

Development of Intelligent Play Practice for Trampolines

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ABSTRACT

This paper addresses the use of technology as an add-on to traditional and well-known dynamics of play. By introducing the process of development simulated by the interactive trampoline, this paper seeks to emphasize the relationship between physical activity, safety and sociality as important issues for future development of interactive design for play practices.

Categories and Subject Descriptors

D.2.5 [Design]: Testing, design.

General Terms

Design, development, testing.

Keywords

Interactivity, security, physical playing, children, trampoline.

1. INTRODUCTION

In recent years children's play and everyday life have undergone major changes, and digital technology is playing an ever more significant role in this transformation. Increasingly, technology is integral to toys and games, in museums and in children's communication with each other.

Adding technology to the well-known dynamics of play and games has also embraced outdoor play equipment [11,12,24] in products such as ICON created by KOMPAN, the SPIDER from PlayAlive or DIGIPLAY from Lappset. In the research field of play, interest in the combination of physical activity and technology has increased [10,11,12,14,24]. Digital playgrounds have largely been using computer games as an attraction and a motivating force in engaging children in outdoor activity in order to create physical activity and new forms of learning [16].

By describing the development of a piece of practical and physical digital playground equipment, the interactive trampoline, the present paper aims to reveal some of the challenges that appear in a design process whose aim is to develop the technology for a familiar and popular dynamic of play. The project took place as

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IDC 2012, June 12–15, 2012, Bremen, Germany.
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part of an industrial innovation project called *Play and Learning – Kids 'n Tweens Lifestyle*, which was funded by the EU, aiming to bring companies and researchers together to create products for children aged 3-12 years. First, the background for the research and development is outlined. This is followed by a presentation of the interactive trampoline, together with the design and development process and the tests carried out during this process. In conclusion, the article reflects on the activities developed and on the games designed for the trampoline.

2. BACKGROUND

The starting point for the development project was the popularity of the trampoline. In Denmark the trampoline is the most popular unorganized physical leisure activity among children aged 6 to 12 years old [21]. Subsequently, the question arises as to how it is possible to maintain and strengthen play activity on the trampoline, and the central idea of the project is that technology might be able to contribute additional play value, so to speak, to this popular play equipment. The idea was, in other words, to create a trampoline version 2.0.

Another important consideration forming the basis for further development relates to the risks in using the trampoline. In the past ten years we have seen a 100-fold increase in the number of visits to A&E as a result of trampoline jumping, roughly 65 percent of the injuries occurring on the trampoline and 35 percent from falling off it. Two or three children jumping simultaneously increases the risk of injury twofold, while the smallest child is thirteen times more likely to get injured than the older children on the trampoline [18]. In the design process considerations of risk and safety therefore played a significant role in decisions to develop activities in which only one person jumped at any one time in order to reduce risk (and increase safety) [2,3,4,19,23].

The triad of knowledge – about interactive play equipment, use of the trampoline and about theories of play – was to contribute to the development of interactive activities for the trampoline. The technology involved is often added on as a supplement to traditional play equipment such as swings, slides or climbing gear, or is seen as the motivating force in the development of entirely new types of interactive play equipment [24].

The PLAYWARE project in Denmark, based on robotics work and developing homogeneous interactive tiles that are built into different surfaces and programmed with different games, has done amazing work in the field. The tiles have a pressure sensitive area and the actuators display different colors and sounds. Here they have, for example, developed Hopscotch, Ping Pong and Color Race using intelligent solutions of hardware and software [10,11,12,14].

The Interactive Institute in Sweden is developing DIGIWALL, an interactive climbing wall. The wall has levers embedded with sensors that detect where there are climbers and which communicate from the wall through light and sound [20].

In the UK the Play Dale Company has developed the in-play system whereby a stainless steel frame incorporating push, pull and rotational interfaces as well as light and sound gives feedback to encourage physical play activities.

PlayAlive from Denmark has developed the Spider, based on a touch sensitive interface with light and sound, the so-called satellite, and from this starting point has developed motion and memory games. In addition, the satellite is also used for the playing surfaces in the landscape.

Mostly these interactive play concepts consist of interfaces with sound, light and touch, and an attempt to eliminate screen-based activities [10,12,24]. The majority of the concepts are based on motion within a relatively limited area, and for most of the projects an important part of the philosophy seems to be that the play equipment must be able to work as play equipment even though the technology is not activated. For all projects adaptivity plays an important role, in the sense that the system acknowledges the needs of the users and adapts to those needs. Finally, the play activities and games developed for the different kinds of equipment seem only to of a relatively short duration. With all these considerations in mind we came up with a framework for the design process of the interactive trampoline.

