



## **ETHNOGRAPHIC STUDIES (FREE-PLAY AND CHILDRE'S ROUTINES)**

The design process started by two ethnographic studies in order to identify further implications for design (Dourish, 2006) building on the relationship between free play and children's routines. These studies aim at define the General Design Concept as framework to propose specific objects to promote free play. We involved children in the research of the implications of design, using ethnographic methods (Dourish, 2006) to include their feelings, interest and constrains since the beginning of the project (Druin, 2002).

### ***CHILDREN AND FREE PLAY***

A preliminary ethnographic phase studied the relationship between the objects children use during free play and the activities they perform. We observed children playing in places where they usually have opportunities for free play: school breaks, the park and their houses. Through 24 independent sessions we identified a list of evocative objects children include in their games, as well as the activities surrounding those objects. Our observations indicated that the most common object in children activities is their own body. As they are developing motor skills, they often feel engaged in physical challenges. They naturally play games related with physical aspects of their body, such as gravity, coordination, aim, strength, synchronization, etc. That is, the body is the always-present object children play with.

Related to the activities, we categorized them into 2 groups: games and explorations. For example, regarding activities involving dance, they can explore it freely, or play specific music related games. Explorations can include just moving around, enjoy the music and try to move according to that. The games include a common goal and a setup of rules and constrain, e.g. a game where everybody has to move until the music stops, if someone moves he/she loses. Games and explorations can be collaborative, open-ended, and spontaneous. Games have rules (flexible or not) and a final objective (flexible or not) in which someone loses or wins and usually have a specific name. Whereas mere explorations have no defined rules and goals, can be shorter, are changing constantly, and are difficult to

see by external observers (Markopoulos, 2008). Researchers cannot read what children are thinking; asking them directly would be useless and they could look like they are doing nothing, but in their imagination they could be experiencing their own explorations. Both, explorations and games can be described as free-play depending on the degree of freedom they have to let emerge the activity or make it evolve.

### ***CHILDREN'S ROUTINES***

A second ethnographic study identified that kids participating in the studio, had little opportunities for free-play. We investigated their routines by immersing into the spare time of 8 families in Barcelona, and by having informal conversations with them about their habits and routines.

Although each family is different, coordinating routines is a big challenge for all of them. In Spain children usually go to school from 9 to 17, and very often they go to extracurricular activities from 17 to 19. During this kind of structured activities they have no opportunities for free play, because they are not allowed to do whatever they want, educators plan the activities according to their own requirements, there is rules kids can not change freely, and there is specific goals to achieve. During this time they have a long brake at lunch that they can spend at home or at school. The ones who enjoy their lunchtime at school spend at least one hour of free time. After 17hrs some children are allowed to spend some free time at the park or at home. After that, they have time to do their homework, play a little bit more, eat and go to sleep.

If week-days offer some opportunities for free-play, during the weekends children we studied have few small opportunities for free-play, since they still have to take care of many family duties that are typical boring moments, or they are attending to more structured activities. Boring moments for children can include transportation, visiting grandparents, shopping or simply having to go with parents in their family duties because they cannot leave kids at home alone.

Interestingly enough, we observed that during their free time children did not always played free-play activities: spontaneous, collaborative, open-ended, creative, fun, pleasurable and physically active

activities. Often they would play with video consoles in the lunchtime at school, watch T.V. at home, or involve in the practice structured sports after school.

During their spare time at home, some of them are part of single-child families, and do not have the companionship of another child which is fundamental for free-play. Some other children live in apartment buildings where they are not encouraged to move freely. In the city, streets are not used as a space to play, as it can happen in typical neighbors of houses or in housing complex, where kids are at the glance of their parents while parents are doing home duties. Thus, a typical free-play such as going out to play is only possible at parks, and only allowed under the companionship of some adult, thus children depend on their availability to do it.

After observing children's routines we agree with Veitch (2010) that some of these characteristics of the environment limit children's opportunities for free-play and some characteristics of modern live style as well. However, we also conclude that in their routine they often experience typical small boring moments, that they can take advantage of with their playful attitude and some additional feedback. Clothes or accessories, as gloves, funny packs, or shoes, are objects they often take with them everyday and everywhere. Adding a playful value to those accessories can encourage them to take advantage of those moments to create new opportunities for free play. Accessories are objects attached to children's body, augmented with sensors can react according to body's activities. Playful accessories are smart clothes that give feedback to children's activities to encourage playing around specific body behaviors.

