
Don't Steal My Balloons: Designing for Musical Adult-Child Ludic Engagement

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Abstract

Play—in particular *adult-child play*—is an important component of child development. This article investigates how to design for adult-child play through *Sound Happening*, an interactive installation for musical play. We present a preliminary analysis of participant interactions with *Sound Happening* at The Children's Museum of Pittsburgh, where a total of 112 children and 53 adults interacted with the exhibit. The data from these interactions indicates that *Sound Happening* can facilitate both verbal parental engagement and partnered adult-child play. We highlight several features of *Sound Happening* that can be used as

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design principles for adult-child play environments. These include incorporating embodied interfaces, designing for multiple levels of engagement, and utilizing culturally recognizable interaction modalities.

Author Keywords

installation design; interaction design; adult-child play, play; musical play; sound design; museum; play

ACM Classification Keywords

Human-centered computing~Collaborative interaction

Introduction

Play is a crucial component of childhood education, contributing to the development of children's physical, cognitive, social, and emotional skills [5]. Adult caregivers who engage in play with their children can enhance the socio-cognitive benefits of play while also strengthening relationships with their children [5]. Creating environments that facilitate adult-child play is therefore a key aspect of designing for *ludic engagement* (i.e. designing for playful or game-like interactions rather than function) [11] in museums.

However, much of the existing literature on parent-child interactions in museums focuses on verbal contributions of parents to play interactions (e.g. asking questions, regulating behavior, directing play)



Figure 1: A mother watches her son interact with *Sound Happening*. She encourages him to experiment with the balls and listen to the different sounds that they make.

[7,13]. Studies that have focused on parental engagement in more active play (e.g. role play, physical play) with their children have revealed that parents tend to shy away from these types of interactions in public spaces like museums [12].

We aim to create a framework to guide the design and evaluation of adult-child play in museum contexts that will fill this gap in the literature. This paper discusses an initial exploration towards this goal. Using *Sound Happening*—an installation in which participants playfully manipulate musical sounds by moving colorful balls around a defined interaction space—as a design probe, we explore adult-child play interactions within the context of a children’s museum.

Related Work

Play is an important component in child development and learning. It can contribute to the building of physical, social, emotional, and intellectual skills [5]. Adult involvement in play has been shown to enhance children’s socio-cognitive development and can help to strengthen relationships between adult caregivers and their children [5]. In addition to providing benefits for children, play can also foster happiness and creative engagement for adults [2]. As a result, the design community has begun to investigate ways of fostering ludic engagement [3,11]. Since play often conflicts with the typical responsibilities and expectations associated with adulthood, engaging in play with children can provide adults with an *alibi* through which they can reap the benefits of play without worrying about embarrassment [3]. A variety of literature in museum studies has investigated how parents engage with their children in open-ended play in an effort to better

understand types of parental engagement in the museum environment [7,12,13].

A significant portion of the research focuses on the ways in which parents engage verbally with their children during play [13] and how to encourage verbal interactions via exhibit graphics [7]. Other researchers have investigated non-verbal interactions, observing exhibits designed to encourage pretend play and specifically looking for more involved parent interactions such as pretending or engaging in role play [12]. Their results suggest that while parents do engage verbally with their children during play, they tend to shy away from engaging as a play-partner. This is in line with research that suggests that adults tend to avoid play in public spaces that could be perceived as embarrassing or in conflict with social norms [3].

Several researchers have begun to explore ways in which adult fears of social embarrassment can be ameliorated in order to encourage ludic engagement. Deterding discusses a variety of ways to design for adult play, including separating players from non-players, framing play activities within an environment where play is socially acceptable, creating interfaces for engagement that do not require unusual or embarrassing interaction dynamics, and including alibis that allow adults to “save face” with socially acceptable excuses while engaging in play activities [3]. *Cultural forms*, or “historically elaborated social constructions that are inherently linked to social practices” (e.g. hide-and-seek, jump rope) [6], are particularly well-suited for creating environments for adult-child play because they evoke easily recognizable framings, natural interaction dynamics, and a set of accepted social norms for engaging in the activity.

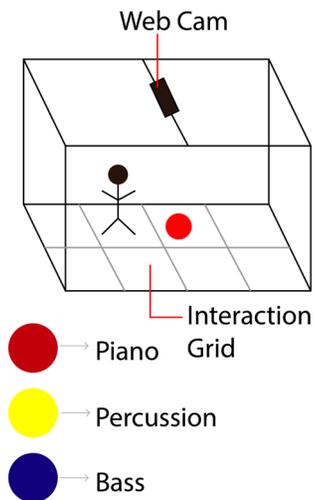


Figure 2: A diagram of the *Sound Happening* installation. Participants interact with balls while standing underneath a webcam that tracks the motion of the balls. Participants stand on an invisible grid, where movement from one section of the grid to another causes different sounds to play. Each grid section maps to a different tone and each ball maps to a different instrument.

