Audience Experience in Social Videogaming: Effects of Turn Expectation and Game Physicality

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ABSTRACT
Videogames are often played socially with both co-players and audiences. Audience members’ experiences are not well understood, nor are the factors of videogaming sessions that influence their experience. We conducted a study to examine the effects of game physicality and turn anticipation on audience members’ experiences in social videogaming sessions. Pairs of participants played games under three conditions of physicality (controller-based, Wii, and Kinect) and their expectation of turn-taking was manipulated. Their enjoyment, game engagement, social engagement and sense of participation were measured. We found that the introduction of turn-taking into the session had positive effects for audience members – both anticipated and residual play effects – and that Kinect gameplay resulted in a more enjoyable experience for audience members. We argue that audience members’ experience changes as they become more active within a session, and suggest there are design opportunities between purely active ‘players’ and passive ‘audience members’.

Author Keywords
Audience experience; social gaming; physical videogames; turn-taking.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
HCI has recently turned its attention to videogaming and the ways in which games can be designed to support or promote different types of sociality (e.g. [23]). However, there has been little consideration given to the differences in roles within a gaming situation. Videogames are frequently played in the presence of people who act as audience members – those who are not actively playing, but who are nevertheless engaged in the game and are an integral part of the social situation. The experience of videogame audience members is poorly understood, which inhibits our ability to design games to enhance their experience. In this work we seek to understand how audience members enjoy and engage with games.

There may be many reasons why an individual might be in the role of audience member rather than playing the game. Pre-existing social roles might direct participants in one direction or another – for example, a parent might suggest their child play a game while they stand aside in a supporting role. There may be constraints on the number of active players – fewer controllers than participants, or a game that only supports a limited number of players. Or, individuals may simply prefer to watch from the sidelines.

Advances in gaming technologies and shifting consumer demands have led to increasingly physical and mimetic games, and these games lend themselves to use by a variety of people who do not fit the stereotypical gamer profile [8]. As such, one factor that might influence the experience of audience members is the level of physicality of the game being played. Work within HCI has suggested that physical interfaces are inherently more engaging and present unique social characteristics (e.g. [2,23]). It seems reasonable to expect that these increasingly physical forms of gameplay also lend themselves to a more performative situation: a player jumping, ducking, and punching certainly seems more engaging and enjoyable to watch than one who is pressing buttons on a controller, and the division between those standing up to play and those sitting back watching becomes more striking. While HCI has examined how players are influenced by game physicality (e.g. [22]), to our knowledge there have been no experimental studies to date looking at how the physical control of games and the visibility of these controls might influence the experience of those watching.

Another factor that might influence the audience’s experience is the anticipation of their own play. That is, there may be a difference between a person who spends the entire gaming session watching and a person who watches knowing that they will soon take a turn to play themselves. In many social gaming scenarios turn-taking is a core part of the situation, but the effect of turn-taking is not well understood. More generally, the social situation in which a game is played will be influenced by a number of factors;
prior work (e.g. [24]) has examined how sociality affects players’ experiences, but has largely neglected audiences.

From a theoretical perspective, an account of audience experience will contribute to our understanding of social gaming and social computing more generally [17,23]. Audience members occupy an interesting and underexplored space between ‘user’ (player) and ‘non-user’ [18]. From a practical perspective, game designers and marketers should consider audiences when planning and designing games, and it is important that they understand the social and physical influences on audience members’ experiences in order to broaden the appeal of their games.

In this paper, we outline an initial account of audience experience in physical videogaming sessions. We begin by reviewing the HCI literature, experimental and qualitative, looking at the physicality of game controllers and the sociality of gameplay. We then describe a study that was conducted to investigate the effects of physical gameplay and turn-taking on the audience members’ experience.

RELATED WORK

Social Gameplay

The experience of gaming with another person is generally regarded as having different, usually more positive, characteristics than playing alone. Voida & Greenberg [23] described console gaming as having intensely social characteristics, seen as a place for players with varied levels of skill and different levels of status to come together, and to be given equal time and opportunity to take a turn or participate.

The effect of the presence of co-actors (almost always a co-player) has also been studied experimentally. For example, Weibel et al. [24] examined the effect of playing a videogame with a human compared with playing against a computer on the players’ subjective experience of spatial presence (being ‘in the game’), flow, and enjoyment. By manipulating the players’ expectations of an opponent (in fact, all players played against a computer) they found that the experience of playing against a perceived human was more enjoyable and also resulted in higher levels of presence and flow.

