

Author's Version

The original publication is available at www.springerlink.com

To cite this article:

Korhonen H., Saarenpää H., Paavilainen J.

Pervasive Mobile Games – a New Mindset for Players and Developers

Fun and Games 2008, LNCS 5294, pp. 21-32

DOI: http://dx.doi.org/10.1007/978-3-540-88322-7_3

© Springer-Verlag Berlin Heidelberg 2008

Pervasive Mobile Games – a New Mindset for Players and Developers

Hannu Korhonen¹, Hannamari Saarenpää², Janne Paavilainen²

¹ Nokia Research, P.O. Box 1000, 00045 Nokia Group, Finland,
hannu.j.korhonen@nokia.com

² University of Tampere, Kanslerinrinne 1, 33014 Tampereen Yliopisto, Finland
{hannamari.saarenpaa, janne.paavilainen}@uta.fi

Abstract. Pervasive games are an emerging new game genre, which includes context information as an integral part of the game. These games differ from traditional games in that they expand spatio-temporal and social aspects of gaming. Mobile devices support this by enabling players to choose when and where a game is played. Designing pervasive games can be a challenging task, since it is not only limited to the virtual game world, but designers must consider information flow from the real world into the game world and vice versa. In this paper, we describe a user study with an experimental pervasive multiplayer mobile game. The objective was to understand how the players perceive pervasiveness in the game and what the crucial factors are in the design. Based on the results, we propose initial design guidelines and compare them to other design guidelines for the pervasive games.

Keywords: Mobile Game, Pervasive Game, Game Design, Design Guidelines, Context, Asynchronous gameplay

1 Introduction

Pervasive games introduce a new emerging game genre that pushes the boundaries of the traditional games and enables new kinds of gaming experiences for players. One of the most exciting aspects in these games is that the context information is utilized to modify a game world or it is converted to game elements. In addition, gaming can be blended into the daily life and normal social situations of the players.

Pervasive gaming is a wide domain, which can consist of the real world games augmented with computing functionality, or virtual computer entertainment is brought back into the real world [12, 13]. Magerkurth et al. introduce several pervasive game genres such as smart toys, affective gaming, augmented tabletop or real world games, and location-aware games [12]. Even though it is not a comprehensive list of pervasive game genres, it gives a good overview to the broadness of the domain.

Our research focuses on pervasive games that are played with mobile devices. The mobile device is a good platform for pervasive games, since it is pervasive by its nature. It is capable of acquiring information about the current context and it can send information (e.g. location) to a game system, which then defines the appropriate player context.

Designing pervasive mobile games is a challenging task as many new issues need to be taken into account in a design. As context information is a crucial element in these games, the designers should emphasize this aspect in the design as well. Moreover, the pervasive games are often played in environments inhabited by people who are not playing the game. The game design must ensure that the game does not disturb too much players' social interaction outside the gameworld or disrupt non-players' ongoing activities. Further, since the players may be distracted from their surroundings by focusing on the game at hand, they may become a hazard for themselves or others. Designing a game to avoid these problems is a key factor in acceptance of the pervasive games.

In this paper we describe a user study with an experimental pervasive mobile game. Our objective was to find out how players perceive pervasiveness and what issues are important in a pervasive mobile game design. The contribution of the paper is a list of initial design guidelines for pervasive mobile games.

2 Related Work

Pervasive games have been studied for several years, but there are only few design guidelines available for helping designers in their task. Eriksson et al. present design guidelines for socially adaptable games that are played in different social context than traditional games [5]. The guidelines are as follows: *support interruptability, allow multiple communication channels, consider ambiguity, design for external events, allow modes of play based on social roles, minimize social weight, and analyze intended player groups from several perspectives*. They highlight essential aspects in design and are focusing on how the game can be adapted to social environment in which the game takes place, but they are missing the role of context information.

Crossmedia games are one type of pervasive games that use multiple gaming devices in addition to media channels like TV and radio [14]. Ghellal et al. [6] discuss game design aspects that designers should take into account when designing pervasive crossmedia games. Many of the design challenges in crossmedia games are concentrated on using several devices at the same time, but pacing the game was also seen important. The initial design guidelines say that the game should support both active and passive participation as well as different temporal involvements. The problem with these guidelines is that they focus too much on the devices instead of players so they are not sufficient enough to be used for designing other pervasive games besides crossmedia games. For example these guidelines don't give any assistance on how one should design context sensitiveness.

