Interactive and Live Performance Design with Children
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ABSTRACT
Performative Experience Design (PED) is an extension of experience design focusing on the unique time-bound encounter between performers and spectators. Technology is purposefully designed to enhance the experience between audience and performers. PED has been studied with adult participants; however, it has not been explored with children. We conducted a Cooperative Inquiry session to explore 1) how children want to interact with live performances; 2) how they seek to change a story in live performances; and 3) a specific technique that might facilitate designing for such interactions. We present our initial findings regarding children’s perceptions of what constitutes live performance and the ways in which children want to use technology to interact with, direct, and respond to narrative structures and characters within live performances. We include a discussion of the features of a specific co-design technique for supporting the ideation process of our child designers.

Categories and Subject Descriptors
H5.2. [Information Interfaces and Presentation]: User Interfaces – User-centered design

General Terms
Design, Human Factors

Keywords
Children, Cooperative Inquiry, co-design, interactive theatre, live performance, Performance Experience Design

1. INTRODUCTION
Given the proliferation of pervasive technologies (e.g., mobile, wearable), design approaches to support new kinds of user experience known as pervasive or mixed reality experiences [1] are increasingly of interest to HCI researchers [1,2]. Researchers are establishing new frameworks to guide designers in ways to include spectators (or audience) and performers in meaningful interactions in public spaces [1,2,7]. For example, [1] used an urban street game, Uncle Roy All Around Us, to develop design recommendations for using mobile technologies to frame the experience of live performances for bystanders and players, thereby reducing some of the risk inherent with strangers interacting in public spaces. Design work in the area of live performance is also known as Performative Experience Design (PED). PED is an extension of experience design focusing the unique-time-bound encounter between performers and spectators, in which technology is purposefully designed to enhance the experience [7]. These works provide a foundation for understanding how new technologies are breaking "the fourth wall" through which audiences passively experience live performances in traditional, proscenium arch-based theaters. However, these studies focused on the user experience of adults, not children. In contrast, child development studies have shown that children possess a natural predilection toward mixed reality as well as performative play as a means for learning and literacy development [e.g., 3,5]. Our exploratory study aims to build on mixed reality and PED design research for adults to understand children’s perceptions of interactive live performance and the consequent live performance designs they are inclined to develop.

In this paper, we present our initial findings regarding children’s perceptions of what constitutes interactive, live performance and the ways in which they want to use various technologies to interact with, direct, and respond to the narrative structures and characters within live performances. We worked to explore the questions raised by PED of “how can we understand the dynamic of performative experience between spectator, performer, and device within HCI? How do we reason about interactions with this new dynamic, and how do we design for them?” [7]. We investigated children’s ideas through a single design session using techniques that focused on the physical interactions that are possible during live, interactive performances. We found that children 1) tend to limit live performances to musicals and plays held in a space with a clear distinction between stage and audience; 2) are hesitant to break the fourth wall, wanting to remain part of the audience; and 3) believe all audience members need to have a fair and equal chance of interacting with or providing input to a performance.

2. METHODS
2.1 Cooperative Inquiry and “Big Props”
Children have their own unique opinions and needs that are different from adults so it is important to include children as fundamental stakeholders throughout the design process. [6] Cooperative Inquiry is a design method in which adults and
children work as equal partners in an intergenerational design team to solve design problems [6]. Within the Cooperative Inquiry method there are a number of techniques researchers can use to elicit design ideas or feedback from the team. One technique used to facilitate design work when considering how to encourage physical movement is Big Props [8]. For Big Props, small groups of design partners use an assortment of physically large items, such as umbrellas, cardboard boxes, or tablecloths to develop interactions and movements for dynamic situations. We conducted a design session using Big Props because we were specifically concerned with how children approach physical interactions between an audience and the performers.

### 2.2 Design Session Structure

The structure of our design session mirrored previous Cooperative Inquiry sessions [6]. First, all child and adult co-design partners individually answer the question of the day (QoD). This question is developed around the content of the session’s activity and helps the partners begin thinking about the design context for the session. The QoD for the interactive theater session was, “What kind of performances have you seen with real people?”

