Enhancing Site-Specific Theatre Experience with Remote Partners in *Sleep No More*

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ABSTRACT

We demonstrate an overview of our audience participation experiment which enhances the immersive experience of live participants in the theatrical show of *Sleep No More* using wearable computing devices, augmented portal objects, operators, and actors. Each of live participants were partnered with a corresponding online participant to explore and experience the interactive immersive performance together. We report on our techniques for orchestrating participatory experience, engagement level with the performance and networked partnership, and suggestions for some directions for future research.

Categories and Subject Descriptors

H.5.3 [**Information Systems**]: Group and Organization Interfaces - *Collaborative* Computing; C2.4 [**Computer-Communication Networks**]: Distributed systems - client / server, distributed applications; J.5 [**Arts and Humanities**]: Performing arts.

General Terms

Design

Keywords

Site-specific, Mixed reality, Collaborative, Theatre, Performance, Ubiquitous, Wearable

1. INTRODUCTION

Site-specific theatrical performances, often taking place at unique and specially adapted non-theater locations, present distinctive forms of narrative immersive experience. These performances commonly immerse audience members into a physically-created fictional world, often without the involvement of state of the art technologies [11][6]. In addition, audience members typically explore the performance site, taking journeys through original choreography, music, and installation. Often times, such performances deliver personalized narrative content enabling each audience member to have a unique experience created by his/her own actions. Site-specific theatrical performances, which already provide an immersive experience to participants, bring new opportunities to design and experiment with immersive media technologies, such as ubiquitous computing.

Recent studies and deployments of ubiquitous technology in mixed reality performance and gaming environments demonstrate that interweaving the real world and a virtual fictional world can provide unique and rich immersive experiences [7][2][10][1]. In such environments, the experience of participants is normally mediated through incorporating mobile devices and wireless networks [3]. Similar to site-specific theatrical performance experiences, mixed reality performances offer audience members the opportunity to explore, interact, and discover their own narrative pathways.

In contrast to these mixed reality projects, the project presented in this paper incorporated mixed reality boundaries into an existing site-specific theatre performance. The objective was to enable online individuals to work with an individual live audience member to provide a unique and interactive experience for both. In this paper, we demonstrate an overview of our audience participation experiment which enhanced live participants' immersive theatre experience. We begin with a brief introduction to the production itself. We then present techniques we deployed to engage live participants in the experience as well as some of the ubiquitous technologies built specifically for providing this experience. Lastly, we discuss live participants' participatory experience in the experiment, including interactions with the online participants. Feedback from both online and live participants suggests additional experiments to refine the mediated relationship between the two.

2. INTRODUCING *SLEEP NO MORE*

Sleep No More is an immersive, site-specific, and interactive theatre performance by Punchdrunk [8]. The story of the performance is inspired by Shakespeare's Macbeth and narrated in a Hitchcock style. In the performance, audience members wear a mask (See Figure 1.) and freely walk around the performance space. The audience members can choose to follow characters, themes, or simply explore the world of *Sleep No More* as a large art installation.

The work presented in this paper is in the context of *Sleep No More* and a collaborative project between the MIT Media Lab and Punchdrunk: the project merged theatre with an online platform and partnered live audience members

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Figure 1: Top left: A mask that the audience wear at the performance. Top right: Masks with wearable computing system integrated. Bottom left: A live participant interacting with the typewriter portal. Bottom right: An example of online interface.

with online participants. We explored unique methods of encouraging close relationships between remote and live participants who are strangers to each other. In addition, the development of an accompanying online virtual world was essential to have online participants explore and experience the interactive immersive performance [5]. We built a web application based on Multi-User Domains (MUDs) (See Figure 1.)[4]; their adventures primarily took place through typing in texts in a console interface. The interface then narrated the story behind the performance and immersed the online participants in a dynamically evolving image sequence, with prerecorded video sequence and live video streaming, and in the binaural audio environment. All the multimedia contents provided to them were prepared based on the physical *Sleep No More* performance space.

For live participants, we also developed a wearable computing system within the existing *Sleep No More* masks (See Figure 1.) that monitored their physiological state and mediated communication with remote participants. In addition, we installed technologically augmented portal objects such as an automatic typewriter and a dust mirror display to serve as critical points of communication in establishing the mixed-reality relationship. Following the practice of the prior mixed-reality performance system [9], almost all communication between remote and live participants was filtered and recontextualized by operators, actors, and stewards, to keep the quality of the performance and the story consistent. Operators were the mixed-reality assistants to both live and online participants in the control room who used a custom software to achieve this while stewards, in-show ushers, physically monitor the location of live participants and guided to places when it was necessary. This project pushed the state-of-the-art technologies of wireless network communication systems and web standards by delivering personalized multimedia content and story associated with the performance, encouraging each partner to have a unique experience co-created in realtime by a pair's joint actions.