Lankoski et al. describes a location-aware mixed reality game, *The Songs of North*, which was used to study design solutions for pervasive games [9]. One guideline they found was a support for communication since players can be present in the game at different times. They also discovered the importance of a player control which is related to the temporal gameplay; the player is not punished for not being present in the game or playing seldomly. Lankoski et al. did not present proper guidelines but rather observations on important design issues. That is probably one reason why they seem to have missed issues like communication between the player and the server.

3 The Game Concept

Mythical: The Mobile Awakening¹ is an asynchronous slow-update multiplayer game where players access a magical world through their mobile phone. The magical world is divided into four factions (Dawn, Sun, Dusk, and Moon). The players gain experience and learn spells by completing rituals either alone or together with other players. The spells are then used in encounters to battle against AI opponents or other players (Figure 1B). The game content is based on folklore mysteries and local history for creating an exciting atmosphere.

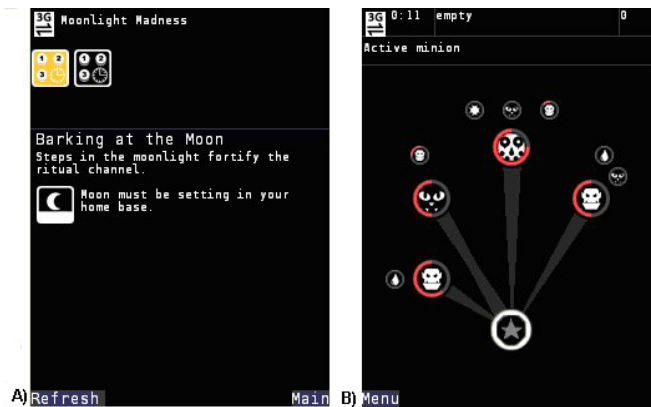


Fig. 1. Screenshots from the game. A) Context information sets conditions when the ritual component can be completed successfully. B) Slow update gameplay in the encounters.

The game features context-aware gameplay where the real world phenomena have an effect in the game world. Context information derived from the real world is used in the rituals where the reward of the ritual depends on how well the player has met the context conditions set initially (Figure 1A). There are three types of context information used: spatio-temporal, environmental and proximity. Spatio-temporal context is used in two ways: players select a home base from the predefined list and the game content and some environmental context information is then validated against information on that location. Time of the day is frequently used context information that defines when some rituals can be completed. Environmental context information is based on temperature, cloudiness and astronomy. Temperature is used in a breakpoint manner; some rituals require that the temperature is either above or below 0 degrees Celsius. Cloudiness has three possible options: clear, partly cloudy, and cloudy. Astronomy information is related to the Moon and Sun positions over the horizon and to the phases of the Moon. The proximity context is based on scanning Bluetooth devices. Rituals can require scanning either a specific or a given number of Bluetooth devices.

Asynchronous gameplay favors casual play style and Bogost has suggested that such feature could be the future of casual multiplayer gaming [3]. Slow update

¹ <http://www.mythicalmobile.com/>

gameplay means that the game events are not continuous, but they happen in predefined intervals ranging from less than a minute to several hours.

The game was implemented upon MUPE² / Equip 2³ platform and it is running on mobile phones supporting MIDP2.

4 User Study

To find out how pervasive features affect the gaming experience, we conducted a user study on the game on November 2007. Next we describe the procedure and the participants who took part in the study.

4.1 Participants

We had six participants, four females and two males, between 15 and 16 years. They were all regular video game players (approximately 10 to 25 hours per week). They played games mainly with a computer. Mobile games were not popular among the participants. Two participants played mobile games daily, but for others it was rare. None of the participants had any previous experience from pervasive games.

4.2 Procedure

The user study period lasted one week. The participants were instructed to play the game freely in their own time as much as they wanted to. Thereafter they were interviewed about their playing experiences. We conducted in-depth one-to-one interviews that lasted about 1.5 hours each. With these interviews we wanted to find out the overall opinion and attitudes towards the pervasive mobile game, and how the participants perceived context information that was embedded in the game design. The interviews revealed issues about how the implementation of these features had succeeded as well as opinions towards pervasive games in general. All interviews were audio recorded for later analysis. After the interview, the participants were also asked to fill in the background questionnaire, which revealed their gaming habits.

