, California (2006)
10. Nachmanovitch, S.: Free Play:Improvisation in Life and Art. Penguim Putnam, New York (1990)
11. Leal Penados, A., Gielen, M., Stappers, P.J., Jongert, T.: Get up and move: an interactive cuddly toy that stimulates physical activity. In: Personal and Ubiquitous Computing 14, 5, 397 – 406 (2009)
12. Piaget, Jean.: Science of education and the psychology of the child. Orion Press, New York (1970)
13. Prensky, M.: Digital Game-Based Learning. Fun, Play and Games: What Make Games Engaging. MacGrawHill (2001)
14. Seitinger, S.: An ecological approach to children's playground props. In: 5th International Conference on Interaction Design and Children, pp. 117 -- 120. ACM, Tampere, Finland (2006)
15. Steffen, D., Adler, F., Weber Marin., A.: Smart Semantics Product Semantics of Smart Clothes. In: International Asociation of Societies of Design Research, pp. 79 – 88. ACM, Seoul, Korea (2009)
16. Ridén A, Wiberg A, Maehr W, Nordqvist T.: UbiComp and Toys The Difficulties of Integrating Technology into the Everyday Object. In: 2th Scandinavian Student Interaction Design Research Conference. Gothenburg, Sweden (2006)
17. Rosales, A.: Collective creation of games using free-play technologies. In: 9th International Conference on Interaction Design and Children, pp. 335 -- 339. ACM, Barcelona, Spain, (2010)