Shared-Screen Social Gaming with Portable Devices

Jarmo Kauko
Nokia Research Center
Visiokatu 1
33720, Tampere, Finland
jarmo.kauko@nokia.com

Jonna Häkkilä
Nokia Research Center
Yrttipellontie 6
90230, Oulu, Finland
jonna.hakkila@nokia.com

ABSTRACT
Mobile phones are designed as personal devices, and thus mobile games often lack the social element present in other game platforms, e.g., in console games. In this paper, we present an interaction method for social gaming with portable devices. The interaction method combines displays of multiple devices to form a shared screen visible to all players. We conducted an experiment with 40 participants to compare the social setting between our method and a typical console game environment. The results show that the amount of oral communication was significantly higher in the mobile device setup. The results on subjective experience were inconclusive, but revealed that players’ perceptions of a social situation were affected by various factors such as ergonomics, distance, support for spectators, and symbolic meanings of the seating arrangement. Our findings help to understand the design space of social co-located gaming, and show that mobile phones are a potential platform for such games.

Categories and Subject Descriptors
H.5.2 [Information Interfaces and Presentation]: User Interfaces – Interaction styles, graphical user interfaces, evaluation/methodology. H.5.3. [Information Interfaces and Presentation]: Group and Organization Interfaces – Collaborative computing.

General Terms
Design, Experimentation, Human Factors.

Keywords
Mobile games, social interaction, game experience.

1. INTRODUCTION
Conventional card and board games have a long history as popular social activities for friends and families to spend time together. Digital games, on the other hand, have often been viewed as anti-social and isolated activities. Recently this view has been changing as social aspects of digital games have gained more emphasis. We have witnessed this change of focus in academic research but also in games industry. This is supported by the increasing popularity of massively multiplayer online games (e.g., World of Warcraft), party games (e.g., SingStar), and games played in social network services such as Facebook.

Online games enable playing together over distance, but lack the sense of being together, as the social presence is only partially mediated through the interface of the game. Game consoles allow players to physically get together to play games, but they are restricted in specific places, e.g., in players’ living rooms. Moreover, being in the same physical space alone may not guarantee socially rich game experience, as noted by Magerkurth et al. [11] and Kort et al. [2].

Portable devices offer an interesting gaming platform as they allow playing in various locations and situations. Current portable devices have network capabilities that enable playing with remote or co-located friends. This would allow players to play games physically together, practically anywhere. However, the form factor and design of current mobile devices does not support social aspects, mainly due to the lack of shared screen and difficulty of observing others’ play [20].

We address this problem by utilizing multiple portable devices and their spatial relationships to create a shared social game space. In our approach, players are sitting around a table and facing each other. This facilitates social interaction similarly to conventional board games. In this paper, we study how the seating arrangement affects social interaction and presence during competitive gameplay. First, we review existing work related to social co-located games. We then explain our game concept and design. Next, we describe our experiment with 40 participants to compare the social setting to a typical console game setup. We discuss the results of the experiment along with our observations. Finally, we conclude the paper with the main results and implications for future research.

2. RELATED WORK
Magerkurth et al. [11] criticize that interaction in current digital games is technology centered and propose a conceptual framework for increasing social interaction through physical interfaces. They suggest that in game consoles and LAN parties the social experience is hampered by players sitting beside each other and focusing primarily on their screen and input devices. Our experiment is motivated by this hypothesis, as we compare the social setting between a face-to-face tabletop setting and a side-by-side console game setting.

These issues are further explored by Kort et al., who argue that digital game experiences are situated and shaped by the socio-spatial context [2]. They claim that most co-located digital gaming takes place in sociofugal contexts that promote privacy and counteract direct social interaction. They discuss various
socio-spatial factors that affect the social situation, including size and orientation of the screen, number of screens, type of control device, and furniture layout. We consider many of these factors in our experiment.

Szentgyorgyi et al. studied social aspects of handheld gaming with Nintendo DS [20]. They found that players are motivated to play together in various contexts, but the device’s form factor creates individual, private gaming spheres that diminish the social experience. The most important reason was the lack of a shared display, preventing players from observing, commenting and coordinating actions. Another reason was the limited support for spectators, as the player’s manipulations using the touch screen or buttons, as well as the results of those manipulations, are largely hidden due to the small size of the device. We aim to solve these problems by using multiple mobile phones to form a shared display.

