Exertion in Networked Games

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ABSTRACT

Physical play familiar from sports activities is a favorite pastime across all cultures and has been attributed with many social, mental and physical health benefits. However, the players have to be in the same physical location together in order to experience these benefits. To address this issue, an approach is proposed that combines the advantages of exertion interactions, as known from traditional physical games, with the advantages of networked games, such as allowing distributed players to engage and form social bonds over a distance. "Table Tennis for Three" is a prototypal game that allows three players in three geographically distant locations to play a table tennis-like game together with a real ball, table and bat. A critical reflection on the player experience through video analysis resulted in the identification of salient themes. One theme that was identified was the heightened role of the physical, in contrast to the virtual world in which the players act, which affects the way play unfolds. Considering such themes can inform the design of future exertion games and are hoped to inspire a new way of thinking when creating digital games that utilize interaction styles beyond conventional input devices.

Categories and Subject Descriptors

H5.2. Information Interfaces and presentation (e.g., HCI): User Interfaces.

General Terms

Design, Experimentation, Human Factors

Keywords

Exertion Interface, physical, tangible, videoconferencing, sports, exhausting, team spirit, social interaction, connectedness.

1. INTRODUCTION

Participating in physical play can have many advantages, particularly from a health and social perspective. From a physical health standpoint, physical activity can contribute to a healthier body, reducing the risk of obesity, cardiovascular disease, diabetes, and more [16] [19]. From a social and mental health viewpoint, physical group activities are believed to teach social skills [3], encourage team-building and support individual growth and community development [8]. Some argue that physical play, or sport, can foster social integration and personal enjoyment [18], provide opportunities to meet and communicate with other people, bring people together from various cultural backgrounds, and can contribute positively to self-esteem and well-being [3].

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2. AIMS AND OBJECTIVES

To provide an opportunity for geographically distant participants to profit from the health and social benefits offered by physical games, I am working on creating an understanding of how interactive games need to be designed if they aim to support exertion and what opportunities an augmentation with telecommunication technologies can offer. The aim is to combine the advantages of information and telecommunication technology (connecting geographically distant participants) with the advantages of traditional exertion games (health and social benefits) to facilitate the creation of a new approach to computer games.

For this approach, I am utilizing the concept of an "Exertion Interface"; an interface that deliberately requires intense physical effort [13]. The aim is, however, not to replace existing exertion games experiences, but rather to provide participants with an activity of comparable benefits when their partners are not available because they are located far away. One possible way to overcome this challenge is to expand the range of potential activity partners by allowing people to engage in games activities with remote partners. I believe these new types of computer-mediated exertion activity experiences have the potential to support social connectedness between remote players and maintain the bonds of friendship in a way comparable to traditional physical games, hence providing an opportunity to contribute to our understanding of digital games from a novel perspective.

3. RELATED WORK

Other researchers have investigated the convergence of computing technology and physical game or sport activities. Related work derived recently from a CSCW perspective, and the term *Computer Supported Cooperative Sports* [15] has been coined. To encompass social play, some use *Computer Supported Cooperative Play* [9]. Larssen et al. [10] applied body-centric human-computer interaction frameworks to an

analysis of a game played with the EyeToy camera. They found that although these frameworks can be useful in analyzing specific aspects of the game, there is still a lack of understanding of the body in interactive systems [10].

Bianchi-Berthouze et al. investigated the cognitive benefits of including bodily actions in interactive systems. Their work found that such an approach could unleash regulatory properties of emotion, leading to more engagement in games. The authors have shown that computer games can facilitate more bodily movement, contradicting prior work that claimed that computer gaming necessarily leads to a decrease in body motion [4]. In a follow-up study, they have investigated the effects of introducing a co-player to such a game [11]. The authors found that the quality of the engagement changes, from "hard fun" to "fantasy" and "curiosity" to "social fun", generated by a higher level of arousal and positive experience facilitated by the movements that were "natural to the scenario of the game" [11].

De Kort et al. described a framework for the sociality characteristics in games, describing that "gaming is often as much about social interaction, as it is about interaction with the game content" [7], similar to the findings on "kinesthetic movements" from Moen [12], indicating the applicability of the sociality concept to exertion activities. However, there is still a lack of theoretical understanding how these sociality characteristics take shape in exertion interactions that are supported by interactive systems.

A small number of exemplary games exist that can be framed within these framework approaches. However, not many support verbal or visual interaction between the participants, and most of them only exist in research labs so far. One of the few commercial systems is used at the *ergo_bike trophy* [1], which allows riders of exercise bicycles to race against other remote players via a laptop attached to the handlebar, which is combined with a videoconferencing environment.

The advent of a new style of computer games with exertion-like interaction has gained recent attention through the commercial success of the Nintendo Wii: in order to hit the virtual tennis ball, the player uses the controller like a racquet [2]. However, most games either are not networked or do not make use of the Wiimote, in particular the lack of imagination by game designers to utilize the potential of Wii's novel input devices and their support for more social play has been criticized [5, 6].

