Double Dribble: Illusionism, Mixed Reality, and the Sports Fan Experience

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ABSTRACT
Fans of spectator sports are changing the ways they access sports media faster than major sports leagues and media are changing their delivery approaches. The result is a situation that fails both the marketing and communication needs of the teams/leagues and the fan experience needs of the fans. In this project, we conceptualize a mixed reality platform that connects globally distributed fans to each other and live NBA games in real-time. We ask whether the design direction is even plausible and devise a low-cost experience prototype [5] with which to experiment. We present the findings from two rounds of experimentation. We also see this study as an expansion on the notion of "transformation" in mixed reality [12] including not merely actual changes of states across realities, but also *illusory* ones, which may contribute to uses of mixed reality in entertainment contexts.

Categories and Subject Descriptors
H.5.2. Information interfaces and presentation: User Interfaces.

General Terms
Design, Human Factors

Keywords
Mixed reality, entertainment computing, sports informatics, sports communications, illusion

1. INTRODUCTION
For most of the last century, spectator sports have relied on mass communications-based broadcast media (e.g., TV, print, radio) to reach their fans. Increasingly, this model is becoming problematic for several reasons. Fans, which generations ago were largely local/regional, are now global. One has only to look at how Michael Jordan has transformed basketball, and arguably sports in general, with increased viewership across the globe and increased international players in the NBA (the National Basketball Association, the premier basketball league in the United States). In the NFL (National Football League), 42% of all fans live outside of the market of their favorite team [6]. Even among "avid" fans, 50% will never attend a live game of their favorite team during their lifetimes [6].

Recent evidence also demonstrates that the reach of broadcast media is eroding among sports fans. A recent study reveals that 52% of media engagement with sports comes through sources other than TV, with Internet-based sources on the rise [1]. Fans want more access to sports media, they want to feel that they are part of a community of fans, and they want to have forums in which to express their emotional support [8]. These trends pose problems for both teams and fans. Teams' outreach and marketing efforts need to undergo substantial changes to accommodate the new climate. Fans crave interactive social spaces that go beyond Web forums in social and emotional robustness.

In this project, we conceptualized and evaluated a mixed reality social game designed to address these issues substantially. Designed in collaboration with industry partners from the NFL, NCAA, game development, and sports marketing, the mixed reality environment (MRE) provides fans a 3D social space with a diverse range of social and game activities that simultaneously connect them to live sports and to other fans around the world. At the same time, its novelty poses questions about whether fans could even make use of and enjoy it. In this paper, we present our design process and evaluations from two experiments that suggest promise for approaches of this nature.

2. PRIOR WORK
A growing body of research examines the use of MREs in different areas, including sports. Yet most of the MREs for sports were designed to enhance sport performance, such as computer-assisted analyses and visualizations of player motion [4, 7]. We have seen little literature on the use of MREs for sports communications and marketing.

Instead, we turned our attention to general theoretical work on MREs. Milgram and Kishino present a taxonomy of six categories of mixed reality environments [11]. Supplementing these categories, they mention environments in which data from the real world is used to alter virtual users' interaction, the approach that we eventually adopted. We were especially interested in the notion of "boundary," which describes the relationships between the two realities being mixed, as a way of understanding how information and objects pass from one to the other [9]. Our goal was to mix the realities of a live professional sports game with a casual game of the same sport (we began with basketball) taking place in virtual space and "boundary" provided one useful framework to understand how the two realities relate to one another. We also made use of the

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notion of "transformation," which explores how actions in one reality are able to change the state of another reality [12]. As discussed below, one of our contributions in this paper is to explore how the *illusion* of transformation can be used to create compelling experiences even where transformations do not take place. Specifically, we aimed to create the illusion that casual play in the virtual space actually affected the live NBA game, a counterintuitive notion that nonetheless appears to describe a common "felt experience" among our participants [10].