Theories of situated learning [9] also indicate that learning environments should allow for individuals with different levels of expertise to collaborate and share knowledge with each other. This suggests that designers should consider factors relating to both adult and child play when developing exhibits. Designing for adult-child play necessitates considering multiple ways of experiencing the installation that may differ depending on the visitor's age.

Our work builds on the existing research on designing for adult-child play, using the *Sound Happening* installation as a design probe for investigating adult-child play dynamics in a children's museum, with the end-goal of developing a schema to guide the design and evaluation of adult-child play in museums.

Installation

Sound Happening is an interactive installation in which participants can make music by moving colorful balls around a defined space (Fig. 1). Inspired by Kaprow's notion of a *happening* [8]—or a participatory, spontaneous, improvisational experience unique to a particular moment in time—*Sound Happening* is driven by the desire to open up the experience of music-making to people with all levels of musical experience. Musical play has been shown to contribute to early childhood development [14], making it particularly relevant for a children's museum context.

The technical implementation of *Sound Happening* incorporates computer vision, color-tracking, and sound design. A web-cam mounted above the interaction space tracks the balls using Max/MSP, a visual programming language for music and media manipulation. The Max/MSP program maps the location

of the different colored balls to one of 16 different squares in a 2x8 grid representation of the interaction space (Fig. 2). The combination of the square location and the ball color is then mapped to a unique musical note, which is sent to Ableton Live music software, modified aesthetically, and finally played back to the user through a set of speakers placed around the installation. Each colored ball (blue, red, or yellow) corresponds to a different instrument type (percussion, piano, or bass) and moving each ball in the XY plane triggers different sounds within its instrument palette. Multiple participants can interact with the space at the same time using different colored balls to create unique soundscapes with all three instruments. In other words, the installation acts as a sort of "invisible keyboard", where participants can trigger tones in the interaction space depending on a) where they are standing with the ball in the space and b) what color the ball is. For instance, moving the red ball into the back right corner will elicit a low bass tone (the low note because of the location, the bass instrument because the red ball was used), while moving it to the far opposite corner will play the highest bass tone.

Data Collection

We installed *Sound Happening* and recorded participant interactions during the summer of 2017 at the Children's Museum of Pittsburgh as part of an artist residency at the museum. We installed the project in its own room in order to control entry to the space and informed participants that they would be recorded for research purposes via large and clearly visible signs placed directly outside of the room. Fliers detailing the research project were available for participants to read and take home.

Don't Steal My Balloons: Iterative Design at the Children's Museum of Pittsburgh

Mission: The museum aims to provide a space for children to explore creatively while learning, with a strong emphasis on joyful, fun experiences. Our goal was to transform *Sound Happening* into a *tough art* exhibit, or a museum exhibit that maintains artistic intentionality while also withstanding hours of daily hands-on use by children of all ages.

Discoveries: We discovered that different ball types engendered different types of activities – using bouncy balls led to chaotic interactions, as balls bounced off the ceiling and were used aggressively by older kids. Balloons afforded gentler play but were frequently stolen—they were perceived as souvenirs. We finally settled on beach balls, which afforded gentle play and were not perceived as being free for the taking.

Analysis

Aggregate Statistics

We obtained approximately 16 hours and 9 minutes of continuous footage over the course of three separate days. From this continuous footage, we were able to obtain approximately 3 hours and 33 minutes of footage of visitor interactions with the system. Interaction sessions ranged from 12 seconds to roughly 20 minutes, with several groups returning for multiple interactions with the system. The average interaction time was 2 minutes.

As is typical in museum settings, the majority of interactions with the system involved groups. Group size ranged from individual interactions to large school groups (size > 10) with an average size of 3 to 5 people. 3 children and 6 adults interacted with the system individually, with holding times of a few seconds to 5 minutes. A total of 112 children and 53 adults interacted with the exhibit. ~84 of the children interacting were in the younger elementary school age group, which is consistent with the typical audience of the museum. The majority of adults (33) alternated between physically interacting and observing, with interaction sessions lasting ~30 seconds.

Case Study

We will now look at a specific interaction between a woman and her child (using a “thick description” technique [4]) in order to illustrate the variety of ways in which parents engage with their children in the context of the *Sound Happening* installation.