For the co-design task, the team split into three small groups of both adults and children. Seven children, ages 7-11, were grouped by similar ages (i.e., two 7-8 year olds were paired together, as were two 9 year olds and three 10-11 year olds). We used a modified version of the Big Props technique: rather than using typical props, we used readily available pieces of technology (e.g. a flashlight, smartphone, game and television controllers, stopwatch, etc.). The team used these technology props to focus their design ideas on the interaction with the performers, rather than having them concentrate on creating new technologies. Each small group received one bag filled with four to six different technology props and were told the technology props did not have to function as expected. The design task given to the groups was “How would you involve audiences in live performances using technology?” Teams also had to demonstrate how they would use the technology props to change each of two predetermined stories.

We purposefully selected a short, traditional tale, and a larger, broader narrative to see what trends would emerge from both. The first story was Hansel and Gretel. We gave a brief overview of Hansel and Gretel to refresh children’s memories. The second story was Harry Potter. Here, the children could pick any aspect or story within Harry Potter. We chose two stories that varied in aspects such as length, complexity, and genre in order to explore what common themes would emerge across differing stories.

Each group considered how they would interact with the first story using technology and then presented their ideas to the entire team. After these presentations the bags of technology were rotated; the groups created technology interactions for the second story; and their ideas were again presented to the full team. For each presentation, an adult design partner noted the ideas each group presented on a whiteboard. This allowed us to formulate the Big Ideas generated from the design session, where a researcher uses the raw notes transcribed on the large whiteboard to identify common themes or unique ideas. One adult presented these ideas to the team and discussed them at the end of the session.

### 2.3 Data Collection and Analysis

At least one adult in each group took participant-observation notes guided by our research questions. Researchers noted how the child co-designers might 1) repurpose or otherwise appropriate the technology; 2) change the story; 3) combine technologies; 4) interact physically with the technology and/or elements of the story as they enacted it; and 5) engage in any other interesting interactions. Segments of the session and all presentations were also photographed and video recorded.

Immediately after the session, the adult researchers used their field notes to collaboratively code for major themes surrounding how children could affect live performances [4]. During this debriefing session, the adults shared and compared their experiences from their separate small group interactions and their interpretations of the session’s outcomes. From this collaborative open-coding process [4], the following major themes arose: controlling performers’ behavior; audience factions and voting; audience distance and interaction mediated only via their technology; and telling happier stories. A core group of co-authors conducted a second round of thematic analysis on these themes, during which they grouped similar design ideas together [4].

### 3. FINDINGS

#### 3.1 Reflections on Technique

Although our intention in modifying the Big Props technique was to retain the inherent physicality of the technique, it was occasionally difficult to elicit physical responses from the design team after substituting with technology props. The adult partners found that they had to instigate acting out scenes, as the child partners appeared more comfortable discussing their ideas from a passive, rather than active, perspective. This may have been a result of their more traditional fourth-wall understanding of audience-performer interaction (detailed in the following section). While the children desired the ability to impact the performance, they did not want to become directly involved as performers.

#### 3.2 Perceptions of Live Performance

To frame the QoD for the child designers, we presented live performance as any experience in which performers are in front of those watching in real-life. From their responses to the QoD, we found the child partners had a conventional understanding of live performance. The most common answer was a play in a theater, with a distinct divide between audience and performers. No child talked about audience participation. They omitted many different types of performances such as comedy shows, concerts, dance performances, etc. In particular, the children focused on the specific plays and musicals, professional or amateur, they had seen, such as Peter Pan, Hamlet, or a school play. Some children mentioned the type of performance they had seen, such as opera.

#### 3.3 Technology Mappings

The child partners made direct and conventional mappings when using familiar technology props. For example, children used remote controls to affect events and characters in the storyline. Video game controllers manipulated performers directly as if avatars in a game. The youngest children repurposed a television remote as a “secret remote” to set off a bomb. The remote contained buttons for the number one through nine: for larger remote controls to affect events and characters in the storyline.

