

Collectic – Discovering The World Around Us

Jonas Hielscher

Student at the Media Technology MSc Program, Leiden University, The Netherlands

jonas@pixelsix.org

ABSTRACT. In this paper I present the game *Collectic*. It is developed for the *Sony Playstation Portable* and uses existing wireless local area network access points in a city as a main game element. In the game, the player has to move through the city to search and collect new access points. In my study, I am concentrating on developing game concepts, that use real life properties as game elements and can be easily played everywhere at any moment. By using the physical world as a game board, players are stimulated to rediscover the real world around them in a new and playful way. I am also interested in the social effects, that result from expanding the *magic circle* of play by mixing the real world with the game world.

KEYWORDS

Pervasive Games, Location Based, Treasure Hunt, PSP, WLAN, Expanding the Magic Circle, Re-appropriation of Technology, Seamless Design, Mixing Realities

1 Introduction

The motivation of developing the game *Collectic* lays in observing the development of the market for home computer games and portable game consoles. Digital computer games become more and more important in people's leisure time. Especially massive multiplayer role playing games (MMORPGs) like *World of Warcraft* have a growing number of players, in January 2006 *World of Warcraft* had in total 6.500.000 active subscriptions¹. In these games, the player sits behind her/his computer and plays with others in a virtual world over the Internet. While playing, the player isolates herself/himself from the world around him. But at the same time s/he is connected with other players over the whole world [1,2]. One could say, that the perception space of everyday life shrinks, while on the other hand it grows globally in virtual worlds. This phenomenon of playing in a virtual world, while isolating oneself from the real world, can also be found in most games for portable game consoles. Most of these games are clones of the home console games and make no extra use of the unique properties of mobile computing [3]. The experience in the virtual game world is clearly separated from the physical world the game is played in. With the introduction of portable game consoles, games can now be played at any location, but in most games the location itself has no effect on the game and visa versa.

With the game *Collectic*, I connect both worlds by using physical movement and existing elements in the real world as an essential game element. In the game, the player uses a *Sony Playstation Portable* (PSP) as a sensor device to find existing *wireless local area networks* (WLAN) in her/his local surroundings. By doing this, I hope to stimulate the player to physically move around and explore her/his surroundings in a new and playful way.

¹ <http://www.mmogchart.com/>

2 Pervasive Games

Breaking out of traditional boundaries of a medium and interweaving the experience with the real world can also be found in other media. Already in the sixties, artists like Joseph Beuys or Nam June Paik experimented with media to stimulate people to rethink and rediscover their local surroundings and society. In 2003 the German art group LIGNA broadcasted the radio program *Radioballet*. In this program, the listeners were asked to take their radio with them, go to the central station of Leipzig and perform several movements together, like lying on the floor. In the same year, the movement of *flash mobbing* started. In *flash mobbing*, people use the Internet to arrange meeting other people at a specific location and time, to do a specific performance. All these movements expand the traditional boundaries of the medium and create a new, reflective experience on the medium and the world around us.

In the field of game studies games that are interwoven with the physical world, by mixing elements from the real world with the game world are called *pervasive games*. Many different forms of gaming have been grouped under the concept of *pervasive games*. Indoor gaming forms like *Smart Toys* and *Augmented Tabletop Games* are seen as pervasive forms of gaming, as well as outdoor activities like *Augmented Reality Games* or *Location-Aware Games* (Magerkurth) [4]. Because of the diversity of games grouped under the term *pervasive games*, *pervasive games* can not be seen as a single genre, but more as a whole field. With the common ground, that they all try to interweave the physical world and expand the traditional *magic circle*² of play. Montola defines pervasive gaming as a form of gaming that is systematically blurring and breaking the traditional boundaries of games:

“*Pervasive game is a game, that has one or more salient features that expand the contractual magic circle of play socially, spatially or temporally.*” [8]

In my research, I am focusing on *Location-Aware Games*. Games, that are played in urban surroundings and experimenting with the effects of mixing realities.