Reeves et al. proposed a framework for analyzing interaction as spectator experience [15]. They discussed the visibility of interactions in terms of manipulations and effects. They defined manipulations as user activity in the vicinity of an interactive system, even if it is not sensed by the system. Effects, on the other hand, cover both system output and its effects on the user, e.g., emotional responses to system output. Our interaction method supports the visibility of both manipulations and effects, aiming to enhance the dual performer-spectator roles during gameplay.

Social factors in digital games have been recognized as an important research topic. For example, interactive tabletop installations [10] and augmented reality (AR) games [14] have been proposed as potential solutions to enrich the social game experience. However, systematic study of these systems has been difficult due to the lack of established methods and metrics. In fact, there is no common agreement on what constitutes the social experience in games.

The challenge of measuring social game experience was recognized by Mandryk et al. in their study of co-located collaborative play [12]. They provided a comprehensive review of existing methods, including questionnaires, interviews, (retrospective) think-aloud techniques, as well as video coding of gestures, body language, and verbal communication. As an alternative method, they proposed physiological measures for collecting continuous, objective data. Whereas this approach seems promising, Mandryk et al. concluded that more research is needed to understand how different experiences are reflected by physiological responses.

To probe players’ awareness of and involvement with their co-players, de Kort et al. developed a Social Presence in Games Questionnaire (SPGQ) [3]. The questionnaire is based on existing work on social presence technologies, tailored for gaming using focus group interviews with gamers. It consists of three components: psychological involvement – empathy (PIE), psychological involvement – negative feelings (PIN), and behavioral engagement (BE) with Cronbach's alpha of 0.856, 0.68 and 0.84 correspondingly.

Gajadhar et al. used SPGQ along with other questionnaires to compare playing against virtual, mediated and co-located opponents [4]. Player experience was significantly influenced by the level of social presence, indicating that increase in subjective social presence results in higher involvement and enjoyment. Moreover, Gajadhar et al. studied the effects of audio and video channels in a mediated game setting [5]. Their findings suggest that higher social presence also increases the feeling of flow.

Overall, qualitative methods and tailored questionnaires have been used more commonly than physiological measures or SPGQ. Findings obtained from such research are not directly comparable to our results. However, we review here previous work that contributes to the overall understanding of social game experience and thus helps to frame our own research. Xu et al. studied social interaction and presence in a mobile augmented reality game [21]. They used a mixed method approach combining observation, interviews, and questionnaires. The questionnaires were adopted from existing social presence literature for mediated environments. Their findings suggest that having a shared game board for the augmented reality game increased social presence between participants. We use a shared display in both game settings, and concentrated on how the spatial relationship between the players affects the social setting.

Henrysson et al. developed a collaborative AR tennis game for mobile phones to study collaboration and awareness between players [6]. They used the phone as a see-through window to the game field, but also as a tennis racket. In their experiment, they compared the interface with and without live video from the camera. As a third condition, they used a black cloth between the players to eliminate visibility completely. Questionnaire results provided evidence that the social awareness was affected by these manipulations. In addition, the ease of collaboration was ranked to be highest in the AR with live video condition. Henrysson et al. conclude that one of the key benefits of AR is to provide a combined view to co-players and virtual game content. Our goal is to maintain awareness between players with a traditional non-AR display setting.

Strömberg et al. studied the usage of a public display to enhance mobile multiplayer games [19]. They conducted two evaluations to test their game prototype FirstStrike, with and without a public display. They reported that the public display increased social interaction, including verbal communication and eye contact, as the players were less concentrated on their personal devices. However, it should be noted that the game prototypes were not identical in the two evaluations, and the amount of social interaction was not explicitly measured. Our motivations of using a shared display are the same, but our idea is to combine the mobile phones to create the shared display.

The idea of sharing displays of portable devices between players was explored by Sanneblad and Holmqist [17]. They used pocket PCs and peer-to-peer WLAN networking to enable players to join and leave game sessions at any time. The pocket PCs were used to display different parts of the game, encouraging players to collaborate by sharing displays. For instance, in a game called Pac-Man Must Die, players collect dots that are distributed between the displays. Players can move to other displays through portals. Players then need to locate the destination display in the physical space by interacting with other players. We use shared displays similarly to facilitate social interaction, but our design is extremely simplified to enable controlled experimentation.

Brunnberg et al. studied how players’ attention can be divided and balanced between digital interaction devices, physical
environment, and co-players [1]. This was referred as blended attention. They designed a mixed-reality game that was played from the back seat of a car. The game required players to follow the traffic and to identify other players in nearby cars. The game was controlled using tangible interaction devices to minimize requirements for constant visual attention. Further, blended attention was achieved by designing simple tasks that unfold sequentially. In our game, blended attention is supported through spatial and temporal design. However, in our game setup the visual attention is mainly focused on interaction devices, and blending of the social context occurs in the peripheral vision.