Although many of the ways in which the child designers appropriated the technology props were direct mappings to typical uses, they generated a much wider variety of audience interaction options when using a prop with multiple functions in everyday life or whose functions were unfamiliar or amorphous. For example, in the Harry Potter scenario, a laser pointer and flashlight enabled
performers to act out the game “Quidditch.” The laser pen became a light-based “Snitch” that performers playing “Seekers” chased. Likewise, the larger beam shining from a flashlight became a “Quaffle” that performers followed and “caught” as audience members moved the light. Similarly, another group used an old-fashioned aerial antenna as a searching tool (to find the witch from Hansel and Gretel). Other alternative mappings included using a stopwatch to store magical spells and transforming a calculator cover into a vehicle for characters in the story. Technologies such as a stopwatch, flashlight, and laser pointer have distinct purposes in everyday life but more amorphous affordances as interaction devices between audience and performer. These technology props do not present specific interaction functions as do game controllers or remotes. Consequently, our child design partners seemed to generate a wider variety of interactions with technology props with more nebulous functions than they did with props with more established functions (i.e., flashlight vs. game controller; antenna vs. remote).

Other unique ways our child designers repurposed technology props were likely the result of unfamiliarity with their uses in everyday life. For example, one bag of technology included a presentation remote (one that advances slides in a computer-based presentation). When an adult design partner asked the children in the group what the object was, they responded that they did not know. Despite its conventional buttons, one child ignored these features, attaching the remote to her shoe. She explained that the number of stumps determined which effect took place (e.g. one stomp caused a spider to appear and attack Hansel and Gretel).

### 3.4 Technology Distribution and Fairness

Child design partners described technologies as intentionally distributed to the audience in a variety of ways and combinations, specifically: 1) randomly given to “lucky” audience members; 2) given on a first come, first serve basis; 3) distributed to every audience member; and 4) passed on to from one audience member to another. In each of these ways, technology, or the means to be a participant-spectator, is given to an audience member at the performance venue, rather than having an audience member attend a performance with an existing technology with the freedom to decide whether or not to participate. That is, the child design partners did not presume that potential participant-spectators would have technology available to interact (e.g., mobile phones) before they entered the live performance. If there were factions in the audience (or different roles to fulfill), the audience members who came earliest to the performance could choose what faction they wanted to be a part of or what aspect of the performance they wanted to control based on which technology they chose. Once a limit of available technology or available audience roles was reached, all other members of the audience would be assigned a faction or role randomly. When there was a limit to the number of audience members who could receive an interactive performance technology, the technology would be randomly assigned. In one case, a child designer specified that the technology was hidden under chairs and audience members had to find them.

For each distribution method there was an element of fairness and politeness. Technology was randomly assigned when there was a limit on the amount of technology available. Another idea was to share or pass the technology from one audience member to the next, with audience members given a specific time limit to control their interaction. The idea of politeness also emerged as a small group explained using a smartphone as small screen in front of them so they could see the performance if someone sitting in front of them was too tall, and to be able to listen to the performance on headphones if a person wanted it to be louder.

### 4. DISCUSSION

#### 4.1 The Audience as Directors

Our child design partners sought some aspect of control over the story, wanting to influence story narratives, but entirely new story elements and storylines themselves were rare. In only one instance did the children use technology to change a scene and therefore change the plot, in this case when the outcome was undesirable (e.g., Dumbledore dying in the Harry Potter series). Instead, the child designers focused on existing characters and story facts. Their emphasis on what actions characters should carry out may have resulted from how we delivered the design prompt. We did not explicitly tell our child design partners they could go beyond the bounds of each story’s realm.

Rather than making sweeping plot changes, our child design partners concentrated on directing performers in ways that would help their favorite characters. Directing the performers could have resulted from the technology devices used during the session, as a number of remotes were included. As noted earlier (section 3.3), the children used familiar objects in familiar ways, such as with the Xbox controller to control a character like a video game avatar. In these cases, the child partners used the technology to help protagonists and hinder antagonists. Children identified with the “good guys” in each story (i.e., Hansel and Gretel, Dumbledore from the Harry Potter series) while wanting to attack, foil, or control the “bad guy” (i.e., the witch in Hansel and Gretel, Voldemort from the Harry Potter series). For example, one group used a stopwatch to hold spells for Harry Potter to make it easier for him to cast spells and used a remote control to force Voldemort to dance.

The children talked about how audience members may disagree about directions for performers. Although the audience could direct the performers, the performers explicitly retained the freedom to decide whether or not to respond to audience control. It may be that children trust in performers and familiar theater etiquette to ensure that performers will only respond to audience input that leads to a positive audience experience. Furthermore, while the child designers enjoyed having a voice, they did not see their direction or interaction as the most important aspect of the experience; enjoying the performance was more important.