2.1 Location-Aware Games

From the technological development of mobile computing new forms of *pervasive games* evolved. The development of mobile devices equipped with GPS, WiFi, GSM or RFID technology, makes it possible, that digital games can leave one's private space and enter the public space. Games that regard the entire world, the architecture we live in, people that surround us and elements of everyday life can be called *location-aware games* [4]. In the last years many different *location-aware games* were developed. The following examples show a few games, that can be further categorized as *treasure hunt* [9] or *item hunt* [10] games. In these games the main task of the player is to search for virtual or physical items in his/her physical surroundings. The following game were a starting point of my research and form a base of the development of the game *CollecTic*.

² The term magic circle, was first mentioned in Huizinga's book *Homo Ludens* (1955) [5]. Later it became frequently used metaphorically for the game/play space in the field of game studies. In the book *Rules of Play* (2004) Salen and Zimmerman introduce the term *magic circle* in their theoretical framework as a core concept in game design [6]. In their work the *magic circle* defines the space within a game. According to Salen and Zimmerman the boundary of the *magic circle*, that separates the game world from the world outside the games, can be either closed or open, depending on the formal or in-formal form of the game/play. Because in game forms like *pervasive games* or *Live Action Role-Play* (LARP) the borders of the *magic circle* get expanded and blurred, the usefulness of the term is questioned and discussed [7]. In this paper the term is used to emphasize the differences between traditional games, with defined boundaries in time and space, and *pervasive games*, that expand these boundaries.

Treasure (2005) is a multiplayer game played on a predefined outdoor area. It was developed at the Department of Computing Science of the University of Glasgow [11]. Players search with GPS equipped hand-held computers for virtual coins hidden in the game area. Interesting about this game, is the way the game handles the limitations of WLAN coverage. In the play area WLAN coverage is not constantly available. Instead of trying to disguise this limitation, they have made it a central component of the game-play. Players can hide in the shadows of missing connectivity, sneak up on other players and steal their coins when the thieves enter the WLAN connected area.

Pac-Manhattan (2004) is a large-scale urban game that utilizes the New York City grid to recreate the 1980's video game sensation Pac-Man [12]. In the game *Pac-Manhattan* one player is dressed as Pac-man and has to run around the Washington square park area of Manhattan while attempting to collect all of the virtual dots that are placed in the streets. Four other players, dressed as the ghosts, will attempt to catch Pac-man before all of the dots are collected. *Pac-Manhattan* was developed in New York University's Interactive Telecommunications graduate program, in order to explore what happens when games are removed from their "little world" of tabletops, televisions and computers and placed in the larger "real world" of street corners and cities.

Neighbourhood Satellites (2005) is a project by Myriel Milicevic from the Interaction Design Institute Ivrea [13]. In the game the player is equipped with a laptop connected to a sensor device, the neighborhood satellite. With the satellite the player can detect local environmental conditions, like air pollution and light conditions. *Neighborhood satellites* is a research project on how to reconnect people to their local surroundings by observing environmental data directly. Data that had been obscured before.

In all examples, players have to search for hidden virtual elements, that are only visible to them. This makes the games obscure for outsiders and can create confusion about the players' actions. In the game *Pac-Manhattan* the performance is clearly emphasized as a game activity by wearing game character costumes. In the other examples, the actions are more difficult to interpret. In *Treasure* and *Neighborhood satellites*, players can choose how expressive their actions should be and how easily they can be interpreted by others. This is also possible in the game *Collectic*. While in *Treasure* and *Pac-Manhattan* the virtual items have to be placed/mapped in advance in the real world, *Neighbourhood Satellites* uses existing elements, that are already there but can only be seen with the game device. This is also done in *Collectic*, where players discover the existing infrastructure of wireless networks in their surroundings.

3 Overview of CollecTic

The game *Collectic* is developed as a part of my graduation project for the Masters program Media Technology at Leiden University in 2006. The game is developed for the Sony PSP and uses the standard features of the console, especially scanning for wireless access points to the Internet.

3.1 The Game

Collectic can be played anywhere, where WLAN (IEEE 802.11) access points can be found by a PSP. The objective of the game is to search for different access points, to collect them and to combine them in a puzzle in order to get points. In the game, the player has to move around in her/his local surroundings, using her/his PSP as a sensor device in order to find access points (figure 1). The game is designed as a single player game, but it can be easily played competitive after each other or at the same time with two PSPs.