The interviews were processed in a way that all individual comments were written down to paper slips so each of them could be understood alone. After that we constructed an affinity diagram [2] from the approximately 700 comments we got from the interviews, combined related comments together, and gave a title for the group that described those comments (Figure 2). This method is well known in user-centered design projects for utility software, but in game evaluations it has not been used extensively as far as we know of.

We found this method to be time-consuming but useful; it forced us to think about each comment and what it actually meant. It also allowed us to see bigger entities as

² <http://www.mupe.org>

³ <http://sourceforge.net/projects/equip/>

comments were not grouped based on the question, but according to their similarity of the topic. Results section describes some of the topics in more detail.



Fig. 2. First level categorization of interview comments.

5 Results

In this section we describe some of the interview results, which revealed that pervasive mobile games will undoubtedly change many existing practices, but on the other hand they also provide new possibilities for gaming.

5.1 Rethink game and play sessions

One of the first new things for the participants was the concept of a game session. In traditional video games the game session has a clear beginning and an ending and play sessions are mostly continuous. In pervasive mobile games this is not anymore straightforward as the game sessions might be fragmented and the whole game session can last hours or even days. The participants commented that this new style requires some learning and they had some troubles at the beginning to get used to it.

U2: *"I didn't leave the encounters unfinished before exiting the game."*

U4: *"I felt mostly like I could leave the game at any time. Still I wanted to finish started rituals and battles."*

U6: *"I had to get used to the playing style that you can leave the game in the background and it continues."*

For other participants this playing style was intuitive and they had accustomed to fragmented play sessions and slow update game mechanism that enabled flexibility.

U5: *"I felt like I could leave the game at any time."*

U3: *"I just started the encounter and let it play alone. I did not have to do any preparations, just to make sure that the game can roll on its own."*

5.2 Leaving the game situation active makes the player curious about it

Having the game active on the game server after log out caused an interesting dilemma for the participants. Do they just let the game play alone or should they log in again to see that everything is going alright? The participants stated that they were interested in and wondering what was going on in the game while they were away.

U6: *"I came back to the game if I was even a slightly curious about it."*

U3: *"I thought the game in some extend even though I was not playing it."*

U4: *"I thought about the game at times when I wasn't playing it if I had just left the game aside and thought that I would continue it later."*

After returning to the game the participants checked the current game state and reviewed previous game events in encounters.

U5: *"I usually read the texts that appeared after the battle I had just finished."*

U4: *"I have used the log feature and I think it is useful."*

U3: *"I could follow game events in the encounters and observe what kinds of minions or spells the opponent used."*

However, reviewing the current game state was not satisfactory, since the participants could have missed something interesting or important and it was too late to influence to the game events anymore at that point. Some participants tried to overcome this shortcoming by accessing the game several times a day to be on the safe side.

U3: *"Sometimes when I entered duels they seem to be almost finished."*

U2: *"If there would have been more actions happening at times when I wasn't playing the game, then it would be more interesting and it would irritate if I would have missed something important."*

U6: *"I checked the game quite frequently and I did not leave it alone for an hour or more."*

U2: *"I checked the game at least two to five times per day."*

5.3 The game should notify about important events

Based on the participants' comments the game should have kept the players aware of the game events. Three participants mentioned that the game could send SMS messages to a player when something important has happened in the game and the player is not online. This would reduce frequent logins to the game.

U5: *"I think the SMS feature would be fun. Then you don't have to access the game all the time."*

U4: *"The SMS feature would have make things easier when you wouldn't have to go into the game just to check out if something interesting has happened."*

The notification feature was built in to the game, but none of the participants had activated it. There were UI design problems related to this feature, but since it is a novel feature in mobile games, the participants did not expect to find it in the game.

5.4 Finding proper intervals for slow update mode

The important question for slow update gameplay is how to define event intervals that support this gaming mode. The participants stated that they had two approaches for this. They used short intervals (30-45 seconds), in which events occurred almost in real time or considerably longer intervals, which left room for other activities.

U6: *"Sometimes it was good that the encounters lasted longer, because then I had a chance to do something else."*

U4: *"I think that the encounters are sometimes really slow but then again it makes it possible to do something else at the same time."*

The game event intervals between one to five minutes were considered problematic. They are too short for leaving the game unattended, but at the same time it was boring to wait for the next game event to take place.

