

GlowSteps – A Decentralized Interactive Play Environment for Open-Ended Play

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Abstract. In this paper we present the interactive play environment GlowSteps. GlowSteps consists of ten flexible tiles that respond with light feedback on player's actions. The play environment is developed to support both social and physical play and is designed with the intention to encourage children to create their own play and games. The tiles can be programmed with different interaction behaviors leading to a variety of play experiences. This showcase illustrates our design approach for such interactive play environments, combining the fields of decentralized systems and open-ended play.

Keywords: Play Environment, Open-ended play, Decentralized Systems.

1 Introduction

Play is an important activity in children's lives. It gives them an opportunity to practice skills and explore imaginary worlds [1]. Players can immerse themselves in a world different from everyday life, with its own boundaries and rules [4]. In our research, we are interested in how to design for play, focusing on developing decentralized play environments that support open-ended play. Such environments consist of multiple players and interactive objects and aim to encourage physical play and social interaction.

Within the field of play, we focus on open-ended play. This means that the designs we develop do not offer predefined game rules or goals but instead provide local interaction opportunities that children can attach meaning to and create their own games with [2, 7]. In this way, children can play with the design in different ways, which enhances the play experience. The design intention is to support different goals, rules, stories, roles and so on to enhance children's imaginations and creativity. Designing for open-ended play differs from designing a game with predetermined rules and goals. Open-ended play leaves room for improvisation; for players to create their own games. Therefore, designers have to clearly define their design space and make conscious decisions on which properties to design and which to leave open for players to interpret themselves [7].

Instead of designing play environments incorporating video projection or virtual reality, we focus on tangible objects that embody mechanics for interaction. In this way, we want to emphasize both spatial (environment) as well as personal (object) interaction between players and objects as well as between objects. These players and objects together form a decentralized environment. In previous work, we have developed a framework for designing decentralized interactive play environments [5]. Such environments are a collection of interactive elements, each with their own interaction rules. These elements decide on actions based on locally available information and can communicate with each other. As play can have a high degree of unpredictability, we believe that the properties of scalability, robustness and self-organization [3] of a decentralized system can be very useful.

2 GlowSteps

In this section we present our design called GlowSteps. We describe the design and the different interaction behaviors. Next, we discuss several recent user evaluations.

2.1 Design and Interaction

GlowSteps is a set of interactive tiles that responds with light output on input measured by pressure sensors. If someone stands on a tile or touches it with their hands, the lights react depending on the current interaction behavior. The tiles are autonomous objects that together form a decentralized play environment. They can be picked up and moved around. In this way, children can create their own play spaces. GlowSteps is an improved version of an earlier prototype called FlowSteps [6].



Fig. 1. Impression of children playing with GlowSteps

The following scenario describes how children might play with GlowSteps:

Peter and Jessica are playing with GlowSteps. They place the tiles in a path and jump on them one after another. The tiles light up in different colors. “We have to make them all red!” shouts Jessica. She continues to jump on one tile until it is red. “No,” says Peter, “I make a rainbow and you have to repeat it.” Suddenly, one tile lights up in blue. “Did you see that?” asks Jessica. Peter nods. “I think we have to catch it!” Together they run towards the tile with the blue light.

So far, three interaction behaviors have been designed for GlowSteps: Catch, Create and Toggle. We will now describe these behaviors in more detail. *Catch* is designed to encourage physical active play. One tile lights up in a certain color for a short amount of time. In this time, players must step on that tile to ‘catch’ the light. All tiles then flash to communicate that the light has been caught. If the players are not quick enough, the light disappears and then appears again at another tile. Players can prevent the light to come to a certain tile by stepping on that tile. In this way, they ‘block’ the tile. *Create* is focused on expression and creativity. This interaction behavior is more reactive than active, i.e. the tiles themselves do not light up but they react on the players stepping on them. When a player steps on a tile, this tile starts to cycle through a range of colors (e.g. from red to blue to green to yellow to purple and so on) and a player can ‘stop’ this by stepping down the tile again. This tile then ‘freezes’ in the last color. After a while, it fades out. In this way, players can ‘draw’ and create patterns, or they can come up with a sequence of colors that other players need to repeat as in the scenario above. Lastly, *Toggle* is developed to stimulate both competitive and cooperative play. All tiles light up in red, green or blue. By stepping on a tile, this tile moves to the next color in the sequence (e.g. red, then green, then blue and then red again). Players can decide to turn all tiles into one color; but if one player is aiming for red and the other for blue, they have to compete against each other. All three interaction behaviors are rather simple but have the potential to lead to diverse forms of play.

2.2 User Evaluations

On several occasions, children played with GlowSteps in both formal and informal settings. The Catch scenario was tested in a user study with 36 children in the age of 6 to 9 years old at a primary school. Children played in groups of three with the design. The teacher set up these groups and the children could play for a fixed amount of time (about ten minutes) in an unused room in their school. Early analysis showed us that children played in various ways with the design, moving the tiles around and creating games involving stepping on the tiles and catching the lights. The study also gave us important insights in how to improve the interaction behavior of GlowSteps, as children did not seem to understand or use all interaction opportunities. For example, some children were not aware of the fact that they could ‘block’ tiles.

The Create and Toggle scenarios were developed more recently. They have been exposed at a public ‘open’ day event at our university. At this occasion, children could engage with GlowSteps in a more informal setting. They could play alone or

with other children for as long as they wanted. During this day, all three different interaction behaviors were tried out. Throughout the day, many children (and adults) played enthusiastically with GlowSteps. The different interaction behaviors resulted in various forms of play as stepping on the tiles, catching the light or playing hopscotch.

We plan to do more, mostly formal, studies in the near future, in which we want to evaluate the interaction behaviors in more detail and further improve them. Exploring how children interact with our design gives us important insights that are extremely valuable in our iterative design process.

3 Proposal for Demo

The proposed installation for ACE 2013 will include GlowSteps with various interaction behaviors. We aim on presenting the three interaction behaviors described in this paper, although they might be improved depending on user evaluations performed in the meantime. During the conference, participants can try out the different versions, compare their experiences and give us feedback. Furthermore, we hope to discuss our design approach focusing on decentralized systems and open-ended play in more detail.

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