Presence experience in mobile gaming

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ABSTRACT
As a growing number of people play computer games with small-screen mobile devices such as handheld computers, mobile phones and handheld game consoles, it is important to know whether the gaming experience is comparable to that for playing with a PC on a large screen. One important aspect of gaming experience is whether people feel themselves engaged in the game activity and whether they feel present in the game world. In the present study participants played a rally game either with a PC or with a PDA, and presence was measured by the MEC-SPQ presence questionnaire. The results showed that, even though there was no difference in attentional engagement between conditions, participants experienced significantly higher levels of presence in the PC condition. Some user characteristics, measured by the Witmer and Singer's ITQ questionnaire, played a mediating role between device type and different aspects of presence.

Keywords
Mobile gaming, presence, attentional engagement, user characteristics

INTRODUCTION
Games on mobile phones emerged when Nokia introduced the simple Snake game in the late 1990's. Some years later mobile games became downloadable which speeded their access to mass markets. Since then, mobile gaming has become more and more popular. A growing

Proceedings of DiGRA 2005 Conference: Changing Views – Worlds in Play.

number of people play computer games with small-screen mobile devices such as handheld computers, mobile phones and handheld game consoles. One reason to the success of mobile gaming is that people can play these games nearly everywhere. However, despite of the popularity of mobile gaming, quite little is known about the gaming experience when people play with mobile devices. For example, it can be hypothesized that the game activity is experienced as less engaging when using mobile devices.

One important aspect of gaming experience is whether people feel themselves present in the game world. Presence is a psychological state in which the illusion of non-mediation is perceived, even though the person always knows that the experience is mediated [8]. When a person feels present in the mediated environment, at some level, the person has the illusion that he/she is situated within the mediated environment, at some level, he/she knows that the experience is not real.

Since game players are typically highly engaged and absorbed in the gaming activity, there are good reasons to assume that sense of presence is a commonly reported experience of game players. Retaux [4], however, found that, according to their own comments, game players do not typically feel physically present in the game environment but rather feel involved in it. Sometimes, the possibility to interact with the game world may induce high levels of presence. For example, in Lessiter et al.'s [3] study, an interactive computer game elicited feelings of presence and engagement, but the level of presence was lower than that for IMAX 3-D cinema. Recently, Takatalo and his colleagues [6] found that participants who played a first-person three-dimensional driving game including lots of camera movement experienced clearly higher levels of physical presence than those who played a third-person two-dimensional driving game that does not include camera movement.

Mobile gaming and presence

When people play with small-screen devices, feelings of presence should be lower for several reasons. First, because of small screen size, the game world should be considered less realistic, and there is also a larger opportunity that attention is distracted away from the activity at hand which should contribute to the reduction of presence. There is mixed evidence of the effect of screen size, however. IJsselsteijn and his colleagues [1] found a large effect of screen size on the subjective sense of presence in the moving video condition but not in the still video condition. In addition, there seemed to be no effect of screen size on the objective measure of presence. It is possible that it is not the large screen as such that is important, but the fact that high degree of realism in vision is possible when the screen is large. In fact, there is some evidence that people enjoy more games whose graphics is realistic and of comparable quality [9].

The sound quality of small-screen devices is also lower than that of large-screen devices. It can be assumed that high-quality realistic stereo sound makes people feel them more present in the computer-generated world than less realistic monophonic sound. In Wood et al.'s [9] study, realistic sound was deemed to be one of the most important structural characteristics, and Sweetser and Johnson [5] provided evidence that game players typically think that audio is important for keeping the player immersed in the game.

In addition to graphics and sound, there are also other possible differences between mobile gaming and gaming with large screen devices that may have an impact on immersion and

presence. For example, more advanced control methods (e.g., joystick and foot pedals) are possible when playing with a large-screen device. When interacting with the game by using a joystick or foot pedals, instead of small knobs or buttons, the game player may be better able to concentrate on the activity, and this improved concentration may lead to higher levels of presence.

In the present study, participants played a rally game either with a PC computer or with a handheld device (PDA). It was hypothesized that participants experience higher levels of presence when they play with a large-screen device, and individual differences in immersive tendencies play a mediating role in presence.

METHOD

Participants

Fifty volunteers participated in the experiment (33 females, 17 males). The mean age of the participants was 27 with a range between 19 and 39. They were ignorant of the purpose of the study before participating. Participants were selected in the order of their announcement to an email message. They were paid for their participation (each one received two movie tickets, total value about 13€). Twenty-eight of the participants had not ever played the two rally games (14 participants in both experimental groups), 22 of them had tried one of these two games.

