Designing for Social Interaction in Collaborative Games on Large Multi-Touch Displays

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Abstract

Although computer games enable people from all around the world to play games together and can provide very immersive virtual environments, most computer games are still played in a separate fashion quite contrary to the social events that physical games are. Large interactive surfaces can bridge this gap, bringing together the best of both worlds: highly social activity and colorful, dynamic game worlds. With this paper we contribute to research on gaming on large multi-touch displays. Based on game mechanics successfully brought to small multi-touch devices, we developed our own game introducing features and gestures specifically designed for large surface and multi-player gameplay with special regard for the social interaction among players. We provide insights on the social protocol of collaborative multi-player gaming on large interactive displays by studying people playing our game. Our results suggest that communication and social interaction does not just happen by itself but must be designed into the game, taking into account the specifics of multi-touch interaction, such as non-verbal communication possibilities between players.

1 Introduction

Playing games is often a highly social activity, giving us a good excuse for spending time chatting and relaxing with our friends. With the rise of the computer and the internet, games have conquered a new domain and today it is quite normal to play together or against other people from around the world. Despite the possibility of voice chat, webcams or even sharing the same room, classical video games still bind each player in front of their screen and keyboard, creating a layer of separation. While this is fun and rewarding in itself, it is certainly less of a social experience than playing a round of "foosball" with your friends.

Large interactive surfaces such as multi-touch tables have the potential to bridge this gap between traditional physical games and computer games. They provide rich and parallel

input, many devices also recognize markers or objects, while at the same time they retain the main strength of computer games, i.e. displaying a dynamic, immersive, and colorful world, and relieving the player from the hassle of manually keeping track of the rules and the state of the game world. Multi-touch on mobile devices is nowadays well established and games are among the most successful and numerous applications on modern smart phones. Large interactive surfaces are already approaching the mainstream, increasing interest in multi-touch games specifically designed to take advantage of their interaction potential. But designing games that really exploit the social interaction between players is not an easy task. Surprisingly, not much systematic research has been done in this area, and no guidelines or specialized game design theory exist in this field.

Figure 1: Our game prototype has a collaborative and competitive aspect, designed to study social aspects in gaming on large multi-touch screens.

We designed and implemented a game prototype based on the highly successful casual game *Galcon*[1] and included mechanics and gestures specifically geared to take advantage of large multi-touch screens and to increase social interaction in a two to four player scenario (figure 1). The main contribution of this paper is the report we give on the social protocol during game play observed in a first study done with our system and the implications for future

[1] http://www.galcon.com

work in this area. We also provide insights gained through a structured, moderated discussion with our test players on pros and cons of a collaborative multi-touch gaming environment. Our results suggest that communication and social interaction does not automatically emerge but can and should be designed into the game, taking into account the specifics of multi-touch interaction, such as non-verbal communication possibilities between players.

2 Related Work

2.1 Territorality in Collaborative Workspaces

Scott et al. observed certain territorial behaviors among participants taking part in two complimentary studies focusing on playful tasks (Scott et al. 2004). They found that a group of players interacting on a table surface to solve a collaborative instruction subconsciously subdivide the individual workspace into three regions of interaction dedicated to different actions: A *personal* region in front of every individual player to prepare and arrange thoughts in order to share them with the group, a fixed and sharable *group* region between the players to share some contributions, and a *storage* region used as a stack for ideas and materials prepared for subsequent actions. According to their conclusions this phenomenon is motivated by social norms and the overall cultural context.

2.2 Tabletop Gaming

Magerkurth et al. created a framework for interactive tabletop games called STARS (Magerkurth et al. 2004). By creating several games within this framework the researchers gained insights into group dynamics and their influence on the overall game experience. They observed that players react very sensitively to mappings of game board components onto the virtual domain. An element like rolling the dices helps players to regulate the pace and connote influence on the resulting numbers. Magerkurth et al. therefore suggest taking carefully into account which elements extract advantages from a virtual modulation. Tse et al. modified two commercial games of different genres and implemented a multi-touch interaction combined with speech control (Tse et al. 2007). Although no user tests were performed the authors describe the interaction as very efficient and intuitive. The complement of speech commands thereby helps to coordinate with fellow players without the need of a discrete and direct cooperation.

3 Designing a Co-Located Multiplayer Game

In order to elaborate the influence of game design elements on social interaction in collaborative games we developed a prototype game based on *Galcon* (figure 1). It is a fast-paced strategy game for up to four players split into two teams. A close collaboration, good management of resources and a strategic line of action are the key for a team to succeed within

this game. We chose casual games as these are easily accessible, while still offering an appealing challenge and long-term motivation. They are thus well suited for a study which does not require prior knowledge from participants. *Galcon* is further qualified as it allows multiple interaction points which can involve many participants simultaneously and takes full advantage of the multi-touch technology, rather than games relying upon an ego-perspective or a single character.