Figure 2: The overall interaction flow of the performance

3. EXPERIENCE DESIGN

The overall interaction flow of the performance system is shown in Figure 2. The figure represents interactions between a single pair of partners. In the actual trial run, two to five instances of the same model were running in parallel to allow multiple pairs to journey through the augmented world of *Sleep No More* together. Furthermore, the pair could communicate with each other primarily through the intervention of the operators and the actors. They interpreted the messages between the partner and recontextualize them to maintain the quality of performance and narrative story. For this reason, tracking every action of the pair in the physical and virtual performance spaces were critical to the design of the experience. For this reason, using a wearable computing system and augmented portal objects, as well as incorporating operators, actors, and stewards were essential in achieving this goal.

3.1 A Mask and the Wearable Computing System

In the regular production of *Sleep No More*, the live participants are required to wear masks to participate in the performance. They are also asked to be silent during the show as they freely walked around the building. These constraints provided us a unique opportunity to invent novel methods for establishing remote communication. One way we addressed this problem was to implement noninvasive wearable computers, sensors, and actuators inside the existing mask. The basic interaction model using the wearable computing system is illustrated in Figure 3. The wearable system captured the activities, expression, and physiological state of the live participants, and these data could then fed into the online participant. Such strategy was one of our effort to establish shared experience between the pair.

In addition to implementing sensors, we also integrated a bone conduction headset, an audio actuator producing a vibration through the bones of the skull, in the mask. In this way, the remote participants could send audio messages, through the interpretation of operators and actors, to the live participants. The headsets were ideal for this project because they kept the participants' ears free, allowing them to experience the immersive audio within the physical performance space while enabling them to have access to extra information coming from a remote location. The bone conduction transducers were integrated into the thick strap of a mask that could be worn individually around the head like a headband.

3.2 Augmented Portal Objects

In addition to making communication possible through the wearable computing system, we also made some physical objects around the performance space as gateways for the live participants to be able to communicate with the remote participants. Although they were of antique quality, these

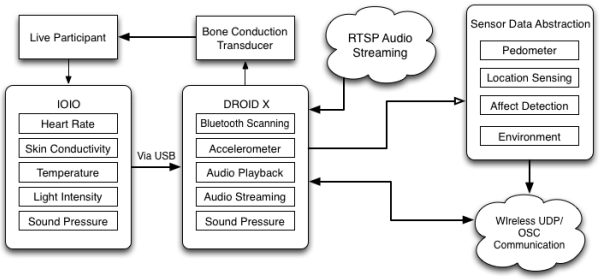

Figure 3: The basic interaction model of the live participants through the wearable system.

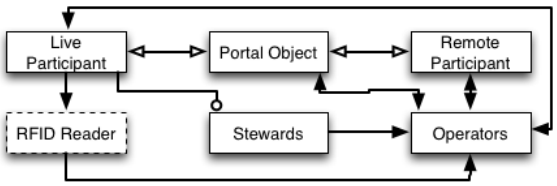

Figure 4: The basic portal object interaction flow: White arrow heads represent a direction of communication that may or may not exist depending on the type of the portal object. A white circle represents that stewards were always monitoring the position of the live participant. The RFID reader is represented with a dotted box because some portal objects were not equipped with the reader.

objects were typically everyday objects such as a telephone, a typewriter, a radio, and a mirror. In addition to these objects, we created a motorized ouija board that served as an initial point of contact between the pair at the beginning of the performance. For the pair, encountering the portal objects were special moments that allow them to discover more about the story behind the performance by sharing narrative information about their individual experiences.

We illustrate the basic portal object interaction flow in the Figure 4. Depending on the type of portal object, the directionality of the communication that took place between the pair differed. For example, one of the mirrors displayed a computer augmented hand writing when a live participant passed in front of the object. The message sent from a remote participant was displayed to give a live participant additional clues to discover the story. In another example, although the modalities of communication differed between the pair, the typewriter was able to realize bidirectional communication. The online participants' keyboard strokes on a computer keyboard mechanically triggered the physical keystroke of the typewriter to send messages and the live participant responded by verbally talking to the remote participant using a hidden microphone in the space.

To make the portal interactions successful, RFID readers were used to detect the live participants' presence near a portal object so that the operators could prepare for the optimal portal interaction. Some of the portal objects were not equipped with an RFID reader, but stewards were also almost always present near the portal objects to report the situation of the live participants to the operators.