Similarly, Ravaja et al. [16] examined the experience of social gameplay by varying the opponent type (computer, stranger, or friend) and measuring various experiential constructs. They found that playing against a human rather than a computer led to higher levels of engagement, arousal, and spatial presence, and that these effects were generally amplified further when playing against a friend over a stranger.

Physical Gameplay

In recent years researchers and the gaming industry have turned their attention to videogames that require physical activity of varying degrees. Videogames now exist on a continuum from using traditional controllers with simple buttons and knobs, to using physical controllers with varying degrees of natural mapping, to employing whole-body interaction using the Kinect and other similar systems.

The gestures required to engage in physical videogame play are, by their nature, more performative and publicly visible than the types of interactions commonly associated with traditional videogame play. Through physical movements a player’s game manipulations are made available to other co-actors and become a resource for sociality [2,7]. As such, the increasing role of physicality in videogames should be considered a core part of the sociality of games and gaming technologies.

Players’ relationships with these physical games have been explored in a number of ways, including understanding their usefulness as promoting a form of exercise [14], as well as ascertaining how the changing forms of game control are leading to different types of player experiences.

Bianchi-Berthouze [2] conducted a series of experiments to examine the effect of controller type on engagement. The more physical controllers emphasized higher levels of movement. She found that movement was positively correlated with game engagement. Similarly, Skalski et al. [20] examined the effect of the naturalness of the control mapping on game enjoyment, concluding that a more natural controller results in higher levels of player enjoyment.

A review of the above experimental studies, and others, was provided by Vanden Abeele et al. [22]. They noted that although the literature generally indicates that natural controllers present advantages over traditional game control systems, the marked differences observed in these studies’ results – both in nature and extent – may reflect methodological differences, making cross-study comparisons fraught. Additionally, each of these studies focuses exclusively on the experience of players; none of them speak to how game physicality might influence the behavior and experiences of those who are watching.

Effect of Physicality on Sociality

As certain genres of games become increasingly physical [8], there is also a need to understand the social effects of these systems and their place within gaming contexts.

Whitson et al. [25] argued that as console games become more physically oriented, they are becoming more grounded in the physical spaces they inhabit, and as such encourage a more dynamic exchange between the ‘game world’ and the ‘real world’. This, in turn, provides co-players and audience members an increased opportunity to be part of the gaming situation through their observation of and communication with the player and each other, and therefore to become engaged in the game.

There is little published experimental work examining the intersection of physical and social gaming [22]. One such study was an experimental comparison of physical and traditional controllers conducted within pairs of co-players.
The researchers measured a number of characteristics of the social setting and found that some did differ with higher levels of physicality. Specifically, the players’ reported engagement was higher with a physical controller, and video analysis showed they were more vocal and more willing to use non-game gestural movements when using the physical controller. However, the small and homogenous sample (10 pairs of participants, all female) make it difficult to draw strong conclusions from this study.

Vanden Abeele et al. [22] performed a similar study evaluating two types of controller (traditional and physical), and measured a variety of experiential factors. In general their results were consistent with expectations – physical controllers were perceived as increasing the players’ sense of spatial presence, but at the cost of lower perceived control. Enjoyment was not directly measured in this study. Their results also indicated a gender difference, which they suggest may be due to males’ tendency to be more competitive and to adjust their gameplay strategies accordingly. However, it should be noted that in both of these studies [2,22], no aspect of the social situation was manipulated. Additionally, the social relationship between group members was not controlled. As such these studies would be better characterized as studies of videogame controller physicality within a fixed social setting, rather than examining the sociality of physically controlled games.

If we consider the broader HCI literature outside of experimental work, there is some consideration given to the sociality of physical gameplay. Harper & Mentis [7] described “the mocking gaze”, a sense of playful derision of the active player of a Kinect game, who must perform oddly exaggerated physical gestures in order to be recognized by the sensor technology. They argued that this leads to a sense of social fun, and that the gestures provide a resource for play and for gentle mocking of family members within the safe space of a videogame.

Similarly, Downs et al. [6] described the ways in which the physical nature of Kinect gameplay enables different types of social play. This includes the types of mocking and derision described by Harper & Mentis [7], as well as the emulation of players’ movements, the provision of sports-like commentary, the peculiarities of the sensor’s technical abilities and the resulting effects on players’ avatars, and the use of the Kinect games’ video replay features to capture and re-experience moments.

**Audiences and Audience Experience**

Games are complex social systems that afford a variety of social roles to emerge. If we consider collocated console games, these roles can be seen to be on a continuum, with the most active roles involving full co-play, and the most passive being co-present others who pay no attention to the game. Between these two extremes lie a variety of types of ‘audience’ – those who are not actively playing the game but are, to some degree, engaged in the game experience.