3.1 Game Controls

During the conceptual design of the game's interaction we defined the following major requirements in order to assist the overall game concept:

- The interaction gestures had to be *accessible* and *consistent* in order to reduce the number of commands a player has to remember. This should help to focus on the gameplay itself as well as on the collaborative team play.
- The user's action on the surface should be easily *distinguishable* throughout the performed gesture. We adapted this guideline from the concept of speech commands introduced by Tse et al. in order to support a non-verbal communication between the participants (Tse et al. 2007).
- No user detection (hardware limitation)

We decided on the following three interaction gestures with the presented guidelines in mind: single-fleet selection and moving, multi-fleet selection and moving, planet protection. The single fleet selection is adapted from the original game, while multi-fleet selection had to be redesigned, as inputs on our hardware are not assigned to users. While the original Galcon lacks any defensive controls we wanted to introduce this to our game to enrich the social interaction. Given below we will describe these game controls in detail.

3.1.1 Single-Fleet Selection

This control is implemented in a drag and drop manner. The player selects a planet while constantly keeping touch to the surface with his finger. After hovering over a destination planet the player can release the finger from the surface to command an armada of space ships from the selected start to this end point (figure 2). The single selection gesture can be applied to any object in the game world. Most users should already be familiar with this control paradigm. Consequently, this gesture follows the concepts of accessibility and consistence.

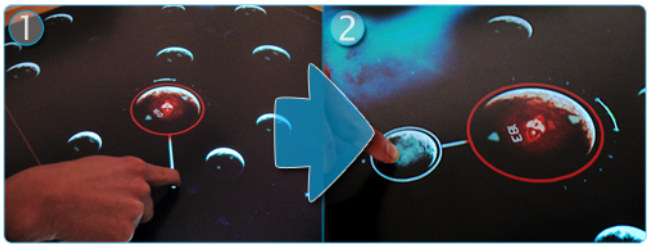

Figure 2: Choosing a destination planet with a single selection gesture at the tables surface

3.1.2 Multi-Fleet Selection

A user needs to touch a conquered planet first by pressing two fingers close to each other on the surface. Now he is able to span a selection circle by moving the fingers in opposite directions. Every allied planet in this circle gets selected at the moment the player releases his fingers from the surface. Now he can command space units from all selected plants with a single fleet gesture directed from one of the currently active planets (figure 3). The implementation of this gesture enables a new strategical element related to a maximum radius dependent on the planet's size. Furthermore, the gesture stays distinguishable from all remaining gestures.

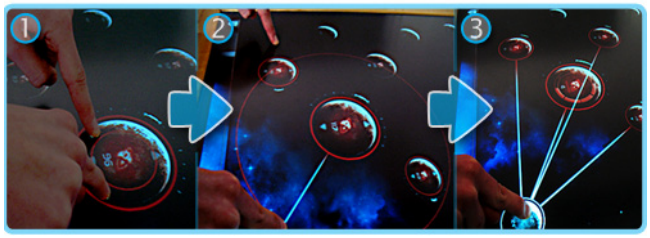

Figure 3: Connecting planets to an alliance with a multi-selection gesture

3.1.3 Shield

By pushing the finger on a region next to the desired planet, a player can draw a shield. Now he can span a protection angle around the axis of the planet, just limited by the shield energy every team has at one's disposal (figure 4). One player per team can easily activate the shield drawing functionality with a button in his or her screen corner. The hidden agenda of this concept being to motivate team cooperation in order to protect an attacked planet successfully. All gestures are complemented by visual elements in the game so the player can decide on his own on which information he wants to concentrate.

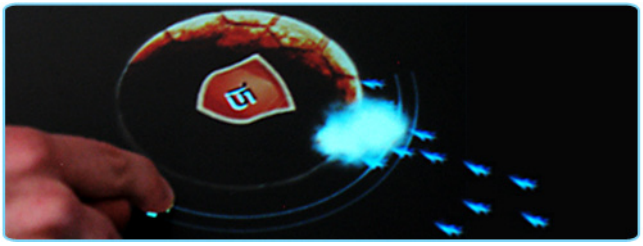

Figure 4: Drawing a shield to protect a planet from damage through attacks

3.2 Social Aspects

We constitute the following aspects of our game to have an influence on social behavior during gameplay. Some of these were design choices, some are inherent to the setup. Expanding the game design to two vs. two player *tag-team* gives us the opportunity to introduce competitive as well as cooperative objectives. As a result we had the chance to have a closer look at a potential difference in behavior. An interdependence in goal, reward, resource and roleplay is a theoretical basis to motivate cooperation between the members of a team (Johnson & Johnson 1995). The *spatial proximity* is comparable to the situation at a classical board game and should thereby contribute to an awareness of a special group feeling. *Missing user detection* might have an influence on the attention the players pay on the surface interaction (Magerkurth et al. 2004). The *fast-paced* character of the game leads to an excessive demand and could result in a closer cooperation as well.

4 User Tests

We performed a user study with our prototype in order to investigate elements of design for highly interactive strategy games on large horizontal multi-touch surfaces with special focus on the motivation of social collaboration between players. The results of this paper should therefore contribute some new ideas for emerging projects dealing with system compatible multi-player design as well.