3. THE INTERACTIVE TRAMPOLINE

The interactive trampoline is a large round king-size trampoline. In the outer curve of the trampoline four satellites are placed. The satellite unit has a contact centre that can display 16 LED lights in seven different standard colors and in 64 color combinations. In addition, the device has a speaker where specific sounds for each game or play activity can be uploaded. The satellite has also built-in motion sensors, which relate to five zones on the trampoline, one near each satellite and one in the middle. Movement data from the satellites is used to conduct games and play activities for the trampoline.



Figure 1: The satellite

3.1 Design of the playing activities

As a starting point we did observations and informal conversation with 5 children, jumping on the trampoline in a backyard. The idea behind was to get a broad view of playing activities around

the trampoline, both the performances and the experiences. Afterwards the development of the games and play activities take place through a design process based on a practice perspective [15] and on four profiles of children developed by the company PlayAlive. Furthermore, we divided activities into different game/play typologies that made it possible for us to ensure different appeals to different children and in that sense to ensure diversity and complexity in the design of the games [6,8,9].

PlayAlive operates with four different children profiles:

Action Andy and Amy: They love speed, excitement and competition. They are the rebellious kinds, who prefer to play outside in the open, where there is room for wild play. Action Andy and Amy like catching, ball games and hiding games.

Mind Max and Macy: They are motivated by intellectual challenges. Max and Macy like competition, but mostly at the tactical and strategic level. They prefer board games and construction toys.

Fantasy Fiona and Felix: They love role-playing and fantasy games where they can fully live out their own fictional world and can tell stories. Competition is not something they are very fond of.

Creative Carla and Chris: Carla and Chris are creative and prefer games where they can create without coming up against all sorts of limitations. They love to draw paint and sing and for them competition destroys the activities they love.



Figure 2: The interactive trampoline

Inspired by Huizinga [8] and Caillois [6], Petersen [20] distinguished between five different play practices, which, alongside the profiles of children shown above, were used as a basis for the design of games and play activities:

Fantasy play is all about pretending and telling a story; poetry and role-play are also important here.

In *construction play* creating something and using creativity play an important role.

In *high activity play* speed, strength; agility and the influence of the vestibular system and of kinesthetic senses are central.

In *moving play* it is about physical interaction between bodies, and there are rules for this interaction.

In *rough-and-tumble play* several elements of competition, risk or fighting are included.

3.2 The playing activities

With the four types of children and the five types of play practices we have developed four play activities for the trampoline. The first, *Energizer*, encourages children to jump as much as they can. *Action Andy and Amy* has been the primary source for this game. In *CircusPlate*, they jump and put as much energy into the satellites as they can. When they jump into a zone, the energy in that zone is filled up and leaves the zones they have left. They have to make sure that there is always a little energy left in all zones. *ZoneJump* is about how many zones they are able to jump in within 45 seconds. In the design process we created the jump at the center of the trampoline to make sure that children did not jump across the trampoline, which would pose a significant risk.

Mind Max and Macy, by contrast, was the prime influence behind both the *CircusPlate* and the *ZoneJump*. When the children are winning, as a reward they will experience sound and light.

The last game is *Gardenband*, where each zone represents an instrument, thereby allowing the children to compose their own music. Furthermore, they can change the loops in the music by pushing the satellites. When they jump into the central zone of the trampoline, the music is stored and they are able to play it again and again. *Gardenband* derives from *Creative Carla and Chris* and to a lesser degree from *Fantasy Fiona and Felix*. High activity play was the main inspiration for *Energizer*, *CircusPlate* and *ZoneJump* and to some extent also for *GardenBand*. Neither *Moving play* nor *rough-and-tumble play* have been as much of an inspiration due to considerations of safety, mentioned at the very beginning of this paper.

After finishing the design of our four games, we tested them among our users. In the following we will sum up methodological considerations relating to our testing and describe what we subsequently learned about our design of the activities and of cause from our testing.

4. METHODOLOGICAL CONSIDERATIONS

The basis for our data production and collection was a triangulation of participant observation, observation and video as well as informal interviews both with children and with the adults around them [5,7,22]. The triangulation was meant to create different perspectives on data, where the observation/participant observations were intended to provide an idea of how the children more generally used the test sites and how they were using the trampoline. The interviews were to be used to obtain impressions of children's experiences and thoughts about their trampoline use and also their thoughts about the activities. Finally, video monitoring was to give us a clearer idea of how the games and play activities worked, for how long children were motivated to be active and of their general strategies in using them [22].

The purpose of the testing was to create data from which we could generate an understanding of the activities on the trampoline, to come closer to an idea of how they functioned and to design and develop new types of activities.