Fig. 1 Table Tennis for Three

4. TABLE TENNIS FOR THREE

I have developed a prototypal game called "Table Tennis for Three", which allows three geographically distant players to play an exertion game together although being apart. It uses a physical ball, bat and table, and allows the players to communicate with one another over a videoconference.

4.1 Gameplay

Each player has a ball, a paddle and a table tennis table. The table is set up so that the ball can be hit against the vertically positioned opposite half of the table (Figure 1). This setup is familiar to table tennis players who practice on their own by playing the ball against the board. This backboard has projected images of eight large 'bricks' on it. These bricks are identical for all players, i.e. they are synchronized across all three stations. These bricks are semi-transparent and are projected onto the backboard with a projector mounted to the ceiling. In addition to the bricks, it also projects two video streams of the other players in the game. One player is positioned on the left of the backboard, and the other on the right. Each table has a set of loud speakers and each player wears a microphone so the three participants can converse with each other.

The backboard is equipped with sensors mounted on the back that detect when and which brick the players are hitting (more technical details in [14]). These bricks 'break' when hit by the ball because the sensors register the location of the impact. All three players see the same brick layout and the same brick status. If a brick is hit once, it cracks a little. If it is hit again (regardless by which player), it cracks more. The crack appears on all three stations. If hit three times, it 'breaks' and is removed from play, revealing more of the underlying videoconferencing: the player 'broke' through to the remote participant. However, only the player that hits the brick the third and final time receives the point, so players can aim to 'snatch' points away from their remote opponents.

5. FINDINGS

Through an interpretive approach to analyzing qualitative data that was gathered via video recordings and interviews, several salient themes were identified that focus on the relationship between exertion and sociality. For the purpose of this document, I concentrate on one: a core aspect specific to exertion games, in contrast to traditional gamepad-controlled games, is a changed distribution in which 'space' the game action occurs. In an exertion game, the gross-motor skills utilized shift the focus of the gameplay to the physical space, away from the virtual world. This can be exemplified by pointing at where spectators in such games would look: their eyes would focus on the player's movements, not so much on the screen, quite different to traditional games, because the 'action' of the game moved to the physical. This shift of game action to the physical world was highlighted in Table Tennis for Three particularly by an increased emphasis on the notion of uncertainty and chance. The players played with a physical ball and bat, and the ball often flew unexpected ways, such as when it bounced off the edge of the bat or table, or the players did not hit the ball as planned and the result was perceived as unexpected. This uncertainty was an integral part of the game and facilitated many social interactions between the players. The players aimed to control and master the physical world around them through their bodily actions, but often encountered

challenges, which resulted in behavior that could be attributed to this notion of chance. The combination of skill and chance is particularly evident in exertion interactions, and gaming in this design space evoked laughter and initiated social interactions.

If these 'actions' would be situated mostly in the virtual world, as in traditional gamepad-controlled games, chance occurrences would need to be programmed into the game [17]. However, players have different expectations when it comes to digital games: for example, a virtual ball bouncing off the virtual racket in a Nintendo Wii tennis game would probably be interpreted as a software bug rather than an essential element of the game, resulting in frustration rather than social interaction.

Exertion games need to face this challenge of addressing a balance between the physical world (in which the exertion occurs), the virtual world (in which the gameplay takes place), and the social space (in which the players interact). The relationship between these spaces is shifted in exertion games because the players use their bodies when participating, resulting in unique challenges for game design. However, I believe being aware of these shifts in terms of game action can help inform the design of future games.

6. FUTURE WORK AND CONCLUSION

The next step in this investigation is to test the developed conceptual framework against another networked exertion game. For this, I am developing an outdoor game that involves jogging. The players can hear through spatialized audio if their jogging partner is running faster or slower. Each player puts on a pair of headphones and while each partner jogs, speed data is collected and used to position the audio of the conversation on a 2D sound plane, oriented horizontally around the player's head. As one player speaks, their partner hears the localized audio and is able to detect whether the audio is coming from the front, the side, or from behind, and thus if the other person is jogging faster, at the same pace, or slower. A mixed interpretive-positivistic approach will reveal if the technological augmentation can contribute to an increased physical benefit as well as increased player engagement.

Physical games play an important role in contributing to our health and social interactions; however, so far, these types of games are restricted to people in the same geographical location. Recent advances in networking technology provide opportunities to support participants who want to benefit from these activities, but are situated in different locations. With the current work, I am aiming to gain a deeper understanding of what part Exertion Interactions play in such games and how technological augmentation should be designed in order to contribute. I have presented current work in this area and outlined future opportunities for the direction in which this research could go, and welcome input from fellow researchers.

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