U2: *"You cannot choose the wave length in every battle so it leaves quite vulnerable feeling when you have like 2 min waves and you cannot leave the game. You have to be in the game and see what happens."*

5.5 Gaming blends into other activities

One of the key features in pervasive games is that gaming is not anymore an isolated activity, but the players can share their time with a game and other tasks at the same time. The participants confirmed that they were listening to music, reading emails, eating and doing other tasks while playing the game. Concurrence of gaming and other tasks is pretty much dependent on concentration level and time that is required to perform actions in the game. If that time is long, it will disturb other activities.

U5: *"This game did not change my daily routines. It was just an addition."*

U6: *"It was really easy for me to concentrate on something else than playing the game even though it was running in the background".*

U3: *"I feel that it is not very distracting if I occasionally take a look what happens in the game world and it does not take very long time".*

5.6 Utilizing context information was appealing

Context information made the game appealing because setting conditions and defining the success rate of actions was different than what the participants were familiar with the traditional video games.

U5: *"I liked those rituals the best where there were different times of the day."*

U3: *"Rituals seem reasonable, especially when you have a multi-component ritual, which can be completed only in certain times of the day".*

The challenge was to find the right context where the ritual could be completed. As the players cannot rely anymore on information provided only in the game world, they must also exploit other sources.

U3: *"I would probably try to figure out the current time of day by checking the outdoor or using a calendar."*

5.7 Sometimes it is not possible to play the game

Finding out the right circumstances to play the game can be a challenging task. Therefore, it is tempting to play when there is a possibility. However, the players' social context or more urgent tasks will limit this possibility. The participants commented that they were thinking about their influence on others while playing the game because they might unintentionally be impolite towards them.

U5: *"There are those rituals tied to a certain time of the day. So as I belong to the School of Dusk, it is quite short time when the rituals are open and we usually have a class at that time. It is quite hard for me to play then."*

U4: *"I think the playing would be quite much depended on my daily schedule."*

U5: *"The others became impatient when I was playing the game and they had to wait for me to finish."*

U2: *"It is quite rude to play this game in certain situations where you really have to be involved."*

6 Design Implications

The user study results indicate that pervasiveness sets some new requirements to the game design. In this section we present implications that the designers should take into account when designing asynchronous pervasive mobile games. Sections 6.1 and 6.2 discuss about utilization of context information in a game. Sections 6.3 and 6.4 deal with issues related to asynchronous gameplay.

6.1 Perception of the current context

Pervasive mobile games typically use context information to define some conditions in the game world or to convert context information to a game element. One part of the fun in the pervasive games comes from discovering the correct context and playing the game when conditions are favorable for the player.

The difficulty in using context information in a game design is that the game system and a player may not have a mutual understanding of the current context. The game design should not rely on context information blindly because it may be inaccurate or unavailable due to various reasons [7]. Inaccuracy can be a result of measurement variation due to different locations. For example, temperature can fluctuate several degrees even within a close range.

A player may also be uncertain how the game system interprets current context information even though it would be otherwise clearly recognizable. For example, the game can utilize environment context information such as cloudiness in the game. Even though cloudy and partly cloudy skies are different by definition, from the player point of view they are alike compared to the clear sky.

Using rigid thresholds with context information should be avoided because information from different sources may vary slightly and thus becomes ambiguous. Therefore, the designer should decide whether similar context information is

considered as same or treated as different in the design. The best option is to utilize only context information that is clearly discernible and unambiguous for the players.

Furthermore, the game should notify the player what the game system considers as current context. The difficult issue for the designers is how the context information should be revealed to the player without contaminating the gaming experience. In addition, there can be several contexts that need be informed simultaneously.

6.2 Equal chance to play

Utilization of context information in the game should be carefully designed and the designers need to make sure that all players have an equal possibility to access relevant information. The player progression should not be depended on context that may be unreachable. Furthermore, most context information is also dynamic and the designers cannot control changes (e.g. weather information), which may place players to unequal position.

In addition to uncontrollable changes in context, there can be player-related reasons why the player cannot access certain information. For example specific time of the day may not be suitable for the player due to other activities or the player's current social context does not allow gaming at that point. The player may not be able to travel to retrieve location specific information or some resources are not available at the player's current location. Our results confirm the previous study, which state that the lack of time and unfavorable location were reported to be the major obstacles for playing the game successfully [1]. Peitz et al. also report results of a pervasive game in which players were frustrated because there were not necessary game resources available at the player's location [15].