We follow Steffen idea (2009) according to what, Adding a playful value to clothes for children, takes advantage of the possibility of current technology to create smart clothes, which only would be useful adding relevant values as suggested by Steffen (2009).

### **GENERAL DESIGN CONCEPT**

The previous exploration, allowed us, to define a general design approach for objects that stimulate free play and allow children to practice of social skills.

We suggest the design of playful accessories for children according to the following design values:

- 1) Every-day accessories
- 2) Augmented with feedback to body challenges
- 3) For individual and shared use
- 4) Using simple set of rules
- 5) And no pre-defined and binding play function

#### ***EVERYDAY ACCESSORIES***

The use of accessories that kids usually take with them everywhere seeks to take advantage of every small opportunity within children's routines to enjoy a free play experience.

#### ***DIRECT FEEDBACK***

Playful accessories react to a specific body behavior, to involve the body, the object they use more often in their games, and provide audiovisual feedback when it happens, to encourage this body challenge.

#### ***INDIVIDUAL AND SHARED USE***

Each child can explore and, play with the accessory by himself, or share the experience with others. During the individual use they have the opportunity to explore their own creativity, and when several children have the same accessory, they share the same kind of information, facilitating play around the accessory.

#### ***SIMPLE SET OF RULES***

A concrete rule system in each accessory reacts to only one behavior with only one kind of feedback, thus children must use their imagination and creativity to explore the possibilities to play with this concrete system.

#### ***NO BINDING FUNCTION***

The accessories satisfy a dressing function, however, they do not have a specific play function. For instance, they do not afford a specific use, such a water gun; instead, they encourage children to imagine how to use them in their games.

While trying to imagine how to play with it, or while playing with the accessory, children must explain ideas, argue/discuss, negotiate, and reach

agreements, thus they are able to practice quite important social skills.

## PARTICIPATORY DESIGN

Current trends in HCI suggest involving children in a participatory design process in order to voice their opinions and inform the design with their own interest, emotions and feelings (Druin, 2002). In addition to involving users in the ethnographic and conceptualization phase, they also participated in the design phase as well. Children contributed initial ideas and concepts, assisted in problem solving and the final evaluation.

### BRAINSTORMING WITH CHILDREN

The process started with 6 sketches of imaginary powerful accessories (see figures 1 and 2) adapted from the methodology described by Morajevi as comicboarding (2007). We explained children that these objects were powerful (“magical”, and “limitless”) and asked them to imagine what these “powerful” objects would do, how the objects would behave, and what they could do with it.



Figure 1. Glove Interaction Sketch



Figure 2. Broche Interaction Sketch

They could enhance initial sketches, make new draws or explain their ideas. We repeated those questions until reaching a concept for a possible interactive system, including shape, reactors, rules and possible uses. Finally, between children and researchers selected two design concepts to be developed further: FeetUp and Statue. FeetUp are shoes that blink while jumping, and Statue is a fanny pack that blinks while the user is moving.

### ITERATIVE PROTOTYPING

We implemented the prototypes in stages. First we implemented one function and tested it with children by asking them to imagine the prototype had all the features included, and to play as if it were fully implemented prototyp. This provided us with the adequate context to capture children’s likes, dislikes, curiosities and needs at each step of the design process.

For example, children naturally suggested the use of sound to complement the experience whenever it was impossible to see the visual feedback while playing. Children also helped define the adequate sensor threshold values to increase the playfulness of objects and also identified several ergonomics and many robustness issues. And moreover kids were testing the ideas and show us how they were enjoying the accessory and practicing social skills. After each new prototype test, we obtained a list of things to improve and the new functionality to add in the following step.

## OBJECT DESIGN CONCEPTS

In this section we describe the resulting design concepts according to the previous phases.

### STATUE

Statue is a playful accessory embedded in a fanny pack that provides audiovisual feedback whenever the user moves (see Figure 3). Statue stimulates children to play around controlled movements; one of the most frequent activities they are challenged while playing folk games. Being statue, move stealthy or try to hide.

### Object Design

For the object design we considered the use of an existing object children can wear and have with them all the time. We used a fanny pack, something easy to wear, something they can wear every day, they can use it to keep personal things, and finally, they can play whenever they find an opportunity to do it (see Figure 3).