#### 4.2 Audience Experience

Another focus was the experience an audience member would have during the performance. Our child partners did not want to merely observe, but also to attend a memorable and entertaining event. To contribute to their experience, all of the small groups designed wearable devices for the audience (Figure 1).

Even so, audience members – with or without wearable devices to enhance their experience – acted only as participants to facilitate and direct. They did not actively become performers themselves. Only one group gave audience members the option to join performers onstage or not. Limited physical movement and a focus on watching the performance from a distinct, separate area from the performance area underscored our observation that the children were unwilling to break the fourth-wall and resist becoming performers themselves. The setting the child partners envisioned implicitly had a large audience. This observation simultaneously links to their original notions of conventional in-theater performances and extends their idea of being part of an exciting, mass participation event.
In all cases, communication between the audience and the performers was one-directional. The audience communicated to the performers. There was no performer-to-audience or intra-audience communication, and a technology device, such as a remote control, mediated all communication. When an audience member talked directly to a performer, it was only one at a time and through a mobile phone. In the instance where audience members could go on stage, they went as a character from the performance. Additionally, the child’s interaction with other performers was limited to a short amount of time on stage consisting mostly of physical actions with little to no dialogue.

4.3 Democratization
Our child design partners made it very clear during the design session that any technology system had to be fair and respond to numerous audience members. For example, a technology system acted as a polling device. If the majority of the audience voted for a performer to do one action versus another, the performer would have to do the most popular action. The majority-rule allows audience members to trust the system, because no single audience member is preferred over another. Alternately, a technology required the audience to take turns to decide the next action. The children insisted that each audience faction had a turn to give input. When choosing an action, individual audience members had a variety of pre-determined actions to choose. This format is similar to the “choose your own adventure” books where the reader can pick which storyline they want from a list of options. In this case, however, the most popular choice wins.

In addition to all audience members being heard by performers, all performers were required to be represented within the audience. Generally, groups of audience members would be randomly assigned a character to control. One group of children, however, stated that an individual audience member could control a specific character. For this one-to-one audience-character mapping, characters were assigned on a first-come, first serve basis. The group explained that the audience members most interested in the performance would come early and be able to be the only person to control a specific character or pick which faction of the audience they wanted to be in.

5. LIMITATIONS
While we have uncovered several themes and expectations that children have when designing for live, interactive, mixed reality performances, our study was limited to a single, initial 90-minute design session with seven child designers. Our observations are exploratory and can benefit from further investigation. Additional design sessions could 1) focus on the types and directionality of interaction (e.g., intra-audience or performer to audience); or 2) tease apart nuances regarding specific affordances of technology props that elicit unique designs for audience-performer or audience-storyline interaction.

In addition, some of the children’s design responses may have stemmed from the way in which the prompts were delivered. For example, we did not explicitly state that they could design live interactions that went beyond a story’s known boundaries. Design responses may also have stemmed from the technology props, which were selected for convenience and variety. Based on the observed limits on the design ideas of the children when using well-known and single-purpose technologies, further exploration using amorphous design props, unknown/rare technologies, or a wider variety of technologies might result in differently designed interactions between audiences and performers.

Our goal for this first session was to learn how children perceived live performance and we did not want to lead the child designers with ideas that did not originate from them. However, in future sessions, it would be informative to make such options explicit, in order to gather more data related to our findings regarding issues like politeness (e.g., will performers be directed to change a well-known story when some audience members demand it?).

6. CONCLUSION
We worked with children ages 7-11 as design partners using the Cooperative Inquiry method and a modified Big Props technique to explore how children would use technology props to interact with a live performance within the context of PED. This exploratory study has contributed to our understanding of children’s perceptions of live performance and the ways they want to interact with it, thus helping to answer questions raised by PED [7]. We found that children want a meaningful and entertaining experience where everyone has an equal and fair way to interact with the performance and that children want to remain a part of the audience, with a distinct divide between audience and performers. These initial findings also inform our development of design techniques that incorporate technology prototypes, in that we observed that child designers who used unconventional or unfamiliar technology props tended to generate more novel ideas and interactions for live performance. We look forward to exploring PED with children in future work with the goal of extending existing frameworks such as [2,7] specifically for young participants.

7. ACKNOWLEDGMENTS
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8. REFERENCES