Airhockey Over a Distance – Connecting People Through Physical Casual Game Play

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Abstract. In modern society, people increasingly lack social interaction, although beneficial to work and personal life. Airhockey Over a Distance aims to work against this trend by recreating the social experience and rapport facilitated by physical, casual game play in a distributed environment. We networked two airhockey tables and augmented them with a videoconference. Mechanics on each table allow for a physical puck to be shot back and forth between the two locations, creating a perceived "shared space" between the participants. Supporting the hitting of a fast-moving, tangible puck between the two players creates a compelling social game experience, which can support social interactions and contribute to an increased connectedness between people who are physically apart.

1 Introduction

Fig. 1. Airhockey Over a Distance

Social interaction is an essential part of what it means to be human. The "social intelligence hypothesis" even suggests that primate intelligence originally evolved to solve social problems [cited in 3]. Our daily interactions with others are crucial for a fulfilling work and social life, and add meaning to our existence. However, today's lifestyle with its associated physical distribution of personal contacts and work arrangements decreases the chances of engaging in social interactions with family, friends and colleagues [9]. Furthermore, it has been noted that commercial success can depend on the existence of social interactions in the work environment [5].

We believe casual physical games such as airhockey, pool or table-tennis, which are known to be social facilitators and 'ice-breakers' in community places, can work against the trend of social decline by supporting networked game-play between participants that are geographically apart. Our approach focuses on two components: providing distributed players with the ability to engage in a conversation at any time and supporting a physical (in contrast to virtual), playful game experience.

Previous work has shown the use of physical interaction in networked entertainment applications [6][8][10]. These games aim to create an illusion of a shared physical object across the network to create a compelling game experience. Our approach supports not just sharing, but passing a physical object back and forth between two physically dispersed locations.

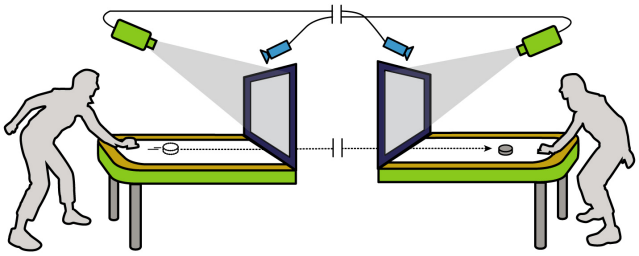

Fig. 2. Conceptual diagram

2 Airhockey Over a Distance

Airhockey Over a Distance is played like a conventional airhockey game: two competing players are trying to score points in the opposing player's goal by hitting a real, physical puck back and forth with a small round bat [Fig 1]. In our implementation, the table is figuratively split in half and the two ends are connected via a network [Fig 2]. Each player is recorded by a camera and the video is displayed on the screen of the opposing player, creating the illusion of playing together on one table [Fig 3]. Once the puck passes the midway-line, it is detected, and a corresponding physical puck is shot out at the other table via four rotating puck cannons (the position is not replicated at this stage). These cannons hold enough pucks for several games, and a lever pushes the bottom puck of the array towards a spinning disc which shoots the puck out at very high speeds [Fig 4]. For the players, it feels like they are passing a real, physical puck back and forward between each other, through the network. A game usually lasts for 2-10 minutes, supporting quick, casual game play.

Fig. 3. Setup including table and projector frame

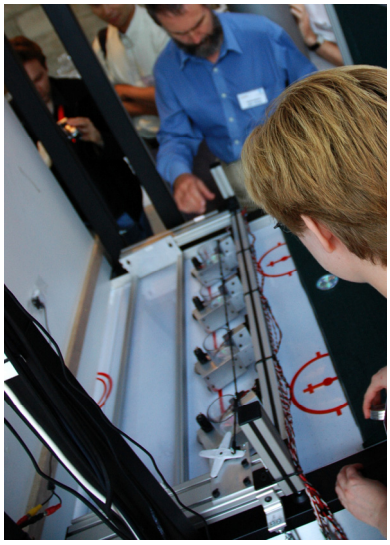

Fig. 4. Puck cannons behind the videoconference screen

3 Pervasive Connectedness

We are aiming for an increased connectedness between remote participants through the inclusion of a videoconference and network component into games that are familiar to players from a co-located setting. Connectedness is enforced by activities like thinking about each other, knowing what the other is doing and feeling, and sharing experiences. We intend to transfer the bonding experience that can occur during co-located game-play to a distributed networked setting in which the players are physically apart. We believe that if users have an enjoyable experience which can create an associated bond between them, recreating this experience between players that are in geographically different locations can be beneficial.