De Kort et al. [10] highlighted the importance of spectatorship in videogame play, but noted that an understanding of “social processes and interpersonal dynamics (is) underrepresented” in the HCI game literature. They presented several phenomena from the field of social psychology that may be relevant to understanding the experience of social videogaming for all of the individuals involved, regardless of their social role.

One such phenomenon is evaluation apprehension, or more broadly, social facilitation effects (see [1] for a review). These effects suggest that the performance of a player will be affected by the presence of a co-player or a spectator, and depending on factors such as the player’s experience with the game, the influence may be facilitatory or inhibitory on their performance. Social facilitation effects have been empirically assessed with games [9]. However, social facilitation effects focus on the player’s instrumental game performance, not their overall experience (such as fun or engagement).

Returning to the HCI literature, when Harper & Mentis [7] described the idea of passively watching a co-present player play a Kinect game, they suggested that this is a form of “selfishness” since they will be gaining enjoyment from mocking the player without allowing themselves to be subjected to the same ridicule.

In each of these examples, the research has primarily focused on the experience of the player, not that of the audience member. There is relatively little literature specifically examining the role of audience members or spectators of technological systems, within the field of videogaming or more broadly.

One notable exception was Reeves [17], who constructed a framework for understanding the role of spectators of public interfaces and their role transitions as they become more or less involved in the system. This work is most relevant to public interactions, but aspects are germane to the consideration of audiences of videogaming. The framework includes the concepts of ‘manipulations’ and ‘effects’ – the interactions necessary to interact with a system and the resulting output. Public systems tend to require and promote more obvious manipulations and present larger, more visible effects.

As videogames begin to require more physical exertion and larger, more obvious gestures [19], and as there continues to be a trend toward larger television screens, we can see that games are becoming more publicly oriented. Consider, for example, the difference between playing a Kinect game and a game on a Nintendo DS or Apple iPad – the console game’s control system and screen both lead to a more social experience [23]. If nothing else, Reeves’ framework [17] suggests that if games continue to follow this trajectory of
increasing physicality, audiences around console games will only become a more prevalent phenomenon.

Some researchers have presented case studies of spectatorship within specific games, usually qualitative in nature. In an interview-based study of the audio channel by spectators of Super Street Fighter IV, Su & Shih [21] highlighted the importance that the gaming technology plays in enabling spectatorship experiences. Cheung & Huang [3] presented an account of the spectatorship experiences of Korean games of StarCraft II and argued that the information asymmetry between players and spectators (i.e. only the players know their underlying strategy and likely next actions) leads to the spectators’ entertainment, both through anticipation and also through the added pleasure of providing analysis, commentary, and predictions. Although it might seem that information asymmetry would be reduced in a collocated, physical gaming scenario, Downs et al. [6] noted that audience members observing Kinect gaming often engaged in commentary and speculation from the sidelines. Similarly, O’Hara et al. [15] observed that while spectators in a public screen-based game were often reluctant to participate directly, they were engaged by some of the social aspects of the game such as the competitiveness between the two cities in which the game was run.

Although some of this literature hints at the audience experience of gaming, there is little examination of these experiences explicitly, and few attempts to ascertain the types of social, technological, and game-related factors that might influence audience experience. Other areas, such as theatre and performance art (e.g. [11]), explore the nature of audiences generally, but the implications of this work for audience of interactive games in a home environment are unclear. In the following sections we present a study that looks specifically at the experience of audience members.

STUDYING AUDIENCE EXPERIENCE IN PHYSICAL VIDEOGAMING

Based on these areas of previous work, and in the absence of directly related studies of audiences in videogaming situations, we set out to investigate two conjectures: that audience members’ experiences are affected by both their own participation in the session and the characteristics of the game itself.

The level of participation in a gaming session has not been manipulated in the literature we reviewed. In all cases, social gaming studies have been conducted using co-players or players’ perceptions of mediated co-player presence. Based on the principle of social facilitation [1] it would be expected that the player’s performance (and, perhaps, experience) would be affected by a co-present non-player; it is less clear what the non-player’s experience may be.

It is also difficult to make specific hypotheses about the nature of the effects of game physicality based on prior experimental work. As observed by Vanden Abeele et al. [22], experimental studies of gaming controller effects tend to have inconsistent and sometimes wildly divergent results. They suggest that this is due to a wide variation in the games and controllers used across studies, in their experimental procedures and measures, and in their participant sampling. Another potentially confounding factor is that in many cases these studies compare games using controllers for which they were not designed.