4.1 Design

In order to collect meaningful information about the impact of our game decisions we employed two complementing approaches: a structured user test session with video analysis and a subsequent moderated focus group discussion. We analyzed in total more than two hours of video with the criteria we had in mind during the conceptual design. In the focus group discussions we concentrated on the personal impressions of players from the test sessions while touching upon peculiarities in our observations.

4.2 Participants

Eight participants between twenty and thirty years of age took part in our study. Most of them were students with an interest in computer games, and none of them had much experience with multi-touch technology. While nobody reported to be an excessive player, all participants know and play casual games as short-term entertainment.

4.3 System

Our prototype runs on a multi-touch table with a sensitive surface of 130cm in width and 80cm in depth. The game is rendered in full-HD resolution and thereby facilitates an ideal combination of readability and playing surface. The system relies on diffuse illumination in order to detect blobs on the surface. The detection is managed by the ReacTIVision framework which provides information about the detected fingers via the TUIO protocol (Kaltenbrunner & Bencina 2007). The game itself is written with the XNA framework in C# and handles the events received from the network port.

5 Results

The following paragraph summarizes the results of our evaluation. We combined our observations with statements made during the group discussions in order to offer insights on the impact of our design criteria.

The concept to bring together opponent teams on the same surface was perceived as innovative and remarkable component. With a growing game experience players intuitively examined how other participants were interacting with the game's controls. Nonetheless, this was not an automatic effect, the players had to interrupt their own actions to get aware of the current constellations. Players referred to this "passive collaboration" where the participants cooperate through the interaction with the system itself as efficient and effective. An observation therefore outperforms the alphanumeric displays as source of information. Furthermore, participants preferred this type of communication since it does not interrupt a teammate in his/her performance.

Additionally, we recognized a territorial behavior among our test candidates while playing our game. Predominantly every single player was operating within a limited personal region trying to keep the enclosed planets under control. Players opposing each other hereby got into a natural conflict for these resources. In most cases a desire for an interregional collaboration just emerged when the personal region got into danger or was already lost (Scott et al. 2004). Contrarily, we could not recognize any influence of the game pace on these characteristics.

The mandatory collaboration we introduced throughout the protection functionality effectively forced cooperation between team-mates. Successful defensive maneuvers consequently lead to emotional comments and regularly resulted in taunt for the opponents. We faced a

similar behavior during game breaks which offered the teams the chance to discuss successful actions or to celebrate a current predominance.

6 Discussion

Even though our group composition is not representative for casual gamers in general, the results offer an overall impression of the variety of influences affecting the collaborative game experience. By having a closer look at the impact of our interaction gestures, we recognize that personality and cultural context play a subliminal role. Some of the players hesitated to interact in a certain region in order to avoid conflicts with their neighbors. Since we have no influence on these elements, we have to take them into account very carefully. Nonetheless, our experiences showed that this inhibition threshold declines within a short amount of time within an informal atmosphere.

In order to encourage a higher social interaction we would even recommend introducing further design elements to extend the need of this interregional collaboration between players. Our observations indicate that a well designed interdependence between players might not only result in a closer cooperation but more importantly in an enhanced entertainment if the players can overcome the described obstacles. We would also assign the concept of special abilities a high potential in the motivation of social interaction. Unfortunately, we can base this estimation just on the results of the discussion since more than half of our protection commands failed in-game due to insufficient implementation. Nonetheless, we would recommend putting this concept even further by giving the players the chance to choose from a range of abilities. Comparable to a massive multiplayer online roleplay game such interdependence in abilities or resources will result in a closer cooperation as well (Johnson & Johnson 1995).

Admittedly, our user test revealed some problems the platform is facing in the case of simultaneous multiplayer interaction. The lack of private control was not referred as distracting, but still it is a serious problem from the perspective of a game designer. Whereas it might not play a role with regard to the casual character of our prototype it does for most other game concepts. In the context of our investigation we could not come up with concepts offering both, rich collaborative multiplayer interaction as well as strategic private gameplay elements.

7 Lessons Learned

We summarize our findings as follows:

A simultaneous interaction on the same surface is an effective and efficient way of nonverbal communication. Nonetheless it takes time and does not automatically result in extensive teamwork. The observation itself outperforms alphanumerical in-game displays.

Territorial behavior as observed by Scott et al. applies to our setup (Scott et al. 2004) as well. Players have to overcome a natural barrier in order to profit from the entertaining effects of collaboration, especially in a foreign environment.

The overall game experience takes advantage of interregional and interdependent game design elements. Assigning roleplay throughout the game concept is a good alternative to motivate teamwork, at least in a strategy game.

8 Conclusion and Future Work

In this paper we discussed a prototype game specifically designed to take advantage of large multi-touch screens and its features designed to further social interaction between players. We presented the results of a user test conducted with our game and provided insights on social protocol and player experience gained by analyzing video material and a structured, moderated discussion with our test players. Our findings support existing theories on territoriality and non-verbal communication as well as offering new insights on control design and collaborative and competitive player interaction. In the future we want to take these lessons into account, specifically focusing more on private and public spaces and on game elements designed to "break the ice" between players. Our study showed that nonverbal communication is an essential advantage of multi-touch gaming environments and already worked quite well in our case study, nonetheless, this should also be taken into account even more in future iterations.

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