Figure 1. showing a player searching for a wireless access point outside the window

Finding and collecting access points

If the PSP receives a signal of a wireless access point, the point will be visualized as a geometric figure (square, triangle or circle) with a specific color and size. The form and color are defined by the unique Media Access Control address³ (MAC address) of the access point (figure 2). The size of the form is determined by the signal strength of the access point. If a player wants to collect a bigger form s/he has to come closer to a spotted access point. All visible figures are starting to blink and to play a sound after each other. The length of time a figure blinks, depends on the strength of the signal. The kind of sound depends on the form and color: the form determines the waveform of the sound (sine, triangle or square wave); the color determines the note (frequency) of the sound (figure 2). If the player presses the button corresponding to the figure that lightens up, s/he collects the figure, meaning the access point. The collected shapes will be placed in the big black square on the screen. During the game, an access point can only be collected once. In order to find new access points, the player has to move around. Through the game s/he is stimulated to rediscover her/his surroundings. It easily happens that the game starts in the player's home (figure 1), where s/he selects the first figures and ends somewhere in the neighborhood, in search for new access points.

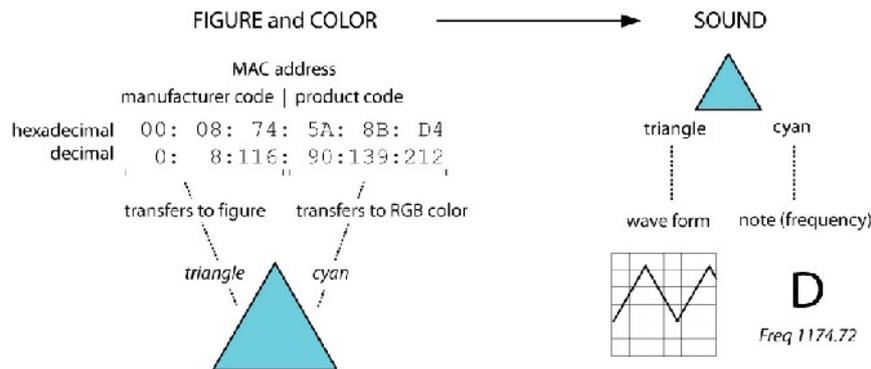


Figure 2. showing the process of mapping the MAC address to a figure, color and sound. The first three numbers of the decimal MAC address define the shape of the figure and the last three numbers define the color. The figure and color define the wave form and frequency of the sound

The puzzle in the black square

The collected figures in the black square can be arranged in a grid of three by three. If a maximum amount of nine shapes is collected, or if the player presses the x button, the grid will be checked for

³ A MAC address is a unique code assigned to most forms of networking hardware. The address is permanently assigned to the hardware. The address consists out of six groups of two hexadecimal digits. An example of a MAC address could be "00:08:74:5A:8B:D4". The first three octets defines the manufacturer and the last three octets represents the serial number assigned to the hardware by the manufacturer.

three equals in a row. The rows will be checked for same shapes and same colors. Combinations of same shape, color and size give extra points. Several equal rows at the same time will also give extra points (Combo bonus). The player is encouraged to not only collect three shapes in a row to easily gain points, but to try to complete the whole puzzle and to get a much higher score for more combinations at the same time (figure 3). With these rules, the player can develop her/his own strategies. S/he can for example decide to first collect only one shape or color and keep others in mind for later.