Our study begins to address the issues of audience experience in social videogaming sessions. We aimed to isolate the effects of different levels of physicality on the audience’s experiences. We operationalize physicality as the amount of visible physical activity performed by the player. In addition we explore how the shifting roles of an audience member throughout a session might influence their experience; specifically, we examine how the introduction of turn-taking (i.e. the anticipation of having a future turn) might change the audience’s experience.

METHOD

Participants

74 pairs of friends (148 participants) were recruited for this study. Seven pairs were removed due to violations of experimental protocol, leaving a total of 67 pairs (134 participants). Participants were not reimbursed but were provided with snacks and beverages throughout their session. Participant demographics are detailed below.

At the beginning of each session participants were randomly assigned to one of two roles:

- Participant PA, who was led to believe they would be the player for all four game rounds;
- Participant PB, who was led to believe they would be the audience member for all four game rounds and would not actually play the games themselves.

Experimental Design

A 3 × 4 mixed model design was employed. Game physicality was manipulated as a between-groups factor with three levels (low, medium, and high physicality) and turn expectation was manipulated across four rounds as a within-subjects factor. Each group participated in all game rounds, each with one game lasting ten minutes. In total each experimental session lasted approximately one hour.

The experiments were conducted in a laboratory. Two rooms were used – one for the ‘low physicality’ condition and the other for the ‘medium’ and ‘high physicality’ conditions. The laboratory rooms included one-way windows; behaviors and conversations were not recorded, however the experimenter did casually observe participants to ensure that the technology worked correctly.

Participant groups were randomly assigned to one of the three physicality conditions. In the ‘low physicality’ condition, players would use a traditional gamepad-style controller that had no requirement for any motion except...
button-pressing and turning knobs. In the ‘medium physicality’ condition players would need to perform simple gestural movements, isolated to one limb, using a gestural control system. In the ‘high physicality’ condition, players would perform large or whole-body movements, generally involving multiple limbs, using a whole-body control system.

The participants’ expectation of turn-taking was manipulated through the use of four game rounds. At the beginning of round 1, P A was told that they would play all four rounds, and P B was told they would always be the audience member. However, between rounds 1 and 2 the participants were informed that the experimenter had changed their mind and that in round 3, P B would play the game and P A would watch. Round 2 proceeded as round 1 had (P A playing, P B watching), and in round 3 the participants swapped roles (P A watched and P B played). In round 4 they returned to the original configuration (P A playing, P B watching). This manipulation is summarized in Table 1.

<table>
<thead>
<tr>
<th>Round</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P A</td>
<td>Play</td>
<td>Play</td>
<td>Watch</td>
<td>Play</td>
</tr>
<tr>
<td>P B</td>
<td>Watch</td>
<td>Watch</td>
<td>Play</td>
<td>Watch</td>
</tr>
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Table 1. Rounds and turn-taking manipulations.

Due to this manipulation, P B’s expectation about the turn-taking nature of the session was altered during the session: in the first round P B watched and expected not to have a turn; in the second round they watched again but expected to have a turn later; in the third round P B did in fact have a turn; and in the fourth round they watched having now had a turn.

Participants were fully debriefed on the deception at the conclusion of the session. No participants indicated they guessed the deception during the session; at the beginning of each session all P A’s expected to play throughout the entire session and all P B’s expected to watch.

Games
Games were selected that were similar enough to compare (within the physicality condition), but that required different types of physical movements (to mitigate rehearsal effects and fatigue between game rounds). After a review of game titles for all three platforms we determined there were no suitable games that were designed for all three platforms, and so decided to use similar but slightly different game titles for each condition. We evaluated a number of games and selected those that fit within a common theme (sports-themed mini-games), and attempted to choose games that had comparable levels of fun and quality while using different physical motions within each physicality condition.

We considered using a custom game, or using non-standard controllers with existing games, but this would have resulted in a less naturalistic experiment. Although the use of different games may present a potential confound to the study design we believe that our approach presents the best tradeoff between full experimental control and ecological validity.

For the ‘low physicality’ condition a Sony PlayStation 3 gaming system was used with a standard wireless controller, and the games were diving, track running, archery, and swimming, all from the game title ‘London 2012: The Official Videogame of the Olympic Games’. For the ‘medium physicality’ condition a Nintendo Wii gaming system was used with a single Wii Remote with built-in MotionPlus, and games were table tennis, bowling, wakeboarding, and golf, all drawn from the game title ‘Wii Sports Resort’. For the ‘high physicality’ condition an Xbox 360 with Kinect sensor were used, and games were boxing (from the title ‘Kinect Sports’) and skiing, golf and tennis (from ‘Kinect Sports: Season 2’).