Stimuli

In the present study participants played a rally game (Colin McRae Rally™ or V-Rally™) in one of two conditions. In the PC condition, the game (Colin McRae Rally™) was displayed on a large screen (1.30 m x 1.70 m), and the PC keyboard was used as an input device. The stimuli were generated with a Dell Precision 350 computer, and the image was projected on the screen by a beamer (Panasonic LCD Projector PT-LC75E). In the PDA condition, the game (V-Rally™) was played on a handheld device (Compaq iPAQ). The screen size of the PDA was 8.0 cm x 6.0 cm.

Procedure

The game session lasted for about five minutes. When the participant had run through a special stage, he/she started it over again. The participants practiced the task five minutes before performing it. During practice they had a possibility to ask advice from the experimenter. The participants played the game at the level to which they had advanced during the practice session. After the experimental session the participants filled out a couple of questionnaires. Presence was measured by the MEC Spatial Presence Questionnaire (MEC-SPQ). It consists of several scales that measure the different concepts integrated in the theoretical MEC model [7]. It includes four process factors [Attention Allocation, Spatial Situation Model (SSM), Self Location (SPSL) and Possible Actions (SPPA)], two variables relating to states and actions [Higher Cognitive Involvement and Suspension of Disbelief (SoD)] and some trait variables. All the process variables, variables relating to states and actions and one of the trait variables [Domain Specific Interest (DSI)] were entered into an analysis.

Witmer and Singer's [8] Immersive Tendencies Questionnaire (ITQ) is aimed to examine individual differences in the ability to experience presence. For example, it aims to measure the capability or tendency to be involved or immersed, and the ability to focus on a particular

activity. It consists of three subscales, Focus, Involvement and Games. According to Witmer and Singer, the Focus items are related to mental alertness, participants' ability to concentrate on enjoyable activities and their ability to block out distractors. Involvement items, in turn, are related to the participants' propensity to get involved passively in some activity; and the Games items are asking how frequently participants play video games and whether they get involved to the extent that they feel they are inside the game.

RESULTS AND DISCUSSION

Even though over half of the participants had not ever played these two rally games before, all of them were able to play the game successfully after the practice session. A one-way between-subjects analysis of variance (ANOVA) showed that the effect of experimental manipulation (PC vs. PDA) on the SSM scale was significant, $F(1,48) = 6.31$, $p < 0.05$. Those who played the game with a PDA scored lower on this scale than those who played the game with a PC (PDA, $M = 2.73$, PC, $M = 3.31$). The effect of device type on the SPPA and on the SPSL scale was also significant, $F(1,48) = 22.87$, $p < 0.001$ and $F(1,48) = 24.87$, $p < 0.001$, respectively. PDA-game players experienced clearly lower levels of presence (SPPA, $M = 2.25$, SPSL, $M = 2.10$) than PC-players (SPPA, $M = 3.28$, SPSL, $M = 3.40$). The effect of device type on Involvement approached significance, $0.05 < p < 0.1$, but the effect on SoD and on Attention was not significant, $p > 0.1$.

Participants, thus, experienced higher levels of presence when the game was projected on a large screen. They were better able to create a spatial situation model of the described environment, and they could more easily accept the depicted space as personal reality. There was, however, no difference in Attention scores. Interestingly, the mean Attention scores were even a bit higher for the PDA group (PDA, $M = 4.23$, PC, $M = 4.20$).

Since user characteristics (domain specific interest and susceptibility to presence) can be assumed to mediate the effect of device manipulation on presence, we replicated the above-mentioned analyses by entering the DSI, Focus, Involvement and Games variables, each in turn, as covariates. Only results of significant or marginally significant interactions are discussed here.

The interaction between device type and Domain Specific Interest was marginally significant in predicting the SSM scores, $F(1,46) = 3.94$, $0.05 < p < 0.1$. In the PC condition, high DSI scorers gave somewhat higher ratings on the SSM scale than low DSI scorers; in the PDA condition, the reverse was the case. That is, participants who are interested in motor sports and who like to play rally games reacted differently relative to those who are less interested in the topic. Those who are more interested in the topic were less capable of producing a mental model of the depicted environment when the game was displayed on a small PDA than when it was projected on a large screen, but the reverse was true for those who are less interested. It seemed to be that the small screen size and less realistic graphics and sound of the PDA bothered more those participants who are more interested in motor sports.