Outside gaming, there are research efforts focusing on social aspects of interacting with portable devices. Hinckley et al. [7] discuss the design space of dual-screen device postures for private, personal, and social use. Their device prototype, the Codex, is a dual-screen tablet computer that can be oriented in eleven different postures. Our design is similar to the “flat on table” posture for two users. Their findings indicate that the dual-display setup has potential for collaboration purposes and provides a separation of thought unlike a single large display.

Kortuem et al. [9] presented a sensor node system for calculating relative positions of multiple mobile devices in a peer-to-peer fashion. They discuss various use cases and visualization methods for the system, but do not consider combining the devices into a shared multi-display setup. A relative positioning system with sufficient accuracy could be used to automate the configuration of such multi-display setup.

3. CONCEPT
3.1 Spatial Multi-Display Configuration
In order to provide a shared game board for the players, we combined two mobile phones into a dual screen system. The phones are placed next to each other on a table between the players, as shown in Figure 1. Together the displays show a wider view to the game world. The devices communicate using Bluetooth to synchronize the game state and screen content.

Gaps and bezels between the displays cause inherent design problems in multi-display configurations. Our design borrows the approach from OneSpace and Mouse Ether [16], research prototypes designed to solve usability issues in multi-monitor PC setups. We used the spatial relationship between the displays to create an illusion of a continuous space. Therefore, the invisible space between the displays is also part of the game field. The distance between the devices is configured before starting the game. The configuration view contains a slider for adjusting the distance, and geometric shapes that help to align the devices (see Figure 2).

Using the spatial relationship between the displays was designed to enforce face-to-face arrangement of players. By utilizing visual cues such as text orientation, users can be guided to use the phone in a certain orientation, e.g., in landscape or portrait mode. Therefore, by specifying the spatial relationship between the phones, we can actually design the spatial relationships between the players. In general, spatial relationships between people determine many social practices in physiological and psychological levels. Sociopetal space refers to a radial arrangement that optimizes visibility between people, thus supporting both verbal and non-verbal communication, including eye contact, facial expressions and body language. Sociofugal space is the exact opposite of sociopetal, supporting privacy and discouraging social interaction. In seating arrangements, side-by-side can be used to foster co-operation, whereas sitting across the table is more suitable for competition. Furthermore, the head of the table is often associated with leadership. Pioneering research on socio-spatial arrangements is summarized by Sommer [18].

We believe that incorporating socio-spatial aspects into game design provides many interesting opportunities. For example, players may have different roles in the game, supported by their spatial orientation towards other players. As a first step towards this direction, we designed our display configuration to facilitate rich social interaction and competitive gameplay.

3.2 Game Design
The game resembles ball games such as tennis, where players use rackets to hit a ball and try to make their opponent to miss it. Displays show a top-down view to the game field. Players can move the rackets by pointing with a stylus on the touch screen. The racket movement is not instant but moves with a constant speed. The speed of the ball is initially 70% of the racket speed, and gradually increases until one of the players misses the ball.
The game field covers both the displays and the area between the displays. The field contains obstacles that cause the ball to bounce and change direction. Obstacles are only partially visible, continuing to the area between the displays (see Figure 3). This requires players to form a mental model of the obstacles based on the visible areas, and update that model according to any unexpected ball trajectories. Therefore, the game is designed to challenge players’ spatial perception and memory.

We designed a simple spatial audio feedback to help players to follow the ball movement in the invisible space between the displays. When the ball hits an obstacle, an impact sound is played by the device that the ball is closer to.

3.3 First Prototype

First version of the game was implemented for Nokia N810 internet tablets. Kauko and Arrasvuori presented a preliminary evaluation of the first prototype [8]. The evaluation was qualitative and mainly concentrated on players’ perceptions of the invisible space between the displays.

Overall findings from the initial study were positive. Participants considered the game setting suitable for playing games with portable devices. Moreover, they appreciated the challenges and surprises provided by the invisible space between the displays. Many participants were surprisingly accurate at forming mental models of the game field. On the other hand, the invisible space was found to stimulate players’ imagination.

One of the research questions in the initial study was related to social interaction facilitated by the display configuration. The findings indicated that the social interaction during the play sessions was strongly connected to challenge, imagination and surprises provided by the invisible space. Players discussed the hidden obstacles and unexpected trajectories of the ball. This was observed to be more frequent when the game was played with more distance between the displays.