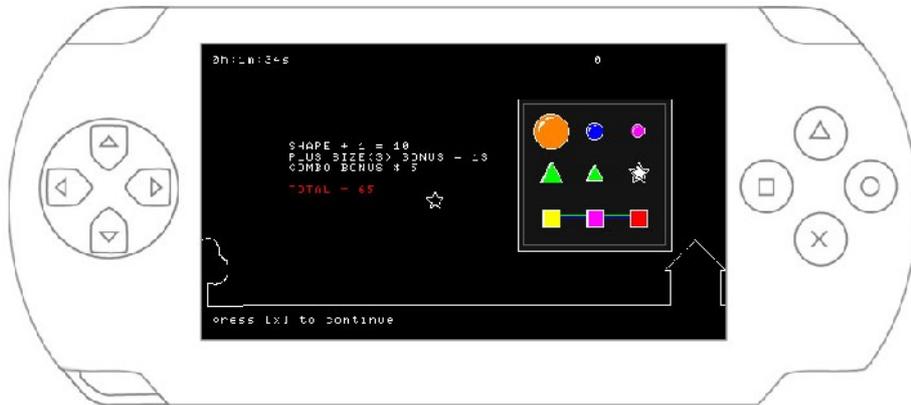


Figure 3. Screen shot, getting points for equals in a row

Unsecured wireless access points – the black/white star

A special form in the game is the black and white star. Every unsecured wireless network is visualized as a star. The star can have either a positive or negative effect, unknown for the player before selecting it. A star can be collected either by pressing the square, triangle or circle button. Only if a player collects a star, it turns out if it is a black or a white one. The black star has the negative effect of throwing all selected figures out of the puzzle, so they have to be selected again. The white star on the other hand, works as a joker. It helps to complete a row. Metaphorically speaking, the stars points to the advantages and disadvantages of unsecured wireless networks⁴.

Game modes - temporal and spatial parameters

Collectic can be played almost everywhere at any time. The player is free to choose where s/he wants to play and thus is able to define her/his own game space. The only parameter a player can change in the program, is the time period the game should last. The player can choose between an unlimited time and a limited time mode between 5 minutes and an hour. During the first tests it happened, that players decided to limit the game space to a small surroundings, like only one street. Through the possibility of changing the temporal and spatial parameters, players are able to define their own game modes and develop new strategies. For example a limited space can encourage the players to observe their surroundings more closely and to be more creative with combining the found access points. An unlimited time could bring up a different strategy, like trying to collect all access points in a whole city or area.

An idea that came up during the first test, is the possibility to use score as a limiting parameter. For example, a game that only lasts until a player reaches 500 points. The player who succeeds in the shortest period of time wins. In this way the *ticking clock* in the game can be a strong dramatic element [16]. Playing this mode with more players at the same time, could possibly also encourage physical competition.

⁴ The advantage of unsecured wireless networks is, that people can easily share Internet access with others. Everyone equipped with a wireless network receiver can connect to a unsecured wireless network. A concerning risk of unsecured wireless networks is the security. Those found in local surroundings are often unsecured for the lack of technological knowledge and not because of any ideological motivations. As a consequence, these networks are not protected against hackers with bad intentions. [14,15]

Technology

The game runs on a Sony PSP up to firmware version 2.0. The game developed with the PSP Software Development Kit⁵ (PSPSDK), a collection of open source tools and libraries written for Sony's PSP gaming console, distributed under a BSD-compatible license. The latest version of *Collectic* is available for downloading at <http://pixelsix.org/collectic>.

3.2 Player Experiences

The first initial tests were held with one player at a time. The game was played in short time intervals (5 or 15 minutes) in a small city area (radius approximately 1km). Before playing, the player got a brief explanation about the interface and that he had to search for wireless access points in her/his surroundings. During the tests, some interesting results could already be concluded. Players intuitively start to move around in their surroundings in the search for new access points. The movement differs by the different strategies players have in their game. Some players move slowly, in order to collect almost every access point, while others move faster in the search of a certain kind of figure or color. During the tests it happened that the games ended in streets, where the player did not often go or never had been. This is an interesting effect of playing games in public. In everyday life, movement through public space is often goal oriented. We are used to go the most efficient way from one point to the other. In *Collectic* the player has no predefined goal where to go. S/he starts exploring her/his surroundings, driven by the current game state. On the one hand the game stimulates to move around without any prejudice about the surroundings, I noticed on the other hand, that the player's perception of her/his surroundings changes. During play players look most of the time on the display of the PSP. It seems that their perception of the surroundings is limited. But in later interviews players reported, that they were actually in a constant interaction between the world around them and the game. Some moments they were more focused on the PSP and others moments they were more focused on their surroundings. Even when they were looking at the PSP, they were still aware of their surroundings and would not for example accidentally walk into an approaching car.

