Designing exertion interfaces for children

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Abstract
We describe our philosophy on designing for children's physical play. It incorporates ideas from game design, persuasive technology and sport motivation theories. We illustrate our approach with two case studies and discuss our experiences with embedding sensor technology to provide a motivating experience for children.

Keywords
Physical play, children, sport, computer games, persuasion, exertion interface, football, challenge.

ACM Classification Keywords
H5.2. Information interfaces and presentation (e.g., HCI): User Interfaces.

Introduction
Designing for physical play is becoming more popular. To stimulate children and adults to move about more, and instead of watching television or playing computer games, a new type of products are being developed that require some form of exercise or exertion [e.g. 6]. Existing products on the market, such as the Nintendo Wii-interface and dance-mat controlled games, already stimulate physical play.

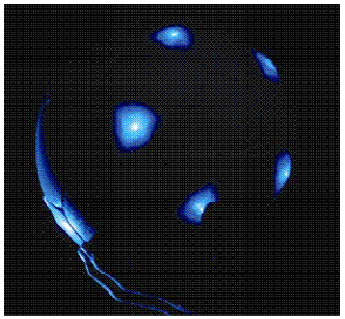

figure 1. The football prototype, that provides feedback using coloured LED's.

Researchers have also worked on designing for children's physical play. Various games have been developed that require children to move while interacting with a game. For example, various sensor based games were designed for children to learn through exploration [7]. In contrast to these solutions, we design mobile and outdoor solutions for physical play not constrained by television or computer screens.

We follow a user-centred design research approach which combines knowledge about child development, game design and persuasion. Children between the age of 8 and 12 year old often quit playing sports. Some of the reasons for quitting are change of interest, not enough fun, and not being good enough [9]. The challenge is to combine opportunities for children to practice diverse skills; e.g., social skills such as negotiating tactics, and cognitive skills, such as the understanding of strategies [9]. Another inspiration source for our design research is computer game design [5]. By applying game design rules, such as providing appropriate challenges and motivating feedback we create appealing experiences for children. Other inspiring theories can be found in the literature on persuasion [4]. Fogg describes how technology can be used for motivating people to certain behaviours, e.g., how technology can function as a tool to make keeping track of certain behaviour easier. A final theme of our work is how sensors and actuators can extend the physical play experience

We have extensive experience with involving children in design [e.g., 1, 3] and have already applied our approach on designing for physical play in a number of projects [2, 8]. The different domains include leisure activities such as sensor-controlled robots, playground solutions, and sport contexts. We will illustrate our design approach with two recent cases.

Case 1: Pinball Football

The aim of this project was to make football-like games more fun and motivating to play. The concept designed is an interactive ball with an embedded accelerometer. Because of the direct feedback it provides, children playing with it will become more aware of their abilities and develop their self-esteem. The feedback is provided by changing colors displayed on the surface of the ball, according to the quality of the action. This way, children will be motivated to train and get to the highest goal. To adjust the challenge for different skill levels, the ball will adjust its range to the level with which it is being played. Three games have been designed to be played with the ball. For example, for the Five Pass Game two teams of two players each need to score in the same goal. Because players are both offenders and defenders individual techniques are emphasized. The ball measures the acceleration when it is kicked; this enables the ball to count the number of passes. The ball will light up little bit more after each pass. After five passes the ball will be fully lit and both of the teams can use it to score a goal. After 10 seconds the ball will turn off. The team which scored the most goals will be the winner.

The design was tested with children. This provided input about whether they understood how the games work and whether they them motivating. The results inspired a number of changes to the ball and the games. For example, the feedback should be more visible, and the time that the ball will be lit to score a goal can be shorter than originally implemented.

Figure 2. A picture of a magician illustrating how to throw a spell and a picture of a magic wand prototype, that provides feedback about the amount of magic it contains.

Case 2: Sunday Forest Funday

The aim of this project was to make walking in the park more fun and interesting. The concept consists of a game, in which children become wizards who can use magic spells to scare away monsters and cure animals. A child can do quests issued by the wizard in the forest, which can be found on the web. With an online account, progress can be kept, quests to do in the forest can be downloaded and new spells can be downloaded and mastered. Spells are a combination of gestures and spoken components. Stereo sounds on headphones represent the other actors in the game. An advantage is that the game is location independent and can be played in any forest.

Various aspects of the game were tested with children. Some children were involved in verifying whether they understood the game, could perform the spells, and pinpoint the directions of the sounds indicating the various animals in the game. Some children used the prototype to practice the spells, and other children were asked about the meaning of the various sounds. The results showed the spells have to be made simpler, but the game concept itself is very understandable.

Conclusion

The two cases illustrate our design approach. They show how measuring behavior with sensors can be used to provide feedback about local goals with appropriate challenge. In turn the feedback motivates children to practice skills and enjoy games. Through the student projects we have explored our design approach. In a recently started project, in collaboration with Philips Research, on designing Intelligent Playground solutions we will focus on taking the designs to a higher level allowing better evaluations of the ideas on challenge and motivating feedback.

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