4. TRIAL RUN

The trial run of our experimental augmentation was held over a one-week period with as many as five pairs in each of five performances. Both remote and live participants were selected to represent a cross-section of a typical audience with a broad range of familiarity with the show in particular and Punchdrunk productions in general. Participants were informed that they were participating in a research project exploring connecting audience members in a live performance context and they were instructed not to discuss their experiences until the pilot period was concluded.

Both remote and live participants were given a date and performance time to come to the show. Remote participants were given a URL thirty minutes prior to their entry point into the virtual experience and given the exact time they were to log into the web interface. Live participants were taken aside from a bar present in the show at their start time and masked out of view of other audience members before being sent into the performance space. The trial run ultimately saw thirteen pairs of participants overall.

5. DISCUSSION

We had formal debriefing sessions with both remote and live participants after each trial run, and we describe some of the comments made by the participants and also our findings through these sessions. As this project was about merging site-specific theatre with an online platform and remotely partnering live participants with online participants, we focus our discussion on the relationships that were created or not created between the two.

5.1 The Experience of Live Participants

Live participants came from a diverse background in terms of their prior experience with the production. Some had never experienced the performance prior to our trial run while others attended the show as many as twenty times. In general, the experience of the live participants were enriched because they were immersed in the spectacular physical performance world where multiple performers and a few hundred audience members played active roles.

One of the most common comments from the live participants was that they felt very special in the performance space because they were on their own journey, independent from the rest of the live audience members. They were also wearing the special mask prepared for this trial which also made them feel privileged in the performance space. One participant commented that it was satisfying to be on one's individual path, making different decisions from general audience. However, some participants, especially the first-timers, were confused with what to do in the performance space provided to them. For example, although this was not true, one participant thought that the performance experience was prepared specifically for him and there were always clues left for him about what he was supposed to explore in the space.

Many live participants also experience discomfort with the mask we designed for the trial. Even though we had warned participants not to wear glasses for the trial, the biggest complaint came from the glasses wearers. The tightness of the mask, which was necessary to make the bone conduction work, made the experience painful for participants with glasses because the mask was pushing in the glasses towards their face. Their comments on the bone conduction head

set were mixed because the headsets often were too loose and this caused the participants' head to feel ticklish. The experience of the headsets can be very enriching, but we found that there is a technical problem of how to constantly and firmly attach the bone conduction headset on the participants' skull while making them feel comfortable wearing the mask. We think that this is an essential engineering requirement in providing an immersive experience with a bone conduction headset.

5.2 Remote Participants

The previous experiences of the remote participants with the show were also diverse. Some had no prior experience with the show while others had a lot of knowledge about the story. The general experience of the remote participants was also mixed: some were very engaged while others felt frustrated and lacking a rich experience. One participant said, "[I] thought I'd only be giving about 20 percent attention, but [I] was completely absorbed" in the experience. A disengaged participant noted that "I found [the experience] a bit flat. The story was text mostly and very setting-based. But, since it wasn't a novel, there wasn't enough description to get any sense of this setting." Most participants also desired more communication with the live participant and connection with the real *Sleep No More* world. Another participant said that "the main thing for me was about feeling a genuine connection with the real world, which I didn't really get." Most participants were satisfied with the story, but many note that they felt remote and disconnected from the real world. The remote participants also had mixed feelings about the visual aesthetics of the online world. Some complained about issues related to the user interface experience, such as text rolling off of the screen and that there was no way for them to scroll down to see the off-screen texts. Some participants liked the subtly changing fonts and background images as they virtually move around the scene. The videos and images also made many participants feel that they were more immersed in the online experience.

6. FUTURE DIRECTIONS

Based on the formal feedback from the participants in the trial run, we found that operators needed to be more familiar with the stories behind the performance. They also needed to be good communicators, as the interaction often involves facilitating exploration by the pair. A number of operators indicated that mediating the experience for the remote participant can be exhausting because of the cognitive load required. In our trial, each operator dealt with one pair of an online and an onsite participants. We believe that experimenting with the number of operators per pair and educating operators with the narrative story of the performance can bring even richer experience to both live and remote participants. Technologically, we believe that further testing of our enhanced performance systems can bring about a better immersive experience for the live and remote participants.

7. CONCLUSION

We presented our project, which incorporated mixed reality boundaries, into an existing site-specific theatre performance. The objective was to enable online individuals to work with selected live participants to provide a unique and narrative-driven interactive experience for both. We demonstrated an overview of our audience participation experiment that enhanced live participants' immersive theatrical experience. We also presented our design strategies to engage live participants and some of the ubiquitous technologies built specifically to address them. We then discussed their participatory experience in the site-specific theatre show, including interactions with the remote participants. We concluded from the formal feedback collected from both online and live participants that additional experiments are needed to refine the mediated relationship between the pair.

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