3. CONCEPTUALIZING DOUBLE DRIBBLE

Our project, code-named "Double Dribble," combines a virtual world and streaming audiocast of a NBA or NCAA game to create an experience that blends both realities. Double Dribble is designed to be a casual, socially-oriented simulation of a basketball game that leverages the strength of MREs and allows participants to play basketball games with fans across the globe. The participants can "help their team" win by contributing to the score during the live event. Figure 1 shows a concept mockup of Double Dribble [2].

Figure 1: Double Dribble interface mockup

Double Dribble mixes the realities of an in-world basketball game and a real-life broadcast game. The design seeks to accommodate the primary audience—avid sports fans—and also a secondary audience of more casual fans, such as friends of avid fans, who tag-a-long. In contrast to commercial basketball video games, Double Dribble does not attempt to simulate the depth of action in a game, but rather provides an easy-to-play design that leaves players' hands and minds free enough to engage socially and to follow the audio of the live (or prerecorded) game feeds. A scoreboard displays the local score (the casual virtual game), the live NBA score, as well as a combined hybrid score.

To leverage the strengths of mixed reality, we introduced a game mechanic we called the NBA "ghost player." When the score changes in the real-life NBA game, play is interrupted in virtual reality (VR), and a non-player character (NPC), represented as an NBA ghost appears, steals the ball, and scores in VR to increment the NBA score. After this animation, the ball is returned to the opposing team in the VR game. We focused much of our experimentation around this mechanic.

Another feature we introduced was a group of commentators, whom we called "trash talkers." These are participants who, for various reasons, do not wish to participate in the basketball play but do enjoy standing around chattering about it. This is a common social structure we observed in a prior study we conducted of events held in the massively multiplayer online world, Second Life. This feature, in addition to broadening the appeal of Double Dribble to people not interested in playing simulated basketball, also supports the social dimension of the game. The design contains many more features, but descriptions of them are omitted here to enable us to focus on those that we believe are core to this study.

4. CONSTRUCTING THE EXPERIENCE PROTOTYPE

Building functional virtual reality platforms is not a trivial endeavor. Before seeking the resources to build a functional prototype, we felt it was important to evaluate whether the general direction of our design was even plausible. The experience prototype was developed to address the following research questions. Can participants simultaneously pay attention to all the different information channels involved? How does players' awareness of the live event affect their behavior? Do players actually experience the illusion that their casual game play affects the NBA game? Most importantly, is the experience enjoyable and engaging?

To evaluate our concept, we decided to simulate the primary activities and behaviors of our mixed reality design in physical reality. Following the experience prototype model proposed by [5], we approached this problem by having participants play a casual game of basketball in a gym, in front of other participants acting as trash-talking commenters, while we played the audio of an NBA game and posted the three sets of scores in real-time on a blackboard (Figure 2): the local game score, the NBA game score, and the combined score.

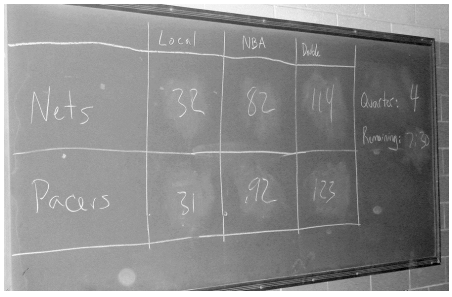

Figure 2: A blackboard was used during the experiments to track the three scores

Twenty-two participants ranging from 20 to 55 years of age were recruited for the two experiments (10 for the first and 12 for the second), with 3 female (1 and 2 respectively) and 19 male participants. All participants follow sports activities online regularly and some play sports video games. 5 indicated that basketball was one of their favorite spectator sports. The games were played four-on-four, with the remaining participants serving as trash-talkers; some players swapped roles during the experiment.