However, if some context is available only for some players, the game design should enable and emphasize collaboration between the players. With this solution all players may access context information equally. This will also increase player-to-player interaction in the game. Other possibility is that context information is time-independent and the player can use it when it becomes available. If certain context is not available, the player should always be able to do some other things that will require some other information. Finally, the game should provide meaningful things to do that do not require any context conditions to be fulfilled. Other alternative is that the player can complete the task, but the reward is determined based on how well the context conditions were met.

6.3 Adjustable play sessions

Players play pervasive games as time permits it. Gaming can be very sporadic and the game design should take this into account. Moreover, as the play sessions are blended into other activities it is possible that the player needs to leave the game without prior notice or play sessions are short by default. Peitz et al. argue that short play sessions will promote social adaptability of the pervasive mobile game [15].

The game should be designed so that it is possible to leave the game at any time without reducing the player's chance to win the game. Disconnections are likely to

happen in pervasive games and the game design should manage these properly [4]. In the multiplayer games the design should consider what kinds of effects the abandonment of the player has on other players.

In asynchronous gameplay the player should be able to adjust the pace of the game and match it to available playing time. Sometimes it is preferable to play the game almost in real time while some other time a slower game pace is preferred as it gives more possibilities to lie back, and time to do other things at the same time. In this case the game requires minimal attention, but the player can still keep track on game events. Our study results indicate that the length of the short play session should be less than five minutes. These short play sessions allow the players to play the game and have some other activities at the same time without disturbing each other. Longer play sessions are preferred when the players have time to be invested for gaming.

6.4 Communication outside gameworld

Communication is a very important factor in multiplayer games. Players quite often create their own tools or utilize existing tools if the game design lacks required features (e.g. for communication) [8]. Even though the support for communication between the online players is a common feature in many games, asynchronous communication is gaining attention as well. Linner et al. introduce a framework, which enables rapid development of pervasive games that also supports offline communication [11]. The system buffers received messages and the player can see them on the next login. Lindley et al. also describes a pervasive mobile game that allows the players to receive alerts, although they are not actually playing the game (the game character is in a dormant mode) [10].

The participants in our study highlighted very clearly that they want to be aware of the game events when they are offline. This observation expands the current design practice because currently the communication stays inside the game world and the players will receive messages when they log in to the game next time.

From the interaction design point of view communication to the offline players is interesting because the game user interface expands outside the game and the game events are communicated by using some alternative communication channel. The designers should decide both the communication and presentation methods when providing information from the game world.

The designer can use direct or indirect communication methods. The benefit of the direct communication is that messages will be delivered immediately and the player can act without delays. The drawback of this solution is that it will generate costs to the game master because one has to use a messaging service such as SMS, MMS, or email. Indirect communication means that important game data is accessible through a medium, which does not require the player to log into the game world. One viable option is to use a web page, which displays the game events to the players. This solution does not create extra costs as the game server and the web server can be in the same local network and information is transferred internally. Indirect communication assumes that the players are active and will check the web page spontaneously. However, it is possible that the players will not get information in time.

Instead of using messaging services or web services for communication it is possible to build automatic update functionality to the game itself. In this solution the client connects to the game server at certain intervals and retrieves the recent game events. Information is then displayed to the player. The player can view information without accessing the game, but if some actions are needed then the player has to log into the game. This solution creates frequent data traffic between the mobile device and the game server, and the player pays expenses of the traffic.

Presentation method depends on the communication method. SMS/MMS messages can have certain limits on how long messages can be, but for emails the length is not an issue. However, it should be noted that the emails are supposed to be read on a mobile device in order to achieve immediate information delivery. Textual information is in many cases sufficient, but images and graphics can make the messages more appealing.

Another important issue in a presentation method is to decide what game events are communicated to the player. In other words how many messages the player will receive when not logged in. The basic rule is that the player should be notified about anything that would cause actions when the player is actively playing the game. However, the number of the messages should not be overwhelming because it can easily lead to negligence and may disturb player's other activities. The player should be able to define the proper number of messages depending on the player's needs and interest in monitoring the game offline.