We believe the following recommendations can contribute towards our aim:

1. The game should be familiar to users.

By modifying an existing game, the inhibition to join is much lower for the user than by introducing a new game. Furthermore, if the rules are already known to the players, it is easier to engage in play. However, due to the fact that recreating the same game in a networked environment is not always practical or technologically feasible, modifications to the rules or type of play might be necessary. However, the core interaction (such as hitting a puck, kicking a ball) should be kept as familiar as possible, to encourage a rapid take-up by the participants.

2. The videoconferencing system should be high-quality.

High-quality for audio and video is necessary for supporting social interactions, in which facial expressions, gestures and vocal changes play an important role.

3. Physical interaction

We believe the physically of the game contributes to the bonding experience and can hence create a stronger connectedness than, for example, a mouse and keyboard interaction. Hitting a puck back and forth, as in our example Airhockey Over a Distance, requires fast hand-eye coordination, and missing a puck often elicits amusement and laughter by players. Being able to check how hard (and therefore how fast) a player can hit a puck is also something participants are eager to test. The strong force-feedback of the puck being hit, as well as the resulting characteristic sound further adds to the compelling game experience that made airhockey an arcade hit worldwide for so many years [1].

4. Pervasive Connectivity

We envision networked social games to be accessible in the home but also in social spaces, such as arcades, pubs, social clubs etc. Wherever people want to play, they should be able to. For the user it should not matter if she or he plays against a local player or remote player. Wherever she or he chooses to “have some fun” by a game, it should be possible with a co-located or remote player. The presence of a videoconference should not affect the interaction with the other player significantly. We see Airhockey Over a Distance as an example of a pervasive networked game that is part of a distributed set of tools within our environment through which we facilitate, maintain and establish our social bonds with remote others. This is a subset of the

concept described by [4] on pervasive computing. Physical networked games can be a valuable addition to the pervasive game genre [2], which includes augmented board games and mobile games already, explicitly supporting remote social interactions.

4 User Scenarios

We envision Airhockey Over a Distance to be played in places which afford a socializing opportunity. Setting up a table in canteens of two different branches of a distributed corporation could enable employees to play with colleagues they would otherwise never meet. If they are located in different time-zones, such a system would allow employees to check the availability of their remote counterparts and make them aware of their work culture, supporting social interactions on a serendipitous and casual basis.

Airhockey Over a Distance does not require any special skills nor does it have complex rules or a steep learning curve, hence it is very accessible. Players might not even need to speak the same language in order to have an enjoyable experience together; hence Airhockey Over a Distance has the potential to be played internationally.

Arcade parlors are another possible venue for Airhockey Over a Distance, in which co-located airhockey tables are installed already. Networked versions would allow friends from different cities to play and socialize together. Smaller versions could be available as add-ons for personal console game systems, which already include a network component, making them suitable for the mass-market.

Placing connected airhockey tables into youth clubs could enable teenagers to get in contact with young adults from different countries in order to learn in a playful way about other cultures and languages. Installing setups in hospitals could give inpatient children the opportunity to play with peers in other hospitals or to play with friends from their home in order to work against isolation and loneliness.

5 Virtual Airhockey

Fig. 5. Virtual Airhockey is played on the same table

We are aiming to measure the connectedness a physical game of Airhockey Over a Distance can create between remote players. In order to do that, we have also built a vision-based version of the networked airhockey table [Figure 5]. It uses the same videoconferencing technology and is played on the same physical table; however, the puck is virtual, projected from above. The players use a modified bat which includes a tracking system to hit the virtual puck back and forth.

In order to keep confounding factors to a minimum, the rules of the virtual and physical game are the same, as are the size of the table and the videoconference screen. The main difference is the physicality of the puck; however, the projected puck looks similar to a physical puck, since a physical puck is flat and only a few millimeters high. The player is able to hit the virtual puck, and even sound effects are included, however, the player does not receive the force feedback from the impact when hitting the puck.

We are planning a comparative experiment between the physical and the virtual game. Our main focus is the interaction between the participants and the connectedness the game creates. We aim to investigate if the physicality and hence the physical feedback of the hits influence the interaction levels and if it can contribute to a perceived "shared space" between the remote players. We hypothesize that the physicality better replicates the experience of sharing a table with a game partner, and therefore the two players have an increased sense of connectedness with each other, contributing towards social interactions and hence resulting in a stronger interpersonal bond. The results will allow us to better understand the significance of distributed physical interfaces on interactions between geographically separated participants.

6 Conclusions

We believe the physicality of Airhockey Over a Distance creates a compelling game experience different than most current networked computer games. We are currently conducting experiments to compare the effect on connectedness between a virtual and a physical game of airhockey. We believe from preliminary feedback we gained at an internal event [7] that this physical distributed game can facilitate an increased bond through social interaction between geographically separated participants. We aim to gather further evidence by exposing Airhockey Over a Distance to a wider audience.

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