The participants used pointing and gestures to support verbal communication, for example when discussing about ball trajectories. The playing distance was considered small enough to follow the actions and intentions of the other player. The participants felt that the situation was socially comfortable and non-intrusive. One of the participants suggested that the social situation was better in comparison to a console game setting, where players are sitting side-by-side and looking at a TV. This was one of the motivations of our second prototype and the experiment presented in this paper.

3.4 Second Prototype

Based on the results of the initial study [8], we developed a new version of the game for Nokia N97 and 5800 Xpress Music phones. Game appearance and user interface were completely redesigned. Also, minor improvements were done for the game design. For instance, we wanted to reward risk taking and playing near the net. Thus, catching the ball in the dark area of the playing field (see Figure 3) increases the ball speed temporarily by 25%.

4. EXPERIMENT

Our initial study [8] focused on how the dual-screen configuration and the invisible space between the displays were perceived by the users. In this experiment, we concentrated on comparing the social situation to a typical console game setting. Our primary hypothesis was that face-to-face situation increases social interaction and allows better awareness of co-player’s behavior and emotions. In the initial study, some participants expressed that the game was more social when played with more distance between the devices [8]. We wanted to confirm this finding and test how it depends on the social setting.

4.1 Participants

We recruited total of 40 participants for the experiment. Participants were recruited in pairs, so that they knew each other beforehand. Four of the pairs had also played together before. Almost all (38) participants had some previous experience with games. Console games were played more than mobile games, and single player games were played more than multiplayer games. Although the most (36) participants had experience with mobile games, only 11 had tested mobile multiplayer games and none of the participants played them actively. Figure 4 summarizes the previous player experience of all participants. Each participant received a movie ticket as a reward for participating.

![Figure 4: Previous player experience of test participants.](image_url)
4.2 Conditions
Nokia N97 mobile phones were used to test the game in the face-to-face setting. As a comparison, the same game was implemented for a console setting. The test setup is illustrated in Figure 5. In the console version, we used two 21" LCD monitors side-by-side and Sony PlayStation 3 (PS3) gamepads as input devices. For each monitor, the game view was rendered to a window of 640x360 pixels, matching the resolution of the N97 display. The LCD monitors were configured to use resolution of 1024x768, so that the window uses most of the screen space vertically. Horizontal window position was automatically adjusted to match the target distance selected from the configuration menu.

The racket movement was controlled using one of the analog joysticks of the PS3 gamepad. We adjusted the speed of the rackets to relatively slow, so that it was equally easy to control with both input methods. Therefore, the game requires anticipation of the ball movement rather than fast and accurate reflexes.

Our intent was to make the two game settings as identical as possible, but we realized that they differ in relation to more than one variable. The main differences between the settings were the input method (touch vs. gamepad), player orientation (face-to-face vs. side-by-side), player distance, display size, and display orientation. We considered controlling these variables and manipulating each variable separately. However, other combinations of the variables did not seem natural for players or feasible to implement. For instance, using touch to control a console game or a gamepad to control a mobile game was not considered meaningful. Therefore, we opted to compare the most relevant game settings, acknowledging that more fine-grained experiments may be required in the future to separate these factors.

In addition to the game setting, we wanted to test how the distance between the devices affects the social situation. We compared two playing distances, 150 pixels and 360 pixels. The smaller distance was selected to match the bezel width of the LCD monitors, and was approximately 1/6 of the game field. The bigger distance was equal to the screen height, corresponding to 1/3 of the game field.

We used 2x2 (setting x distance) within subjects design to test how the social interaction and presence during the game are affected. The playing order was counterbalanced between the pairs. For each condition, the game was played until one of the players reached 7 points.

At the beginning of the test session, the game concept was introduced to the players. The players were then allowed to practice the game in both settings with a display distance of 255 pixels, until one of the players reached 10 points.

4.3 Measures
We used social presence questionnaire to measure the subjective presence [3]. The participants filled the same questionnaire after each of the four game sessions. The last questionnaire had an additional question about the preferred play setting for social gaming, and a free form field for the reasons. For each three categories of the questionnaire (PIE, PIN, BE), we used the mean results of the related questions from the both players.

We used the percentage of oral communication during the play session as an objective indicator of social interaction and experience. We used two video cameras and additional microphones to record all test sessions. The amount of oral communication was analyzed from video recording using a stopwatch. The amount was then divided by the duration of the session. In addition to speech, non-verbal communication such as laughter was included.