Groups played all four games within whichever physicality condition they were assigned to, but the order of games was counterbalanced between participant groups.

Measurement of Dependent Variables
All participants completed a short demographic questionnaire at the beginning of the session. In addition, at the end of each game round participants completed a 30-item questionnaire. In the case of round 1, this was completed before the participants were informed of the upcoming player switch in round 3. Each item was on a 7-point Likert-style scale (from ‘strongly disagree’ to ‘strongly agree’, with 4 representing neutral). Both the player and audience member completed these questionnaires, although the wording for some items was reversed depending on the participant’s role. The order of items was randomized for each questionnaire version.

The questionnaire included items measuring the following constructs: enjoyment (the level of fun the participant had), mood (the participant’s emotional state), game engagement (how immersed in the game the participant felt), social engagement (how immersed in the social situation the participant felt), and subjective participation (the extent to which the participant felt an active part of the gaming session). Multiple items were used to measure each construct. Post-study analysis found that Cronbach’s alpha was above 0.7 for each subscale, so the arithmetic mean of the items in each subscale was calculated and acted as the dependent variable for subsequent analyses. Dependent variables generally did not correlate highly with one another. One exception was enjoyment and mood (R=.77); as a result of its high correlation and similar item list, mood
has been excluded from the reported analyses. Further details about the questionnaire are published separately [5]. In addition, manipulation check items were included to assess the participants’ subjective performance (i.e. how well they felt they played) and physicality (i.e. how physically active they felt the player was).

RESULTS
Except where stated, statistical tests reported are mixed-model analyses of variance (ANOVAs) with post-hoc t tests. Eight missing post-round questionnaire responses were imputed using the Expectation-Maximization function in SPSS 21.0. Effect sizes are reported as partial $\eta^2$ and are interpreted as small ($\leq .01$), moderate (.06) or large ($\geq .14$) [4]. Because $P_A$ and $P_B$ are non-independent samples (due to being drawn from the same pairs), data for each participant type were analyzed separately. In the analyses below we principally discuss the results from $P_B$, since they were predominantly the audience member.

Participant Demographics
Participants’ mean age was 23.69 years (standard deviation 6.68 years). Although condition assignments were random, participants in the Wii condition were slightly older (mean=26.00 years, standard deviation=8.13 years). 68% of participants were male. Most participants were regular gamers: only 20% reported they play games ‘rarely’ or ‘never’. 51% of participants reported they sometimes played games socially (with others present in the room), and 41% reported they sometimes played games with the other participant they had come to the experiment with. 93% of participants had prior experience using the Wii, and 44% had prior experience with the Kinect.

Effect of Game Physicality on Subjective Physicality
Separate one-way ANOVAs were performed for $P_A$ and $P_B$, and each showed a significant effect of physicality (for $P_A$, $F_{2,265}=95.08$, $p<.001$, $SE=.16$, $\eta^2_p=.42$; for $P_B$, $F_{2,265}=107.48$, $p<.001$, $SE=.14$-$15$, $\eta^2_p=.45$). Both participant types reported significantly higher subjective physicality in the Wii condition ($M_A=5.23$, $M_B=5.48$) compared to the Controller condition ($M_A=2.83$, $M_B=3.22$), and in the Kinect condition ($M_A=5.75$, $M_B=6.06$) compared to the Wii condition, although the difference was not as large. Although analyses were separated, both are shown in Figure 1. $P_A$ consistently rated physicality as very similar to, but slightly lower than $P_B$, but the significance of this effect could not be assessed using inferential statistics.

Effect of Game Physicality on Subjective Performance
Separate one-way ANOVAs were performed for $P_A$ and $P_B$ and showed a significant main effect of physicality on subjective performance (for $P_A$, $F_{2,265}=14.73$, $p<.001$, $SE=.16$, $\eta^2_p=.10$; for $P_B$, $F_{2,265}=7.34$, $p<.001$, $SE=.14$-$15$, $\eta^2_p=.05$). Both participant types rated subjective performance as significantly lower in the Wii condition ($M_A=4.69$, $M_B=5.09$) than the Controller condition (for $P_A$, $M_A=5.75$, $p<.001$; for $P_B$, $M_B=5.59$, $p=.01$) and the Kinect condition (for $P_A$, $M_A=5.75$, $p<.001$; for $P_B$, $M_B=5.85$, $p<.001$). The differences between the Kinect and Controller conditions were not significant.

Repeated measures ANOVAs showed no significant main effects of round number on subjective performance for either participant.

