Pirates: Proximity-Triggered Interaction in a Multi-Player Game

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ABSTRACT

We show how proximity-sensing technology can be integrated into computer game design to provide richer game experiences in social settings. To explore the theme of *proximity-triggered* interaction, we have constructed *Pirates!* – a multi-player, wireless computer game for handheld computers, played throughout a physical environment. The players' physical locations in the environment trigger game events.

Keywords

proximity, wireless computer games, social interaction, handheld computers

INTRODUCTION

While computers and other interactive technologies provide exciting directions for game design and gameplay, computer games also tend to eliminate many of the social aspects of "traditional" gameplay. Whereas playing non-electronic games (e.g. board games, hide & seek etc.) is mostly a collective activity, involving more than one person in direct interaction, playing computer games is very often an individual activity contained within stationary computers [5].

Meanwhile, powerful handheld computers equipped with wireless networking and communication technology open up a range of new application areas for computers. One such class of applications take the users' spatial location into account, e.g. to facilitate interaction between users that are co-located, or to provide functionality that depends on their position relative to local resources [4]. We have explored how proximity sensing technology can be utilized in the design of novel computer games, where the players' location in physical space is used to create an enhanced experience where some of the social aspects of traditional gameplay are regained.

THE PIRATES! GAME

Pirates! is a multi-player computer game that takes place in a fantasy archipelago setting, where each player is the captain of a ship. Game objectives include solving different missions, such as finding treasures, trading with commodities found on the islands, and fighting other players in sea-battles. As missions are completed, the players gain experience points that translate into rank, and as goods are traded for money, ships are upgraded to sturdier ones.

The game is implemented to run on handheld computers connected in a Wireless Local Area Network (WLAN). A local server maintains and controls the virtual game environment, and keeps a record of what events take place in the game. In addition to the WLAN adapters, each handheld device is fitted with custom-made proximity sensors, used to determine the players' location in physical space.

Figure 1: Pirates! players during a demonstration at the HUC2k conference, Bristol, UK.

Although the game is played on handheld computers and is maintained by a server, the players must roam a physical environment, the *game arena*, in order to explore the virtual game environment. Hence, walking between different places in the game arena, becomes equivalent to sailing between islands on ocean. As a player enters the proximity of an island, or another ship in the game arena, he or she has the choice to make landfall and explore the island or engage in battle, respectively.

Most game-related actions are mediated by the graphical interface on the handheld computers, through which the players make choices to trade goods, explore islands, or fight opponents. However, in order for those options to become available to the users, they must move around in the game arena. To make landfalls on specific islands, or to battle co-players, they must walk up to them, forcing the players to not only watch the computer screen but also to look at other players and the real world.

Social interaction in Pirates!

Zagal *et al.* outline the characteristics of social interaction in multi-player games [5]. They define social interaction to be the "purposeful and bilateral communication that occurs between at least two human beings", which is either *spontaneous*, or *stimulated*. Spontaneous social interaction occurs naturally between players, whereas stimulated social interaction is interaction mandated by the game. When we created Pirates!, we specifically wanted to design a computer game that could be played in a social setting, i.e. where people are co-located in a physical space. Although it is intrin-

sically a multi-player game, it is possible for a single player to play Pirates! regardless of the presence of other players. Hence, social interaction is not mandated to succeed in the game, but since it takes place in a social setting, the game encourages social interaction and small talk to occur naturally during gameplay. Whereas social interaction in Pirates! is primarily spontaneously induced, the game at times initiates stimulated social interaction. This occurs when the game detects that two players are in close proximity of each other at the open sea, which triggers the option for the players to initiate a battle.

Pirates! was first tested during the conference reception of an academic event, HUC2k. In the test, 31 participants played the game for an average duration of 19 minutes each. Our observations of the test users indicated success in bringing a computer game into a social setting. Overall, the users were enthusiastic about the experience and that it allowed them to play together with other co-located players.

PROXIMITY-TRIGGERED INTERACTION IN PIRATES!

In Pirates!, a player's location in the game arena dictates the game events, such as the possibility to explore an island, or engage in combat with another player. To determine the players physical whereabouts, we made use of short range radio frequency (RF) proximity sensors. We placed sensors on a number of fixed locations in the game arena, marking virtual islands in the game. We also fitted each handheld computer with a similar proximity sensor, used to detect when the players are in proximity of islands (*player-to-place proximity*), or other players (*player-to-player proximity*). This setup enables some of the game mechanics to be taken "out of the box" and forces the player to physically navigate the game arena in order to explore the virtual game environment. Some variations to this scheme can be made. For example, *thing-to-thing* proximity can be used to acknowledge spatial relations between moveable objects, and *thing-to-place* can provide mechanisms for moveable objects to trigger different game events in different places. In summary, the formalization of proximity to places, people, or things allows the encoding of semantic information to cue interaction in the game [3].

Pirates! uses a *relative positioning* technique, i.e. the game does not keep track of the absolute locations of players or islands, only their relative position to one another. A noteworthy implication for social interaction, particularly when using a relative positioning technique, occurs when proximity is measured without regards to the physical layout of a place [3]. Consider a scenario where two users are spatially close to one another, but separated by a wall. While they are indeed close, the wall clearly affects their social interaction.

While we could have deployed an *absolute positioning* technique and calculated the players' positions using the WLAN and a triangulation algorithm, we chose not to for one important reason. In order to obtain high resolution spatial information, an equally fine-grained model of the relevant space, a coordinate system, is required. This means that whenever we may want to set up the game in a new arena, we have to remodel the coordinate system, which would be both time consuming and unnecessary. Using relative positioning simply provides us with a more flexible system architecture, and a simplified deployment procedure.

RELATED WORK

Inter-personal awareness devices, such as the *Hummingbirds* [2] offer proximity-triggered functionality, much in the same fashion as the Pirates! sensors do. They use RF-based sensors, and a relative positioning technique, to notify their users whenever other Hummingbirds (i.e. other users) are in the vicinity. However, the proximity-sensors used in Pirates!, are used not only to detect proximity to another person, but also to fixed locations in the game arena. Hence, the Pirates! proximity-sensors are part of a more complex system, where they are used to trigger game events.

Another application that uses relative positioning, but with Infrared (IR) communication, is the *Meme Tag* [1], designed specifically to be used in social settings. Due to the use of short-range IR communication, a technique that requires line-of-sight between sending and receiving devices, they encourage people to interact socially, which is further enhanced by their nametag design. The strength of a rigid and narrow communications range in the Meme Tags, would be a shortcoming in Pirates!, unsuitable for the explorative theme of the game.

CONCLUSION AND FUTURE WORK

We have shown how proximity-sensing technology can be integrated into computer game design to provide richer game experiences in social settings. By equipping mobile game consoles with sensors, games can detect when two or more players are within proximity of each other, which triggers possibilities for stimulated social interaction between players. Further, mapping places in the virtual game world to physical locations in the game arena, can be used to trigger additional game related events by a player's movement between these locations. Observations of test users at a conference reception, showed that Pirates! is suitable to bring into social settings.

In the current implementation of Pirates!, all game-related artifacts are encoded in the game mechanics. To explore the coupling between physical and virtual game properties further, we would like to explore how moveable, physical artifacts may represent virtual game elements. For example, a physical treasure chest can be tagged, allowing players to interact with not only locations in the arena, but also physical artifacts.

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