5. RESULTS
A 2x2 repeated measures ANOVA was conducted to analyze both the questionnaire results and the percentage amount of oral communication. All tests are two-way and assume sphericity.

5.1 Questionnaire
Behavioral engagement was significantly higher when played with the short distance between the devices ($F_{1,19} = 9.117$, $p <$
In both conditions the SPGQ-BE was rated very high. Mean score for the short distance was 4.550 (standard deviation 0.585) and for the large distance 4.228 (SD 0.765). Other significant main or interaction effects were not observed. Mean questionnaire results for each condition are displayed in Figure 6.

For the post-test question regarding preferred social game setting, results were surprisingly equal. Mobile game was preferred by 21 participants, whereas the console setting was preferred by 18 participants. One participant was not able to decide. Participants enumerated various reasons for selecting their preference. We analyzed the explanations based on similarity and higher level concepts that emerged from the data. Based on this we identified eight separate but interconnected categories. The amount of answers related to each category is shown in Figure 7.

**The largest category was functional reasons, related to portability, screen size, and controller preference. This was the only category clearly supported by both game settings, although it was more popular for those preferring the game console. Many of these explanations were not directly related to the social aspects, but may have an indirect link. For instance, portability enables social gaming in various places, as noted by one participant:**

"The fact that with mobile devices you could set it up anywhere with your friends. Would be good pass-time fun for example when travelling."

The second most popular category supporting console setting was ergonomics. The reasons were related to seats, posture, comfort and convenience, as illustrated by the following statement:

"It was more comfortable to play with console, couch was nice and atmosphere was more relaxed."

Another explanation supporting only the console setting was related to spectators. Although the mobile devices were visible on the table, the setting was not considered as spectator friendly. The following statement exemplifies this category:

"Sitting next to one another instead of facing one another, in the latter the game feeling was 'just the two of us'. In game console setting I could hear the audience behind us cheering."

Interestingly, explanations related to visibility of actions were used only in favor of the console setting. This indicates that the participants did not value the ability to observe co-player’s hand movement. On the contrary, some participants felt that the hand and stylus was blocking the view:

"Visibility of the game field + movements on the game field better observable (in the console setting)."

The most popular category for explanations supporting the mobile game setting was symbolic meaning of sitting face-to-face. Participants felt that this supports the competitive atmosphere of playing against each other. This is exemplified by the following statements:

"Face-to-face gave an extra ‘pleasure’ of excitement"

"Clear confrontation. We were face-to-face with the co-player. We were also leaning towards each other."

Distance was mentioned by many of the participants. This was more related to the perceived distance or intimacy, rather than actual physical distance between the players. A related category was connection between the players. These were often mentioned together in the same explanations. The most of the explanations related to distance and connection were in favor of the mobile setting, but there was also one participant using the same reasons against it:

"In the mobile device setting there is a table between players. I do not feel connected as comfortably as sitting next to the other player"

The final category was the ability to communicate during the gameplay. These explanations suggest that communication was
considered important and the face-to-face situation was
appreciated:

“Face-to-face, although did not watch the face...easier to start
discussion during the play...not talking to machine, talking to
other player.”

5.2 Communication
The first pair was excluded as an outlier as their results deviated
over 1.5 times the standard deviation from the mean. Due to poor
instructions the first pair communicated with the test moderator
rather than with each other. The rest of the participants were
instructed to ignore the test setting and play the game as they
would at home. The percentage of oral communication was
significantly higher in the mobile game setting (F1,18 = 4.530, p <
0.05). In addition, there was a significant interaction effect
between the game setting and the playing distance (F 1,18 = 4.440,
p < 0.05). This suggests that the playing distance affected the
difference between the mobile and console game setting. Mean
values are shown in Figure 8.

We observed that in both play settings, participants’ visual
attention was mainly on the display. They only rarely glanced at
the co-player or the environment. Participants occasionally used
hand gestures, such as pointing towards a point on the game field.
However, our impression was that the oral communication had
major role in the communication during gameplay.

6. DISCUSSION
Although there were measurable differences between the playing
conditions, the results need further interpretation. In the
following, we discuss these findings in the light of previous work.
We also contribute to the ongoing discussion on measuring social
aspects of game experience.

6.1 Playing Distance
In our experimental design, the playing distance was not our
primary concern. It was included mainly to study the effects of
the social setting with two variations of the game. However, it is
interesting to examine the results to analyze how the playing
distance actually affected the social aspects of the game.