Effects of Physicality Condition
We now focus our attention on the experience of participant $P_B$. A significant main effect of physicality condition was found for enjoyment ($F_{2,64}=3.94$, $p=.02$, $SE=.16$, $\eta^2_p=.11$). Post-hoc tests showed the Kinect condition ($M_B=5.67$) was rated significantly more enjoyable than the Wii condition ($M_B=5.05$, $p=.01$). There were no significant differences between the Kinect and Controller ($M_B=5.25$) conditions, or between the Wii and Controller conditions.

Although other constructs (game engagement, social engagement, or subjective participation) generally showed a similar pattern of results (Figure 2), no significant main effects were observed. In addition, breaking down each physicality condition by mini-game showed no significant differences in these constructs.
Effects of Round Number

For participant P_B, a significant main effect of round number was found for enjoyment \( (F_{3,192}=20.35, p<.001, \ SE=10.13, \ \eta^2_{p}=.24) \), game engagement \( (F_{3,192}=40.55, \ p<.001, \ SE=12.15, \ \eta^2_{p}=.39) \), subjective participation \( (F_{3,192}=71.69, \ p<.001, \ SE=07.18, \ \eta^2_{p}=.53) \) and social engagement \( (F_{3,192}=6.41, \ p<.001, \ SE=11.14, \ \eta^2_{p}=.09) \) (Figure 3).

Enjoyment post-hoc tests showed that round 1 (M_B=4.92) was rated as significantly less enjoyable than rounds 2 (M_B=5.24, \( p=.01 \)), 3 (M_B=5.85, \( p<.001 \)) and 4 (M_B=5.31, \( p=.001 \)). Significant differences were also seen between rounds 2 and 3 (\( p<.001 \)), and rounds 3 and 4 (\( p<.001 \)), but not between rounds 2 and 4 (\( p=.49 \)).

Game engagement post-hoc tests showed that participants rated engagement significantly lower in round 1 (M_B=3.92) than in rounds 2 (M_B=4.43, \( p<.001 \)), 3 (M_B=5.42, \( p<.001 \)), and 4 (M_B=4.33, \( p=.004 \)). Significant differences were also seen between rounds 2 and 3 (\( p<.001 \)), and rounds 3 and 4 (\( p<.001 \)), but not between rounds 2 and 4 (\( p=.45 \)).

Subjective participation post-hoc tests showed that players rated their subjective participation significantly lower in round 1 (M_B=4.34) than in rounds 3 (M_B=6.59, \( p<.001 \)) and 4 (M_B=4.73, \( p=.02 \)). Although subjective participation was rated higher in round 2 (M_B=4.62) than round 1, this difference was not significant (\( p=.09 \)). Significant differences were also seen between rounds 2 and 3 (\( p<.001 \)) and rounds 3 and 4 (\( p<.001 \)), but not between rounds 2 and 4 (\( p=.36 \)).

Social engagement post-hoc tests showed that social engagement was significantly lower in round 1 (M_B=4.69) than in round 3 (M_B=5.10, \( p<.001 \)), and in round 2 (M_B=4.76) than round 3 (\( p=.001 \)). No significant differences were observed between rounds 1 and 2 (\( p=.34 \)) or between round 4 (M_B=4.91) and any other rounds.

Interactions of Round Number and Physicality

No interaction effects were significant. We have not discussed them here, with one exception. For enjoyment (Figure 4), in the Wii and Kinect conditions the same general pattern was observed as in Figure 3. For Wii, a significant difference was seen between rounds 1 (M=4.61) and 2 (M=4.99, \( p=.03 \)), rounds 1 and 3 (M=5.74, \( p<.001 \)), rounds 2 and 3 (\( p=.01 \)), and rounds 3 and 4 (M=4.88, \( p=.002 \)). In the Kinect condition, significant differences were seen between rounds 1 (M=5.30) and 2 (M=5.64, \( p=.049 \)), rounds 1 and 3 (M=6.12, \( p<.001 \)), and rounds 1 and 4 (M=5.62, \( p=.046 \)), and rounds 2 and 3 (\( p=.002 \)), and rounds 3 and 4 (\( p=.01 \)). However, the controller condition showed significant differences between rounds 1 (M=4.83) and 3 (M=5.67, \( p=.01 \)), and rounds 1 and 4 (M=5.42, \( p=.02 \)), but not between rounds 1 and 2 (M=5.08, \( p=.40 \)) or rounds 3 and 4 (\( p=.30 \)). Although the overall interaction effect was not significant, we provide these details to add context to our later discussion.