Figure 3. Statue Prototype

Motion measurement is embedded in the fanny pack, it is placed around the waist thus it can detect movements from the upper side of the body or the bottom.

The audiovisual feedback is embedded in the surface of the fanny pack, allowing everyone to see it and listen to it.

#### Setup

The hardware includes 1 accelerometer, 1 microcontroller embedded inside the fanny pack, 1 piezo speaker and 2 external LED arrays.

#### Interaction rules

The interaction system reacts to a specific factor: children's movement. An accelerometer detects every movement in the Y and Z axis, the microcontroller detects when it exceeds a certain threshold, to exclude slow movements, and when it happens triggers a signal to blink LEDs and play chimes on a piezo speaker. The system discards the information of horizontal movements, thus kids can find the way to walk and not make the accessory blink.

#### FEETUP CONCEPTUAL DESIGN

FootUp is a playful accessory embedded in a pair of shoes that provides visual feedback whenever the

user jumps, or is off the ground (see Figure 4). FootUp stimulates children to play against gravity, one of their most frequent activities related to free-play.

#### Object Design

For the object design we considered the use of an existing object children usually wear when they are outside. We embedded visual feedback directly into children's shoes in order to associate the jump activities with the part of the body mainly involved in the activity.



Figure 4. FeetUp Prototype

#### Interaction rules

The interaction system reacts to a simple factor; children jumping. The shoes give feedback when children are jumping; they blink when both feet are not touching any surface.

#### Setup

The hardware includes 2 pressure sensors, 2 microcontrollers, 2 emitter and receiver radios and 2 LED arrays. The pressure sensor is placed under the sock inside each shoe, and detects how much pressure is being applied in the heel. The sensor detects when each foot had been lifted from the floor. One microcontroller, attached to the each sock around the ankle, reads sensor data, validates sensor values and sends a radio frequency signal to the same device on the other foot. When both microcontrollers confirm that the two pressure sensors have been lifted, they activate an LEDs mounted on the shoe surface.

## EVALUATION

9 kids tested each accessory in groups of 3 to 5 children at after-school activities center. Each group experienced each accessory for 30 minutes under the monitoring and companionship of at least 3 observers and educators. Structured observations (Markopoulos, 2008), guided the understanding on how objects stimulated free play and which kind of activities the objects promoted.

## RESULTS

Children spontaneously explored the accessories trying to discover how they worked. During the discovery process they collaborated with each other describing and sharing their discoveries with their peers.

In particular, when playing with the statue accessory, children spontaneously propose several games to play using the accessory feedback. They proposed playing around 10 different folk games, such as “hide and seek” or “frozen tag”.



Figure 5. Slow Race Game with Statue

During the sessions they played few of those games (see figure 5), and the audiovisual feedback from the accessory gave them information to argue when somebody where doing good or bad, and made popular games more interesting, adding a new level of difficulty.

On the contrary to the *statue* session, when playing with FeetUp, the exploration process took longer. All of participants were involved in discovering how they worked, and came up with hypothesis and arguments to discuss about it.

After agree about how it works, children enjoyed looking at the lights and moving around, each child explored the accessory in their own way: one played

classic ballet, other danced capoeira, while others did handstands and brake dance.

It was difficult to involve all children in one single game during the evaluation session; however, some of them got interested in the explorations of other children and had valuable social interactions with them. While someone were trying to explain how to make handstands, for example, the one who were trying to learn about, try to ask the right questions to improve his/her handstands.

Children played open-ended activities while being physically active all the time using both accessories. They used their own creativity and imagination to find ways to include the accessories in their games.

## CONCLUSION AND FUTURE WORK

We have presented the design process to create a General Design Concept to propose objects to encourage free play. We have presented two prototyped objects that emerged from this design concept.

We evaluated the resulting accessories in order to understand how they encourage free play. Both designs stimulated spontaneously open ended, collaborative and physical activities.

Although, discovery, communication and physical challenges were widely experienced during the FeetUp sessions than during the *Statue* sessions; playfulness was more obvious on it.

Future objects should encourage the playability of Statue and the challenges of FeetUp. In order to approach it, future work will include continue ethnographic phase looking for other core activities of folk games, to involve in the concept of future playful accessories. Also will include evaluate the actual General Design Concept with new insights emerged from the evaluation session, to involve it in the design of future accessories.

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