Using visual feedback of mobile device in *location-aware games* has the problem, that the player has to constantly switch her/his focus between the display and the world around him. To deal with this problem, the game uses auditive feedback in addition. Like this one doesn't have to look at the screen all the time. In the interviews some players reported, that only after a while they started to understand the meaning of the sound signals and then looked less at the PSP. This means, that experienced players would look less at the display and would perceive their surroundings more. In future versions of the game, I will have a closer look on how to improve the auditive feedback, in order to make it easier to understand.

Another point of the interviews was, that a lot of players were surprised about the huge amount of wireless access points they could find. Through the game, they got aware of this hidden and growing infrastructure in their urban surroundings. Discovering this infrastructure makes the player see certain places in a different light during the game and also afterwards. For example discovering a place with a lot of stars, can be seen in the game as an important place to gain high points. At the same time it may shows, that at this place the owners of the access points care less about the security of their Internet connection.

5 <http://ps2dev.org/psp/Projects/PSPSDK>

4 Discussion

Creating pervasive games for public space involves new aspects and strategies in game design. Dealing with uncertainty of technology is as important as handling the social effects of mixing realities.

Re-appropriation of Existing Technologies

One important strategy in is the handling of existing technologies in game design. To come up with new and different game concepts, it is important to have a close look at how certain technologies function, instead of what their original use is. In this way it is possible to re-appropriate their function and create a new game experience. In the game *CollecTic*, I make use of the WLAN function, without trying to actually connect to the Internet. The MAC addresses of found wireless access points are not used to create a network connection between the PSP and the access point, but are re-appropriated to generate geometrical figures that can be collected in a city. This is just a slightly different use than the original, but already creates completely new game possibilities. Other examples of using re-appropriation of existing technologies as a game design strategy can be found in *Wario Ware: Touched!*⁶ and *Monster Rancher*⁷. In the game *Wario Ware: Touched!*, developed for the Nintendo DS, the player has to blow into the microphone of the game console in order to move a ship on the display. In this game the microphone is not used to record sound, but as a sensor device that sense the intensity of a blow. *Monster Rancher* is a battle game between monsters, that are bred from the data of a player's CD/DVD collection. The game uses the unique serial number, that can be found on a CD or DVD and changes it into a visual and statistical representation.

Seamful Design

Another important aspect in the handling of technology is to deal with the limitations and uncertainty of technology in physical space. *Seamful design* is a novel approach of Ubiquitous and Mobile Computing discussed by Weiser to reveal and exploit inevitable technical limitations and boundaries rather than hiding them [17, 18]. This strategy is comparable with the idea of re-appropriation as explained above. Also in the strategy of *seamful design*, the functioning of used technology has to be studied closely. Discovered limitations and boundaries are then exploited as a design resource. In *CollecTic* this strategy is used in a way, that the game uses the changing signal strength as a game element and adapts itself easily to almost every environment. Another creative way of *seamful design* can be found in the game *Treasure*, as described above, where players can hide in the shadows of missing WLAN coverage.

Mixing Realities

Location-aware games such as *CollecTic*, played outdoor in public space, confront the player's in-game desires with elements of the real world. The game space, the so called *magic circle* of play is now interfered by real consequences. In location-aware games the game space is mixed with elements of the real world. The player has to consider not only the in-game consequences, but also the consequences of his/her actions in the real world. In *CollecTic* this conflict between in-game and real life consequences occurs, when the player has to decide, either to look on the PSP while moving, or to stop the game to move safely. But it can also occur, if a player decides to enter a non-public space, like an office building or a private garden, in the hope to collect an access point more easily. Mixing realities can also be a very dramatic game element by playing with the uncertainty, if something has real or only in-game consequences. In the theatrical pervasive game *Uncle Roy All Around You* [19] a game situation occurs, where the player enters an empty office and has to sign a contract where he commits that he will help a stranger for the next year. An online player on the Internet, who sees the player in the office through a web cam, is asked the same commitment. After both signed their contract, they have entered a year long contract with each other.