DISCUSSION

From these results we can identity four distinct effects. First, when participants played the game themselves they reported higher levels of enjoyment, game engagement, subjective participation, and social engagement than when watching. While this may seem obvious, it is an important validation of the underlying assumption that playing and watching games are different experiences. Second, there is an anticipated play effect: when participants were told they would have a turn themselves their experience changed. Third, these changes in experience persisted beyond their own turn, lasting even when they knew they would not have another turn – we term this the residual play effect. Fourth, there is an effect of game physicality on audience enjoyment. In the following sections we discuss these effects in more detail.

Anticipation and Turn-Taking

We observed a clear effect of round order. Audience members found the session more enjoyable after being told
they would be having a turn themselves (i.e. between rounds 1 and 2), and this effect persisted through all subsequent rounds. Their engagement in the game followed a similar pattern. This suggests that at the point where audience members found out that they would be more actively involved in the session they became more engaged in the game itself, and their enjoyment also increased. It is interesting to consider how these two factors (enjoyment and game engagement) might be related. For example, at the point when an audience member is told they will have a turn, they might become conscious of future evaluation by the other participant, and therefore pay more attention to (i.e. become more engaged in) the game. This increased engagement may act as a mediator of their enjoyment.

Somewhat surprisingly, social engagement was only affected when the participant actually had a turn. In contrast to game engagement, the social engagement construct measures the participant’s sense of being part of a team, and of being attentive to and attended to by the other person. One’s own direct participation in the game would not immediately seem to affect these directly. A possible explanation is that the active player is dividing their attention between the game and the social situation. While they feel that they are giving a high level of attention to the audience member, they are in fact generally more absorbed in the game and have fewer attentional resources available for socialization than they might assume, but subjectively sense that they are attentive to the social situation. In contrast, the audience member has more resources available to evenly split their attention and is more cognizant of their split attention. Future work could attempt to validate the existence of such an ‘audience attentiveness bias’, and how it might change in the presence of evaluative and non-evaluative audience members (similar to the implications made by social facilitation theory [1]).

Passive and Active Audiences

Overall, there is a characteristic pattern for several of the effects we observed: in round 1 they are lowest; in round 2 they increase; in round 3 they peak; and in round 4 they return to round 2 levels. We assume that the differences between rounds 1 and 2 are due principally to the revelation that the audience member will, in fact, have a turn. Of course there may be other factors at play: the player may generally become more used to the control system of the game after the first round, or might adapt their play style on the basis of knowing there is now a potential competitor. However, we did not set up the situation to be competitive, we found no evidence of a novelty effect (when a player might be unfamiliar with the game controls), and we did not observe a significant change in either participant’s performance by round. As such we argue that the turn-taking manipulation is the most likely candidate for any changes in audience experience after round 1.

The characteristic pattern described above seems to indicate that once an audience member becomes aware that they will have a turn, their involvement in the session shifts from being strictly a passive audience member into an ‘active audience member’ (the anticipated play effect). This provides additional support to prior work that suggests that there may not be a strict dichotomy between ‘player’ and ‘audience’, but that an individual can sit along a continuum between these extremes [6]. Interestingly, we found that their experience changes for the entire duration of the session – even once they have had a turn and sit back down to watch again (the residual play effect).

The interaction of physicality and round on enjoyment may provide some clues to this phenomenon. When using a traditional controller the audience member has little reference for what it is like to be the player of the game; using Reeves’ terminology [17], the manipulations that the player performs are secretive and not publicly available. As such, when the experimenter reveals that the audience member will have a turn, they have no physical frame of reference for what this experience might be like, and their enjoyment does not shift until they actually have a turn themselves. At this point they more fully appreciate and understand the game. In contrast, in the Wii and Kinect conditions the player’s actions are public and obvious from the start of the session, and so the audience member is able to appreciate what their own involvement will entail from the point at which they find out they will take a turn. However, the interaction effects we speak of here were not significant, and so these explanations require further study and the factors require further correlation with other variables.

Game Physicality

There was a significant effect of physicality condition on audience enjoyment: Kinect games were rated as the most enjoyable for audience members. Interestingly, Wii games scored lower than controller-based games even though they included elements of physicality. There are several possible reasons why this might be the case.

Some prior work (e.g. [12]) has found evidence of Wii games being less preferable than traditional controller-based games on the basis that they provide less fine-grained control to players. While it could certainly be argued that Kinect games also provide only gross control mechanisms, without the tangible presence of a controller (such as a Wii Remote) there is less potential for direct comparison between Kinect- and controller-based games. The experience of playing a Kinect game feels qualitatively different to either a Wii-based or controller-based game. In Wii games, if players expect a high degree of control and do not get it their performance may be impaired, and as their performance degrades this could in turn negatively influence audience experience.