Based on the results of our initial study [8], we expected the
playing distance to affect the gameplay in two ways. Firstly, the
size of the invisible space affects the amount of surprises. This
clearly affected the experienced behavioral engagement. With the
small playing distance, players’ actions depended more on each
other, as there was less uncertainty in the game. Also, surprising
events were a source of puzzlement and introduced discussion
during the game.

Secondly, the distance determined the size of the game field and
thus the pace and speed of the game. As the ball took more time
to traverse through the field, players had more time to
communicate. This was not reflected in our oral communication
measurement, as we measured percentage amount of
communication. In fact, the total amount of communication
reveals a different result, as illustrated in Figure 9.

This may explain our preliminary findings [8] suggesting that
large playing distance makes the game more social. The result,
however, seems to apply only for the mobile game setting. Our
interpretation is that the face-to-face setting was better suited for
deep and reciprocal conversations, whereas the playing distance
determined the temporal pace of game events that triggered
communication.

6.2 Ergonomics
One of the interesting findings was that many participants
considered ergonomics as an important difference between the
game settings. In the mobile game setting, the position of the
mobile devices was fixed. This clearly restricted participants’
movement and postures. None of the participants reported fatigue
or discomfort. However, participants seemed to be more relaxed
in the console game setting.

The same problem was reported by Xu et al. [21]. In their study,
players commented that they would rather “sit back on the coach”
and that the augmented reality interface required them to “bend
too much”. We believe that a fundamental challenge is to design
an ergonomic interaction method that supports the social aspects
of the game, such as rich communication and behavioral and
emotional awareness between the players.

6.3 Visibility of Manipulations
One of the main differences between the game settings was the
input method, particularly the ability to observe co-player’s
actions in the physical space. Using the classification by Reeves
et al. [15], the users’ manipulations in the console setting were
hidden, whereas in the mobile setting they were revealed. Based
on the questionnaire results and freeform explanations, this did
not seem to have impact on the game experience.
The reason for this may have been the simplicity of the interactions. Reeves et al. [15] discuss that the preparation and follow-through are important part of manipulations. In addition, they suggest that manipulations can be used to express skill and control, or to introduce an aesthetic component to the interaction. We designed the interactions as simple as possible so that the game was equally easy to control with two different input methods. We believe that this over-simplification diminished the benefits of having visible manipulations in the mobile game setting.

6.4 Measuring Social Game Experience

Gajadhar et al. used SPGQ to measure social presence in a similar game called WoodPong [4]. They reported psychological involvement as a single subscale (SPGQ-PI), instead of separating SPGQ-PIE and SPGQ-PIN. Their results showed that both SPGQ-BE and SPGQ-PI were rated highest in the co-located game setting. They reported that in the co-located setting, mean score for SPGQ-BE was 3.1 and for SPGQ-PI 2.8. In comparison, our mean score for SPGQ-BE was 4.39 and combined mean score for SPGQ-PIE and SPGQ-PIN was 3.02. The difference in SPGQ-BE is interesting, particularly since our game was deliberately designed to introduce a random element by hiding information between the displays. One possible explanation is the different set of actions. In our game, the paddles can be moved in two dimensions, whereas in WoodPong only up and down movement is possible. This suggests that the concept of behavioral engagement may be related to both the available space of actions and awareness of the actions between the players.

Another interesting observation during our experiment was participants’ interpretations of questions related to negative feelings in SPGQ-PIN. Most players seemed to value “revengefulness” and “malicious delight” as positive emotions implicit in competitive games. However, one participant strongly disagreed with 21 out of 24 statements (6 disagreed with all statements of SPGQ-PIN in all conditions). Her implicit in competitive games. However, one participant strongly commented that feelings such as “revengefulness” and “envy” were a part of the game experience. Therefore, the subjective results revealed that the social game experience is more diverse and multidimensional than what was captured based on the oral communication. Participants’ social experience was shaped by many seemingly unrelated factors, such as ergonomics and symbolic meanings.

Based on these results, we conclude that social interaction during gameplay can be facilitated by face-to-face game setting. Moreover, mobile phones can be used to create such a sociopetal game setting. At the same time, we stress that a better understanding of the social game experience is needed to explore interaction methods and designs that will push the limits of portable gaming.

8. ACKNOWLEDGMENTS

We want to thank Jussi Huhtala for graphics design and Ari-Heikki Sarjanoja for UI design. We also thank Aino Ahtinen, Arto Puikkonen and Panu Åkerman for helping with the experiment.

9. REFERENCES