7 Conclusions

In this paper we have presented design challenges that game designers face when designing pervasive mobile games. We also present design implications how to overcome these challenges. These design implications were derived from a user study that was conducted with an experimental pervasive multiplayer mobile game. The game design utilized three types of context information in the game world: spatio-temporal, environmental, and proximity. Another important feature was an asynchronous slow update gameplay, which allowed the players to play the game whenever they wanted to and collaborate with other players without disturbing their gaming experience. The user study results indicated that when designing pervasive mobile games, the designer should pay attention to player's freedom to play the game. This means that the player should be able to adjust play sessions according to the available time they have. When the player is offline, communication outside the game world also becomes a crucial factor for convenient gameplay. Another important factor in pervasive games is the utilization of context information. The designers should ensure that both the players and the game system have mutual understanding of the current context. In addition, the game design should support that all players have equal chance to access relevant context information. By following these high level guidelines we believe that it is possible to design more enjoyable pervasive mobile games and introduce this new game genre to a wider player population.

Acknowledgements. IPerG (www.iperg.org) is an Integrated Project (FP6-004457) funded under the European Commission's IST Programme. We would like to thank all project members for their contribution to designing and implementing the game and the user study participants for their valuable comments.

References

- 1 Bell M., Chalmers M., Barkhuus L., Hall M., Sherwood S., Tennent P., Brown B., Rowland D., Benford S., Capra M., Hampshire A., Interweaving Mobile Games with Everyday Life, in proceedings of ACM SIGCHI, 2006, pp. 417-426.
- 2 Beyer H., Holtzblatt K. Contextual Design: Defining Customer-Centered Systems, Morgan Kaufmann 1998, pp. 154-163.
- 3 Bogost I., Asynchronous Multiplay: Futures for Casual Multiplayer Experience. Other Players conference on Multiplayer Phenomena, 2004, The IT University of Copenhagen. <http://www.bogost.com/downloads/1.%20Bogost%20-%20Asynchronous%20Multiplay.pdf>.
- 4 Broll W., Ohlenburg J., Lindt I., Herbst I., Braun A., Meeting Technology Challenges of Pervasive Augmented Reality Games, in proceedings of 5th ACM SIGCOMM workshop on Network and system support for games (NetGames'06), 2006.
- 5 Eriksson, D., Peitz, J., Björk, S., Socially Adaptable Games, in proceedings of DIGRA 2005 Conference: Changing Views - Worlds in Play, 2005.
- 6 Ghellal, S., Bullerdiek, S., Lindt, I., Pankoke-Babatz, U., Adams, M., Söderlund, T., Oppermann, L., Design Guidelines for Crossmedia Game Production, Public IPerG Deliverable D8.1. <http://www.pervasive-gaming.org/Deliverables/D8.1-Design-Guidelines-for-Crossmedia.pdf>.
- 7 Henriksen, K., Indulska, J., Modelling and using imperfect context information, in proceedings of the Second IEEE Annual Conference on Pervasive Computing and Communications Workshops, 2004, pp. 33-37.
- 8 Koivisto E.M.I., Supporting Communities in Massively Multiplayer Online Role-Playing Games by Game Design, in proceedings of DIGRA Conference: Level Up, 2003.
- 9 Lankoski P., Heliö S., Nummela J., Lahti J., Mäyrä F., Ermi L., A case study in pervasive game design: the songs of north, in proceedings of the third Nordic conference on Human-Computer Interaction (NordiCHI'04), 2004, pp. 413-416.
- 10 Lindley C.A., Game Space Design Foundations for Trans-Reality Games, in proceedings of the international conference on Advances in Computer Entertainment Technology (ACE'05), 2005, pp. 397-404.
- 11 Linner D., Kirsch F., Radusch I., Steglich S., Context-aware Multimedia Provisioning for Pervasive Games, in proceedings of the Seventh IEEE International Symposium on Multimedia (ISM'05), 2005, pp. 60-68.
- 12 Magerkurth C., Cheok A.D., Mandryk R.L., Nilsen T., Pervasive Games: Bringing Computer Entertainment Back to the Real World, ACM Computers in Entertainment Vol. 3 No. 3, 2005.
- 13 Montola M., Waern A. & Niewdorp E. 2006. Domain of Pervasive Gaming, Public IPerG Deliverable D5.3b. Available at <http://iperg.sics.se/Deliverables/D5.3b-Domain-of-Pervasive-Gaming.pdf>.
- 14 Ohlenburg J., Lindt I., Pankoke-Babatz U., Ghellal S. Report on the Crossmedia Game Epidemic Menace, ACM Computers in Entertainment, Vol. 5 No. 1, 2007.
- 15 Peitz J., Saarenpää H., Björk S., Insectopia – Exploring Pervasive Games through Technology already Pervasively Available, in proceedings of the international conference on Advances in Computer Entertainment Technology (ACE'07), 2007, pp.107-114.