During local play in the gym, we played prerecorded audio of an NBA telecast of the fourth quarter of a playoff game between the Indiana Pacers and the New Jersey Nets. The 12 minutes of game time mapped to about 45 minutes of real time, including stoppages of play and commercials. The audio was played through a boom box. When a basket was scored in the NBA game, one of the reseachers shouted, "Ghost Pacers, two-pointer!" or "Ghost Nets, three pointer!" to indicate that the ghost player, performed by another one of the researchers, should stop local play, take the ball, and shoot a lay-up, a 3-point jump shot, or free throws, depending

on the shot in the NBA game. (When he missed, we counted the basket anyway, to maintain the coherence of the illusion.) Per the design, once he scored his basket(s), he returned the ball to the opposing team and play resumed. Throughout play, trash-talkers were encouraged to talk about whatever they wanted to, game-related or otherwise.

5. RESULTS

We collected video of participants' performance and administered a follow-up survey and informal group interviews. We used them to answer the four research questions posed earlier.

5.1 Attention to Information Channels

We were interested in observing how the participants handled the different "media" channels available to them in this experiment. The different channels that provided information about the event that was currently taking place included the audio for the pre-recorded NBA game; the chalkboard updating the scores of the game as well as the time left; the communication space including trash-talking, player-to-player communication, and administrative communication (e.g., telling the ghost player to score a basket for the real teams); and finally the local game itself. We believed that such multitasking would be possible through a selective awareness of the environment and all of its information channels.

We found, though, that participants' focus remained primarily on the court. They did, however, glance at the scoreboard, with increasing frequency as time went on. Questions about the time remaining were also common, again, especially as time progressed. For both trash talkers and players, it was clear from the interviews and surveys that practically no one paid much attention to the game audio. Possible explanations include the reverberations in the gym, the fact that the audio was taken from a televised broadcast (and hence assumed viewers could see the action), and the cognitive challenge of paying attention to so many things at once. No one indicated that a lack of interest in the real game was a problem, however.

5.2 Awareness of Multiple Realities

It should not be surprising that participants in our study did not attend to the audio channel, which was an important boundary to the reality of the NBA game. Prior research has shown similar disconnects occur across mixed reality boundaries [3]. We were also interested in seeing in what ways, if at all, participants were aware of from the reality of the NBA game.

We found that in general participants did maintain a sense of awareness of the real NBA game. This increased dramatically as time went on. We found that the ghost player's impact in the video analysis was clearly visible in this regard. There was broad consensus that the ghost player was the primary mechanism through which they remained aware of the NBA game. This connection was made apparent when the ghost player scored 10 consecutive points for the opposing team. In many ways, he controlled the game's pace and temporality. Ghost player shots from the field had generally little impact on play, presumably because they occurred quickly. Ghost player free throws, however, had a dramatic effect. In addition to slowing down play, free throws also invited negative commentary and even boos from the trash talkers, and the body language of the players on the court also suggested frustration and annoyance. These frequent, immersion-breaking interruptions acted as reminders of the other reality, that of the simultaneous NBA game.

5.3 Illusion of Transformation

So, it seemed that whether or not participants wanted, they were forced to become aware of the NBA game to engage in their own local game. This was only part of our objective, however. We wanted participants to develop some sort of emotional connection with the NBA game itself. We wanted to give participants a novel environment in which they could feel like they have some impact on the game, even if they are rationally aware that it is an illusion. We wanted to play off the emotional energy of the spectator who yells at the TV after his team loses a game in the last minute of play.

We found this emotional connection partly in the gameplay. The ghost player, especially, had an important impact for the gameplay. About half described the ghost player positively, about half negatively. Players certainly needed to be acclimatized to the presence of this external intrusion to their local game. As this mechanism became more familiar to players, they became increasingly aware of the momentum shifts as signified by the ghost player, as stated by one of our participants. Simultaneously participants suggested that they began to try to figure out how to strategize around the ghost player and how to use it to their benefit.