6 <http://www.warioware.biz/touched/>

7 <http://www.tecmogames.com/games.asp?id=10>

Playing in public touches another matter: the relationship between a player and non-players in public space. The player's behavior can change through the awareness that her/his actions are being watched. In this way, the play activity can get performance qualities. In the paper *Performance versus Gameplay? Research on performative gameplay in Massive Multiplayer Online Games* [20] I discuss the performative qualities of play in virtual public space. In some sense this is comparable with real public space, but with the exception that in virtual worlds everyone knows that they play a game. A key element that can create performative play, is the awareness of being watched by others. If a player separates herself/himself from others by doing unexpected movements or actions, it creates attention and her/his action can be seen as performance. In the performance *Warship* (2001) the artist Brodi Condon uses the MMORPG *Anarchy Online* to let a virtual character, facing to the computer screen of the viewer, constantly worshipping. By changing the rules of the game Brodi Condon creates a performance, that can be seen by other players in side the virtual world and from outside. Playing games in public space where they are not expected, changes the rules of the public space and creates performative play. But the play can cause different emotions from outsiders, like fascination, confusion or even irritation. Taking this in account, playing in public space creates an intensive, performative and reflective expression. In some pervasive games, non-players get invited in one way or another to participate, sometimes without knowing that they take part in a game. This is a clear ethically challenging style of game design, but can also create a very engaging experience. The social expansion of including non-players in pervasive games is further discussed by Montola and Waern in their research:

“The use of social expansion has proven an effective and enjoyable strategy to deeply engaging game play, and the transition between roles often form an intriguing part of the gameplay. The potentially most interesting design alternatives are the ones that make the game feel more tangible, real and immersive by compromising the magic circle the most. However, these are also the potentially most problematic designs. We intend to address this by further exploring the ethical challenges of social expansion, in particular from the non-player perspective.” [21]

5 Conclusion

Pervasive games are a new field of gaming, that create intriguing and exciting gaming experiences by blending real and virtual game elements. While traditional computer games focus the users' attention mainly on the computer screen in 2D/3D virtual environments, *pervasive games* on the other hand integrate also physical and social aspects of the real world.

With the game *CollecTic* I presented a *pervasive game*, that can be played easily almost everywhere at any time. It uses the PSP as a kind of sensor device to stimulate the players to move around and explore their local surroundings. The game creates an awareness of the physical space and on the same time an awareness of the hidden infrastructure of the growing wireless Internet. Playing *CollecTic* in public space creates a reflective experience of play, the total immersion of traditional home computer games has changed to a constant interaction between the in-game desires and real life influences.

With this study I presented ways, how play can promote fearless interaction with the real world and create a reflective view on one self, others and technology. *Pervasive games* are a new way to rediscover the world around us.

6 Acknowledgments

Thanks to my supervisor Bas Haring of Leiden University's Institute of Advanced Science (LIACS), thanks to Kaisu Koski of University of Lapland and to Jelle van der Ster for commenting on a draft of this paper. Further more I would like to thank Laurens Simonis for helping me with programming, all the people who tested and reviewed the game and the Open Source Community, who developed the PSPSDK, for sharing it and helping with their knowledge.