When predicting the SoD, a significant interaction between device type and Focus was found, $F(1,46) = 7.81$, $p < 0.01$. Those with high scores on the Focus scale were more capable of suspending disbelief in the PC condition than those with low scores; in the PDA condition, the high scorers, however, gave lower ratings than low scorers. There were also two marginally significant interactions: The interaction between device type and Focus was marginally

significant in predicting the SPPA scores, $F(1,46) = 3.90$, $0.05 < p < 0.1$, and the Attention scores, $F(1,46) = 3.23$, $0.05 < p < 0.1$. In general, those with high scores on the Focus scale were more engaged and experienced higher levels of presence than those with lower scores in the PC condition, but the reverse was true in the PDA condition. Interestingly, low Focus scorers were even more engaged in the game activity in the PDA condition than in the PC condition. It seemed to be that the limitations of the small-screen device bothered more those participants that were better able to concentrate on the gaming activity.

When predicting the Attention, a marginally significant interaction between device type and the ITQ's Involvement scale was found, $F(1,46) = 3.12$, $0.05 < p < 0.1$. Those with low scores on the Involvement scale were more engaged in the game activity in the PDA condition than in the PC condition, but there was no difference between conditions for high scorers. The interaction between device type and the ITQ's Games scale was significant for Attention, $F(1,46) = 5.36$, $p < 0.05$, and the interaction between device type and Games was marginally significant for SPSL, $F(1,46) = 3.47$, $0.05 < p < 0.1$. Those with low scores on the Games scale were more engaged in game playing in the PDA condition than in the PC condition, but the reverse was the case for high scorers. Both low and high Game scorers were less involved in the activity in the PDA condition than in the PC condition, but the difference was much larger for high scorers.

Even though level of presence was lower for the PDA condition, participants, however, also experienced some presence when they played the game with the PDA. It is possible that, if some requirements are met (e.g., visual quality is comparable, interaction with mobile device is fluent and the game session is moderate in duration), the mobile gaming experience can be highly engaging and enjoyable, even though people do not experience high levels of presence.

It is also possible that, during years of experiences with PC games, game players have created PC game specific cognitive schemas that are not suitable when playing games with a small-screen device. But as the game players' experience with mobile gaming increases, these schemas are adapted to reflect the unique characteristics of mobile games. As a result, their performance will improve, and they will perhaps also experience higher levels of presence.

Since the white screen fills up a much larger part of the visual field than the PDA screen, it is not a very surprising finding that participants experienced higher levels of presence in the large screen condition. What is perhaps more interesting is that PDA users were able to focus attention on the game stimulus at least as well as those who played the game with a PC. Apparently, in order to be involved in the gaming activity, PDA users had to firmly look at the small screen, and they were also highly capable of doing that. This deeper concentration on gaming did not result in comparable levels of presence for these two conditions, however.

There is previous evidence suggesting that sense of engagement is a central aspect of gaming experience [2]. Our results suggested that, when people play games they are typically highly engaged in the task, and, therefore it is not very important whether they played with a PC or with a PDA. The results also suggested that there is a complicated relationship between attentional engagement and presence. Since people have to pay attention to some extent to a media stimulus in order to experience presence, attention is a necessary prerequisite for presence, but it alone is not sufficient.

User characteristics had an influence on participants' presence ratings. Overall, it seemed to be that, for people who are less interested in the topic of the game and who are less able to concentrate on media stimuli, it is unimportant whether the game is displayed on a large PC screen or on a tiny PDA screen. The limitations of the small-screen device bother to a greater degree those people who are more interested in the topic and are better able to focus their attention in the activity.

CONCLUSION

It is not very surprising that the participants experienced a higher sense of presence when the game was projected on a large screen. What is more interesting is the fact that attentional engagement was at the same level in the two conditions. It seems to be that playing on a mobile device can be quite engaging and enjoyable. Since there is not much possibility to increase the size of small screens, designers should think of alternative ways to make the gaming experience more immersive. One possibility is to develop multimodal interfaces for next-generation mobile game devices and improve their ability to present high-quality sound.

ACKNOWLEDGEMENTS

This research has been funded by the European Community, FET Initiative "Presence Research Activities", Project "Presence: MEC (IST-2001-37661). We thankfully acknowledge the support of the European Commission.

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