In a related finding, only 1 out of 22 actually knew the final score of the NBA game, which suggests a lack of separate awareness of the two realities. More interesting, only half in both experiments correctly answered which NBA team won, substituting instead the team that won in the local setting. This belief that the wrong team won, in spite of participants' glances at the scoreboards and reported use of the ghost player as a connection to the NBA game, lends evidence to support our notion that design will lead to an illusion in which the local players feel they have some ability to affect the NBA game held. By "illusion," we mean something akin to the perception of a white movie screen turning into a clear pane of glass onto an external reality when the film begins, a suspension of disbelief enabled by the awareness that fictive or alternate realities have their own laws and standards of plausibility. This illusion in the context of spectator sports may also be enabled by the same phenomenon that makes so many sports fans embrace superstitious behaviors for important games, such as not shaving or wearing a certain pair of "lucky" socks.

5.4 Enjoyable Experience

Not only did our observations show for us the promising direction for bringing fans together to support their favorite teams, it shows that players began to be very much engaged in the activity they were participating in. Not all of the core features, though, contributed to make the experience more compelling.

First, the "trash-talk" seemed to contribute the least to the experience. They appeared to be effective barometers of participant feelings (a positive sign), but they also seemed to contribute less than what we have observed in online games that we have studied. Analysis of the video revealed that most of the "trash-talk" was not typical trash talk at all. Coaching, for instance, was one of the more common types of speech. Nearly half of the participants simply skipped the question concerning the participants on the questionnaire, and the available responses were vaguely positive ("trash talking is always fun") about the activity, but negative about its implementation ("not enough trash talkers"). These responses

suggested that the trash-talking likely contributed less than it might, if more participants had been available to do it. Considering we recruited participants for this, the setup of the experiment may have also contributed to this. Both the frequency and enthusiasm, however, of the "trash-talk" increased as the game proceeded, as evidenced by the video.

Second, the ghost player mechanic, though controversial, appeared to be more positive than negative, especially in its ability to connect the two realities. While not all participants reported liking the ghost player, all the players certainly attended to it in their strategy.

Finally, participant reports were largely positive about the experience as a whole. 20 out of 22 answered on the anonymous survey that they agreed or strongly agreed with the claim that the game was fun to play. Interviews with the participants drew out some nuance. Many of the participants described a three-stage process, which began in skepticism, moved into fun and accommodation, and ended up with emergence and emotional intensity. As one participant explained about his heightened intensity near the end of the game, "I couldn't let the Pacers lose!"

6. LIMITATIONS AND FUTURE DIRECTIONS

We observed three confounding factors from running this experiment: the use of non-live data and being connected to the NBA game, the failure to engage in the different channels of information, and the differences between this experience prototype and the proposed final implementation.

First, our use of a recorded, rather than live, game may have diminished the effects of the illusion. Although we do not preclude real-time games in this environment, such an environment ought to be able to support NBA games that have been played already. What we observed was that participants often began to identify much more with the team they were playing for rather than with the game that was being played. It is this notion of player and team identity that makes the illusion so powerful.

Second, any light the experiments shed on the problem of cognitive overload from the information channels during the experience of this obviously complex activity is problematized. Though all the same elements will be present in the final design, they will do so in different modes. For instance, trash talking in the designed game will occur in IM, rather than out loud. Thus, chat will not compete with the game audio as it did in our experiment, but it will compete with game play, since both make use of the keyboard and hands.

Third, there are sure to be many differences between this experience prototype and the final implementation including the social network of the proposed space, the context in which games get started, the medium through which the game is played, and so forth. At this point, commenting on whether these differences undermine the engagement and illusion felt by these players is speculation. Only future iterations of the design can provide insight into this. Our next step is to implement this step of the design and see what differences are found in participant behavior.

7. CONCLUSION

We believe the experiments provide evidence that the design direction is promising for future work given our goals, though the experiments were intended to inform the direction of, rather than particular implementation of, our design. Despite the complexity of the realities being mixed together, participants found ways to obtain and make use of the information/realities they cared about. Also, in addition to the obvious benefits of a networked application for people who are distant in space, the Double Dribble experiments enabled participants to express themselves emotionally through a much more robust medium than the text window of a Web forum. Finally, we believe that the study lends evidence to the notion that beyond literal transformations across boundaries, we can also design for the illusion of transformation across boundaries, a finding that should be of relevance especially to the domain of entertainment computing.

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