A mother and her child, a boy around three years old, approach the installation, where there are three beach balls (red, yellow, and blue) lying on the floor in a

rectangle demarcated by black tape. The mother introduces the exhibit to her son, using the information on the sign to explain that to him that he can make music by moving the balls. She points out that the installation is a prototype of a new exhibit and encourages her son to move the balls to test it out. The boy takes her advice and approaches the exhibit, vigorously kicking the balls. His mom reminds him to be gentle— “you can move the balls without practicing your karate moves”. The boy does not heed his mother’s suggestion and punts the yellow ball to the other side of the room. His mom encourages him to move the ball inside of the square so that it will make noise, and begins to engage with the balls, setting an example by gently kicking the yellow ball back into the interaction space. The boy seems to understand this time, and he follows her lead, gently moving the red ball around the space with his foot. The two of them continue to move the balls around the space together, switching between the different colors and listening to the sounds they make.

After about 20 seconds of joint physical play, the mom proposes an experiment. She tells her son to test the balls to see which one makes which kind of noise, asking him whether the balls all make the same kind of noise or whether they make different kinds of noises. She encourages him to listen to what he hears, and squats down next to the interaction space to watch him experiment with the balls (Fig. 1). The boy first tries out the blue ball and listens to the sound that it makes. He then tests the red ball and has a realization. He excitedly shares his discovery with his mom - the balls are causing noises to be played! His mom confirms that this is right. The boy then tests the final (yellow) ball to see what type of noise it makes. The mom then asks



Figure 3: A father and his daughter interact with the *Sound Happening* installation. Adult-child partnered physical play tended to occur in small groups, like the father-daughter dyad pictured here. In contrast, larger groups (size > 5) tended to exhibit more chaotic interaction patterns, in which children engaged in free ball play (without much regard for the sound playing) and adults monitored the interaction and/or engaged in one-shot interactions like tossing errant balls back into the interaction space.

her son to imagine what it would be like if every time he moved “baby brother,” he made a noise like the balls do. The boy continues to kick the balls for a bit and then runs off to explore a different area of the room. The interaction lasts 1 minute, 52 seconds.

Discussion

In this case study, we see parental engagement in several different forms. The mother engages in a variety of verbal interactions with her child—she encourages him to interact with the system, describes the exhibit to him, and imparts social norms by reminding her child to be gentle with the exhibit materials. She also prompts her child to interact with the system in particular ways—for instance, encouraging him to experiment to see which ball makes which noise. The questions that the woman asks her child indicate that *Sound Happening* has potential to engage participants in a variety of different skill-building play activities related to early childhood development, including the learning of social norms (e.g. being gentle), the practice of motor skills (e.g. moving balls), sensory exploration (e.g. experiencing sound), recognition of cause and effect (e.g. understanding that moving a ball creates sound), and creative exploration (e.g. making music, imagining “baby brother” making sounds like the balls do). These initial observations suggest that future designs could more explicitly incorporate opportunities for learning.

The mother in our case study also moves beyond verbal interaction with her child and engages in partnered play with him. She sets an example, showing her child how to properly move the balls around the space by doing it herself. Then she continues to play with the balls alongside her son. The aggregate statistics we collected

indicates that *the majority of adults (33) engaged in this type of partnered physical play* coupled with observation and verbal engagement. Partnered play is less frequently seen in adult-child museum interactions but is an important goal of exhibits that strive to facilitate adult-child play, as generative play involves not just didactic instruction but also open-ended exploration. Adult-child play can also give children self-confidence, as they are able to interact on a more equal level with their caregiver than in everyday interactions.

We suspect a variety of factors may contribute to *Sound Happening's* ability to facilitate both verbal parental engagement and partnered adult-child play. First, the balls provide an embodied mode of interaction that evokes the cultural form [6] of ball play. Prior research on the socio-cognitive benefits of tangible interactions [10] suggests that the *Sound Happening* interface is well-suited for a child-driven learning environment. The cultural form of ball play also provides a clear framing with a set of predefined social norms that may make it easier for adults to interact with the installation without fear of social embarrassment. Adults only have to engage by moving balls as they would in any other sporting activity—rather than by donning costumes as they might have during pretend play, which has been shown to be less successful at engaging adults in museum environments [12]. We discovered through iterative design that beach balls specifically afforded gentle, exploratory physical play, whereas bouncy balls led to more chaotic, aggressive play and balloons were perceived as being free and were taken from the exhibit.

Sound Happening also allows for multiple levels of interaction. Younger children can engage with age-

relevant concepts such as motor skills, sensory exploration, and understanding cause-and-effect, as evidenced by our case study. Older children and adults can engage in deeper interactions like making rhythms and musical patterns, creating an experience that is complex enough to sustain adults' interest.

Conclusion and Future Work

Aggregate statistics and a case study relating to adult-child interaction indicate that the embodied interface, cultural framing as a ball game, and multiple levels of engagement make *Sound Happening* amenable to facilitating adult-child play. These features can be used as design principles for future installations that aim to facilitate adult-child play.

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