References

- 1 Kolo, C., Baur, T., "Living a Virtual Life: Social Dynamics of Online Gaming" (2004). Available at: <http://www.gamestudies.org/0401/kolo/>
- 2 Sirlin, D., "World of Warcraft Teaches the Wrong Things" (2006). Available at: http://www.gamasutra.com/features/20060222/sirlin_01.shtml
- 3 Ericsson, M., "Enchanting Reality - A Vision of Big Experiences on Small Platforms", *Digital Games Research Association (DiGRA) "Level Up" Conference*, November 2003. Available at: <http://www.digra.org/dl/db/05163.11401>
- 4 Magerkurth, C., Cheok, A.D, Mandryk, R.L., Nilsen, T., "Pervasive Games: Bringing Computer Entertainment Back to the Real World", *ACM Computers in Entertainment*, July 2005. Available at: http://pergames.de/PervasiveGames_CIE.pdf
- 5 Huizinga, J., "Homo Ludens", *The Beacon Press*, Boston, 1955.
- 6 Salen, S., Zimmerman, E., "Rules of Play. Game Design Fundamentals", *MIT Press*, Massachusetts, 2004.
- 7 Copier, M., "Connecting Worlds. Fantasy Role-Playing Games, Ritual Acts and the Magic Circle", *Proceedings of DIGRA 2005 Conference*, Vancouver, Canada, June 2005.
- 8 Montola, M., "Exploring the Edge of the Magic Circle. Defining Pervasive Games", *DAC 2005 Conference, IT University of Copenhagen*, Denmark. Available at: <http://users.tkk.fi/~mmontola/exploringtheedge.pdf>
- 9 Rashid O., Mullins I., Coulton P., and Edwards R., "Extending Cyberspace: Location Based Games Using Cellular Phones," *ACM Computers in Entertainment, Vol 4, Issue 1*, January 2006.
- 10 Kiefer, P., Matyas, S., Schlieder, C., "Systematically Exploring the Design Space of Locationbased Games", *Pervasive 2006. Workshop Proceedings*, Ireland, May 2006. Available at: http://www.ipsi.fraunhofer.de/ambiente/pergames2006/final/PK_Kiefer_DesignSpace.pdf
- 11 Barkhuus, L., Chalmers, M., Tennent, P., Hall, M., Bell, M., Sherwood, S., Brown, B., "Picking Pockets on the Lawn: The Development of Tactics and Strategies in a Mobile Game" *Department of Computing Science, University of Glasgow, UK*. Available at: <http://www.dcs.gla.ac.uk/~matthew/papers/treasureUbiComp2005.pdf>
- 12 Bloomberg, A., Boelhauf, K., Crowley, D., Hall, C., Lee, W., Molefe, M., Olson, M., Phalines, M., Romeo, M., Stephensen, O., Thienthong, P., Vigeant, P., *Pac-Manhattan*, New York University, Interactive Telecommunications program, 2004. website: <http://www.pacmanhattan.com/>
- 13 Milicevic, M., *Neighbourhood Satellites*, Interaction Design Institute Ivrea, 2005. website: <http://www.neighbourhoodsatellites.com/>
- 14 Berend, L. E., "Wireless Network Hacking", *GSEC Practical Assignment 1.4b* Available at: http://www.giac.org/certified_professionals/practicals/gsec/2372.php
- 15 "Securing Wi-Fi Wireless Networks with Today's Technologies", *Wi-Fi Alliance, (2003)*. Available at: http://main.wi-fi.org/membersonly/getfile.asp?f=Whitepaper_Wi-Fi_Networks2-6-03.pdf
- 16 LeBlanc, M., "Tools for Creating Dramatic Game Dynamics", *The Game Design Reader*, MIT Press, Cambridge, Massachusetts, 2006.
- 17 Weiser, M., "The world is not a desktop", *ACM Interactions 1(1)* (1994).
- 18 Broll, G., Benford, S., Oppermann, L., "Exploiting Seams in Mobile Phone Games", *Pervasive 2006. Workshop Proceedings*, Ireland, May 2006. Available at: http://www.ipsi.fraunhofer.de/ambiente/pergames2006/proceedings/PROCEEDINGS_PerGames_2006.pdf
- 19 Flintham, M., Anastasi, R., Benford, S., Drozd, A., Mathrick, J., Rowland, D., Tandavanitj, N., Adams, M., Row-Farr, J., Oldroyd, A., Sutton, J., "Uncle Roy All Around You: Mixing Games and Theatre on the City Streets", *Digital Games Research Association (DiGRA) "Level Up" Conference*, November 2003. Available at: <http://www.digra.org/dl/db/05163.14092>
- 20 Hielscher, J., Performance versus Gameplay? Research on performative gameplay in Massive Multiplayer Online Games (2006). Available at: http://pixelsix.org/RvS-Blog/JHielscher_performance-vs-gameplay.pdf
- 21 Montola, M., Waern, A., "Participant Roles in Socially Expanded Roles", *Pervasive 2006. Workshop Proceedings*, Ireland, May 2006. Available at: http://www.ipsi.fraunhofer.de/ambiente/pergames2006/proceedings/PROCEEDINGS_PerGames_2006.pdf