The trampoline was tested at two locations in Vejle (in Denmark). The first was a local children's activity centre called *Legelandet.dk* (picture one and two), where it was tested for two days, placed among other play equipment. The place consists of, among other things, an indoor play area with inflatable, foam-covered climbing castles and slot machines. Next, the trampoline was tested in *Spinderihallerne* for three days in the school vacation. *Spinderihallerne* is a reconstructed factory that is used

for a variety of cultural activities. During the winter holiday the place was reserved for various cultural activities for children. They could play chess; they could paint or take a different creativity course. The trampoline was the only physical activity. Finally, the *GardenBand* activity was also tested by a group of physiotherapists at the annual seminar for children physiotherapy (Dalum Landbrugsskole the 24th and 25th February 2011).

5. DISCUSSION OF THE TESTING

Energizer: The activity is the simplest design for the interactive trampoline. The game was not used very much but often just played once, and then the children would find something else more interesting to do. Just jumping up and down is not in the long run motivating, and we assume that is the reason why the children quickly went on to do something else. Also, *Energizer* was difficult to play with more than one person. The children clearly preferred playing together at the other activities that were better accommodated to multiple players, even though at the outset they were not designed for multiple players but as a single player system [1,3,3].

CircusPlate: The activity aims to generate high intensity activity, and it also encourage the children to play tactical, and therefore, we assume, the children acknowledge the fact that being more than one person at a time, was an advantage. Four children at the trampoline when playing *CircusPlate* made it possible for each child to take care of one satellite each. That setup made it possible to perform even better. As one boy said in the interviews:

Boy: Yes, it is really hard.

I: Isn't it hard work playing on the trampoline back home?

Boy: Well, I just jump a few times and then do some somersaults. When you are engaged with the game activities you have to use your brain and more energy to move quickly. This is a very good game, and I would like to buy it if I could.

ZoneJump: *ZoneJump* is the most popular activity among the activities developed for the children on the interactive trampoline. The level of intensity was also high.

With the three activities mentioned above one goal was to encourage physical activity on the trampoline, but as with many of the existing products on the market the use of the game activities showed that interest in them has a limit in the long run. Once the children had tried the interactive activities a few times, they reverted to using the trampoline as they were used to at home [14]. The play activities on the trampoline generate higher intensities in the sequences where they are used, but the desire to repeat the games is limited. Could the development of more sophisticated adaptability have prolonged the use of the play-games? This seems to be the unanswered question.

GardenBand: *GardenBand* was different from the other play activities. It is about creating music, about feeling the rhythm and being physical at the same time. There is no limit to the activity. A major problem with the activity was the volume of sound, as it was difficult for the children to hear the changes in the loops and the differences in the number of instruments. The low volume made all the sounds very alike, and very soon it just becomes noise, without any structure or meaning. This was very clear from the videos, and the children simply started pushing the satellites again and again, trying to make some sense out of the game but without really succeeding. Few of the play activities that were started by the children were completed. After repairing the

volume, we tested the play activity again with some physiotherapists. By switching between measuring points, the physiotherapist testing the activity was able to compose her own melody and simultaneously adjust the pace of the melody to the jumping rhythm in the trampoline. In that sense the adaptive potential of the technology was in some way exploited.

6. SECURITY CONSIDERATIONS

As mentioned in the beginning of the paper, our knowledge of safety played a major role in the design of the interactive activities for the trampoline. As shown in the above during the testing, the children preferred to jump together while playing the games and also to take part in the playing activities together. The only time they played the game one at a time was when adults on site managed the play situation around the trampoline. It is worth mentioning, though, that both *CircusPlate* and *ZoneJump* encouraged the children to be placed in different zones of the trampoline, as they were responsible for their own areas. In that sense the playing activities constituted a lower threat to one another in that they were not very close to each other, as if there had been no technology on the trampoline. In the future it might be relevant to further examine how the technology can on one hand keep children safer and on the other hand is able to create good opportunities for the fun to be retained. There seems to be a tendency for the development of play equipment to take safety more seriously than having fun. Our study showed potential for including technology as a way of dealing with both safety and fun. This is precisely where the challenge lies when it comes to creating safe play [23,25].

7. CONCLUSION

The article has presented some of the challenges we have experienced in developing the interactive trampoline. From the very beginning physical activity, safety and technology were central themes, but the relationship between them created some insights that should be borne in mind in future development of interactive play activities. Our observations showed us, not surprisingly, that children prefer playing together on the trampoline, and that dimension challenged our desire to promote a safer environment in the trampoline. On the other hand it seemed that the children, because of the social playing together were more active than when playing alone. The relationship between challenge, physical activity, safety and sociality must therefore in the future be considered paramount. Lastly, the development of the design showed us qualities on one hand enhancing technology in the existing play equipment, but importantly on the other hand is to make sure, that the equipment also can be used without the technology.

8. ACKNOWLEDGMENTS

We would like to thank PlayAlive A/S, PE Redskaber A/S, the EU Foundation and The Carlsberg Foundation.

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