Indeed, we found that participants’ subjective game performance ratings were slightly but significantly lower for Wii games than for Kinect or controller games. This could suggest that the Wii games were, on average, more
difficult than the games in the other conditions. It is certainly plausible that a player struggling with a game or its controls will be less interesting to watch than a player who plays expertly.

Another potential explanation is that the games used in this study are less visually interesting to watch, or that participants are simply fatigued with Wii gaming or its aesthetic. Over 90% of our participants had used a Wii before. This made it difficult to compare the experiences of audience members who had prior Wii experience with those who did not; however, we conducted such a comparison for the Kinect condition (41% of the participants in the Kinect group had used a Kinect before, and we compared those who had with those who had not). No significant differences were observed, suggesting that platform novelty may not be a key determinant of experience.

A more interesting possibility is that Wii gaming exists in a zone between controllers and full-body gaming: a well-designed controller game might be interesting to watch with one’s full attention on the screen, and a Kinect game might be interesting to watch splitting one’s time between the screen and observing the (often exaggerated) full-body gameplay. Wii games still promote this dual attention between the screen and player, but the gestures that players perform are less interesting to watch. Further work would be needed to disentangle the factors of the game design, platform novelty and physicality.

**Design Implications**

Although this work is intended principally to inform an understanding of audience experience, the findings do suggest that there may be design implications that future work could extend and validate. The suggestion that the mere foreknowledge of having a turn changes an audience member’s experience leads to the implication that notions of a strict dichotomy or barrier between a player and an audience member are problematic and limiting.

Most commercial games, including the ones used in this study, are designed to be played by one or two players at a time. However, there is an opportunity to expand the design space of games to include additional gradations of ‘audienceship’. For example, it may be possible to allow different degrees of participation by audience members. Morrison et al. [13] presented suggestions to enable crowds of sports spectators to interact with each other and the wider stadium environment, although these were specific to large-scale events. When considering more private, physical gaming technologies like the Kinect, one can imagine using the sensor’s capabilities to detect the presence of audience members and allow them to participate in various ways, if they so choose. Similarly, ‘second screen’ interactions (such as those enabled by the Wii U GamePad and SmartGlass for Xbox) might provide opportunities for audience members to participate in games beyond standing up and playing directly.

These results may also have implications for the design of turn-taking mechanisms in games. In many games turn-taking is achieved by manually swapping players at a suitable point in the gameplay (e.g. at the end of a level or mini-game, or when a character loses a life). Our results suggest that by declaring a turn-taking session ahead of time the experience of audience members will differ.

**CONCLUSIONS**

In this paper we have argued that audiences are frequently a part of social gaming situations, but that their experiences are not well understood. The main aim of this paper has been to describe an experimental study of social videogaming audiences within the context of physical gaming. We found that the experience of audience members changes when they are informed that the gaming session involves turn-taking rather than mere observation. At this point audience members seem to shift from a passive to an active state, even before and after they have their own turns, and this active state results in higher levels of enjoyment and engagement with the game. We introduced the terms *anticipatory and residual play effects* to describe these changes in experience based on the introduction of turn-taking. However, contrary to expectations, increasing levels of physicality did not necessarily lead to a more positive audience experience. While Kinect gameplay was rated as more enjoyable for audience members than other types of gameplay, Wii gaming was rated as the least enjoyable. Several potential reasons for this finding were suggested, including issues with game control, novelty, difficulty, or having intrinsically uninteresting gestures.

Of course, this study only considered the influence of two factors on audience experience. There are other factors that are likely to be equally interesting and important, and we hope that future work will attempt to isolate how other situational (e.g. room configuration), social (e.g. watching friends vs. strangers) and game design factors (e.g. competitive vs. collaborative games) shape audience experience. We also only considered the experience of a single audience member at a time; undoubtedly, larger audiences will have very different social processes and dynamics that will influence the experience.

We also temper the results of our physicality manipulation on the basis that different games were used in each of the conditions. Although we went to great lengths to mitigate any confounding factors, the differences between the games used in each condition may have affected the physicality manipulation results in unexpected ways.

Additionally, the sizes of the differences observed are often in the order of one scale point. Nevertheless, we are encouraged by the statistical effect sizes that were observed (most of the significant effects are moderate to high strength), and also note that the majority of participants tended to score highly in general, potentially resulting in a compressed scale – few participants would rate a social...
gaming session as a negative experience, whatever factors may be manipulated.

Finally, as noted above, this study considered ‘audience member’ and ‘player’ as a strictly dichotomous separation. Our findings suggest that audiences are in fact much more complicated and nuanced, and we hope further work and future game designs will begin to color in this gap.

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